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November 2018

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

Volume 1
(Chapters 1 through 14)

U.S. Department of Energy
Office of Environmental Management

Availability of the

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR REMEDIATION OF AREA IV AND THE NORTHERN BUFFER ZONE OF THE SANTA SUSANA FIELD LABORATORY

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

Location: Ventura County, California

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This document is available on the DOE NEPA website (http://energy.gov/nepa) for viewing and downloading.

Abstract:

This *Final 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 laws, regulations, orders, and agreements. The alternatives analyzed in this environmental impact statement (EIS) involve the disposition of remaining DOE facilities and support buildings, remediation of soil and groundwater, and disposal of all resulting materials 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's preferred alternative for soils remediation is the Conservation of Natural Resources, Open Space Scenario. DOE is identifying this as the preferred alternative because it would be consistent with the risk assessment approach typically used at other DOE sites, other California Department of Toxic Substances Control- (DTSC-) regulated sites, and U.S. Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites, which accounts for the specific future land use of the site. Use of a risk assessment approach would be consistent with the process being used by Boeing for the land it owns at SSFL and recognizes the Grant Deeds of Conservation Easement and Agreements that commit Boeing's SSFL property, including Area IV and the NBZ, to remaining as open space. This scenario would use a CERCLA risk assessment approach that would be protective of human health and the environment rather than look-up table values (action levels). The 2010 *Administrative Order on Consent for Remedial Action* (AOC) between DOE and the DTSC allows DOE and DTSC to agree upon changes to the AOC to better meet cleanup objectives. DOE expects to engage DTSC in discussions about such changes in order to implement this soil remediation alternative.

For building demolition, DOE's preferred alternative is the Building Removal Alternative. Under this alternative DOE would demolish the 18 DOE-owned buildings in Area IV and transport the resulting waste off site for disposal. Demolition of thirteen facilities and disposition of the resulting debris would be in accordance with DOE requirements and applicable laws and regulations. Three facilities at the Radioactive Materials Handling Facility (RMHF) and the two facilities comprising the Hazardous Waste Management Facility would be closed in accordance with DTSC-approved Resource Conservation and Recovery Act (RCRA) facility closure plans.

DOE's preferred alternative for groundwater remediation is a combination of the Treatment Alternative and the Monitored Natural Attenuation Alternative. DOE would treat the groundwater plumes with higher concentrations of contaminants (the Former Sodium Disposal Facility, Hazardous Materials Storage Area, Building 4100/56, and Building 4057 plumes) in accordance with the results of the final RCRA Groundwater Corrective Measures Study. Source removal is the preferred alternative for the strontium-90 source. Monitored natural attenuation would be used for plumes that are not amenable to active treatment – the two plumes with the lowest concentrations of trichloroethylene (the Metals Clarifier and RMHF plumes) and the tritium plume. DOE's proposed groundwater remedial actions would be included in the final Corrective Measures Study submitted to DTSC for approval.

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 EPA and changes in cleanup requirements (as a result of the 2010 AOC), 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 the draft EIS.

In preparing this *Final SSFL Area IV EIS*, DOE considered comments received during the public comment period on the *Draft SSFL Area IV EIS* (January 13 through March 14, 2017) and late comments received after the close of the public comment period. Public hearings on the *Draft SSFL Area IV EIS* were held in Simi Valley, California and Van Nuys, California and a meeting with Native American tribal members was held in Simi Valley, California. DOE considered every comment received at the public hearings and by U.S. mail, email, and through the website during preparation of this *Final SSFL Area IV EIS*.

This *Final SSFL Area IV EIS* contains revisions and new information based in part on comments received on the *Draft SSFL Area IV EIS*. Volume 3 contains the comments received on the *Draft SSFL Area IV EIS* and DOE's responses to the comments. DOE will use the analysis presented in this *Final SSFL Area IV EIS*, as well as other information, in preparing one or more Records of Decision (RODs) regarding cleanup activities in Area IV of the SSFL and the adjoining NBZ. DOE will is ROD(s) no sooner than 30 days after the U.S. Environmental Protection Agency publishes a Notice of Availability of this *Final SSFL Area IV EIS* in the *Federal Register*.

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ACRONYMS, ABBREVIATIONS, AND CONVERSION CHARTS

ACRONYMS, ABBREVIATIONS, AND CONVERSION CHARTS

AEA	Atomic Energy Act
AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
AOC	*Administrative Order on Consent for Remedial Action*
APE	area of potential effects
ARB	California Air Resources Board
ATSDR	Agency for Toxic Substances and Disease Registry
B.C.E.	Before Common Era
BMP	best management practice
Boeing	The Boeing Company
BTV	background threshold level
CAAQS	California Ambient Air Quality Standards
CAIRS	Computerized Accident/Incident Reporting System
CalEPA	California Environmental Protection Agency
CDFW	California Department of Fish and Wildlife
C.E.	Common Era
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESA	California Endangered Species Act
CFR	*Code of Federal Regulations*
CMWD	Calleguas Municipal Water District
CNDDB	California Natural Diversity Database
CNEL	Community noise equivalent level
CO	*Consent Order for Corrective Action*
CO_2	carbon dioxide
CRF	California red-legged frog
CRPR	California Rare Plant Rank
CSP	Cancer Surveillance Program
CWA	Clean Water Act
DART	days away from work, restricted duty, or transfer to another job
dB	decibels
dBA	decibels A-weighted
D&D	decontamination and decommissioning
DNL	day-night average sound level
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPM	diesel particulate matter
DTSC	Department of Toxic Substances Control
EA	environmental assessment
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act

ESAL	equivalent single-axle load
ETEC	Energy Technology Engineering Center
FAL	field action level
FGC	California Fish and Game Code
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FSDF	Former Sodium Disposal Facility
GHG	greenhouse gases
GWIM	Groundwater Interim Measure
GWP	global warming potential
HCS	Highway Capacity Software
HMSA	Hazardous Materials Storage Area
HPTP	Historic Properties Treatment Plan
HSA	Historical Site Assessment
HWMF	Hazardous Waste Management Facility
ICRP	International Commission on Radiological Protection
LARWQCB	Los Angeles Regional Water Quality Control Board
$L_{eq\text{-}workday}$	equivalent sound level during workday hours
Leq	equivalent sound level
LCF	latent cancer fatality
LLW	low-level radioactive waste
L_{max}	maximum noise level
LOS	level of service
LUT	Look-Up Table
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MBTA	Migratory Bird Treaty Act
MCL	maximum containment level
MDC	minimum detectable concentrations
MEI	maximally exposed individual
MLLW	mixed low-level radioactive waste
MOU	Memorandum of Understanding
MRL	method reporting limit
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NNSS	Nevada National Security Site
NOI	Notice of Intent
NOx	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPPA	Native Plant Protection Act
NRC	U.S. Nuclear Regulatory Commission
NRHP	*National Register of Historic Places*
OSHA	Occupational Safety and Health Act
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl

PCE	perchloroethylene
PM_n	particulate matter less than or equal to *n* microns in aerodynamic diameter
PRG	Preliminary Remediation Goal
PSD	prevention of significant deterioration
QCB	Quino checkerspot butterfly
RADTRAN	Radioactive Material Transportation Risk Assessment
RBSL	risk-based screening levels
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RFI	RCRA Facility Investigation
RISKIND	Risks and Consequences of Radioactive Materials Transport
RMHF	Radioactive Materials Handling Facility
ROD	Record of Decision
ROI	Region of Influence
RTL	radiological trigger level
SHPO	State Historic Preservation Officer
SMMNRA	Santa Monica Mountains National Recreation Area
SNAP	Systems for Nuclear Auxiliary Power
SO_2	sulfur dioxide
SPTF	Sodium Pump Test Facility
SR	State Route
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
SVE	soil vapor extraction
SWPPP	stormwater pollution prevention plan
SWRCB	State Water Resources Control Board
TCE	trichloroethylene
THPO	Tribal Historic Preservation Office
TPH	total petroleum hydrocarbons
TRAGIS	Transportation Routing Analysis Geographic Information System
TRC	total recordable case
TSD	treatment, storage, and disposal
USACE	U.S. Army Corps of Engineers
U.S.C.	*United States Code*
USFWS	U.S. Fish and Wildlife Service
VCAPCD	Ventura County Air Pollution Control District
VOC	volatile organic compound
WAC	waste acceptance criteria
WCS	Waste Control Specialists

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}

Chapter 1
Introduction

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) has prepared this *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final SSFL Area IV EIS)* in accordance with the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) and DOE NEPA 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 soils, buildings, and groundwater. Information provided in this environmental impact statement (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 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 enjoined 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. The order 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 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]

1.1 Purpose and Need for Agency Action

DOE needs to complete remediation of SSFL Area IV and the NBZ[2] to comply with applicable requirements for cleanup of radiological and hazardous substances. These requirements include laws, regulations, orders, and agreements. To this end, DOE proposes 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; remediate chemically and radiologically impacted soil in Area IV and the NBZ; remediate groundwater in Area IV and the NBZ; dispose of resulting material; and restore the affected environment in accordance with applicable laws, orders, regulations, and agreements with the State of California.

[1] *Order Granting Plaintiffs' Motion for Summary Judgment* (Case No. 3:04-CV-04448-SC, May 2, 2007).

[2] In this EIS, statements regarding DOE soil remediation in the NBZ refer to those portions of the NBZ that have been impacted by past DOE operations. Portions of the NBZ also are being addressed by the National Aeronautics and Space Administration (NASA), where releases from past NASA operations in Area II have migrated into the NBZ.

1.3 History of the Site

Located in Ventura County, California, on 2,850[3] 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).

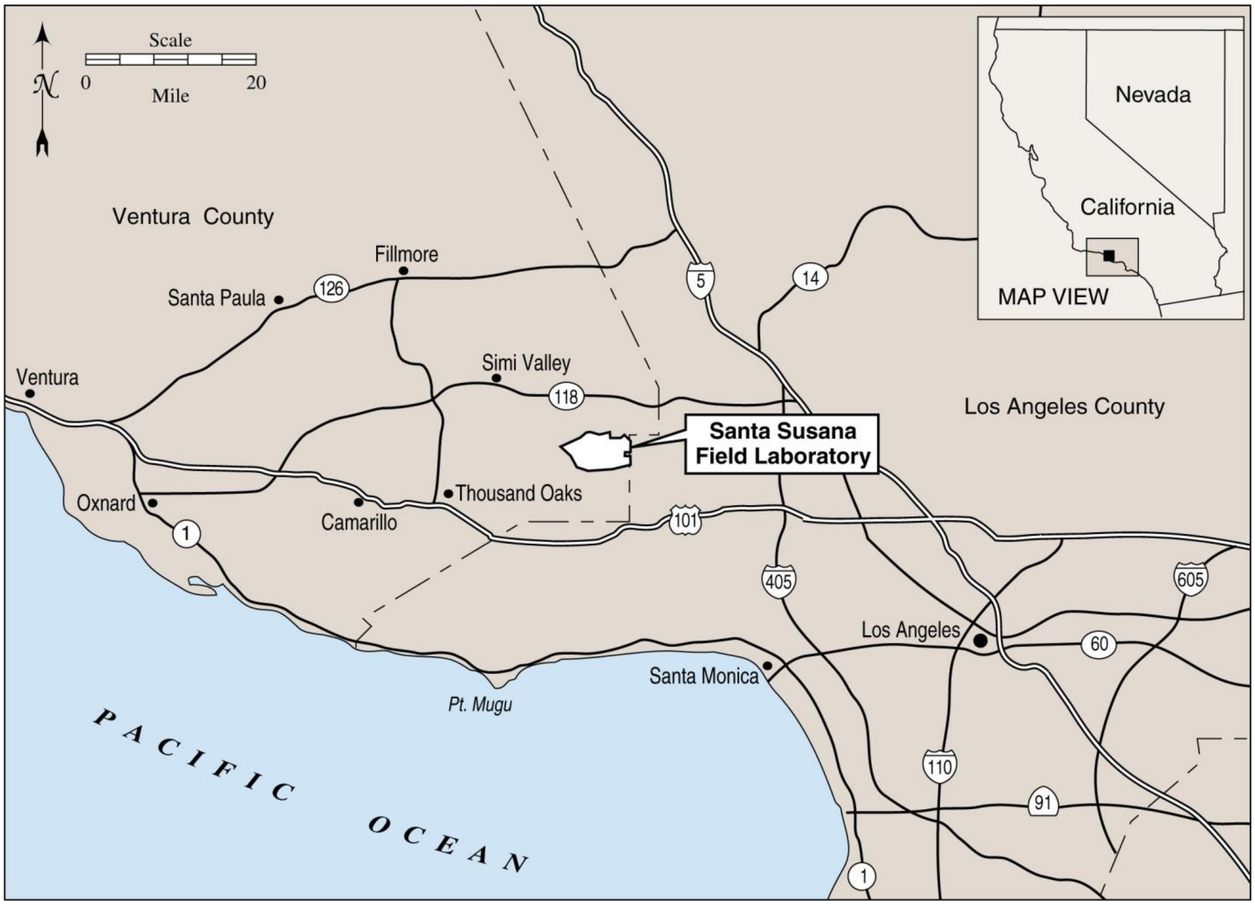

Figure 1–1 Project Location, Santa Susana Field Laboratory

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 in

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

the 290 acres of 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 *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 for commercial entities. Boeing is responsible for decontamination and demolition of the buildings it owns in Area IV.

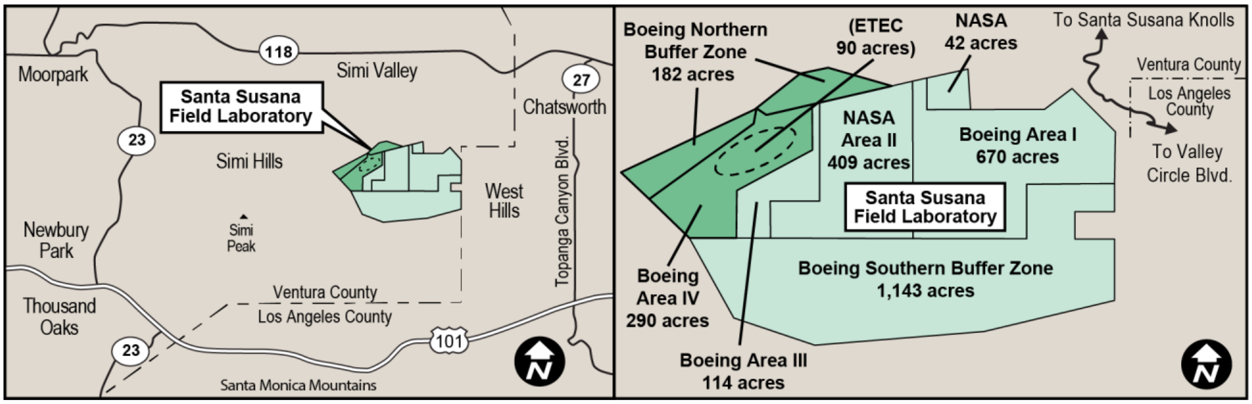

Figure 1–2 Santa Susana Field Laboratory and Surrounding Communities

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 owned by 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 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 many 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 the 2010 *Administrative Order on Consent for Remedial Action* [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. DOE and its contractors assigned unique identification numbers to 272 structures in Area IV that were used during its operational period (Sapere 2005).[4] Most of these structures have been removed. Today the major structures remaining in Area IV are 22 buildings (18 owned by

[4] Structures included engineered items such as buildings, lean-tos, electrical substations, guard shacks, and parking lots.

DOE[5] and 4 owned by Boeing). Prior building demolition and soil remediation efforts resulted in removal of much of the chemical and radioactive material from Area IV.

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 held that DOE was in violation of NEPA and issued an order that 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.[6] 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 one or more RODs.

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[7] and groundwater at SSFL to risk-assessment-based levels.[8]

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*

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; 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 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.

[5] Five of the 18 DOE buildings are regulated by DTSC under its hazardous waste regulatory authority; the other 13 buildings are not.

[6] *Order Granting Plaintiffs' Motion for Summary Judgment* (Case No. 3:04-CV-04448-SC, May 2, 2007).

[7] 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 activities.

[8] The risk-based cleanup targets for soil under the 2007 CO are a risk of 1×10^{-6} (a lifetime chance of 1 in 1 million of developing a cancer), and a hazard index of 1 (the level below which no toxic effects would be expected). Safe Drinking Water Act Maximum Contaminant Levels are the target cleanup levels for groundwater.

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.

The U.S. Environmental Protection Agency (EPA) conducted a preliminary assessment/site inspection of ETEC starting in 1989 to assess potential 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 determine that ETEC/Area IV was not eligible for inclusion on the National Priorities List (NPL), also known as the Superfund List, and no further action by the Federal Superfund program was warranted (EPA 2003a, 2003b). 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 notified EPA of its position that EPA should not list SSFL on the NPL (California EPA 2009a). Based on the State's input, EPA decided not to list SSFL on the NPL. Subsequently, the 2010 AOC in conjunction with the earlier 2007 CO, defined the expectations for the cleanup.

National Environmental Policy Act Terminology Used in this *Final 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.

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.

1.4 Area IV and Northern Buffer Zone Characterization

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 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 (HGL 2011) 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 (HGL 2012a).[9] 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. The results were reported in the *Final Gamma Radiation Scanning Report, Area IV Radiological Study, Santa Susana Field Laboratory, Ventura County, California* (HGL 2012e).
  - *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).
  - *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 (HGL 2012d).

> **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

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

(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 2006b, 2007a, 2009a).

In 2010, DOE entered into the 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.[11] 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[12] 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.[13] 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).[14] As was done with the EPA radionuclide background study, the DTSC chemical background study results were

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 buildings. 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. Verification of cleanup levels is required by DTSC. Backfill soil must also meet the chemical and radionuclide LUT values. If potential sources of backfill identified by DOE do not meet the LUT values, then following a consultation process, DTSC shall determine the best available source of backfill. No "leave-in-place" alternative and no "onsite burial or landfilling" is allowed. The 2010 AOC specifies that all actions taken by DOE shall be in accordance with applicable local, State, and Federal laws and regulations. It specifically 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 (SRAIP) that clearly describes a schedule for implementation of the planned remedial actions. Per the 2010 AOC, the identified activities were to be accomplished by 2017. On June 30, 2017, DOE sent a letter to DTSC acknowledging that the 2017 date would not be met (DOE 2017a). The schedule for completion of the project has not been determined.

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

12 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.

13 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 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 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."

14 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.

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.

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. DOE also sampled drainages and conducted random sampling of the NBZ in coordination with EPA. 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 and naturally occurring organic materials); mercury (from electrical components and as heat transfer medium); and metals (antimony, cadmium, chromium VI, mercury, selenium, and silver) (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 the volume of soil exceeding the AOC LUT (Administrative Order on Consent Look-Up Table) values. For this *Final SSFL Area IV EIS*, DOE refined its evaluation of the geographic information system (GIS) and soil sampling data to develop a more accurate picture of the distribution of chemical constituents in Area IV and the NBZ. Based on this analysis and accounting for uncertainty, DOE estimates that as much as 1,616,000 cubic yards of soil exceed the AOC LUT values; this volume was 1,413,000 cubic yards in the Draft EIS (see Appendix D). This reanalysis provided a more accurate understanding of the locations in Area IV and the NBZ where total petroleum hydrocarbons (TPH),[15, 16] were the only exceedance of an AOC LUT value. At these locations where only TPH was found, there were no exceedances of any other chemical or radionuclide. DOE believes that soil at these locations may be suitable for onsite treatment through natural attenuation. For purposes of analysis in this Final EIS, and after accounting for onsite treatment and the application of the exemptions process for sensitive biological or cultural resources (see the text box regarding the 2010 AOC on the preceding page), the total volume of soil that does not meet the AOC LUT values is approximately 881,000 cubic yards; this volume was 933,000 cubic yards in the Draft EIS (see Appendix D).

The terms of the 2010 AOC 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 assistance was anticipated to support post-cleanup confirmation sampling and analysis for radionuclides in remediation areas to verify cleanup completion, as well as to verify that backfill/replacement soils are consistent with LUT values for radionuclides. EPA is not a signatory to the 2010 AOC. Any future involvement by EPA (e.g., verification sampling) would be contingent on future agreements and funding, similar to those previously established for EPA's radiological characterization of Area IV and the NBZ. DTSC will perform verification sampling and analysis of soils in remediation areas and of backfill/replacement soils for chemical constituents.

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15 The analytical method used for detecting TPH also detects TPH-like compounds that are of a biological origin (e.g., compounds resulting from the decay of plants and animals).

16 DOE contracted with Sandia National Laboratories, California Polytechnic State University, San Luis Obispo, and the University of California, Riverside to conduct soil studies in support of possible soil cleanup technologies. One of these studies concluded that some of the TPH exceeding the AOC LUT values is naturally occurring material and that there are clear technical problems with measuring TPH at low levels (Nelson et al. 2015d).

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 *Final RCRA Facility Investigation (RFI) Groundwater Work Plan, Portions of Area IV under DOE Responsibility, Santa Susana Field Laboratory, Ventura, California* (CDM Smith 2015a), and *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2018a). The feasibility of groundwater treatment technologies (e.g., pump and treat, bedrock vapor extraction, thermal treatment) was evaluated in the *Draft Area IV RCRA Corrective Measures Study* (CDM Smith 2018c), and the potential environmental impacts of the groundwater treatment options are included in this Final EIS. DOE will work with DTSC and EPA to ensure that cleanup activities are conducted in compliance with all applicable regulations and agreements.

1.5 Future of Area IV and the Northern Buffer Zone

Boeing is the landowner of Area IV and the NBZ. Prior to publication 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)*, Boeing stated that its intent was to maintain its portion of SSFL (including Area IV and the NBZ) as undeveloped open space. Further, Boeing stated that it would restrict future land use to prevent development for any commercial, industrial, agricultural, or residential purpose regardless of zoning changes beyond its control (Boeing 2016a). Subsequent to issuance of the Draft EIS, Boeing formalized its intent to protect its property at SSFL as open space. In April 2017, Boeing and North American Land Trust entered into a Grant Deed of Conservation Easement and Agreement (conservation easement) to permanently preserve nearly 2,400 acres of land at SSFL, including Area IV and the NBZ as open space (Ventura County 2017a). In November 2017, Boeing and North American Land Trust entered into a second Grant Deed of Conservation Easement and Agreement to protect approximately 53 additional acres along the Southern Buffer Zone of SSFL (Ventura County 2017b).[17] The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site. They permanently bind the property, regardless of who owns the land. North American Land Trust will monitor and enforce the conservation easements.

1.6 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 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."

1.7 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 material, and restore the

[17] The Grant Deeds of Conservation Easement and Agreements were recorded by Ventura County on April 24, 2017 (recordation number 20170424-00053180-0) and November 11, 2017 (recordation number 20171117-00149829-0).

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.[18] 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 when 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 one or more RODs that will be issued no sooner than 30 days after the EPA Notice of Availability of the *Final SSFL Area IV EIS* is published in the *Federal Register*.

If DOE decides to implement the building removal alternative, DOE would pursue plans to expeditiously implement the selected alternative for the 13 DOE buildings that are not regulated by DTSC as hazardous waste facilities. Implementation of a building demolition decision for any of the five DTSC-regulated facilities, as well as decisions on soil and groundwater remediation, is contingent on completion and/or approval of a number of other documents. These documents are addressed in Section 1.9, "Related NEPA and Other Documents."

1.8 Organization of this EIS

This EIS consists of 14 chapters (Volume 1), 13 Appendices (Volume 2), and a Comment Response Document (CRD) (Volume 3). The chapters, appendices, and CRD are 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

[18] 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.

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, "Evaluation of Remediation Activity Impacts on Human Health"
  - Appendix H, "Evaluation of Transportation and Traffic Impacts"
  - Appendix I, "Wetlands Assessment"
  - Appendix J, "U.S. Fish and Wildlife Service Biological Opinion"
  - Appendix K, "Cost-Benefit Analysis Report"
  - Appendix L, "Sensitivity Evaluations"
  - Appendix M, "Contractor Disclosure Statements"

- The CRD is organized into the following sections:
  - Section 1 describes the public comment process for the *Draft SSFL Area IV EIS;* the format used in the public hearings on the *Draft SSFL Area IV EIS;* the organization of the CRD and how to use it; and the changes made by DOE to the *Final SSFL Area IV EIS* in response to the public comments.
  - Section 2 presents topics of interest from the public comments received on the *Draft SSFL Area IV EIS* that required a detailed response or appeared frequently in the comments, as well as DOE's response to each topic of interest.
  - Section 3 presents comments received via the *SSFL Area IV EIS* website, email, and U.S. mail, as well as the written comments and transcripts of the oral comments received during the hearings. The comments and DOE's responses are presented side by side.
  - Section 4 lists the references cited in the CRD.

1.9 Related NEPA and Other Documents

Four existing NEPA documents have been identified as having a direct relationship to this EIS and are discussed in this section. In addition, this section discusses 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 soil remediation plan required under the 2010 AOC (referred to as a Soils Remedial Action Implementation Plan [SRAIP] in the 2010 AOC); and various 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 Special Resource Study* (NPS 2016). 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 would take place.

DOE has prepared and submitted to DTSC the 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 *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2018a) and a *Draft Area IV RCRA Corrective Measures Study* (CDM Smith 2018c) to address groundwater remediation 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 when selecting alternatives for one or more RODs. The identified related NEPA documents, CEQA program EIR document, 2010 AOC (DTSC 2010a) documents, and RCRA documents are summarized in Sections 1.9.1, 1.9.2, 1.9.3, and 1.9.4, 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.

1.9.1 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 issue appropriate NEPA documentation based on the results of these surveys and studies.

National Park Service *Rim of the Valley Corridor Special Resource Study Final Summary* (NPS 2016). 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 Rim of the Valley Corridor Special Resource Study area (see Chapter 3, Figure 3–4). The National Park Service issued the *Rim of the Valley Corridor Draft Special Resource Study and Environmental Assessment* (*Draft ROTV Study and EA*) (NPS 2015e) in April 2015.[19] As stated in the EA, the purpose was 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 (SMMNRA); 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 Study and EA* included alternatives for determining whether the area would be suitable as an addition to the SMMNRA. 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 SMMNRA. Additional lands would only be acquired and incorporated from willing landowners. In a 2015 FONSI (NPS 2015f), the National Park Service recommended expanding the existing SMMNRA boundary to include significant portions of the study area, more than doubling the size of the SMMNRA. As explained in the *Rim of the Valley Corridor Special Resource Study Final Summary* (NPS 2016), implementation of the selected alternative would require congressional legislation. If implemented, 170,000 acres would be added to the SMMNRA to bring the total to 323,000 acres.

1.9.2 Related CEQA Document

As required by CEQA and the California Health and Safety Code, in September 2017, DTSC issued the *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California (Draft Program EIR)* (DTSC 2017a) to evaluate the potential impacts of proposed remedial actions at SSFL from the combined actions of DOE, NASA, and Boeing. In the *Draft Program EIR*, DTSC also evaluated alternatives to the use of Woolsey Canyon Road for transporting soil and debris from SSFL. The final 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.

[19] The National Park Service did not issue a standalone final EA, but finalized the ROTV EA by issuing a companion document, the *Rim of the Valley Corridor Special Resource Study & Environmental Assessment Errata* (NPS 2015g), as well as a FONSI (NPS 2015f).

1.9.3 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 a single SRAIP or multiple SRAIPs if it is determined that the complexity of the cleanup is better addressed in a stepwise manner. DOE is to submit its draft SRAIP(s) to DTSC. The draft SRAIP(s) will be made available for public comment.

1.9.4 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, submitted to DTSC in 2015, includes Buildings T029 and T133 (now Buildings 4029 and 4133). On August 13, 2018, DTSC announced a 45-day public comment period for the closure plan.

***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, submitted to DTSC in 2015, addresses Buildings 4021, 4022, and 4621. On August 13, 2018, DTSC announced a 45-day public comment period for the closure plan.

***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. Three additional areas with historically lower concentrations of groundwater contamination (mainly solvents) are being evaluated for potential cleanup methodologies: the RMHF TCE plume, Metals Clarifier TCE plume, and Building 4057 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) was evaluated in the *Draft Area IV RCRA Corrective Measures Study* (CDM Smith 2018c). 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.

***Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2018a).** DOE completed additional groundwater investigations and reported the results in the *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV, Santa Susana Field Laboratory, Ventura County, California*. The report includes a detailed discussion of the geology in Area IV and the NBZ; a summary of the conceptual site model of three-dimensional groundwater flow and contaminant migration; information on the magnitude and extent of the existing groundwater contamination plumes in Area IV and the NBZ;

and additional statements on the impact of fine-grained units on the groundwater flow and contaminant migration.

***Draft Area IV RCRA Corrective Measures Study* (CDM Smith 2018c).** The *Draft Area IV RCRA Corrective Measures Study* identifies and evaluates potential groundwater remedies for each of DOE's groundwater plumes and a strontium-90 source in Area IV and the NBZ. DOE's proposed groundwater remedial actions will be reviewed by DTSC; upon receiving approval, DOE will define the actions to be performed for groundwater remediation.

1.10 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 1.10.1): summarize the scoping activities conducted for this EIS (Section 1.10.2); describe DOE's additional public involvement activities (Section 1.10.3); provide an overview of SSFL-related public involvement activities conducted by other agencies (Section 1.10.4); describe the public comment period on the Draft EIS (Section 1.10.5); and summarize the major changes made between the Draft and Final EISs (Section 1.11).

1.10.1 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 the draft EIS. These NEPA public involvement opportunities are described below.

1.10.2 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.

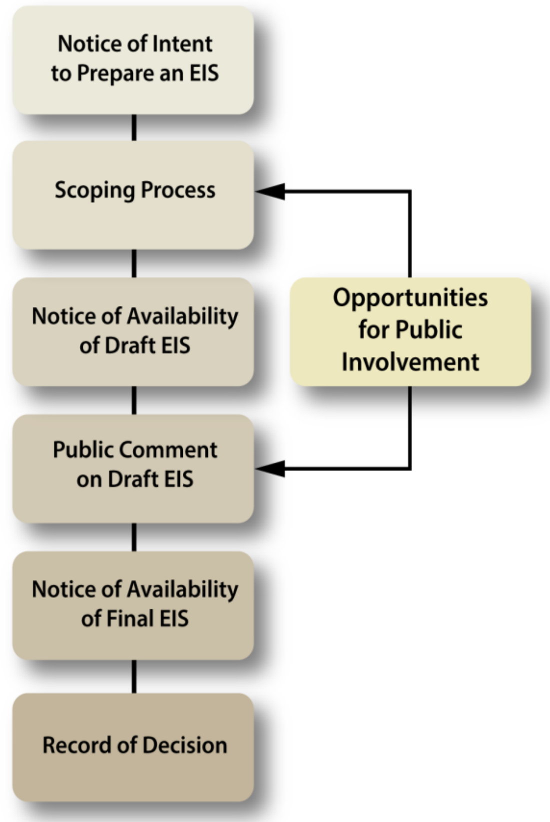

Figure 1–3 EIS Public Involvement Opportunities

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 comments from individuals, an elected official, organizations, Government agencies, a Native American organization, and a Native American tribe. In its 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 reported receiving 1,272 comments from 309 commenters. In comments on this EIS, an organization noted that its efforts resulted in the submission of scoping comments from 427 individuals that DOE had not fully accounted for in its reported numbers. (See comment 136-4 of the CRD in this EIS.) Those comments are hereby acknowledged, and the substance of those comments was accounted for in developing this EIS. **Table 1–1** contains a summary of key scoping comments from the 2014 scoping period.

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 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 resource 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.
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).

Category	Issues
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 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 = 2010 *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.

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 the potential use of metal boxes, roll-off bins, or other containers for removed soil, as well as liners 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 or recreational 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.

1.10.3 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 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 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 periodically 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.

1.10.4 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 request, 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 periodically 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.

1.10.5 Draft EIS Public Comment Period

This section describes the public comment process for the *Draft SSFL Area IV EIS* and the procedures used to respond to those comments. Section 1.10.5.1 describes the public comment process and the means of receiving comments on the Draft EIS. It also identifies the comment period and the locations and dates of the public hearings on the Draft EIS. Section 1.10.5.2 addresses the public hearing format.

1.10.5.1 Public Comment Process

DOE prepared the *Draft SSFL Area IV EIS* in accordance with NEPA and CEQ and DOE NEPA implementing regulations at 40 CFR Parts 1500–1508 and 10 CFR Part 1021, respectively. An important part of the NEPA process is solicitation of public comments on a draft EIS and consideration of those comments in preparing a final EIS. DOE distributed copies of the *Draft SSFL Area IV EIS* to those Federal agencies and State and local governmental entities; American Indian tribal governments; and members of the public that are most likely to be interested in or affected by the proposed alternatives, as well as those organizations and individuals who requested a copy. Copies also were made available on the Internet and in regional DOE public document reading rooms and public libraries.

> *Comment document* – A communication in the form of an electronic communication (website entry, document upload, or email), a letter, transcript, or written comment from a public hearing that contains comments from a sovereign nation, government agency, organization, or member of the public regarding the *Draft SSFL Area IV EIS*.
>
> *Comment* – A statement or question regarding the draft EIS content that conveys approval or disapproval of proposed actions, recommends changes, or seeks additional information.

On January 13, 2017, EPA published a notice in the *Federal Register*, announcing the availability of the *Draft SSFL Area IV EIS* (82 FR 4336). A 60-day comment period, from January 13 to March 14, 2017, was announced to provide time for interested parties to review and comment on the Draft EIS. On March 17, 2017, EPA published an amended *Federal Register* notice, announcing an extension of the public comment period to April 13, 2017. During the public comment period, DOE held two public hearings, as well as a hearing for Native Americans, to provide participants with opportunities to learn more about the content of the Draft EIS from exhibits, fact sheets, and other materials; to hear DOE representatives present the results of the Draft EIS analyses; to ask questions; and to provide oral or written comments.

Table 1–2 lists the date and location of each hearing and the numbers of attendees and commenters. The attendance estimates are based on the number of registration forms completed and returned, as well as a rough "head count" of the audience.

Table 1–2 Hearing Locations, Attendance, and Numbers of Commenters

Location	*Date*	*Attendance*	*Number of Oral Commenters*
Native American Hearing, DOE offices	February 17, 2017	7	3
Simi Valley, California	February 18, 2017	87	32
Van Nuys, California	February 21, 2017	73	43
Total		167	78

In addition, Federal agencies and State and local governmental entities; Native American tribal governments; and members of the public were encouraged to submit comments via the U.S. mail or online at www.SSFLAreaIVEIS.com. **Table 1–3** lists the number of comment documents received by each method of submission.

Table 1–3 Numbers of Comment Documents Received by Method of Submission

Method of Submission	*Number of Comment Documents*
Online at www.SSFLAreaIVEIS.com	477
U.S. mail	104
Email	35
Campaigns (primarily by email)	660
Petitions (Petition 1, signed by 7 individuals; Petition 2, signed by 10 individuals)	2
Public hearings (oral and written)	85
Total	1,363

Upon receipt, all written comment documents were assigned a document number for tracking during the comment response process. Transcripts from each public hearing also were assigned document numbers corresponding to each speaker. All comment documents were then processed through the comment analysis and response sequence for inclusion in the CRD, and electronic versions of the originally submitted documentation were maintained. The text of each comment document was analyzed to identify individual comments, which were numbered sequentially. DOE responded to all comments received through April 13, 2017, and considered comments received after April 13, 2017, in preparing this *Final SSFL Area IV EIS*. Comments that DOE determined to be outside the scope of the *SSFL Area IV EIS* are acknowledged as such in the CRD. The remaining comments were then reviewed and responded to by policy experts, subject matter experts, and NEPA specialists, as appropriate.

The CRD presents the comment documents, including the campaign letters,[20] as well as the public hearing transcripts, along with DOE's responses to the comments. **Figure 1–4** illustrates the process used for collecting, tracking, and responding to the comments.

The comments and DOE responses were compiled in a side-by-side format, with each identified comment receiving a separate response. All comments and responses are numbered with a comment identification number to facilitate matching each comment with its response.

Integration of the comment response process into preparation of this *Final SSFL Area IV EIS* served to focus revision efforts and ensure consistency throughout the final document. The comments assisted in determining whether the alternatives and analyses presented in the *Draft SSFL Area IV EIS* should be modified or augmented, whether information presented in the Draft EIS needed to be corrected or updated, and whether additional clarification was necessary to facilitate better understanding of certain issues. Change bars in the margins of pages in Volumes 1 and 2 of this *Final SSFL Area IV EIS* indicate where substantive changes were made and where text was added or deleted. Editorial changes are not marked.

[20] A letter was considered to be part of a campaign if a significant number of comment documents were received with substantially the same text in the body of the document.

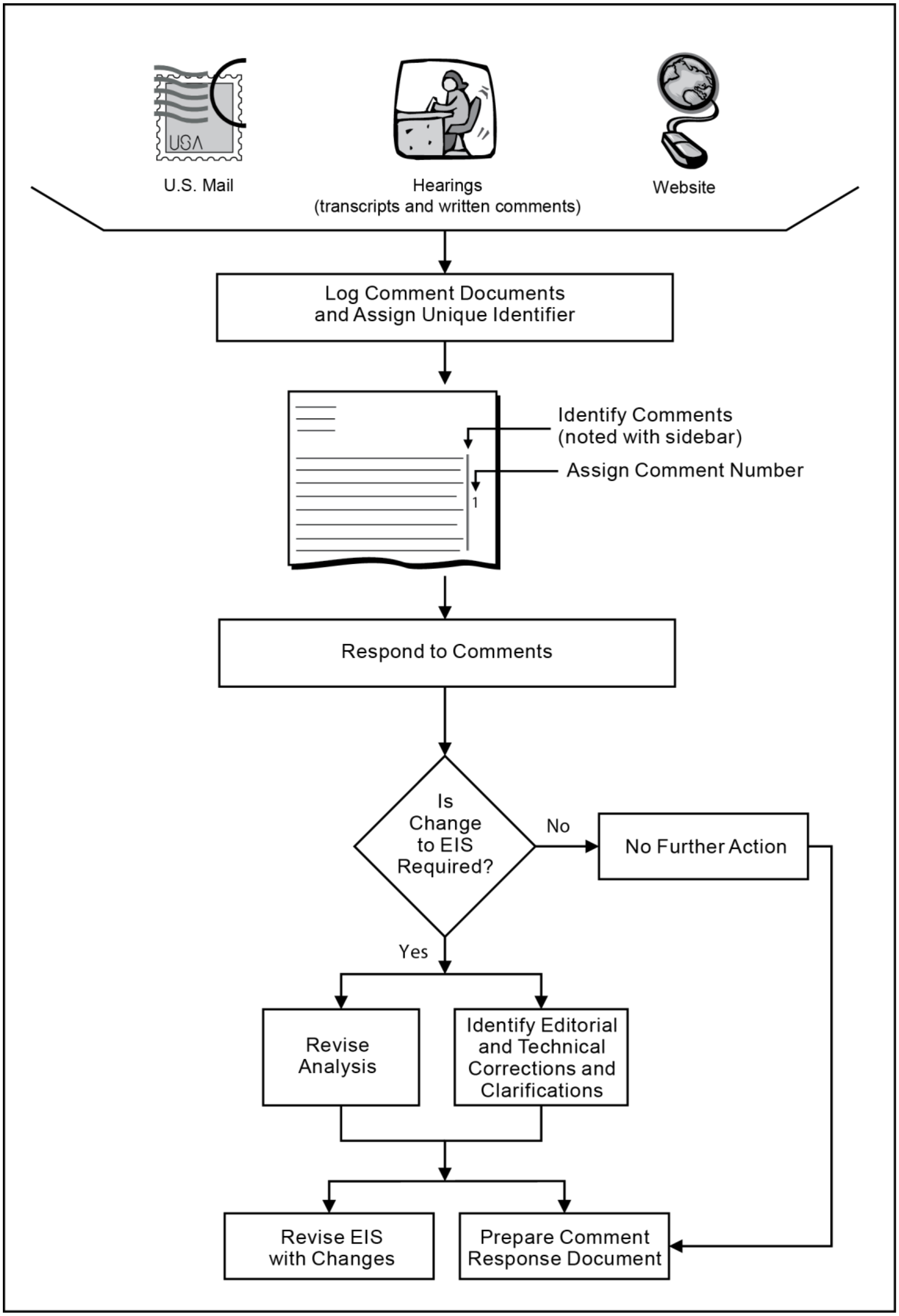

Figure 1–4 SSFL Area IV EIS Comment Response Process

1.10.5.2 Public Hearing Format

The public hearings were organized to encourage public comments on the *Draft SSFL Area IV EIS* and provide members of the public with information about the NEPA process and the proposed actions. A court reporter was present at each hearing to record and prepare a transcript of the comments spoken publicly at the hearing. These transcripts are included in Section 3 of the CRD. Written comments were also collected at the hearings. Comment forms were available at the hearings for anyone wishing to use them.

At each of the public hearings, poster displays were staffed by DOE subject matter experts. Members of the public were invited to view the displays and ask questions of the subject matter experts prior to the formal hearings. The displays addressed the NEPA process and the alternatives included in the *Draft SSFL Area IV EIS*.

The DOE Site Manager for ETEC opened the hearings with welcoming remarks and a brief history of ETEC. The DOE Document Manager then provided an overview of the *Draft SSFL Area IV EIS* and the NEPA process. Following the overview presentation, a meeting facilitator opened the public comment session. To ensure that everyone interested in speaking had the opportunity, a time limit was established based on the number of people who indicated a desire to speak. As part of the comment response process, the transcripts and written comments collected at the hearings were reviewed for comments on the Draft EIS, as described above.

1.11 Changes Between the Draft and Final EISs

In preparing this *Final SSFL Area IV EIS*, DOE made revisions to the *Draft SSFL Area IV EIS* in response to comments received from other Federal agencies and State and local government entities; Native American tribes; and the public. In addition, DOE updated information due to events or the availability of information in other documents published since the Draft EIS was provided for public comment in January 2017. DOE also changed this Final EIS to provide more environmental baseline information, update project data, and revise consequence analyses, as well as to correct inaccuracies, make editorial corrections, and clarify text. Vertical change bars appear alongside such changes in Volumes 1 and 2 of this *Final SSFL Area IV EIS*. Editorial changes are not marked. The following summarizes changes made to the *Final SSFL Area IV EIS*.

Public Comment Period and Comments Received on the *Draft SSFL Area IV EIS*

Sections 1.10.5 and S.8.2 were added to the Final EIS in this chapter and the Summary, respectively, to describe the public comment period on the Draft EIS and the types of comment received.

Changes Made for the *Final SSFL Area IV EIS*

Sections 1.11 (this section) and S.9 were added to this chapter and the Summary, respectively, to identify changes made to the Draft EIS in preparing the Final EIS.

Additional Studies and Reports

Sections of this Final EIS were updated based on new reports, studies, and agreements that became available after publication of the Draft EIS. These reports include:

- *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2018a)
- *Draft Groundwater Corrective Measures Study, Area IV* (CDM Smith 2018c)
- Report on the results of groundwater pumping as an interim measure at the Former Sodium Disposal Facility (CDM Smith 2018b)

- Additional archaeological studies from 2015 (Corbett et al. 2015) and 2017 (CH2M Hill 2017)
- Results from the Bravo Bedrock Vapor Extraction Treatability Study (CH2M Hill 2015)
- U.S. Fish and Wildlife Service Biological Opinion for the Cleanup of Area IV of the Santa Susana Field Laboratory, Ventura County, California (see Appendix J)
- *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California* (DTSC 2017a)

Boeing Land Use Covenants

This Final EIS was revised to reflect the Grant Deeds of Conservation Easement and Agreement (Ventura County 2017a, 2017b) executed by Boeing and North American Land Trust, which restrict future land use of Boeing's property to open space, including the property that DOE is cleaning up. In April and November 2017, Boeing made legally binding commitments to conservation easements held by North American Land Trust that permanently preserve as open space habitat nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. In accordance with the easement, "the Property shall be managed and maintained in a manner such that any use of the Property must be consistent with preservation, protection, and maintenance in perpetuity of the Conservation Values of the Property…" Those conservation values are identified as significant natural, ecological, cultural, historic, aesthetic, educational, scientific, scenic, and open space values. The conservation easement is a legally enforceable document that, among other restrictions, forever prohibits residential, agricultural, or commercial development or uses of the site.

Updates to Alternatives

In response to comments on the Draft EIS regarding volume estimates, DOE re-evaluated the GIS and soil characterization data used in estimating the area and volume of soil subject to remediation. This resulted in a revised estimate of the total volume of soil estimated to exceed the AOC LUT values of 1,616,000 cubic yards compared to 1,413,000 cubic yards presented in the Draft EIS. The re-evaluation also resulted in a revised estimate of the volume of soil, following adjustments for soil that exceeds the AOC LUT value for TPH only and the areas in which the exemption process would be applied. The volume of soil to be removed under the Cleanup to AOC LUT Values Alternative following these adjustments is 881,000 cubic yards, compared to 933,000 cubic yards evaluated in the Draft EIS. Information regarding soil volume calculations is included in Appendix D.

To fully reflect future land use in accordance with the Boeing conservation easements described above, DOE modified the Conservation of Natural Resources Alternative to include two scenarios. The first scenario uses risk-based cleanup levels based on the exposure scenario as evaluated in the Draft EIS, which is an onsite resident with no garden. A second scenario was added to more accurately reflect the future open space use of the site; it establishes risk-based cleanup levels commensurate with exposure of an onsite recreational user. The soil remediation alternatives, including the two Conservation of Natural Resources scenarios, were also revised to account for removal of an area of mercury-contaminated soil[21] and to reflect risk-based protection of ecological resources.

[21] An area with mercury-contaminated soil would be removed under all alternatives, regardless of human health or ecological risk, to ensure that runoff from the area does not result in exceedances of stormwater discharge limits.

Substantial changes in the volume of soil requiring removal under the Conservation of Natural Resources Alternative resulted from the performance of additional risk assessments. The more extensive risk assessments resulted in reductions in the volumes of soil requiring removal for the identified exposure scenarios. In this Final EIS, the Conservation of Natural Resources, Residential Scenario would remove 52,000 cubic yards of soil. In the Draft EIS, this same scenario was estimated to remove 148,000 cubic yards of soil. A discussion of the basis for and the process that resulted in the reduced volumes is presented in Appendices D and K.

In the Draft EIS, the area and volume of soil that would be remediated in areas in which the exemption process would be applied were not quantified, but were expected to be a small increment. The additional risk assessment work combined with the re-evaluation of GIS and soil characterization data conducted in developing this Final EIS shows that about 4 acres would require cleanup in the areas in which the exemption process would be applied.

In response to comments and based on a construction-estimating evaluation (DOE 2018b), the level of operations and the daily number of trucks hauling Area IV soil and backfill was revised. Rather than 32 to 48 heavy-duty truck round trips per day, a lower number of 16 daily truck trips was used. This extended the planning-level schedule for completion from 10 to 26 years for the Cleanup to AOC LUT Values Alternative; from a little over 3 to 6 years for the Cleanup to Revised LUT Values Alternative; and from a little over 1 to less than 2 years for the Conservation of Natural Resources Alternative (both scenarios).

Use of Risk rather than Dose in Risk Assessments

In this Final EIS, the risk assessments performed for determining areas requiring remediation under the Conservation of Natural Resources Alternative (both scenarios) used the target risk range for alternatives of 1×10^{-6} to 1×10^{-4} (1 in 10,000 to 1 in 1 million) to evaluate cleanup of soil with radioactive constituents. Soil with radioactive constituents would be removed to ensure that the risk to an onsite user (either a hypothetical resident or recreational user) following remediation would not exceed the upper end of the risk range. This is different than the approach presented in the Draft EIS, which used 25 millirem per year plus ALARA for cleanup of radioactive constituents. Cleanup that results in cancer incidence that falls within the risk range would be well below the 25 millirem per year dose constraint of DOE Order 458.1.

Sensitivity Analyses

DOE added a sensitivity evaluation appendix (see Appendix L) to evaluate how uncertainties or possible changes would affect environmental consequences. In response to public comments, a sensitivity evaluation of the Cleanup to AOC LUT Values Alternative was added. The purpose of the evaluation, which assesses the potential impacts if all areas exceeding the AOC LUT values were excavated and removed from the site, was two-fold. It serves as a comparison point for commenters who believed that DOE's application of the 2010 AOC exemption process for protection of biological and cultural resources was overly broad and/or objected to use of natural attenuation to treat certain low-concentration contaminants. It also responds to commenters who suggested that DOE's volume estimates may be low for the Cleanup to AOC LUT Values Alternative.

Sensitivity evaluations were included for all soil remediation alternatives to evaluate the effects of events (e.g., funding constraints, weather events) that may result in remediation proceeding at a slower rate than anticipated under the base case analyses (that is, the soil remediation action alternatives evaluated in Chapter 4, Environmental Consequences). For these sensitivity evaluations, it was assumed that remediation would proceed at about half the rate as under the base cases, thereby essentially doubling the durations.

A sensitivity evaluation of the Building Removal Alternative was performed to evaluate the effects of accelerating building demolition activities. The sensitivity evaluation assumes that building demolition and removal of debris from the site would be completed in about a year's time, rather than the 2 to 3 years evaluated under the Building Removal Alternative.

Updated Alternative Concepts Considered but Dismissed from Detailed Study

Chapter 2, Section 2.2.3, Alternative Concepts Considered but Dismissed from Detailed Study, was revised to provide additional information regarding transportation options that were considered but not studied in detail. The revised Section 2.2.3 includes information based on the *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California* (DTSC 2017a). Transportation options considered include use of roads other than Woolsey Canyon Road for truck travel to and from SSFL; construction of overland conveyor systems to move soil to a truck or train loading station; and transporting contaminated soil as a slurry in a pipeline.

Preferred Alternative

At the time the Draft EIS was prepared, DOE did not have a preferred alternative. DOE has identified its preferred alternatives in Chapter 2, Section 2.7, of this Final EIS.

Updated Groundwater Characterization Information

DOE has completed additional groundwater investigations and reported the results in the *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2018a). Chapter 3, Section 3.4 of this Final EIS was updated with information from the draft remedial investigation report, including a reference to the detailed discussion of the site's geology, a summary of the conceptual site model of three-dimensional groundwater flow and contaminant migration at the site, updated information on the magnitude and extent of the existing groundwater contamination plumes in Area IV and the NBZ, and additional information on the impact of fine-grained units on the groundwater flow and contaminant migration. A figure was added to this Final EIS to show the current location of known groundwater seeps.

Updated Information on Groundwater Remedies

The *Draft Area IV RCRA Corrective Measures Study, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2018c) was completed after publication of the Draft EIS. This Final EIS incorporates additional groundwater remedies identified in the corrective measures study.

Stormwater Control Plan

DOE added information to this Final EIS in Chapter 4, Section 4.3.1, to describe the stormwater control plan that will be developed for soil remediation actions. The Final EIS notes that the stormwater control plan will incorporate all appropriate runoff control measures recommended by the Stormwater Expert Panel. This Final EIS also notes that the stormwater control plan will detail the potential configuration and design of the additional erosion control measures required by Mitigation Measure SW-2 to respond to any runoff from the site that exceeds the design capacity of the best management practices and National Pollutant Discharge Elimination System monitoring locations identified in Section 4.3.1, along with the avoidance measures identified by Mitigation Measure SW-1.

Protection of Biological Resources

Prior to and subsequent to issuance of the Draft EIS, DOE consulted with the U.S. Fish and Wildlife Service (USFWS), in compliance with the Federal Endangered Species Act (ESA) and the California Department of Fish and Wildlife (CDFW). The purpose of the consultation was to comply with regulatory requirements and identify ways to avoid potential impacts on rare, threatened, and endangered species and develop appropriate measures to mitigate or offset project–caused impacts on listed species populations and their essential habitats. As a result of DOE's analysis and this process, DOE identified proposed areas where the exemption process would be applied in the Draft EIS. The areas proposed for application of the exemption process in this Final EIS reflect a continuation of consultations with USFWS and CDFW, as well as input received in the public comments.

The 2010 AOC explicitly provides for exemptions to cleanup for impacts to species or habitat protected under the ESA. In addition to complying with the ESA, DOE has a responsibility to protect species and habitats in accordance with other laws and regulations. This Final EIS was revised to reflect completion of the consultation process with USFWS, which included DOE's preparation and submission of a biological assessment to USFWS, followed by USFWS issuing a biological opinion (see Appendix J); biological resources will be protected in accordance with the results of the biological opinion. Based on consultation with CDFW and comments from Ventura County, DOE also proposed areas in which the exemption process would be applied for protection of State-listed species, State-sensitive species, and sensitive habitats. The Final EIS was also revised to reflect that the SRAIP(s) prepared by DOE and approved by DTSC will reflect the final determination of cleanup areas.

Ecological Risks

In response to public comments on the Draft EIS, this Final EIS more quantitatively addresses ecological risk. Where appropriate, the Final EIS reflects cleanup levels that are based on both human health risks and ecological risks (see Appendix K).

Onsite Human Health Impacts

In response to comments, DOE added a quantitative evaluation of human health impacts to potential onsite post-remediation receptors for all alternatives. These post-remediation receptor scenarios include a recreational receptor and an onsite suburban resident (without a garden). The modeling results are included in Chapter 4, Section 4.9 of this Final EIS.

Offsite Human Health Impacts

Potential risks to the offsite public under all proposed alternatives were added to Chapter 4, Section 4.9, of this Final EIS. Impacts were evaluated both during remediation and post-remediation. Potential impacts were calculated for a recreational user and a suburban resident with a garden. A discussion of the potential cumulative impacts on human health for the offsite public was added to Chapter 5, Section 5.5.9, of this Final EIS.

Protection of Cultural Resources

Chapter 4, Section 4.11, of this Final EIS was revised to clearly address inadvertent discovery of cultural resources during cleanup activities and cleanup within exemption areas. Text was added to acknowledge the possibility of identifying previously unrecorded resources during soil removal and building demolition and to indicate that procedures in the National Historic Preservation Act, Section 106, programmatic agreement would be followed if such resources are discovered. The text was also revised to correct statements implying that cleanup would not occur in the areas in which the exemption process is applied. Cleanup would occur in the areas in which the exemption process is applied to remove chemicals or radionuclides that exceed risk-based cleanup criteria. These cleanups would be carefully planned and executed to minimize impacts on cultural resources.

Childcare Centers, Preschools, Parks, and Recreation Centers

In this Final EIS, DOE added the locations of childcare centers, preschools, parks, and recreation centers, in addition to schools, to its evaluation of truck traffic and potential adverse effects on children.

Revised Information for NASA and Boeing Activities

The soil volumes and other cumulative impacts information presented in Chapter 5, Table 5–1, of the Draft EIS were up to date at the time of its publication. Subsequent to release of the Draft EIS in January 2017, new information became available (Boeing 2017a; NASA 2017a). Therefore, the NASA and Boeing values in Table 5–1 were updated in this Final EIS to reflect the latest information.

Additional Laws, Regulations, Permits, and Agreements

Additional laws, regulations, permits, and agreements were added to Chapter 8 of this Final EIS including:

- Mandatory Commercial Organics Recycling (Assembly Bill Number 1826)
- U.S. Army Corp of Engineers, Clean Water Act Section 404 Permit
- California Department of Fish and Wildlife, Streambed Alteration Agreement
- Los Angeles Regional Water Quality Control Board, Section 401 Water Quality Certification
- Ventura County, Oak Tree Permit
- Access Agreement between DOE and Boeing dated December 20, 2013 (Boeing and DOE 2013)

Chapter 2
Alternatives

2.0 ALTERNATIVES

2.1 Introduction

This chapter of this *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final 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, this environmental impact statement (EIS) analyzes an alternative that would entail cleanup to meet the Look-Up Table (LUT) values for residual concentrations of chemicals and radionuclides in soil established in accordance with the 2010 *Administrative Order on Consent for Remedial Action* (2010 AOC) between DOE and the California Department of Toxic Substances Control (DTSC) (DTSC 2010a) (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 suitable replacement soil that meets the AOC LUT values. Consistent with National Environmental Policy Act (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 [a Residential Scenario and an Open Space Scenario in which the assumed receptor is a recreational user]). 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 action alternative is to demolish the 18 structures it owns in Area IV and transport the materials off site for disposition (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 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);[1] the Council on Environmental Quality's (CEQ) 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, as well as changes in circumstances, informed the development of the action alternatives analyzed in this EIS.

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1 *Order Granting Plaintiffs' Motion for Summary Judgment* (Case No. 3:04-CV-04448-SC, May 2, 2007).

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 (Santa Ynez Band of Chumash Indians 2014b), evaluated the complexities of implementing soil cleanup in accordance with the 2010 AOC, and adjusted to reflect commitments to future land use. 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 elements 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[2] 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). Input from stakeholders suggested strongly that DOE should analyze a full range of alternatives. Also, 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" (Santa Ynez Band of Chumash Indians 2014b). DOE 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.

Another event that affected the alternatives evaluated in this Final EIS was a change in circumstances that occurred after issuance of the *Draft SSFL Area IV EIS*. In 2017, The Boeing Company (Boeing) and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site. 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

[2] 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 (URS 2012) and radiological background levels (HGL 2011).

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 (that also demonstrates compliance with DOE's dose limit 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 and to comply with applicable Federal, State, and local laws and regulations. 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.

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, changed circumstances, 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 (with a Residential Scenario and an Open Space Scenario).

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 Potential 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, changed circumstances, 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, 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)[3] 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.[4] The AOC also allows DOE and DTSC to agree upon changes to better meet cleanup objectives. DOE expects that it will need to engage DTSC in discussions about such changes in order to implement any soil remediation alternative. In addition, DOE would conduct its remediation activities in compliance with other applicable laws, regulations, and orders (see Chapter 8). These include other environmental regulations such as those implementing the Federal Endangered Species Act, the Federal National Historic Preservation Act, and State and local requirements for protection of biological resources; safety regulations such as those addressing worker and public safety; and applicable Federal and California 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.

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

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[3] 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.

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

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 2012a, 2012b, 2012d, 2012e).[5] DOE's chemical characterization effort included a series of related, complimentary activities. DOE collected samples along with EPA at the locations EPA identified through its historical site assessment and gamma survey. DOE also sampled drainages and conducted random sampling of the NBZ in coordination with EPA. Finally, working with DTSC, DOE conducted a separate data gap analysis that reviewed site operations and chemical releases and identified additional locations that were sampled. The result of DOE's chemical characterization effort was the collection and chemical analysis of 5,854 samples. DTSC published the provisional AOC LUT values for radionuclides in January 2013 and the AOC LUT values for chemicals in June 2013.[6] These AOC LUT values are listed in Appendix D, Tables D–2 and D–3.

To meet revised regulatory requirements and commitments, adapt to changed circumstances, and 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 for a hypothetical suburban resident scenario and an open space scenario (exposure of a recreational user), 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 its 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 1.10. 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

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

[6] 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 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).

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 risk-based methodologies 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). In addition to evaluating a risk-based cleanup scenario based on a hypothetical future resident (Conservation of Natural Resources – Residential Scenario), in this Final EIS DOE included a risk-based scenario that is consistent with the 2017 conservation easements recorded with Ventura County (Ventura County 2017a, 2017b) that ensure that Area IV and the NBZ will exist only as open space following cleanup (Conservation of Natural Resources – Open Space Scenario).

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 includes 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 (NIDIS 2018). California's Governor Brown signed legislation in May 2018 that strengthens the State's water resiliency in the face of future droughts with provisions that include: (1) establishing an indoor, per person water use goal of 55 gallons per day until 2025, 52.5 gallons from 2025 to 2030, and 50 gallons beginning in 2030; (2) creating incentives for water suppliers to recycle water; and (3) requiring both urban and agricultural water suppliers to set annual water budgets and prepare for drought (State of California 2018).

DOE also included a separate Protect Native American Interests criterion. The Santa Ynez Band of Chumash Indians has identified the entire SSFL as a Native American sacred place (referred to herein as the Santa Susana Sacred Site and 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), and also notified DOE of its identification of a portion of SSFL as an Indian sacred site for consideration consistent with Executive Order 13007, *Indian Sacred Sites*. Since that time there have been additional activities related to recognizing SSFL's special significance to Native Americans and these efforts may result in the designation of one or more NRHP-eligible traditional cultural properties. DOE is consulting with the State Historic Preservation Officer (SHPO), the federally recognized Santa Ynez Band of Chumash Indians, the Indigenous Community Representatives,[7] and other consulting parties to develop a programmatic agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for listing on the NRHP.

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 K 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. Although DOE does not own the land, this goal is consistent with the 2017 conservation easements

[7] At the time the *Draft SSFL Area IV EIS* was prepared, DOE interacted with and received input from the Santa Susana Field Laboratory Sacred Sites Council (SSFL Sacred Sites Council), an organization established by a group of Native Americans with ancestral ties to SSFL land. The organization comprised representatives from the Chumash, Fernandeño Tataviam, and Gabrielino/Tongva tribes, including the federally recognized Santa Ynez Band of Chumash Indians, as well as other interested tribes that are not federally recognized. When DOE began consultation to prepare the programmatic agreement, a new group of Native Americans, including some of the same individuals from the SSFL Sacred Sites Council, was convened. The group asked to be referred to as the Indigenous Community Representatives and includes representatives from the Santa Ynez Band of Chumash Indians; Barbareño/Ventureño Band of Mission Indians; Fernandeño Tataviam Band of Mission Indians; Gabrieleno Tongva Tribe; Kizh Gabrielino Band of Mission Indians; and Tongva Ancestral Territorial Tribal Nation.

for the Boeing property at SSFL, which includes Area IV and the NBZ (Ventura County 2017a, 2017b).

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.

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. Before cleanup can begin, DOE needs to issue this Final EIS and a Record of Decision (ROD) and DTSC needs to issue a final California Environmental Quality Act (CEQA) program environmental impact report (EIR).[8] DOE 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. Additionally, DOE must obtain regulatory approval of documents required by the 2010 AOC (for example, a soil remediation plan, called a Soils Remedial Action Implementation Plan [SRAIP] in the 2010 AOC). These documents and decisions apply to all of the soil action alternatives DOE evaluated in this EIS. In June 2017, DOE submitted a letter to DTSC documenting the mutually acknowledged situation that cleanup cannot proceed until the required environmental documents are completed and that DOE was therefore unable to meet the 2017 cleanup expectations as described in the 2010 AOC (DOE 2017a).

[8] 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* was issued for review on September 7, 2017.

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	The 2010 AOC called for a schedule to be included in the Soil Remedial Action Implementation Plan that ensured soil cleanup was completed by 2017.	Prior to commencing cleanup, several regulatory actions must be completed: DOE must complete NEPA activities, including issuing a ROD; DTSC must complete CEQA activities and issue its Findings; DOE must prepare and DTSC must approve a Soil Remedial Action Implementation Plan. This alternative concept was dismissed because these regulatory actions were not completed as of the 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 included in its *Draft Program EIR* a transportation study that that evaluated alternative means of transporting debris and soil from SSFL. DOE evaluated the study and agreed with DTSC's analysis and conclusion that the Woolsey Canyon Road truck route is the most feasible and has the fewest adverse environmental effects. A summary of the DTSC study is presented in Section 2.2.4.
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 consistent with Boeing's intended future land use of undeveloped open space as provided for in its conservation easements (Ventura County 2017a, 2017b).
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 than 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 as established in conservation easements (Ventura County 2017a, 2017b). DOE assumed cleanup levels based on a hypothetical suburban residential land use scenario and an open space scenario.[a]
No Action (Abandon Area IV)	Proposed in the 2008 NOI. Cessation of all DOE management and oversight of SSFL Area IV.	DOE determined that for each of its activities (soil remediation, building removal, and groundwater remediation), a 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 a risk assessment for both chemicals and radionuclides. For this alternative, DOE evaluated a hypothetical suburban residential scenario and an open space scenario as potential future land uses. Other future land uses were not evaluated because they are prohibited by the Boeing conservation easements.[a]

Alternative Concept	*Alternative Description*	*Reason(s) for Dismissal*
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.	Neither of these concepts is sufficiently developed to be considered in this EIS. Commercial development or uses of Boeing-owned land (which includes Area IV and the NBZ) is prohibited in the conservation easements.[a]
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 881,000 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 onsite treatment of the water 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 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] Boeing and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements (conservation easements) with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space the land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements are legally enforceable documents that forever prohibit residential, agricultural, or commercial development or uses of the site. Although Boeing's intended future land use is undeveloped open space, the human health impacts analysis in this EIS includes a hypothetical onsite suburban residential scenario (in addition to an open space 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 the conservation easements restrict future land use and prohibit residential, agricultural, or commercial development or use (Ventura County 2017a, 2017b), DOE did not include the indirect garden pathway of ingestion of homegrown fruits and vegetables in the analysis of a hypothetical onsite suburban residential receptor.

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 truck loading site or railroad siding;
- developing intermodal transport strategies for waste containing radioactive constituents above LUT values, such as (1) truck to train or (2) truck to ship, followed by shipment through the Panama Canal to Texas, then truck transport to a disposal facility in Texas;
- 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 its draft *Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California* (*Draft Program EIR*) for the entire SSFL, DTSC conducted a transportation study that evaluated alternative means of transporting debris and soil from SSFL.[9] 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 used this information in the development of its transportation study for its *Draft Program EIR*. The *Draft Program EIR* concluded that the "environmentally superior alternative" (pursuant to CEQA Guidelines section 15126.6(e)(2)) that meets the needs of the project objectives includes the transportation of removed soils from SSFL and backfill to SSFL by truck using Woolsey Canyon Road. Appendix J of the *Draft Program EIR* concluded that this route had the "fewest adverse environment effects."

DOE reviewed the DTSC analysis of alternative transportation routes and modes as presented in the *Draft Program EIR* and generally agrees with the results and conclusions of the screening analysis and the analysis of the two scenarios that were evaluated in detail.

The *Draft Program EIR* considered, but rejected, two alternatives for transporting contaminated soil off site that DOE had not previously identified in this *SSFL Area IV EIS* – the Slurry Pipe

[9] The Draft Santa Susana Field Laboratory Project Transportation Feasibility Analysis was included as Appendix J in the *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California* (DTSC 2017a).

Alternative and a Super Scooper Alternative. The Slurry Pipe Alternative would use a pipeline to move a mixture of soil and water from the site to an offsite transfer location for shipment to a disposal site. While not specifically addressed in this *SSFL Area IV EIS*, this concept fits the general category of alternative mode transportation-related concepts. The slurry pipeline concept is more complex than other conveyor alternatives. In addition to the construction of a slurry pipeline, this alternative would require the construction of a facility to mix the soil with water and a facility that could transfer the slurry at a rail or truck transfer station. Additionally, the Slurry Pipe Alternative would be expected to generate more wastes and different types of waste (i.e., semi-solids and contaminated water) than other transport concepts that would require safe management and disposal. These technical issues are not offset by any discernable advantages of the Slurry Pipe Alternative over other conveyance systems.

The Super Scooper Alternative would use an airplane to pick up dirt as it flies over the site. This concept is commonly associated with fighting wildfires where an airplane loads water as it skims the surface of a water body. NEPA requires that an EIS consider reasonable alternatives to a proposed action. DOE agrees with the analysis in the *Draft Program EIR* that this is not a reasonable alternative as it there is no known application of this process for collecting soil.

DOE concurs with DTSC's conclusions regarding the two alternatives that were analyzed in *Draft Program EIR*. The alternatives were the Reduced Truck Trip Scenario and Conveyor Transport, which included two options: Edison Road Overland Conveyor to Truck Route Option and North American Cutoff Road Overland Conveyor to Rail Route Option.

The DTSC Reduced Truck Trip Scenario analyzed in the *Draft Program EIR* would limit the number of truck trips per day to 48, reduced from 96, for all remediation activities by Boeing, DOE, and NASA. With respect to DOE's proposed action in this Final EIS, DOE assumes a lower number of daily truck trips (an average of 16 and maximum of 32)[10] based on an assessment of how much soil could safely be excavated and loaded within the Area IV and NBZ remediation areas (note that DOE's change in daily truck trips was only for the DOE action). DOE's assessment of a lower number of daily truck trips as part of any action alternative was similar to the assessment of DTSC's Reduced Truck Trip Scenario in the *Draft Program EIR*. The lower number of daily truck trips would reduce the daily and annual risks and other environmental impacts; however, the overall risks or impacts determined for an alternative would remain essentially the same, but be spread out over a longer period of time.

The two options of the DTSC Conveyor System Scenarios would replace the truck transport of soil from SSFL with transport by conveyor systems (under both options soil would be transported by truck until the conveyor systems were constructed). With respect to DOE's alternative assessment, in this *Final SSFL Area IV EIS*, these two options are consistent with the alternative transport systems DOE assessed and dismissed from further analysis. The two conveyor system options analyzed in the *Draft Program EIR* would require the construction of the conveyor systems. Additionally, the Edison Road Overland Conveyor to Truck Route Option would require a to-be-constructed truck loading site located near the intersection of Guardian Street and Tapo Canyon Road in Simi Valley. The North American Cutoff Road Overland Conveyor to Rail Route Option

[10] In DOE's *Draft SSFL Area IV EIS*, DOE assumed that it would fully use its allotment in accordance with the *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 2015a) and make 32 daily truck round trips for the first 2 years of the project and an average of 48 daily round trips thereafter. Based on an evaluation of the rate of excavation and disposal of soil by DOE's Environmental Management Consolidated Business Center (DOE 2018b), DOE revised the estimated average number of daily truck round trips to 16 in this Final EIS. DOE also recognized that the daily number of truck round trips could occasionally exceed 16, but would not exceed 32.

would require the construction of a new rail-car loading facility to be located near the east end of Smith Road in Simi Valley.[11] DOE believes that the time required to study, design, secure rights-of-way, perform environmental analysis, obtain permits, and construct such large infrastructure projects would delay availability of a conveyor system relative to the availability of other options.

A summary of DTSC's *Draft Program EIR* analysis of transportation alternatives is presented in Section 2.2.4

Ultimate Land Use of Area IV after Cleanup

Members of the public made many suggestions regarding the ultimate use of Area IV. 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, a variety of the community concepts concerning the ultimate use of the land are not included as part of the alternatives. Boeing, the landowner, and North American Land Trust recorded two conservation easements with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space habitat nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site. 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 Conservation of Natural Resources Alternative scenarios evaluated in this EIS are based on a risk assessment approach that would render the site safe for future use as open space. One scenario is a Residential Scenario that evaluates potential impacts 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. The other scenario is an Open Space Scenario that uses a recreational user scenario that more accurately reflects the future land use in accordance with the conservation easements.

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 the 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

[11] The *Draft Program EIR* assumed that for the 4 years required to construct the conveyor system, soil would be transported from the site by trucks via Woolsey Canyon Road. The *Draft Program EIR* also assumed that throughout the remediation effort backfill would be transported to SSFL by truck.

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 the Resource Conservation and Recovery Act (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 881,000 cubic yards of soil proposed for removal 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 revised LUT values for chemical constituents, or that use a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) risk assessment approach to evaluate cleanup levels for a suburban residential land use scenario or an onsite recreational user scenario. Consistent with the Boeing and North American Land Trust conservation easements (Ventura County 2017a, 2017b) that establish legally enforceable land use restrictions that prohibit use of the site for residential, agricultural, or commercial purposes, other land uses were not evaluated.

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 initially determined that the 2008 NOI alternatives were not feasible and eliminated them from detailed study in the draft EIS (with the exception of a No Action Alternative with continued monitoring and security). Consistent with the provisions of the Boeing conservation easements and agreements, this Final EIS includes an alternative largely consistent with the Offsite Disposal of SSFL Area IV Material that was proposed in the 2008 NOI. The 2008 NOI alternatives are presented below, and where appropriate, 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 for each action – soil remediation, building demolition, and groundwater remediation – in which no cleanup would occur, but security of the site would continue (see 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 for each cleanup activity 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 associated with future land use as discussed above under Cleanup Based on Different Land Use Scenarios. As discussed in that prior section, other future land uses (e.g., residential, agricultural or commercial) were not evaluated because they are prohibited by the conservation easements (Ventura County 2017a, 2017b). Waste disposal under all alternatives evaluated in this EIS would be at offsite facilities as was proposed for this alternative.

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 approved out-of-state disposal facilities. 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.

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. Interest was also expressed in possible use of the former Sodium Pump Test Facility (Buildings 4462 and 4463) for commercial purposes. Neither of these proposals is sufficiently developed to be considered in this EIS. With respect to the second proposal, as discussed in Section 2.1, the conservation easements prohibit the commercial development or use of the site (Ventura County 2017a, 2017b).

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[12] and natural and enhanced attenuation.[13] 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 soils exceeding the AOC LUT value for total petroleum hydrocarbons (TPH)[14] and soils with noncarcinogenic polycyclic aromatic hydrocarbons (PAHs).[15] 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 action 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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12 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.

13 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.

14 Constituents that are reported as TPH include natural organic material from plant sources (Nelson et al. 2015d). Consequently, there will be a continuing source of chemicals that are detected as TPH in the soil using normal laboratory methods.

15 In the Draft EIS, soils with TPH and PAH were discussed together because DOE proposed that both would be treated through natural attenuation. Through more detailed analysis of sampling data, TPH was identified as the only constituent exceeding its AOC LUT value over large areas of Area IV and the NBZ (54 acres), resulting in an increase in the volume of TPH soil from 150,000 cubic yards to 620,000 cubic yards (see Appendix D). A much smaller portion of Area IV and the NBZ contain noncarcinogenic species of PAH. In this Final EIS, the focus of the discussion and analysis is therefore on the large areas where TPH exceeds its AOC LUT value; however, DOE proposes that the noncarcinogenic PAH would also be managed by natural attenuation.

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 881,000 cubic yards were subject to soil washing, assuming three treatment systems were working continuously, it would take approximately 34 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; require establishment of a water treatment capability on site or the offsite transport of wash water; take longer than the longest alternative considered in this EIS (i.e., 26 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 (in the form of landfarming) were eliminated from further evaluation in this EIS; DOE has incorporated bioremediation in the form of monitored natural attenuation into its plans for remediation of Area IV and the NBZ.

2.2.4 Alternative Transportation Concepts Considered by DTSC in the Draft Program Environmental Impact Report

In the *Draft Program EIR* (DTSC 2017a), DTSC addressed the issue of alternative means of removing contaminated media associated with the SSFL cleanup by all three entities (DOE, NASA, and Boeing). DOE is incorporating the DTSC analysis by reference in this *SSFL Area IV EIS*. Appendix J, "Draft Santa Susana Field Laboratory Project Transportation Feasibility Analysis," of the *Draft Program EIR* considered construction of new roads and the use of alternative transportation modes, primarily conveyor systems, to transport soil to either a new truck loading facility or a new rail depot. Subsequent to evaluating and screening alternative transportation routes and modes in Appendix J, DTSC included analyses of two of them as transportation alternatives to the *Draft Program EIR* proposed project. The *Draft Program EIR* analysis concluded that transporting soil by truck using the Woolsey Canyon Road was the most technically feasible and least environmentally impactful option for the transport of soil from SSFL and backfill to SSFL. The following sections summarize the DTSC analyses and conclusions from the transportation feasibility study and the *Draft Program EIR* analysis of alternate routes and modes of transportation.

2.2.4.1 Transportation Alternatives Considered but Rejected from Analysis in the *Draft Program EIR*

Table 2–2 provides a summary of alternative transportation routes and modes and the reason DTSC rejected each from analysis in the *Draft Program EIR*. Among the reasons DTSC cited for eliminating alternatives were "proximity of residential areas, presence of public or private roadway connections as part of the route, presence of private reserve lands, and the ability of public roadways within each route to generally handle large trucks;" various reasons that they are not feasible; and/or potential impacts compared to other transportation routes evaluated.

Table 2–2 Transportation Alternatives Considered but Eliminated from Analysis in the *Draft Program EIR*

Alternative	*Alternative Description*	*DTSC Reason(s) for Rejection from Analysis*
Alternate Haul Routes (Draft Program EIR Section 6.2.4.1, Table 6-1)	*Each of the options considered for this alternative would use roads other than Woolsey Canyon Road for transporting waste by truck from the site to a major roadway and backfill to the site.*	
Montgomery Fire Road	Two routes that use the Montgomery Fire Roads extending from the western edge of SSFL and 1) northwest connecting to SR 118 or 2) west connecting to SR 23.	These alternative routes would have some of the longest lengths of new roadway over current unpaved access roads and public/private lands. These routes would not connect to a rail transfer sites. Therefore, they were eliminated from further analysis.
Runkle Haul Road	A route extending from the western edge of the SSFL site going generally north using Runkle Haul Road and Sequoia Ave. connecting to the public roadway within a residential area on Sequoia Ave.	The presence of existing and future residential areas directly adjacent to the route and an increased number of miles on public roads, including those within residential areas, made this route less preferred than others.
Arness Fire Road	A route extending from the western edge of the SSFL going generally north, using the Arness Fire Road (located slightly east of Runkle Haul Road) connecting to the public roadway on Pepper Tree Lane.	This corridor would have a northern connection with public roadways adjacent to an active youth camp. The route would parallel the campsite and would exit onto public roadways near the campsite. This route was eliminated from further analysis because of its direct proximity to the youth camp.
Black Canyon Road	A route extending from the northeast boundary of the SSFL following Black Canyon Road to the north to SR 118.	This route would use a very curvy road thorough mountainous, hilly terrain rendering long-term truck movement over this roadway infeasible.
Bell Canyon Road	A route extending from the south boundary of SSFL using Bell Canyon Road and connecting to Valley Circle boulevard or Topanga Canyon Boulevard and subsequently to SR 101 or SR 118 southeast of SSFL.	A sizeable proportion of this route would be via a private, gated neighborhood. Long-term truck hauling would not be feasible via this route.
Alternative Transportation Methods (*Draft Program EIR* Section 6.2.4.2, Table 6-2)	*Each of the options considered for this alternative would use alternative conveyances to move soil from the site to a highway or rail depot.*	
Bi-Modal Canister	The use of a shipping container that can be transferred directly from a truck onto a train.	This option would not eliminate or reduce the number of trucks accessing local roadways and would not reduce local air emissions or traffic volumes in residential areas. Thus, this option was eliminated from further analysis.
Helicopter/Air Lift/ Cargo Plane/Blimp	The use of aircraft to move soil offsite to a transfer depot	Aerial transport would not be feasible due to the logistics of loading and offloading aircraft as well as cost of air travel.
Slurry Pipe	Mixing contaminated soil with water and transporting the resulting mixture to a transfer depot through a pipe	Determined to be infeasible due to logistics of mixing contaminated soil with water and creating, managing and disposing of contaminated water.
Truck to Rail	The use of trucks on Woolsey Canyon Road to transport soil to a rail depot	This option would not eliminate or reduce the number of trucks accessing local roadways and would not reduce local air emissions or traffic volumes in residential areas. Thus, this option was eliminated from further analysis.
Tunnel	Construction of a tunnel connecting the site to a truck depot	Construction would involve significant ground disturbance and costs and has the potential to cause significant environmental impacts. This option would also not reduce potentially significant impacts of the proposed project. Therefore, this option was eliminated from further analysis

Alternative	Alternative Description	DTSC Reason(s) for Rejection from Analysis
Natural gas or non-diesel trucks	Replace diesel powered trucks with either gas powered or all electric vehicles	While alternative fuels and associated alternative-fueled equipment are available, such fuels and equipment are not feasible for implementation for this project. Natural gas is available in sufficient quantities, but the equipment available is currently limited to a few manufacturers or still in the prototype stage. Therefore, there is insufficient availability of natural gas fueled trucks for hauling materials from the SSFL site to appropriate receiver facilities. Electric engines were considered. However, due to the daily relocation of equipment throughout the SSFL site and the need for trucks to travel long distances away from the SSFL site; lack of charging stations in proximity to daily cleanup locations; and downtime for recharging; electric equipment was determined to not be feasible.
Rail-Veyor	Use of a compact autonomous train system that operates on its own elevated track that would follow local topography	This method is not considered to be feasible because of the need to establish curving track on significant vertical grades present in the vicinity of the SSFL site, and the limited capacity that could be provided due to the non-continuous flow operation (via single-trains running on single tracks) unlike what a conventional ground-based conveyor could provide.
Barges	Use of a barge to transport soil	The use of a barge would not be feasible due to lack of access to waterways at or near the SSFL site.
Conveyor to truck	Use of a conveyor system to transport soil to an offsite truck depot	The alternatives analysis considers the use of a conveyor system that unloads onto a rail yard where material could be shipped to a disposal facility by rail. The conveyor [to rail] option selected for further analysis would result in potentially fewer impacts than the conveyor to truck option. Therefore, this option was eliminated from further analysis. [a]
Rail from project site	Construct a rail spur to SSFL for the purpose of rail transport directly from the site	It would not be feasible to locate a rail transfer facility on the SSFL site due to the significant vertical grades present in the vicinity of the site. Also this option would have limited capacity due to the non-continuous flow operation (via single-trains running on single tracks); unlike what a conventional ground-based conveyor could provide.
Sky-way or aerial tram	Use an overhead cable system to transport containers of waste to an offsite truck or rail loading location	The use of a sky-way or aerial tram that would unload in an offsite area would reduce truck trips in residential areas. However, the alternatives analysis considers the use of a conveyor system that unloads onto a rail yard where material could be shipped to a disposal facility by rail. The conveyor option selected for further analysis would result in potentially fewer impacts because the aerial tram option would result in significant airspace penetration. In addition, an aerial tramway may not be allowed under existing zoning in the vicinity of the project site due to local structural height restrictions. Therefore, this option was eliminated from further analysis.
Truck and container option (i.e., truck to rail)	Use of a container that can be transferred from a transport truck to a rail car	This option is similar to the Bi-Modal Canister option described above and is not considered for further analysis, because it would require use of existing roadways to haul contaminated soil to a rail yard. This option would not avoid adding vehicle traffic to local residential roads.
Super scooper	Use of an airplane to load soil into its payload while in flight	Super scoopers can load water into the payload area as it skims a water body for use in fighting wildfires. There are no known uses of this method for soil transport. Therefore, this option is considered infeasible.

DTSC = Department of Toxic Substances Control; EIR = environmental impact report; SR = State Route.

[a] Although the *Draft Program EIR* identified this option as rejected from analysis, Alternative 4a (Edison Road Overland Conveyor to Truck Route) was included in the EIR analysis.

Source: DTSC 2017a.

2.2.4.2 Transportation Alternatives Analyzed in the *Draft Program EIR*

The *Draft Program EIR* carried two transportation scenarios forward from the Appendix J feasibility study for evaluation as alternatives to the proposed project. These alternatives were identified as capable of feasibly meeting most of the project objectives with the potential to substantially reduce significant effects of the proposed project; the proposed project transportation action being the shipment of removed soil and backfill by trucks via Woolsey Canyon Road. These two transportation alternatives were analyzed in sufficient detail to assess whether the environmental impacts would be less than, the same, or more than those of the proposed project. They are:

1. Reduced Truck Trip Scenario, and
2. Conveyor System, with two options:
   Edison Road Overland Conveyor to Truck Route, and
   North American Cutoff Road Overland Conveyor to Rail Route.

The *Draft Program EIR*-analyzed Reduced Truck Trip Scenario would limit the number of daily truck trips to 48 (instead of the baseline 96 daily trips), for the combined remediation activities of Boeing, NASA, and DOE, resulting in lower daily impacts from traffic, but extending the project duration. The *Draft Program EIR* estimated that adopting this scenario would extend the remediation schedule by 6 years. All other aspects of the project would remain the same. Table 6.3 of the *Draft Program EIR* provides a comparison by impact area between this scenario and the proposed project. Potential benefits to lowering the daily truck traffic would be lower impacts associated with daily traffic and lower impacts due to daily air pollutant and greenhouse gas emissions. However, the *Draft Program EIR* indicated that in all other impact areas this alternative would have similar or greater impacts compared to the proposed project due to the increase in the duration of cleanup operations. This alternative would use the same route as the proposed project, Woolsey Canyon Road, as the route to and from SSFL.

The Conveyor System Alternative included two options, referred to as the Edison Road Overland Conveyor to Truck Route (Edison Road Conveyor) Option and the North American Cutoff Road Overland Conveyor to Rail Route (North American Cutoff Road Conveyor) Option. The Edison Road Conveyor would be constructed along Edison Road, a private road along a Southern California Edison right of way, starting at the western end of the SSFL site to a to-be-constructed truck loading site located near the intersection of Guardian Street and Tapo Canyon Road in Simi Valley. DTSC selected this alternative for analysis over other transportation alternatives primarily because the route from the site to the transfer station would provide relatively direct access to a location where a truck loading area could be constructed and it would follow the route of an existing road (used by Southern California Edison for inspection and maintenance of a transmission line along the roadway) where the land is already disturbed.

The North American Cutoff Road Conveyor would consist of a conveyor system extending from the northeastern boundary of the SSFL site to a new rail car loading facility to be located near the east end of Smith Road in Simi Valley. DTSC selected this conveyor alternative for analysis because (1) the corridor would terminate at a rail site where a transfer station could be constructed, (2) the route would follow an existing roadway, (3) there would be a relatively short (3.1 miles) conveying distance, (4) the route would avoid industrial and residential areas, and (5) terrain is acceptable for a conveyor system.

Both of these alternatives were evaluated with the assumption that the project start date would not be delayed (compared to a proposed activity start date) to allow for construction of the conveyor system and initially all transportation of material from the site would be by truck. Construction of the conveyor systems was assumed to require 4 years.[16, 17] Once operational, the conveyor systems would be used only for soil removal; backfill would continue to be transported to SSFL by truck.

In its analysis of these two transportation options, the *Draft Program EIR* indicated that the alternatives did have the potential to reduce impacts in some areas (traffic related impacts, noise, air quality exposure of sensitive receptors, some aspects of transporting hazardous waste [accidents, proximity to schools, emergency response plan]). However, DTSC concludes that for a majority of the impact areas assessed, the impacts were similar or greater than those associated with the proposed project (*Draft Program EIR*, Table 6–3). DTSC notes in the *Draft Program EIR* that the Transportation Feasibility Study (Appendix J of the *Draft Program EIR*) shows that "transporting soil by truck via Woolsey Canyon Road was the most technically feasible and least environmentally impactful option" for the transport of soil from SSFL and backfill to SSFL.

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 to 3 years of the project, with soil remediation starting towards the end of building removal activities. 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 90 acres of land would be disturbed and 881,000 cubic yards of soil would be removed and disposed of off site (see Table 2–5 in Section 2.4.4). Up to 25 workers would be involved with soil removal activities at any one time, not including truck drivers hauling soil off site. Approximately 57,500 heavy-duty truck round trips over 26 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

[16] The *Draft Program EIR* assumed that for the 4 years required for construction of the conveyor system, soil would be carried from the site by trucks via Woolsey Canyon Road. The *Draft Program EIR* also assumed that throughout the remediation effort backfill would be transported by truck via Woolsey Canyon Road.

[17] DOE does not believe that completing all of the actions required to construct any conveyor system is attainable in 4 years. In addition to time for necessary studies, design, and construction, there could be a significant amount of time committed to gaining access to the land (ownership or right-of way), as well as extensive permitting and other environmental compliance activities.

well as to ensure restoration activities and/or onsite treatment methods are effective. As many as 43,100 heavy-duty truck round trips would be needed to bring backfill to the site (see Table 2–6 in Section 2.4.4). There would also be about 52 miscellaneous heavy-duty truck round trips (e.g., for delivering and removing soil remediation equipment).

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 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 1,616,000 cubic yards of soil does not meet the chemical or provisional radiological AOC LUT values (see Table 2–3) (see Appendix D).[18] 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 2012b). The estimated volume of soil requiring remediation was adjusted, as described below, to account for soil with low concentrations of constituents detected as TPH[19] that are naturally occurring or would be treated on site by monitored natural attenuation and areas in which an exemption process would be applied for the protection of biological and cultural resources.

Based on soil treatability studies, it was concluded that some of the soil characterized as exceeding TPH contains naturally occurring organic material and that accurately detecting TPHs at low concentrations is problematic. Both of these factors make concentrations of TPH appear higher than those attributable to petroleum-based origins (Nelson et al. 2015d; DTSC 2018a). Soil treatability studies also concluded 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). These studies led DOE to conclude that natural attenuation will be able to reduce TPH concentrations adequately given sufficient time (CDM Smith 2015b; Nelson et al. 2015a). In its soil remediation plan submitted to DTSC for approval, DOE would propose use of onsite treatment (as allowed under the 2010 AOC) through monitored natural attenuation processes for low concentration TPH soil. The estimated volume of soil at locations with only TPH contamination is 620,000 cubic yards. This is an increase in the volume estimated for this soil type compared to that estimated in the Draft EIS (150,000 cubic yards). The increase is the result of two factors as discussed in Appendix D – additional analysis of available sampling data provide better delineation and separation of areas with only TPH, and the current estimate includes TPH-only soils in areas in which the exemption process would be applied whereas the earlier estimate did not. Natural attenuation for this soil was assumed under all soil remediation alternatives; however, because there are natural sources (decaying organic matter) of chemical constituents detected as TPH (Nelson et al. 2015d), they are always being replaced and will never completely disappear.

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[18] In the Draft EIS, DOE estimated 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; the estimated volume that was the basis for analysis was 1,414,000 cubic yards. Based on additional evaluation and more detailed analysis of the sampling data using geographic information system analysis, DOE has refined its estimate of the volume of soil that exceeds AOC LUT values to 1,616,000 cubic yards (see Appendix D). To account for uncertainty associated with estimating the soil volume from sampling data and to ensure that the soil volume estimate bounds what would actually be removed, the volume estimate was increased by a factor of 20 percent.

[19] As used in this EIS, low concentrations are considered to be concentrations in soil that do not pose a threat to groundwater and therefore could be treated through natural attenuation. DOE included all soil in which chemicals detected as TPH were the only constituents above AOC LUT values in the estimated volume that would be left on site and believes that most of this soil would be appropriate for natural attenuation.

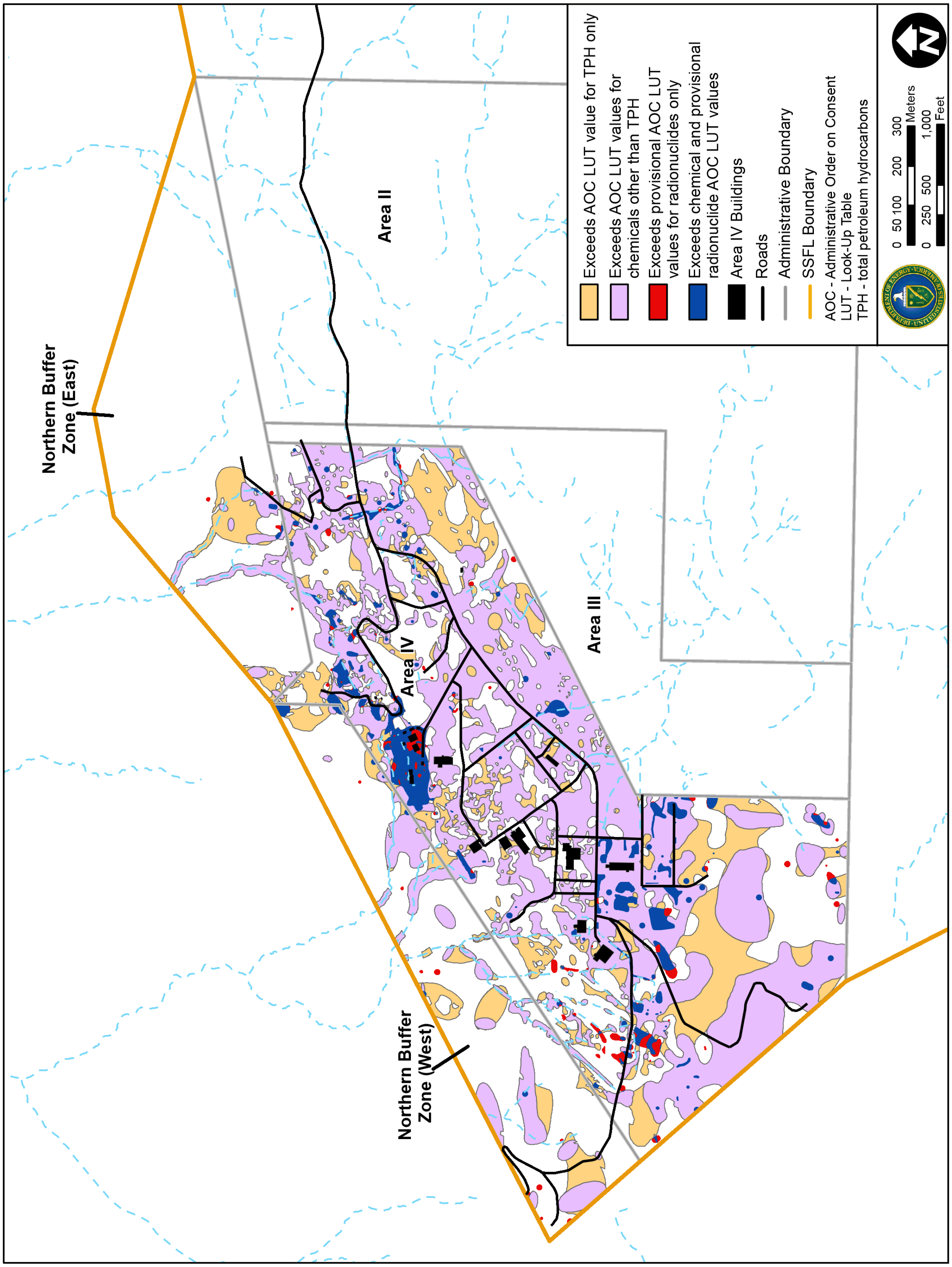

Figure 2–1 Extent of Chemical and Radiological Constituents Above AOC Look-Up Table Values

The 2010 AOC (DTSC 2010a) provides for exemptions to protect biological resources in accordance with the Endangered Species Act and "Native American artifacts that are formally recognized as Cultural Resources." In addition to explicitly recognizing the ESA, the 2010 AOC also acknowledges that DOE must comply with applicable local, State, and Federal laws and regulations. As a means of complying with other applicable laws and regulations related to protection of biological and cultural resources, DOE proposes application of the exemption process in additional locations in Area IV and the NBZ that include sensitive species and habitats protected under State and local regulations.

DOE consulted informally with the U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Wildlife (CDFW), DTSC, and others starting 2009 (see Appendix E) regarding protection of biological resources at SSFL. Informal consultation guided biological surveys at SSFL and led to the development of a biological assessment. DOE initiated formal consultation with USFWS in 2018 in compliance with Section 7 of the ESA, which resulted in issuance of a USFWS biological opinion (see Appendix J) that defined an area in which the exemption process would be applied and establishes requirements for preservation of federally protected species in Area IV and the NBZ.

DOE's biological surveys also identified plant and wildlife species that have the potential to occur in Area IV or the NBZ and that have threatened, endangered, or rare status under the California Endangered Species Act (including listed, proposed, and candidate species); are protected under the California Native Plant Protection Act, the Ventura County list of locally sensitive species, and the Bald and Golden Eagle Protection Act; or are classified as California Fully Protected Species or California Species of Special Concern. To comply with the laws and regulations for protecting these species, DOE proposes additional areas in which the exemption process would be applied. In addition to identifying areas within which the exemption process would be applied, potential suitable habitat for two federally listed species has been identified in Area IV or the NBZ. Neither species has been documented recently (within the last 5 years) on Area IV or the NBZ, but due to the possible long duration of the proposed project, habitat conditions may change and these species may use the site at some point during project implementation. As a result potentially suitable habitat for these species has been identified and mapped (see Chapter 3, Section 3.5), but not included in the currently identified areas subject to the exemption process. If the areas identified as potential suitable habitat are occupied by federally listed species in the future, DOE would propose that the areas also be subject to the exemption process.

DOE is also consulting with the California SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a programmatic agreement in accordance with NHPA, Section 106 that provides for the identification and evaluation of historic properties, determination of adverse effects on historic properties, and consultation concerning measures (e.g., avoid, minimize, or mitigate) to resolve any adverse effects on historic properties for the duration of the remediation process. Consultation regarding cultural resources is also 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 determined by SHPO as eligible for the NRHP or the *California Register of Historic Places* would be protected in accordance with the programmatic agreement.

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 locations proposed for application of the exemption process for protection of biological and cultural resources. To protect cultural resources in Area IV and the NBZ, their locations are not explicitly identified in Figure 2–2.

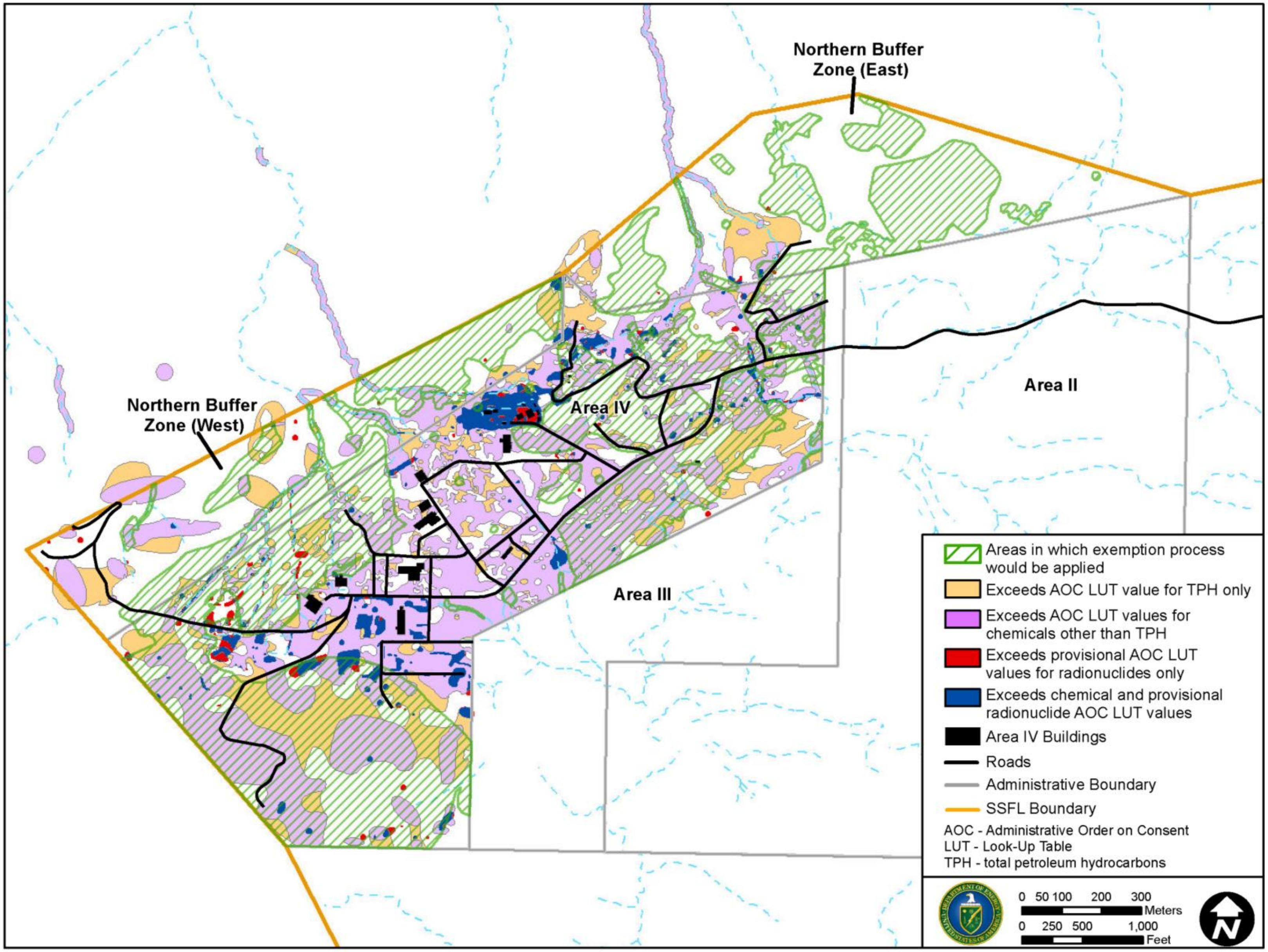

Figure 2–2 Identification of Areas in which the Exemption Process would be Applied

Most of the area identified for protection of cultural resources (6.2 acres) overlaps with areas in which the exemption process would be applied for protection of biological resources. Areas subject to the exemption process solely for cultural resources (less than 2 acres) account for less than 1 percent of the total area in which the exemption process would be applied. Within the areas in which the exemption process would be applied, DOE would remove soil containing chemical and radioactive constituents that pose a risk to human health or ecological resources as determined using a CERCLA risk assessment, while minimizing disturbance to the surrounding areas.

As shown in Figure 2–2, there are soils within the areas in which the exemption process would be applied that exceed the AOC LUT value for TPH only (tan areas in the figure). These TPH-only soils were discussed earlier in this section as soils that DOE proposes to leave them in place for monitored natural attenuation; consequently, the volume of soil subject to removal was reduced by 620,000 cubic yards. The incremental volume of soil within areas subject to the biological and cultural exemption process (non-TPH soil) that DOE proposes leaving in place is 115,000 cubic yards (see Appendix D).

As a result of these adjustments to the soil volume, 881,000 cubic yards of soil exceeding the AOC LUT values is considered in the Cleanup to AOC LUT Values Alternative (see Appendix D). This alternative would disturb about 90 acres of land, including 4 acres within areas in which the exemption process would be applied; the level of cleanup of those 4 acres would be determined by a risk assessment. **Table 2–3** summarizes the preliminary estimated soil volumes by 2010 AOC (DTSC 2010a) considerations.

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 would be described in the forthcoming soil remediation plans to be submitted to DTSC for approval and were not used in developing the above adjustments to estimated soil volumes analyzed in this EIS.

Table 2–3 Preliminary Estimated Soil Volumes for Remedial Actions per 2010 AOC Considerations

Soil Category Description	***Soil Volumes (cubic yards)***	***Area (acres)***
Estimated volume of soil exceeding the chemical AOC LUT values only (radionuclides below the AOC LUT values)	1,506,000	204
Estimated volume of soil exceeding the chemical AOC LUT values with radionuclides above the provisional AOC LUT values	106,000	15
Estimated volume of soil exceeding the provisional radionuclide AOC LUT values only (chemicals below the AOC LUT values)	4,000	3
Total volume of soil exceeding the chemical or radionuclide AOC LUT values	**1,616,000**	**222**
Volume of TPH soil potentially subject to monitored natural attenuation	620,000	54
Volume of soil for which the proposed biological and cultural exemption process would be applied [a]	115,000	77
Total volume of soil potentially subject to removal	**881,000**	**90**

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

[a] There is overlap between soils that exceed the AOC LUT value for TPH only and those in areas subject to the exemption process. The total volume and area of soil exceeding the AOC LUT value only for TPH is included in the above line. Entries on this line represent soils in areas in which the exemption process would be applied that exceed an AOC LUT value for constituents other than TPH.

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

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 the provisional AOC LUT values, the following four categories of soil requiring disposal are expected to be removed during remediation efforts:

1. *Non-waste soil* – Soil containing chemical constituent concentrations below levels that would require disposal as a RCRA hazardous waste and below risk-based screening levels, but above the chemical AOC LUT values, and radionuclides at or below the provisional 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[20] 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. *Moderate-risk soil* – Soil containing chemical constituent concentrations below levels that would require disposal as a RCRA hazardous waste, but above risk-based screening levels, and radionuclide concentrations at or below the provisional 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. *Hazardous waste* – Soil containing chemical constituent concentrations that would require disposal as a RCRA hazardous waste and radionuclide concentrations at or below the provisional 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. *Low-level radioactive waste (*LLW)/Mixed LLW (MLLW) – Soil containing radionuclide concentrations above provisional radiological AOC LUT values and any concentration of chemical constituents; this includes soil containing chemical concentrations expected to require disposal as a RCRA hazardous waste. This soil would be transported to a licensed commercial facility or authorized DOE facility for disposal of LLW and/or MLLW, based on the concentration of chemical constituents and the acceptance criteria of the facility.

Table 2–4 presents the preliminary estimates of soil volumes based on the soil categories for transportation and disposal considerations.

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. Up to 25 workers would be involved with soil removal activities at any one time, not including the truck drivers hauling the debris off site.

[20] 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 2–4 Preliminary Estimated Soil Volumes for Transportation and Disposal

Soil/Waste Category	*Soil Chemical/Radionuclide Classifications*	*Soil Volumes (cubic yards)*
1. Non-waste soil	Chemicals above AOC LUT values, but below risk-based screening levels and levels requiring disposal as a RCRA hazardous waste. Radionuclides at or below provisional AOC LUT values.	718,000
2. Moderate-risk soil	Chemicals above risk-based screening levels, but below levels requiring disposal as a RCRA hazardous waste. Radionuclides at or below provisional AOC LUT values.	51,000
3. Hazardous waste	Chemicals above standards expected to require disposal as a RCRA hazardous waste. Radionuclides at or below provisional AOC LUT values.	2,000
4. LLW/MLLW	Radionuclides above provisional AOC LUT values. Any concentration of chemicals.[a]	110,000
Total		**881,000**

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; RCRA = Resource Conservation and Recovery Act.

[a] Although most of the soil with radionuclides above provisional AOC LUT values also has chemicals above AOC LUT values, a total of 4,000 cubic yards of soil is estimated to exceed provisional radionuclide AOC LUT values only.

DOE anticipates focusing initially on removing soil identified as exceeding the radiological AOC LUT values and soil that would require management as RCRA hazardous waste. Following characterization and radiological surveys of the transportation containers and vehicles, these soils would be transported for disposal as LLW or MLLW at a licensed commercial facility or an authorized DOE facility, or as hazardous waste at a permitted commercial facility, respectively. DOE would then remove the remaining non-waste and moderate-risk soils which should require management only for chemical constituents that exceed the AOC LUT values. DOE would continue to perform radiological surveys as the remainder of the soil is excavated and packaged for shipment to identify any potential residual pockets of soil containing radioactive constituents.

For the purpose of analysis in this EIS, **Figure 2–3** shows the locations in Area IV and the NBZ that would be cleaned up under the Cleanup to AOC LUT Values Alternative. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated will be refined (e.g., larger-scale, more-detailed maps showing expected remediation boundaries would be developed). The figure shows the locations that would be cleaned up within the areas in which the exemption process would be applied for protection of sensitive biological and cultural resources, as allowed under the 2010 AOC (DTSC 2010a). DOE would identify these areas and the rationale for their protection in a soil remediation plan that would be submitted to DTSC for approval prior to initiating remediation activities. The identified areas have been evaluated as posing a potential risk to human health or ecological resources, as determined using a risk assessment. The human health risk assessment is based on a residential receptor, without a garden. DOE would remove soil containing chemical and radioactive constituents in these areas through carefully planned, focused removals that would result in minimum disturbance.

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[21] 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.

[21] Future involvement by EPA (e.g., verification sampling) would be contingent on future agreements and funding.

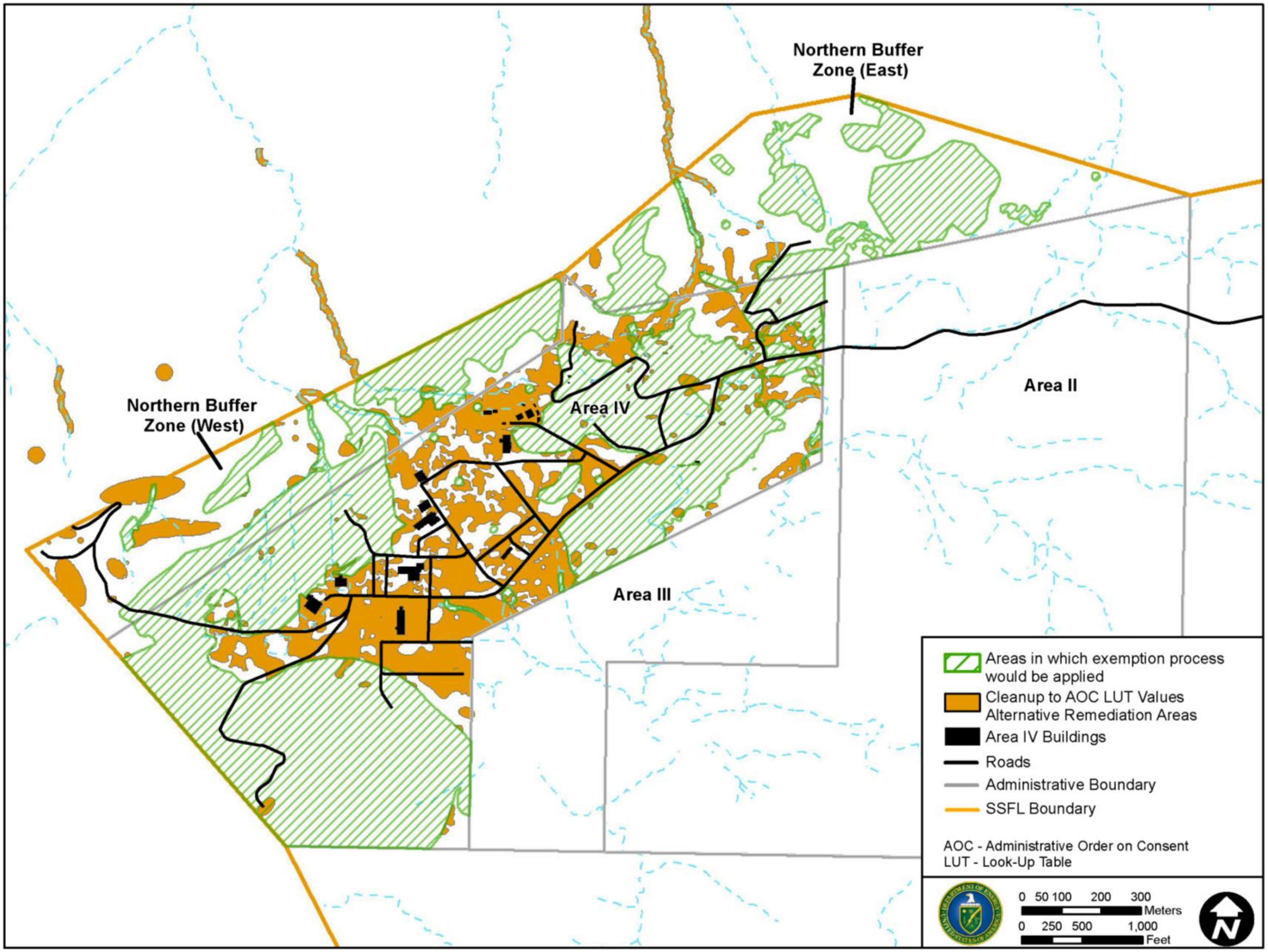

Figure 2–3 Soil Remediation – Cleanup to AOC Look-Up Table Values Alternative

Following confirmation 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 contouring and slope stabilization (see Appendix D). This would require transporting up to 661,000 cubic yards of backfill (if 881,000 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 all of the requirements of the 2010 AOC (that the backfill meets the AOC LUT values) (see Appendix D). NASA has also tested soils from multiple offsite backfill locations in the region[22] and found that materials at these sites that might meet the AOC LUT values are predominantly a sand-and-gravel mixture with no materials capable of restoring excavated areas at SSFL to pre-cleanup conditions (NASA 2017b). A sand and gravel mixture is not soil and, therefore, would most likely not support regrowth of native vegetation. In addition, DOE has had bags of soil from two home improvement stores analyzed. Many of the chemicals on the AOC LUT are ubiquitous and found in varying concentrations in soil. Analysis of the home improvement store soil 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).[23] DOE would not proceed with large-scale excavation of soil until an acceptable source of backfill material is identified.

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 2–4 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 2–4** 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

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22 NASA sampled borrow sites in addition to the borrow sites sampled by DOE and their analytical results showed constituents that exceeded LUT values for chemicals for all sites tested.

23 On December 21, 2016, DOE sent a letter to DTSC describing DOE's efforts and difficulty in locating backfill soil that meets the 2010 AOC requirements and requesting initiation of the consultation process (DOE 2016).

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 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 method/minimum detection limits for constituents whose 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 method/minimum detection limits are lower than what is typically used as a standard for soil cleanup. Most cleanups are based on a CERCLA 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, 1 to 2 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.[24]

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.

[24] 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.

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 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, "Establishing 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 method/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 AOC LUTs published by DTSC identify 116 chemicals and 16 radionuclides to be considered. 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).[25] DTSC analyzed 148 soil samples for 110 different chemicals[26] 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

[25] 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.

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

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][27] 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 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 2012b) 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.

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 2006b, 2007a, 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 110,000 cubic yards) to a chemically impacted soil cleanup (approximately 1,612,000 cubic yards), based on the chemical AOC LUT values.

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.

[27] 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.

- 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 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. 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.

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

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 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:

- 90 acres of land disturbed in Area IV and the NBZ;
- 881,000 cubic yards of soil removed and 661,000 cubic yards of backfill emplaced, resulting in up to 101,000 heavy-duty truck round trips (13,000,000 to 45,000,000 million truck miles[28]);
- 162,500 round trips of cars or light-duty trucks primarily due to worker commutes;
- substantial increase in the wear on local roadways;
- About 45.5 million gallons of water used;
- 2.8 to 7.7 million gallons of fuel used for trucks and heavy equipment; and
- 30,000 to 80,000 metric tons (total) of greenhouse gases (as carbon dioxide [CO_2]) generated.[29]

Disturbing 90 acres of land in order to remove 881,000 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 661,000 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 881,000 cubic yards of soil and 661,000 cubic yards of backfill soil would result in more than 101,000 heavy-duty truck round trips (up to 45,000,000 truck miles) over about 26 years and 162,500 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 45.5 million gallons of water (used primarily for dust suppression) would represent an unnecessary use of a valuable resource in an areas already stressed by drought. In addition, the irreversible consumption of 2.8 to 7.7 million gallons of fuel for truck transportation and heavy

[28] The 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).
[29] See preceding footnote.

equipment use would contribute to the generation of a total of 30,000 to 80,000 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. Under this alternative, DOE evaluates two future use scenarios: the Residential Scenario evaluates the hypothetical situation of a person living on site and the Open Space Scenario evaluates a situation consistent with Boeing's planned future use of the site as open space habitat (see Section 2.1). DOE expects that it will need to engage DTSC in discussions about changes to the 2010 AOC in order to implement any soil remediation alternative. The 2010 AOC allows DOE and DTSC to agree upon changes to better meet cleanup objectives.

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 risk-based screening levels (RBSLs). The RBSLs would be calculated for the direct exposure pathways[30] of a 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[31] of 1. The lower of either the human health or ecological RBSL would be used for each constituent. However, if the RBSLs for a chemical are less than the corresponding AOC LUT value, the AOC LUT value would become the revised LUT value for that chemical.

As with the Cleanup to AOC LUT Values Alternative, DOE anticipates focusing initially on removing soil identified as exceeding the radiological AOC LUT values and soil that would require disposal as hazardous waste, prior to removal of the other soil types. Following characterization and radiological surveys of the transportation containers and vehicles, this soil would be transported off site for disposal as LLW or MLLW or hazardous waste, respectively. Once soils in the areas identified as exceeding the AOC LUT values for radioactive constituents or chemical concentrations that would require management as hazardous waste are removed, the remaining soil should require management only for non-hazardous concentrations of chemical constituents. DOE would continue to perform radiological surveys of the remaining soil as it is excavated and packaged for

[30] 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.

[31] 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 2015d]) 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.

shipment to ensure that if there are any residual pockets of soil containing radioactive constituents, they are detected and disposed of as LLW. 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. Within the areas in which the exemption process would be applied, soil would be removed if a CERCLA risk assessment indicates that it poses a risk to human health or ecological resources. Therefore, the volume of soil to be removed from areas subject to the exemption process would be the same as that under the Cleanup to AOC LUT Values Alternative.

Approximately 190,000 cubic yards of soil would be removed under this alternative (see Table 2–5 in Section 2.4.4). For the purpose of analysis in this EIS, **Figure 2–5** shows the extent of chemical and radioactive constituents above the revised LUT values that would be remediated and those areas from which soil would be removed in the areas in which the exemption process would be applied. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated will be refined (e.g., larger-scale, more-detailed maps showing expected remediation boundaries would be developed). Approximately 12,400 heavy-duty truck round trips over about 6 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 9,300 heavy-duty truck round trips (rounded value) would be needed to bring 143,000 cubic yards of backfill to the site. There would also be about 52 miscellaneous heavy-duty truck round trips (e.g., for delivering and removing soil remediation equipment).

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 50 constituents (34 chemicals[32] that exceed risk-based screening levels 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 detection of a constituent actually represents contamination from ETEC operations (see Section 2.3.3.1). Under this alternative, a smaller volume of backfill would be needed (143,000 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.

[32] The number of chemicals in the revised LUT (34) is much smaller than the number in the 2010 AOC LUT (116). One reason is that the AOC LUT (DTSC 2013b) includes chemicals that did not qualify as chemicals of concern in Area IV or the NBZ as indicated in the *Draft Chemical Data Summary Report, Santa Susana Field Laboratory, Ventura County, California* (CDM Smith 2017). The chemicals included in the revised LUT are those that exceeded the suburban resident (without a garden) RBSL in 1 percent of the site characterization sample results, as well as others that were detected in multiple samples in a small area (i.e., hot spots). Refer to Appendix D for a comparison of the chemicals included in the risk analysis under each soil remediation action alternative.

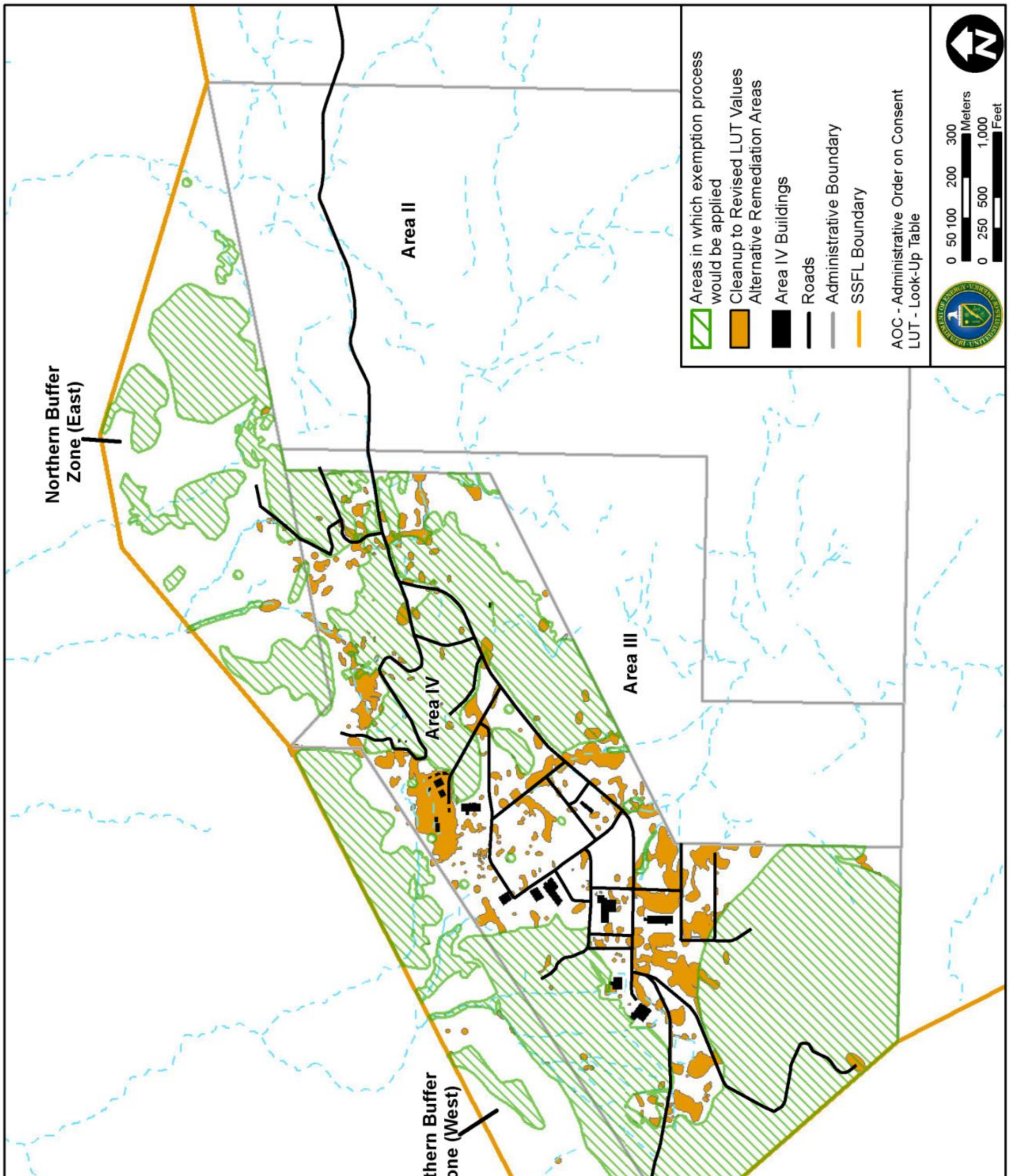

Figure 2–5 Soil Remediation – Cleanup to Revised LUT Values Alternative

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 and ecological resources. This alternative reduces risk to the public and the environment, yet conserves natural resources, including biological, cultural, and water resources. Two scenarios are evaluated under this alternative, a Residential Scenario and an Open Space Scenario. The human health risk assessments differ between the two scenarios, resulting in different cleanup levels. However, under both scenarios, the same ecological risk assessment was performed to evaluate the potential effects of chemical and radionuclides in the soil on biotic receptors. Cleanup is determined by whichever risk assessment (human health or ecological) results in the lower concentration allowed to remain in the soil. For either alternative, there would be about 52 miscellaneous heavy-duty truck round trips (e.g., for delivering and removing soil remediation equipment) in addition to the number of truck round trips identified below for each scenario.

Residential Scenario—For the Residential Scenario, 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 human health risk assessment (risk assessments were performed following more-current EPA guidance). Cleanup would be targeted at locations posing risk based on the outcome of a risk assessment. Area IV and the NBZ would be subdivided into smaller areas or units over which concentrations would be averaged for purposes of evaluating risk. For each unit, risk assessment calculations would be performed individually for each chemical, and then the results summed to determine the risk value or hazard index. The risk results for each unit would be compared with the target risk range for alternatives of 1×10^{-6} to 1×10^{-4} (1 chance in 10,000 to 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 soil with chemical concentrations that exceed the risk assessment criteria and dispose of it in accordance with applicable requirements. In developing this Final EIS, DOE conducted risk assessments for 19 of the 156 assessment units into which Area IV and the NBZ were divided. The 19 units were selected because they represented the areas with the highest concentrations of chemical or radioactive constituents and/or because they had the highest density of samples exceeding an RBSL. An additional 51 assessment units were evaluated with respect to whether sample results in those units exceeded RBSLs and were similar to the 19 units for which risk assessments were performed. Soil with radioactive constituents would be remediated to meet the target risk range of 1×10^{-6} to 1×10^{-4}, although, based on those risk assessments and evaluations completed for this EIS, it appears that removing soil based on chemical risk also removes most of the radionuclides that would present sufficient risk to warrant removal. The concentrations of radionuclides in soil that would remain on site are expected to be considered as low as reasonably achievable (ALARA),[33] and well below the DOE standard of 25 millirem per year (DOE Order 458.1) for exposure of the hypothetical onsite suburban resident.

[33] 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 in 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.

For the purpose of analysis in this EIS, **Figure 2–6** shows the extent of soil removal that would be required under the Residential Scenario. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated would be refined (e.g., larger-scale, more-detailed maps showing expected remediation boundaries would be developed). This scenario would avoid the excavation and offsite transport of soil with concentrations that are less than risk-based levels. Because cleanup in areas in which the exemption process would be applied would be based on a risk assessment approach, the locations requiring cleanup in areas subject to the exemption process under this scenario would be the same as those under the two previous alternatives. Approximately 52,000 cubic yards of soil would be removed for offsite disposal (see Table 2–5 in Section 2.4.4). As shown in Table 2–6 (see Section 2.4.4), approximately 3,400 heavy-duty truck round trips over about 2 years would be required to remove the soil for disposal under this scenario, 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 2,500 heavy-duty truck round trips (rounded value) would be needed to bring 39,000 cubic yards of backfill to the site.

Open Space Scenario—The Open Space Scenario is based on an exposure scenario consistent with Boeing's future plans for the land in Area IV and the NBZ. Boeing and the North American Land Trust recorded Grant Deeds of Conservation Easement and Agreements to permanently preserve land at SSFL as open space (Ventura County 2017a, 2017b). The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development on site. Because there would be no permanent structures on the site, a recreational user scenario was used to evaluate the level of cleanup appropriate for use of Area IV and the NBZ as open space. The recreational user is assumed to visit the site 75 days per year and spend 8 hours on site on each visit over a period of 30 years. Exposure would be through the direct pathways of inhalation, inadvertent ingestion, and dermal contact (for chemicals) or direct exposure (for radionuclides). As with the Residential Scenario, risk assessments would be performed for each unit and results of the analysis for each constituent would be summed to determine a risk value or hazard index. The risk results for each unit would be compared with the target risk range for alternatives of 1×10^{-6} to 1×10^{-4} (1 chance in 10,000 to 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. For the purpose of analysis in this EIS, **Figure 2–7** shows the extent of soil removal that would be required under the Open Space Scenario. As DOE develops its soil remediation plan for soil cleanup, the areas to be remediated would be refined. As with the Residential Scenario, this scenario would avoid the excavation and offsite transport of soil with concentrations that are less than risk-based levels. Because the human health risk levels are based on the amount of time spent on site, the quantity of soil removed under this scenario would be less than that removed under the Residential Scenario. Cleanup in areas in which the exemption process would be applied would be the same as the Residential Scenario and the two previous alternatives. Approximately 38,200 cubic yards of soil would be removed for offsite disposal (see Table 2–5 in Section 2.4.4). As shown in Table 2–6 (see Section 2.4.4), approximately 2,500 heavy-duty truck round trips over less than 2 years would be required to remove the soil for disposal under this scenario, 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 1,900 heavy-duty truck round trips (rounded value) would be needed to bring 29,000 cubic yards of backfill to the site.

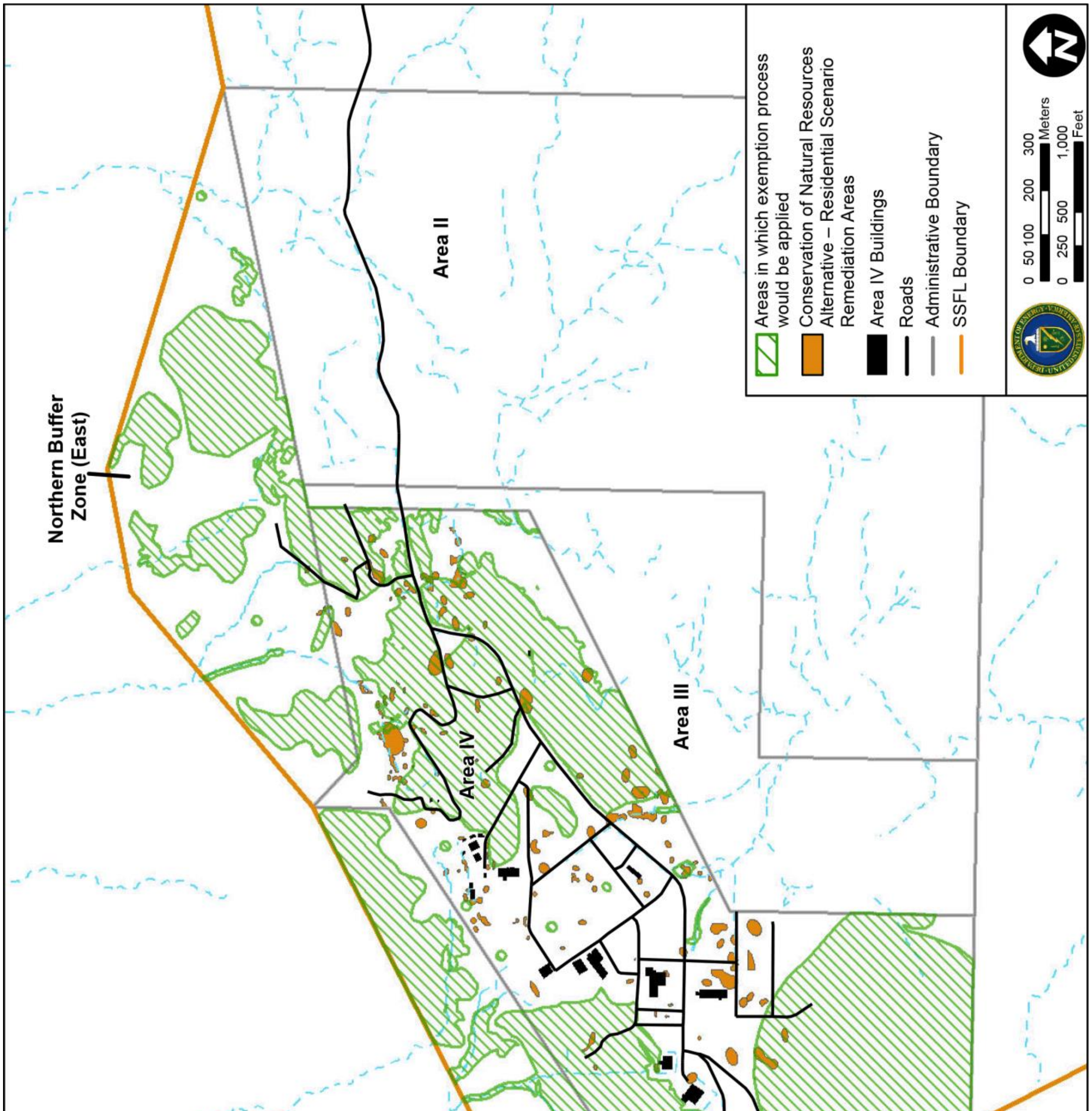

Figure 2–6 Soil Remediation – Conservation of Natural Resources Alternative – Residential Scenario

Cleanup based on CERCLA 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. Implementation of either of the Conservation of Natural Resources Alternative scenarios 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 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 assessment unit to determine whether soil meets the cleanup targets (i.e., a cancer risk of 1×10^{-6} to 1×10^{-4} [a lifetime chance of 1 in 10,000 to 1 in 1 million of developing a cancer], a hazard index of 1 [the level below which no toxic effects would be expected]). 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 (29,000 to 39,000 cubic yards), and the allowable concentrations of chemical and radionuclides would be less restrictive than those for the Cleanup to AOC LUT Values Alternative, finding a backfill source that has the physical, chemical, and microbial characteristics that would support establishment of native vegetation may still be a challenge. A search for such soil would be conducted in support of project implementation.

2.4.3 Soil Remediation Sensitivity Analyses

DOE recognizes that this EIS presents data and analyses that reflect the current state of knowledge and planning at the time the EIS is prepared. To assess the effects of recognized uncertainties and in response to comments on the Draft EIS, DOE performed sensitivity evaluations to assess the effect that certain uncertainties would have on potential environmental consequences (see Appendix L).

A sensitivity evaluation was performed using the Cleanup to AOC LUT Values as the base case, but addressing comments that the volume of soil assumed to be cleaned up may be too small or that additional cleanup should be conducted in the areas in which the exemption process would be applied. This sensitivity analysis evaluates impacts of what DOE believes would be the largest reasonably foreseeable volume of soil being removed from Area IV and the NBZ. The volume of soil to be removed includes that from all areas exceeding AOC LUT values, that is, no areas would be subject to an exemption process and soil exceeding the AOC LUT value for TPH would not be left on site to naturally attenuate. This sensitivity evaluation considers removal of 1,616,000 cubic yards of soil over 47 years compared to 881,000 cubic yards of soil removed over 26 years under the Cleanup to AOC LUT Values Alternative.

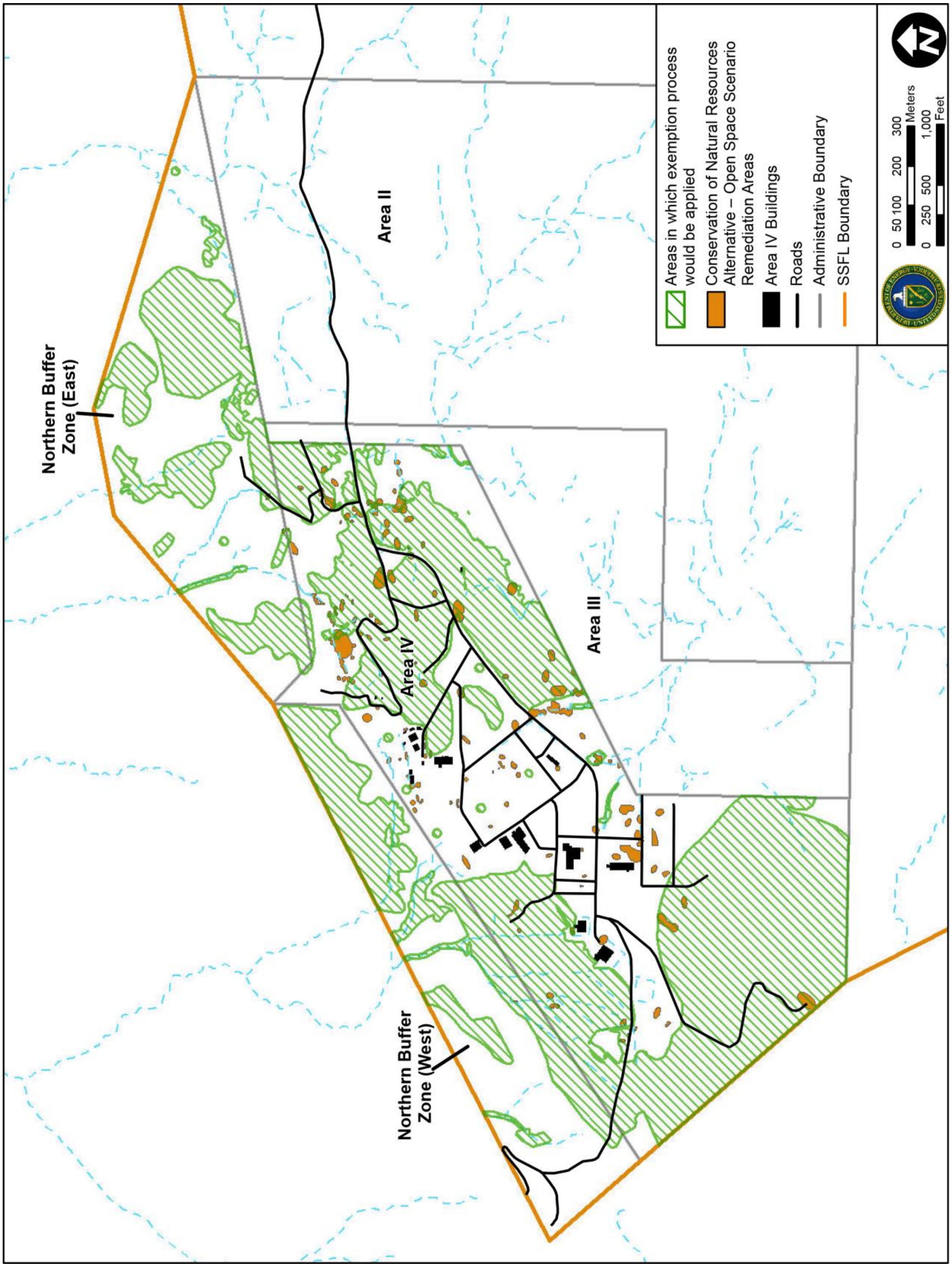

Figure 2–7 Soil Remediation – Conservation of Natural Resources Alternative – Open Space Scenario

Other sensitivity evaluations were performed using each soil remediation action alternative as the base case against which the effects of events that could constrain the pace of cleanup were evaluated. Events that could constrain the pace of cleanup include the availability of Federal funding for remediation and weather events. The sensitivity evaluations assume the same volume of soil is removed under each of the soil remediation action alternatives and scenarios, but removal occurs at half the rate assumed in the base case analyses; that is, the average number of heavy-duty truck round trips per day would be 8, rather than 16. The result is a doubling of the duration of the cleanup – the Constrained Scenario of the Cleanup to AOC LUT Values Alternative, would take about 51 years rather than 26 years as evaluated for that alternative; the Constrained Scenario of the Cleanup to Revised LUT Values Alternative would take about 11 years rather than 6 years; and the Constrained Scenarios of the Conservation of Natural Resources Alternative (both the Residential and Open Space Scenarios) would take about 3 years instead of 2 years.

2.4.4 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.

As described in the preceding sections, DOE evaluated the No Action Alternative and three action alternatives (one of which has two scenarios) for soil cleanup within Area IV and the NBZ. Regardless of the action alternative/scenario, in its soil remediation plan submitted to DTSC for approval, DOE would propose the use of monitored natural attenuation for the onsite treatment of 620,000 cubic yards of soil containing TPH. DOE would also propose that areas identified for the application of the exemption process for protection of biological and cultural resources would be remediated to a level determined through a risk assessment. Consequently, cleanup in the areas in which the exemption process would be applied would be the same under all action alternatives/scenarios.

- 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 selectively remove soil requiring disposal as LLW or MLLW or hazardous waste prior to focusing on removal soil containing only chemical constituents (that do not require disposal as hazardous waste). Remediation would proceed across Area IV and the NBZ with removal of soil exceeding the AOC LUT values based on a point-by-point determination. An estimated 881,000 cubic yards of soil would be removed from the site over a 26-year time frame. The number of heavy-duty truck

round trips (rounded values) would be about 57,500 for removing soil from the site and 43,100 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 selectively remove soil requiring disposal as LLW or MLLW or hazardous waste prior to focusing on removal of soil containing only chemical constituents (that do not require disposal as hazardous waste). As with the Cleanup to AOC LUT Values Alternative, DOE would make soil remediation decisions on a point-by-point basis. An estimated 190,000 cubic yards of soil would be removed from the site over about a 6-year time frame. The number of heavy-duty truck round trips (rounded values) would be about 12,400 for removing soil from the site and 9,300 for transporting backfill to the site.

- Conservation of Natural Resources Alternative – DOE would clean up soil to a level that would protect human health and the environment 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. Two cleanup scenarios are evaluated. Under the Residential Scenario, cleanup levels would be based on a hypothetical onsite suburban residential scenario, as outlined in the SRAM (MWH 2014), as well as ecological risk. Under the Open Space Scenario, cleanup levels would be based on an onsite recreational user scenario and ecological risk. Constituent concentrations would be averaged over a risk assessment area or unit, consistent with CERCLA risk assessment practice.[34] Chemically and radiologically impacted soil would be removed to achieve a cancer incidence risk of 1 chance in 10,000 to 1 chance in 1 million and a hazard index of 1. Following cleanup of radiologically impacted soil to meet the risk range, the dose from soil remaining on site would be well below the dose constraint of 25 millirem per year. Under the Residential Scenario, an estimated 52,000 cubic yards of soil would be removed from the site in about a 2-year time frame. The number of heavy-duty truck round trips (rounded values) would be about 3,400 for removing soil from the site and 2,500 for transporting backfill to the site. Under the Open Space Scenario, an estimated 38,200 cubic yards of soil would be removed from the site in less than 2 years. The number of heavy-duty truck round trips (rounded values) would be about 2,500 for removing soil from the site and 1,900 for transporting backfill to the site.

[34] Risk assessments evaluating onsite impacts in this Final EIS were performed following EPA guidance and using more-recent risk assessment modeling parameters than are included in the SRAM.

Each of the soil remediation action alternatives would require approximately 1.75 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 continuing drought conditions in Southern California and other uses for this resource.

Similarly, regardless of the soil remediation 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 soil to offsite disposal facilities, as well as large quantities of backfill to Areas IV. 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[35] 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 would be transported off site for disposal in haul trucks with a 23-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 heavy-duty 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).

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 require an average of 16 heavy-duty truck round trips daily for soil removal.[36] Even though there may be variations in daily use and occasional truck trips for deliveries and other remediation activities, DOE expects its number of daily truck round trips to occasionally approach 24 and to always be within its 32-truck round trip allotment.

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[35] Woolsey Canyon Road is the only serviceable road for heavy-duty 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.

[36] Based on an evaluation of the rate of excavation and disposal of soil by DOE's Environmental Management Consolidated Business Center (DOE 2018b), DOE revised the estimated average number of truck trips per day to 16 in this Final EIS. In the Draft EIS, the number of daily truck trips was assumed to be 32 to 48 based on the number allowed according to the *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 2015a).

Table 2–5 provides the soil volumes that would be removed under each action alternative. As shown in Table 2–5, within the accuracy of the estimates of soil volume and weight, the same quantities of soil identified as hazardous waste would be remediated under all of the action alternatives. Under the Cleanup to AOC LUT Values Alternative and the Cleanup to Revised LUT Values Alternative, all soil with radionuclide concentrations above provisional AOC LUT values would be removed and disposed of as radioactive waste. Under both scenarios of the Conservation of Natural Resources Alternative, much smaller volumes of soil would be removed that require disposal as radioactive waste. Soil would be removed so that the residual risk is within the target risk range of 1 in 10,000 to 1 in 1 million, but most of the soil that would require disposal as radioactive waste would be removed because of chemical risk or toxicity, not because of its radionuclide content. As shown in Table 2–5, a large volume of non-waste soil would be removed under the Cleanup to AOC LUT Value Alternative and a lesser quantity under the Cleanup to Revised LUT Values Alternative. Based on a CERCLA risk assessment approach to site cleanup, this soil would not be removed from the site as shown for both scenarios under the Conservation of Natural Resources Alternative.

Table 2–6 shows the number and timing of heavy-duty truck round trips that would be required to transport the soil for disposal and backfill for site restoration. Estimated numbers of annual heavy-duty truck round trips are based on a planning level evaluation of the number of truck round trips that would occur per day. For soil remediation, heavy-duty truck round trips were assumed to average 16 per day for soil removal and delivery of backfill, although the actual number of truck trips on a given day may be higher or lower (peak daily heavy-duty truck round trips are not expected to exceed 32). In addition to the routine transport of waste and backfill, there may be occasional truck trips for other purposes, such as the delivery of heavy equipment.

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 residual site risk following remediation with each increment of soil removed, proceeding from the alternative with the least soil removed (Conservation of Natural Resources Alternative, Open Space Scenario) to that with the most soil removed (Cleanup to AOC LUT Values Alternative), the largest reduction in risk would occur between the No Action Alternative and Conservation of Natural Resources Alternative, Open Space Scenario. Even though the largest increment of soil would be removed between the Cleanup to Revised LUT Values Alternative and the Cleanup to AOC LUT Values Alternative, there would be minimal change in the residual site risk associated with removal of this soil. (See the text, Comparison of Risk Management and Cost among Soil Remediation Alternatives following Table 2–6.)

Under all action alternatives, DOE would clean up in the areas in which the exemption process would be applied for protection of sensitive biological and cultural resources (see Figures 2–3, 2–5, 2–6, and 2–7). DOE would identify the areas that would be protected and those that would require cleanup in the soil remediation plan that would be submitted to DTSC for approval. DOE would take action in these areas to remove constituents in the soil that pose a risk to human health or the environment (as determined using a risk assessment). 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 2–5 Remediation Soil Quantities by Alternative

	Cleanup to AOC LUT Values Alternative	*Cleanup to Revised LUT Values Alternative*	*Conservation of Natural Resources Alternative*	
			Residential Scenario	*Open Space Scenario*
Project Duration	26 years	6 years	About 2 years	Less than 2 years
Affected Area	90 acres	38 acres	10 acres	9 acres
1. Non-waste soil Chemicals above AOC LUT values, but below risk-based levels and hazardous waste standards. Radionuclides at or below provisional AOC LUT values.	718,000 cubic yards 1,077,000 tons 46,800 truckloads	28,000 cubic yards 42,000 tons 1,800 truckloads	a	a
2. Moderate-risk soil Chemicals above risk-based levels, but below hazardous standards. Radionuclides at or below provisional AOC LUT values.	51,000 cubic yards 76,500 tons 3,300 truckloads	50,000 cubic yards 75,000 tons 3,300 truckloads	49,000 cubic yards 73,500 tons 3,200 truckloads	36,000 cubic yards 54,000 tons 2,300 truckloads
3. Hazardous waste Chemicals above hazardous waste standards. Radionuclides at or below provisional AOC LUT values.	2,000 cubic yards 3,000 tons 130 truckloads	2,000 cubic yards 3,000 tons 130 truckloads	2,000 cubic yards 3,000 tons 130 truckloads	2,000 cubic yards 3,000 tons 130 truckloads
4. LLW/MLLW Chemicals below or above AOC LUT values. Radionuclides above provisional AOC LUT values.	110,000 cubic yards 165,000 tons 7,200 truckloads	110,000 cubic yards 165,000 tons 7,200 truckloads	1,000 cubic yards 1,500 tons 65 truckloads	200 cubic yards 300 tons 13 truckloads
Total Volume	881,000 cubic yards	190,000 cubic yards	52,000 cubic yards	38,200 cubic yards
Total Weight	1,322,000 tons	285,000 tons	78,000 tons	57,300 tons
Total Heavy-Duty Truck Round Trips [b]	57,500 truckloads	12,400 truckloads	3,400 truckloads	2,500 truckloads

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

[a] Non-waste soils are those cleaned up because they exceed chemical LUT value(s) even if they do not pose a risk. Under the Conservation of Natural Resources Alternative, soil is removed based on risk; therefore, no non-waste soil would be removed.

[b] Truck round trips were estimated based on transporting 23 tons of soil per truck. If 20-ton trucks were used for hazardous waste and radioactive waste, truck trips would be increased by 2 percent under the Cleanup to AOC LUT Values Alternative, 9 percent under the Cleanup to Revised LUT Values Alternative, and less than 1 percent under the Conservation of Natural Resources Alternative scenarios.

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 2–6 Soil, Waste, and Backfill Heavy-Duty 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***	***Years 9 through 27***	***Year 28***	***Totals***
Soil Remediation Alternatives											
Cleanup to AOC LUT Values Alternative											
Soil removal	0	0	2,300	2,300	2,300	2,300	2,300	2,300	2,300	310	57,500
Backfill soil	0	0	1,700	1,700	1,700	1,700	1,700	1,700	1,700	240	43,100
Totals	0	0	4,000	4,000	4,000	4,000	4,000	4,000	4,000	550	101,000
Cleanup to Revised LUT Values Alternative											
Soil removal	0	0	2,300	2,300	2,300	2,300	2,300	960			12,400
Backfill soil	0	0	1,700	1,700	1,700	1,700	1,700	720			9,300
Totals	0	0	4,000	4,000	4,000	4,000	4,000	1,700			21,700
Conservation of Natural Resources Alternative – Residential Scenario											
Soil removal	0	0	2,300	1,100							3,400
Backfill soil	0	0	1,700	830							2,500
Totals	0	0	4,000	1,900							5,900
Conservation of Natural Resources Alternative – Open Space Scenario											
Soil removal	0	0	2,300	210							2,500
Backfill soil	0	0	1,700	150							1,900
Totals	0	0	4,000	360							4,400
Building Removal Alternative											
Building removal	600	600	300								1,500
Backfill soil		590	290								880
Totals	600	1,200	590								2,400
Groundwater Remediation Alternatives											
Groundwater Monitored Natural Attenuation Alternative [b]											
Groundwater Treatment Alternative [b]											
Sr-90 Source Removal – Bedrock	0	0	0	340							340
Backfill soil	0	0	0	200							200
Totals	0	0	0	530							530

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

[a] This table shows round trips for heavy-duty trucks hauling soil and 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 (see Appendix H, Table H–17). 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 16 heavy-duty truck round trips per workday.

[b] Small quantities of waste would be generated by groundwater monitoring or treatment activities. They would be periodically removed from the site in light- to medium-duty trucks.

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

> **No Action Alternative**
> Cost: $3.3 million
> Cancer risk: 1 chance in 500 to 200,000
> Hazard index: 0.1 to 100
>
> **Conservation of Natural Resources Alternative, Open Space Scenario**
> Cost: $43 million
> Cancer risk: 1 chance in 100,000 to 3,300,000
> Hazard index: 0.01 to 0.3
>
> **Conservation of Natural Resources Alternative, Residential Scenario**
> Cost: $50 million
> Cancer risk: 1 chance in 20,000 to 1,000,000
> Hazard index: 0.1 to 1
>
> **Cleanup to Revised LUT Values Alternative**
> Cost: $230 million
> Cancer risk: 1 chance in 20,000 to 2,000,000
> Hazard index: 0.06 to 0.9
>
> **Cleanup to AOC LUT Values Alternative**
> Cost: $774 million
> Cancer risk: 1 chance in 20,000 to 2,500,000
> Hazard index: 0.05 to 0.9

Appendix K 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 alternatives 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 19 Area IV exposure units; the representative exposure units 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 19 exposure units is expected to represent the upper bound across Area IV and the NBZ for cancer risk and for noncancer hazard. The text box shows costs and ranges of risks and hazard indices for the evaluated 19 exposure units.

Figures 2–8 and **2–9** present a comparison of the residual risks following cleanup and the costs for each soil remediation alternative. Referring to the scale on the left side of the figure and the blue line, Figure 2–8 shows that risk to a hypothetical onsite resident is reduced as alternatives are compared from left to right and that risks for all of the action alternatives are within or below the EPA target risk range of 1×10^{-6} to 1×10^{-4} (1 in 10,000 to 1 in 1 million). Using the scale on the right side of the figure and referring to the green line, the figure shows that costs increase as alternatives are compared from left to right. Comparing the Conservation of Natural Resource Alternative, Residential Scenario to the Cleanup to Revised LUT Values Alternative shows a small reduction in risk and a substantial increase in cost. The reduction in risk is less and the increase in cost much greater when comparing the Cleanup to Revised LUT Values Alternative to the Cleanup to AOC LUT Values Alternative. Figure 2–9 presents similar information, but with risks and costs presented for a recreational user.

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 2–10**. 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; Hazardous Waste Management Facility (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

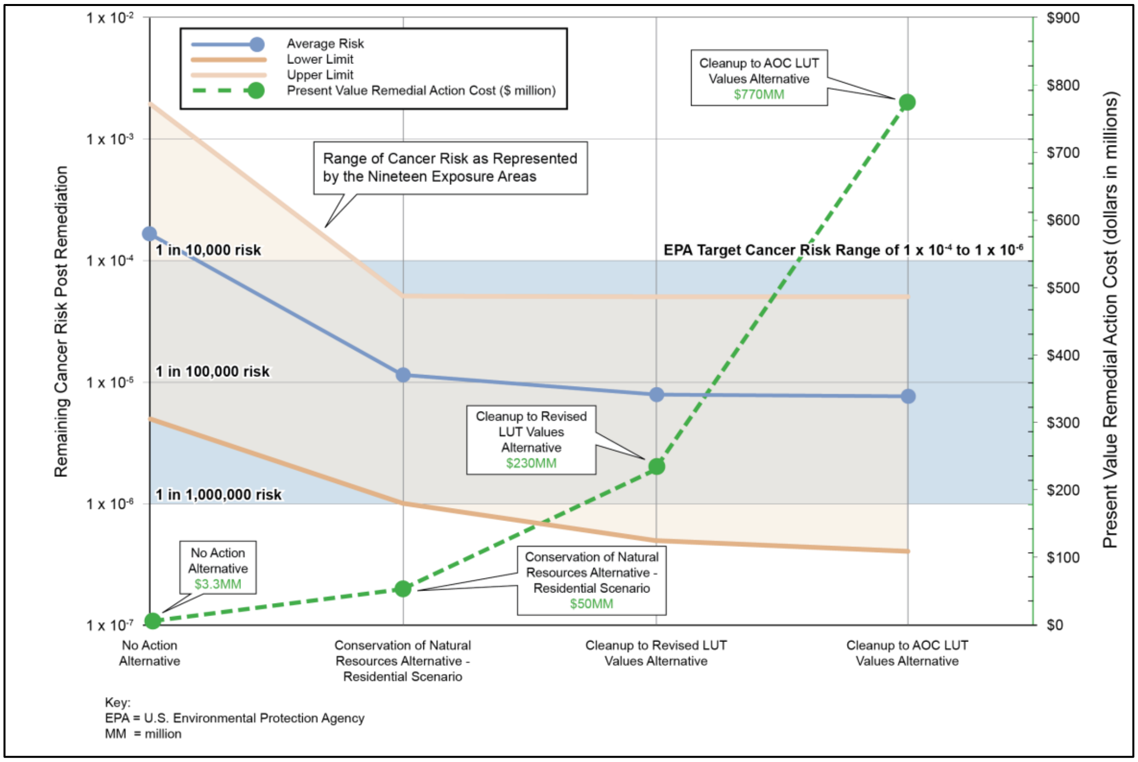


Figure 2–8 Cancer Risk and Cost Comparison of Soil Remediation Alternatives – Hypothetical Onsite Residential Receptor

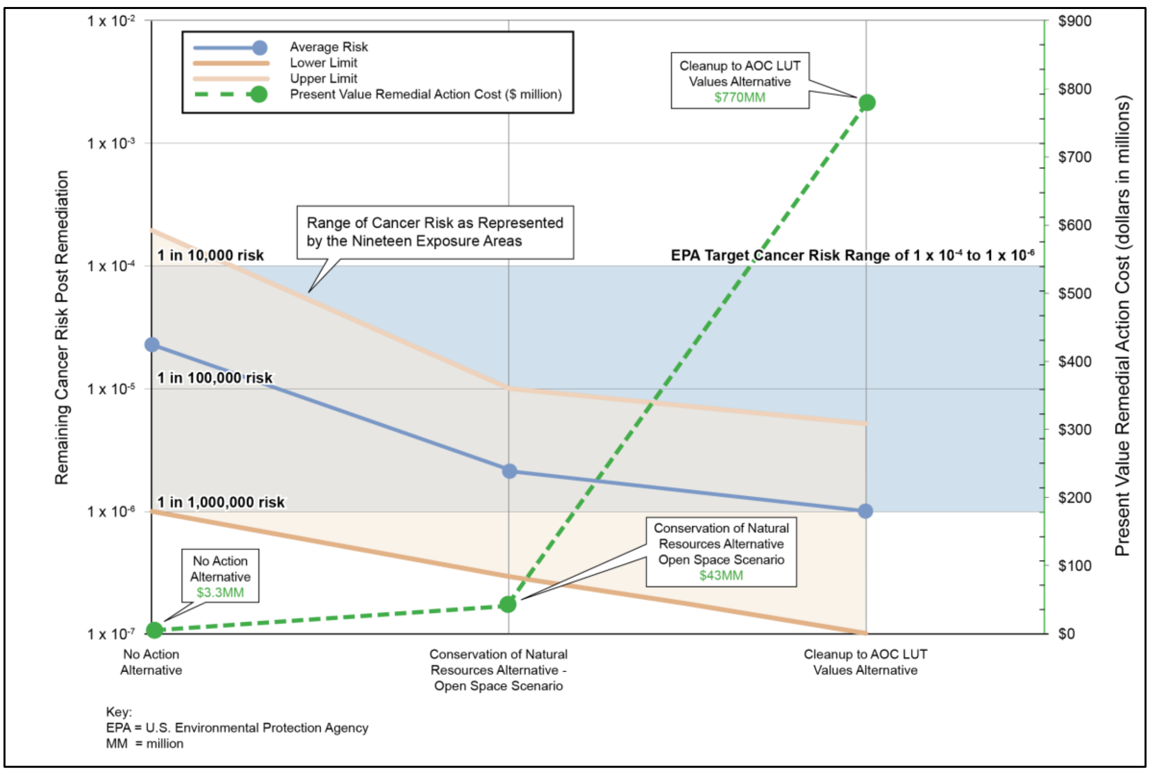
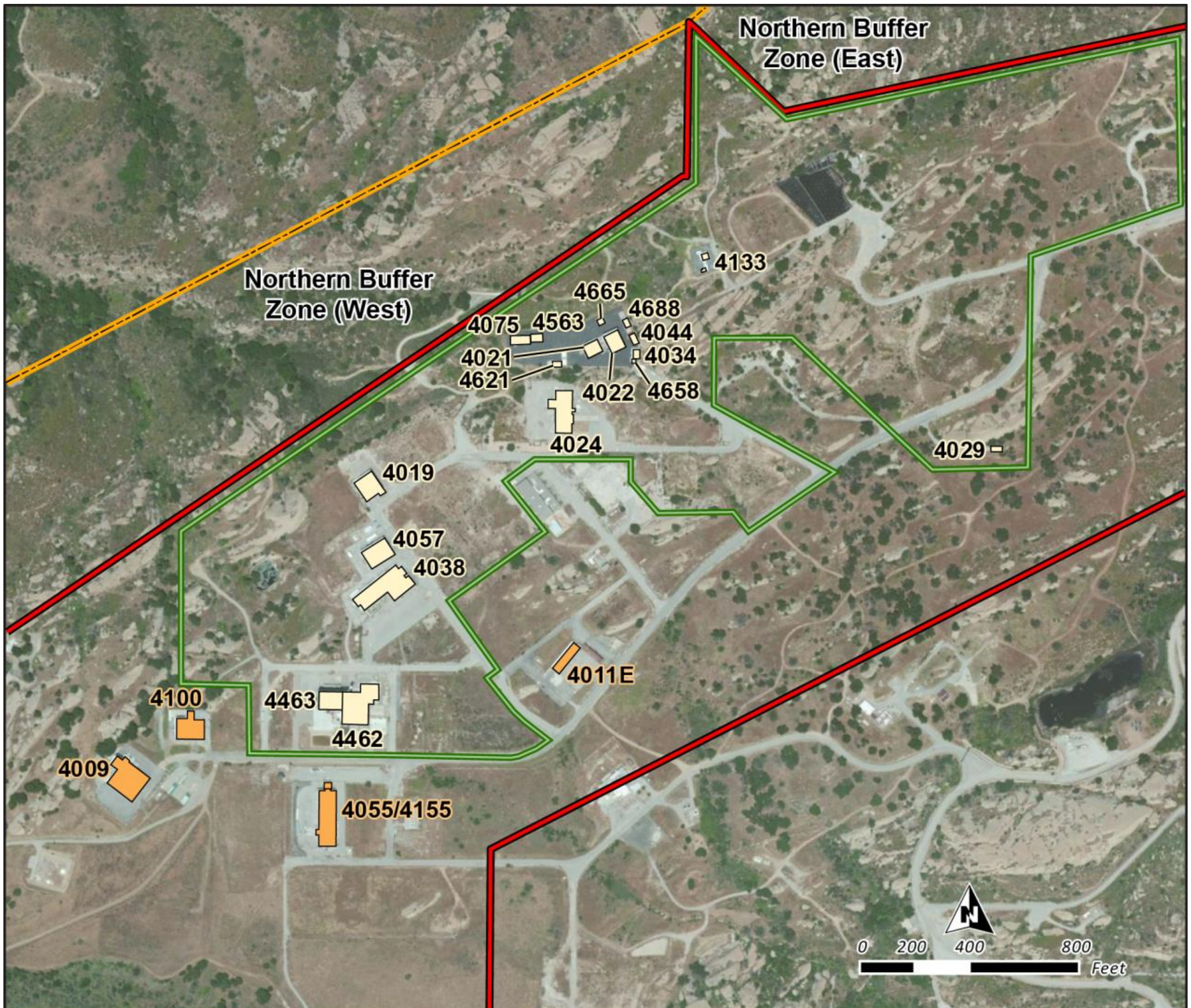


Figure 2–9 Cancer Risk and Cost Comparison of Soil Remediation Alternatives – Onsite Recreational Receptor



Radioactive Materials Handling Facility – Buildings 4021, 4022, and 4034
Sheds 4044, 4075, 4563, 4621, 4658, 4665, and 4688
Hazardous Waste Management Facility – Buildings 4029 and 4133
Sodium Pump Test Facility – Buildings 4462 and 4463
Systems for Nuclear Auxillary Power (SNAP) – Buildings 4019 and 4024
ETEC Office Building 4038
Building 4057 Warehouse
Data source: Appendix D.

DOE Structure
Boeing Structure
Department of Energy (ETEC) Boundary
Area IV Boundary
SSFL Boundary

Figure 2–10 Remaining Structures in Area IV

(Buildings 4044, 4075, 4563, 4621, 4658, 4665, and 4688). HWMF no longer manages hazardous waste and the RMHF no longer manages radioactive waste. Five buildings operated as RCRA storage and treatment facilities are regulated by DTSC, three at RMHF (Buildings 4021, 4022, and 4621) and the two HWMF buildings (Buildings 4029 and 4133). DOE has prepared and submitted RCRA closure plans for these facilities to DTSC. Building 4057 is used for field equipment storage and Building 4034 is used as an onsite office by the operating contractor; 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 2–10, and dispose of or recycle the materials off site. The above-ground and below-ground structures would be demolished and the entirety of demolition debris would be completely removed from the site. Demolition of buildings other than those regulated by DTSC may start following the issuance of a DOE ROD for this EIS. Demolition of the DTSC-regulated buildings would additionally depend on a decision following completion of the DTSC CEQA program EIR and approval of the RCRA closure plans. Assuming necessary documents are completed and approvals received such that building demolition can proceed uninterrupted, it would take between 2 and 3 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 2–6). 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 by DOE's demolition contractor to ensure worker safety is maintained throughout the demolition process and regulatory requirements and DOE guidelines are met. These plans would include identifying potential hazards, such as active electrical service, the presence of radiological or chemical materials, or building structural issues, and specifying protective equipment and procedures to protect workers from specific hazards.

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 2–10) 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. Waste from the buildings within RMHF and Buildings 4019 and 4024 would be managed and disposed of off site as radioactive waste. Waste from other buildings that have a radioactive history was also assumed to be disposed of as radioactive.[37] During project implementation, process knowledge, radiological surveys, and waste characterization would be performed and waste would be managed and disposed of in accordance with their actual characteristics, DOE Orders, regulations, and disposal or recycle facility acceptance criteria. 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 free of DOE-added radioactive materials would be managed as radioactive waste and would be transported to a Federal or commercial LLW or MLLW facility.[38]

Building materials from structures associated with hazardous waste management or chemical usage permits would be transported, as needed, to a permitted California Class I or 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. The four air monitoring stations along the perimeter of Area IV that constitute the DOE air monitoring network would operate during building demolition and loading of trucks. If the monitors detect unexpected levels of dust or radiation, corrective action would be taken to further control emissions. 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 2–7 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 2–7, 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 60 workers would be involved with DOE building demolition activities at any one time, not including the truck drivers hauling the debris off site.

DOE may decide to accelerate the schedule and shorten the duration of the building demolition activities. For purposes of evaluating the potential impacts of an accelerated schedule, in this EIS it is assumed that the project would be completed in about half the time (about 1 year) by doubling the actions necessary to accomplish demolition and waste disposal (e.g., 2 work crews, twice the number of waste shipments). Appendix L, Sensitivity Evaluations, includes an assessment of the change in environmental effects that an accelerated building removal would cause relative to the base case of the Building Removal Alternative.

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[37] Waste from all buildings with a radioactive history is assumed to be disposed of as radioactive waste. Waste only from Buildings 4038, 4057, 4462, and 4463 is not assumed to be radioactive.

[38] 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 DOE's Nevada National Security Site and the commercial facilities Energy*Solutions* in Utah, and Waste Control Specialists, in Texas.

Table 2–7 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	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
Debris [c]	7,220
Hazardous debris [c, d]	130
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, 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. To be determined to be free-released debris or free-released hazardous debris, material would not exhibit radioactivity above background levels.

[d] Includes waste materials regulated under statutes other than the Resource Conservation and Recovery Act (e.g., the Toxic Substances Control Act).

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.

Currently, water, sewer, and gas services to all Area IV buildings have been severed. Six buildings are connected to electrical service (Building 4024 and RMHF Buildings 4021, 4022, 4034, 4044, and 4621), 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 56 landfill site. Since then, additional deep 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 wells to depths of less than 100 feet (one of which has since been closed and sealed). As of May 2018, the Area IV groundwater monitoring well network consisted of 124 wells, 66 deep bedrock wells and 58 shallow wells, with additional wells planned. Not all wells have water every year and 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 4100/56 landfill TCE plume; the Building 4057 perchloroethylene (PCE) plume; the tritium plume (in the area of the former Building 4010); the Hazardous Materials Storage Area (HMSA) TCE plume; and the RMHF bedrock strontium-90 source (see **Figure 2–11**). 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 2–11, the FSDF TCE and tritium plumes extend into the NBZ; the boundary of the RMHF TCE plume is uncertain and may extend into the NBZ, but likely at concentrations below the MCL.

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 and RCRA requirements, the groundwater cleanup standards are the Safe Drinking Water Act maximum contaminant levels, 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 *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV* (Draft Remedial Investigation Report) (CDM Smith 2018a) was prepared that synthesizes historic and current groundwater characterization data and defines the locations and extent of groundwater contamination for which DOE is responsible. A *Draft Groundwater Corrective Measures Study, Area IV* (Draft Corrective Measures Study) (CDM Smith 2018c) has been developed concurrently with this EIS to identify, 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. Both the Draft Remedial Investigation Report and Draft Corrective Measures Study have been submitted to DTSC. In support of the Corrective Measures Study, DOE collected extensive hydrogeological data that will support the transport and fate modeling needed for remedy selection. All groundwater remedies would involve monitoring to assess remedy effectiveness.

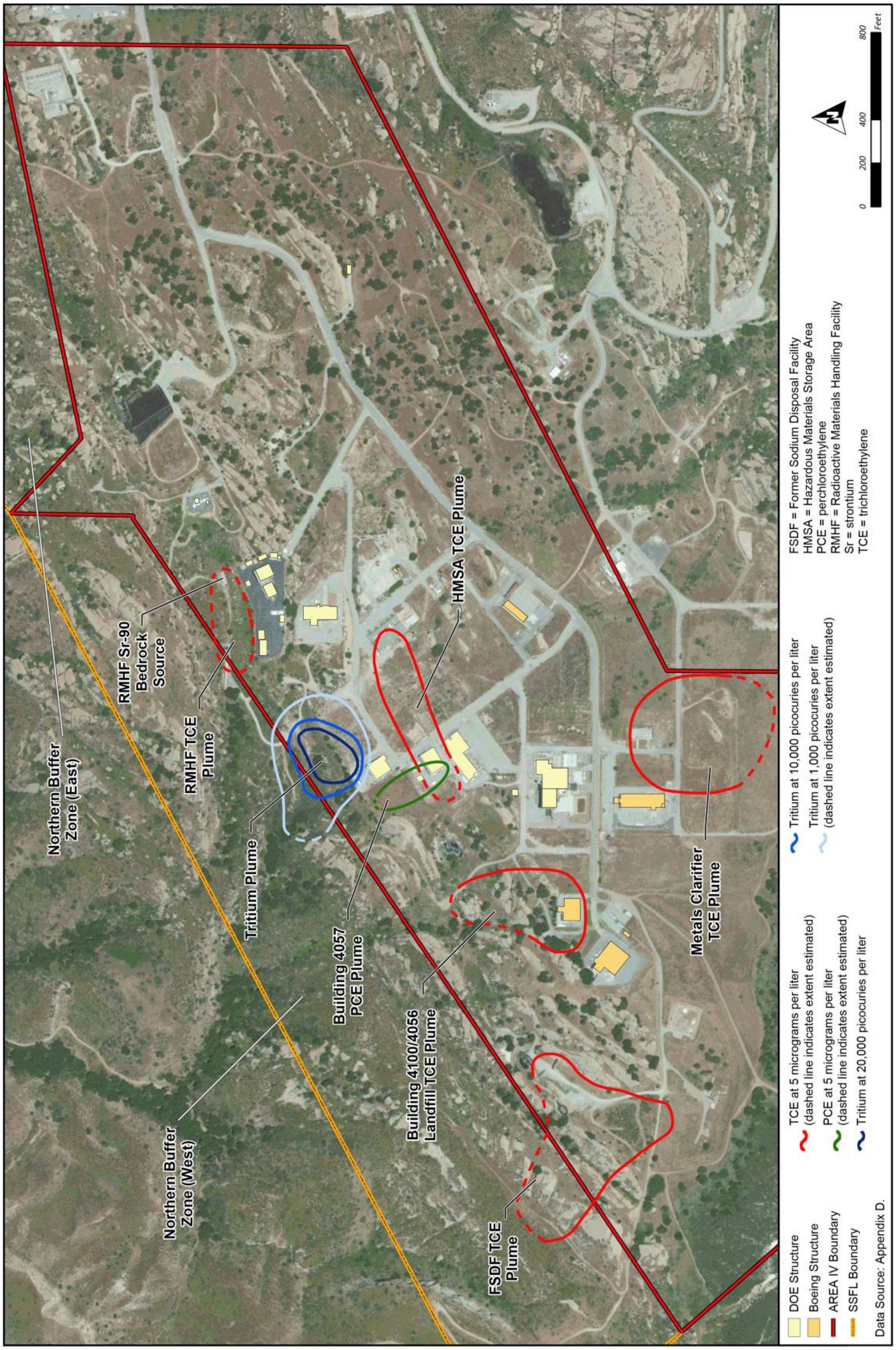

Figure 2–11 Groundwater Plumes and Strontium-90 Source

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. This Final EIS evaluates the potential impacts that could occur during groundwater remediation activities identified in the Draft Corrective Measures Study, assuming implementation of the appropriate groundwater remediation technologies that would result in the largest potential impacts. 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 referred to in the following discussion are shown in **Figure 2–12**.

2.6.1 Groundwater No Action Alternative

Under the No Action Alternative for groundwater, current groundwater monitoring would continue in accordance with the requirements of the 2007 CO. This includes visiting all wells to check water levels and sampling selected wells. Because this is the No Action Alternative, it was assumed that DOE would not implement additional monitoring or actions other than those to which they have previously committed. As part of the SSFL-wide groundwater interim measures, DOE would continue to implement the FSDF Groundwater Interim Measure that was initiated in November 2017 to extract TCE-contaminated groundwater.[39] 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 200 gallons of purge water would be annually generated during this effort. Consistent with current practice, purge water would be collected in tanker trucks during the sampling process, then transferred to 55-gallon drums. The drums would be transported to a permitted hazardous waste treatment facility by truck for treatment and 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 that reduce the concentrations of constituents over time. 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

[39] A *Draft Santa Susana Field Laboratory Former Sodium Disposal Facility Groundwater Interim Measures Implementation Plan* (CDM Smith 2015c) was developed for constructing and operating a groundwater treatment system at the FSDF for removal of TCE. In recent years, water levels at the FSDF have been low because of less than average rainfall and the TCE concentration has dropped. The winter of 2016-2017 produced sufficient rainfall to saturate near-surface fractures harboring TCE. DOE began pumping groundwater from FSDF well RS-54 in November 2017. The well was repeatedly pumped dry in about 20 minutes, allowed to recover (i.e., refill with water), then pumped again. The well failed to recover in March 2018 and pumping was stopped. DOE continues to check water levels at the FSDF and pump it when enough water has accumulated. By June 2018, a total of 330 gallons of groundwater had been removed (CDM Smith 2018b).

Figure 2–12 Proposed Groundwater Treatment Areas

an effective natural attenuation process for radionuclides with relatively short half-lives (a half-life is the time required for the radioactivity of a specific isotope to decrease to half its original value). The half-life of tritium is 12.3 years, which is short enough for natural attenuation to be effective in reducing tritium concentrations relatively quickly.

Monitored natural attenuation requires demonstration that the natural processes are in place and working prior to its selection as a remediation technology. It also requires that monitoring be conducted throughout the period of remediation to confirm that the natural processes are continuing to be effective. Monitored natural attenuation would only be considered as a groundwater remedy for locations where a source to groundwater no longer exists or has been reduced through an active remedy as explained in the bullets below. 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.

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 radionuclide decay or natural chemical decomposition over time. Most monitoring would be completed in 10 to 50 years; however, monitoring of strontium-90 contamination at the RMHF leach field would last about 150 years. Monitoring time frames would be adjusted based on sampling results. The DOE groundwater plumes, the contaminants and their concentrations, and the expected monitoring are listed below (CDM Smith 2018a):

- For the FSDF TCE plume, TCE and 1,1,1-trichloroethane are currently above 1,000 parts per billion, and there are low levels (below the maximum contaminant level [MCL]) of perchlorate present (CDM Smith 2018a). Monitored natural attenuation would not be considered until concentrations were reduced to less than 50 parts per billion through active remediation. The remaining TCE would be monitored until it reached the MCL of 5 parts per billion.
- For the HMSA perched groundwater plume with TCE at 200 parts per billion (North Wind 2018), monitored natural attenuation would be implemented after pump and treat reduced the volatile organic compound mass and reduced concentrations. Monitored natural attenuation would then be performed until it reached the MCL of 5 parts per billion.
- For the Building 4100/4056 landfill TCE plume, TCE is currently approximately 48 parts per billion (CDM Smith 2015a). Monitored natural attenuation would be implemented after active treatment through pump and treat and would be performed until the PCE concentration reached the MCL of 5 parts per billion.
- For the Building 4057 PCE plume (currently at 48 parts per billion) (CDM Smith 2018a), monitored natural attenuation would be implemented after about 3 years of active treatment through pump and treat. Monitored natural attenuation would then be performed until the PCE concentration reached the MCL of 5 parts per billion.
- For the Metals Clarifier TCE plume (currently at 11 parts per billion) (North Wind 2018), monitoring would be performed until the concentration reached the MCL of 5 parts per billion.
- For the RMHF leach field, both strontium-90 and TCE would be monitored. Strontium-90 has a 28.8-year half-life. With an MCL of 8 picocuries per liter and maximum activity concentrations of 183 picocuries per liter in 2010, 29.5 picocuries per liter in 2015, and 65.8 picocuries per liter in 2018, monitoring would need to continue for about 150 years. For the TCE plume (currently 2.1 to 11 parts per billion [CDM Smith 2018a]), 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 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 (CDM Smith 2018a). Tritium in the plume was measured at 31,600 picocuries per liter in the first quarter of 2018 (North Wind 2018).

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. For purposes of analysis, five new monitoring wells were assumed, but the actual number will be determined from the Corrected Measures Study and approved by DTSC. 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).

Shallow, hollow-stem auger wells would 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 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.

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 hazardous waste treatment facilities. Approximately 100 gallons of development water per well installation would be generated.

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, DOE would identify the treatment technology to be applied to each plume or source area in a final RCRA Corrective Measures Study to be subject to DTSC for approval. Treatment technologies being considered for each plume or source area are based on an assessment included in the *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV* (CDM Smith 2018a). **Table 2–8** shows the treatment technologies that DOE deems most appropriate for each of the groundwater plumes and the strontium-90 source.

Table 2–8 Potential Application of Groundwater Treatment Technologies

Plume or Source	Treatment Technology				
	Pump and Treat	Bedrock Vapor Extraction	Source Isolation	Source Removal	Monitored Natural Attenuation
FSDF TCE plume	✓	✓			✓
Building 4100/56 TCE plume	✓	✓			✓
Building 4057 PCE plume	✓	✓			✓
Tritium plume					✓
HMSA TCE plume	✓	✓			✓
RMHF strontium-90 source			✓	✓	
Metals Clarifier TCE plume					✓
RMHF TCE plume					✓

FSDF = Former Sodium Disposal Facility; HMSA = Hazardous Materials Storage Area; PCE = perchloroethylene; RMHF = Radioactive Materials Handling Facility; TCE = trichloroethylene.

[a] The Metals Clarifier and RMHF TCE plume concentrations are in the 10 to 15 parts per million range and would not be amenable to treatment.

[b] The tritium plume would meet its MCL by 2025 through radioactive decay so is not addressed by any active treatment.

The treatment technologies discussed below are being considered for groundwater remediation. They include the technologies deemed most appropriate for each plume (as identified in Table 2–8, as well as other technologies identified in the Draft Corrective Measures Study (CDM Smith 2018c). The Metals Clarifier TCE plume and the RMHF TCE plume concentrations are in the range of 10 to 15 parts per billion 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. DOE expects that water would be withdrawn from existing wells, so no new wells would need to be installed. If it is determined that new wells are required, installation and impacts would be as described for the Monitored Natural Attenuation Alternative. A preliminary design of a pump and treat system has been prepared for the FSDF Groundwater Interim Measure treatment system (see Section 2.6.1) that is representative of systems that would be deployed if pump and treat were implemented for other plumes. Groundwater would be extracted (pumped) to the surface and transferred via above-ground piping to a double-walled 4,000-gallon polyethylene tank. 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 different types of resins to remove perchlorates and metals. The influent tank and filters would be situated in a secondary containment (a bermed and lined area) that is capable of holding the contents of the tank and filters should there be a leak. Following treatment, water would be pumped to a 20,000-gallon storage tank prior to release at the site. 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 disposed of on site – either released to the surface under a National Pollutant Elimination Discharge System (NDPES) permit or for dust control, piped aboveground from a storage tank to an underground infiltration system, or transported off site. This underground 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; construction of the infiltration system would require another week. No new staff would be needed to operate the extraction and treatment systems. Filters, spent granulated activated carbon, and resins would be replaced monthly. Used filtration materials would be taken off site for regeneration or disposal.

In some instances, Area IV wells may not produce sufficient quantities of water to support operation of an on-site treatment system (e.g., some wells cannot sustain a 0.5-gallon per minute pumping rate). For these low-producing wells, water would be pumped on a periodic basis into a water storage tank as described above. About every 90 days, the collected water would be transported to a hazardous waste treatment facility using a tanker truck for treatment and disposal.

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.

Bedrock Vapor Extraction. VOCs such as TCE present in fractured bedrock could potentially be removed through bedrock vapor extraction (BVE). With this technology, air is pulled through the subsurface into wells using a vacuum pump placed at the top of the well. The BVE system works by pulling air from the surface down into the area being remediated using bedrock core holes that have intercepted fractures harboring TCE. 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 BVE would require a treatability study to test the technology in the Area IV site geology. The technology was tested in Area II with some success (CH2M Hill 2015), but fracture size and density differ in Area II compared with Area IV. Fractures in Area IV are smaller and more widely spaced which would make it more difficult to extract the TCE. The results of the study are being evaluated as part of the Draft Corrective Measures Study (CDM Smith 2018c) to determine whether BVE is feasible in Area IV and, if so, the number of wells that would be needed.

The system would be automatically operated and periodically visited by an onsite technician. Based on the lateral extent and concentration of contaminants in the vadose zone (the unsaturated zone above the groundwater table), DOE estimated a BVE 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 4 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 30 feet by 60 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 45 feet; the elevation of the floor of the excavation would be about 1,760 feet above mean sea level. The source removal activity would occur after RMHF is removed and would take up to 60 days and require five workers.

A total of 3,000 cubic yards of rock and soil would be removed. The volume of excavated material that would be disposed of off site would be larger (approximately 4,500 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 2–12 shows the location of the bedrock removal area. The excavated rock and 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. Following removal of the strontium-90 contaminated bedrock, the excavation would be backfilled with clean soil and the site would be planted with native vegetation.

Enhanced Groundwater Treatment. Enhanced groundwater treatment is a potential technology that could be used to reduce the TCE or PCE 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 or PCE.

This technology is only effective in locations with sufficient fracture density and fracture width to allow movement of the treatment media into the bedrock fractures containing contaminated groundwater. Treatability studies conducted by Boeing in Area IV have demonstrated difficulties with movement of the treatment media into bedrock fractures (CH2M Hill 2016). Nonetheless, DOE is retaining this as a potentially viable technology in the Draft Corrective Measures Study (CDM Smith 2018c).

2.7 Preferred Alternative[40]

DOE's preferred alternative for soils remediation is the Conservation of Natural Resources, Open Space Scenario. DOE is identifying this as the preferred alternative because it would be consistent with the risk assessment approach typically used at other DOE sites, other DTSC-regulated sites, and EPA CERCLA sites, which accounts for the specific future land use of the site. Use of a risk assessment approach would be consistent with the process being used by Boeing for the land it owns at SSFL and recognizes the Grant Deeds of Conservation Easement and Agreements (Ventura County 2017a, 2017b) that commit Boeing's SSFL property, including Area IV and the NBZ, to remaining as open space. This scenario would use a CERCLA risk assessment approach that would be protective of human health and the environment rather than LUT values (action levels). The 2010 AOC allows DOE and DTSC to agree upon changes to the AOC to better meet cleanup objectives. DOE expects to engage DTSC in discussions about such changes in order to implement this soil remediation alternative.

For building demolition, DOE's preferred alternative is the Building Removal Alternative. Under this alternative DOE would demolish the 18 DOE-owned buildings in Area IV and transport the resulting waste off site for disposal. Demolition of thirteen facilities and disposition of the resulting debris would be in accordance with DOE requirements and applicable laws and regulations. Three facilities at the RMHF and the two facilities comprising the HWMF would be closed in accordance with DTSC-approved RCRA facility closure plans.

DOE's preferred alternative for groundwater remediation is a combination of the Treatment Alternative and the Monitored Natural Attenuation Alternative. DOE would treat the groundwater plumes with higher concentrations of contaminants (the FSDF, HMSA, Building 4100/56, and Building 4057 plumes) in accordance with the results of the final Corrective Measures Study. Source removal is the preferred alternative for the strontium-90 source. Monitored natural attenuation would be used for plumes that are not amenable to active treatment – the two plumes with the lowest concentrations of TCE (the Metals Clarifier and RMHF plumes) and the tritium plume.

[40] This section identifies DOE's preferred alternative at the time of publication of this Final EIS but does not predetermine DOE's decision, which will be announced in one or more RODs.

DOE's proposed groundwater remedial actions would be included in the final Corrective Measures Study submitted to DTSC for approval.

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 2–9** 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 and all soil remediation action alternatives, the land use designation for Area IV and the NBZ would be consistent with Ventura County's general plan designation and zoning, and with the landowner's (Boeing's) two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).

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 3.3 percent, which could result in weekday motorist delays or the perception of 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 26 years under the Cleanup to AOC LUT Values Alternative, slightly more than 26 years under the Cleanup to Revised LUT Values Alternative, or 2 years or less under the Conservation of Natural Resources Alternative (both scenarios). 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 1.5 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 1.75 million gallons of water, primarily for dust control. The total water use would be about 46 million gallons under the Cleanup to AOC LUT Values Alternative, 11 million gallons under the Cleanup to Revised LUT Values Alternative, or 3.5 million gallons under the Conservation of Natural Resources Alternative Residential and Open Space Scenarios. 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 0.004 percent of CMWD's combined imported and local water supply, water use is an important consideration because of California's drought conditions. In response to continued drought concerns, California's Governor Brown signed legislation in 2018 that strengthens the State's water resiliency in the face of future droughts with provisions that include: personal daily water use reduction goals, incentives for water suppliers to recycle water, and: requirements for urban and agricultural water suppliers to set annual water budgets and prepare for drought (State of California 2018). 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 vast majority of the Santa Susana Formation in Area IV is located within areas that are proposed for protection of endangered species using an exemption process involving removal of soil that poses a risk to human and/or ecological receptors. As discussed in Chapter 2, Section 2.3.2, DOE would refrain from soil removal actions in the areas where the exemption process would be applied 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.[41] 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 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 under both the residential and open space scenarios. 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

[41] 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.

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. These at-risk locations are zones where earthquake-induced landslide could occur; these zones are overwhelmingly occur in the NBZ. Because the total area in the NBZ to be remediated is only about 0.6 acres, the potential risks to workers would be small. 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's 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 (both options), 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. DOE would minimize risks to workers by proposing to implement the exemption process stipulated in the 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, because the soil structure would be loosened and the stabilizing root structures would be removed leading to a reduction of soil quality and functional capability within eroded areas. 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. The greatest potential for erosion would occur under the Cleanup to AOC LUT Values Alternative because of the projected disturbance of about 90 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 38 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 10 acres would be disturbed outside the proposed exemption areas under the Residential Scenario and 9 acres would be disturbed outside the proposed exemption areas under the Open Space Scenario.

All of the soil remediation action alternatives would impact soil resources, including loss of soil function if the backfill is not compatible with native plants at Area IV and the NBZ.[42] 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 (both scenarios). 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 unique characteristics would represent a resource that would be less available to other users in Ventura County or other counties.

[42] 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.

A source of 661,000 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, 143,000 cubic yards of backfill would be required that meet revised LUT values for chemicals and AOC LUT values for radionuclides. Under the Residential Scenario of the Conservation of Natural Resources Alternative, 39,000 cubic yards of backfill would be required that contain concentrations of chemicals and radionuclides meeting risk-assessment-based values. Under the Open Space Scenario, about 29,000 cubic yards would be required. 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.

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. 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.

The Soil No Action Alternative would leave chemical and radioactive constituents in soil. The extent to which the impacted soil represents a source of contaminants to groundwater is under investigation. 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 90 acres of land in Area IV and the NBZ. 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 33 acres of relatively undisturbed native habitat (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) would be affected by remediation activities. There would be fewer impacts within the areas where the exemption process would be applied because remediation would occur via focused removal actions that would minimize soil and habit disturbance. Focused removal actions in accordance with the exemption process would affect an estimated 4 acres of the 90 acres removed under this alternative. As discussed in Section 2.3.2, within areas in which the exemption process would be applied, DOE would remove chemical and radioactive constituents in the soil that pose a risk to human health or ecological resources as determined using a traditional risk assessment, while minimizing disturbance to the surrounding areas. In this event, remediation within the areas where the exemption process would be applied would be less severe and less extensive, and restoration would be more feasible than in 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 38 acres) would be less than half of that affected under the Cleanup to AOC LUT Values Alternative. Impacts would be further reduced under the Conservation of Natural Resources Alternative because even fewer acres would be disturbed (about 10 acres under the Residential Scenario and 9 Acres under the Open Space Scenario). 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 14 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected under the Cleanup to Revised LUT Values Alternative, while about 5 acres of relatively undisturbed native habitat would be affected under the Conservation of Natural Resources Alternative (under either the Residential or Open Space Scenario). Under both of these alternatives, potential impacts would be generally similar to those under the Cleanup to AOC LUT Values Alternative.

Under the Cleanup to AOC LUT Values Alternative, about 0.02 total acres of wetlands would be directly affected. Additionally, about 0.32 acres of ephemeral drainages would be affected, of which 0.16 acres are considered potentially Jurisdictional Waters of the U.S. 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, with about 0.02 acres directly affected, but the area of ephemeral drainages affected would be smaller (about 0.16 acres, of which 0.07 acres are potentially jurisdictional Waters of the U.S. Under the Conservation of Natural Resources Alternative, about 0.02 total acres of wetlands would be directly affected (the same as that under the preceding alternatives) but the area of ephemeral drainages would be less (0.04 acres, of which 0.02 acres are potentially jurisdictional

Waters of the U.S.). 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 of the extensive remediation in Area IV and the NBZ. Within 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 exemption process would be applied and 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 would be affected (38 acres and 10 or 9 acres, respectively, compared to 90 acres under the Cleanup to AOC LUT Values Alternative). Potential suitable habitat for two federally listed species, the coastal California gnatcatcher (Threatened) and least Bell's vireo (Endangered) has been identified in Area IV and the NBZ (USFWS 2018). Neither species has been documented recently (within the last 5 years) in Area IV or the NBZ, but due to the possible long duration of the proposed project, habitat conditions that may change, these species may use the site at some point during project implementation. Thus, potentially suitable habitat for these species has been identified and mapped (see Chapter 3, Section 3.5). If the areas identified as potential suitable habitat are occupied by federally listed species in the future, DOE would propose that those areas also be subject to the exemption process in order to avoid or minimize impacts on these species (USFWS Biological Opinion 2018, in Appendix J).

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 30,000 to 80,000 metric tons under the Cleanup to AOC LUT Values Alternative, 12,000 to 34,000 metric tons under the Cleanup to Revised LUT Values Alternative, 1,500 to 4,000 metric tons under the Conservation of Natural Resources Alternative, Residential Scenario, or 1,100 to 3,000 metric tons under the Conservation of Natural Resources Alternative, Open Space Scenario. 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 26 years under the Cleanup to AOC LUT Values Alternative, 6 years under the Cleanup to Revised LUT Values Alternative, and 2 years or less 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).

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 (0.26) under the truck option or 2 (2.3) under the truck/rail option. Under both the Cleanup to Revised LUT Values Alternative and either of the 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 up to 3.3 percent during 26 years of soil removal, with about the same increase under the Cleanup to Revised LUT Values Alternative during 6 years of soil removal. The weekday average daily traffic on Woolsey Canyon Road would increase by about 3.3 percent under both scenarios for the Conservation of Natural Resources Alternative. The duration of soil removal would be about 2 years under the Residential Scenario and less than 2 years under the Open Space Scenario. 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, motorists could experience or perceive 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 and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by directing traffic to or from SSFL through multiple routes between SSFL and major highways. Delays at the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6–2).

Due to DOE traffic and compared with 2018 baseline conditions, the level of service (LOS)[43] rating for Woolsey Canyon Road would change from A to B during AM peak traffic conditions under all soil remediation action alternatives. The increase in the volume-to-capacity (V/C) ratio for the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard would range from 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years. For example, under the Cleanup to AOC LUT Values Alternative, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM peak traffic conditions during most of the 26 years of soil removal. Traffic conditions under the Cleanup to Revised LUT Values Alternative would be similar to those for the Cleanup to AOC LUT Values Alternative, except that because soil removal would require only 6 years, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete. However, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM peak traffic conditions during some of the 6 years of soil removal. Because soil removal under the Conservation of Natural Resources Alternative would require only 2 years or less, depending on the scenario, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete. The intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at a D to E LOS rating during AM peak traffic conditions.

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

[43] 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).

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 258,000 under the Cleanup to AOC LUT Values Alternative, 56,000 under the Cleanup to Revised AOC LUT Values Alternative, 15,000 under the Conservation of Natural Resources Alternative (Residential Scenario), or 11,000 under the Conservation of Natural Resources Alternative (Open Space Scenario). 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 live on the site after loss of institutional control or intrude onto the site, whether the intrusion is temporary and occasional or more permanent. Although under the Soil No Action Alternative DOE's intent would be to prevent public access to the site through fencing, signage, and routine patrols by site security personnel, two scenarios involving hypothetical public receptors were analyzed: an onsite suburban resident and a recreational user. Therefore, the onsite suburban resident was considered under the Soil No Action Alternative and the soil remediation action alternatives after remediation is completed. The onsite recreational user was considered under both the Soil No Action Alternative and the Conservation of Natural Resources – Open Space Scenario, after remediation. Site access was assumed to occur for the Soil No Action Alternative in spite 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). Two sets of background impacts were calculated for each receptor: one based on all background contaminants of potential concern (COPCs) and one on only the contaminants of concern (COCs) remaining for site data after background and frequency of detection screening for comparison to site impacts based only on COCs. The background for all chemicals and radionuclides indicates the total impact from background and is provided for reference. However, the health impacts for remediation alternatives are evaluated only for the COCs that remain after background and frequency of detection screening and thus removing contaminants that were only in background soil and not considered site related. The background health impacts for only the COCs is for comparison to the remediation alternative risks. The difference between the background impacts for COCs and the impacts for remediation alternatives indicates the contribution to health impacts from site activity related concentrations remaining onsite for each alternative. Potential impacts were then calculated for the various remediation alternatives for a hypothetical future onsite suburban resident and a hypothetical onsite recreational user.

Onsite soil impacts were calculated based on 19 example 10,000-square-meter exposure units representing the higher soil concentrations of COCs. The total[44] COC cancer incidence risk ranges in the 19 example exposure units from within the target risk range for remediation alternatives (1×10^{-6} to 1×10^{-4}) (EPA 1991) to less than the threshold for comparison of alternative impacts (i.e., less than 1×10^{-6}; see Section 4.9.7 for impact thresholds) for all soil remediation alternatives

[44] All cancer risks presented in this summary table are combined risks from chemicals and radionuclides. See cautions about combining chemical and radionuclide risks in Section 4.9.5.1.

except the No Action Alternative, which ranges from 5 times the 1×10^{-6} threshold for comparison to 2.3×10^{-3}, which is greater than the target risk range for remediation alternatives. All soil action remediation alternatives have the same total cancer incidence risk maximum rounded to 1 significant figure (5×10^{-5}) except for the Conservation of Resources Alternative – Residential Scenario, which is only slightly higher for the maximum (6×10^{-5}). The hazard index ranges from one-tenth of the impact threshold of 1.0 to just below (0.9) or equal to the impact threshold (1.0) for all soil remediation alternatives except the Soil No Action Alternative, which ranges from one-tenth of the impact threshold to 100 times the impact threshold. The radiological COC dose range for current or future onsite resident and recreator receptors after any remediation is significantly less than the public dose impact threshold (25 millirem per year) for all soil remediation alternatives, including the No Action Alternative. The highest resident dose obtained for any of the 19 example exposure units for any alternative was 6.4 millirem per year. 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 per year (NCRP 2009).

All impacts on the offsite resident and recreator receptors from soil remediation activities are 5 to 6 orders of magnitude less than all thresholds for impact comparison for all soil remediation alternatives, including the no action alternative. This means that they all have insignificant impacts on offsite receptors and there is no significant difference between the remediation alternates for these receptors.

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 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-seventeenth to one-twenty-third (depending on the scenario) of that under the Cleanup to AOC LUT Values Alternative because about one-seventeenth to one-twenty-third of the volume of soil would be removed. The potential for exposure under the Cleanup to Revised LUT Values Alternative would be about one-fifth of that under the cleanup to AOC LUT Values 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 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 about 26 years) than under the Cleanup to Revised LUT Values Alternative (a duration of 6 years) or the Conservation of Natural Resources Alternative (a duration of 2 years or less). 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. Quantitative estimates of worker impacts were not calculated for the soil remediation alternatives because they will be controlled in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders and those control limits are not expected to be exceeded. However, smaller remediation volumes means fewer impacts.

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 110,000 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, Residential Scenario, about 1,000 cubic yards would exceed risk-assessment-based values for radionuclides and be classified as LLW or MLLW. About 200 cubic yards of soil would be classified as LLW or MLLW under the Conservation of Natural Resources Alternative, Open Space Scenario. Under all soil remediation action alternatives, about 2,000 cubic yards of soil would be removed that would be classified as hazardous waste. Under the Cleanup to AOC LUT Values Alternative, about 769,000 cubic yards of soil would be removed that would exceed chemical AOC LUT values and would be classified as nonhazardous waste. Under the Cleanup to Revised LUT Values Alternative, about 78,000 cubic yards of soil would be removed that would exceed the revised LUT values for chemicals and would be classified as nonhazardous waste. Under the Conservation of Natural Resources Alternative, Residential Scenario, about 49,000 cubic yards of soil would exceed risk-based values for chemicals and be classified as nonhazardous waste; under the Conservation of Natural Resources Alternative, Open Space Scenario, about 36,000 cubic yards of soil 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, the McKittrick Waste Treatment Site and Antelope Valley Landfills would each receive waste from Area IV and the NBZ, representing about 16 percent of the daily permitted tonnage limits for these facilities, the percentages for other facilities would be smaller. 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 adverse impacts are expected on cultural resources under the Soil No Action Alternative. There are no architectural resources in the APE that are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected under any alternative. For archaeological resources, consistent with the 2010 AOC (DTSC 2010a), DOE has identified locations of known archaeological sites as areas in which the exemption process would be applied. In the soil remediation plan that DOE would submit for DTSC approval, DOE would propose that areas subject to the exemption process be cleaned of chemical and radioactive constituents if they pose a risk to human health or the environment. At this time, DOE risk assessments have identified soils that would need to be remediated that are on or near some archaeological sites. Therefore, some archaeological sites may be impacted by cleanup activities under any of the soil remediation action alternatives. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more Historic Properties Treatment Plan(s) (HPTP). The HPTP(s) will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation. The overall potential adverse effects related to archaeological resources would be similar but would vary somewhat among the alternatives, depending on extent of cleanup. Under all alternatives, in the unlikely event that an unanticipated archaeological resource is encountered, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

Soil remediation could have adverse impacts on traditional cultural resources under all action alternatives. In addition to potential impacts on specific archaeological resources, soil remediation could change the general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Improved access and increased traffic related to cleanup activities could impact traditional cultural resources by introducing more people, equipment, and possible vandalism during the duration of cleanup activity. 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 (90 acres disturbed), less under the Cleanup to Revised LUT Values Alternative (38 acres disturbed), and smallest under the Conservation of Natural Resources Alternative (10 acres and 9 acres disturbed under the Residential and Open Space Scenarios, respectively). DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for the NRHP.

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.[45]

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 minority or low-income populations, including Native American tribes, in the SSFL ROI and the regional ROIs.

[45] 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.

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 minority or low-populations, including Native American tribes, in the SSFL ROI.

Under all soil remediation action alternatives, increased traffic could cause weekday motorist delays on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. 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 minority or low-income populations, including Native Americans, 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 (26 years) than that under the Cleanup to Revised LUT Values Alternative (about 6 years), which in turn would be somewhat longer than that under the Conservation of Natural Resources Alternative (2 years or less depending on the scenario). Except for Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volume on the evaluated roads and intersections may be reduced by use of multiple routes between SSFL and major highways. Therefore, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI.

Under all soil remediation action alternatives, there would be no significant 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 minority or low-income populations, including Native American tribes, 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 impacts are expected on minority or low-income populations, including Native American tribes, 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 26 years under the Cleanup to AOC LUT Values Alternative and about a fifth this long under the Cleanup to Revised LUT Values Alternative and a tenth this long under the Conservation of Natural Resources Alternative. 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 and its intersection with Valley Circle Boulevard, traffic volume on SSFL area roads and intersections 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 2–9 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 (Residential and Open Space Scenarios)***
Land resources	- Land use for Area IV and the NBZ would be consistent Ventura County's general plan designation and zoning, and with the landowner's (Boeing's) two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).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.	- Land use during and after remediation would be consistent with Ventura County's general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). - During 26 years of soil removal, the average daily traffic on Woolsey Canyon Road would increase by up to 3.3 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 1.5 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 1.75 million gallons; total water use would be about 46 million gallons. Annual use would represent about 0.004 percent of CMWD's annual supply. Water use is an important consideration because of California's drought conditions and California's 2018 legislation targeting reductions in water use statewide (State of California 2018). - There would be onsite impacts on aesthetics and visual quality during the 26 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.	- Land use would be the same as that under the Cleanup to AOC LUT Values Alternative. - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for 6 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 11 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 6 rather than 26 years.	- Land use would be the same for both scenarios as that under the Cleanup to AOC LUT Values Alternative. - Impacts on recreation areas would be similar to those under the Cleanup to AOC LUT Values Alternative, except that increased traffic would last for 2 years or less. - 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 3.5 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 26 years.

Resource Area	Alternatives			
	Soil No Action	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources (Residential and Open Space Scenarios)*
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] - Some activities in the NBZ could take place in zones where earthquake-induced landslides could occur, leading to worker risks. However, because the total area in the NBZ to be potentially remediated is only about 0.6 acres, the potential risks to workers would be small. 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. Nonetheless, DOE would minimize as needed using the 2010 AOC (DTSC 2010a) exemption process. No work would take place in areas of seismic landslide risk unless concentrations in soil present a risk to human health or the environment. - Soil erosion is possible because of the disturbance of about 90 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 6611,000 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.	- 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 minimal because the Santa Susana Formation containing these resources is largely located within areas that would be subject to the exemption process. Outside of the areas that would be subject to the exemption process, the potential for impacts on paleontological resources would be less than that for 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 AOC LUT Values Alternative, with reduced risk to workers due to the lesser potential for work within these zones. - 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 38 acres). - About 143,000 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.	The impacts under the Residential and Open Space Scenarios and are as follows: - Impacts on bedrock geologic resources would be the same as those under the Cleanup to AOC LUT Values Alternative for both the Residential and Open Space Scenarios. - 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. - 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 with much reduced risk to workers because of the little potential for work within these zones. - Potential soil erosion impacts would be reduced compared to those under the Cleanup to Revised LUT Values Alternative because less acreage would be disturbed. Under the Residential Scenario about 10 acres would be disturbed and under the Open Space Scenario about 9 acres would be disturbed. - The Area IV-wide potential for loss of soil function would be reduced under both the Residential and Open Space Scenarios compared to under the Cleanup to Revised LUT Values Alternative. About 39,000 cubic yards of backfill with concentrations of chemicals and radionuclides meeting risk-assessment-based values would be required under the Residential Scenario and about 29,000 cubic yards of backfill of this quality would be requires under the Open Space Scenario.

Resource Area	*Alternatives*			
	Soil No Action	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
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 were to occur that exceeds the design of the NPDES system.	No adverse short-term impacts on surface water quality and runoff quantity and velocity are normally expected. During soil remediation, 90 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 (38 acres) would be disturbed.	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: Same as under the Cleanup to Revised LUT Values Alternative, except the potential for impacts would be less because less acreage (10 acres for the Residential Scenario and 9 acres for the Open Space Scenario) 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; potential 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.	The impacts under both the Residential and Open Space Scenarios are the same as under the Cleanup to AOC LUT Values Alternative.
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 90 acres would increase the difficulty of re-establishing native plant species and would reduce or eliminate the value of habitat for most wildlife species until the vegetation has reestablished. 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 33 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 areas where the exemption process would be applied because remediation within these areas would occur via focused removal actions that would minimize soil and habitat disturbance. - Approximately 0.34 acres 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,	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (38 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 14 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 areas where the exemption process would be applied would total about 4 acres as described under the Cleanup to	- Impacts on vegetation and wildlife habitat and biota would be reduced because the remediated acreage (10 acres for Residential Scenario or 9 acres for Open Space Scenario) would be considerably less than the 90 acres affected under the Cleanup to AOC LUT Values Alternative. Impacts would also be less than those under the Cleanup to Revised LUT Values Alternative (9 or 10 acres vs. 38 acres). The much 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 5 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected by remediation activities Impacts within the areas where the exemption process would be applied would total an estimated 4 acres as described under the Cleanup to AOC LUT Values Alternative. - Impacts on aquatic and wetland habitats and biota would be similar to those described under the Cleanup to AOC LUT Values Alternative, but a smaller area of ephemeral drainages would be directly affected than either of the preceding alternatives (less than 0.06 acres for both scenarios).

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
		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 areas where the exemption process would be applied and 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 and the total area directly affected by soils removal is estimated to be 4 acres.	AOC LUT Values Alternative. - Impacts on aquatic and wetland habitats and biota would be similar to those described under the Cleanup to AOC LUT Values Alternative, but a smaller area of ephemeral drainages would be directly affected. - Impacts on threatened, endangered, or rare species and critical habitat would be similar to those described under the Cleanup to AOC LUT Values Alternative	- Impacts on threatened, endangered, or rare species and critical habitat would be similar to those described 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 30,000 to 80,000 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 34,000 metric tons of CO_2 would be emitted, primarily from vehicles.	For the Residential Scenario, emissions of the same types of pollutants as those under the Cleanup to Revised LUT Values Alternative, but in smaller total quantities. For the Open Space Scenario, emissions of the same types of pollutants as those under the Residential Scenario, but in slightly smaller total quantities. For the Residential Scenario, a total of 1,500 to 4,000 metric tons of CO_2 would be emitted, primarily from vehicles. For the Open Space Scenario, a total of 1,100 to 3,000 metric tons of CO_2 would be emitted, primarily from vehicles.
Noise	No noise impacts above baseline conditions are expected.	- Noise levels from onsite remediation are expected to increase at the closest residence during the 26 years of soil removal, but would be well below 65 dBA CNEL and would increase by less than 5 dBA CNEL (thresholds 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 26 years of soil removal, although traffic noise would increase compared to baseline conditions. Assuming an occasional peak of 32 daily heavy-duty truck round trips, time-averaged daily noise levels along the evaluated haul roads could increase by up to 1.4 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	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 6 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of soil removal would be less than 2 years under the Residential Scenario.

	Alternatives				
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***	
		increase would be no more 1.2 dBA (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL).			
Transportation [a]	No impacts above baseline conditions are expected.	**Shipment of radioactive waste – truck option** [b] Shipments – 7,170 truck shipments *Incident-free risks:* - Crew LCFs: 0 (4×10^{-4} to 1×10^{-3}) - Population LCFs: 0 (1×10^{-4} to 3×10^{-4}) *Accident risks:* - Population LCFs: 0 (3×10^{-10} to 6×10^{-9}) - Traffic fatalities: 0 (0.05 to 0.6) **Shipment of radioactive waste – truck/rail option** [b] Shipments – 7,170 truck shipments from SSFL to an intermodal facility and then 450 rail shipments *Incident-free risks:* - Crew LCFs: 0 (1×10^{-4} to 3×10^{-4}) - Population LCFs: 0 (1×10^{-4} to 2×10^{-4}) *Accident risks:* - Population LCFs: 0 (3×10^{-10}) - Traffic fatalities: 0 (0.09 to 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.	***Residential Scenario*** **Shipment of radioactive waste – truck option** [b] Shipments – 65 truck shipments *Incident-free risks:* - Crew LCFs: 0 (3×10^{-6} to 1×10^{-5}) - Population LCFs: 0 (9×10^{-7} to 3×10^{-6}) *Accident risks:* - Population LCFs: 0 (3×10^{-12} to 6×10^{-11}) - Traffic fatalities: 0 (4×10^{-4} to 5×10^{-3}) **Shipment of radioactive waste – truck/rail option** [b] Shipments – 65 truck shipments from SSFL to an intermodal facility, then 5 rail shipments *Incident-free risks:* - Crew LCFs: 0 ($1\times10^{-6}$to 3×10^{-6}) - Population LCFs: 0 (1×10^{-6} to 2×10^{-6}) *Accident risks:* - Population LCFs: 0 (3×10^{-12} to 4×10^{-12}) - Traffic fatalities: 0 (1×10^{-3} to 3×10^{-3})	***Open Space Scenario*** **Shipment of radioactive waste – truck option** [b] Shipments – 13 truck shipments *Incident-free risks:* - Crew LCFs: 0 (7×10^{-7} to 2×10^{-6}) - Population LCFs: 0 (2×10^{-7} to 6×10^{-7}) *Accident risks:* - Population LCFs: 0 (5×10^{-13} to 1×10^{-11}) - Traffic fatalities: 0 (9×10^{-5} to 1×10^{-3}) **Shipment of radioactive waste – truck/rail option** [b] Shipments –13 truck shipments from SSFL to a an intermodal facility, then 1 rail shipment *Incident-free risks:* - Crew LCFs: 0 (3×10^{-7} to 6×10^{-7}) - Population LCFs: 0 (2×10^{-7} to 4×10^{-7}) *Accident risks:* - Population LCFs: 0 (6×10^{-13} to 8×10^{-13} - Traffic fatalities: 0 (2×10^{-4} to 5×10^{-4})

Resource Area	*Alternatives*				
	Soil No Action	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources (Residential and Open Space Scenarios)*	
		Shipment of nonradioactive waste, backfill, equipment, and supplies [b] *Truck option:* - 93,430 truck shipments - Traffic fatality risks: 0 (0.26) *Truck/rail option:* - 50,280 truck shipments of waste from SSFL to an intermodal facility, then 3,200 rail shipments; 43,140 truck shipments of backfill, equipment, and supplies Traffic fatality risks: 2 (2.3)	**Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 14,560 truck shipments - Traffic fatality risks: 0 (0.04) *Truck/rail option:* - 5,220 truck shipments of waste from SSFL to an intermodal facility and then 330 rail shipments; 9,340 truck shipments of backfill, equipment, and supplies Traffic fatality risks: 0 (0.24)	***Residential Scenario*** **Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 5,920 truck shipments - Traffic fatality risks: 0 (0.02) *Truck/rail option:* - 3,330 truck shipments of waste from SSFL to an intermodal facility and then 210 rail shipments; 2,590 truck shipments of backfill, equipment, and supplies - Traffic fatality risks: 0 (0.15)	***Open Space Scenario*** **Shipment of nonradioactive waste, backfill, equipment, and supplies [b]** *Truck option:* - 4,400 truck shipments - Traffic fatality risks: 0 (0.02) *Truck/rail option:* - 2,480 truck shipments of waste from SSFL to an intermodal facility and then 160 rail shipments; 1,920 truck shipments of backfill, equipment, and supplies - Traffic fatality risks: 0 (0.11)
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 up to 3.3 percent during the 26 years of soil removal. Traffic increases on other evaluated roads would be smaller. Weekday motorist delays or perceived delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways. Compared with 2018 baseline conditions, the LOS rating for Woolsey Canyon Boulevard could change from A to B during AM traffic conditions. The increase in V/C ratio for the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard would range from 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years. For example, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic	Increases in weekday average daily traffic, and potential motorist delays or perceived delays, would be similar to those under the Cleanup to AOC LUT Values Alternative, except the increased level of traffic would last for about 6 years. Traffic increases on other evaluated roads would be smaller. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways. Potential changes in LOS ratings and V/C ratios would be similar to the Cleanup to AOC LUT Values Alternative, except that because soil removal would require only 6 years, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete. However, the unsignalized	Increases in weekday average daily traffic, and potential motorist delays or perceived delays, 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 or less depending on the scenario. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways. Potential changes in LOS ratings and V/C ratios would be similar to the Cleanup to Revised LUT Values Alternative, except that because soil removal would require up to 2 years, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete. Under the Residential and Open Space Scenarios, traffic would impose about 15,000 and 11,000 ESALs, respectively, on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but could still result in the affected roads needing repair sooner than currently anticipated.	

	Alternatives			
Resource Area	**Soil No Action**	**Cleanup to AOC LUT Values**	**Cleanup to Revised LUT Values**	**Conservation of Natural Resources (Residential and Open Space Scenarios)**
		conditions during most of the 26 years of soil removal. Traffic would impose about 258,000 ESALs on the evaluated roads, which would likely have adverse impacts on road pavement and result in the affected roads needing repair sooner than currently anticipated.	intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic conditions during some of the 6 years of soil removal. Traffic would impose about 56,000 ESALs on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but could still result in the affected roads needing repair 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 26 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 6 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 or less. Workers would have less exposure to chemical and radioactive constituents than under the Cleanup to Revised LUT Values Alternative. Remediation worker protection would be the same as that under the Cleanup to AOC LUT Values Alternative.
	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 (881,000 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 about 1/5 of that under the Cleanup to AOC LUT Values Alternative because the volume of soil that would be disturbed would be less (190,000 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 (38,200 cubic yards under the Open Space Scenario to 52,000 cubic yards under the Residential Scenario).
	Members of the public [d] *Hypothetical Onsite Suburban Resident* – Total COC cancer risks from chemicals and/or radionuclides [d] in Area IV ranges from 5 times greater than the threshold for comparison (1×10^{-6}) to an order of magnitude above	**Members of the public** *Hypothetical Onsite Suburban Resident and Recreator* – Chemically and radioactively impacted soil exceeding AOC LUT values would be removed. Thereafter, total COC cancer risks from chemicals and/or radionuclides in Area IV and the NBZ ranges in the 19 example exposure units from less than the threshold for comparison (1×10^{-6}) to within the acceptable	**Members of the public** *Hypothetical Onsite Suburban Resident and Recreator* – Chemically impacted soil exceeding revised LUT values would be removed, as would radioactively contaminated soil exceeding AOC LUT values. Thereafter, total COC cancer risks from chemicals and/or	**Members of the public** *Hypothetical Onsite Suburban Resident and Recreator* – Chemically and radioactively impacted soil exceeding risk/dose assessment-based values would be removed. Thereafter for both scenarios, total COC cancer risks from chemicals and/or radionuclides in Area IV and the NBZ ranges in the 19 example exposure units from equal to the impact threshold value to less than the threshold for comparison (1×10^{-6}) to within the acceptable range for evaluated alternatives (10^{-6} to

Resource Area	Alternatives			
	Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)
	the threshold for acceptable impacts (<1×10^{-4}), while the toxicity ranges from less than 1.0 to 100. Based 19 example exposure areas; Cancer risk: 5×10^{-6} to 2×10^{-3} Hazard index: 0.1 to 100 *Hypothetical Onsite Recreational User* – Cancer risk and toxicity impacts from chemical and/or radionuclides [c] in Area IV and the NBZ are comparable to or less than those determined for background soil. Based 19 example exposure areas; Cancer risk: 1×10^{-6} to 2×10^{-4} Hazard index: 0.02 to 30. *Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. <u>Suburban Resident:</u> Cancer risk: 1.2×10^{-11} Hazard Index: 2.0×10^{-7} <u>Recreator:</u> Cancer risk: 5.0×10^{-12} Hazard Index: 4.8×10^{-8}	range for evaluated alternatives (10^{-6} to 10^{-4}), while the toxicity range does not equal or exceed 1.0. Cancer risk: 4×10^{-7} to 5×10^{-5} Hazard index: 0.05 to 0.9 *Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. <u>Suburban Resident</u>: Cancer risk: 9.8×10^{-11} Hazard Index: 1.8×10^{-6} <u>Recreator:</u> Cancer risk: 4.8×10^{-11} Hazard Index: 5.0×10^{-7}	radionuclides in Area IV and the NBZ ranges in the 19 example exposure units from less than the threshold for comparison (1×10^{-6}) to within the acceptable range for evaluated alternatives (10^{-6} to 10^{-4}), while the toxicity range does not equal or exceed 1.0. Cancer risk: 5×10^{-7} to 5×10^{-5} Hazard index: 0.06 to 0.9 *Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. <u>Suburban Resident</u>: Cancer risk: 3.0×10^{-11} Hazard Index: 1.4×10^{-6} <u>Recreator:</u> Cancer risk: 1.3×10^{-11} Hazard Index: 7.4×10^{-7}	10^{-4}), while the toxicity range does not exceed 1.0. <u>Residential Scenario (Resident):</u> Cancer risk: 1×10^{-6} to 5×10^{-5} Hazard index: 0.06 to 1.0 <u>Open Space Scenario (Recreator):</u> Cancer risk: 3×10^{-7} to 1×10^{-5} Hazard index: 0.01 to 0.3 *Offsite Suburban Resident and Recreational User* - The impacts are 5 to 6 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. *Residential Scenario* Suburban Resident: Cancer risk: 1.4×10^{-11} Hazard Index: 2.3×10^{-6} *Open Space Scenario* Cancer risk: 1.1×10^{-11} Hazard Index: 3.4×10^{-6} <u>Recreator:</u> *Residential Scenario* Cancer risk: 5.8×10^{-12} Hazard Index: 1.5×10^{-6} *Open Space Scenario* Cancer risk: 4.5×10^{-12} Hazard Index: 2.4×10^{-6}

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
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 – 110,000 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 769,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 110,000 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 78,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	*Residential Scenario:* LLW/MLLW – 1,000 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 49,000 cubic yards *Open Space Scenario:* LLW/MLLW – 200 cubic yards Hazardous waste – 2,000 cubic yards Nonhazardous waste – 36,000 cubic yards No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.
Cultural resources	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No historic properties would be affected. ***Traditional Cultural Resources***. No adverse impacts are expected.	***Architectural Resources.*** No historic properties would be affected by soil remediation. ***Archaeological Resources***. Should a historic property not be exempted from cleanup requirements, including any unanticipated discovery made during soil remediation, appropriate avoidance, minimization, and/or mitigation measures will be implemented in accordance with the Section 106 Programmatic Agreement currently under development. ***Traditional Cultural Resources***. Soil remediation would result in changes to the setting and general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Adverse impacts on the integrity of traditional cultural resources are possible from disturbance of landscape due to soil removal (881,000 cubic yards, 90 acres), increased human activity and equipment during 26 years of soil removal, augmented site access during remediation, and potential discovery of unanticipated resources during soil remediation.	***Architectural Resources.*** No historic properties would be affected by soil remediation. ***Archaeological Resources***. Similar to the Cleanup to AOC LUT Values Alternative, but with less likelihood of unanticipated discoveries during soil remediation because less area would be disturbed. ***Traditional Cultural Resources***. Adverse impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced magnitude. There would be reduced changes in setting because there would be less soil removal (190,000 cubic yards, 38 acres), less human activity and equipment (for approximately 6 years rather than 26 years), reduced duration of site access during remediation, and less potential for unanticipated discoveries.	***Architectural Resources.*** No historic properties would be affected by soil remediation. ***Archaeological Resources***. Similar to the Cleanup to AOC LUT Values Alternative, but with less likelihood of unanticipated discoveries during soil remediation because less area would be disturbed. ***Traditional Cultural Resources***. Adverse impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced magnitude. There would be reduced changes in setting because there would be less soil removal (52,000 cubic yards and 10 acres under the Residential Scenario and 38,200 cubic yards and 9 acres under the Open Space Scenario), less human activity and equipment (for 2 years or less under both scenarios), reduced duration of site access during remediation, and less potential for unanticipated discoveries.
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 26 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 26 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,	- Employment would increase by 25 workers for 6 years, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for about 6 years, but is not expected to have socioeconomic impacts on businesses on the evaluated routes between SSFL and major highways.	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: - Employment would increase by 25 workers for 2 years or less, with minor beneficial socioeconomic impacts. - Truck traffic in the SSFL vicinity would last for 2 years or less, 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

Resource Area	Alternatives			
	Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)
		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 26 years of soil removal. - Because there are few, if any, local businesses along the main access routes to the three evaluated LLW/MLLW disposal facilities, there would be no socioeconomic impacts on businesses in the vicinities of these facilities. Because of the small numbers of daily deliveries of soil to the evaluated hazardous waste facilities (daily average less than 1), no socioeconomic impacts are expected on businesses near these facilities For deliveries of nonhazardous soil to the evaluated facilities, which could occur up to 9 per day for most years, 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.	- 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 about 6 years. - Potential impacts on local businesses near the disposal or recycle facilities would be similar to the Cleanup to AOC LUT Values Alternative, with the same daily deliveries over the same delivery durations to the evaluated radioactive and hazardous waste facilities, and the same lack of potential for socioeconomic impacts on businesses near these facilities. There would be a similar peak delivery rate to the evaluated nonhazardous waste facilities (up to 9 per day), but this rate of waste delivery would last for only 1 year; over the other 5 years of delivery, the daily rate would range from 1 to 4. No or minimal socioeconomic impacts are expected on businesses near these facilities There would be reduced disposal fees at the evaluated hazardous waste facilities.	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 Alternative because of the slightly shorter operational duration of soil removal. - Potential impacts on local businesses near the disposal or recycle facilities would be similar to the Cleanup to Revised LUT Values Alternative, except that the total number of shipments to radioactive waste facilities would be substantially reduced for both scenarios, 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 LLW/MLLW or hazardous waste facility. No or minimal socioeconomic impacts are expected on businesses near the evaluated nonhazardous waste facilities.

	Alternatives			
Resource Area	***Soil No Action***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the SSFL ROI. - During the 26 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 minority or low-income populations, including Native American tribes, in the regional ROIs.	- Potential impacts on minority or low-income populations, including Native American tribes, 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 about 6 years. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes.	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: - Potential impacts on minority or low-income populations, including Native American tribes, 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 or less. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes.

Resource Area	Alternatives			
	Soil No Action	Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)
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 26-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 about 6 years rather than 10 years. - There would be similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities compared to the Cleanup to AOC LUT Values Alternative, but soil removal and associated increased traffic would occur for a much shorter duration. No disparate impacts are expected on sensitive-aged populations in the regional ROIs	The impacts would be the same under both the Residential and Open Space Scenarios and are as follows: - 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 about 2 years under the Residential Scenario or less than 2 years under the Open Space Scenario. Under both scenarios, 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 shorter durations. 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; V/C ratio = volume-to-capacity ratio; VOC = volatile organic compound.

[a] "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 areas where the exemption process would be applied 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 95% Upper Confidence Limit (UCL95) on the mean concentration for al constituents that had a frequency of detection greater than 2.5 percent for chemicals or 5 percent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018b).

[f] All Caner risks presented in this summary table are combined risks from chemicals and radionuclides. The contributions from each are shown in the tables below. See cautions about combining chemical and radionuclide risks in Section 4.9.5.1.

2.8.1.2 Potential Environmental Consequences of the Building Demolition Alternatives

Environmental consequences for each resource area are summarized in **Table 2–10** and evaluated for the Building No Action and Building Removal Alternatives.

Land resources. Under both the Building No Action and Building Removal Alternatives, land use for Area IV would be consistent with Ventura County's general plan designation and zoning. Land use would also be consistent with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).

Under the Building No Action Alternative, no impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity. During the 2 to 3 years required for building demolition under the Building Removal Alternative, the average daily traffic on Woolsey Canyon Road would increase by up to 5.2 percent above baseline conditions. The traffic associated with this alternative could result in traffic delays or the perception of delays that could discourage weekday use of Sage Ranch Park, but the potential for delays or perception of delays would likely be less than that for any of the soil remediation action alternatives. There is less potential for discouraged weekday use of other recreational areas in the SSFL vicinity; nonetheless, traffic on other roads past other recreation areas may be reduced by routing truck traffic among multiple routes between SSFL and 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, up to about 250,000 gallons per day of demolition work would be used under the Building Removal Alternative, or about 250,000 gallons annually during the two years of building removal and about 130,000 gallons during the last assumed year of building removal. Total water use would be about 630,000 gallons. 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 0.0006 percent of CMWD's combined imported and local water supply, water use is an important consideration because of California's drought conditions which culminated in local and State-wide measures to significantly reduce water consumption (see Section 2.8.1.1, "Land resources") 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 to3 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 no buildings are located within the Santa Susana Formation, which has a known potential for paleontological resources (see Section 2.8.1.1).

The equipment for building demolition would be staged wherever possible on existing concrete or asphalt areas or on previously disturbed soil. 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.

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. 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. 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 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 and be gradually reduced through attenuation or decay. Under the Building Removal Alternative, no adverse short-term impacts are expected on water quality from stormwater runoff. This alternative would remove potential sources 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 because the remaining buildings are not sources of chemicals and radionuclides to groundwater. No substantial impacts are expected on groundwater quantity. If work is performed during a wet year, 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. Any groundwater contaminants removed during dewatering would result in a small improvement in water quality at the Building 4024 location.

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, and nesting activities could be disturbed depending on the timing of the demolition activities. 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. No federally or State-listed wildlife species are known or expected to use the existing buildings. Adverse impacts on individual (State-listed as rare) Santa Susana tarplants could occur if they are established next to buildings at the time that demolition occurs. 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[46] 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 4,400 to 7,100 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 exceed that evaluated for the soil remediation action alternatives (see Section 2.8.1.1) and would not result in adverse noise impacts along the evaluated 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.

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[46] 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.

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.

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 weekday average daily traffic on Woolsey Canyon Road would increase by up to 5.2 percent above baseline conditions during the 2 to 3 years required for building removal. Because of the presence of slow-moving heavy duty trucks, there could be weekday motorist delays or perceived delays on this road and its intersection with Valley Circle Boulevard. Traffic increases on other evaluated roads would be smaller. Except for Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic on roads and intersections may be reduced by distributing traffic among multiple routes between SSFL and major highways.

There could be a change, compared to 2018 baseline conditions, in the LOS rating for Woolsey Canyon Road from A to B during peak AM traffic conditions. This may be more likely on a limited number of days when the daily number of truck shipments could spike to 12. Projected traffic growth would have less impact on the implementation of the Building Removal Alternative than any of the soil remediation action alternatives, because only 2 to 3 years would be required to implement the Building Removal Alternative, and because the alternative could be largely implemented before there would be significant traffic growth in the SSFL area. There would be less congestion at the intersection of Woolsey Canyon Road with Valley Circle Boulevard, because during the period of building removal, this intersection during both AM and PM peak traffic conditions could potentially operate at a D to E rating during AM peak traffic conditions and a C rating during PM peak traffic conditions.

Truck traffic under the Building Removal Alternative would impose about 6,200 ESALs on roads between SSFL and major highways, which is much less than the ESALs projected under the soil remediation action alternatives. Still, the ESALs could have adverse impacts on road pavement, which may result in affected 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).

The health impact to onsite workers during building demolition activities was also evaluated. Building demolition provide a risk of cancer incidence to workers of 1.2×10^{-4} and a dose well less than the worker dose limit of 5000 millirem per year (250 millirem per year). In all cases, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders.

The impacts on the offsite resident and recreator receptors from building demolition activities are 1 to 3 orders of magnitude less than all thresholds for impact comparison for all alternatives, including the no action alternative. This means that they all have insignificant impact and there is no significant difference between the remediation alternatives for these receptors.

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. No adverse impacts are expected on cultural resources under the Building No Action Alternative, except buildings would remain that may be considered intrusive in the context of the viewscape of traditional cultural resources. Under the Building Removal Alternative, there are no architectural resources in the APE that are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected. For archaeological resources, known archaeological sites would not be affected because no sites are located in the immediate vicinity of buildings to be demolished. In the unlikely event that unexpected archaeological resources are present beneath existing foundations, subsurface vaults, or concrete slabs, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds. Regarding traditional cultural resources, removal of built structures could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources.

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 up to 60 workers during the 2 to 3 years of demolition activities. 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in these ROIs.

Under the Building Removal Alternative, the average daily traffic on Woolsey Canyon Road could increase by up to 5.2 percent during the 2 to 3 years of building demolition, and no more than 2.4 percent on other evaluated roads. 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 minority, low-income, or Native American populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse traffic-related impacts are expected on minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 during the 2- to 3-year period of building demolition, 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 2–10 Summary of Potential Environmental Consequences under the Building Demolition Alternatives

Resource Area	*Alternatives*	
	Building No Action	***Building Removal***
Land resources	- Land use would be consistent with the Ventura County general plan designation for SSFL as open space; although it is zoned rural agriculture and open space; a special use permit currently allows industrial uses (Ventura County 2011a, 2015a). Land use would also be consistent with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity. - 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.	- Land use before and after building demolition would be consistent with Ventura County's existing general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). - During the 2 to 3 years required for building demolition, the average daily traffic on Woolsey Canyon Road would increase by up to 5.2 percent above baseline conditions. The traffic associated with this alternative could result in traffic delays or the perception of delays that could discourage weekday use of Sage Ranch Park, but the potential for delays or perception of delays would likely be less than that for any of the soil remediation action alternatives. There is less potential for discouraged weekday use of other recreational areas in the SSFL vicinity; 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. Up to about 250,000 gallons of water from CMWD would be annually used (630,000 gallons total). Water use is an important consideration because of California's drought conditions which culminated in local and State-wide measures to significantly reduce water consumption. There would be impacts on views of Area IV during the 2 to 3 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] 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.
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.

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 protected nesting 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. No federally or State listed wildlife species are known or expected to use the existing buildings. Adverse impacts on individual State-listed as rare 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 4,400 to 7,100 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.	Under the Building Removal Alternative, noise emanating from Area IV would increase compared to that under the Building No Action Alternative, but would not be expected to cause adverse impacts at the nearest residence to Area IV. Increased traffic under the Building Removal Alternative compared to baseline conditions is not expected to result in adverse noise impacts along the evaluated routes between SSFL and major highways (see Section 2.8.1.1).
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 2×10^{-4}) - Population LCFs: 0 (1×10^{-5} to 5×10^{-5}) *Accident risks:* - Population LCFs: 0 (4×10^{-11} to 9×10^{-10}) - Traffic fatalities: 0 (7×10^{-3} to 8×10^{-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} to 3×10^{-5}) *Accident risks:* - Population LCFs: 0 (3×10^{-11} to 5×10^{-11}) - Traffic fatalities: 0 (1×10^{-2} to 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 (7.4×10^{-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 up to 5.2 percent above baseline conditions during the 2 to 3 years required for building removal. Because of the presence of slow-moving heavy duty trucks, there could be weekday motorist delays or perceived delays on this road and its intersection with Valley Circle Boulevard. Traffic increases on other roads would be smaller. Except for Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic on roads and intersections may be reduced by distributing traffic among multiple routes between SSFL and major highways. There could be a change in the LOS rating for Woolsey Canyon Road from A to B during AM traffic conditions. This may be more likely on a limited number of days when the daily number of truck shipments could spike to 12. Because the Building Removal Alternative would be initiated early in the remediation of Area IV and the NBZ (in 2018 or 2019) and because of the 2 to 3 year duration of the activity, it may be completed before most of the assumed 1 percent growth in SSFL area traffic would occur (see Section 4.8.2, "Traffic Congestion"). During the period of building removal, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at a D to E rating during AM traffic conditions and a C rating during PM traffic conditions. Traffic would impose about 6,200 ESALs on the evaluated roads, with some adverse impacts on road pavement resulting in the impacted roads needing 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** *Onsite Suburban Resident and Recreational User* – No impacts are expected because access to the buildings would be restricted. *Offsite Suburban Resident and Recreational User* – The impacts are 1 to 3 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact.	**Workers** Conservatively assuming no reduction in exposure as D&D progresses, impacts would be: *Individual worker* - Dose: 250 millirem per year - Cancer Incidence Risk: 1.2×10^{-4} (1 in 8,300) 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** *Onsite Suburban Resident and Recreational User* – 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). *Offsite Suburban Resident and Recreational User* – The impacts are 1 to 3 orders of magnitude less than all thresholds for impact comparison which is considered insignificant impact. Resident: - Radiological cancer risk: 1.0×10^{-7} - Radiological dose: 5.0×10^{-7} millirem Recreator: - Radiological cancer incidence risk: 8.2×10^{-9} - Radiological dose: 2.7×10^{-1} millirem
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	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No historic properties would be affected. ***Traditional Cultural Resources***. No adverse impacts are expected, although buildings would remain that may be considered intrusive in the context of the viewscape of traditional cultural resources.	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No adverse impacts are expected because no archaeological sites are located in the immediate vicinity of buildings to be demolished, and there is low likelihood of unanticipated discoveries during building removal. ***Traditional Cultural Resources***. Removal of structures could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of 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 up to 60 workers with minor beneficial socioeconomic impacts. - Increased traffic during the 2 to 3 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 minority or low-income populations, including Native American tribes, 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 minority, low-income, or Native American populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse traffic-related impacts are expected on minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 during the 2- to 3-year period of building demolition, 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 all roads and intersections, except Woolsey Canyon Road and its intersection with Valley Circle Boulevard. Traffic volumes on SSFL-area roads and intersections could be reduced 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 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.

2.8.1.3 Potential Environmental Consequences of the Groundwater Remediation Alternatives

Environmental consequences for each resource area are summarized in **Table 2–11** and evaluated for the Groundwater No Action, Groundwater Monitored Natural Attenuation, and Groundwater Treatment Alternatives.

Land resources. Under the Groundwater No Action Alternative, land use for Area IV and the NBZ would be consistent with the existing Ventura County general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). 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 24,000 gallons would be used under the Groundwater Treatment Alternative. Water use under either action alternative would occur during a single year and would not exceed 6×10^{-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 3,000 cubic yards of subsurface bedrock, but excavation of this minimal volume would not impact the availability of aggregate materials in Ventura County. The loss of this bedrock is not expected to impact paleontological resources because the Chatsworth Formation (where the excavation will occur) has a low potential for 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 (projected to be up to 2 weeks for each system), including overland piping, and during the subsequent 5 years of treatment system operation. About 3,000 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. There would be a long-term reduction of potential sources of surface water contamination from groundwater seeps. 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. About 5 additional monitoring wells may be installed for the additional monitoring required under this alternative. Installation of the new monitoring wells may generate about 500 gallons of waste water that would be shipped off-site for treatment and disposal. As part of current groundwater monitoring operations, about 200 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. Some of the treatment technologies that could be implemented include withdrawal and treatment of groundwater. No adverse impacts are expected if water is treated and re-injected on-site. Onsite discharge of treated groundwater or off-site disposal of water would reduce the quantity of local groundwater by the amount discharged or transported.

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 areas in which the exemption process would be applied. If a monitoring well were required in such an area, BMPs, mitigation measures and impact avoidance and minimization 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 habitat 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, soil backfilling, and treatment system installation activities, as well as from on-road vehicles. A total of 500 to 1,700 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 approximately 530 shipments of excavated bedrock and backfill as well as a few deliveries of equipment in heavy-duty trucks. 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 0.10 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 0.80 percent, with smaller increases during other years and on other evaluated roads.

Although there would be only a small annual number of truck shipments and other traffic associated with the Groundwater Monitored Natural Attenuation Alternative, with only one annual truck shipment during most years evaluated under this alternative, these small numbers of shipments would occur in a heavily trafficked area. During the peak year of shipment of waste, equipment, and supplies, the AM LOS for the intersection of Woolsey Canyon Road with Valley Circle Boulevard could be operating at an E level. Assuming the continuation of well water sampling for up to two decades, these truck shipments and worker commutes would occur during years having increasing traffic congestion, with this and other intersections operating at an E or F rating during AM or PM traffic conditions.

Truck shipments under the Groundwater Treatment Alternative would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but still small compared to the soil remediation alternatives and Building Removal Alternative. Nonetheless, these small numbers of shipments would occur in a heavily trafficked area. For example, during peak year of shipment of waste, equipment, and supplies, the LOS rating for the intersection of Woolsey Canyon Road with Valley Circle Boulevard could be operating at an E rating during AM peak traffic conditions. This would also be the case for the other years required to implement this alternative, during which time the LOS rating for this intersection could operate during peak AM traffic conditions at an E or F rating.

No routes would experience noticeable increases in ESALs under the Groundwater Monitored Natural Attenuation Alternative, with no damage to road pavement. Traffic under this alternative would impose about 1,700 ESALs on the evaluated roads, with minimal potential for damage to road pavement.

Human health. Under all alternatives, no impacts are expected on a hypothetical future onsite suburban resident because the pumping rate of Area IV and NBZ groundwater is not a sustainable water supply for prolonged household use, particularly by multiple households (CDM Smith 2015a) and, therefore, 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. Bedrock removal activity provides a risk of cancer to workers (of 2.8×10^{-5}) and a dose (36 millirem) well less than the DOE worker dose limit (5 rem per year). In all cases, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders. 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.

The impacts on the offsite resident and recreator receptors from groundwater remediation (bedrock removal) activities are 4 to 6 orders of magnitude less than all thresholds for impact comparison.

Waste management. Consistent with current site monitoring activities, about 200 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 require about 5,000 gallons of well installation water delivered from an offsite source. Installation of the 5 wells would generate about 10 cubic yards of well cuttings and about 500 gallons of wastewater. It was assumed that the well cuttings would be transported by truck to a nonhazardous waste facility and the well installation water by truck to a permitted hazardous waste treatment facility, consistent with its waste acceptance criteria. In addition, about 200 gallons of purge water (wastewater) would be annually generated during groundwater sampling activities which would also be transported by truck to a permitted hazardous waste treatment facility. Under the Groundwater Treatment Alternative, about 4,500 cubic yards of containerized 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 10,000 pounds of media may be replaced during 5 years of water treatment operations, with a total media volume of about 13 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 adverse impacts are expected on cultural resources under the Groundwater No Action Alternative. There are no architectural resources in the APE that are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected under any alternative. For archaeological resources under both action alternatives, groundwater monitoring and treatment activities would have no effect on archaeological resources because installation of equipment would avoid identified sites. In the unlikely event that an unexpected archaeological resource is present, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds. For traditional cultural resources under both action alternatives, the introduction of additional modern elements (e.g., well equipment, treatment systems, storage tanks, overland piping) could have a minor, temporary impact during installation of the system and then during the operation of these systems, but above-ground elements would be designed to avoid adverse effects on the landscape.

Socioeconomics. Under all groundwater remediation alternatives, no socioeconomic impacts are expected in Los Angeles and Ventura Counties regarding employment, regional truck traffic, municipal services, or housing availability. Under the groundwater remediation action alternatives, there would be minimal beneficial socioeconomic impacts from worker employment and purchases of equipment and supplies, no socioeconomic impacts are expected on businesses in the SSFL vicinity, and little or no damage is expected on pavement from additional traffic that could increase expenses for local government. No traffic-related socioeconomic impacts are expected at the evaluated disposal facilities.

Environmental justice. Under all groundwater remediation alternatives, no impacts are expected on members of the public. Thus, no disproportionate impacts are expected on minority or low-income populations, including Native American tribes, 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. In the SSFI vicinity the peak year increase in average daily traffic would be about 0.10 percent under the Groundwater Monitored Natural Attenuation Alternative or 0.80 percent under the Groundwater Treatment Alternative, and the increases during other years and on other roads would be less. Shipments of waste under the groundwater remediation alternatives would primarily consist of excavated bedrock delivered to radioactive waste disposal facilities under the Groundwater Treatment Alternative. Deliveries to a single assumed LLW/MLLW facility would average about 6 per day, assuming all shipments occur during the projected operational period of bedrock removal, which is less than that under the soil remediation action alternatives. No noticeable increase in traffic is expected in the ROI of any evaluated facility (maximum of about 0.43 percent), with no traffic-related impacts. Therefore, no disproportionately high and adverse impacts on minority or low-income populations, including Native American tribes, 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 2–11 Summary of Potential Environmental Consequences under the Groundwater Remediation Alternatives

Resource Area	*Alternatives*		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
Land resources	- Land use for Area IV and the NBZ would be consistent with the existing Ventura County general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with the North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). - 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. - Remediation under this alternative would be consistent with existing general plan designations, zoning and the least consistent with the landowner's (Boeing's) April 2017 Grant Deed and Easement with the North American Land Trust (Ventura County 2017a, 2017b) than any of the other alternative. - 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 1×10^{-5} 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. - Remediation under this alternative would be consistent with existing general plan designations, zoning and most consistent with the landowner's (Boeing's) April 2017 Grant Deed and Easement with the North American Land Trust (Ventura County 2017a, 2017b) than any of the other alternative. - 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 24,000 gallons of water from CMWD would be used for dust suppression during bedrock removal, which would represent about 6×10^{-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 a few weeks 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 3,000 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 (projected to be up to 2 weeks for each system) followed by 5 years of treatment system operation. - About 3,000 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 (groundwater seeps). No change from baseline conditions is expected on stormwater runoff quantity and velocity.	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 are expected on SSFL or regional stormwater control capacities.	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 are expected on SSFL or regional stormwater control capacities.

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 are expected. Positive long-term impacts to groundwater quality would result from removal of contamination sources or treatment of groundwater. No adverse impacts to groundwater quantity are expected if water is treated and re-injected on site. Onsite discharge to surface water or offsite disposal would reduce local quantity by the amount discharged or transported.
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 required in an area in which the exemption process would be applied, BMPs, mitigation measures and impact avoidance and minimization measures would be implemented to 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 areas in which the exemption process would be applied.	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 habitat 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 with application of, BMPs, mitigation measures and impact avoidance and minimization measures 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, soil backfilling, and treatment system installation. Additional emissions would occur from on-road vehicles. A total of 500 to 1,700 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 a few 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). Heavy-duty truck traffic would include approximately 530 shipments of excavated bedrock and backfill as well as a few deliveries of equipment, which are not expected to result in adverse noise impacts along the evaluated routes between SSFL and major highways.

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 – 620 shipments by truck. Traffic fatality accident risks – 0 (3.1×10^{-4})	**Shipment of radioactive waste – truck option** [a] Shipments – 340 truck shipments *Incident-free risks:* - Crew LCFs: 0 (2×10^{-5} to 6×10^{-5}) - Population LCFs: 0 (5×10^{-6} to 2×10^{-5}) *Accident risks:* - Population LCFs: 0 (1×10^{-11} to 3×10^{-10}) - Traffic fatalities: 0 (2×10^{-3} to 3×) **Shipment of radioactive waste – truck/rail option** [a] Shipments – 340 truck shipments from SSFL to an intermodal facility, then 30 rail shipments *Incident-free risks:* - Crew LCFs: 0 (8×10^{-6} to 1×10^{-5}) - Population LCFs: 0 (7×10^{-6} to 1×10^{-5}) *Accident risks:* - Population LCFs: 0 (2×10^{-11}) - Traffic fatalities: 0 (6×10^{-3} to 2×10^{-2}) **Shipment of nonradioactive waste, backfill, equipment, and supplies** [a] *Truck option:* - 320 truck shipments - Traffic fatality risks: 0 (3.9×10^{-3}) *Truck/rail option:* - Not applicable. All shipments are by truck.

Resource Area	Alternatives		
	Groundwater No Action	***Groundwater Monitored Natural Attenuation***	***Groundwater Treatment***
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 0.10 percent above baseline conditions during 1 year. Traffic increases on other roads or during other years when shipments would occur would be smaller. Although there would be only a small annual number of truck shipments and other traffic associated with this alternative, with only one annual truck shipment during most years evaluated under this alternative, these small numbers of shipments would occur in a heavily trafficked area. During the peak year of shipment of waste, equipment, and supplies, the AM LOS for the intersection of Woolsey Canyon Road with Valley Circle Boulevard would be operating at an E level. Assuming the continuation of well water sampling for up to two decades, these truck shipments and worker commutes would occur during years having increasing traffic congestion, with this and other intersections operating at an E or F rating during AM or PM traffic conditions. No routes would experience significant increases in ESALs, with little or no damage to road pavement.	The weekday average daily traffic on Woolsey Canyon Road would increase by 0.80 percent above baseline conditions during 1 year. Traffic increases on other roads or during other years when shipments would occur would be smaller. Truck shipments under this alternative would be small but larger than those under the Groundwater Monitored Natural Attenuation Alternative. Nonetheless, these small numbers of shipments would occur in a heavily trafficked area. For example, during peak year of shipment of waste, equipment, and supplies, the LOS rating for the intersection of Woolsey Canyon Road with Valley Circle Boulevard would be operating at an E rating during AM peak traffic conditions. This would also be the case for the other years required to implement this alternative, during which time the LOS rating for this intersection would operate during peak AM traffic conditions at an E or F rating. Traffic would impose about 1,700 ESALs on the evaluated roads, 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 minimal impacts on workers solely attributable to continuation of the current groundwater monitoring program.	**Worker** Same as the Groundwater No Action Alternative.	**Worker** Workers would receive a radiation dose from excavation of contaminated bedrock. *Individual worker* - Dose: 36 millirem - Cancer incidence risk: 2.8×10^{-5} (1 in 36,000) 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 or offsite suburban resident or recreational user are expected because there is not a sustainable water supply in Area IV and NBZ sufficient for prolonged household use, particularly by multiple households. 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** *Onsite Residents and Recreators* – Same as the Groundwater No Action Alternative. *Offsite Resident and Recreators* – The impacts on the offsite resident and recreator receptors from groundwater remediation (bedrock removal) activities are 4 to 6 orders of magnitude less than all thresholds for impact comparison, which is considered insignificant impact. Resident: - Radiological risk: 5.0×10^{-10} - Radiological Dose: 6.8×10^{-4} millirem Recreator: - Radiological risk: 2.3×10^{-10} - Radiological Dose: 2.9×10^{-4} millirem
Waste management	No impacts are expected on the capacity of the permitted wastewater treatment plant that would receive approximately 200 gallons of purge water annually from Area IV.	Nonhazardous waste – 10 cubic yards Well development water – 500 gallons Monitoring purge water – 200 gallons/year No exceedance of total waste capacity or a daily or annual waste acceptance limit is expected at any evaluated facility.	LLW/MLLW – 4,500 cubic yards [c] Hazardous waste – 13 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	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No historic properties would be affected. ***Traditional Cultural Resources***. No adverse impacts are expected.	***Architectural Resources.*** No historic properties would be affected. ***Archaeological Resources***. No adverse impacts are expected because installation of equipment would avoid identified archaeological sites, and there is low likelihood of unanticipated discoveries during installation of equipment. ***Traditional Cultural Resources***. Above-ground elements would be designed to avoid adverse effects on the landscape.	***Architectural Resources.*** Same as the Groundwater Monitored Natural Attenuation Alternative. ***Archaeological Resources***. Same as the Groundwater Monitored Natural Attenuation Alternative. ***Traditional Cultural Resources***. Same as the Groundwater Monitored Natural Attenuation Alternative.
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 little or 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 minority or low-income populations, including Native American tribes 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI are expected. - The increase in average daily traffic on the evaluated roads in the SSFL vicinity would be greater during 1 year 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 minority or low-income populations, including Native American tribes, in the SSFL ROI. - Shipments of waste under this alternative would primarily consist of excavated bedrock delivered to radioactive waste facilities. No noticeable increase in traffic is expected in the ROI of any evaluated facility, with no expected traffic-related impacts. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, 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; 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 eight 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 (Residential Scenario) + Building Removal + Groundwater Monitored Natural Attenuation	–
Conservation of Natural Resources (Residential Scenario) + Building Removal + Groundwater Treatment	–
Conservation of Natural Resources (Open Space Scenario) + Building Removal + Groundwater Monitored Natural Attenuation	Action Alternative Combination with the Smallest Environmental Consequences (Low Impact Combination)
Conservation of Natural Resources (Open Space Scenario) + Building Removal + Groundwater Treatment	–

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

For most resource areas, the largest potential impacts arise from 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 arise from the combination of the Conservation of Natural Resources (Open Space Scenario), 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. But for those resource areas where 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 from a RCRA Corrective Measures Study (see Chapter 2, Section 2.6). Because the results of this Corrective Measures Study are yet to be finalized, this EIS evaluates the potential impacts that could occur assuming the technologies planned for inclusion in the Corrective Measure Study would be implemented that would have the largest potential impacts. In addition, DOE could decide to implement elements of both groundwater remediation action alternatives. 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 use. No combination of action alternatives would cause a change in land use designation. The High Impact Combination would be the least consistent with Boeing's conservation easements because of the large land area that would be disturbed. Vegetation and wildlife habitat would be removed from about 99 acres of land, including about 33 acres of relatively undisturbed native habitat. The Low Impact Combination would be the most consistent with the conservation easements because soil presenting unacceptable risks would be removed with a minimum of disturbance to existing habitat. About 17 acres would be affected, with vegetation and wildlife habitat removed from about 9 acres of land.

Recreation. Heavy-duty truck traffic under the High Impact Combination would last for 28 years, and the number of average daily heavy-duty truck round trips would range from about 2 to 25. The weekday average daily traffic on Woolsey Canyon Road would increase by 3.3 to 8.6 percent above baseline conditions, where the maximum increase would occur assuming the end of building demolition under the Building Removal Alternative overlaps the first year of soil removal. There would be smaller increases in traffic on other SSFL-area roads. There would be insignificant increase in traffic if both groundwater remediation action alternatives were implemented.

Heavy-duty truck traffic under the Low Impact Combination would primarily occur over 4 years. The average daily truck trips during these years would range from about 2 to 21, and the weekday average daily traffic on Woolsey Canyon Road would increase by 2.2 to 8.6 percent above baseline conditions. The peak daily increase in traffic on Woolsey Canyon Road (8.6 percent) reflects the assumption that the last year of building demolition under the Building Removal Alternative would overlap the first year of soil removal. There would be smaller increases in traffic on other SSFL-area roads. After these 4 years, there would be minor increases in average daily traffic (e.g., about 0.05 percent above baseline conditions on Woolsey Canyon Road), primarily due to shipments of monitoring well purge water and environmental monitoring samples.

Under both the High Impact and the Low Impact Combinations, motorists could experience or perceive delays using Woolsey Canyon Road to access Sage Ranch Park, which could reduce its weekday use. Increased traffic, however, would occur for about one-seventh as many years under the Low Impact Combination as under the High Impact Combination. Except for Woolsey Canyon Road, traffic on any road that may pass a recreation area in the SSFL vicinity could be reduced by distributing truck traffic among the four different routes between SSFL and major highways.

Infrastructure. Annual electrical use would be minimal under all action alternative combinations.

CMWD is the expected source for water for remediation activities such as dust suppression. About 46 million gallons of water would be used under the High Impact Combination. The maximum annual water use would be about 1.9 million gallons. If both groundwater remediation action alternatives were implemented, both the maximum annual and total water use would increase by about 5,000 gallons. About 4.1 million gallons of water would be used under the Low Impact Combination. The maximum annual water use would be about 1.9 million gallons.

Water use is an important consideration because of California's drought conditions which culminated in measures to significantly reduce water consumption in the State. Water use could be potentially reduced by using surfactants or other measures to assist in dust control.

*Aesthetics and visual quality***.** Over all combinations of action alternatives, onsite views at Area IV and the NBZ would be degraded during remediation activities. But over the long term, stabilization and revegetation of affected areas would introduce a new surface texture and color in previously barren areas and improve onsite aesthetics and visual quality.

Geology and soils. About 3,000 cubic yards of subsurface bedrock would be excavated under action alternative combinations such as the High Impact Combination that include the Groundwater Treatment Alternative, with minimal adverse impacts on bedrock geologic resources.

Although soil removed from the Santa Susana formation could impact paleontological resources (i.e., fossil loss), the formation is mostly within areas where the exemption process would be implemented and only focused soil removal would take place. Because building removal, installation of 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 action alternative combination. Nonetheless, potential impacts 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.

There could be risks to workers removing soil within zones where earthquake-induced landslides could occur. None of the buildings to be removed is in a landslide risk area, but the bedrock to be 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. DOE would minimize risks to workers by implementing the 2010 AOC (DTSC 2010a) exemption process if DOE determined that excavating soil in certain 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, and would not increase if DOE implemented both groundwater remediation action alternatives.

Up to 99 acres of land could be disturbed under the High Impact Combination, while about 17 acres could be disturbed under the Low Impact Combination. Disturbed land would primarily include areas where buildings and pavement are removed under the Building Removal Alternative. No appreciable potential for soil erosion is expected from installation of monitoring wells under the Groundwater Monitored Natural Attenuation Alternative, because of the minimal soil disturbance, 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 eroded areas.

About 677,000 cubic yards of backfill would be required under the High Impact Combination. The total quantity of backfill would not increase if DOE implemented both groundwater remediation action alternatives. The quality of this backfill for biological activity, filtration, and vegetation support may be less than current soil at Area IV and the NBZ, in which case the backfill would be less able to support vegetation growth similar to that 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. On December 21, 2016, DOE sent a letter to DTSC describing DOE's efforts and difficulty in locating backfill soil that meets the 2010 AOC requirements and requesting initiation of the consultation process (DOE 2016).

About 42,000 cubic yards of backfill would be required under the Low Impact Combination, which would need to be of comparable quality to 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, finding acceptable sources of backfill may be more likely.

Surface water resources. The High Impact Combination would have the largest potential for impacts on surface water, primarily because of the area of soil disturbance (about 99 acres), while the Low Impact Combination would have the smallest potential for impacts because it would have the least soil disturbance (about 17 acres) and the least potential for soil erosion. 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. Implementing both groundwater remediation action alternatives would have a similar soil disturbance that for implementing the Groundwater Treatment Alternative alone.

Under any combination of action alternatives, DOE would implement BMPs and minimization measures to filter sediments and other contaminants from surface water runoff and to limit increases in runoff velocity and volume. Except possibly for scenarios where unusually large rainstorms occur 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 or in regional waterways or on the capacities of stormwater control systems downstream in regional waterways. Mitigation Measures SW-1 and SW-2 (see Chapter 6, Table 6–2) could be implemented to forestall the risk of impacts. Mitigation Measure SW-1 requires that in drainage areas leading off site, excavations to bedrock and backfilling would be completed outside of the primary rainfall period of December through March. Mitigation Measure SW-2 requires the addition of stormwater retention structures such as catch basins or retention basins or other erosion control measures if runoff studies indicate the NPDES stormwater control system design capacity could be exceeded.

Implementing any action alternative combination 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 High Impact Combination would have the largest positive impact on groundwater quality in the shortest time, with nearly all of the positive impact occurring under the Groundwater Treatment Alternative. Although the Building Removal Alternative would be considered under all action alternative combinations Area IV buildings are not sources of chemicals or radionuclides to groundwater. Although the Cleanup to AOC LUT Values Alternative would remove more chemical constituents in soil than other alternatives, 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, positive impacts on groundwater would differ little among the soil remediation action alternatives. The added benefit to groundwater from soil removal is relatively low because the most highly impacted soil was previously removed. The remaining soil contaminants may not be mobile due to their chemical and physical properties. 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 would be achieved over a much longer time.

If both groundwater remediation action alternatives were implemented, the advantageous features of monitored natural attenuation would be combined with other technologies employing active measures.

Biological resources. The High Impact Combination would have the largest impacts, mainly because this action alternative consists of a combination of actions and includes the Cleanup to AOC LUT Values Alternative. Vegetation, soils and wildlife habitat would be removed from about 9 acres (which includes disturbance from soil remediation, building removal and ground water treatment) of land, including 33 acres of relatively undisturbed native habitat, including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub. This activity would profoundly disturb the affected areas and require substantial, focused, and prolonged efforts to revegetate and restore 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. Native species of birds and bats that roost or nest in the buildings would lose these sites when the buildings are removed. Yet direct impacts on nesting or roosting species could be avoided or minimized through a combination of, timing of demolition to avoid seasons when nesting is occurring; humanely hazing of wildlife within the buildings, thus inducing them to leave prior to demolition; and implementing measures to prevent their re-entry. 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. 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 disturbance under the Groundwater Treatment Alternative through the installation and operation of treatment units and excavation of bedrock; however, impacts on threatened, endangered, or rare species would likely be avoided due to the localized nature of the activities, the small areas affected, and the proximity of likely well sites to existing roads and disturbed areas. If both groundwater remediation action alternatives were implemented, surface disturbance would be essentially the same as that for implementing the Groundwater Treatment Alternative alone.

The Low Impact Combination would affect approximately 17 acres and have the smallest impacts. The Conservation of Natural Resources Alternative would remove vegetation and wildlife habitat from about 10 acres (Residential Scenario) or 329 acres (Open Space Scenario), including about 4 acres affected by focused removals within areas in which the exemption process would be applied. The Conservation of Natural Resources Alternative under both scenarios 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. Impacts under the Building Removal Alternative are summarized above. Impacts under the Groundwater Monitored Natural Attenuation Alternative would be smaller than those under the Groundwater Treatment Alternative, but either groundwater remediation 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 four combinations of action alternatives that would result in the highest potential impacts from airborne emissions of carbon monoxide, carbon dioxide, sulfur oxides, nitrogen oxides, and particulates (PM_{10} and $PM_{2.5}$): (1) Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives; (2) Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives; (3) Conservation of Natural Resources, Residential Scenario, Building Removal, and Groundwater Treatment Alternatives, and (4) Conservation of Natural Resources, Open Space Scenario, Building Removal, and Groundwater Treatment Alternatives. Emissions under the Groundwater Monitored Natural Attenuation Alternative were not calculated because this alternative would generate very low emissions. Emissions for the four combinations of action alternatives would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative were implemented and slightly larger if both groundwater remediation action alternatives were implemented.

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.

Peak annual emissions from the four groups of action alternative combinations were compared to annual indicator emission thresholds for the three domains. 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 trucks. Emissions were determined for remediation activities at Area IV and the NBZ, and for truck transport of waste, recycle material, backfill, and equipment. Emissions from truck transport of waste and recycle material were determined assuming shipment to nearby or distant disposal sites. Peak emissions are estimated for a year when soil removal under any of the soil remediation action alternatives overlaps with building removal. Peak emissions under the Groundwater Treatment Alternative occur in different year.

Ventura County. A range in peak annual emissions would occur within Ventura County from each of the four groups of combined action alternatives. Annual emissions would peak during the first year of soil removal in combination with the third year of building removal (year 2021). Annual combustive emissions would decrease each subsequent year due to replacement of older and higher-emitting vehicles with newer vehicles that comply with more-stringent emission standards. Peak annual emissions of PM_{10} and $PM_{2.5}$ would occur for one year under the Conservation of Natural Resources Alternative, Recreational Scenario, combined with the Building Removal Alternatives due to the large quantity of nonhazardous soil removed during this year, producing the largest amount of fugitive dust. The second highest peak for annual emissions of PM_{10} and $PM_{2.5}$ would occur in 2025 or 2025 to 2045, respectively, if soil was instead removed under the Cleanup to Revised LUT Values Alternative or the Cleanup to AOC LUT Values Alternative.

Peak annual emissions of most pollutants for a nearby or distant disposal site scenario would not vary substantially under any of the action alternative combinations, and would be well below the indicator emission thresholds for Ventura County. For most pollutants, the largest contributors to combustive emissions would be off-road construction equipment removing soil and building material and backfilling excavated areas. 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.

Each of the combined action alternatives could produce the same amount of peak day emissions under a nearby or distant disposal site scenario, as each combined action alternative could generate 32 truck trips per day to the same disposal facilities under each scenario.

Relatively low to moderate levels of daily combustive emissions such as carbon monoxide (up to 82 pounds per day) and nitrogen oxides (up to 92 pounds per day) would be generated intermittently from mobile equipment and trucks over a large portion of Area IV, throughout approximately 3.1 miles of SSFL roads, and within Woolsey Canyon Road between the site gate and the Los Angeles County boundary. The emissions would be diluted in the atmosphere to the point that they would cause minimal 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, there would be minimal impacts from hazardous air pollutants and toxic air contaminants from the four action alternative combinations, including diesel particulate matter (DPM) from equipment and haul trucks in Ventura County.

Each combined action alternative would produce relatively moderate levels of daily PM_{10}.emissions (up to 97 pounds per day). The largest contributor to PM_{10} emissions would be fugitive dust from operation of equipment and trucks on unpaved surfaces and paved SSFL roads. It was assumed for analysis that DOE would implement measures that would reduce fugitive PM_{10} and $PM_{2.5}$ emissions 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. These controls and restrictions would ensure that emissions of fugitive dust under the action alternative combinations would not contribute to an exceedance of a PM_{10} ambient air quality standard at any offsite location.

The impact of air emissions on sensitive members of the population is a concern. The above analyses demonstrate that combustive and fugitive dust emissions from remediation activities would cause minimal increases in ambient air pollutant levels beyond the SSFL boundary. The nearest sensitive receptors are residences located about 1 mile south-southeast of Area IV in the Bell Canyon area. Transport of the emissions to a distance of nearly one mile to the nearest residence or farther would further dilute these pollutant concentrations to well below any level of health concern.

South Coast Air Basin. A range in peak annual emissions would occur within the South Coast Air Basin. Annual emissions for all four combined action alternatives would peak during the first year of soil removal and the third year of building removal (in 2021) due to: (1) maximum emission rates for the on-road vehicle fleets, and (2) maximum annual activity levels and resulting miles traveled by the haul trucks within this domain. All emissions within the South Coast Air Basin would occur from worker commuter vehicles and heavy duty trucks hauling waste to offsite facilities and backfill to SSFL.

Peak annual emissions under all four combined action alternatives would not exceed the South Coast Air Basin indicator emission thresholds under a nearby or distant disposal site scenario. Peak annual emissions under a nearby disposal site scenario would occur under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative combined with the Building Removal Alternative. The Conservation of Natural Resources Alternative, Open Space Scenario, combined with the Building Removal Alternative would generate the smallest annual emissions under a nearby disposal site scenario. Peak annual emissions under a distant disposal site scenario would be the same for all four combined action alternatives, because during the peak year the same number of truck trips traveling the same distances through the South Coast Air Basin would occur for each combined action alternative.

Each of the four combined action alternatives could have the same peak daily emissions under a nearby or distant disposal site scenario, because there could conceivably be 32 daily truck trips under each combined action alternative to the same disposal facilities under each scenario. Except for nitrogen oxides, the nearby and the distant disposal site scenarios would both emit relatively low daily levels of any evaluated pollutant (less than 15 pounds per day).

Under the nearby disposal site scenario, moderate levels of nitrogen oxides emissions (61 pounds per day) would be emitted daily under each combined action alternative. Elevated emissions of nitrogen oxides (114 pounds per day) would occur under a distant disposal site scenario from all action alternative combinations. These emissions would occur intermittently from up to 32 daily haul truck round trips and would extend over several hundred miles of roads across the South Coast

Air Basin. The emissions would be diluted in the atmosphere to the point that they would cause minimal impacts in a localized area and would not contribute to or exacerbate an exceedance of an ambient air quality standard.

For the reasons mentioned above, minimal impacts due to hazardous air pollutants and toxic air contaminants (such as DPM) would occur within the South Coast Air Basin under any of the four action alternative combinations. For example, DPM emissions from a 2021 average California truck fleet within the South Coast Air Basin under a nearby soil disposal site scenario would be about 31 pounds per year, or 0.4 pounds during a peak day based on 32 daily truck round trips. The emissions would occur over 160 miles of roadway that span a large portion of the air basin. As a result, populations adjacent to roads used for the transport of materials from SSFL would be exposed to very low levels of DPM emissions (and other hazardous air pollutants and toxic air contaminants) from haul trucks and likely would experience no noticeable health effects.

Many sensitive receptors exist along the roads that haul trucks would use to transport materials through the South Coast Air Basin. The above analyses demonstrate that truck emissions would minimally increase ambient air pollutant levels adjacent to these roads. Therefore, remediation activities would not expose sensitive receptors to any level of air quality health concern within the South Coast Air Basin.

Outside Ventura County and the South Coast Air Basin. A range in peak annual emissions would occur outside Ventura County and the South Coast Air Basin. Annual emissions for the combined action alternative scenarios would peak during the first year of soil removal and the third and final year of building removal (in 2021) due to: (1) maximum emissions rates for the on-road vehicle fleets, and (2) maximum annual activity levels and resulting miles traveled by the haul trucks within this domain. All emissions outside Ventura County and the South Coast Air Basin would be from trucks hauling waste to offsite facilities.

None of the evaluated pollutants would exceed indicator emission thresholds in any of the domains outside Ventura County and the South Coast Air Basin under a nearby or distant disposal site scenario. Peak annual emissions under a nearby or distant disposal site scenario would occur under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative combined with the Building Removal Alternative. The Conservation of Natural Resources Alternative, Open Space Scenario, combined with the Building Removal Alternative would have the smallest annual emissions under both a nearby and a distant disposal site scenario.

Each of the four groups of combined action alternatives could have the same peak daily emissions under a nearby or distant disposal site scenario, because there could conceivably be 32 daily truck trips to the same disposal sites under each action alternative combination. As with peak annual emissions, pollutant emissions are relatively low except for nitrogen oxides. Under a nearby or distant disposal site scenario, relatively high levels of daily nitrogen oxides emissions would occur under each of the combined action alternatives (152 and 592 pounds per day, respectively). These emissions would occur intermittently from up to 32 daily haul truck round trips and would extend over hundreds of miles of roads. The emissions would be diluted in the atmosphere to the point that they would cause minimal impacts in a localized area and would not contribute to or exacerbate an exceedance of an ambient air quality standard.

Under any combination of action alternatives there would be minimal impacts from hazardous air pollutants and toxic air contaminants (such as DPM emissions) outside of Ventura County and the South Coast Air Basin. Based on a 2021 average California truck fleet, the haul trucks would generate about 0.004 pounds per day (at 32 round trips per day) or about 0.5 pounds per year (at 4,000 truck trips per year) along a given mile of road. As a result, populations adjacent to roads used for transport of materials from SSFL would be exposed to very low levels of hazardous air pollutants and toxic air contaminants from haul trucks and likely would experience no noticeable health effects.

Sensitive receptors exist along the roads that haul trucks would use to transport materials outside of Ventura County and the South Coast Air Basin. The above analyses demonstrate that truck emissions would minimally increase ambient air pollutant levels adjacent to these roads. Therefore, remediation activities would not expose sensitive receptors outside of Ventura County and the South Coast Air Basin to any level of air quality health concern.

Green cleanup. The above analysis was made assuming average off-road and on-road vehicle fleets for the years 2019 and 2021. These impacts may be reduced by measures discussed in Chapter 6 of the EIS, such as use of off-road equipment and on-road trucks that meet EPA Nonroad Tier 4 and 2007 EPA Heavy Duty Highway standards, respectively. For example, in the Ventura County domain, implementing the green cleanup fleets proposed by DOE as Mitigation Measure AQ-1 (see Chapter 6, Table 6-2) would reduce emissions from the average calendar year 2021 fleets by the following amounts as averaged over emissions of volatile organic compounds, carbon monoxide, nitrogen oxides, and PM_{10}: (1) 49 percent for off-road equipment that meet EPA Nonroad Tier 4 emission standards; and (2) 66 percent for a fleet of on-road heavy-duty trucks that are no more than 5 years old. In the South Coast Air Basin and the evaluated domain outside Ventura County and the South Coast Air Basin, emissions from the average year 2021 truck fleet would be reduced by 71 percent as averaged over volatile organic compounds, carbon monoxide, nitrogen oxides, and PM_{10}; and 81 percent solely for nitrogen oxides.

Climate change. Over the four groups of combined action alternatives, peak annual emissions of CO_2 would range from about 2,000 to 10,000 metric tons; total emissions of CO_2 would range from about 6,000 to 88,000 metric tons. Emissions under each action alternative combination would be slightly smaller if the Groundwater Monitored Natural Attenuation Alternative were implemented and slightly larger if both groundwater remediation action alternatives were implemented.

The maximum total carbon dioxide emissions would occur under the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. These emissions would represent negligible contributions to climate change, and 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 measure AQ-1 (see Chapter 6, Table 6–2) 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 alternatives and the adaptation strategies needed to respond to future conditions. For the SSFL region, the main effect would be increased temperature and aridity. Analyses predict that the region will experience: (1) increased temperatures, droughts, and wildfires; and (2) scarcities of water supplies (California Energy Commission 2012; IPCC 2013; USGCRP 2017). Current operations at SSFL have adapted to droughts, high temperatures, wildfires, and scarce water supplies. However, near-term exacerbation of these conditions could impede SSFL remediation. For example, remediation could be impeded if the occurrence of wildfires increased over the duration of remediation activities.

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. Under the High Impact Combination, during nearly all years there would be 16 average daily heavy-duty shipments of waste, backfill, and equipment, but the number of shipments could increase to 21 during one year assuming soil shipments overlapped with shipments during the final year of the Building Removal Alternative, or 25 during a second year assuming soil removal overlapped with shipments of contaminated bedrock under the Groundwater Treatment Alternative. Under the Low Impact Combination, the average daily number of heavy-duty truck shipments would range from 2 to 21, with the largest number of shipments occurring in one year assuming soil shipments overlapped with shipments during the final year of the Building Removal Alternative. Assuming a peak of 32 daily truck round trips and assuming 32 daily truck round trips, time-averaged noise levels in residential areas would increase by no more than 1.4 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL, and would increase by no more than 1.2 dBA CNEL along the roads where noise levels exceed 65 dBA CNEL. 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 established for this EIS as defined in the *L.A. CEQA Thresholds Guide* (LA 2006).

The High Impact Combination would have the longest noise duration, about 28 years. 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 Low Impact Combination would have the shortest noise duration. Because much less soil would be removed, almost all remediation activities under this combination of action alternatives could be completed in 4 years. After that, there would be very minor traffic noise, primarily due to transport of monitoring well purge water for offsite disposition and monitoring samples to offsite laboratories.

Transportation. Under the High Impact Combination, for incident-free transport and assuming all waste shipments were by truck, the maximum risks to truck crews and the population would occur for shipment to WCS in Texas, with potential LCF risks of 1×10^{-3} (1 chance in 1,000) and 4×10^{-4} (1 chance in 2,500), 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 about 3,300); and the maximum risks to populations would occur for shipment to WCS in Texas, 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 reasonably foreseeable accidents from minor to severe, would be 7×10^{-9} (1 chance in about 140 million), assuming all shipments were sent by truck to WCS in Texas or 4×10^{-10} (1 chance in 2.5 billion) by the truck/rail option to WCS in Texas. 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. The maximum risk of a traffic accident fatality would be 1 (calculated value of 0.7), assuming all shipments were sent by truck to WCS in Texas.

Under the Low Impact Combination, for incident-free transport conditions and assuming all waste shipments were by truck, the maximum risks to truck crews and the population would occur for shipment to WCS in Texas, with LCF risks of 2×10^{-4} (1 chance in 5,000) and 6×10^{-5} (1 chance in about 17,000), respectively. Assuming the truck/rail option, the maximum LCF risks to truck/rail crews would occur for shipment to NNSS (5×10^{-5} LCF, or 1 chance in 20,000); and the maximum LCF risks to populations would occur for shipment to WCS in Texas (4×10^{-5} LCF, or 1 chance in 25,000). The maximum radiological risk from an accident, considering reasonably foreseeable accidents from the minor to the severe, would be 1 × 10^{-9} LCF (1 chance in 1 billion), assuming all shipments were sent by truck to WCS in Texas or 7 × 10^{-11} (1 chance in about 15 billion) under the truck/rail option to either NNSS or WCS in Texas. The maximum risk of an accident fatality would be 0 (0.1), assuming all shipments were sent by truck to WCS in Texas.

The largest risks from transporting nonradioactive waste under the truck and truck/rail options would occur under the High Impact Combination. Under the truck option, there would be about 6 (6.3) accidents and 0 (0.26) traffic fatalities. If both groundwater remediation action alternatives were implemented, there would be no substantial change in the calculated risk. Under the truck/rail option, there would be about 10 accidents and 2 (2.3) 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 1 (0.61) and 0 (0.026), respectively, under the truck option and 1 (0.63 and 0 (0.12), respectively, under the truck/rail option.

Traffic. Under the High Impact Combination, there would be about 104,000 heavy-duty truck round trips, including truck shipments of backfill, equipment, and supplies. In addition, there would be about 201,000 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 28 years, the average daily traffic would increase by about 4.1 to 8.6 percent above baseline conditions during the first 4 years of project activities, and by about 3.3 percent above baseline conditions during the remaining years. The maximum increase (8.6 percent) was determined assuming the start of soil removal overlapped with the end of building demolition, which is assumed for analysis to occur in 2021. Because of the presence of slow-moving heavy duty trucks, motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to and from SSFL could experience or perceive delays compared to baseline conditions; there could also be delays or perceived delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. These delays or perceived delays would be similar to those under the Cleanup to AOC LUT Values Alternative (see Chapter 4, Section 4.8.2.1.2), but would last for 28 years rather than 26 years.

Potential impacts on the LOS rating of roads and intersections in the SSFL vicinity would be similar to those under the Cleanup to AOC LUT Values Alternative. Compared to 2018 baseline conditions, the LOS rating of Woolsey Canyon Road could change from an A rating to a B rating during AM traffic conditions. In addition and compared to 2018 baseline conditions, the V/C ratio for the unsignalized intersection of Woolsey Canyon Road and Valley Circle Boulevard could increase by 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years, with some intersections operating at an E or F rating during AM or PM traffic conditions. For example, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic conditions during most of the 26 years of soil removal. To some extent, traffic in the SSFL area due to DOE remediation activities may be reduced on roads and intersections other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard by distributing traffic among multiple routes between SSFL and major highways. Delays at this intersection may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6-2).

Traffic associated with the High Impact Combination would impose about 266,000 ESALs on the evaluated routes between SSFL and major highways. These ESALs were determined assuming each route received all traffic. Some of the evaluated roads already need repair, and the ESALs could cause additional damage to the roads, causing them to require 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 28-year period by about 58 round trips compared to the High Impact Combination estimate of 104,000. 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 6,900 heavy-duty truck round trips. In addition, there would be about 51,000 round trips of cars or light-duty trucks, primarily from worker commutes. The largest increase in weekday traffic would occur on Woolsey Canyon Road, where the average daily traffic would increase by about 2.2 to 8.6 percent above baseline conditions during the first 4 years of project activities, and by about 0.05 percent during remaining years. The maximum increase (8.6 percent) was determined assuming the start of soil removal overlapped with the end of building demolition.

Similar to the High Impact Combination, there could be delays or perceived delays for motorists on Woolsey Canyon Road or its intersection with Valley Circle Boulevard due to the presence of slow-moving heavy duty trucks. However, the great bulk of the heavy-duty truck shipments would last for 4 years rather than 28.

Potential impacts on the LOS rating of roads and intersections in the SSFL vicinity would be similar to those under the Cleanup to Revised LUT Values Alternative, except that major truck traffic would occur over a 4-year period rather than 6. (After this 4-year period, there would be only minor traffic including 1 medium-duty truck shipment per year.) Compared to 2018 baseline conditions, the LOS rating of Woolsey Canyon Road could change from an A rating to a B rating during AM traffic conditions. In addition, the V/C ratio for the intersection of Woolsey Canyon Road and Valley Circle Boulevard could increase by 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years, with some intersections operating at an E or F rating during AM or PM traffic conditions. Nonetheless, fewer intersections in the SSFL area could have LOS ratings of E or F at the end of the 4-year period of major traffic for the Low Impact Combination, than would be the case for the 28 years required for the High Impact Combination. During these four years, the intersection of Valley Circle Boulevard with Woolsey Canyon Road could operate at an E LOS rating during AM traffic conditions. To some extent, traffic in the SSFL area due to DOE remediation activities may be reduced on roads and intersections other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard by distributing traffic among multiple routes between SSFL and major highways. Congestion at this intersection may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6-2).

Traffic associated with the Low Impact Combination would impose about 18,000 ESALs on the evaluated routes between SSFL and major highways. These ESALs were determined assuming each route received all traffic. Some of the evaluated roads already need repair, and the ESALs could cause additional damage to the roads, causing them to need repairs 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 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 a future onsite receptor. Consequently, the combined impacts on a future onsite receptor would be dominated by the impacts associated with soil. The impacts on an onsite suburban resident following completion of any of the soil action alternatives would be smaller than those under the No Action Alternative; the impacts would be similar for all of the action alternatives. The High Impact Combination, under which the most soil would be removed from the site, would have a residual cancer risk of 4×10^{-7} to 5×10^{-5} and toxic chemical hazard index range of 0.05 to 0.9 (based on 19 risk assessment units evaluated). The High Impact Combination includes soil remediation under the Cleanup to AOC LUT Values Alternative, and the risks cited above for this combination of alternatives are conservatively those for the hypothetical onsite resident because this receptor would experience the larger risks of the two evaluated receptors (onsite receptor and onsite recreational user) for this soil remediation alternative. The Low Impact Combination includes soil remediation under the Conservation of Natural Resources Alternative, Open Space Scenario, and the risks cited above reflect the potential risks for only the onsite recreational user consistent with the risk-based analysis for this alternative and scenario.

Offsite receptors would receive a combined impact from each of the alternative groups. Potential offsite impacts from the soil remediation alternatives and the strontium-90 removal activity are orders of magnitude less than those for the Building Removal Alternative. Combined cancer risks to an offsite resident and offsite recreational user would be 1.0×10^{-7} and 8.4×10^{-9}, respectively.

Implementing different combinations of action alternatives would have little effect on the maximum number of workers annually on site, but would have a large effect on the number of years that workers could be exposed to chemical and industrial hazards. Under the High Impact Combination, workers would be subject to hazards over a 28-year period, while under the Low Impact Combination; workers would be subject to hazards over a 4-year period. In addition, there could be a combined radiological 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 radiological 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 maintained 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 125,000 cubic yards, which would not impact the disposal capacity at Energy*Solutions* in Utah, NNSS, or WCS in Texas. Under the truck option there would be about 1,000 to 8,500 truck shipments that would occur over 3 to 6 years, depending on the combination of action alternatives. The average daily number of offsite shipments would range from about 2 to 13 under the High Impact Combination or about 2 under the Low Impact Combination. 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. About 30 waste delivery trucks may be daily processed at NNSS given the current scope of operations and personnel. Thirteen daily trucks would represent about 43 percent of this assumed limit, indicating a potential for 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. DOE assumed that there could be similar concerns for waste deliveries to Energy*Solutions* in Utah or WCS in Texas. However, any concerns may be alleviated through careful scheduling and coordination with the disposal facility operators, by use of multiple facilities, or the truck/rail option for delivery of waste to rail-accessible facilities.

Delivery of 13 daily shipments reflects the assumption of an overlap between the second year of soil remediation and the year when strontium-contaminated bedrock would be removed under the Groundwater Treatment Alternative This overlap, and the assumed overlap between the first year of soil remediation and the last year of building removal under the Building Removal Alternative, especially affects the delivery frequency for LLW/MLLW because the operational plan is to remove the radioactive and hazardous soil as quickly as possible, so removal of soil with these constituents is front-loaded. (A small volume of hazardous soil is projected, so the effect of the operational plan falls primarily on radioactive soil.) 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 or WCS in Texas compared to those under the truck option.

The total hazardous waste volume (about 2,100 cubic yards for all action alternative combinations) would not impact the disposal capacity at any evaluated hazardous waste facility (see Chapter 4, Table 4–82). There would be about 140 to 260 truck shipments from SSFL that would occur over 3 to 7 years, depending on the combination of action alternatives, with an average daily number of offsite shipments of less than 1. Under the truck option, there would be the same number of daily deliveries to any single disposal facility. The projected shipments would not impact any daily or yearly receipt limit, if applicable, at any of the facilities. Under the truck/rail option, there would be reduced daily shipments (all by rail) to US Ecology in Idaho.

The total nonhazardous waste volume would range from about 770,000 cubic yards under the High Impact Combination to 37,200 cubic yards under the Low Impact Combination. The high end of the range would represent about 33 percent of the capacity being constructed or planned at the McKittrick Waste Treatment Site in California (assuming all waste was sent to that site). Under the High Impact Combination would be about 50,300 truck shipments from SSFL over 28 years, or about 2,500 truck shipments over 4 years under the Low Combination. The average daily number of offsite shipments would range from less than 1 to about 9 under both the High and Low Impact Combinations. Only transport to the Mesquite Regional Landfill was evaluated under the truck/rail option. Under either the truck or truck/rail option waste shipments would not exceed any annual or daily receipt limit at any of the facilities. About 3,540 cubic yards of recycle material would be delivered to offsite recycle facilities over about 2 to 3 years under all combinations of action alternatives. There would be less than one average daily shipment. No impacts on recycle capacity are expected.

Cultural resources.

Archaeological and Architectural Cultural Resources. There are no structures (architectural resources) in the APE that are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected under any combination of action alternatives, and no impacts on this resource class have been determined under NEPA.

For archaeological resources, consistent with the 2010 AOC (DTSC 2010a), DOE has identified locations of known archaeological sites as areas in which the exemption process would be applied. In the soil remediation plan that DOE would submit for DTSC approval, DOE would propose that areas subject to the exemption process be cleaned of chemical and radioactive constituents if they pose a risk to human health or the environment. At this time, DOE risk assessments have identified soils that would need to be remediated that are on or near some archaeological sites. Therefore, some archaeological sites may be impacted by cleanup activities under any of the soil remediation action alternatives. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more HPTP(s). The HPTP(s) will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation. The overall potential adverse effects related to archaeological resources would be similar but would vary somewhat among the alternatives, depending on extent of cleanup. Under all alternatives, in the unlikely event that an unanticipated archaeological resource is encountered, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

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 based on the prior disturbance associated with facility construction. Similarly, it is unlikely that the groundwater remediation action alternatives, implemented together or separately, would encounter unanticipated archaeological resources during installation of equipment.

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, Open Space Scenario, which would cause the least soil disturbance of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative and both groundwater remediation action alternatives would be unlikely to encounter unanticipated archaeological resources.

Traditional Cultural Resources. Under all alternatives, soil remediation could have adverse impacts on traditional cultural resources. In addition to potential impacts on specific archaeological resources, soil remediation could change the general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Improved access and increased traffic related to cleanup activities could impact traditional cultural resources by introducing more people, equipment, and possible vandalism during the duration of cleanup activity. DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for the NRHP.

The High Impact Combination would have the greatest potential to impact traditional cultural resources, primarily because this combination would have the most landscape alteration and longest cleanup duration. Removal of built structures under the Building Removal Alternative could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources. Groundwater remediation action alternatives, whether implemented together or separately, are unlikely to impact traditional cultural resources in Area IV and the NBZ because above-ground elements would be designed to avoid adverse effects on the landscape.

The Low Impact Combination would have the least potential to impact traditional cultural resources, primarily because this combination includes the Conservation of Natural Resources Alternative, Open Space Scenario, which would have the shortest cleanup duration and would result in the least landscape alteration of any of the soil remediation action alternatives. As discussed above, removal of built structures under the Building Removal Alternative could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources. Groundwater remediation action alternatives, whether implemented together or separately, are unlikely to impact traditional cultural resources in Area IV and the NBZ because above-ground elements would be designed to avoid adverse effects on the landscape.

Socioeconomics.

Employment. For most years under the High Impact Combination, the number of onsite workers would range from 25 to 60 workers. In addition, during 1 year an additional 5 workers would be needed over a few weeks to install groundwater treatment equipment as well as about 5 workers over about 60 working days to remove bedrock containing strontium-90. Under the Low Impact Combination, the number of onsite workers would range from 25 to 60 for 4 years, plus 6 workers in 1 year working an average of 5 days for each well to install 5 wells. For all years there would be 6 workers working an average of 20 days per year for environmental monitoring.

Under any combination of action alternatives, remediation 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. Workers would likely primarily originate from these two counties, with minimal new spending or economic activity in the region.

Truck traffic. The High Impact Combination would result in increased traffic in the SSFL vicinity over 28 years, with the most noticeable increase occurring on Woolsey Canyon Road. However, the additional traffic is not expected to result in socioeconomic impacts on businesses along this road, and traffic on other evaluated roads would increase by no more than 4 percent above baseline conditions, assuming all traffic traversed each road, with minimal potential for impacts. The largest concentration of retail establishments, restaurants, and other businesses is on Topanga Canyon Boulevard. The projected increase in average daily traffic (about to 0.5 percent above baseline conditions) is not expected to significantly impact businesses along this road (see Appendix H, Table H–23).

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 along Woolsey Canyon Road, and average daily traffic on other evaluated roads would increase by no more than about 4 percent, assuming all traffic traversed each road, with minimal potential for socioeconomic impacts on businesses. The average daily traffic on Topanga Canyon Boulevard would increase by about 0.5 percent above baseline conditions, which is not expected to have noticeable socioeconomic impacts on businesses along Topanga Canyon Boulevard (see Appendix H, Table H–23).

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 required for remediation of Area IV and the NBZ, which could range from 6,900 heavy-duty truck round trips under the Low Impact Combination to 104,000 heavy-duty truck round trips under the High Impact Combination.

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 28 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. Under the High Impact Combination, LLW and MLLW would be delivered to an assumed single disposal facility at average daily rates ranging from 2 to 13, with deliveries occurring over 6 years. The high end of this range was determined assuming that the second year of soil removal overlapped with the removal of strontium-90 contaminated bedrock under the Groundwater Treatment Alternative. Under the Low Impact Combination, LLW and MLLW would be delivered to an assumed single disposal facility at an average daily rate of about 2, with deliveries occurring over 3 years. This truck traffic is not likely to have socioeconomic impacts on businesses in the vicinities of the disposal facilities, because of the location of the disposal facilities in isolated, rural areas, and the ease of accessing the facilities from highways.

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 is that very small quantities of hazardous waste (about 13 cubic yards) might be generated under the Groundwater Treatment Alternative. The largest average daily truck deliveries to a single assumed hazardous waste facility would be less than 1 delivery. This frequency of truck traffic would not have socioeconomic impacts on businesses in the vicinities of the disposal facilities.

The differences among action alternative combinations for shipment of nonhazardous waste are primarily due to differences in soil volumes removed under the soil remediation action alternatives. Under both the High and Low Impact Combinations, the average number of heavy-duty trucks receiving at a single assumed waste disposal facility could range up to 9 per day, with waste being shipped to disposal facilities over 28 or 4 years, respectively. No or minimal socioeconomic impacts would be expected on businesses in the vicinities of any of the facilities because of the locations of the facilities or the ease of access from major highways.

Deliveries to an assumed single recycle facility would average less than 1 truck per day, a delivery level which would have no impact on traffic volume in the vicinities of any of the recycle facilities, and thus no socioeconomic impacts on businesses in the vicinities of these facilities.

Environmental justice.

SSFL ROI. Under any combination of action alternatives, the risks to a member of the public from both the incidence of cancer and a cancer fatality would be dominated by impacts from background levels of chemical and radioactive constituents. There would be no disproportionately high and adverse impacts on minority or low-income populations, including Native Americans.

Under the High Impact Combination, the largest increase in weekday traffic would occur on Woolsey Canyon Road, where over 28 years, the average daily traffic would increase by 2.2 to 8.6 percent above baseline conditions (see Appendix H, Table H–23). The largest increase (8.6 percent) results from the assumption that soil removal overlaps with the final year of building demolition under the Building Removal Alternative. 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 increase by 2.2 to 8.6 percent above baseline conditions (see Appendix H, Table H–23). Thereafter, there would be small numbers of annual shipments of purge water and environmental samples from 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 roads between SSFL and major highways. However, 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. Thus, impacts on minority or low-income populations, including Native American tribes would be the same as those experienced by the general population. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI.

Regional ROIs. Regional environmental justice impacts depend on the potential increases in truck traffic on the roads in the vicinities of the offsite facilities.

The average daily deliveries to a single assumed LLW/MLLW facility could range from 92 to 13 under the High Impact Combination, or would be about 2 under the Low Impact Combination. Assuming all deliveries were made to a single disposal facility, the projected frequency of truck traffic would not cause significant impacts in the ROI for that facility. As discussed previously, the high end of the range under the High Impact Combination was conservatively determined assuming that the second year of soil removal overlapped with the removal of strontium-90-combaminated bedrock under the Groundwater Treatment Alternative.

There is almost no difference among the combinations of action alternatives regarding the total quantity of hazardous waste (about 13 cubic yards of waste). Even if all waste deliveries were made to a single hazardous waste facility, the projected frequency of truck traffic (less than 1 truck delivery per day) would not cause significant impacts in the ROI for that facility.

Under both the High and Low Impact Combinations, the average number of heavy-duty trucks at a single assumed nonhazardous waste facility could range from less than 1 to 9 per day, with shipments lasting for 28 or 4 years, respectively. Under either combination there would be none to minimal traffic impacts in the vicinity of any nonhazardous waste facility. For both the High and Low Impact Combinations, there would be little difference in impacts if either groundwater remediation action alternative, or both groundwater remediation action alternatives, was implemented.

Under any combination of action alternatives, there would be less than 1 average daily shipment of recycle material to recycle facilities during the 2 to 3 years of building demolition, with no impacts on traffic volumes in the vicinities of any of these recycle facilities.

Considering 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 any of the evaluated recycle and disposal facilities.

Sensitive-aged populations.

SSFL ROI. Under the High Impact Combination, the largest increase in traffic would occur on Woolsey Canyon Road, the weekday average daily traffic would increase by 2.2 to 8.6 percent above baseline conditions over all 28 years, but by about 3.3 percent for most years (see Appendix H, Table H–23). 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. Traffic volumes on other SSFL area roads are not expected to be significantly 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 increase by 2.2 to 8.6 percent above baseline conditions (see Appendix H, Table H–23). Thereafter, there would be small numbers of annual shipments of purge water and environmental samples associated with groundwater monitoring. Increases in traffic on the other SSFL-area roads would be similar on an annual basis to those under the High Impact Combination but would have a much shorter duration.

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 routes are not expected to be significantly 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.

Regional ROIs. Even if all waste deliveries were made to a single LLW/MLLW or hazardous waste disposal facility, significant increase in traffic would be expected, with no adverse impacts on the general public. Furthermore, no schools or recreation areas have been identified in the ROIs of the radioactive and hazardous waste facilities. Therefore, no disparate impacts are expected on sensitive-aged populations in the ROIs of these facilities.

The High Impact Combination would generate the most nonhazardous waste to be shipped to disposal facilities. Assuming all nonhazardous waste was shipped to a single assumed facility, traffic-related impacts would 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 Low Impact Combination would generate much less nonhazardous waste, which would be shipped to disposal facilities over approximately 4 years, with minimal traffic-related impacts. As discussed for "Environmental Justice," for both the High and Low Impact Combinations, there would be a negligible difference in impacts if either groundwater remediation action alternative, or both groundwater remediation action alternatives, was implemented.

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 nonhazardous waste facilities.

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 2–12** 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 2–12 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:** 17 to 98 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 7,000 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:** 164 to 265 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:** 181 to 363 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 regular drought conditions in Southern California, the State of California implemented water use reduction targets in 2018. 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 17 to 98 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation in Area IV and the NBZ. 42,200 to 678,000 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 164 to 265 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 207,300 to 291,300 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 1813 to 363 acres of soil disturbance and loss of soil with mineralogical and biological composition capable of supporting unique vegetation at SSFL. 249,500 to 969,300 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	Approximately 9 to 99 acres of habitat would be disturbed by removal of vegetation and soils, including about 5 to 33 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 habitat for most wildlife species until the vegetation has re-established. 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.	Approximately 194 to 275 acres of habitat would be disturbed. Similar impacts as described for DOE. Approximately 11 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.	Approximately 235 to 414 acres of habitat would be 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.

Resource Area	DOE Contribution to Cumulative Impacts	NASA and Boeing Contribution to Cumulative Impacts	Other Contributions to Cumulative Impacts	Cumulative Impacts
Air quality and climate	Onsite activities would not contribute to exceedance of an ambient air quality standard at an offsite location. There would be up to 32 peak day 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 88,000 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 14,000 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 Ventura County and 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 232,000 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. DOE shipments would average about 16 per day but in any case would remain at or below 32 per day throughout all stages of the project. On a day with 32 heavy-duty truck round trips, time-averaged noise levels in residential and recreation areas along potential haul routes are expected to increase by up to 1.4 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, where the final noise level would exceed 65 dBA CNEL, the noise level would increase by no more than 1.2 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 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 4.7 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, where the final noise level would exceed 65 dBA CNEL, the noise level would increase by no more than 1.3 dBA CNEL (the threshold for an adverse impact when the final noise level exceeds 65 dBA CNEL is an increase of 3 dBA CNEL). 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:** No potential LCFs are estimated to occur. **Nonradiological impacts:** Approximately 0 to 2 potential accident fatalities are estimated depending on the Alternative from DOE transportation activities.	**Radiological impacts:** No LCFs would be anticipated.[a] Boeing remediation activities are not expected to generate any radioactive waste. **Nonradiological impacts:** Up to 1 potential accident fatality is estimated 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:** 100,320 estimated traffic fatalities occurring in California from 2019-2046. 26,530 estimated traffic fatalities in the four neighboring counties (2019-2046).	**Radiological impacts:** 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**: 0 to 3 potential accident fatalities are estimated to result from SSFL (DOE, NASA, and Boeing) transportation activities; representing about up to 0.004 percent of the total number of traffic fatalities expected in California and up to about 0.014 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 (about 3.3 to 8.6 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C for approximately 4 to 12 years. **Pavement deterioration:** 6,900 to 104,000 heavy-duty truck trips depending on the action alternative combination; from 15,000 (Low Impact Combination) to 226,000 (High Impact Combination) equivalent single axle loads would be imposed on SSFL-area road pavement by vehicles associated with DOE remediation activities.	**Level of service:** Largest weekday, average daily traffic increase would be on Woolsey Canyon Road (about 20 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** 72,000 to 96,000 heavy-duty truck trips depending on the remediation option; from 147,000 to 196,000 equivalent single axle loads would be imposed on SSFL-area road pavement by vehicles associated with DOE remediation activities.	**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:** SSFL-area road pavement would deteriorate over time due to the passage of vehicles including heavy-duty trucks not associated with SSFL remediation. 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.	**Level of service:** Largest percentage traffic increase would be on Woolsey Canyon Road (about 29 percent). The LOS on Woolsey Canyon Road could degrade from LOS B to C. **Pavement deterioration:** 80,000 to 199,000 heavy- and medium-duty truck trips associated with DOE. NASA, and Boeing remediation activities, depending on the DOE action alternative combination and the range in shipments by NASA; from 162,000 to 422,000 equivalent single axle loads would be imposed on SSFL-area road pavement by vehicles associated with DOE, NASA, and Boeing remediation activities. Between 7 and 61 percent of the equivalent single axle loads would be attributable to DOE activities. Increased truck traffic could damage the 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 26 years, consistent with the current EPA default recommendations. 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 26 years, 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, 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 offsite impacts have been shown to be several orders of magnitude less the threshold for alternative comparison. Therefore, the impacts from adjacent areas under control of NASA or Boeing to a resident in Area IV are also 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 200 to 110,000 cubic yards of LLW/MLLW, about 2,0000 cubic yards of hazardous waste, 36,000 to 769,000 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 estimated to generate and ship off site about from less than 1 to 56 percent of the SSFL cumulative volume of LLW and MLLW, less than 1 percent of the cumulative volume of hazardous waste, 3 to 66 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:** Some archaeological sites may be impacted by cleanup activities. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more HPTP(s). The HPTP(s) will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation. **Architectural resources:** No structures located in DOE-administered areas are NRHP-eligible. **Traditional cultural resources:** The character-defining traits of the traditional cultural resources at Area IV and the NBZ 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	**Archaeological resources:** NRHP–eligible areas on NASA-administrated lands would be addressed 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 traditional cultural resources would have similar impacts as those described for DOE.	Of the 126 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 encountered 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 archaeological sites, 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 without mitigation. Potential destruction of NRHP-eligible sites in Area IV and the NBZ would add to cumulative, regional impacts. However, this would be a small contribution to cumulative, regional impacts due to the small number of sites impacted and the implementation of mitigation measures through the Section 106 Programmatic Agreement. The overall number of archaeological sites in the region, particularly those that are not eligible for the NRHP, could continue to be reduced as a result of past, present, and reasonably foreseeable future actions. **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

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
	impacts would be achieved through restoration of viewsheds by removal of structures. Removal of contamination could also be beneficial.			achieved through restoration of viewsheds by removal of structures at SSFL. Removal of contamination at SSFL could also be beneficial.
Socio-economics	**Employment:** DOE onsite activities would require 85 workers. Workers would likely originate primarily from Ventura and Los Angeles Counties. **Truck Drivers and Traffic:** DOE would require from 7 to 41 truck drivers. A maximum of 41 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 30 to 132 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 235 to 260 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 37 to 173 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 10 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

Resource Area	*DOE Contribution to Cumulative Impacts*	*NASA and Boeing Contribution to Cumulative Impacts*	*Other Contributions to Cumulative Impacts*	*Cumulative Impacts*
				at LLW or MLLW facilities, 39 at hazardous waste facilities, and 4 at recycle facilities (see Appendix D).[c]
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; HPTP = Historic Properties Treatment Plan; 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 *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final 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. Over its operational lifetime, 272 structures and associated infrastructure were used in Area IV 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.

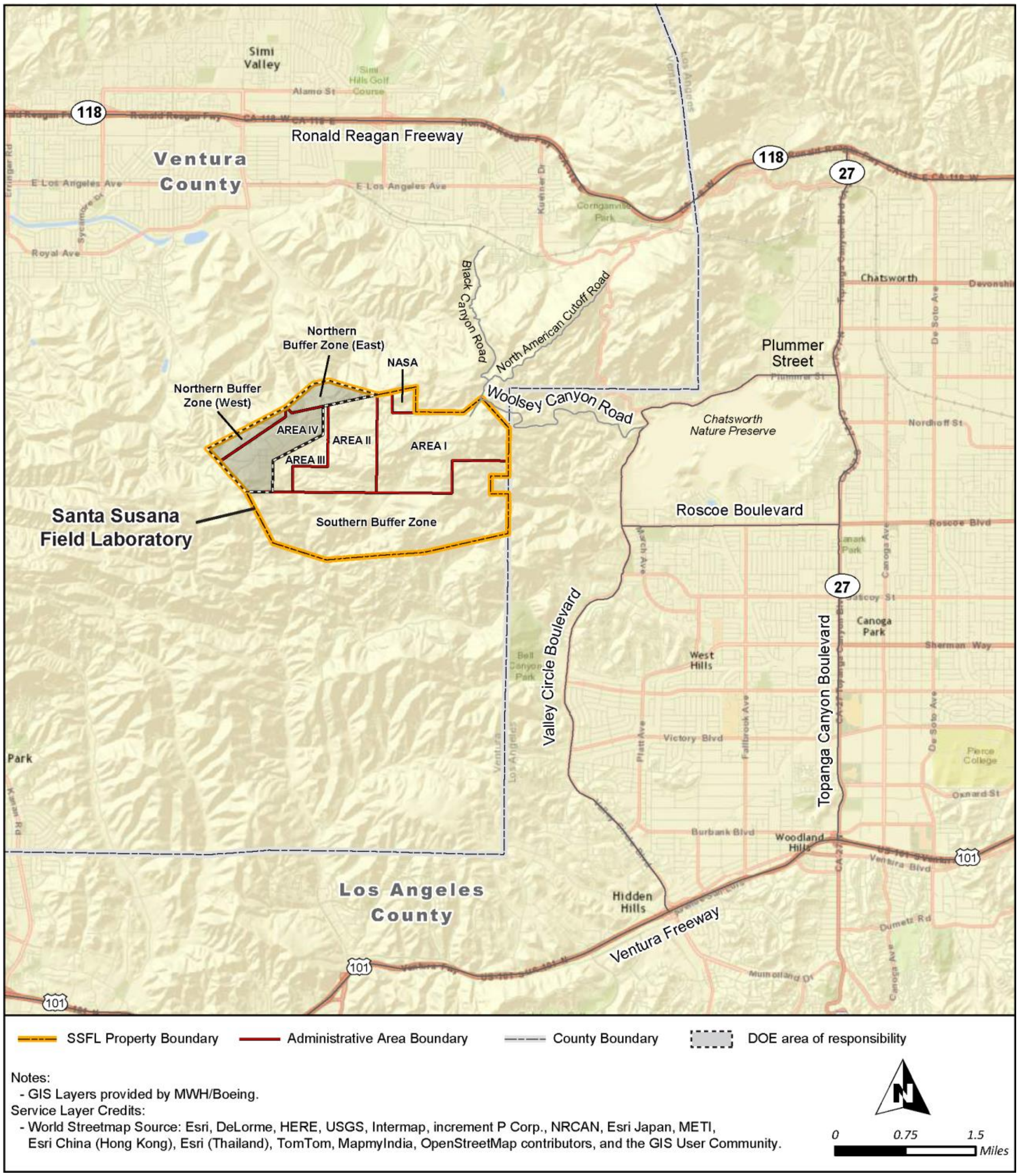

Figure 3–1 Santa Susana Field Laboratory Location

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.

In 2017, Boeing and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements (conservation easements) with Ventura County that permanently preserve as open space about 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ (Ventura County 2017a, 2017b). The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site.

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.

Figure 3–3 shows the general land uses in the vicinity of SSFL. 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 northwest, 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.

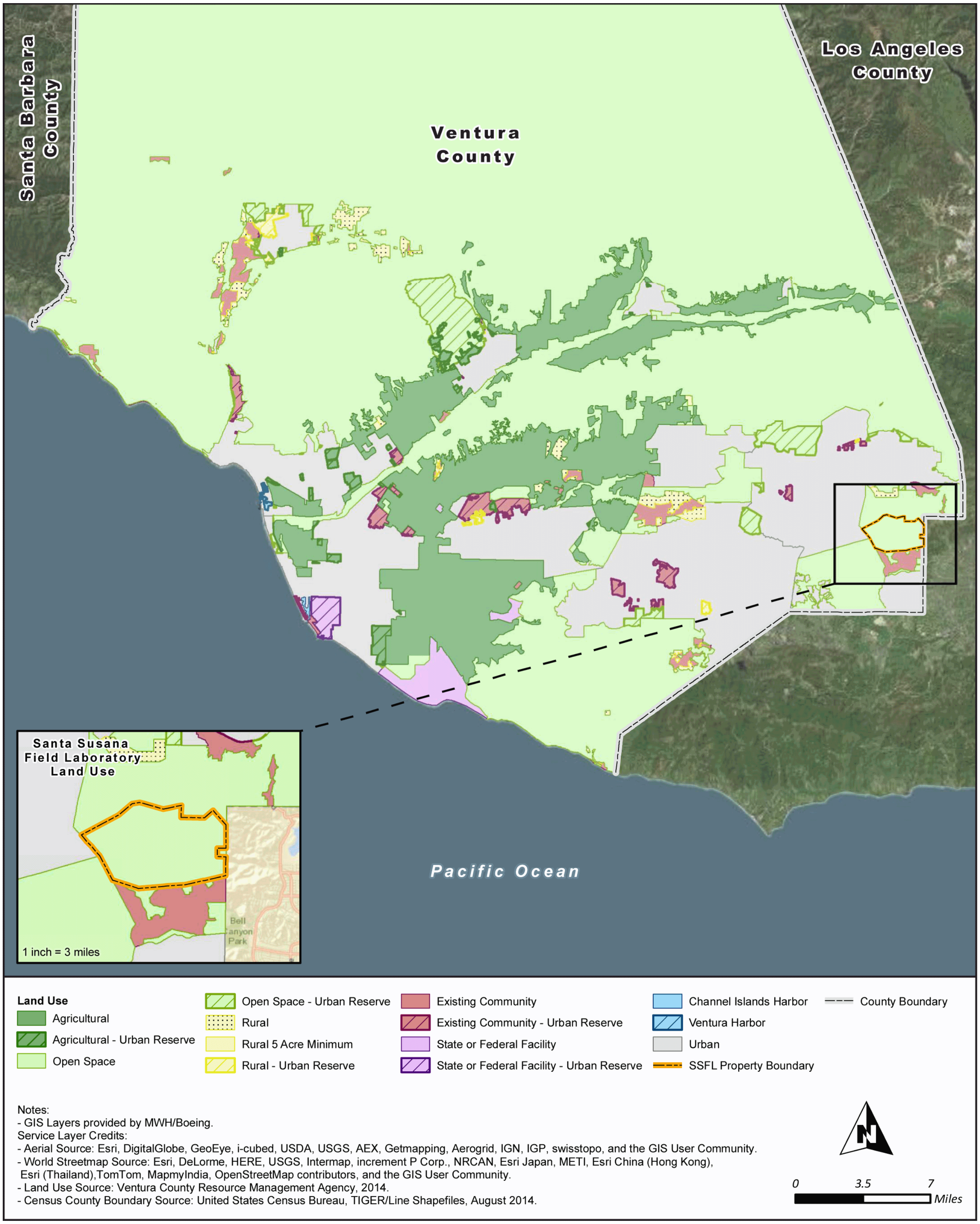

Figure 3–2 Ventura County Land Use Map

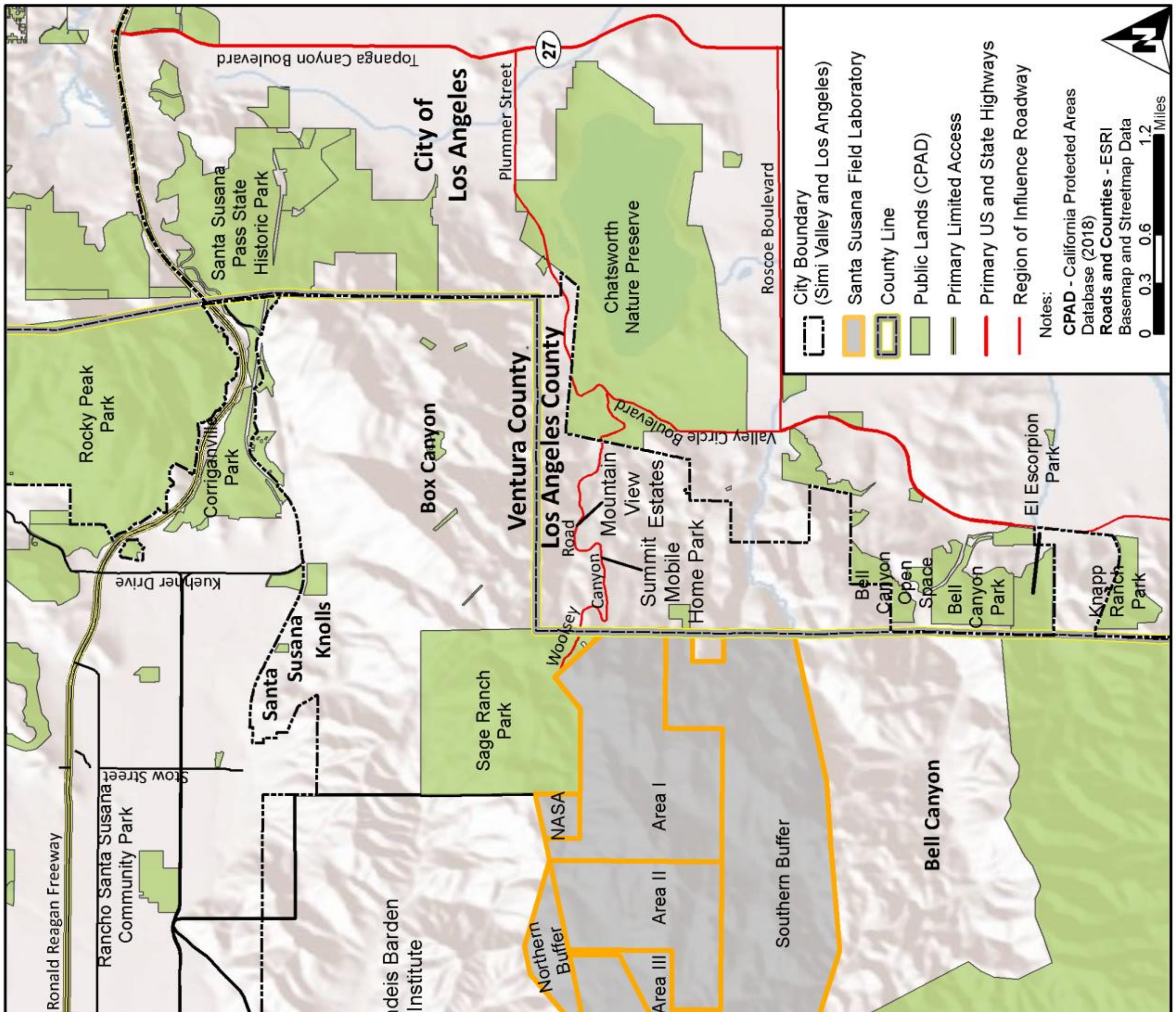

Figure 3–3 General Land Uses in the Vicinity of Santa Susana Field Laboratory

Santa Monica Mountains National Recreation Area/Rim of the Valley Corridor Special Resource Study

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).[1] 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). **Figure 3–4** provides an overview of the study area. This area incorporates a region with high biological diversity, functioning wildlife migration corridors, highly scenic landscapes, and important archaeological resources that offer unique educational opportunities to the public. The purpose of the study was to assess the national significance of these resources and the public's opportunity to enjoy and learn from the resources. In the *Draft ROTV EA*, issued in April 2015, the National Park Service analyzed 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 analyzed ranged 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. In the *Rim of the Valley Corridor Special Resource Study Final Summary* (NPS 2016) and in its Finding of No Significant Impact (NPS 2015f), the National Park Service concluded that the resources were nationally significant requiring protection and adding lands to Santa Monica Mountains National Recreation Area would enhance protection of those resources benefitting surrounding communities and the region.

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).

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[1] The National Park Service did not issue a standalone final EA, but finalized the ROTV EA by issuing a companion document, the *Rim of the Valley Corridor Special Resource Study & Environmental Assessment Errata* (NPS 2015g), as well as a FONSI (NPS 2015f).

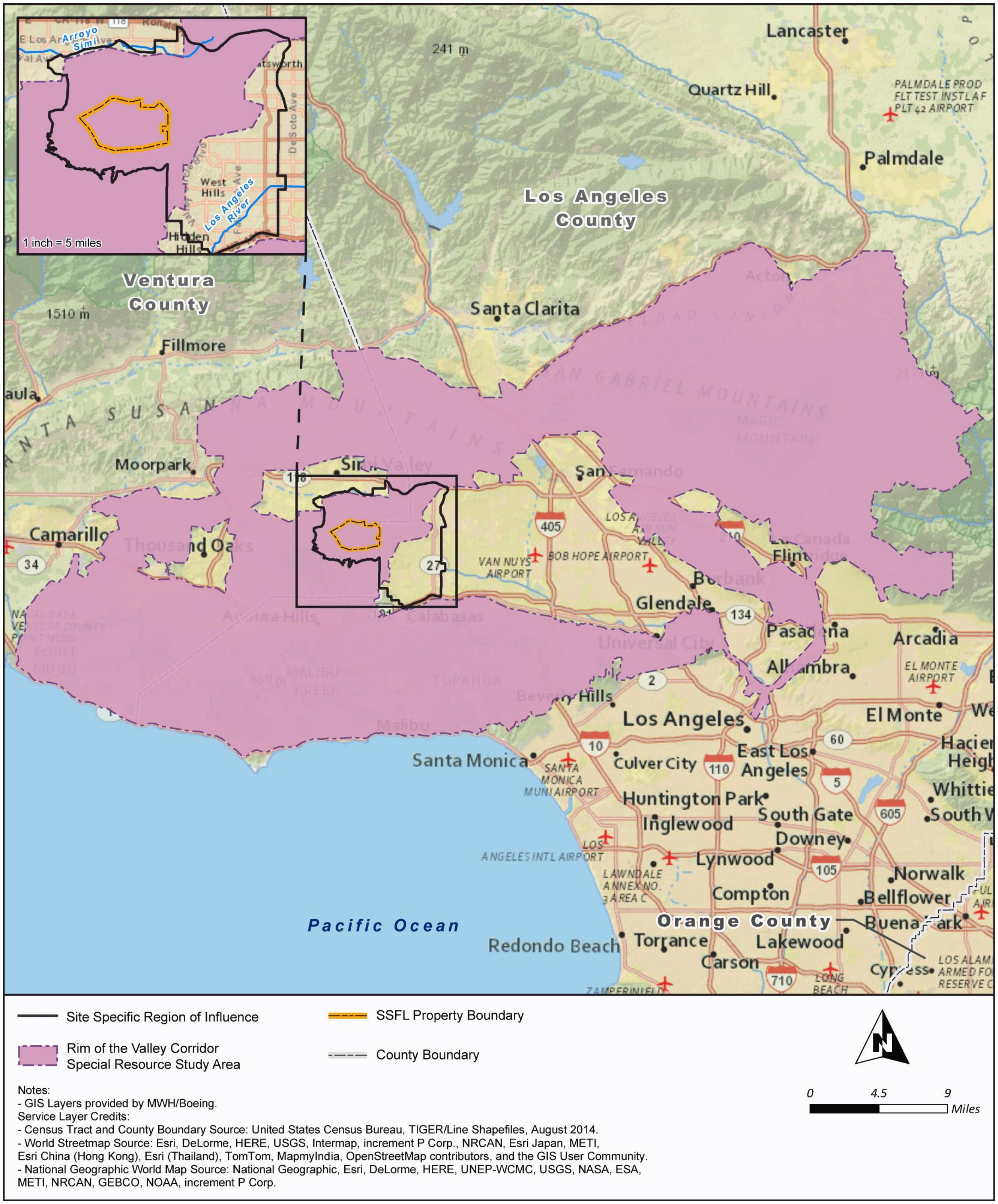

Figure 3–4 Rim of the Valley Corridor Special Resource Study Area

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 4 are owned 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 2–10 in Section 2.5 shows the locations of these buildings.

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). CMWD's primary water supply comes from the Metropolitan Water District via water from the State Water Project pumped from Northern California. A secondary supply comes from the Metropolitan Water District's Colorado River Aqueduct. CMWD is also acquiring reclaimed water from Triunfo Sanitation District and the City of Simi Valley. Local storage to meet summer demands is in Lake Bard near Thousand Oaks (an off-channel reservoir that does not receive runoff from SSFL) and aquifer storage. Currently groundwater is not being actively used due to salt water intrusion from the Pacific Ocean.

In 2011, CMWD projected that in 2035 it would have a combined water supply of 195,389 acre feet per year to accommodate population and job growth (CMWD 2011). In 2015, CMWD revised their projections to account for lower than expected supply. **Table 3–1** provides updated CMWD projections for its imported and local water supply through 2040, which accounts for these revisions. The table also provides a comparison with projected demand. In 2011, during the development of an earlier Urban Water Management Plan, CMWD reported that municipal and industrial uses account for 90 percent of the water distributed by CMWD's purveyors (CMWD 2011). 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 by the reduced availability of State Water Project supplies and by the CMWD service area's cooler than normal weather in 2010 (CMWD 2011). Demand is expected to continue to lower through 2025 and then slowly begin growing, as shown in Table 3–1, although not to the levels previously recorded in 2005 and 2010.

The supply and demand projections may not fully 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). On May 17, 2017, in response to improved conditions, the Calleguas Board of Directors rescinded the Stage 3 Shortage that had been in effect for its service area (CMWD 2017). The Board still called for expanded water use efficiency measures by area water users in light of looming State mandates and urged State and Federal agencies to move forward on the implementation of the California WaterFix and EcoRestore[2] along with pursuing other water supply reliability programs.

In 2018, Southern California returned to a severe drought condition (National Integrated Drought Information System 2018). Given the uncertainty with the implementation timeline for these statewide water supply reliability programs, the return to shortage declarations in the foreseeable future with recurrence of dry conditions Statewide and in the CMWD service area are likely.

Governor Brown signed legislation in May 2018 that strengthens the State's water resiliency in the face of future droughts with provisions that include: (1) establishing an indoor, per person water use goal of 55 gallons per day until 2025, 52.5 gallons from 2025 to 2030 and 50 gallons beginning in 2030; (2) creating incentives for water suppliers to recycle water; and (3) requiring both urban and agricultural water suppliers to set annual water budgets and prepare for drought (State of California 2018).

Table 3–1 Calleguas Municipal Water District Total Water Demand and Supply Comparison

		2020	2025	2030	2035	2040
Normal Year Supply and Demand Comparison (acre-feet)						
Supply totals [a]		123,695	126,959	126,764	125,973	126,614
Demand totals [b]		98,568	96,437	99,076	101,600	103,893
Difference		**25,127**	**30,522**	**27,688**	**24,373**	**22,721**
Single Dry Year Supply and Demand Comparison (acre-feet)						
Supply totals [a]		124,735	128,004	127,815	127,027	127,678
Demand totals [b]		107,110	104,209	106,586	109,504	112,183
Difference		**17,625**	**23,795**	**21,229**	**17,523**	**15,495**
Multiple Dry Years Supply and Demand Comparison (acre-feet)						
First year [c]	Supply totals [a]	123,164	130,180	130,749	130,073	130,502
	Demand totals [b]	101,316	97,728	100,033	102,807	104,075
	Difference	**21,848**	**32,452**	**30,716**	**27,266**	**26,427**

[a] Supply totals include recycled water.
[b] Demand will be higher if planned local production projects are not constructed by Calleguas purveyors.
[c] Second and third year totals were the same as first year.
Source: CMWD 2015.

[2] California WaterFix and Eco Restore, formerly known as the Bay Delta Conservation Plan, is a project to provide a reliable water delivery system by constructing two large, tunnels to carry fresh water from the Sacramento River under the Sacramento-San Joaquin Delta to intake stations for the State Water Project and the Central Valley Project.

Natural Gas

Southern California Gas Company supplied natural gas to SSFL in the past. However, there is no longer active gas service to buildings in Area IV; the supply lines have been abandoned in place by the Southern California Gas Company.

Sewer System

Septic tanks and their associated leach fields were used at SSFL until 1961, 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 3–5** shows the locations of the existing electrical distribution infrastructure. Most of the buildings in Area IV have been disconnected from the electrical lines serving Area IV. There are five buildings within the RMHF (Buildings 4021, 4022, 4034, 4044, and 4621) that have electrical service. Building 4024 is the only building outside the RMHF that has electrical service.

Communication System

Cellular telephone coverage from Simi Valley is used for phone communication. Two-way radios are used for onsite emergency communication.

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).

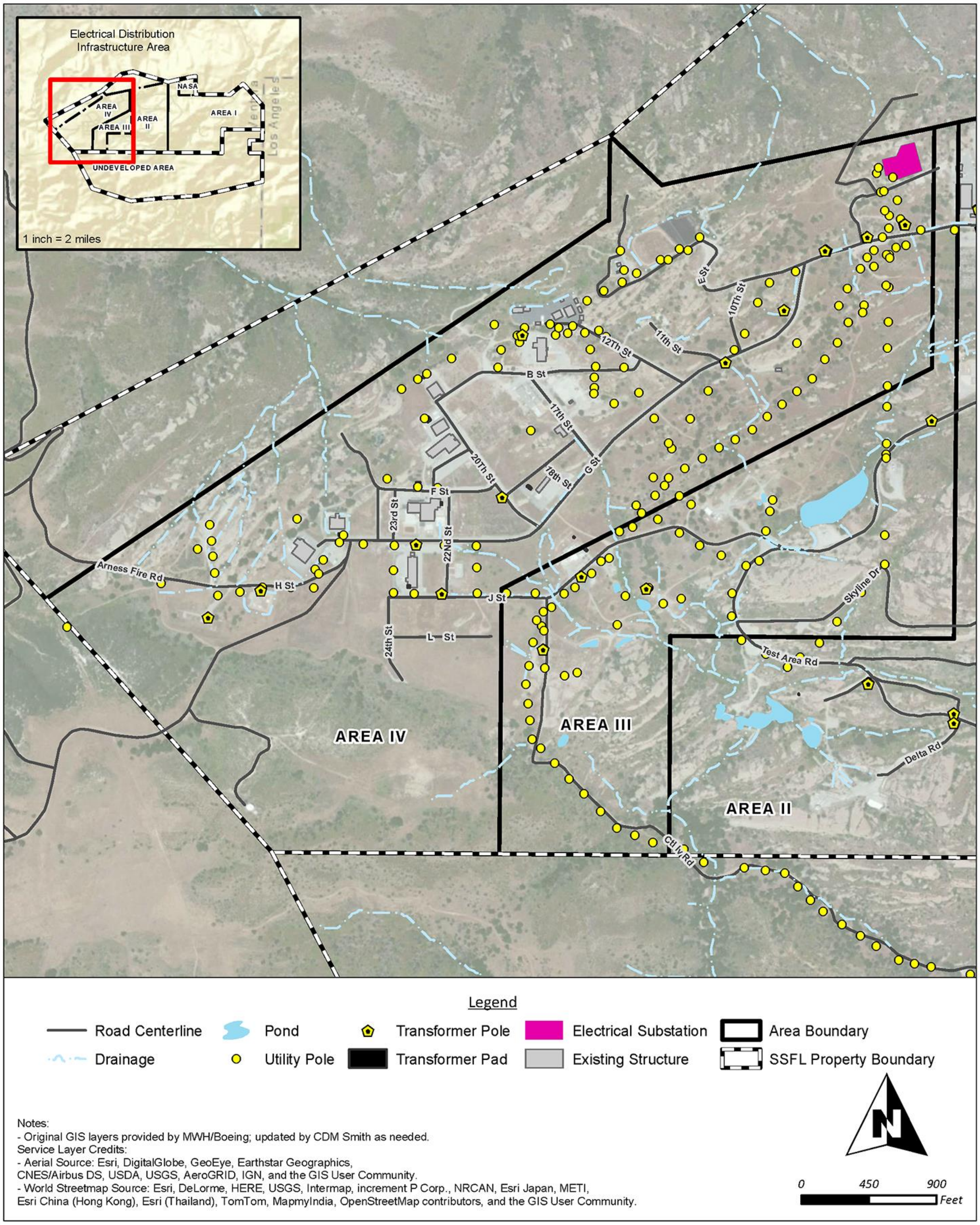

Figure 3–5 Santa Susana Field Laboratory Electrical Distribution System

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 generally not visible from roadways outside of SSFL. Views of Area IV are blocked by a bedrock ridge forming the northern boundary of the NBZ, and only the top of the hill forming the southern boundary of Area IV is visible from portions of Simi Valley. No portion of Area IV is visible from Bell Canyon or the San Fernando Valley. Visitors to Sage Ranch Park who hike the ridgeline north of Area I have distant views of a portion of the southern parts of Area IV. Distant views of portions of Area IV are also visible from fire roads west of the site. Only workers and those on official tours or business are able to access the site. Onsite workers primarily experience foreground views limited to an urban-industrial landscape that is in transition to a natural setting. 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 to the north.

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 foreground or mid-ground views of Area IV are available. Sage Ranch provides mid-ground views of Areas I and II and distant views of part of Area IV. 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 most views of Area IV from Simi Valley including the adjacent Brandeis-Barden property. There are limited spots along the northern edge of Area IV, and the top of the rounded hill forming the southern Area IV boundary where Simi Valley is visible (View Point 1 in **Figure 3–6**); 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 3–6 were selected based on their representation of common views experienced by local 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 3–2**.

Table 3–2 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.

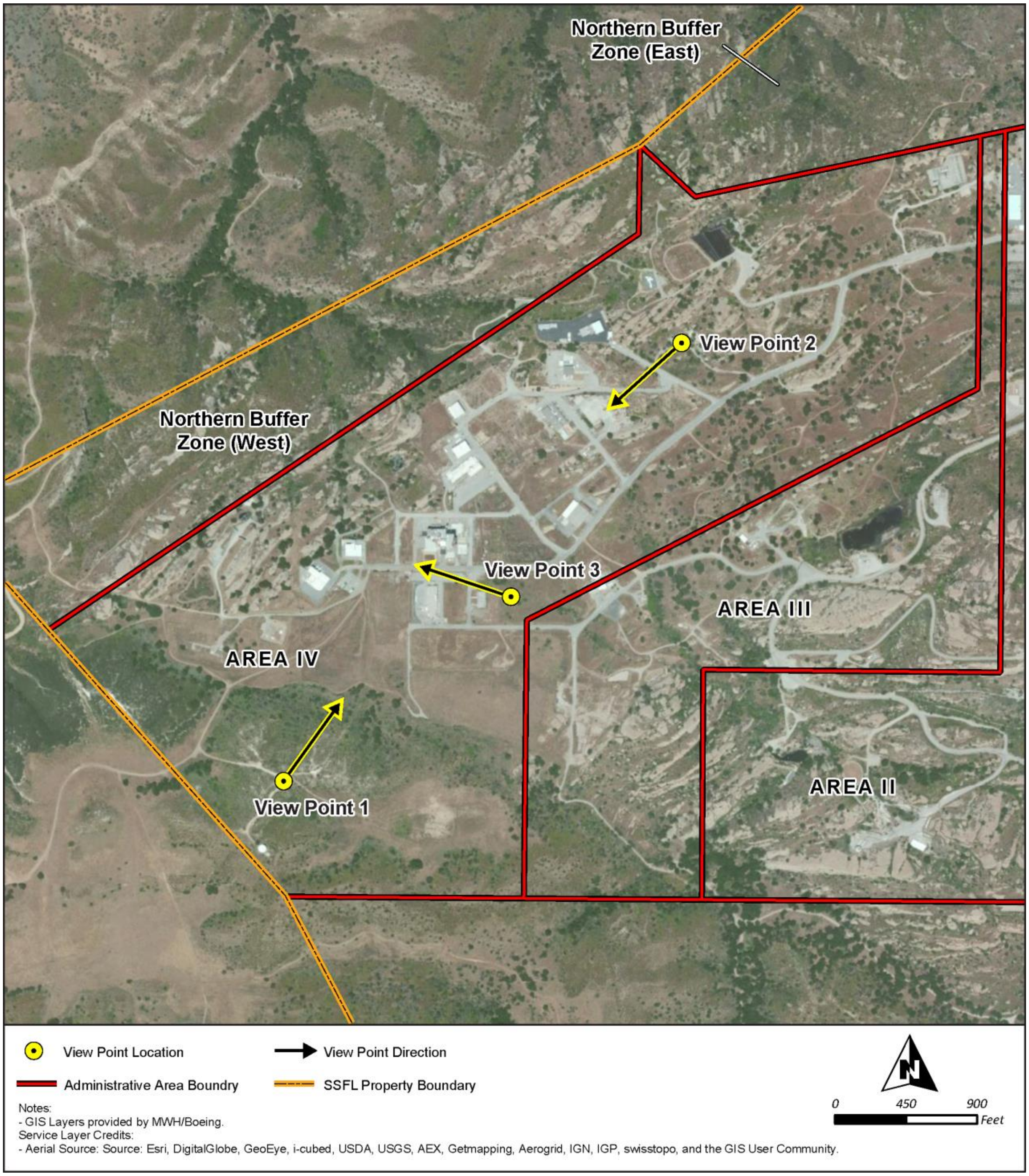

Figure 3–6 Representative Area IV Viewing Points

Viewing Point 1, shown in **Figure 3–7**, 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 3–7 Viewing Point 1

Viewing Point 2, shown in **Figure 3–8**, 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 3–8 Viewing Point 2

Viewing Point 3, shown in **Figure 3–9**, 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 3–9 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 3–10**, 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 3–11** 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.

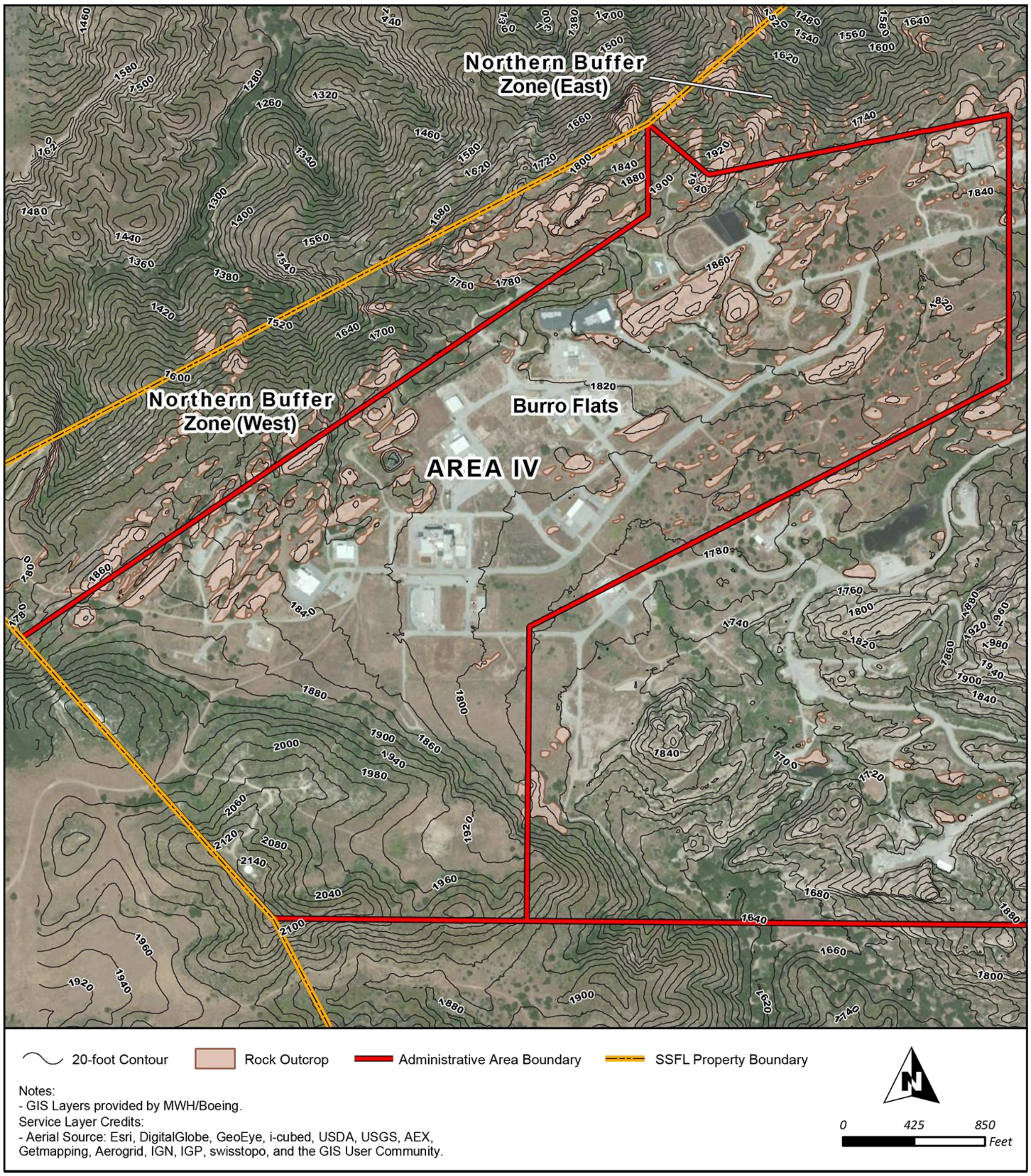

Figure 3–10 Topographic Map of Area IV and the Northern Buffer Zone

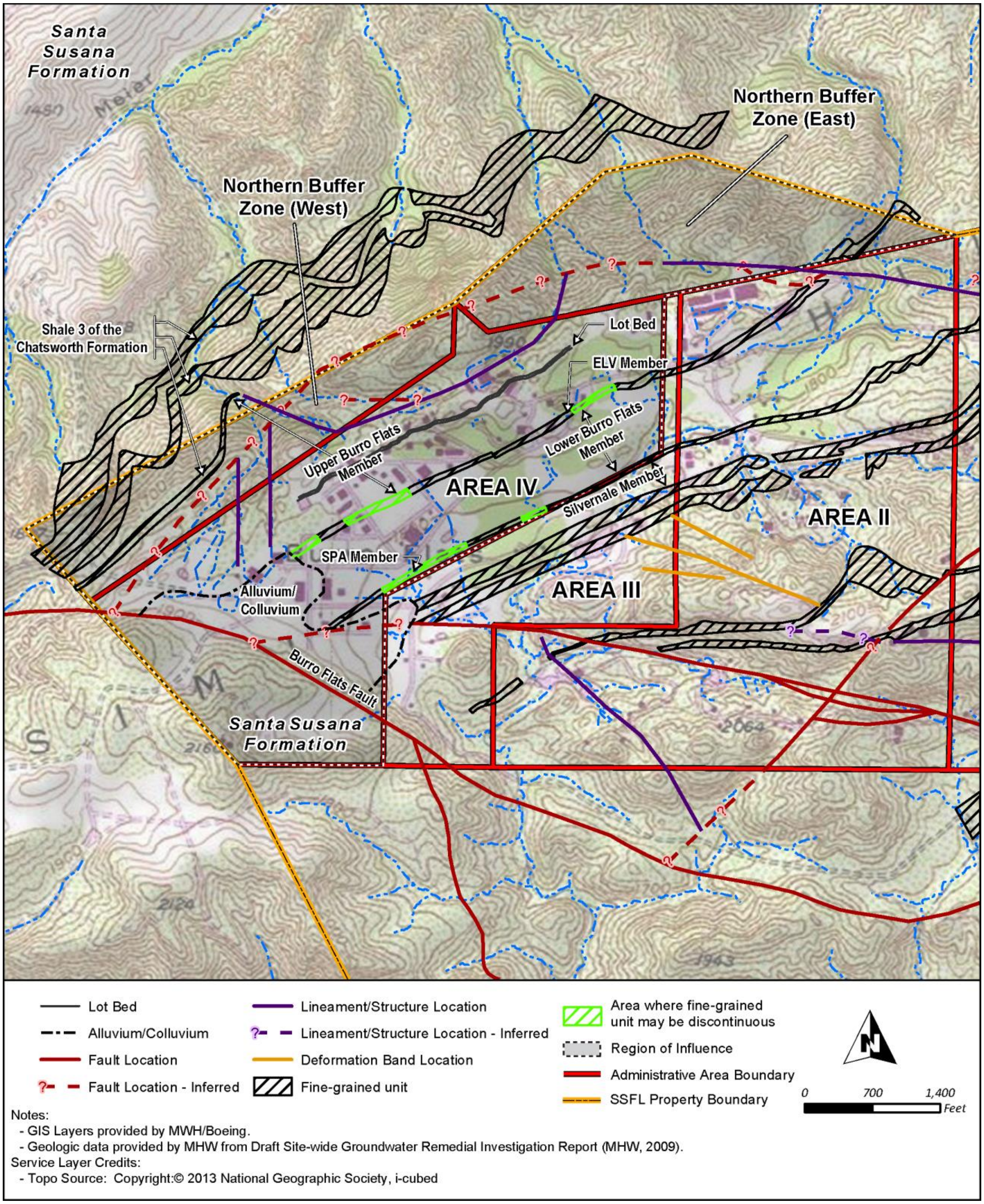

Figure 3–11 Geologic Map of Area IV and the Northern Buffer Zone

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;
- 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 (youngest) unit outcrops are 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. 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 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. The Burro Flats Fault crosses the entire width of the southern part of SSFL. Most of the investigative work on this fault was performed in Areas II and III where the fault exhibits aspects of both a partial hydraulic barrier and a zone of enhanced hydraulic conductivity. In Area IV, groundwater flows away from the Burro Flats Fault. Pumping groundwater at the FSDF has no noticeable effect on the water height in a well near the fault, indicating that the bedrock between the fault and the pumped well has a very low hydraulic connectivity. The fault does not represent a migration pathway for the movement of Area IV groundwater contaminants (CDM Smith 2018a).

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 3–12**). This designation is based on topography, geologic materials and structure, geotechnical data, rock strength data, and estimates of earthquake-related shaking.

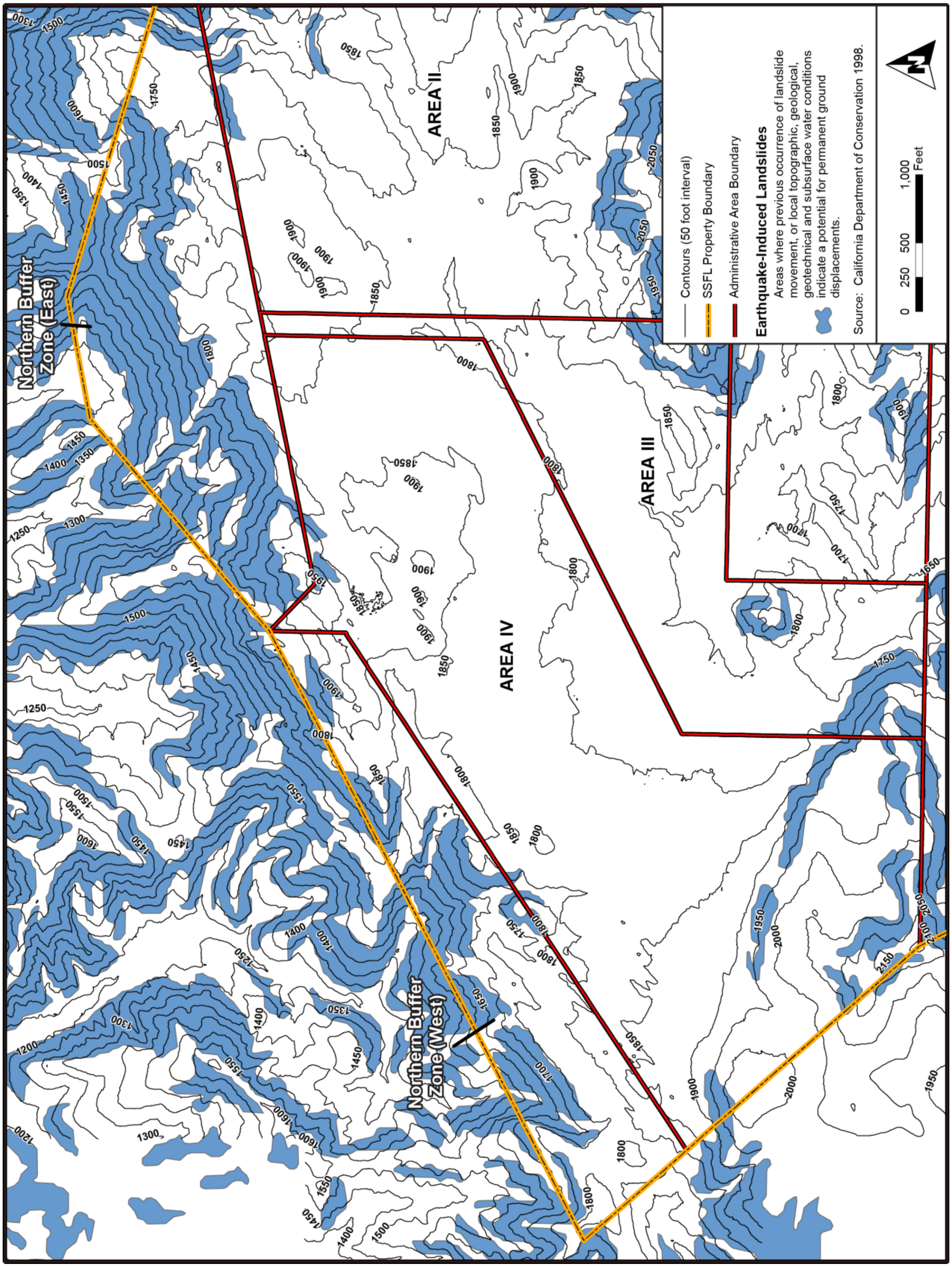

Figure 3–12 Seismic Hazard Zones at Santa Susana Field Laboratory and the Northern Buffer Zone

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 3–13**. 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).

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).

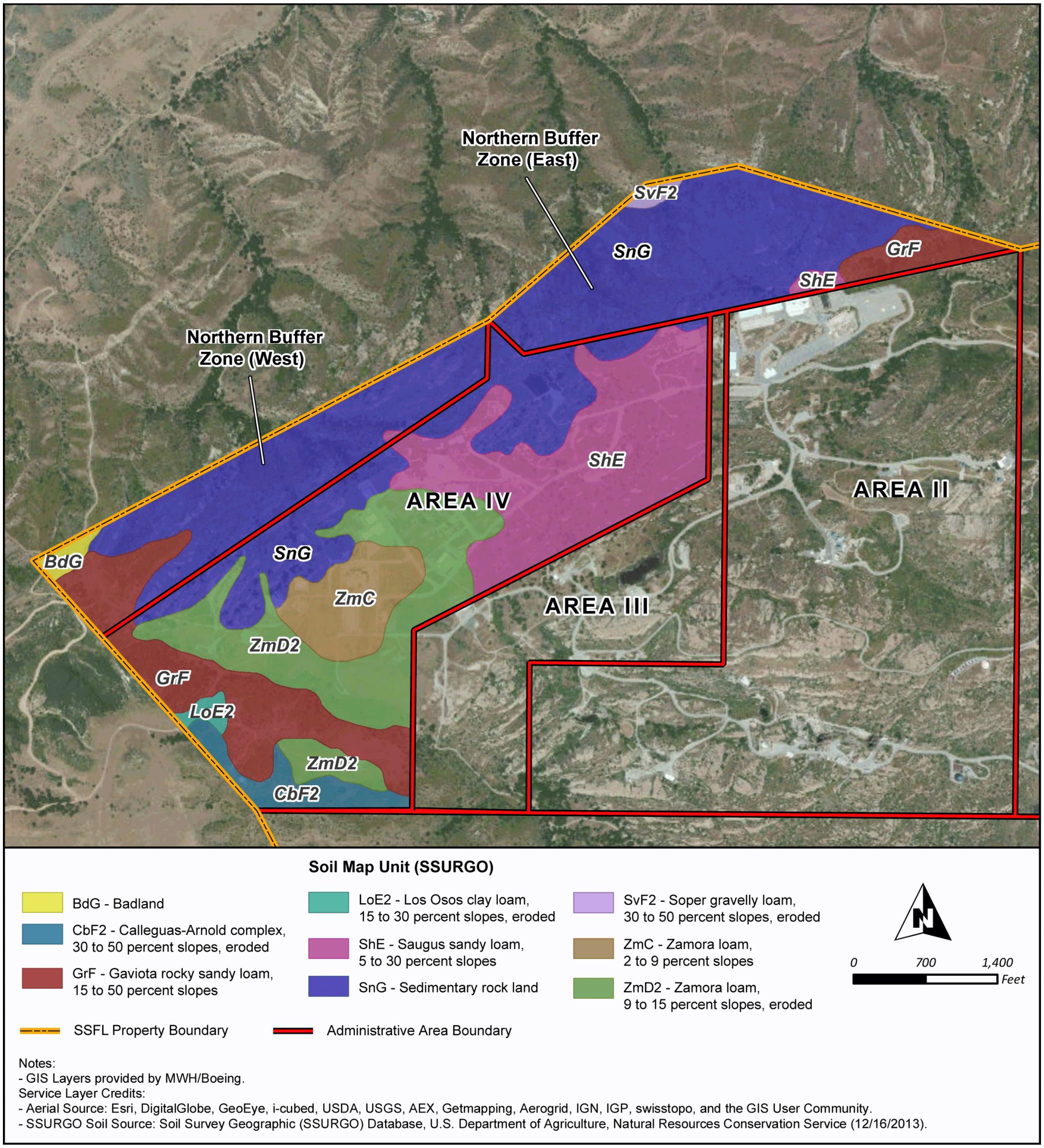

Figure 3–13 Soil Type Distribution in Area IV and the Northern Buffer Zone

3.2.5 Extent of Soil and Weathered Bedrock with Concentrations of Chemicals and Radionuclides Exceeding Look-Up Table[3] 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.

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.

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, inadvertently, 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 Cleanup Act of 1984 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 3–14**. 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 2006b; 2007a, 2009a).

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[3] 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.

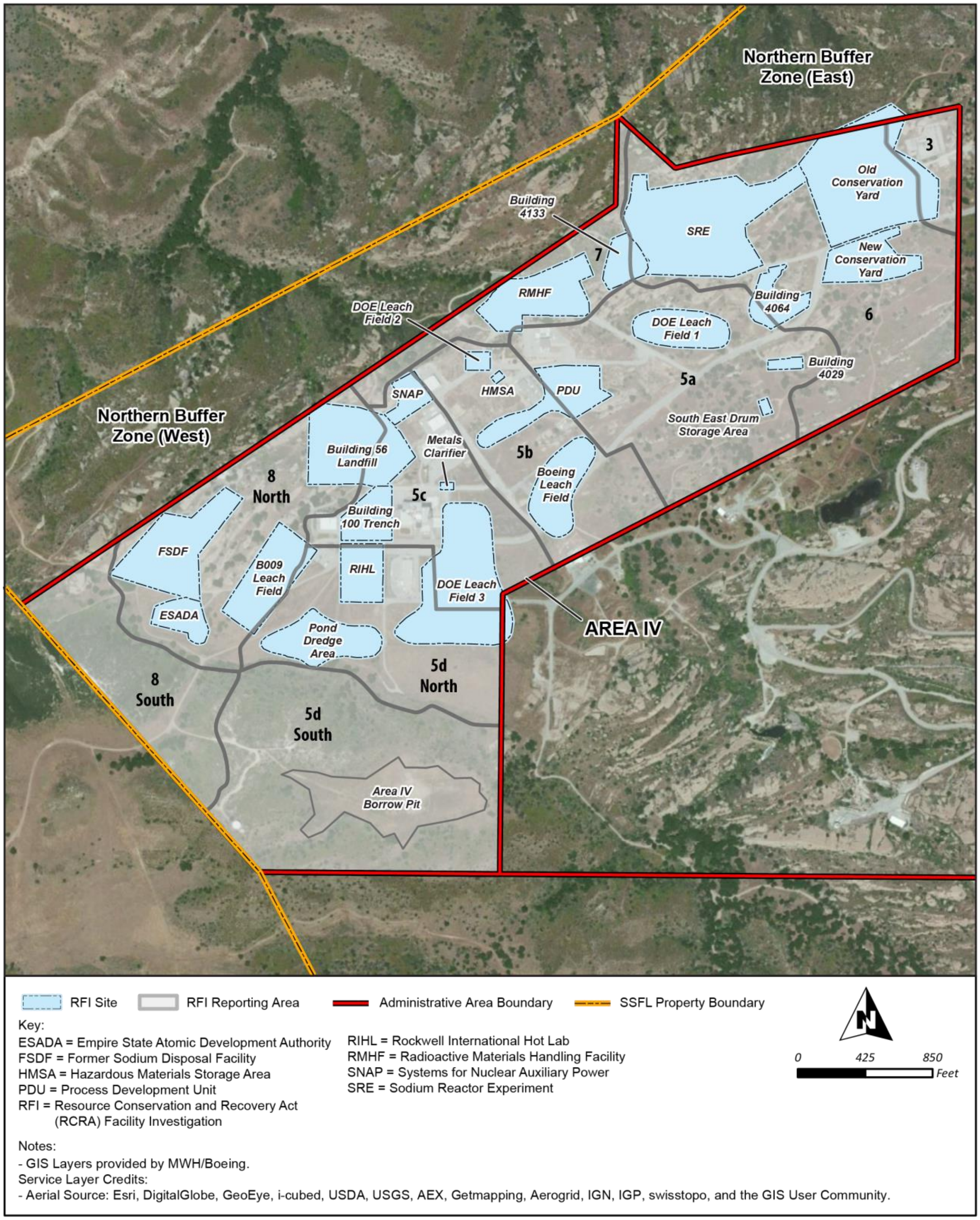


Figure 3–14 RCRA Facility Investigation Sites

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.

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)[4] established by EPA. Eleven radionuclides equaled or exceeded the FALs and were identified as site-related.[5] 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).

[4] Look-Up Table values for radionuclides had 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.

[5] 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.

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 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 collected 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 3–15** 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 3–14):

- 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

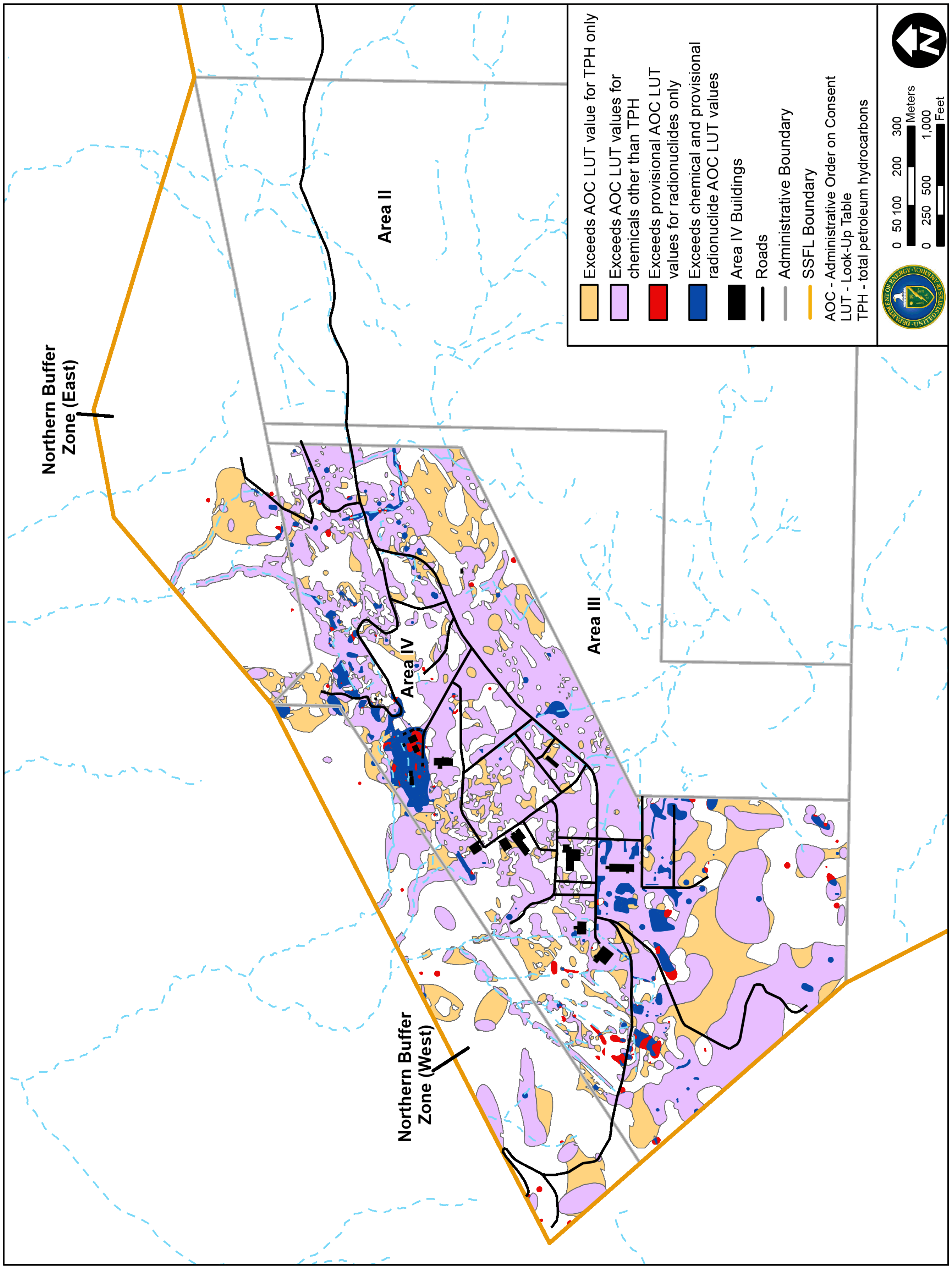


Figure 3–15 Extent of Radiological and Chemical Constituents above Look-Up Table Values

conducted in 1995 identified mercury, total petroleum hydrocarbons (TPHs), PCBs, and dioxins in soil; additional soil and debris removal continued until 2000. In all, 14,000 cubic yards of soil were removed from the 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, decontaminated, and removed in 1978, and approximately 265 cubic yards of radioactive waste were removed (Rockwell 1979). DOE released the area of the building for unrestricted use in 1982.
- 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 several upstream process areas. Although the largest upgradient facility was the Process Development

Unit, other facilities that may have contributed runoff to the pond included the RMHF, the SNAP Environmental Test Facility, the Sodium Component Test Laboratory, and various buildings within the central part of Area IV. 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 Weathered Bedrock with Concentrations of Chemicals and Radionuclides Exceeding Look-Up Table Values

The 2010 AOC (DTSC 2010a) addresses soil and weathered bedrock containing chemicals and radionuclides exceeding LUT values. The estimated volume of soil containing chemical concentrations above LUT concentrations is 1,616,000 cubic yards. The estimated volume of soil containing radionuclides above LUT values is 110,000 cubic yards. Over 97 percent (by volume) of soil containing radionuclides above LUT values also contains chemicals above LUT values. In other words, less than 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 the FSDF.
- The 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 3–15, 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 3–16**.

3.3.1 Existing Conditions

Most surface water within the ROI is present intermittently (i.e., only following seasonal rain events). 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 (see Figure 3–18 in Section 3.4 for seep locations). 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 Area IV of 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. Although the rainy season typically starts in October and ends by May, the majority of rainfall on site occurs during the months of December, January, February, and March. Average annual rainfall at SSFL is approximately 18.8 inches (Stantec 2018), 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.

The regional watersheds for Arroyo Simi and the Los Angeles River are depicted in **Figure 3–17**. 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[6] of water quality impaired

[6] 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.

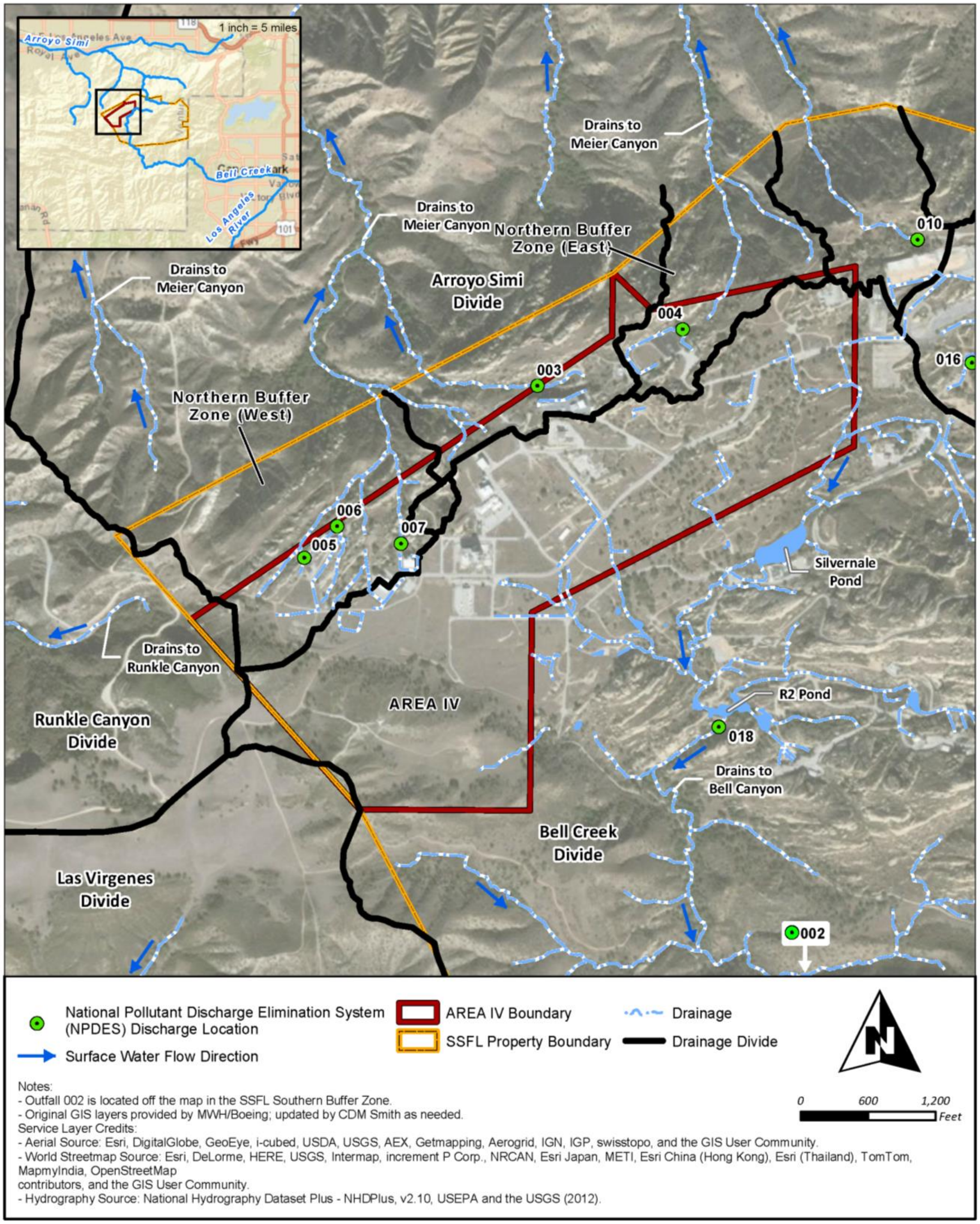


Figure 3–16 Area IV Surface Water

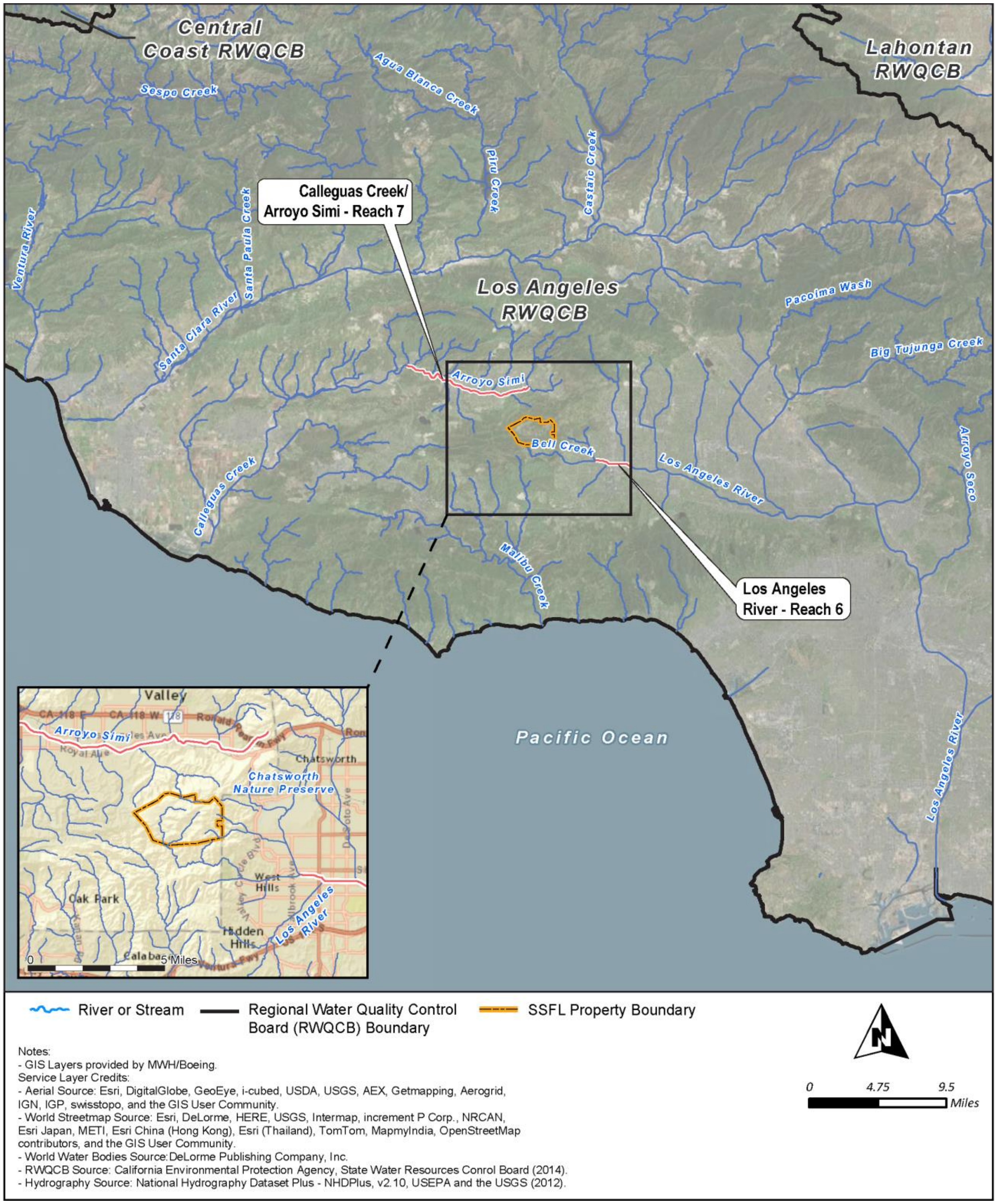


Figure 3–17 Regional Drainage Basin

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 (see Figure 3–18 in Section 3.4). 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 2018a).

The seven outfalls (Outfalls 2, 3, 4, 5, 6, 7, and 18) shown in Figure 3–16 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 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 3–3**.

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 outfalls in 2013, 2014, 2015, 2016, or 2017 (Boeing 2007c, 2008c, 2009a, 2010a, 2011a, 2012c, 2013a, 2014b, 2015d, 2016c). There was an exceedance for iron and chronic toxicity at Outfall 002 in 2017 and an exceedance for iron in 2018 (Boeing 2017b, 2018). However, since total metals are commonly associated with sediment particles, Boeing believes that the iron concentration observed in stormwater runoff in the Outfall 002 watershed was the result of high intensity rain events that caused erosion and total suspended solids consisted of native sediments and soil (Boeing 2017b, 2018). In addition, based on subsequent stormwater samples collected in January and February of 2017 and which produced passing chronic toxicity results, the failed chronic toxicity test in 2017 was viewed as episodic. 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.

Table 3–3 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
5	Former Sodium Disposal Facility	Intercepts runoff from the drainage originating from the FSDF area before it continues downstream into the Calleguas Creek/Arroyo Simi watershed	Three-stage filter of sand, GAC, and zeolite
6	Former Sodium Disposal Facility	Intercepts runoff from the drainage originating east of 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.

3.4 Groundwater Resources

The ROI for groundwater resources, shown in **Figure 3–18**, 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 in soil to the top of bedrock to measure groundwater levels and 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[7] (MCLs) that are attributable to historical DOE activities (areas of impacted groundwater). Per the 2007 CO (DTSC 2007), specific cleanup levels for groundwater were developed as part of the Draft Groundwater Corrective Measures Study (CMS). As described in the Draft CMS, MCLs will be used as indicators of water quality goals. **Figure 3–19** shows the plumes of impacted groundwater for Area IV and the NBZ.

[7] 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.

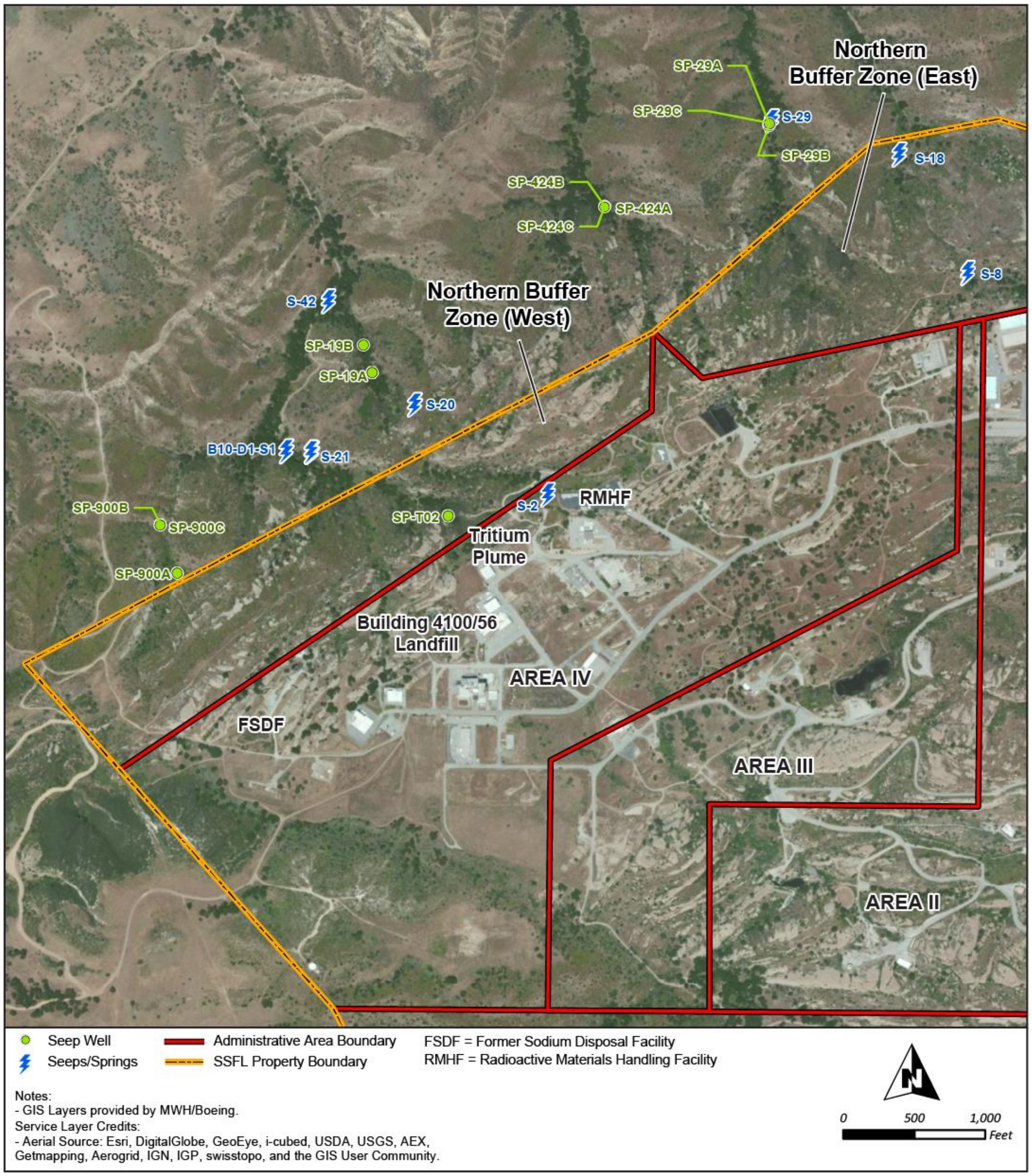


Figure 3–18 Region of Influence for Groundwater

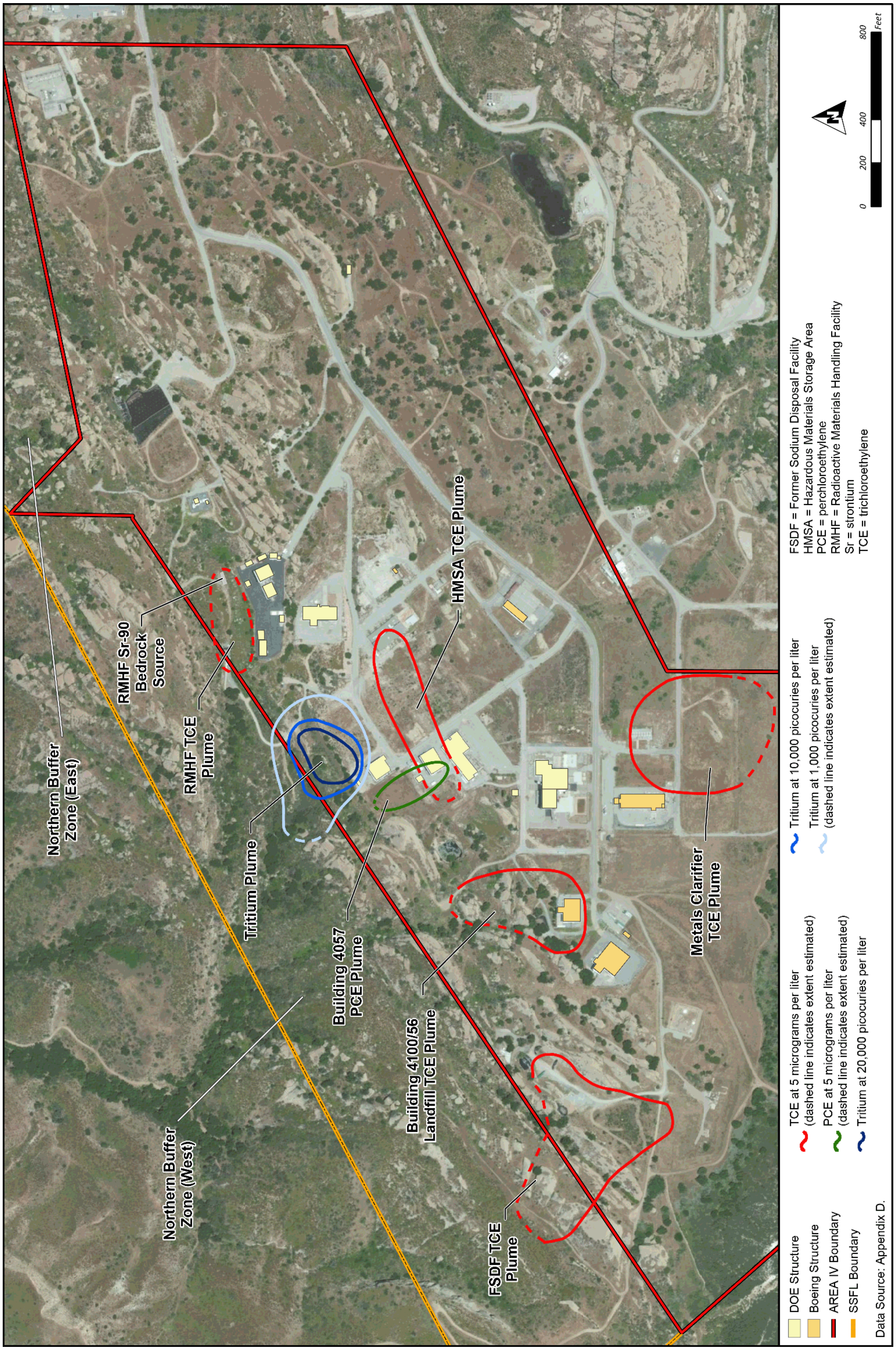


Figure 3–19 Groundwater Plumes

Because SSFL is not located within a 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 3–20 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 18.8 inches per year (Stantec 2018). 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 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.

The fate and transport of contaminants within groundwater zones beneath Area IV and the NBZ occur as follows. TCE (and other water soluble constituents) present in soil is dissolved by precipitation infiltrating through the soil and migrates to the perched near-surface groundwater. Once in the groundwater, the dissolved constituents migrate with groundwater flow. Impacted perched groundwater leaks through the low-permeability layer and infiltrates through the underlying weathered and competent (unweathered) rock and into fractures in the Chatsworth Formation. In the Chatsworth Formation, the impacted groundwater is expected to migrate slowly, primarily to the northwest and southeast. The constituents 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 is 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 3–20 on the slopes of the NBZ and to the northwest of the NBZ.

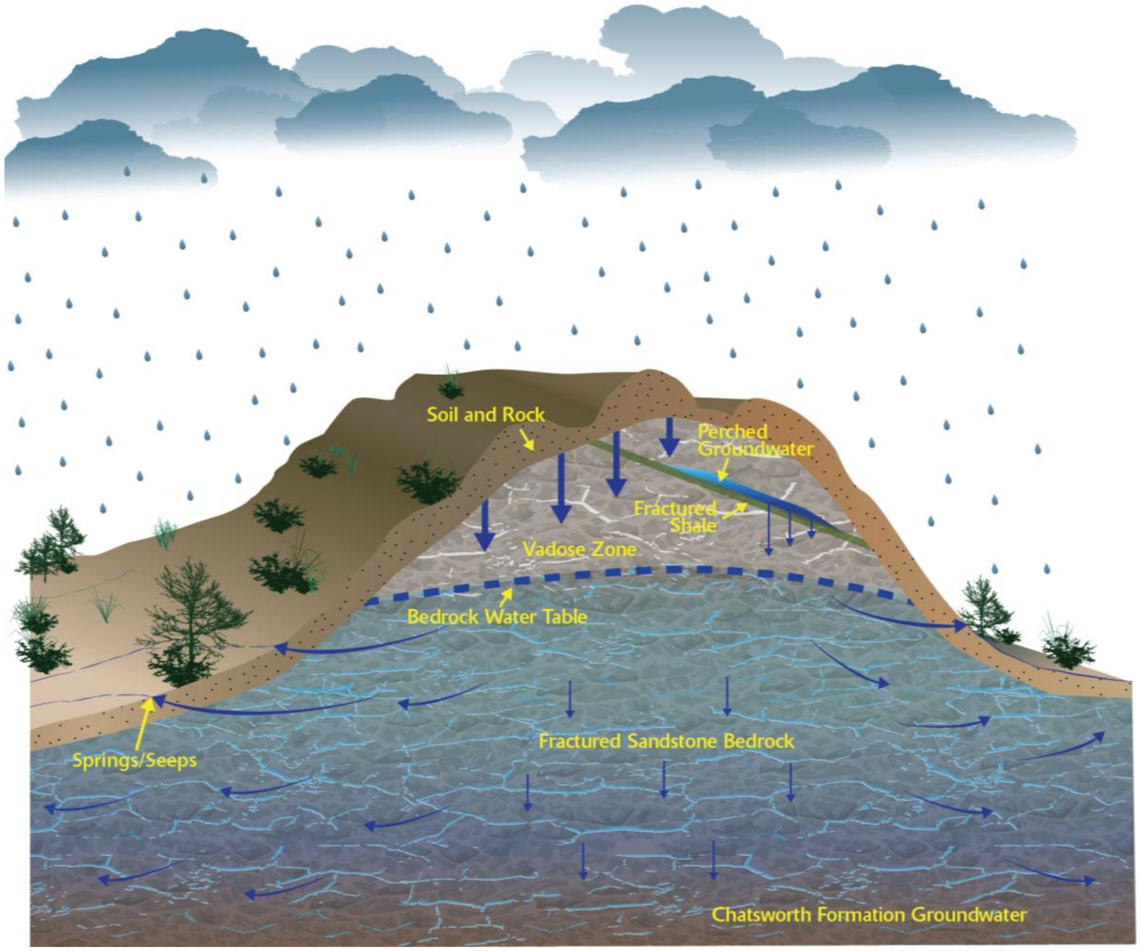


Figure 3–20 Groundwater Movement Conceptual Model

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 piezometers and 10 shallow bedrock groundwater wells were installed in Area IV. Additional piezometers were installed in 2007, 2008, and 2018 (MWH 2009b; CDM Smith 2018d).

Near-surface groundwater can exist beneath portions of Area IV and the NBZ in the alluvium and weathered bedrock that sits on the bedrock. It can occur as perched groundwater above and separated by an unsaturated zone from the Chatsworth Formation groundwater. It can also occur in direct contact with 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 wet periods, there is a larger area of near-surface groundwater occurring in the central part of Area IV. Water-level data indicate that the highest groundwater levels coincide with the groundwater mound present in the central part of Area IV (CDM Smith 2018a), consistent with the understanding that near-surface groundwater is structurally controlled by fine-grained rock found underlying the same area.

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 56 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 intervals of 200 to 400 feet.

Where a number of wells are located close together, but are open at different depths, the vertical gradients 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).

The potentiometric surface elevation (i.e., level to which water rises in a well) is controlled by recharge into wells from water contained in fractures. In many wells within Area IV, a fracture that produces water is present at, or slightly above, the current water table elevation (CDM Smith 2018a). Groundwater flow in the Chatsworth Formation is controlled by the presence and interconnectedness of fractures and fine-grained units; fine-grained units act as barriers to groundwater flow.

3.4.2 Hydrogeologic Study Areas

Four distinct hydrogeologic areas occur within Area IV and the NBZ. These areas are defined based on differences in surficial and subsurface geology and differences in geologic strata and structures that influence localized groundwater presence and flow. The areas, shown on **Figure 3–21**, include the following:

The South Hydrogeologic Area is located south of the Burro Flats Fault within the Santa Susana Formation. It is geologically distinct from the remainder of Area IV, which is composed of Chatsworth Formation. There are no near-surface monitoring wells or piezometers in this area. There is one bedrock monitoring well that is open to the Santa Susana Formation (CDM Smith 2018a).

The Northwest Hydrogeologic Area is located along the western and northern boundaries of Area IV and includes the western edge of Burro Flats from the Lot Bed west to the western limit of the NBZ, which is a topographically rugged area.

Surface water drainage in the southwestern end of the Northwest Hydrogeologic Area flows north into pathways that trend northeast. Near the RMHF, surface drainage pathways flow west and then to the north, and at the SRE flow is to the east and then north.

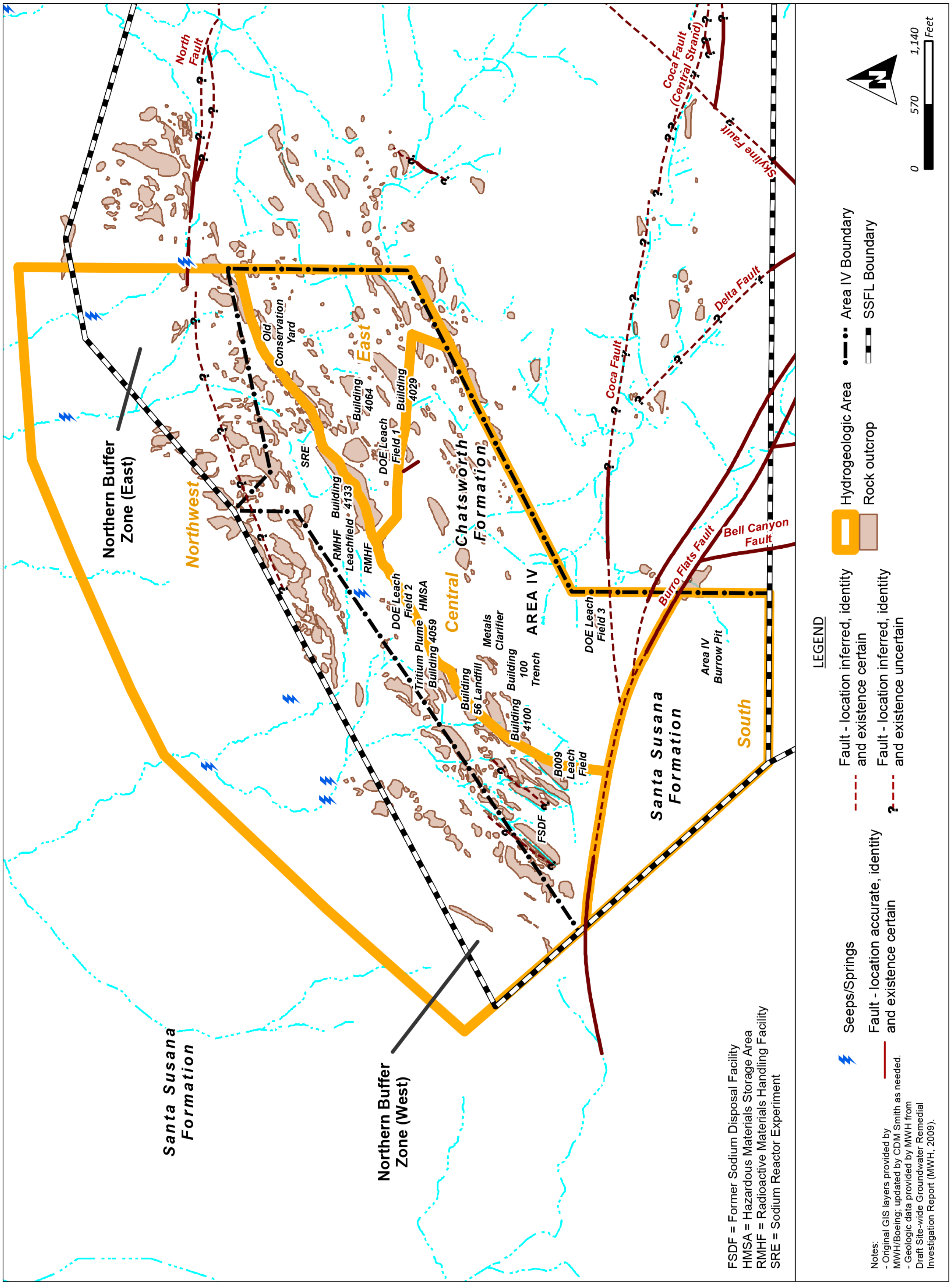


Figure 3–21 SSFL Area IV Hydrogeologic Investigation Areas

Groundwater hydraulic gradients (that indicate the overall direction of groundwater migration) are generally toward the northwest and southeast from the center of Area IV. Generally, vertical gradients are downward in the Burro Flats plateau and upward beyond the escarpment that marks the boundary of rugged terrain to the northwest. Seeps and springs occur within the NBZ and offsite areas to the northwest of the Northwest Hydrogeologic Area (Figure 3–21). Groundwater samples taken from the seeps and springs provide data used to delineate the extent of contaminant plumes (see Section 3.4.3).

Pumping tests (GRC 1995, 1997; MWH 2006a) in the Northwest Hydrogeologic Area indicate that groundwater elevation and flow are controlled by fine-grained units and fractures. The rate of groundwater flow both laterally and vertically is slow. Hydraulic conductivities of 0.03 feet per day, consistent with published values for tight sandstone, have been measured (Harding Lawson 1995). Bulk hydraulic conductivity of the Chatsworth Formation is low (MWH 2007a) and groundwater sampling was either extremely slow or not possible (CDM Smith 2018a).

The sandstone present within the Northwest Hydrogeologic Area includes 5- to 10-foot thick beds of hard sandstone interbedded with thicker beds of weak and fractured sandstone. This area exhibits (based on bedrock core samples) tighter bedrock with fewer fractures compared to other locations in Area IV (MWH 2007a). The hard sandstone is expressed at the ground surface as ridges of sandstone. There are two north-south trending deformation bands (areas of localized compaction, sheer, and/or dilation that develop in porous rocks, such as sandstone, and can restrict and/or change the flow of groundwater) in the Northwest Hydrogeologic Area at the FSDF. These features are not faults. The southwest portion of the Northwest Hydrogeologic Area (the FSDF area) has the fewest number of fractures found in the upper 100 to 200 feet of sandstone. The number of fractures increases to the northeast. The relatively thin shale beds found in the sandstone are fractured. Fractures in the bedrock are the primary conduits for contaminant migration; however, groundwater cannot be extracted from fractures that are small or few in number and lack connection with each other. Groundwater flow, and therefore contaminant migration, is slow where fractures are small and poorly connected.

The Central Hydrogeologic Area is located within the majority of the Burro Flats plateau in Area IV. At the surface, this area exhibits the flattest terrain (minimal relief) with fewest bedrock outcrops compared to the other hydrogeologic areas.

Much of the soil in the Central Hydrogeologic Area was disturbed during the development of facilities within Area IV. The thickness of the soils typically is greater than 6 feet and is as much as 12 feet in some areas. Some of the fine-grained units that can perch groundwater are present just below the soils. There are no known faults in the Central Hydrogeologic Area.

The highest near-surface groundwater elevations (historically close to 1,800 feet above mean sea level) are found in the Central Hydrogeologic Area. Elevations decrease outward to the west, southwest, and southeast of the Central Hydrogeologic Area. The fine-grained units underlying the area inhibit downward groundwater movement and allow groundwater to accumulate above the units. During dry periods the groundwater elevations are lower. In 2016, a piezometer in the Center Hydrogeologic area was dry (i.e., the water level was below the bottom of the near-surface piezometer).

Chatsworth Formation groundwater in the Central Hydrogeologic Area is mounded and flows northwest, southwest and southeast from a high of about 1,781 feet above mean sea level (in July 2016) (CDM Smith 2018a). There are no clustered monitoring wells in this area; therefore, vertical hydraulic gradients cannot be evaluated.

Pumping activities in the area have demonstrated that the northern portion of the Central Hydrogeologic Area is hydraulically interconnected in a fairly uniform way in various horizontal directions (CDM Smith 2018a). In the presence of a hydraulic gradient, groundwater flow, and therefore contaminant migration, will be faster in this area than in those areas where fractures are less connected.

The East Hydrogeologic Area is located east of the Central Hydrogeologic Area and south of the Northwest Hydrogeologic Area. Although this area lacks steep terrain seen in the Northwest Hydrogeologic Area, the area exhibits extensive bedrock outcrops. Soils are thin (generally less than 3 feet thick), and drainage is generally north to south. Bedrock beneath the East Hydrogeologic Area that outcrops at the surface consists of hard massive beds of sandstone, and shales of the ELV and SPA members. There are no known faults in the East Hydrogeologic Area.

Similar to the Central Hydrogeologic Area, the underlying fine-grained units inhibit downward movement of groundwater and allow near-surface groundwater to accumulate above the beds. In 2016, near-surface groundwater was only found in PZ-151 (CH2M Hill 2017).

Chatsworth formation groundwater hydraulic gradients indicate groundwater flow to the north, northeast, and northwest in this area. There are no monitoring well clusters in the East Hydrogeologic Area to evaluate vertical gradients.

3.4.3 Extent of Impacted Area IV and NBZ Groundwater

The current conditions of the groundwater were evaluated during the development of the *Draft RCRA Facility Groundwater Remedial Investigation Report, Area IV, Santa Susana Field Laboratory, Ventura, California (Draft Groundwater Remedial Investigation Report)* (CDM Smith 2018a). The evaluation was facilitated by the division of Area IV and the NBZ into 14 groundwater investigation areas under DOE's responsibility, 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. This section includes a description of the methodology used for evaluating the current conditions of groundwater in Area IV and the NBZ followed by a description of the eight groundwater investigation areas where impacted groundwater was identified.

Analytical data from groundwater samples collected in Area IV and the NBZ were evaluated to identify contaminants of concern (COCs). The COCs were identified based on their frequency of detection and/or the consistency of detection in a specific well. In determining metal COCs, the natural concentration in background wells and the presence of site-related metals in soils were also considered. Most groundwater COCs in Area IV and the NBZ were VOCs and, to a lesser extent, 1,4-dioxane, metals, perchlorate, radionuclides, petroleum hydrocarbons, and nitrate. Metal COCs include cadmium, copper, lead, manganese, molybdenum, and selenium.Analytical results were also evaluated to determine if any COCs exceeded groundwater screening levels. Groundwater screening levels are groundwater concentration comparison values used to assess the possible presence of a groundwater contaminant (Haley & Aldrich 2010).

Most groundwater COCs in Area IV and the NBZ were VOCs and, to a lesser extent, 1,4-dioxane, metals, perchlorate, radionuclides, petroleum hydrocarbons, and nitrate. Metal COCs include cadmium, copper, lead, manganese, molybdenum, and selenium. Twelve volatile organic compound COCs were identified in groundwater: trichloroethylene (TCE), cis-1,2dichloroethene (cis-1,2-DCE), trans-1,2-DCE, 1,1-DCE, vinyl chloride, tetrachloroethylene (PCE), 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dicloroethane (1,1-DCA), 1,2-DCA, 1,4-dioxane, carbon tetrachloride, and benzene. TCE is the most frequently detected COC. Four of the compounds (cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE and vinyl chloride) were included as COCs because they are degradation products of TCE

(CDM Smith 2018a). Degradation products (also called daughter products) are produced when chemical conditions in the groundwater are suitable to naturally break the chemical bonds in compounds resulting in a different compound. Sometimes the degradation requires that specific bacteria are present.

The horizontal extent of contamination in a groundwater plume (typically shown as the boundary of the plume as depicted on a map, such as Figure 3–19) was determined by analysis of groundwater samples from the network of monitoring wells and seeps. The vertical extent (how deep the plume is) was determined by analyzing groundwater samples from a cluster of wells that are open to water from different depths. In bedrock wells that are completed with an open borehole, the depth of contamination can also be determined by sampling of water from fractures at different depths in the same borehole.

The eight areas of impacted groundwater were evaluated for cleanup technologies in the CMS. The groundwater investigation identified three areas of groundwater with historically higher TCE concentrations in Area IV that are being evaluated for remediation: the FSDF TCE plume (which extends into the NBZ), the Hazardous Material Storage Area (HMSA) perched groundwater TCE plume, and the Building 4100/56 Landfill TCE plume. Three additional areas with historically lower concentrations of groundwater contamination (mainly solvents) are also being evaluated for potential cleanup methodologies: the RMHF TCE plume (which extends into the NBZ), the Metals Clarifier TCE plume, and the Buildings 4057/4059/4626 PCE plume. Additionally, a tritium plume located near the former Building 4010 (which extends into the NBZ) and a strontium-90 source near RMHF are being assessed for groundwater cleanup considerations. Additional information about investigation of impacted groundwater can be found in the *Area IV Groundwater Remedial Investigation Report* (CDM Smith 2018a).

3.4.3.1 Former Sodium Disposal Facility Trichloroethylene Plume

The 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, the 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 were removed at and in the vicinity of the FSDF ponds 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 up to 13 feet of silty fine-sand, sand, and sandy silt with gravel and cobbles from the Area IV borrow pit, and the site was hydro-seeded and planted.

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). The MCL for TCE is 5 parts per billion. Other groundwater contaminants at the FSDF include: 1,1,1-trichloroethane (1,1,1-TCA), 1,1-DCE, trans-1,2-DCE, cis-1,2-DCE, metals, and perchlorate (CDM Smith 2018a). Sampling conducted in 2017 indicates that concentrations of perchlorate are below the MCL (CDM Smith 2018a).

Based on contaminants found in subsurface soil, rock core, and soil vapor samples, the former ponds and drums stored near the ponds are the presumed sources of contaminants found in groundwater at the FSDF. Through various removal actions, the original source of TCE that contaminated soil, sediments, and groundwater was removed down to bedrock. However, residual contamination remains in the underlying water-bearing bedrock fractures.

The FSDF is located within the Northwest Hydrogeologic Area. Impacted groundwater is found in bedrock. Investigations have shown that the primary residual mass of VOCs is found in the fractured bedrock at depths less than 60 feet; the lateral extent of the source of VOCs in rock has not been delineated (CDM Smith 2018a). There is evidence, including the presence of daughter products (chemicals that result from the degradation of TCE), such as vinyl chloride, that some natural degradation of TCE has occurred (CDM Smith 2018a).

Data presented in the *Draft Groundwater Remedial Investigation Report* (i.e., concentrations of contaminants measured in the monitoring wells) indicates that the contaminated groundwater in bedrock has moved northeast (parallel to the geologic strike) and northwest (down the hydraulic gradient) from the source areas (see Figure 3–19) with an extent of about 7.4 acres (CDM Smith 2018a). However, metals-contaminated groundwater is restricted to the area of the former ponds (CDM Smith 2018a). Data from monitoring indicates that the majority of TCE-contaminated groundwater is at depths less than 200 feet into bedrock. The volume of VOC-contaminated groundwater is approximately 66 million gallons and the estimated mass of TCE remaining in groundwater is about 160 pounds (CDM Smith 2018a). Monitoring data indicates that TCE contaminated groundwater has not moved off site (CDM Smith 2018a).

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 the FSDF. The purpose of the GWIM is to initiate groundwater extraction at locations within SSFL that exceed 1,000 parts per billion TCE in groundwater. For Area IV, this definition applies to the FSDF.

From 2013 through 2016, the proposed GWIM pumping well, RS-54, was dry due to prolonged drought. The bedrock fractures contributing water to the RS-54 borehole were resaturated in early 2017 following significant rainfall. In March 2017 concentrations of TCE in RS-54 exceeded 1,000 parts per billion and 1,1,1-trichloroethane exceeded 10,000 parts per billion. In November 2017 DOE initiated periodic pumping and dewatering of RS-54. Due to the tight bedrock fractures, the water level in RS-54 could not sustain continuous pumping (i.e., the well typically went dry within 20 minutes of initiation of pumping). Water removed from RS-54 was collected and taken off site for treatment and disposal (300 gallons were removed during 5 months of pumping). The total mass of TCE removed as a result of this pumping was small (3 grams of an estimated 160 pounds present).

3.4.3.2 Hazardous Material Storage Area Trichloroethylene Plume

TCE-impacted groundwater has been identified at HMSA in the near-surface groundwater within the weathered bedrock of the Central Hydrogeologic Area. HMSA is located on a groundwater divide, with groundwater flowing radially outward, predominantly to the east, southeast, southwest, and west. However, there is not a clear direction of groundwater flow in this discontinuous, near-surface groundwater. Water level data indicate that groundwater within the relatively porous media of the water table flows from a northeast to southwest direction; however, contaminant data indicate that the plume and potentially the groundwater are stagnant. Water levels are generally higher in the piezometers and weathered bedrock wells than in the Chatsworth Formation monitoring wells, indicating a downward vertical flow gradient. The water elevation levels in the HMSA plume have not decreased as rapidly as at other parts of Area IV and NBZ during the recent drought. This is an indication that groundwater does not move as quickly through the rocks underlying the HMSA as it does through bedrock in other areas.

The source of the TCE in the HMSA TCE plume 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. VOCs detected in soil vapor (air in the pore space of soil) in the vicinity of these building locations confirm that they were associated with the sources of contamination. The soil VOCs are believed to be volatilizing from the groundwater in the weathered bedrock into the vadose zone. The low concentrations of VOCs in the soil gas do not indicate that there is a current contaminated soil source of VOCs. TCE present in the soil near the building locations was likely carried downward by precipitation, infiltrated through the surface soil, and migrated to the perched near-surface groundwater. Once in the groundwater TCE migrated with groundwater flow.

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. In 2016, Chatsworth Formation well, was installed in fractured bedrock near the center of HMSA.

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; however, in 2016 the highest concentration of TCE (98 parts per billion) was detected in a newly-installed Chatsworth Formation well. Other VOCs, including 1,2-dichloroethene, acetone, and cis-1,2,-DCE have been found in HMSA groundwater at concentrations below their respective MCLs.

The presence of the TCE breakdown product, cis-1,2-DCE, indicates that some natural degradation of TCE may also be occurring. TCE in the near-surface groundwater also migrates downward to bedrock fractures where the direction of groundwater flow is to the northeast. TCE diffuses from the groundwater in the bedrock fractures into the rock matrix, decreasing the concentration of TCE in the fracture groundwater and slowing the migration of the plume front (CDM Smith 2018a).

The horizontal extent of TCE contamination, about 2.7 acres (see Figure 3–19) has been determined but the vertical extent has not been determined (CDM Smith 2018a). The volume of contaminated groundwater in the HMSA plume is approximately 7.9 million gallons and the estimated mass of TCE is 27 pounds (CDM Smith 2018a).

3.4.3.3 Radioactive Materials Handling Facility TCE Plume

The 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. TCE and strontium-90 have been detected in groundwater monitoring wells installed in the drainage to the north of the RMHF. The source of the TCE and strontium-90 in the groundwater is the former RMHF leach field. Other operations at the 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 the 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 been used for disposal of other liquid wastes generated at the RMHF after that time.

A pipeline directed sanitary effluent from the RMHF Buildings 4021 to 4022 to the leach field. This pipeline was also connected to a liquid waste holdup tank in the yard of the 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 3.4.3.7.

The RHMF is located within the Northwest Hydrogeological Area. Soils in the area of the former leach field are typically less than 1 foot thick. Surface water drainage is controlled by the top of bedrock and flows westward via a prominent east-west trending drainage feature. Chatsworth Formation groundwater is estimated to flow to the northwest. Water levels in a three-well cluster indicate a small downward vertical gradient within the shallower part of the bedrock and a moderate upward vertical gradient in the lower part of the bedrock (CDM Smith 2018a).

Contaminated soil and bedrock were removed from the leach field in 1978. When the bedrock was exposed during excavation of the leach field, east-west oriented vertical fractures were observed. Samples collected within the vertical fractures identified strontium-90 contamination. Following sampling, the fractures were sealed with bituminous asphalt mastic. The excavation was backfilled with 10 feet of soil.

TCE was found in monitoring wells installed in the drainage feature located west of the RMHF in 1989 and 1991; concentrations ranged from 34 parts per billion to 85 parts per billion prior to 1994. At that time, pumping of a monitoring well was initiated and 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 2016, TCE concentrations ranged from less than 0.44 parts per billion to about 4.9 parts per billion (CDM Smith 2018a). The MCL for TCE is 5 parts per billion.

Water table elevations in the near-surface groundwater vary considerably and correlate to monthly precipitation, particularly in the wettest months that had 6-inch precipitation totals. Between 2008 and 2014, groundwater elevations in bedrock wells varied as much as 28 feet. These patterns indicate that recharge to the Chatsworth Formation groundwater occur in response to precipitation. The results of the remedial investigation indicate that the residual TCE contamination is in the weathered upper bedrock. TCE concentrations in the two monitoring wells screened in these zones have decreased from maximums of 87 and 50 parts per billion in 1990 and 1989, respectively, to 11 and 2.1 parts per billion in 2016 (CDM Smith 2018a). There is some indication that natural degradation of TCE into its daughter products is occurring.

The horizontal extent of TCE-impacted groundwater has been defined to the north and west (the direction of groundwater flow), as shown in Figure 3–19, by data from the monitoring well network. The vertical extent has also been defined by data from the monitoring well network. TCE was not detected below a depth of about 300 feet in 2016 (CDM Smith 2018a). TCE has not been detected in groundwater discharging from seeps located downgradient of the RMHF and is not moving offsite. The footprint of the TCE plume is estimated to be about 1.6 acres and the volume of the TCE groundwater plume is approximately 14.7 million gallons. The estimated mass of TCE in the plume is 4 pounds (CDM Smith 2018a).

3.4.3.4 Metals Clarifier Trichloroethylene Plume

The Metals Clarifier groundwater investigation 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.

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 between 2000 and 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. Soil vapor samples collected near Building 4065 contained TCE, and soil vapor at one of the leach fields contained both TCE and PCE.

The Metals Clarifier TCE plume is located within the near-surface groundwater in the Central Hydrogeologic Area. Groundwater level measurements in piezometers and wells were used to determine the direction of groundwater flow. Horizontal groundwater flow in the near-surface groundwater is to the northeast. In the Chatsworth Formation, groundwater flow is to the south and southeast (CDM Smith 2018a). There are no groundwater seeps in the vicinity of the Metals Clarifier TCE plume.

As discussed above, although the source of the contaminants is uncertain, there is evidence that Building 4065 was the source of TCE in the near-surface groundwater. TCE in soil generally enters the near-surface groundwater by infiltrating precipitation. Once in the near-surface groundwater TCE migrates with groundwater flow, diffusing into the weathered rock matrix. Natural degradation of TCE can occur when groundwater conditions are favorable (for example, if the right microbes and groundwater chemistry are present).

Near-surface groundwater is monitored by 3 piezometers located immediately downgradient of the metals clarifier location and the potential leach field source areas. Relatively low and decreasing concentrations (less than or equal to 11 parts per billion [North Wind 2018]) of TCE have been detected in the 3 piezometers that have been monitoring the plume since they were installed in 2000 and 2002. In 2014, only one well with a concentration of 8.7 parts per billion TCE was above the MCL (5 parts per billion). The concentration of TCE in that well decreased to 5.9 parts per billion in 2016. PCE has been detected at concentrations below the MCL in one near-surface groundwater piezometer. All of the piezometers are shallow and only open to the near-surface groundwater, and several have been dry or contained insufficient groundwater for sampling in recent years.

In 2016 a bedrock well was installed into the fractured bedrock near the center of the TCE plume identified in the near-surface groundwater plume. The deeper bedrock well is open to the shallow Chatsworth formation bedrock at a depth of about 30 feet. The Chatsworth Formation well was sampled twice in 2016, once in 2017. TCE concentrations of 0.31, 0.35, and 0.92 parts per billion were detected, indicating that TCE found in the near-surface groundwater has not migrated appreciably into the Chatsworth Formation groundwater (CDM Smith 2018a). Low levels of TCE in the Chatsworth Formation bedrock indicate that a relatively small amount of TCE migrates downward into the deeper groundwater zone (CDM Smith 2018a).

The horizontal extent of contamination in the near-surface groundwater has been determined from the piezometer data and is shown in Figure 3–19. The vertical extent of the TCE plume (less than 30 feet) has been determined using sample data from the bedrock well installed in 2016. The Metals Clarifier TCE plume is essentially limited to the near-surface groundwater. The footprint of the Metals Clarifier TCE plume is about 6.8 acres and the plume consists of approximately 23,700 gallons of TCE-contaminated groundwater. The estimated mass of TCE in this plume is about 4 pounds (CDM Smith 2018a).

3.4.3.5 Buildings 4057/4059/4262 Perchloroethylene Plume

A plume of PCE (also known as tetrachloroethylene)-impacted groundwater that exceeds the MCL of 5 parts per billion is located in the vicinity of former Buildings 4059 and 4626 and the existing Building 4057. The source of PCE detected in the near-surface and Chatsworth Formation groundwater is likely impacted soil near former Building 4626 and, potentially Building 4057. Building 4626 was used for equipment storage. Building 4057 was used as a Liquid Metals Engineering Center Laboratory. A flammable materials storage cabinet was located outside the north wall of the building.

The PCE plume is on the boundary of the Northwest Hydrogeologic Area and the Central Hydrogeologic Area.

VOCs, including PCE, were detected in groundwater collected in a French drain basement sump in Building 4059. In 1978 a maximum concentration of 540 parts per billion PCE was detected in the groundwater from the sump. The facilities associated with Building 4059 included 14 above-ground storage tanks. None of the tanks were reported to contain PCE; however, the contents of two tanks located along the perimeter of Building 4059 were not known (CH2M Hill 2008). 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.

PCE has been detected in soil, soil gas and groundwater in the area of Buildings 4057 and 4626. It is unlikely that PCE remains in soil as a source of groundwater contamination today because the historic soil and soil gas concentrations were low (parts per billion range).

A near-surface groundwater piezometer at the corner of Building 4057 has the highest concentrations of PCE. In 2016 the concentration of TCE at this location was 55 parts per billion, above the MCL of 5 parts per billion. PCE was also detected in soil gas about 100 feet east of this location. Soil samples collected on the south side of nearby Building 4626 were found to contain VOCs, including PCE at a concentration of 37 micrograms per kilogram at a depth of 9 feet. A PCE concentration of 25 parts per billion was detected in a well located less than 100 feet southwest of Building 4059. The well, RD-25, was abandoned in 2004 and replaced with well DD-142 in 2016. The concentration of PCE in DD-142 in 2016 was 12 parts per billion (CDM Smith 2018a). The MCL for PCE is 5 parts per billion. No PCE has been detected in groundwater seep wells located downgradient of the Building 4057 PCE plume indicating that PCE-impacted groundwater is not migrating.

Concentrations of PCE in the plume have decreased since 2004, when dewatering (pumping) stopped. The decrease in concentrations is likely due to diffusion of PCE into the weathered bedrock, and, potentially, some natural degradation (CDM Smith 2018a). Chemical conditions in the groundwater were measured in 2013 and determined to be conducive to natural degradation (MWH 2014); however, the concentration of natural breakdown products of PCE (for example, TCE, and cis-1,2-DCE) have not increased over the same time period that PCE has decreased (CDM Smith 2018a) indicating that despite the apparently favorable groundwater chemistry, natural degradation may not be a significant factor contributing to the decrease in PCE concentrations.

The horizontal and vertical extent of the PCE plume has been defined. The horizontal extent of the PCE groundwater plume (see Figure 3–19) was determined from sampling of monitoring wells and piezometers (CDM Smith 2018a). The footprint of the plume is about 0.9 acres. Groundwater exceeding the PCE MCL is found shallower than 80 feet below ground surface based on concentrations below 1 part per billion found in a bedrock well paired with the well with highest PCE contamination in near surface groundwater. Data collected since about 2000 indicate that the plume is stable (not moving appreciably in the direction of groundwater flow). There are an estimated 1.8 million gallons of PCE-contaminated groundwater and about 4 pounds of contaminant in the PCE plume (CDM Smith 2018a).

3.4.3.6 Tritium Plume

As shown in Figure 3–19, 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. Tritium is a hydrogen atom and therefore easily combines with oxygen to become part of water molecules. Tritiated water moves through the environment in the same way that non-tritiated water moves. When released into the environment, tritiated water will percolate through surficial soils and into the bedrock fractures.

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. With the exception of Building 4019, the SNAP Reactor System Critical Facility (active between 1959 and 1964) and Building 4024, the SNAP Environmental Text Facility (active between 1961 and 1962 and 1965 to 1966), all structures in the area of the tritium plume have been removed. Radiologically impacted bedrock adjacent to reactor vaults was removed as part of the reactor structure removal.

The tritium plume is located within the bedrock of the Chatsworth Formation in the Northwest Hydrogeologic Area. As tritium flows through the fractured rock, it diffuses from areas of higher concentration (groundwater in the fractures) to areas of lower concentration (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. In late 2013 and early 2014, a multi-level cluster of downgradient seep wells was installed. Groundwater from the wells has been analyzed three times since then for tritium.

Tritium has been detected in the wells at concentrations below the MCL of 20,000 picocuries per liter (CDM Smith 2018a).

Several monitoring wells have been sampled multiple times from 2004 through 2017, a span of one half-life of tritium. In 2004 and 2005, the concentrations of tritium in wells RD-90 and RD-95 was 83,800 and 119,000 picocuries per liter, respectively (CDM Smith 2018a). In 2017, the tritium concentration exceeded the MCL at one well (RD-90) with a concentration of 38,300 picocuries per liter. Groundwater in well RD-95 had a concentration just under the MCL (19,600 picocuries per liter) in March 2017 (CDM Smith 2018a). As tritium has not been produced since 1974, the concentration of the remaining tritium is expected to continue to decrease through radioactive decay. Some dilution of the water with precipitation likely also decreases the concentration found in groundwater within bedrock fractures. The estimated date that the tritium would decay to below the MCL is 2026 (CDM Smith 2018c).

A comparison of tritium concentrations in bedrock pore water to the concentrations in monitoring well groundwater (from bedrock fractures) indicates that concentrations are higher in the bedrock pore water. Therefore, concentration gradients would be from the bedrock into the groundwater and the bedrock matrix would be expected to act as a source of tritium in fractures. In 2004 and 2005 rock pore water from bedrock cores (water in the pore spaces of the rock, not groundwater from wells) was analyzed for tritium. The bedrock cores were collected during the installation of monitoring wells. In 2007, two additional cores were collected and the pore water analyzed for tritium. The highest concentrations of tritium are found at or below the water table. The highest recorded concentration, 931,258 picocuries per liter, was found in the pore water of the 2007 bedrock core sample collected from the footprint of the former Building 4010 (the SNAP Reactor Experimental Test Facility) (CDM Smith 2018a). Tritium will flow laterally through the bedrock fractures with groundwater and will diffuse into the bedrock matrix due to concentration gradients. A comparison of tritium activities in bedrock porewater to the activities in monitoring well groundwater (from bedrock fractures) indicates that activities are higher in the bedrock porewater. Therefore, concentration gradients would be from the bedrock into the groundwater and the bedrock matrix would be expected to act as a source of tritium in fractures. However, the concentrations found in the monitoring well groundwater samples continue to decrease at a rate greater than that explained by natural radioactive decay, indicating that the influences of dispersion and dilution exceed that of back diffusion from the bedrock matrix (CDM Smith 2018a).

The volume of tritium-contaminated groundwater is about 8.6 million gallons and the mass of tritium is estimated to be negligible (CDM Smith 2018a). The horizontal extent of the tritium plume in groundwater, as determined by sampling of monitoring wells and shown in Figure 3–19, is about 1.1 acres. The vertical extent has not been defined; however, in this part of the Northwest Hydrogeologic Area (along the NBZ) the vertical gradients are upward. Therefore, further downward migration of the tritium is not anticipated. Groundwater under the upward gradients discharges at seeps in the NBZ. Tritium has been detected in a seep well cluster at concentrations below the MCL (CDM Smith 2018a). The stable concentrations detected in this well cluster indicate that the downgradient edge of the plume is stable and not expected to move beyond the seep well location (CDM Smith 2018a).

3.4.3.7 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 the 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 detected in the excavated materials. After excavation, an average of 300 picocuries per gram of strontium-90 and traces of cesium-137 remained in bedrock cracks (Rockwell 1982). 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 4 to 10 feet of soil. Shallow soils contaminated with strontium-90 in the area of the RMHF former leach field may continue to 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 eight Chatsworth Formation monitoring wells near and potentially downgradient from the former RMHF leach field. 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). In years of less than average rainfall in southern California, the water table drops along with strontium-90 concentrations. The most recent strontium-90 concentration, reported in 2018, was 65.8 picocuries per liter (North Wind 2018). The correlation of water table depth and strontium-90 concentrations indicates that the remaining strontium-90 at the leach field site is located in the shallow bedrock (at a point above the deeper measured groundwater levels) and has not migrated deeply into the bedrock. However, without remediation, this source is expected to remain for a long time.

The current source of contamination to groundwater is strontium-90 in shallow bedrock within 45 feet of the ground surface. The area of the impacted bedrock is estimated to be similar to the size of the leach field (i.e., about 30 feet by 60 feet). Based on sample results from the monitoring well network the extent of strontium-90-impacted groundwater is limited to the immediate vicinity of the former leach field. The horizontal and vertical extent of the strontium-90 groundwater plume has been delineated. No strontium-90 has been detected in downgradient seeps within the NBZ.

Numerical flow model results presented in the *Draft Groundwater Remedial Investigation Report* indicate that the potential for strontium-90 to move off site during a period of several half-lives (i.e., about 150 years) is very low (CDM Smith 2018a). Overall, strontium-90 contamination in the groundwater is expected to present limited risk beyond the onsite local area near the RMHF former leach field or for periods beyond several half-lives of strontium-90.

3.4.3.8 Building 4100/56 Landfill Trichloroethylene Plume

The Building 4100/56 Landfill groundwater investigation area is located northeast of the FSDF. TCE-impacted groundwater has been identified in the Chatsworth Formation groundwater at the Building 56 Landfill. The landfill originated in the 1960s and primarily contains bedrock excavated for the basement of Building 56 (never completed) and asphalt, concrete, and scrap metal collected from other locations of SSFL. 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 first detected in samples collected in the late 1980s from a Building 56 Landfill Chatsworth Formation monitoring well, with concentrations increasing to over 80 parts per billion in 2000 and 2002 (the MCL is 5 parts per billion). In 2016, TCE was reported at 50 parts per billion and 29 parts per billion in 2017 (CDM Smith 2018a). Some fractures in the contaminated well (located at the landfill) are aligned parallel with the geologic beds. The former Building 4009 leach field is located in a direction roughly aligned with the geologic beds. During the 2016 remedial investigation, groundwater from individual fractures within the contaminated well was analyzed. The results indicated that shallow bedrock fractures were less contaminated than deeper fractures. This indicates that the TCE likely did not come from the immediate area of the well, but traveled laterally in fractures from the source area. In addition, TCE was not found in soil and soil vapor at the landfill.

TCE was detected in 2014 at a concentration of 200 parts per billion in Chatsworth Formation well RD-91 located immediately west of Building 4100 (MWH 2014). 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). The building was used 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 and was removed prior to 2001 (CH2M Hill 2008). Soil sampling during the Building 4100 Trench investigation (MWH 2007a) did not identify chlorinated VOCs (such as TCE) in the soil.

TCE has not been detected in near-surface groundwater at concentrations above the MCL in the vicinity of Building 4100, nearby Building 4009 or the Building 56 Landfill.

The assumed source of TCE is associated with Building 4100. The plume in the Chatsworth Formation groundwater extends north and northeastward, roughly parallel to surface drainage features, from well from Building 4100 to the contaminated well at the Building 56 Landfill. In 2016, a Chatsworth Formation well was installed just beyond the toe (northern end) of the landfill, downgradient from known contamination. TCE was not detected in the groundwater at that well (CDM Smith 2018a).

The horizontal extent of the plume as defined by the network of monitoring wells is about 3.8 acres and is well defined. The plume has not migrated beyond the former landfill. This is consistent with a low bulk conductivity for the Chatsworth Formation in the Northwest Hydrogeologic Area. Although the vertical extent has not been defined hydraulic gradients in the NBZ northwest of the Building 56 Landfill are upward. TCE has not been detected in groundwater at a well cluster located downgradient of the landfill, in the NBZ, where upward flow gradients have been documented. In 2016 individual fractures in the contaminated well were sampled, contamination was not found in fractures below a depth of 120 feet (CDM Smith 2018a).

The estimated volume of the Building 4100/56 Landfill TCE plume is about 36 million gallons and the estimated TCE mass in the plume is 270 pounds (CDM Smith 2018a). The concentration of TCE has been relatively stable in recent years (57 parts per billion in 2014 and 50 parts per billion in 2016). During this time TCE daughter product cis-1,2-DCE has been detected in the plume. In the absence of a new source for cis-1,2-DCE, it's presence indicates that some natural degradation is occurring (CDM Smith 2018a).

3.4.3.9 Summary of the Groundwater Contaminant Migration

There are eight areas of impacted groundwater in Area IV and the NBZ that are evaluated for cleanup in the CMS. The primary contaminants in each plume vary and include five TCE plumes, one PCE plume, a tritium plume, and a strontium-90 plume. The movement of the contaminants in groundwater is controlled by the nature of the contaminant and the hydrogeologic setting of the plume. The presence, extent, and migration of groundwater contamination are described in detail in the *Draft Groundwater Remedial Investigation Report* (CDM Smith 2018a). The groundwater contaminant plumes are found within three hydrogeologic areas that have distinctive properties (such as the degree of fracturing or the presence of seeps and springs) that control the flow of groundwater (and therefore the migration of contaminant plumes) in those areas. The hydrogeologic character of each of the study areas was based on data from water level measurements in wells and testing (including pumping of wells and individual fractures in boreholes).

The area of groundwater contamination has been defined (as shown in Figure 3–19) based on groundwater sample analyses from an extensive network of monitoring points (monitoring wells, piezometers, and seeps). Data from wells placed close together, but open to different depths were used to define the vertical extent of contamination. None of the plumes extend beyond DOE-administered areas of Area IV and the NBZ. In addition, some plumes, for example the FSDF TCE plume are in hydrogeologic areas where tests have demonstrated a lack of bedrock fracture connection and low hydraulic conductivity. Groundwater does not easily flow through bedrock with these characteristics; therefore, the groundwater contaminants will not migrate quickly.

In some areas the location of residual mass of contamination (i.e., the mass of contamination still in the weathered bedrock or bedrock matrix) has been identified. For example, strontium-90 in the bedrock matrix in the shallow bedrock at the former RMHF leachfield and TCE in the shallow bedrock fractures near the former ponds of the FSDF. Where the residual source has been identified, it is at depths less than 60 feet. Groundwater contamination has not migrated deeper than 200 feet into the saturated fractured bedrock. In general, the contaminant plumes are found in alluvium and near surface weathered bedrock or in shallow fractures of unweathered bedrock. At the strontium-90 plume, concentrations in groundwater increase when water levels are high enough to come into contact with the shallow zone of bedrock where strontium-90 is present.

Groundwater investigations have been conducted in Area IV and the NBZ for many years and, in some cases, there are many years of data available to evaluate trends in contaminant concentrations. The presence of degradation daughter products indicate that in some plumes (for example the FSDF TCE plume) a degree of natural degradation may be occurring. In other plumes the lack of favorable microbial or geochemical conditions inhibit natural degradation. The historical data at the tritium plume show that concentrations are decreasing as expected due to natural radioactive decay. The strontium-90 concentrations are also decreasing, but due to the long half-life of strontium-90 it will be more than 150 years before concentrations decrease below MCLs.

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 habitats on SSFL include unique communities associated with the sandstone outcrops, which are 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 contribute to the overall temperatures and elevated 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 generally level or flat areas that overlie more-erodible portions of the formation. Most of the development in Area IV took place on Burro Flats, which is the largest area of relatively flat topography.

The NBZ is characterized by steep, sandstone outcrops that parallel the northern border of Area IV to the west and give 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 still visible on the oak trees and large shrubs. The fire bypassed portions of Area IV and the NBZ, leaving portions of vegetation intact near the western end of both areas. 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 majority of Area IV is relatively flat 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 summarized below, as well as surveys conducted specifically to support this EIS from 2009 through 2018.

The California Natural Diversity Database (CNDDB) was accessed on multiple occasions from 2010 through 2017, 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 2017).

The following recent and previously developed biological resource information for SSFL, Area IV, and the NBZ was also analyzed to prepare this Final EIS:

- *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 Reports on Braunton's Milk-Vetch Habitat* (HydroGeoLogic and Envicom 2012; MWH Global 2009; SAIC 2009a). These reports include the results of surveys conducted in 2006 and 2009 within the Braunton's milk-vetch critical habitat and adjacent areas at SSFL Area IV.
- *Santa Susana Field Laboratory Remediation: Biological Assessment, Simi Valley, California* (DOE 2018a).

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).
- *Braunton's Milk-Vetch.* Occupied habitat was visited during SSFL biological surveys conducted for soil characterization studies (2012–2014). In 2014 and 2015, protective fencing was put around surviving Braunton's milk-vetch individuals. In 2017, fenced plants and known suitable habitat in Area IV was surveyed (Leidos 2017). Protective fencing was put around additional Braunton's milk-vetch individuals in 2018.

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 disturbed/developed areas that may become unvegetated (i.e., no vegetation present). 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 different types of communities. 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 3–4 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 3–4 Vegetation Types Identified in Area IV and the Northern Buffer Zone[a]

Vegetation Types	Area IV	Northern Buffer Zone – Western	Northern Buffer Zone – Eastern	Total
	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) [b]	8.1	0.4	1.0	9.4
Nonnative Annual Grassland (AG)	39.8	3.3	1.8	44.9
Steep Dipslope Grassland (SDG) [b, c]	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 [d]	**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] Considered a rare or high priority vegetation type (CDFW 2010b).
[c] Described in SAIC (2009a) as an equivalent to the *Selaginella bigelovii* herbaceous alliance (Sawyer et al. 2009).
[d] Totals may not equal the sums of table entries due to rounding.

Figure 3–22 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, Holland 1986 does not include a suitable vegetation category for weed-dominated areas, so a category was developed to identify this vegetation type. Where applicable, the descriptions below also provide the equivalent vegetation subtypes from the *Manual of California Vegetation, 2nd edition* (MCV2) (Sawyer et al. 2009).

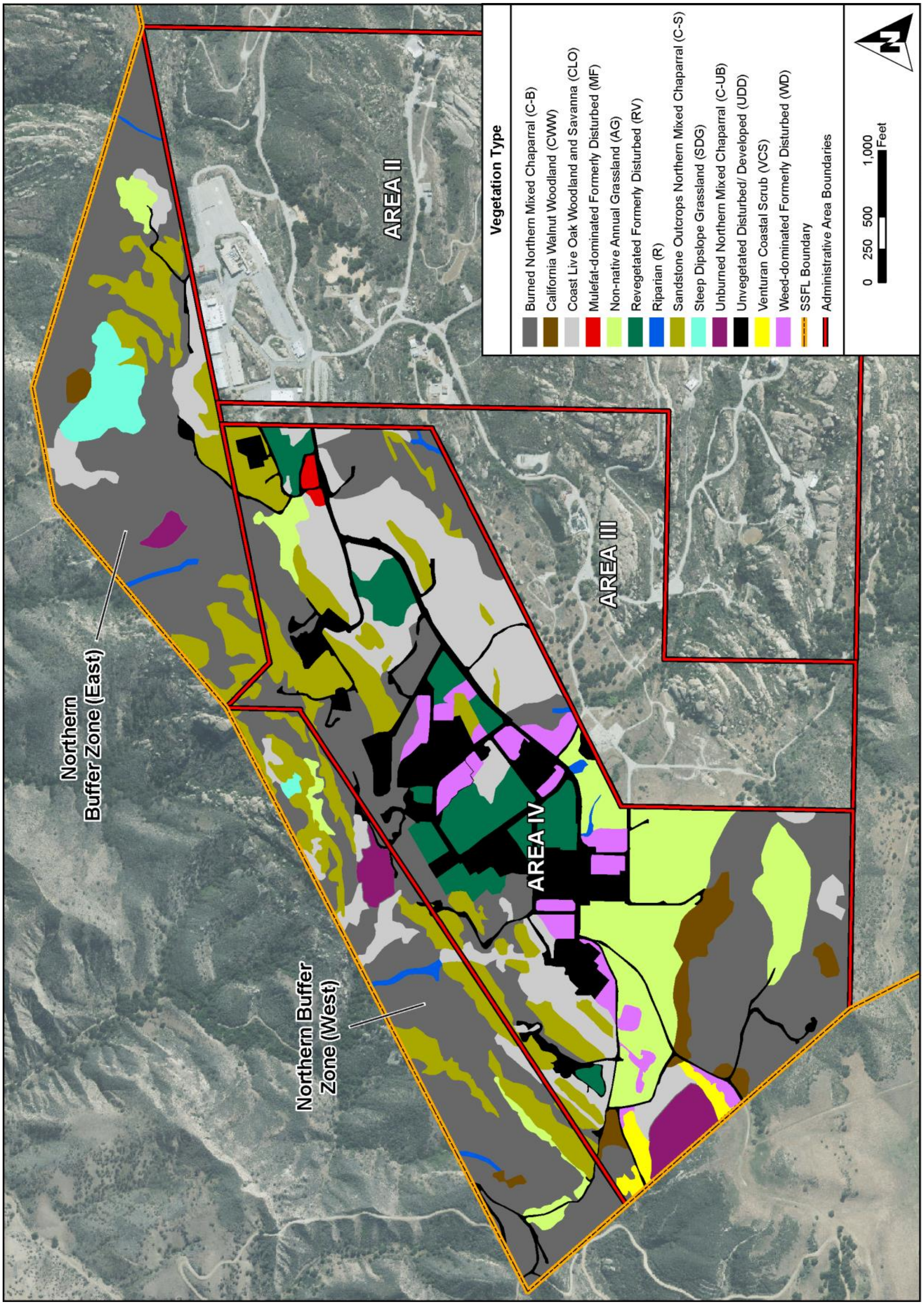


Figure 3–22 Vegetation and Wildlife Habitats Mapped in the Study Area

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 (considered a rare or high priority vegetation type by the California Department of Fish and Wildlife [CDFW]), sandstone outcrops, northern mixed chaparral, California walnut woodland (considered a rare or high priority vegetation type by CDFW), Coast live oak woodland and savanna, wetlands, vernal pools, and riparian habitat. Information about special status plant species documented from Area IV and the NBZ are included as well as 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.

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.

> MCV2 equivalent: ***Adenostoma fasciculatum*** **shrubland alliance** (chamise chaparral), ***Adenostoma fasciculatum-Salvia mellifera*** **shrubland alliance** (chamise-black sage chaparral), ***Cercocarpus betuloides*** **shrubland alliance** (birch-leaf mountain mahogany chaparral), ***Ceanothus spinosus*** **shrubland alliance** (green-bark ceanothus chaparral), ***Prunus ilicifolia*** **shrubland alliance** (holly-leaf cherry chaparral) is considered a rare or high priority vegetation type (CDFW 2010b), ***Eriodictyon crassifolium*** **Provisional Shrubland Alliance** (yerba santa scrub), and possibly other alliances depending on which species are dominant or co-dominant. In addition, the *Adenostoma fasciculatum* shrubland alliance (chamise chaparral) may include several plant species associations where chamise is co-dominant with one or a combination of species or plant types that occur at the SSFL including laurel sumac, thick leaf yerba santa, several species of ceanothus or manzanita (*Arctostaphylos* spp.), California buckwheat (*Eriogonum fasciculatum),* Bigelow's spikemoss (*Selaginella bigelovii),* annual grasses, forbs, or mixed herbs and moss.

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, and Ventura County Locally Important) 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*). 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.

> MCV2 equivalent: There is no MCV2 equivalent, although parts of the areas currently mapped as sandstone outcrops could be assigned a vegetation category based on the dominant or co-dominant plant species. This may require a qualifier to depict the difference between the same vegetation types not on rock outcrops (for example, *Adenostoma fasciculatum-Salvia mellifera* shrubland alliance on rock outcrops). The rock outcrops provide a unique and important habitat type because of their potential to support sensitive plant and wildlife species.

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*).

> MCV2 equivalent: ***Salvia mellifera*** **shrubland alliance** (black sage scrub), ***Malacothamnus fasciculatus*** **shrubland alliance** (bush mallow scrub), ***Artemisia californica*** **shrubland alliance** (California sagebrush scrub), and possibly other types depending on which species are dominant or co-dominant.

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 has 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 with the effects from the past 3 years of severe drought.

MCV2 equivalent: ***Quercus agrifolia* woodland alliance** (coast live oak woodland).

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.]).

MCV2 equivalent: ***Selaginella bigelovii* herbaceous alliance** (bushy spikemoss mats) is considered a rare or high priority vegetation type (CDFW 2010b).

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.

MCV2 equivalent: ***Juglans californica* woodland alliance** (California walnut groves) is considered a rare or high priority vegetation type (CDFW 2010b).

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.

MCV2 equivalent: Several herbaceous alliances may be applied to weed-dominated disturbed sites based on dominant or co-dominant species. For sites undergoing active revegetation, the dominant species is likely to change until the site has reached a sustainable habitat condition. It is likely the final vegetation types will be reflective of what was planted, soil conditions, and adjacent vegetation types.

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.

MCV2 equivalent: ***Baccharis salicifolia* shrubland alliance** (mulefat thickets).

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. 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.

MCV2 equivalent: There is no MCV2 equivalent for formerly disturbed-revegetated.

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.

MCV2 equivalent: There is no MCV2 equivalent, unvegetated areas.

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.

MCV2 equivalent: ***Bromus-Brachypodium distachyon*** **semi-natural herbaceous stands** (annual brome grassland), which on SSFL is dominated by ripgut brome, soft brome (*Bromus hordeaceus)*, and foxtail brome (*B. madritensis)* with other introduced annual grasses; ***Avena*** **semi-natural herbaceous stands** (wild oats grassland); ***Nassella pulchra*** **herbaceous alliance** (purple needlegrass grassland), is considered a rare or high priority vegetation type (CDFW 2010b).

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.

MCV2 equivalent: ***Salix lasiolepis*** **shrubland alliance** (arroyo willow thickets) is considered a rare or high priority vegetation type (CDFW 2010b), although in some areas of the SSFL, the cover of arroyo willow may be less than what is defined for membership in this category due to very sparse cover of riparian trees resulting from suboptimal hydrologic conditions associated with scarce groundwater and very ephemeral stream flows. These conditions result in a very open community with scattered willows interspersed with patches of mulefat and coyote brush in the channel, and scattered oak trees on the banks.

3.5.2.10 Invasive Plant Species

In accordance with Executive Order 13112, as amended by Executive Order 13751 invasive species are defined as, "with regards to a particular ecosystem, a non-native organism 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). Section 3.5.2.6 provides additional detail regarding specific species included under the Formerly Disturbed – Weed-dominated vegetation subtype.

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 that are more vulnerable to invasion than would otherwise be because of the relative openness of the vegetation compared to pre-fire conditions include the following: areas where woody vegetation is re-establishing after the 2005 fire, and areas where subsequent mowing and other mechanical vegetation reduction measures were performed from 2010 through 2014.

MCV2 equivalent: There is no MCV2 equivalent.

Table 3–5 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 3–5 Invasive Plant Species Present in Area IV and the Northern Buffer Zone

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 nomenclature for wildlife species used in the following sections is from standard sources.

The primary habitat types for wildlife species in the study area are oak woodland and savanna, grasslands (both native and nonnative), mixed chaparral, disturbed sites, and riparian, which are described below along with their associated wildlife species. These are more general habitat types than those used to characterize vegetation types in the previous section. It is important to note that the limited human access to SSFL and nearby designated open space areas has prevented encroachment of suburban and urban development, which makes SSFL of regional importance as habitat for endangered, threatened, and sensitive species. Additionally, SSFL is also recognized as an important wildlife corridor where the habitats offer cover, food, and water, as well as provide pathways for wildlife movement (wildlife migration corridors) and habitat linkages (see Figure 3–22). 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. Federal and State-listed species are discussed in more detail in Section 3.5.5.

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 3–22). Wildlife species observed in these types of grasslands also overlap into other adjacent, more extensive habitats such as mixed chaparral. Common reptile species include coastal 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. Coastal western whiptail is a California Species of Special Concern. 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.

Silvery legless lizard (*Anniella pulchra pulchra*) and coast horned lizard (*Phrynosoma coronatum blainvillii*) are two California Species of Special Concern that are fairly widespread on SSFL. The coast horned lizard is generally found in open areas with little vegetation. The silvery legless lizard has generally been observed at SSFL beneath oak tree litter, commonly along ephemeral drainages.

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. Mountain lions and their cubs have frequently been recorded passing through SSFL. 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*), 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*), San Diego desert wood rat (*Neotoma lepida intermedia*), a California Species of Special Concern, and various bats including the western mastiff bat (*Eumops perotis californicus*), a California Species of Special Concern. A resident pair of golden eagles (*Aquila chrysaetos*), a California Species of Special Concern, 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). In addition, multiple native bee species have been observed foraging on Santa Susana tarplant (Galea et al. 2016). 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 3–23 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.[8] 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 56 excavation).

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 I). 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. These aquatic features (e.g., Silvernale, R-2A, and R-2B), drain 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).

[8] Because there are no floodplains, DOE's regulation 10 CFR Part 1022 does not apply with respect to floodplain actions.

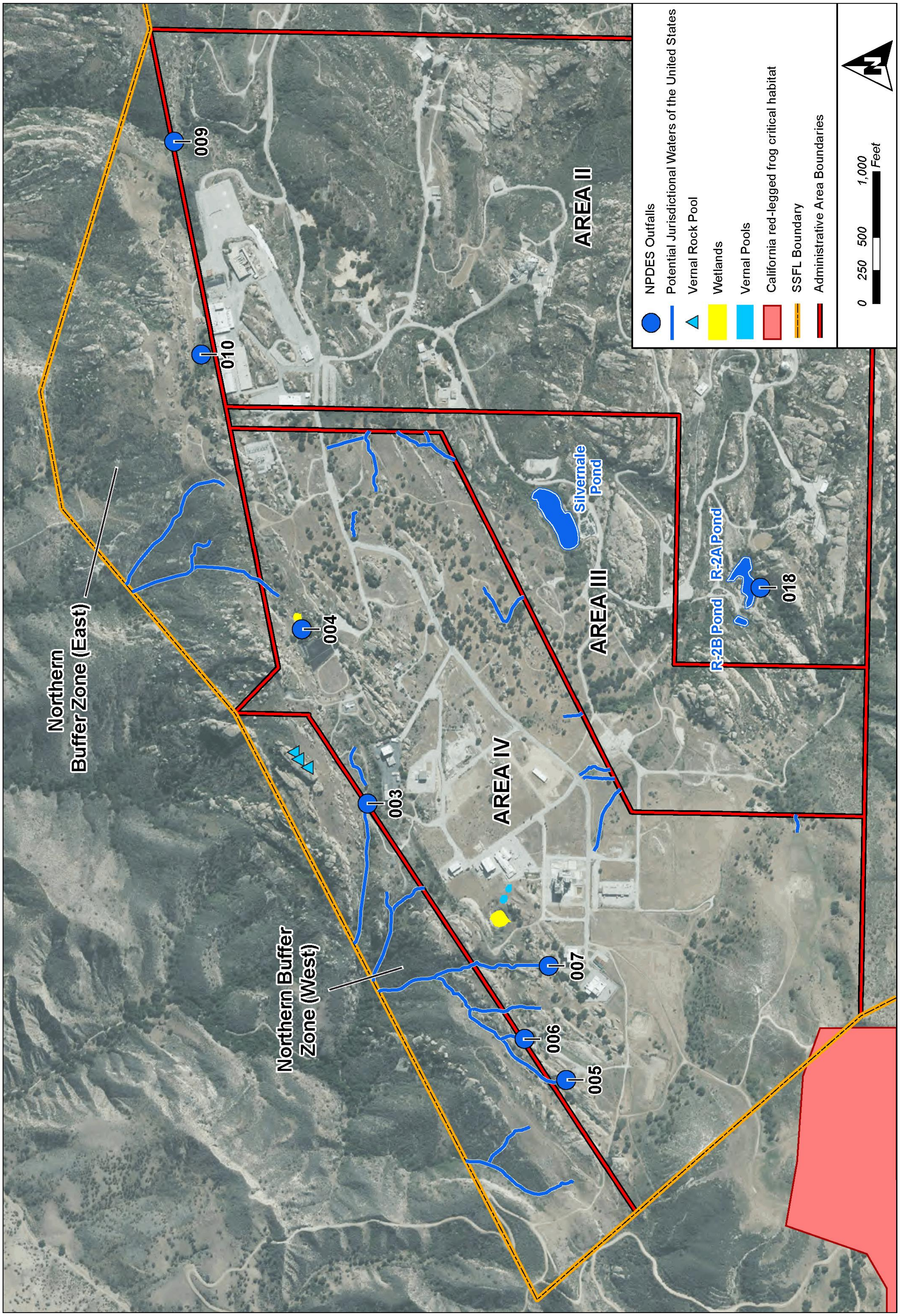


Figure 3–23 Wetlands, Vernal Pools, Ponds and Jurisdictional Waters of the U.S.

Approximately 0.05 acres of potentially jurisdictional wetlands were mapped in Area IV and the NBZ (see Figure 3–23). Potential jurisdictional wetlands included a man-made impoundment (the SRE pond) and vernal pools. As shown in Figure 3–23, 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); are protected under the California Native Plant Protection Act, the Ventura County list of locally sensitive species, and the Bald and Golden Eagle Protection Act; or are California Fully Protected Species or California Species of Special Concern and have 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 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).

Due to the known occurrence of federally listed species in the project area, formal consultation with USFWS under Section 7 of the ESA was completed. USFWS issued a Biological Opinion on August 14, 2018 stating that proposed activities would not jeopardize the continued existence of any federally listed species or result in an adverse modification of critical habitat. A copy of the Biological Opinion is provided in Appendix J. DOE will comply with all terms and conditions and reporting requirements stipulated in the Biological Opinion.

In addition, due to the known occurrence of a State listed species (Santa Susana tarplant) in the project area, DOE consulted with the CDFW under Section 2081(b) of the CESA. DOE expects that this consultation will result in issuance by CDFW of an Incidental Take Permit. DOE will comply with all terms and conditions and reporting requirements stipulated in the Incidental Take Permit.

3.5.5.1 Threatened, Endangered, and Rare Plant Species

Sixteen 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.[9] 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 3–6 as "other sensitive plant species."

The California Native Plant Protection Act (NPPA) enacted in 1977, allows the Fish and Game Commission to designate plants as rare or endangered. The NPPA generally prohibits the import into the State or the take, possession, or sale of NPPA-listed species. The Fish and Game Commission has adopted regulations governing the take or possession of NPPA-listed native plants (CDFW 2015). Incidental take may be authorized under these regulations, unless CDFW determines that issuance of an Incidental Take Permit would jeopardize the continued existence of

[9] A 2009 Biological Assessment (EPA 2009a) and 2010 Biological Opinion (USFWS 2010) were prepared to address EPA's surveys of SSFL Area IV and the NBZ for radiological contamination. The Biological Assessment and Biological Opinion identified nine federally listed or candidate plant species within the project area. Subsequent data and site specific surveys have resulted in the identification of seven additional threatened, endangered, and/or rare plant species with the potential to occur within or in the vicinity of Area IV and the NBZ.

the species. The CESA, enacted in 1970 and amended in 1984, allows the Fish and Game Commission to designate species, including plants, as threatened or endangered. CESA makes it illegal to import, export, "take," possess, purchase, sell, or attempt to do any of those actions to species that are designated as threatened, endangered, or candidates for listing, unless permitted by CDFW (through an Incidental Take Permit). Plants under the NPPA were not subsequently relisted under CESA. Plants protected under the NPPA and CESA were evaluated in this EIS.

Table 3–6 provides a list of these 16 species, their regulatory status, a general habitat description and distribution, and known or potential occurrences in the project vicinity. To date, one federally listed species (Braunton's milk-vetch), one State-listed species (Santa Susana tarplant) and seven other sensitive plant species (Malibu baccharis, Catalina mariposa lily, Slender mariposa lily, Plummer's mariposa lily, Sheathed Wright buckwheat, California black walnut and Ocellated Humboldt lily) have been documented on SSFL. Further details on the federally listed and state listed species that are known to occur in Area IV and NBZ are discussed in the text below.

Table 3–6 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*** [b]
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. Designated critical habitat is also present in the Southern Buffer Zone and beyond the administrative boundary of SSFL, to the west. No records of occurrence or designated critical habitat occur in the NBZ.
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 is known to occur throughout SSFL. In Area IV and the NBZ its presence is generally associated with sandstone outcrops. Santa Susana tarplant is also known to occur in Area I, Area II, Area III and the Southern Buffer Zone.
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.	Suitable habitat is present. This species has not been observed in Area IV or the NBZ; however, focused surveys for this species were not conducted. Focused surveys will be conducted before the start of remediation activities.
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.	Suitable habitat is present. This species has not been observed in Area IV or the NBZ; however, focused surveys for this species have not been conducted. Focused surveys will be conducted before the start of remediation activities.

Scientific Name Common Name	***Status (ESA/CESA/ CRPR/VC)*** [a]	***General Habitat Description***	***Potential Occurrence in the Region of Influence*** [b]
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.	Suitable habitat is present. This species has not been observed in Area IV or the NBZ; however, focused surveys for this species have not been conducted. Focused surveys will be conducted before the start of remediation activities.
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.	Suitable habitat is present. .This species has not been observed in Area IV or the NBZ; however, focused surveys for this species have not been conducted. Focused surveys will be conducted before the start of remediation activities.
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. Focused surveys will be conducted before the start of remediation activities.
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 have not been conducted. The nearest known location is the western Simi Hills, about 6 miles west of Area IV and the NBZ. Focused surveys will be conducted before the start of remediation activities.
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).

Scientific Name Common Name	Status (ESA/CESA/ CRPR/VC) [a]	General Habitat Description	Potential Occurrence in the Region of Influence [b]
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.
Eriogonum wrightii var. membranaceum Sheathed Wright buckwheat	-/-/-/LI	Sheathed Wright buckwheat is a subshrub that occurs from 984 to 7,218 feet in elevation. It is known to occur in Imperial, Los Angeles, Riverside, San Bernardino, San Diego, Santa Clara, Tehama, and Ventura Counties, as well as a specimen record in Santa Clara County and a reported record in Tehama County (CNPS 2016). It is commonly associated with dry gravel and rocky soils	On SSFL, sheathed Wright buckwheat is found in soil pockets on sandstone outcrops in the western NBZ with spikemoss (*Selaginella bigelovii*), lance-leaved Dudleya (*Dudleya lanceolata*), and other low-growing species
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.
Lilium humboldtii ssp. *ocellatum* Ocellated Humboldt lily	-/-/4.2/-	Occurs in loamy soils generally near or within drainages in openings of various communities dominated by woody plants, including oak and riparian woodlands.	This species is not known to occur within Area IV or in the NBZ. However, it has been documented in Area II and the Southern Buffer Zone of SSFL.

[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)

[b] Further details on select individual species distribution and occurrence in the region of influence is included in Section 3.5.5.1 and Figure 3–24.

Source: CDFW 2015; County of Ventura 2014; CNPS 2015; SAIC 2010; EPA 2009a; USFWS 2010.

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 3–24**.

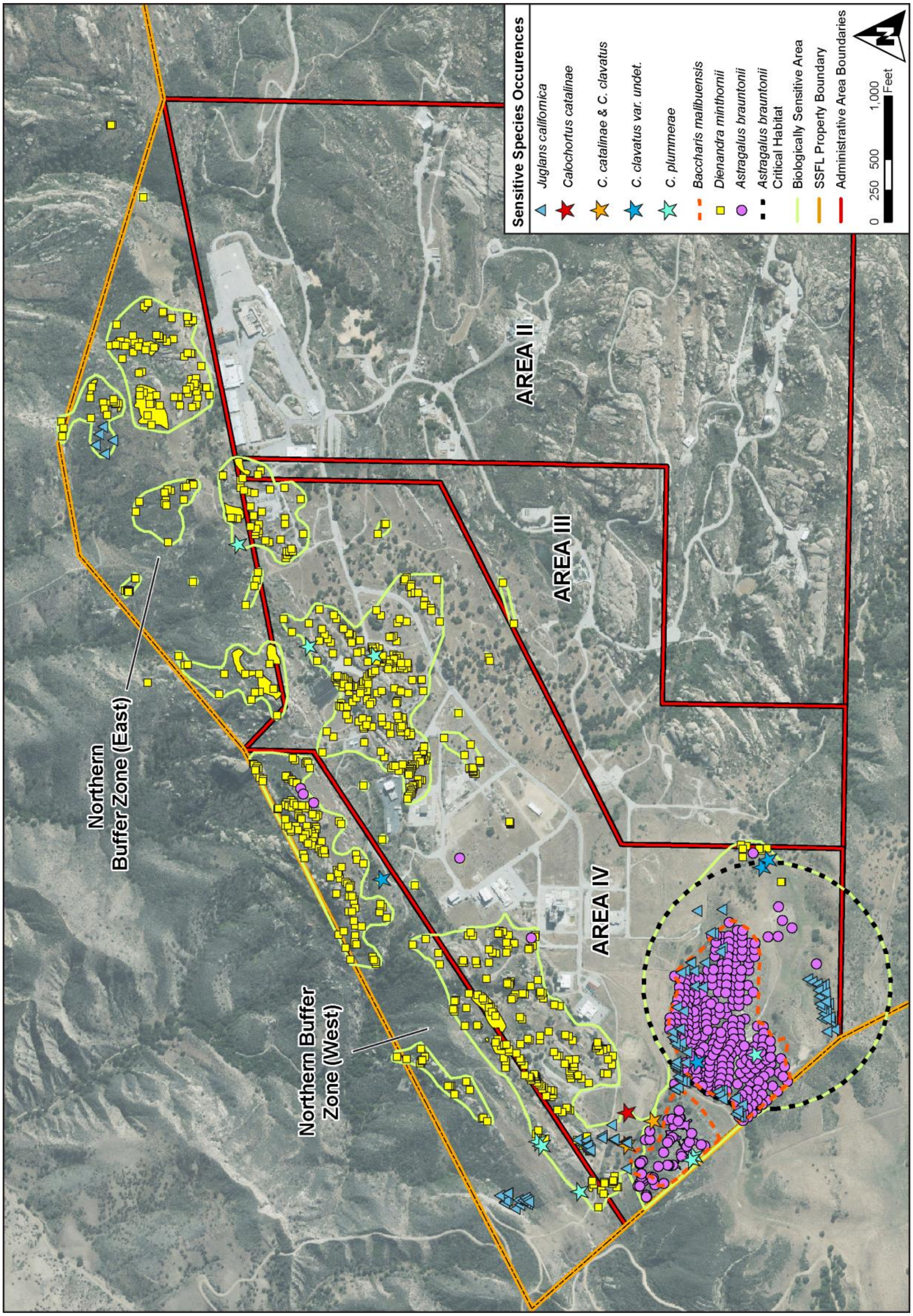


Figure 3–24 Locations of Sensitive Plants

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 3–24). 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 (HydroGeoLogic and Envicom 2012). The locations of these plants are included in Figure 3–24.

The remaining Braunton's milk-vetch individuals were visited by biologists during SSFL biological surveys conducted for soil characterization studies (2012–2014). In March 2014, about 100 plants were observed by biologists, and approximately 10 percent were still alive. Some plants appeared to have been browsed by mule deer (EPA 2010 and observations by the preparers). To minimize further damage to the plants, DOE biologists put protective fencing around a total of 13 surviving individuals in 2014 and 2015 (Leidos 2016). In June 2017, the remaining Braunton's milk-vetch fenced plants and known suitable habitat in Area IV was surveyed. In 2018, protective fencing was put around additional plants. Based on the information known about the biology of the plant, it was expected that most of the known living plants (about 13) had completed their life cycle and had gone dormant and that the next germination would occur after some type of disturbance. In 2017 and 2018, 80 living plants were recorded in Area IV. Most of the plants were located on the hill adjacent to critical habitat, and some were also documented within critical habitat. To date, a total of 21 Braunton's milk-vetch plants have protective fencing (DOE 2018a).

Overall, Braunton's milk-vetch has been documented on SSFL since 2006 (CDFW 2016a; MWH Global, Inc. 2009), following the October 2005 Topanga Fire. Numbers of living individuals observed vary, depending on numerous factors (e.g., site disturbance, shrub cover, herbivory, environmental conditions). In Area IV, the number of living plants observed has fluctuated over the years, from less than 10 to 33,500 (DOE 2018) individuals, with an average of 10,421 plants. Plants have been noted on site in all stages of growth. Observations suggest that the cycle of growth, flowering, and production of seed to replenish the seed bank at SSFL is approximately 4 to 5 years with some individuals possibly living longer. Braunton's milk-vetch individuals are expected to emerge on SSFL, as suitable conditions persist.

Braunton's milk-vetch 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.

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).

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 3–24). 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 3–24. 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 was roughly 850 individuals (SAIC 2009a). Additional locations have been identified since 2009 and all observations cover approximately 66 acres in Area IV with an additional 61 acres in the NBZ. There are an estimated 13 plants per acre in Area IV and NBZ, or about 1,651 plants (Figure 3–24).

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 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), as well as species that are listed by CDFW, or by Ventura County as Locally Important, and that either occur (i.e., have been observed) or have the potential to occur (i.e., suitable habitat is present) in Area IV or the NBZ. This list is presented in **Table 3–7** and includes a total of 26 animal species, of which 14 species have been recorded on SSFL. The table provides the regulatory status, a general habitat description, and the potential for occurrence in the region of influence for each species. Of the 26 animal species, seven are federally listed: California condor, coastal California gnatcatcher, least Bell's vireo, California red-legged frog, Quino checkerspot butterfly, Riverside fairy shrimp and vernal pool fairy shrimp. Three of the federally listed species (coastal California gnatcatcher, least Bell's vireo, and California Condor) also have a State-listed status.

To date, two federally listed species (coastal California gnatcatcher and least Bell's vireo), two California fully protected species (golden eagle and white-tailed kite), and ten California species of special concern (pallid bat, ringtail, western mastiff bat, San Diego desert woodrat, silvery legless lizard, coastal whiptail, coast horned lizard, coast patch-nosed snake, western spadefoot and two-stripped garter snake) have been documented on SSFL. Further details on the federally listed species that are known to occur or have the potential to occur in Area IV and NBZ are discussed in the text below.

As mentioned above, DOE completed Section 7 ESA consultation with the USFWS for federally listed species and obtained an ITA from CDFW for State-listed species. A copy of the regulatory consultation is provided in Appendix E.

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.

Table 3–7 Federally and State-Listed and Other Sensitive Animal Species that May Occur in Area IV and the Northern Buffer Zone

Scientific Name Common Name	*Status (ESA/CESA, CDFW/VC)* [a]	*General Habitat Description*	*Potential Occurrence in the Region of Influence* [b]
Birds			
Polioptila californica. californica Coastal California gnatcatcher	FT/SC/-	Obligate, permanent resident of coastal sage scrub below 2,500 feet 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).	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. Forde (2014) also had similar findings from protocol surveys performed in portions of Area I, III and the Southern Buffer Zone on behalf of Boeing. Based on this information and current conditions, this species may be an occasional visitor.
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.	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). A single individual, which was believed to be a migrating individual, was sighted during August 2011 in Area II in coyote brush adjacent to coast live oak woodland near the Ash Pile in Area II (NASA 2014a). 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.
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.	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).
Ammodramus savannarum Grasshopper Sparrow	-/SC/-	The grasshopper sparrow occurs in grasslands of intermediate height and is often associated with clumped vegetation interspersed with patches of bare ground. Breeding occurs in grassland vegetation including native prairie, fields, pasture, and occasionally cropland.	No records of the grasshopper sparrow occur within Area IV or the NBZ; however, suitable habitat is present in Area IV and the NBZ.

Scientific Name *Common Name*	*Status (ESA/CESA, CDFW/VC)* [a]	*General Habitat Description*	*Potential Occurrence in the Region of Influence* [b]
Aquila chrysaetos Golden eagle	-/FP/-	The golden eagle is commonly found in open and semi-open country such as prairies, sagebrush, arctic and alpine tundra, savannah or sparse woodland, and barren areas, especially in hilly or mountainous regions, in areas with sufficient mammalian prey base and near suitable nesting sites. Nests are most often on rock ledges or cliffs but sometimes in large trees (oak or eucalyptus in California) on steep hillsides, or on the ground.	The golden eagle has been observed foraging over Area IV and the NBZ. It has been recorded nesting north of Area III in the NBZ.
Athene cunicularia Burrowing owl	-/SC/-	The burrowing owl is commonly found in open grasslands, especially prairie, plains, and savanna, and sometimes in other open areas such as vacant lots near human habitation or airports. It spends much time on the ground or on low perches, such as fence posts or dirt mounds. Nests are in abandoned burrows, such as those dug by ground squirrels, foxes, or woodchucks.	No records of the burrowing owl occur within Area IV or the NBZ; however due to the presence of substantial grassland habitats, especially in the Southern Buffer Zone, burrowing owl has the potential to occur in Area IV and the NBZ.
Elanus leucurus White-tailed kite	-/FP/-	The white-tailed kite is commonly found in savanna, open woodland, marshes, partially cleared lands, and cultivated fields. It nests in trees, often near a marsh, usually 20-50 feet above the ground in branches near the top of a tree.	The white-tailed kite has been observed foraging at various locations on SSFL including Area IV and the NBZ.
Mammals			
Antrozous pallidus Pallid bat	-/SC/-	The pallid bat is commonly found in mountainous areas, intermontane basins, lowland desert scrub, and arid deserts and grasslands often near rocky outcrops and water. This species also inhabits open coniferous forest and woodland. Day roosts include crevices of rock outcrops, caves, mine tunnels, buildings, bridges, and hollows of live and dead trees, while hibernation occurs in caves and mines.	The pallid bat has been identified visually and acoustically on SSFL and is likely to have maternity roots, hibernations sites, and/or winter sites. Area IV and the NBZ provide roosting habitat.
Bassariscus astutus Ringtail	-/FP/-	The ringtail is commonly found in rocky areas with cliffs or crevices for daytime shelter and occupies areas with desert scrub, chaparral, pine-oak and conifer woodland, usually within 0.5 miles of water. Dens can be in a rock shelter, tree hollow, under tree roots, in a burrow dug by another animal, in a remote building, or under a brush pile.	No records of the ringtail occur within Area IV or the NBZ. However, one individual ringtail was sighted in 2010 on a rock outcrop near a riparian drainage near the boundary between Area III and Area IV; thus, there is the potential for the ringtail to occur.
Euderma maculatum Spotted bat	-/SC/-	The spotted bat is commonly found in various habitats from desert to montane coniferous stands, including open ponderosa pine, pinyon-juniper woodland, canyon bottoms, riparian and river corridors, meadows, open pasture, and hayfields. Active foraging may be mostly in open terrain, including forest clearings, meadows, open wetlands, and around buildings. Roosts generally are in cracks and crevices in cliffs, or sometimes in caves or in buildings near cliffs.	No records of the spotted bat occur within Area IV or the NBZ; however, roosting and foraging habitat is present in Area IV and the NBZ.

Scientific Name Common Name	Status (ESA/CESA, CDFW/VC) [a]	General Habitat Description	Potential Occurrence in the Region of Influence [b]
Eumops perotis californicus Western mastiff bat	-/SC/-	The western mastiff bat is commonly found in arid and semiarid, rocky canyon country habitats in the Chihuahuan Desert. It roosts in crevices and shallow caves on the sides of cliffs and rock walls, and occasionally buildings. Roosts are usually high above ground with an unobstructed approach.	The western mastiff bat has been recorded acoustically on SSFL. Due to the numerous cliffs at SSFL, potential roost features, and suitable foraging, it is highly likely that this species occurs throughout the year and has roost and maternal sites in Area IV and the NBZ.
Lasiurus blossevillii Western red bat	-/SC/-	Red bats in California appear to be strongly associated with riparian habitats, particularly mature stands of cottonwood and sycamore in the Central Valley and lower reaches of the large rivers that drain the Sierra Nevada. They sometimes use orchards, tamarisk, or other non-native trees. In spring and summer, females occur primarily in lowland riparian habitat, whereas males more often are found at higher elevations. Summer roosts usually are in tree foliage and sometimes in large leafy shrubs.	No records of the western red bat occur within Area IV or the NBZ; however, roosting and foraging habitat is present, especially within the oak woodlands and riparian habitat in Area IV and the NBZ.
Macrotus californicus California leaf-nosed bat	-/SC/-	The California leaf-nosed bat is commonly found in lowland desert scrub. Day roosts are in caves or abandoned mines. Small groups may also use natural rock shelters in canyon walls. Night roosts can be found in open buildings, porches, rock shelters, mines or under bridges. Maternity roosts are in warm sites in old mine tunnels or caves, or areas separate from those used in winter.	No records of the California leaf-nosed bat occur within Area IV or the NBZ; however, roosting and foraging habitat is present in Area IV and the NBZ.
Neotoma lepida intermedia San Diego desert woodrat	-/SC/-	The San Diego desert woodrat is commonly found in sagebrush scrub and chaparral habitats.	The San Diego desert woodrat has been recorded on SSFL and is likely present at numerous locations in Area IV and the NBZ, mainly in association with sandstone outcrops.
Taxidea taxus American badger	-/SC/-	The American badger is commonly found in open areas or areas with little groundcover in cropland/hedgerow, desert, grassland, savanna, shrubland, and chaparral habitats. When inactive, the badger occupies an underground burrow.	No records of the American badger occur within Area IV or the NBZ; however, potential suitable habitat occurs in grasslands, shrublands and chaparral habitats.
Amphibians and Reptiles			
Rana draytonii (*Rana aurora* ssp. *draytonii*) California red-legged frog (CRF)	FT-CH/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 3–23 [USFWS 2010]).	No records of the CRF occur within Area IV or the NBZ (USFWS 2010). In 2010, no evidence of CRF was found during surveys (SAIC 2010). However, two California Natural Diversity Database records exist of the CRF within 3 miles to the south. The USFWS identified the possibility that the CRF 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).

Scientific Name Common Name	Status (ESA/CESA, CDFW/VC) [a]	General Habitat Description	Potential Occurrence in the Region of Influence [b]
Anniella pulchra pulchra Silvery legless lizard	-/SC/-	The silvery legless lizard is commonly found near areas with moist warm loose soil and plant cover, occurring in sparsely vegetated areas of beach dunes, chaparral, pine-oak woodlands, desert scrub, sandy washes, and stream terraces with sycamores, cottonwoods, or oaks. Leaf litter under trees and bushes in sunny areas often indicate suitable habitat.	The silvery legless lizard has been observed on several occasions in the NBZ, in Area I and directly adjacent to SSFL on Sage Ranch Park. It is likely to occur in Area IV and the NBZ especially in the oak woodlands beneath oak tree duff.
Aspidoscelis tigris stejnegeri Coastal whiptail	-/SC/-	The coastal whiptail is commonly found in a variety of generally hot and dry open areas with sparse foliage in chaparral, woodland, and riparian habitats.	The coastal whiptail has been frequently observed at SSFL in the NBZ, Southern Buffer Zone, and Areas I and II. Additional suitable habitat exists for this species in Area IV.
Lampropeltis zonata (pulchra) California mountain kingsnake (San Diego population)	-/SC/LI	The California mountain kingsnake is commonly found in coniferous forest, oak-pine woodlands, riparian woodland, chaparral, manzanita, and coastal sage scrub. It can be found in wooded areas near a stream with rock outcrops, talus or rotting logs that are exposed to the sun.	No records of the California mountain kingsnake occur within Area IV or the NBZ; however, habitat for this species is present on SSFL, including in Area IV and the NBZ.
Phrynosoma blainvillii Coast horned lizard	-/SC/-	The coast horned lizard is commonly found in open areas of sandy soil and low vegetation in valleys, foothills, and semiarid mountains with grassland, coniferous forest, woodland, and chaparral habitats with open areas and patches of loose soil. It is also often found in lowlands along sandy washes with scattered shrubs and along dirt roads, and frequently found near ant hills.	The coast horned lizard was occasionally observed at various locations on the SSFL site from 2008 to 2012 in Area II and in the rock outcrops north of the LOX site in Area I. There is potential for this species to occur in Area IV and the NBZ due to the presence of suitable habitat.
Salvadora hexalepis virgultea Coast patch-nosed snake	-/SC/-	The coast patch-nosed snake is commonly found in semi-arid brushy areas and chaparral in canyons, rocky hillsides, and plains.	No records of the coast patch-nosed snake occur within Area IV or the NBZ; however, this species was recently observed on two occasions at SSFL, near Area I and in the Southern Buffer Zone. There is potential for this species to occur in Area IV and the NBZ due to the presence of suitable habitat.
Spea hammondii Western spadefoot	-/SC/-	The western spadefoot is commonly found in open areas with sandy or gravelly soils, in a variety of habitats including mixed woodlands, grasslands, coastal sage scrub, chaparral, sandy washes, lowlands, river floodplains, alluvial fans, playas, alkali flats, foothills, and mountains. Rain pools that do not contain bullfrogs, fish, or crayfish are necessary for breeding.	No records of the western spadefoot occur within Area IV or the NBZ; however, this species was recently discovered breeding on SSFL in a former detention basin at the southern part of Area I. Other ponded areas in Area IV and the NBZ provide potential breeding habitat for this species. There is potential for this species to occur in Area IV and the NBZ.
Thamnophis hammondii Two-striped garter snake	-/SC/-	The two-striped garter snake is commonly found around pools, creeks, cattle tanks, and other water sources, often in rocky areas, in oak woodland, chaparral, brushland, and coniferous forest.	No records of the two-striped garter snake occur within Area IV or the NBZ; however, this species has been observed at several locations within Area I of SSFL and there is potential for this species to occur due to the presence of suitable habitat in Area IV and the NBZ.

Scientific Name ***Common Name***	***Status (ESA/CESA, CDFW/VC)*** [a]	***General Habitat Description***	***Potential Occurrence in the Region of Influence*** [b]
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.	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).	Area IV includes limited vernal pool habitat, and there are no known records of Riverside fairy shrimp within SSFL. The nearest documented occurrence is west of Simi Valley at Tierra Rejada Preserve, approximately 5 miles from SSFL (USFWS 2008). In 2014, Padre conducted a habitat assessment to identify potential suitable habitat for listed vernal pool branchiopods within 250 feet of proposed remediation in Boeing's Areas I, III, and portions of the Southern Buffer Zone (Padre 2015). These surveys identified 86 potential habitat features; however, only 77 were considered potential habitat for fairy shrimp. Focused surveys for the species have not been conducted in Area IV and the NBZ. Because Area IV and the NBZ are within the range of the species, populations are known to occur in the region, and areas potentially capable of supporting the species occur on site; thus, it is possible that Riverside fairy shrimp could occur within Area IV and the NBZ (USFWS 2010).
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).	Limited vernal pool fairy shrimp surveys have been conducted on SSFL (NASA 2014a). In 2014, Boeing conducted a habitat assessment to identify potential suitable habitat for listed vernal pool branchiopods within 250 feet of proposed remediation impact areas in Boeing's Areas I, III, and portions of the Southern Buffer Zone (Padre 2015). These surveys identified 86 potential habitat features; however, only 77 were considered potential habitat for fairy shrimp. There are no known records of vernal pool fairy shrimp on SSFL. Because the study area falls within the range of the species, populations are known to occur in the region, and areas potentially capable of supporting the species suitable habitat occur on site, thus it is possible that vernal pool fairy shrimp occur within Area IV and the NBZ (USFWS 2010).

Scientific Name Common Name	*Status (ESA/CESA, CDFW/VC)* [a]	*General Habitat Description*	*Potential Occurrence in the Region of Influence* [b]

NBZ = Northern Buffer Zone; ROI = region of influence.
[a] Status
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
CH= Critical Habitat
CESA = California Endangered Species Act (California Department of Fish and Wildlife)
SE = California State-listed as endangered
SR = California State-listed rare
CDFW = California Department of Fish and Wildlife (CDFW 2016)
SC = California species of special concern
FP = California fully protected species
VC = Ventura County; LI = Locally Important
(1 - 5 occurrences in Ventura County)
[b] Further details on federally listed species distribution and occurrence in the region of influence is included in Section 3.5.5.1.
Sources: CDFW 2015, 2016; Faulkner 2010; SAIC 2009a; EPA 2009a; USFWS 2010; County of Ventura 2014; NASA 2014a; Padre 2013, 2014b, 2015).

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 coastal California gnatcatcher generally occupies coastal sage scrub habitats in arid washes, on mesas, and slopes. Based on CNDDB and USFWS records, the coastal California gnatcatcher has been observed approximately 3.9 miles south of Area IV in Las Virgenes Canyon; approximately 9.2 miles west near Little Simi Valley, northwest of State Route 23 and Tierra Rejada Road, Moorpark; and approximately 10 miles west near California Lutheran University (CDFW 2015).

SSFL supports suitable coastal California gnatcatcher habitat. Coastal California gnatcatcher was heard during a site visit in Area IV by Service biologist Robert McMorran on December 2, 2009 (USFWS 2010). No coastal California gnatcatchers were detected during subsequent protocol level surveys encompassing Area IV and the NBZ in 2010, 2011, or 2012 in support of EPA vegetation clearing and gamma scanning activities (Griffith Wildlife Biology 2010, 2011, 2012; HydroGeoLogic and Envicom 2010). In 2014, protocol surveys performed in portions of Area I, III and Southern Buffer Zone on behalf of Boeing did not observe any coastal California gnatcatchers (Forde 2014).

Because the Topanga fire burned much of Area IV and the NBZ in September 2005, several plant communities on SSFL, in addition to Ventura coastal sage scrub, 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, 2018). USFWS determined that Area IV and the NBZ supports approximately 280 acres of potential suitable habitat for the coastal California gnatcatcher (USFWS 2018; **Figure 3–25**), with approximately 33.17 acres of this area classified as Ventura coastal scrub, which is the most preferred habitat for the species.

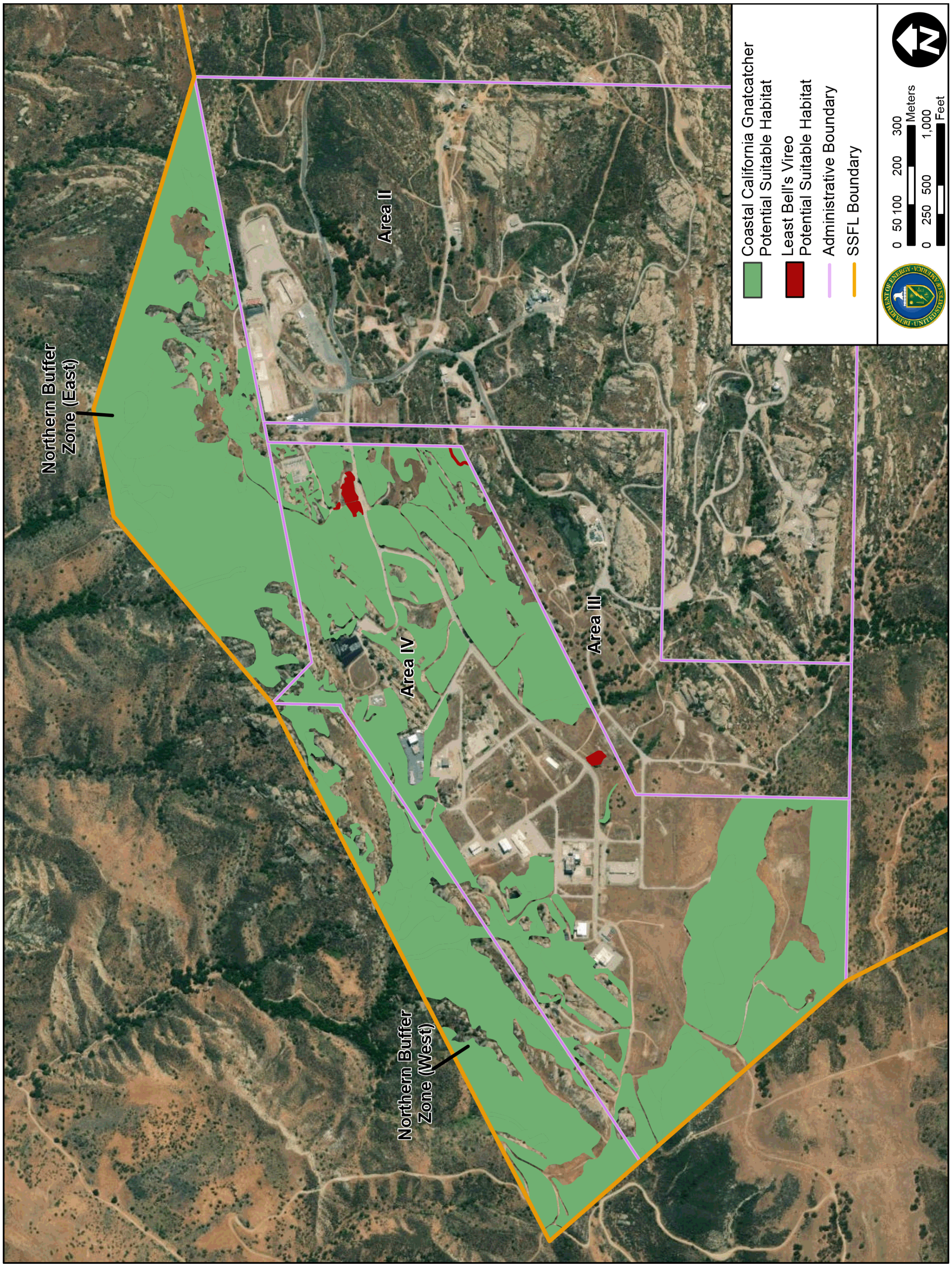


Figure 3–25 Coastal California Gnatcatcher and Least Bell's Vireo Potential Suitable Habitat in Area IV and the Northern Buffer Zone

Forde (2014) also had similar findings from protocol surveys performed in portions of Area I, III and Southern Buffer Zone on behalf of Boeing. Based on this information, potential suitable habitat for the coastal California gnatcatcher occurs in Area IV and the NBZ and this bird may be an occasional visitor to Area IV, and due to additional populations within close proximity to the site (approximately 3.9 miles away) and long duration of the project, the species may increase their use of the site at some point during project implementation.

According to information from USFWS records and the CNDDB, other nearby recorded locations for the coastal California gnatcatcher are located approximately 3.9 miles south of Area IV in Las Virgenes Canyon; approximately 9.2 miles west near Little Simi Valley, northwest of State Route 23 and Tierra Rejada Road, Moorpark; and approximately 10 miles 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).

A single individual least Bell's vireo, which was believed to be a migrating individual, was observed in August 2011, in Area II by NASA consultants (USFWS 2013a). It was observed in coyote brush adjacent to coast live oak woodland (NASA 2014a). A protocol survey (Werner 2012) conducted on Area IV did not find least Bell's vireos, nor have any additional individuals been observed during other field surveys and monitoring conducted on SSFL. The likelihood of least Bell's vireo nesting activity is low because most of the suitable habitat is in small patches, fragmented, or degraded. However, these habitat areas may support unpaired least Bell's vireos, during migration or during the residency season. 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, 2018). A total of 2.5 acres of riparian habitat has been identified on Area IV and the NBZ (Table 3–4). Other areas characterized as "formerly disturbed areas dominated by mulefat," amounting to 0.9 acres in Area IV (SAIC 2009a), are considered potential suitable habitat for this species (Figure 3–25).

Based on this information, it appears that the least Bell's vireo may be an occasional visitor to Area IV or the NBZ. Also, due to the long duration of the proposed project, the riparian habitat onsite may become more abundant, and vireo use of the Area IV and NBZ may increase.

California Red-legged Frog (*Rana draytonii* [*Rana aurora* ssp. *draytonii*]). The California red-legged frog (CRF) 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 CRF (USFWS 2002). Two CNDDB records exist of the CRF 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 3–26**). Area IV and the NBZ also contain several primary constituent elements described in the revised designation of critical habitat for the CRF, as discussed in the Biological Opinion (USFWS 2010).

The CRF 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 CRF (SAIC 2010). Of those, only Outfall 4/SRE pond is within the Area IV (or the NBZ) (Figure 3–26). The report also addressed Silvernale Pond and the ponds at Outfall 018 because of their hydrological connection to Area IV and the potential for CRF, if present at either locality, to migrate into Area IV during a wet period.

Although no evidence of the CRF was found in the three habitats investigated, they each have some physical characteristics suitable for supporting the CRF, at least seasonally, but their distance and isolation from existing CRF locations and aspects of the habitat make occupation by the CRF 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. Furthermore, no life stages of the QCB were detected during the 2012 habitat assessment surveys conducted within Areas I and II at SSFL (Arnold 2012). 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).

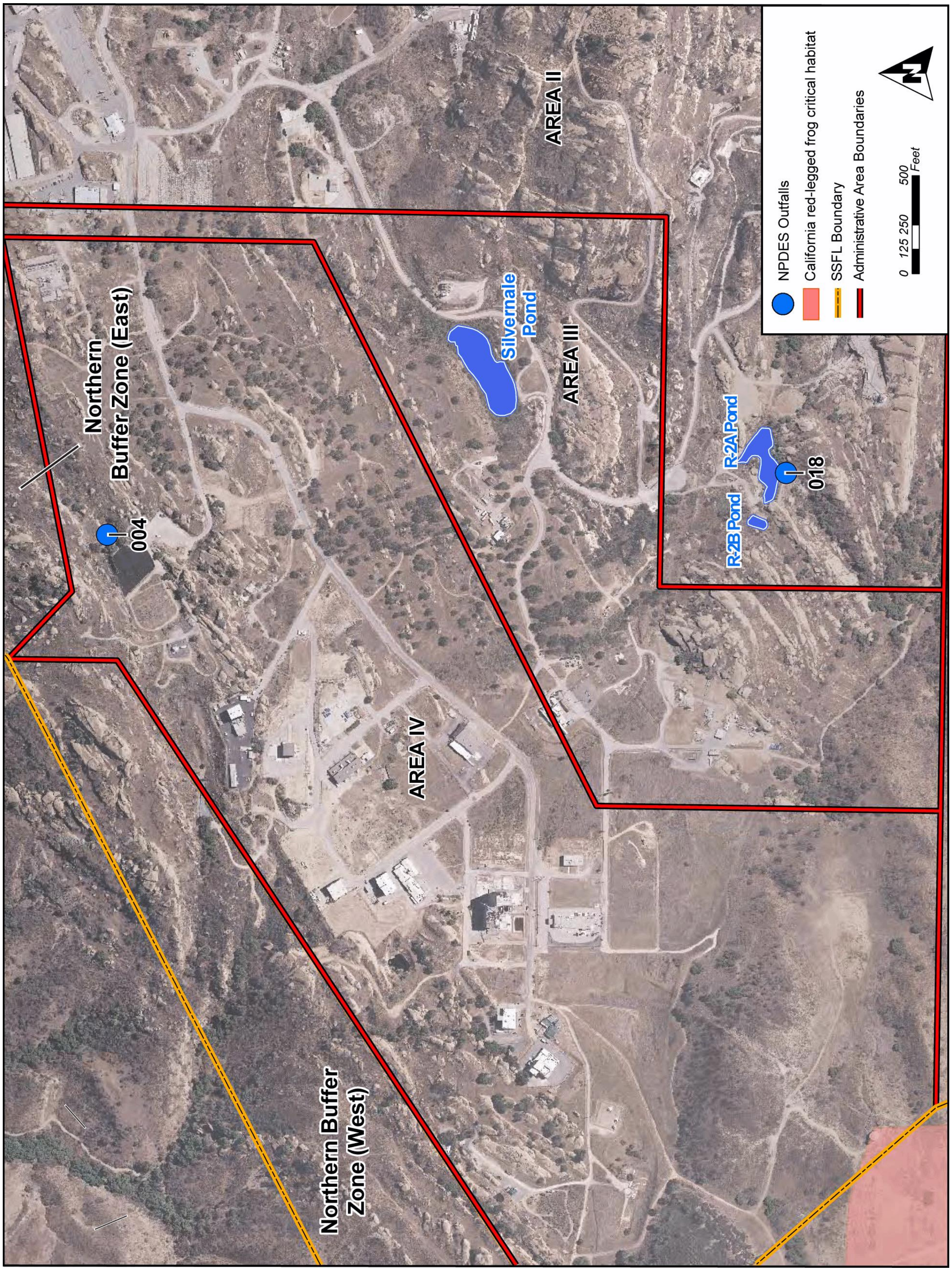


Figure 3–26 California Red-Legged Frog Habitat Assessment Locations at Outfall 4, Silvernale Pond, Ponds at Outfall 18 and Recently Designated California Red-legged Frog Critical Habitat

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. 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). The nearest documented occurrence of Riverside fairy shrimp is west of Simi Valley at Tierra Rejada Preserve, approximately 8 miles from Area IV (CDFW 2015; USFWS 2008). The nearest documented occurrence of vernal pool fairy shrimp is approximately 9 miles northwest of the project site at the Carlsberg vernal pools in Ventura County.

In 2010, nine vernal pools were identified in Areas I and IV (including two isolate vernal pools and three vernal rock pool in Area IV and the NBZ) 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. Subsequent habitat surveys were conducted in 2014 to identify potential suitable habitat for listed vernal pool branchiopods within 250 feet of proposed remediation impact areas in Boeing's Areas I, III, and portions of the Southern Buffer Zone (Padre 2015). These surveys identified 86 potential habitat features; however, only 77 were considered potential habitat for fairy shrimp. The surveys noted fairy shrimp presence in some pools, but protocol surveys were not conducted and the fairy shrimp were not identified. In Area IV and the NBZ, vernal pools and vernal rock pools are present and provide potential suitable habitat for Riverside fairy shrimp or vernal pool fairy shrimp (Figure 3–23). Full protocol surveys would be required for any sites that would be directly impacted by remediation activities (Padre 2014a).

Full protocol surveys would be required for any sites that would be directly impacted by remediation activities (Padre 2014a). Because SSFL falls within the range of these species, they are known to occur in the region, and areas capable of supporting fairy shrimp are present onsite, Riverside fairy shrimp and vernal pool fairy shrimp may occur within Area IV and the NBZ (USFWS 2010, 2018).

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 3–8**.

Table 3–8 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	0.07 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 μg/m^3	–	–
	24-hour	50 μg/m^3	150 μg/m^3	Same as primary
Fine particulate matter ($PM_{2.5}$)	Annual	12 μg/m^3	12 μg/m^3	15 μg/m^3
	24-hour	–	35 μg/m^3	Same as primary
Lead	Rolling 3-month average	–	0.15 μg/m^3	Same as primary
	Quarterly Average	–	–	–
	30-day average	1.5 μg/m^3	–	–

PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; ppm = parts per million; ppb = parts per billion; μg/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 3–27** shows the Ventura County and the South Coast Air Basin analysis domains for SSFL.

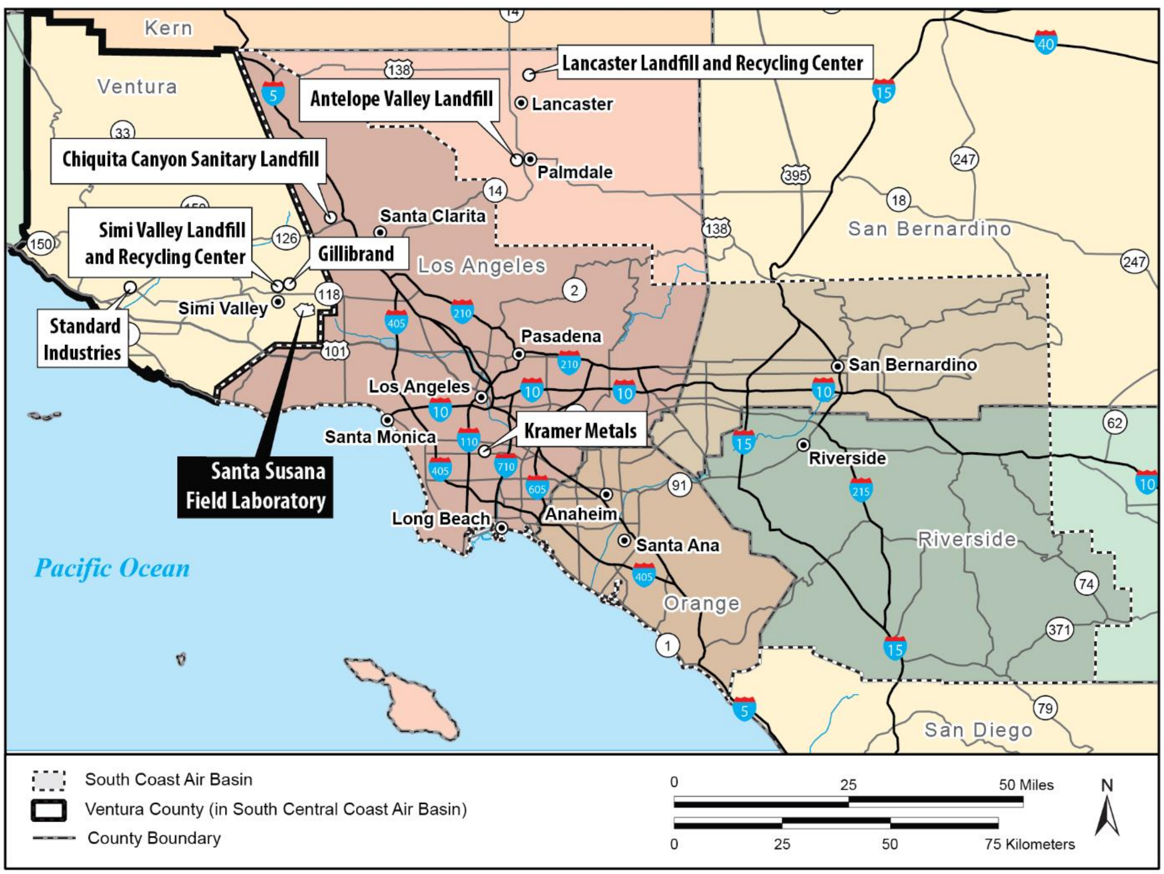


Figure 3–27 Air Impacts Analysis Region of Influence for Santa Susana Field Laboratory

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 3–28** 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 within Area IV 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 Area IV, 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.

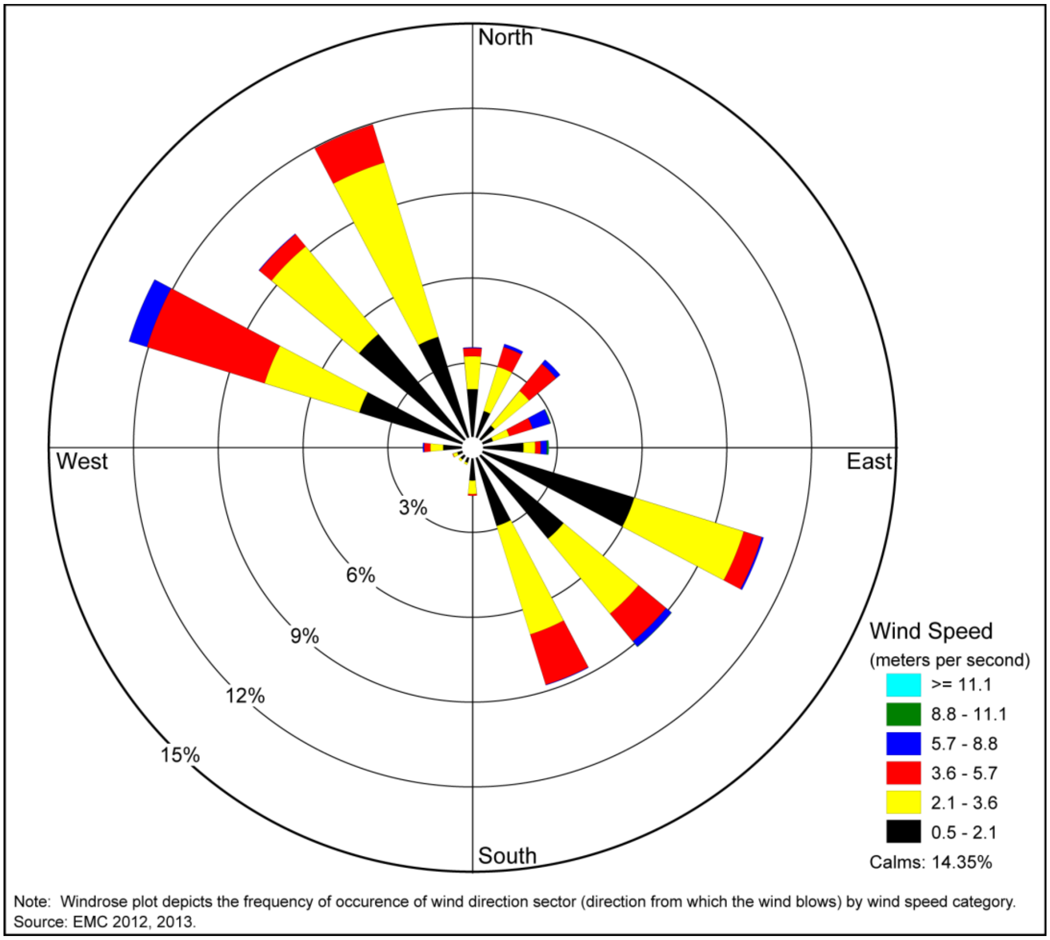


Figure 3–28 2011-2012 Area IV Wind Rose

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.

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, serious nonattainment for $PM_{2.5}$, nonattainment for 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 3–9** summarizes the NAAQS attainment status for regions surrounding these waste management facilities.

Table 3–9 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
Waste Control Specialists (TX)							

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; TX = Texas; 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 3–10 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 3–10 (ARB 2017), 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, PM_{10} levels (1) slightly exceeded the State annual standard each year and (2) exceeded the State and national 24-hour standards in 2015 and 2016.

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 3–10 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 national 24-hour $PM_{2.5}$ standard.

Table 3–10 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*			
				2013	*2014*	*2015*	*2016*
Simi Valley–Cochran Street Monitoring Station (Ventura County)							
Ozone (ppm)	1-hour	n/a	0.09	**0.104**	**0.096**	**0.096**	**0.101**
	8-hour	0.070	0.07	**0.089**	**0.085**	**0.078**	**0.083**
NO_2 (ppm)	1-hour	0.10	0.18	0.04	0.05	0.04	0.04
	Annual	0.053	0.03	0.009	0.009	0.008	0.008
PM_{10} (μg/m³)	24-hour	150	50	41	50	**64**	**166**
	Annual	n/a	20	**23**	**24**	**21**	**23**
$PM_{2.5}$ (μg/m³)	24-hour	35	n/a	29	31	31	35
	Annual	12	12	9	9	8	9
Reseda/Burbank Monitoring Stations (Los Angeles County)[a]							
Ozone (ppm)	1-hour	n/a	0.09	**0.124**	**0.116**	**0.119**	**0.122**
	8-hour	0.075	0.07	**0.092**	**0.092**	**0.094**	**0.098**
NO_2 (ppm)	1-hour	0.10	0.18	0.06	0.06	0.07	0.06
	Annual	0.053	0.03	–	–	0.013	0.012
PM_{10} (μg/m³)	24-hour	150	50	**53**	**69**	–	–
	Annual	n/a	20	**28**	**29**	–	–
$PM_{2.5}$ (μg/m³)	24-hour	35	n/a	**42**	27	**37**	30
	Annual	12	12	10	–	9	9

μg/m³ = 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 2017.

As described in Section 3.9.2, DOE historically has collected air samples and monitors ambient radiation within and offsite Area IV. Monitoring currently occurs within Area IV at the RMHF and Building 55.

DOE initiated an air monitoring program in February 2018 that includes a meteorological station within Area IV and four air monitors along the perimeter of Area IV (NASA/Boeing/DOE 2017). The perimeter stations include three along the north border near the SRE, RMHF, and FSDF and one along the southern border. DOE is operating the system to establish a pre-remediation baseline. The system will continue to operate during remediation activities to monitor any potential air pollutant releases of concern.

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 and nearby roadways, including the distribution of children and persons aged 65-years or older. **Figure 3–29** shows the location along SSFL transportation routes where sensitive receptors 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.

Figure 3–29 Locations along SSFL-Vicinity Transportation Routes with High Potential for Occurrence of Children and Persons Aged 65 Years and Older

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, other than water vapor, 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 59 years (NOAA 2017). As of 2016, carbon dioxide levels are about 33 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 2017).

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 2017).

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 3–11 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 3–11 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	Rock band	110	
Loud auto horn		100	VERY NOISY
Gas lawn mower at 3 feet		90	
Diesel truck at 50 feet, at 50 miles 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	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, $Leq_{-1/2\ hour}$ 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 p.m. and 10 p.m., and 10 decibels are added to sound levels between 10 p.m. and 7 a.m. 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 p.m. and 10 p.m. 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 3–30 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 3–30 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 3–30 for a 24-hour period in August 2011. The locations, hourly noise levels, and daily continuous noise levels are summarized in **Table 3–12**.

On 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 $Leq_{-1/2\ hour}$. 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 $Leq_{-1/2\ hour}$ of 57 dBA with large trucks being the dominant noise source.

Table 3–12 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.

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 3–13**. 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).

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), hazardous waste, nonhazardous waste, and recycle material (including asphalt, concrete, and building materials) to offsite facilities and delivery of supplies and 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).

Table 3–13 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.

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 EIS, 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 3–31** 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).

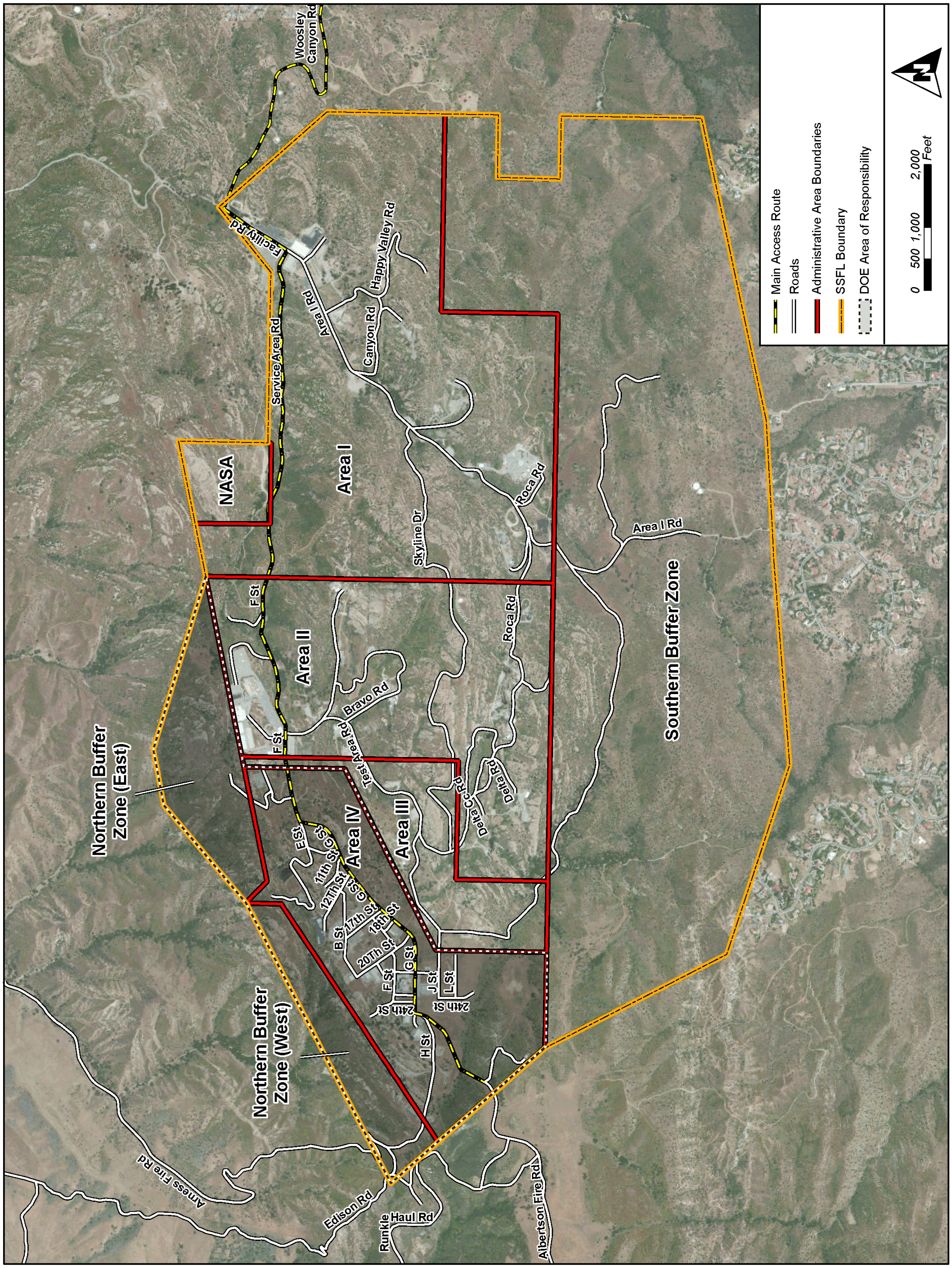


Figure 3–31 Santa Susana Field Laboratory Roadways

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 3–31, travel between Area IV and the Main Gate uses Facility Road, Service Area Road, and 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 soil. 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.[10]

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 3–32 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

[10] 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).

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.

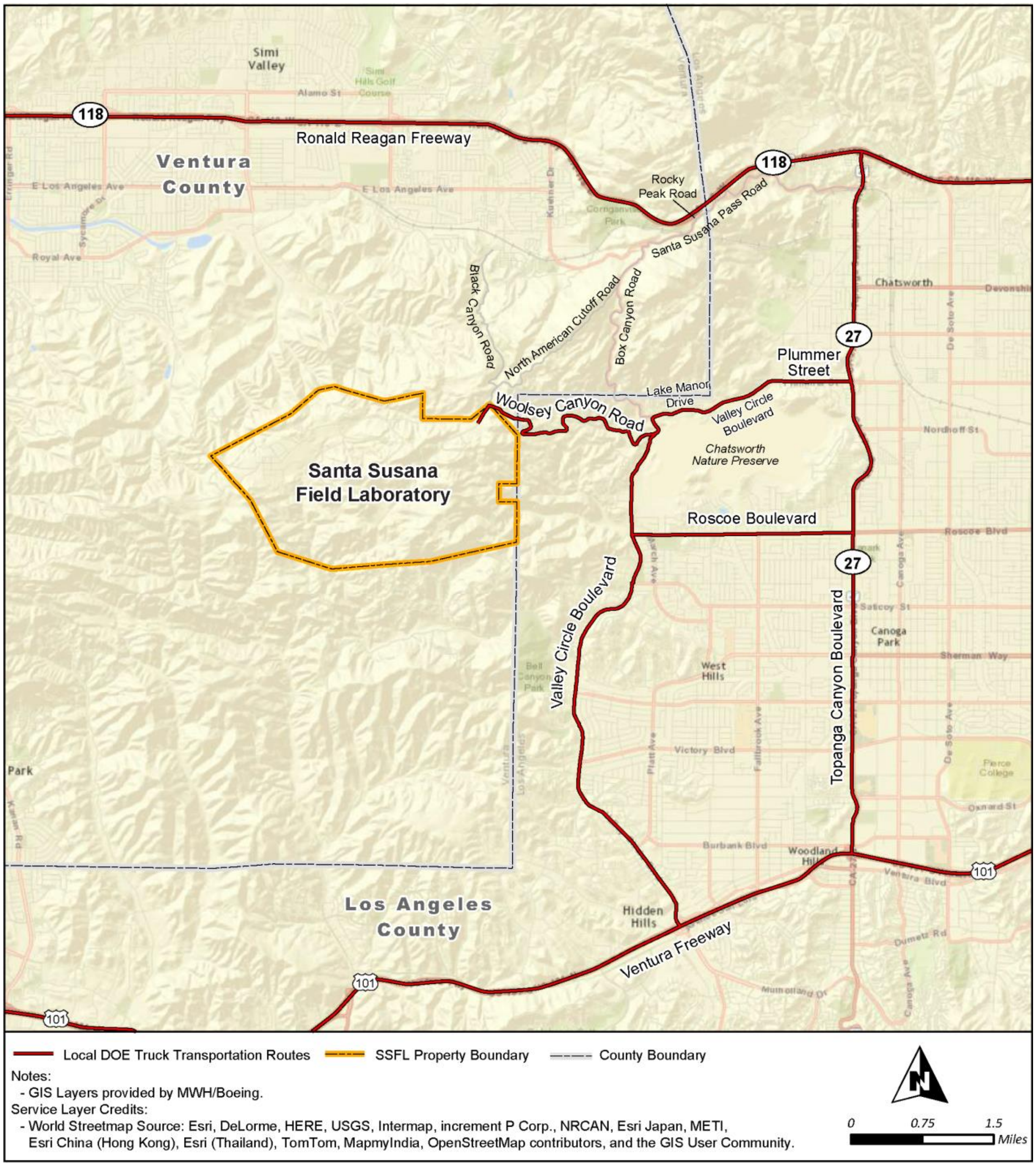


Figure 3–32 Local Transportation Routes for Waste Transportation Vehicles

3.8.2.1 Access Roadways

The SSFL Main Gate is accessible by the following roads:

- 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.

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 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 3–32), 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. Figure 3–29 shows SSFL-vicinity occurrences of recreational centers, parks, schools, and other facilities where congregations of children and persons aged 65 years and older could be expected.

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 segment, 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 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 that 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.

The traffic analysis considers both qualitative and quantitative information regarding the roadway conditions of the offsite local surface roads and freeways. Traffic volumes, level of service (LOS), and crash rates are examined as measures of roadway demand.

LOS is a qualitative measurement of operational conditions 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 3–14** further describes traffic operating conditions for the LOS categories.

Table 3–14 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), 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 3–15**.

As shown, traffic flow on Woolsey Canyon Road is currently stable, as is 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.

Intersection Capacity – Existing Conditions. Based on a traffic study conducted in 2015 (DTSC 2017b, Appendix H), four intersections near SSFL operate at capacity (LOS E) or worse (LOS F) based on signalized intersection control delay and/or volume-to-capacity (V/C) ratio and unsignalized intersection delay for a minor street (for the AM and/or PM peak hours).

Control Delay – the total delay brought about by the presence of a traffic control device (80 seconds and 50 seconds for a signalized and stop-controlled to fail, respectively).

Volume-to-Capacity Ratio (V/C) – a ratio of the traffic demand to signal cycle capacity for signalized intersections; or for roadway segments, the ratio of the traffic demand to the roadway lane capacity. A V/C greater than 1 indicates that the cycle capacity or road segment capacity is fully utilized (approaching unstable conditions).

Table 3–15 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	2,490	LOS A
Valley Circle Blvd [c]	Woosley Canyon to Plummer Street	35	2	0.10	0.55	6,316	LOS D
Plummer Street [d]	Valley Circle Drive to Topanga Canyon Blvd	35	2 to 4	0.10	0.55	5,437	LOS D
Topanga Canyon Blvd [d]	Plummer St to SR 118 (Ronald Regan Freeway)	45	6	0.10	0.55	42,500	LOS D
Topanga Canyon Blvd	Roscoe Blvd to SR 118	45	6	0.10	0.55	47,885	LOS D
Topanga Canyon Blvd	Roscoe Blvd to U.S. Highway 101	45	6	0.10	0.55	46,000	LOS D
SR 118 (Ronald Reagan Freeway) [e]	Junction with Topanga Canyon Blvd	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 Blvd [d]	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 [b]	Victory Blvd to U.S. Highway 101	35	4	0.09	0.55	36,082	LOS E
U.S. Highway 101 (Ventura Freeway) [e]	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] 2017 draft program EIR Traffic Study (DTSC 2017b, Appendix H).

[c] Data source Caltrans 2013.

[d] Data source Urban Crossroads 2011.

[e] Data source Caltrans 2012.

These intersections include:

- Topanga Canyon Boulevard and SR-118 eastbound ramps (signalized; LOS F during both morning and afternoon peak)
- Valley Circle Boulevard and Woolsey Canyon Road (unsignalized; LOS E during morning peak)
- Topanga Canyon Boulevard and US-101 northbound off ramp (unsignalized; LOS F during both morning and afternoon peak)
- Valley Circle Boulevard and US-101 northbound off ramp/Long Valley Road (signalized; LOS E during morning peak).

Based on the referenced analysis (DTSC 2017a), most roadways in the study area have similar baseline LOS and V/C ratios between 2015 and 2018, when DTSC assumed Boeing, NASA, and DOE would start remediation is assumed to start. However, the intersections of Topanga Canyon Boulevard with Victory Boulevard and with Burbank Boulevard both experience a degradation in LOS during the afternoon peak hour (as compared with 2015 conditions), to LOS F and LOS E, respectively.

The draft program EIR Traffic Study (DTSC 2017b, Appendix H) was performed using an analytical procedure known as a Critical Movement Analysis, as described in a Transportation Research Board document known as Circular 212 (TRB 1980). In this Final EIS further analysis was conducted for those roadway segments and signalized intersections that the draft program EIR Traffic Study results showed at capacity or failing (LOS F based on V/C ratio or average control delay) in 2018.

For this Final EIS, DOE used the more recent Highway Capacity Software to perform a more detailed analysis. The analysis in this Final EIS supplements the analysis in the draft program EIR Traffic Study and provides additional detail on traffic operational conditions.

The roadway segment analysis for Woolsey Canyon Road under the baseline condition resulted in a baseline of LOS A with a V/C ratio of 0.17. This roadway segment currently experiences near free-flow conditions except during times when slower moving vehicles use the segment or when bicycle traffic is present. Although bicycle traffic may occur on weekdays and weekends on roads in the SSFL area, it is generally heavier on weekends (DTSC 2017b, Appendix H). This LOS analysis is based on the percent time spent following slower vehicles or bicycle traffic, and considers "no passing" zones on the roadway.

The Highway Capacity Software analysis for the unsignalized intersection at Valley Circle Boulevard and Woolsey Canyon Road resulted in a morning peak hour operating condition of LOS D with a V/C ratio of 0.58. The intersection control delay for this morning peak hour analysis is 32.1 seconds per vehicle, with an operation condition of LOS C during the afternoon peak hour. The signalized intersection analysis for Topanga Canyon Boulevard and the SR 118 eastbound ramps using Highway Capacity Software resulted in an afternoon peak operating condition of LOS D with a control delay of 37.6 seconds. At this intersection, the largest V/C ratio is 1.1 for the exiting freeway traffic turning right onto Topanga Canyon Boulevard. These values represent the existing operating conditions for 2018 using a detailed Highway Capacity Software analysis to support the additional data used in this section.

The California Highway Patrol collects data on collisions in the State, and maintains the information in the Statewide Integrated Traffic Records System. **Table 3–16** provides the collision data for local roadways used for DOE shipments from Area IV.

Table 3–16 Collision Data for Local Roadways

Roadway	*Crashes*	*Crash Rate* [a]	*Fatalities*
Roscoe Boulevard	14	2.65	1
Topanga Canyon Boulevard	59	1.53	3
Valley Circle Boulevard	8	2.04	0

[a] Per 1,000,000 vehicle-miles of travel.
Source: CHP 2014.

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 issued 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 3–17**. 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.

3.8.3 Non-Local Offsite Transportation to Waste Management Facilities

Table 3–18 summarizes 13 representative waste and recycle 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 Gillibrand) are located in developed urban areas where access roadways experience moderate levels of traffic congestion.

Table 3–17 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.

Table 3–18 Representative Waste Management and Recycle Facilities

Site	*Facility Location*	*Level of Roadway Congestion*	*Distance From SSFL (miles)*	*Materials Accepted*			
				Recycled Materials [a]	*Nonhazardous Waste*	*Hazardous Waste*	*LLW/ MLLW*
Representative Waste Disposal Facilities in California							
McKittrick	McKittrick, CA	Low	134		X		
Chiquita Canyon	Castaic, CA	Low	37		X		
Antelope Valley	Palmdale, CA	Low	59		X		
Mesquite	El Centro, CA	Low	270		X		
Buttonwillow	Buttonwillow, CA	Low	120			X [b]	
Westmorland	Westmorland, CA	Low	230			X [b]	
Representative Waste Disposal Facilities Outside California							
US Ecology	Grandview, ID	Low	1,020			X [b]	
Nevada National Security Site	Nye County, NV	Low	350				X
Energy*Solutions*	Clive, UT	Low	780				X
Waste Control Specialists	Andrews, TX	Low	1,160				X
Representative Recycle Facilities [c]							
Kramer Metals	Los Angeles, CA	Moderate	44	X			
Standard Industries	Ventura, CA	Moderate	28	X			
Gillibrand	Simi Valley, CA	Moderate	19	X			

CA = California; ID = Idaho; LLW = low-level radioactive waste, MLLW = mixed low-level radioactive waste; NV = Nevada; TX = Texas; UT = Utah.

[a] Materials such as recyclable metals from buildings with no radiological history.

[b] These facilities may also accept nonhazardous waste.

[c] 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 3–33** shows typical truck routes for soil and debris transport to the representative waste management facilities in California, including the intermodal route to the Mesquite Regional Landfill. Shown on **Figure 3–34** are truck routes to representative recycle facilities.

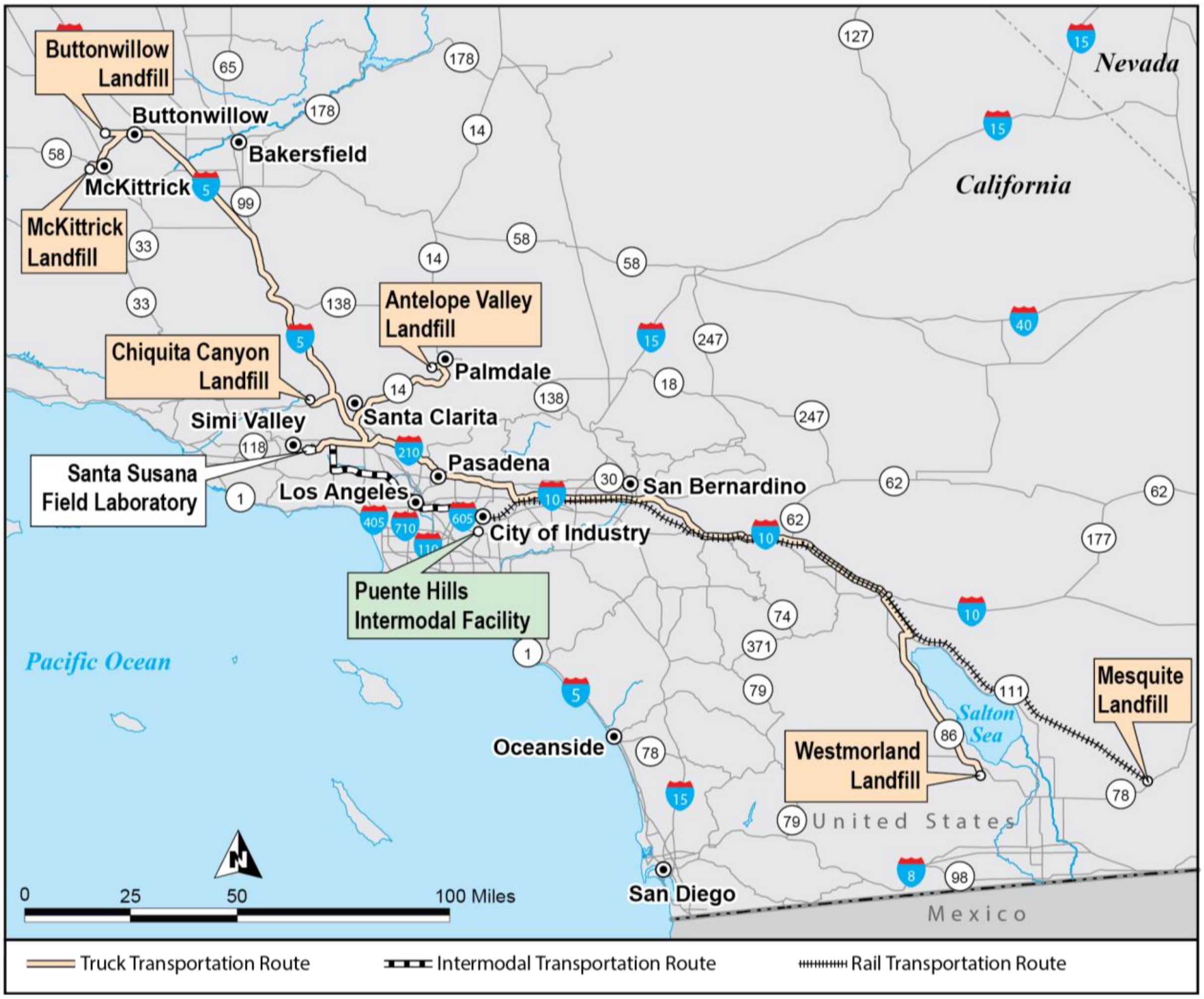


Figure 3–33 Truck and Intermodal (Truck and Rail) Routes to Representative California Waste Management Facilities

In previous years LLW was shipped approximately 330 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 780 miles to Energy*Solutions* (formerly Envirocare, a permitted commercial radioactive disposal facility in Clive, Utah). In this EIS, LLW and MLLW shipment is evaluated for transfer to NNSS, Energy*Solutions*, and Waste Control Specialists (WCS) near Andrews, Texas (approximately 1,160 miles from SSFL). Nonradioactive waste was shipped to the Bradley Landfill in Sun Valley, California, approximately 25 miles east of SSFL. **Figure 3–35** shows typical truck routes to the LLW, MLLW, and hazardous waste disposal facilities in Nevada, Utah, Texas, and Idaho. MLLW includes both LLW and hazardous chemicals. **Figure 3–36** shows intermodal routes to the same out-of-state facilities.

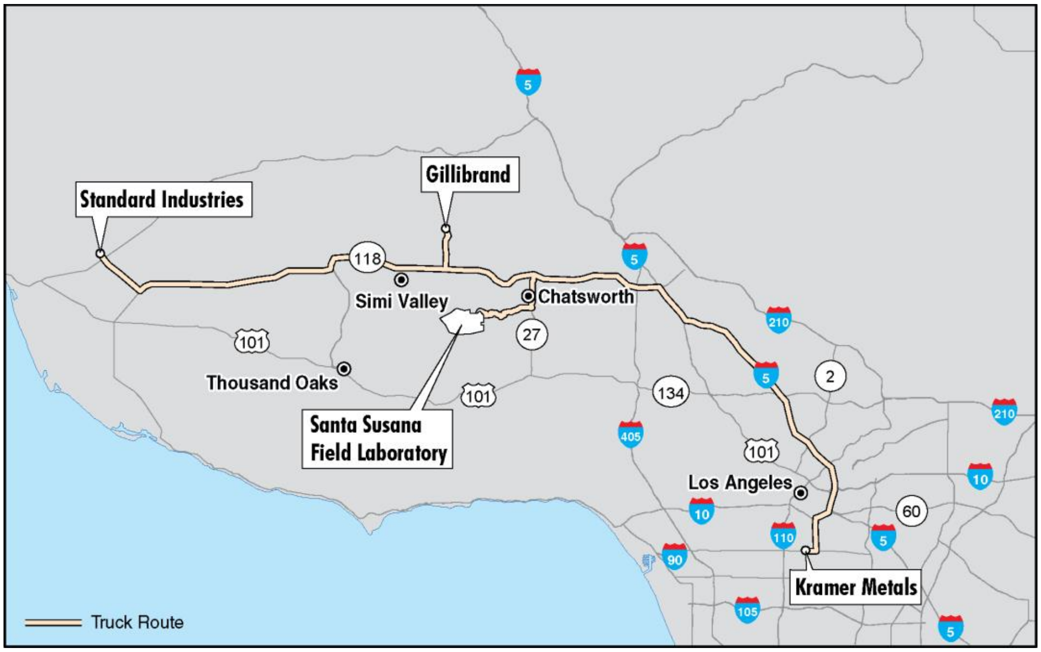


Figure 3–34 Truck Routes to Representative Recycle Facilities

Figure 3–35 Truck Routes to Waste Management Facilities in Nevada, Utah, Texas, and Idaho

Figure 3–36 Intermodal (Truck and Rail) Routes to Waste Management Facilities in Nevada, Utah, Texas, and Idaho

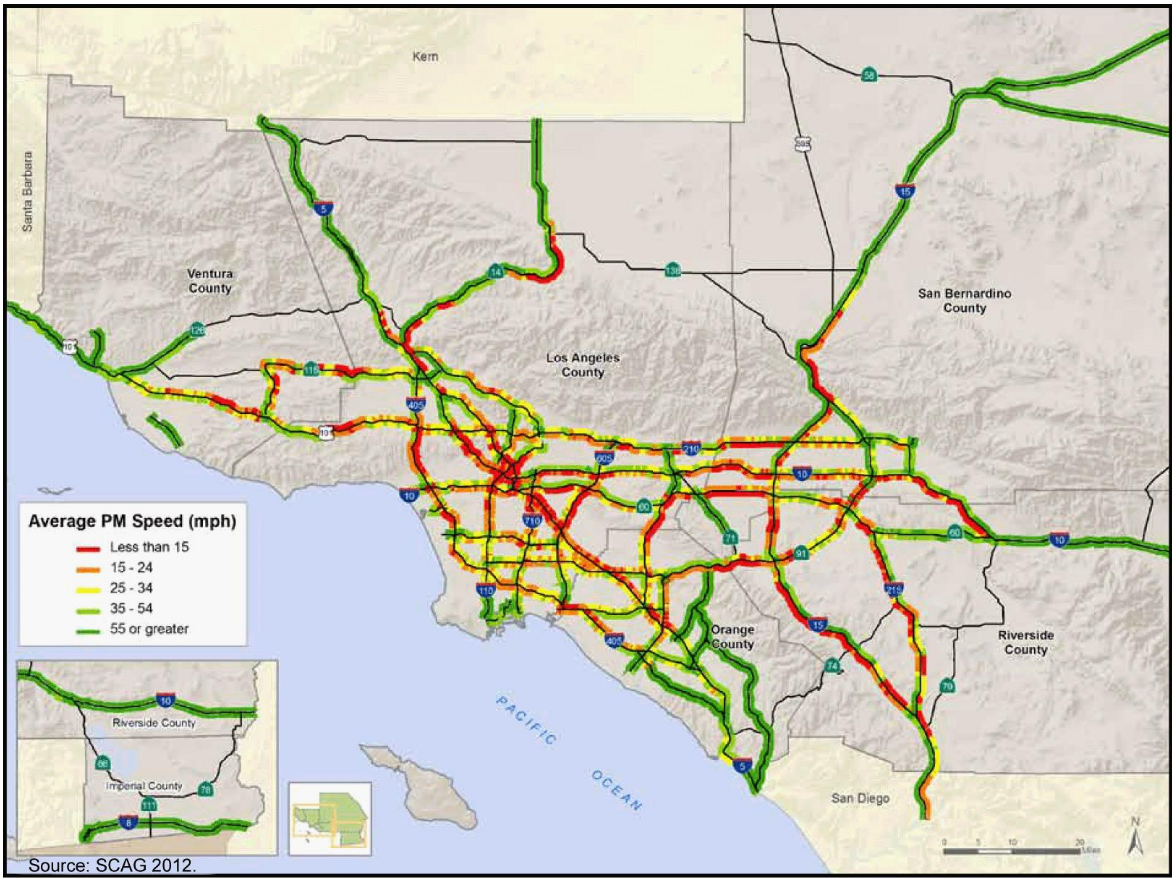
The intermodal routes shown in Figures 3–33 and 3–36 refer to an optional mode of rail transport by which waste would be transported by truck to a location near SSFL where the waste would be transferred to rail cars and then shipped by rail transport to a disposal facility. This optional truck/rail transport system is evaluated for waste shipments to the Mesquite Regional Landfill; the US Ecology facility in Idaho; the Energy*Solutions* and WCS facilities in Utah and Texas, respectively; and NNSS. For intermodal transfer of waste near SSFL, the Puente Hills Intermodal Facility, currently under construction, was assumed for analysis as a representative facility (see Section 3.8.5). For truck/rail transport to NNSS, which does not have direct rail access, a second intermodal location would be required near NNSS where waste would be loaded onto trucks for delivery to the site. For analysis, the Barstow Rail Yard in California, was assumed as a representative secondary intermodal location.

3.8.4 Traffic and Level of Service on Non-Local Highways

Vehicles carrying shipments of waste and recycle material 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 and recycle facilities. These roadways serve intraregional, interregional, and interstate travel and shipping.

Figures 3–37 and **3–38** 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 expected 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.

Figure 3–37 Base Year 2008 Freeway Speed – Afternoon Peak (3pm-7pm)



Source: SCAG 2012.

Figure 3–38 Baseline 2035 Freeway Speed – Afternoon Peak (3pm-7pm)

3.8.5 Railroads

The regional rail network is shown in **Figure 3–39**. Rail routes to representative waste management facilities are shown on Figures 3–33 and 3–36. Burlington Northern Santa Fe Railway and Union Pacific Railroad operate 6 rail yards in the Los Angeles area that offer intermodal transfer services; an additional rail yard is operational in San Bernardino. Also, there are 6 operational intermodal facilities at the ports of Long Beach and San Pedro that are oriented toward transfer of containers from cargo ships. Finally, the Puente Hills Intermodal Facility under construction in the City of Industry, California, was conceived as a location for intermodal transfer of nonhazardous waste from the Los Angeles area to enable rail transport of this waste to a disposal facility. The Puente Hills Intermodal Facility was assumed as a representative intermodal location for truck/rail transport, although other intermodal locations may also be considered as discussed above. The operational date for the Puente Hills facility is uncertain.

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.

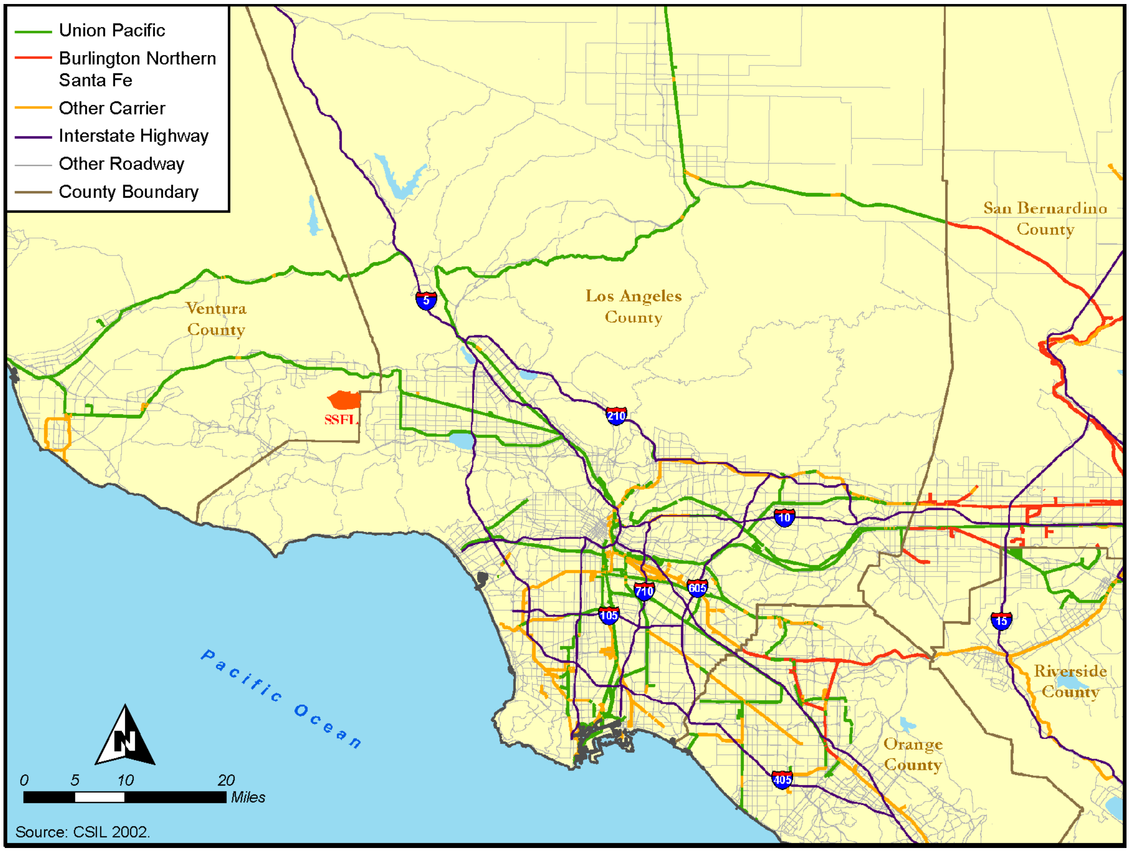


Figure 3–39 Regional Rail Network near the Santa Susana Field Laboratory

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 a.m. and 5 p.m., 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 9 months of 2017, a single worker injury was reported to CAIRS for ETEC (that incident occurred while moving a desk) (Macon 2014, 2018).

3.9.2 Public Radiation Exposure

The potential for radiation exposures among members of the public is published annually in site environmental reports that can be found on DOE's website for SSFL Area IV (see http://www.etec.energy.gov/Environmental_and_Health/Enviro_Monitoring.php).[11] 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.[12]

[11] This website also provides a link to the *Offsite Data Evaluation Report, Santa Susana Field Laboratory, Ventura County, California* (WMH 2007b), which evaluates data collected from 18 field sampling events within 15 miles of SSFL over the past 60 years.

[12] 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.

As indicated in the annual site environmental 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; North Wind 2015d).

To monitor the potential for airborne releases of radioactive material, air samples are collected at two locations in Area IV, including one location at the RMHF. Ambient air samples collected at these locations are analyzed weekly for gross alpha and beta radiation, and annually for isotope-specific activity. As a separate activity, DOE initiated an air monitoring program in February 2018 that includes a meteorological station within Area IV and four air monitors along the perimeter of Area IV (NASA/Boeing/DOE 2017). DOE monitors the four locations along the boundary to provide a baseline of air emissions, including radioactive emissions, from Area IV under current conditions. The system will continue to operate during remediation activities to monitor any potential air pollutant releases of concern.

To monitor the potential for exposures from direct (ambient) radiation, measurements from thermoluminescent dosimeters are obtained quarterly from 6 locations within Area IV as well as 3 offsite locations (at the SSFL Main Gate and at background locations in West Hills and West Lake Village). The California Department of Public Health deploys dosimeters at the same locations for independent monitoring of radiation levels at SSFL and the surrounding area (North Wind 2015d).

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 3–19**, 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.

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.

Table 3–19 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).

Radiation Basics

What is radiation? Radiation is energy. In physics, radiation is the emission or transmission of energy in the form of waves or particles through space or through a material medium. 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).

3.9.3.1 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 3–20**. 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 3–20 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).

Consistent with EPA's recommendation, DOE performed a review of naturally-occurring radionuclides in soil. The results of this study, *Technical Memorandum: Evaluation of Naturally Occurring Uranium and Thorium Decay Chain Radionuclides in Santa Susana Field Laboratory Area IV Soils* (Rucker 2015) will be used in developing the Site Remedial Action Implementation Plan.

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 3–21** for chemicals and **Table 3–22** for radionuclides. Table entries are representative concentrations for each of the sub-areas of SSFL Area IV shown on **Figure 3–40**. In order to focus on the primary chemicals of concern from a health impacts perspective, Table 3–21 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[13] 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 3–21 and 3–22 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 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 3.4.3.6, 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 3.4.3.7 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.

[13] 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 3–21 Mean Chemical Concentrations in Soil at Santa Susana Field Laboratory Area IV and the Northern Buffer Zone

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										
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

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										
Aroclor 1254	0.037	0.012	0.047	0.031	0.040	0.15	0.029	0.043	0.083	0.23	0.017
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 3–22 Radionuclide Data for Soil at Santa Susana Field Laboratory Area IV and the Northern Buffer Zone

Constituent	Sub-area									Maximum Value Area IV and NBZ (pCi/g) [a]	UCL95 on the Mean (pCi/g) [b]	RBSL Value (pCi/g) [c]	LUT Value (pCi/g) [d]
	3	5A	5B	5C	5D	6	7	8	NBZ				
	Number of Samples Exceeding Field Action Levels [a]												
Americium-241					1			2		0.0589	0.004	2.3	0.039
Cesium-137		8	14	2	8	93	154	8	4	196	0.52	0.061	0.225
Cobalt-60			1	1		1	1			0.048	0.0008	0.033	0.0363
Curium-243/244			1						1	0.065	0.002	0.35	NL
Nickel-59		1								23.9	-0.075	737	0.875
Neptunium-237										NR	0.002	0.14	NL
Plutonium-238		1			1					0.049	0.002	4.4	0.0254
Plutonium-239/240				2	2	3	4	2	1	0.187	0.004	3.9	0.023
Strontium-90	1	3	5	1	28	16	61	27	11	21.3	0.147	4.2	0.117
Tritium			1							7.38	0.44	0.24	NL

LUT = Look-Up Table; NBZ = Northern Buffer Zone; NL = not listed; NR = not reported; pCi/g = picocuries per gram; RBSL = risk-based screening level; UCL95 = 95 percentile upper confidence level.

[a] Results reported 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).

[b] UCL95 on the mean is the 95 percent upper confidence limit on the mean of the population (i.e., there is 95 percent confidence that the true mean is less than the UCL95).

[c] RBSLs are concentrations based on a suburban residential scenario in which exposure is through direct inhalation, incidental ingestion, and external exposure from/to soil and a 1×10^{-6} risk of developing a cancer. They do not include the suburban resident garden pathway. The RBSLs were obtained from the RAIS online rad calculator found at "https://rais.ornl.gov/cgi-bin/prg/PRG_search?select=rad" (see Appendix G).

[d] Values are from the Draft Provisional Radiological Look-Up Table Values (DTSC 2013a).

Notes:

– This summary list of COC analytes is based on all constituents that passed background, frequency of detection, and data quality assessment screens as documented in the Radionuclide Data Assessment Report (Leidos 2018b).

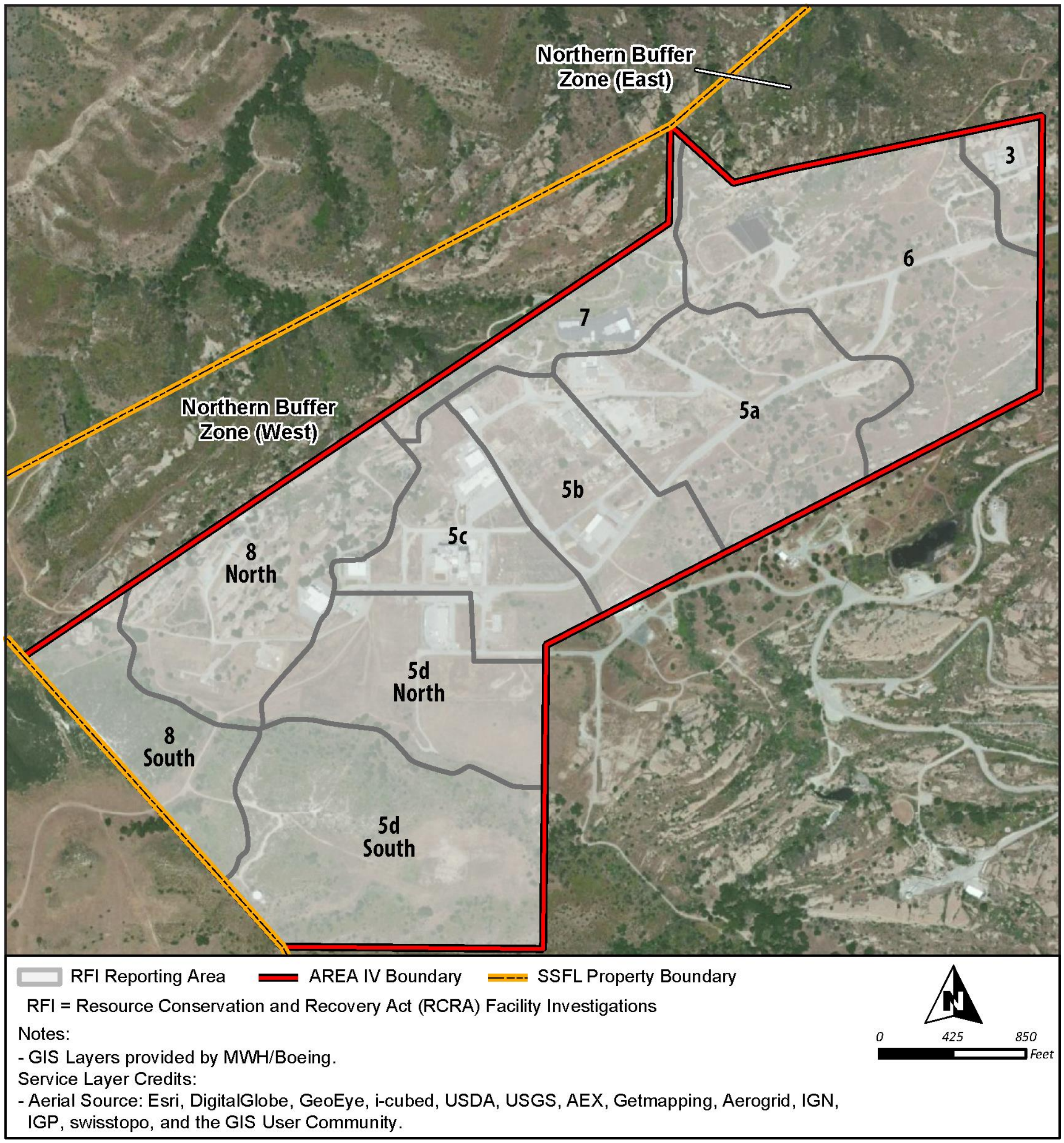


Figure 3–40 Santa Susana Field Laboratory Area IV Soil Characterization Sub-areas

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 Offsite Chemical and Radiological Characterization

In addition to conducting extensive studies to map the chemicals and radioactivity on SSFL Area IV and the NBZ, DOE has conducted monitoring of adjacent and nearby offsite locations. Air monitoring is discussed in Section 3.9.2. Surface water discharge monitoring is discussed in Section 3.3. Groundwater contamination movement is discussed in Section 3.4. A summary of the offsite monitoring results is provided below.

Offsite Monitoring

Boeing, NASA, and DOE jointly issued an *Offsite Data Evaluation Report, Santa Susana Field Laboratory, Ventura County, California* in December of 2007 (MWH 2007b) in which they evaluated the data collected from 18 field sampling and analysis events within 15 miles of SSFL over the past 60 years. Offsite properties included American Jewish University Brandeis-Bardin Campus, Sage Ranch Park, Black Canyon, Woolsey Canyon, West Hills, Dayton Canyon, Bell Canyon, and Ahmanson Ranch. The media sampled included soil vapor, soil, sediment, groundwater, surface water, springs and seeps, bedrock, vegetation, municipal water, and debris. Over 4,000 samples representing over 110,000 analyses of chemicals or radionuclides were evaluated.

The offsite results for chemical and radiological data were evaluated for significance based on comparisons to suburban residential (including garden pathway) risk-based or agency-published screening levels and comparison to background levels considered appropriate for the time. The data results were deemed not significant if:

- Concentrations were all below the screening levels; or
- Concentrations above screening levels were not repeatable, persistent, and/or limited by surrounding data with results less than screening levels. Concentrations in this category may or may not be related to SSFL operations.

The results of the offsite data evaluation showed:

- The offsite sample results for dioxins, PCBs, perchlorate, TPH, and radionuclides were judged to be not significant based on the definitions above.
- The offsite sample results for metals and PAHs were not significant except in the northern drainage area (north of Area I) where a DTSC-approved action was underway to remove soil, construction debris, and clay pigeon debris. The action included removal of down-drainage sediments.
- Offsite sample results for volatile organic compounds were not significant except for the presence of volatile organic compounds in groundwater and soil vapor in the area northeast of SSFL (north of the main entry gate in Area I). The areas were to continue to be evaluated and subject to future work.

DTSC conducted an evaluation of the radiological and chemical data from investigations conducted at and near the SSFL and on the American Jewish University, Brandeis-Bardin Campus property. The results of the evaluation were reported in a 2017 technical memorandum (DTSC 2017d). The data reviewed included historical data collected at Brandeis-Bardin during a multi-media study in 1992 and 1994 under the oversite of EPA. The review also included data collected historically by Brandeis-Bardin's consultant, Joel Cehn, the American Jewish University - Brandeis-Bardin data collected in an investigation conducted in 2016 by Tetra Tech., as well as the Area IV radiological characterization data (HGL 2012b) and chemical characterization data (CDM Smith 2017) collected in support of DOE's remediation effort. The evaluation concluded:

- While chemicals within the undeveloped portions of the Brandeis-Bardin property bordering SSFL may exceed background or detection limit-based LUT values, they do not exceed the respective risk-based screening levels….and most of the LUT exceedance results….slightly exceed the low-level LUT values, likely because they do not have the level of accuracy and precision needed to make definitive comparison to an LUT value. Chemicals investigated within the active Brandeis-Bardin Campus areas are within the range of local background.
- Levels of radionuclides at the Brandeis-Bardin property are within the range of local background.
- The levels of chemicals and radionuclides at Brandeis-Bardin Campus are safe for human health, as determined using risk-based screening levels derived using state and Federal standards and guidelines.
- The Brandeis-Bardin Campus is safe for use by campers, visitors, students, faculty, administrators or staff.
- Contamination at SSFL does not pose a health threat to users of Brandeis-Bardin Institute, or other off-site areas.
- Any credible data demonstrating a threat to human health at Brandeis-Bardin or any other areas from SSFL would result in DTSC taking immediate actions to stop that threat.

Most of the detections for chemicals and radionuclides on the Brandeis-Bardin property were from samples taken during the 1992/1994 multi-media study from areas that were subsequently acquired by Boeing in 1997 to create the Northern Buffer Zone and are no longer part of the Brandeis-Bardin property.

3.9.5 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).[14]

[14] Lung and bladder cancers tend to be cancers strongly associated with other risk factors such as smoking and non-radiation-occupational exposures.

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[15] 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).

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.[16] 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).

[15] A statistical term describing how interactions of certain variables may lead to inaccurate conclusions.

[16] 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).

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).

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 3.9.6. 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).[17]

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 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.[18] 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

[17] 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.

[18] 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.

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.[19] The published information, however, does not provide an association of these rates with their causes (e.g., specific facility operations or human lifestyles). **Table 3–23** 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 2010 through 2014. Also shown are the ranges in mortality and incidence rates for those years across all California counties (NCI 2017). 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 the thyroid cancer incidence rate in Ventura 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.

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 3–23 are for all races and ethnicities and all sexes and ages. To illustrate the more detailed data, **Table 3–24** lists female breast cancer for all ages and the races and ethnicities included in the National Cancer Institute database for the years 2010 through 2014. 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 Asian or Pacific Islander women. Over these same years, the incidence rate of female breast cancer in Los Angeles County was higher than the California average for all races and ethnicities, and White Hispanic, White Non-Hispanic, Black, all Hispanic, and Asian or Pacific Islander Women. The incidence rate in Ventura County was higher than the California average for all races and ethnicities, and White Non-Hispanic, Black, American Indian or Alaskan Native, and Asian or Pacific Islander Women. These morality and incidence rates, however, 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.

[19] 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.

Table 3–23 Cancer Mortality and Incidence Rates[a] for the United States, California, and Los Angeles and Ventura Counties, 2010 through 2014

Location	All Cancers	Thyroid	Breast	Lung and Bronchus	Leukemia	Bladder	Oral Cavity and Pharynx
Mortality Rates							
United States	166.1	0.5	21.2	44.7	6.8	4.4	2.5
California	149.7	0.6	20.4	33.4	6.4	4	2.4
Los Angeles County	145.1	0.7	21.1	29.5	6.4	3.5	2.3
Ventura County	142.8	0.6	20	28.2	7.2	3.7	1.9
California County range [b]	91.1–189.7	0.4–0.8	14.8–30.7	25.5–56.2	4.7–8.7	2.7–5.8	1.9–3.8
Incidence Rates							
United States	443.6	14.3	123.5	61.2	13.6	20.5	11.5
California	409.5	12.7	120.7	44.6	12.6	17.8	10.3
Los Angeles County	388.3	13.4	114.7	38.3	11.9	16	9.1
Ventura County	419.2	18.5	128.8	41.1	12.7	17.9	11.1
California County range [b]	325.3–484.5	7.1–18.5	82.7–147.1	23.9–74.7	11.7–21.5	11.9–35.6	8.6–19

[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 2017.

Table 3–24 Female Breast Cancer Rates[a] (All Ages) for the United States, California, and Los Angeles and Ventura Counties, by Race and Ethnicity,[b] 2010 – 2014

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	21.2	15.2	21.2	29.2	14.4	10.8	11.3
California	20.4	15.5	23.3	30.2	14.7	8.2	12.6
Los Angeles County	21.1	25.8	25.6	32.2	15.1	5.9	13.9
Ventura County	20	12.2	23.2	(d)	11.6	(d)	13.2
California county range [c]	14.8–30.7	11.7–17.8	17.9–31.7	23.4–42.3	10.9–17	5.9 [e]	9.6–21.5
Incidence Rates							
United States	123.5	93.5	128.6	122.8	92.3	72.7	90.2
California	120.7	93.4	139	123	89.1	46.3	95.7
Los Angeles County	114.7	86	144.8	126.8	83	19.2	98.8
Ventura County	128.8	93.4	147.5	128.8	89.1	66.3	99.9
California county range [c]	82.7–147.1	81.4–156.7	87.1–166.9	88.8–208.2	76.1–146.9	19.2–181.5	53.5–125.4

[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 Los Angeles County had data meeting the reporting threshold.
Source: NCI 2017.

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).

A 2005 study addressed the potential for increased cancer incidence and mortality in a cohort of aerospace workers employed at SSFL between 1950 and 1993 concluded that workers who were highly exposed to mineral oils experienced an increased risk of developing or dying from cancers of the lung, melanoma, and possibly from cancers of the esophagus and stomach and non-Hodgkin's lymphoma and leukemia (Zhao et al. 2005). A 2006 follow-up study to the 1999 University of California at Los Angeles study addressed the effects of hydrazine exposure in SSFL aerospace workers. The conclusion was that the findings were consistent with the earlier study and suggested that exposure to hydrazine increased the risk of incidence of lung cancer. An increased risk to colon cancer was also reported (Ritz et al. 2006).

In 2006, another study addressed mortality among radiation workers who were employed for at least 6 months at Rocketdyne/Atomics International for the years 1948 through 1999. Lifetime exposures were derived from company records and linkages with national data to address occupational exposures from other sources. There was a nonsignificant increase in leukemia (excluding chronic lymphocytic leukemia), which was consistent with other radiation studies, as well as a nonsignificant increase in chronic lymphocytic leukemia, a malignancy not associated with radiation exposure. The study found that radiation exposure had not caused a detectable increase in cancer deaths in the evaluated population, but cautioned that the study was limited by the small sample size and relatively low cumulative occupational doses (Boice et al. 2006a). Also in 2006, a study was reported that evaluated mortality among Rocketdyne workers who tested rocket engines during the same period. Nonsignificant associations were seen between kidney cancer and TCE, lung cancer and hydrazine, and stomach cancer and years worked as a test stand mechanic. No trends over the exposure categories were statistically significant. The conclusion was that work at the SSFL rocket engine test facility or as a test stand mechanic was not associated with a significant increase in cancer mortality overall or for any specific cancer (Boice et al. 2006b).

3.9.6 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.). Material to be disposed of in this waste category includes moderate-risk soil, as well as non-waste soil, identified in Chapter 2.

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 3–25**.

DOE suspended D&D and remediation operations at Area IV in May 2007, but environmental monitoring and characterization programs have continued (Boeing 2014c).

Table 3–25 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 [b]	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.

[b] Materials designated in Chapter 2 as moderate-risk soil and non-waste soil would be managed in this category.

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, an Interim Status (Part A) facility under RCRA, 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. The 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. The HWMF 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 3–26**. 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. The landfills and LLW and MLLW disposal facilities are engineered to retain the waste and prevent exposure of the surrounding community to hazardous materials. Each facility has waste acceptance criteria to ensure that this objective will be met. Soil and other wastes removed from Area IV and the NBZ will be characterized to ensure compliance with the waste acceptance criteria for the facilities receiving the materials.

Table 3–26 Categories of Solid Waste Expected to be Generated During Area IV Remediation Activities

Waste Category	*Typical Materials*
Nonhazardous [a]	Soil/Demolition debris [b]
Hazardous	Soil [c]/Demolition debris [b, d]
LLW – radioactive contamination only	Soil/Demolition debris [b]
MLLW – radioactive and hazardous material	Soil [c]/Demolition debris [b, d]

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.

[a] Materials designated in Chapter 2 as moderate-risk soil and non-waste soil would be managed in this category.

[b] Including materials such as asphalt, concrete, steel, wire, and machinery.

[c] 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.

[d] 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 following 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 waste from SSFL remediation and D&D activities.

Candidate nonhazardous waste landfills within California 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. Two additional nonhazardous waste landfills outside California were also identified because they are capable of receiving waste by rail delivery. 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.

Table 3–27 lists the Class II landfills under consideration for disposal of nonhazardous waste from Area IV and the NBZ. **Table 3–28** lists the Class III and unclassified (inert) waste landfills under consideration within California and nearby states. 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.

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 3–27 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	134	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 3.5 million tons of remaining disposal capacity as of September 2017. Waste acceptance limit of 3,500 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, 2017.

Table 3–28 Candidate Class III and Nonhazardous Waste Disposal Facilities

Site [a]	*Location*	*Road Distance (miles)* [b]	*Waste Types Accepted and Services* [c]	*Disposal Capacity*
California 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 is 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				
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.	45,450,000 cubic yards as of September 2017. Waste acceptance limit of 8,000 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.	13,800,000 cubic yards as of August 2017 . Waste acceptance limit of 5,100 tons/day.
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.
La Paz County Landfill (Republic Services)	Parker, Arizona	300	Nonhazardous waste landfill. Accepts solid nonhazardous waste including residential waste, construction and demolition debris, wastewater treatment plant sludge, and asbestos. Can except rail delivery, with transfer from railcars to trucks at a rail siding near the landfill, (e.g., in Parker, Arizona) for delivery of the waste to the landfill.	22,735,000 cubic yards as of December 15, 2011.

Site [a]	Location	Road Distance (miles) [b]	Waste Types Accepted and Services [c]	Disposal Capacity
ECDC Environmental Landfill	East Carbon, Utah	720	Nonhazardous waste landfill. Accepts solid hazardous waste including contaminated soil, municipal solid waste, construction and demolition debris, dry industrial waste, and wastewater treatment sludge. Can accept waste by rail direct rail delivery to the landfill.	About 200 million cubic yards.

[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: Republic Services 2017, 2018; SDLAC 2014; Waste Management 2014; WCI 2014a, 2014b; WMI 2014, 2017.

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.[20] 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,[21] 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.

Table 3–27 lists four California Class II 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 3–27 lists one representative facility and three additional facilities). Similarly, Table 3–28 lists six California Class III and unclassified (inert waste) landfills as well as two out-of-State nonhazardous waste 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 more than two decades, in which time the landfill could be open, and because the landfill is designed and intended for receipt of nonhazardous waste by direct rail delivery (see Appendix D, Section D.4).[22]

Figure 3–41 shows Class II, Class III, and unclassified waste facilities located within 150 road miles of SSFL. **Figure 3–42** 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.

[20] 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).

[21] The Mesquite Regional Landfill is listed in Table 3–26 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 is delayed indefinitely because of reduced nonhazardous waste generation rates in the Los Angeles area. Additional large capacity facilities capable of receiving nonhazardous waste by intermodal rail delivery include the La Paz Landfill in Arizona and the ECDC Landfill in Utah; both landfills are operated by Republic Services. The La Paz Landfill has a disposal capacity of about 25.4 million cubic yards and the ECDC Landfill has a disposal capacity of about 300 million cubic yards.

[22] For analysis, this EIS evaluates environmental impacts from transport of waste to the Mesquite Regional Landfill using the transport distance to the US Ecology facility in Idaho (about 1,020 miles from SSFL). Impacts from shipment to US Ecology would bound those from Mesquite, as well as those from shipment to the La Paz County Landfill in Arizona and the ECDC Environmental Landfill in Utah, respectively 300 and 720 miles from SSFL. The La Paz County Landfill can accept waste by rail delivery assuming transfer to trucks at a rail siding near the landfill. The ECDC Environmental Landfill can accept waste by direct rail delivery. See Table 3–29.

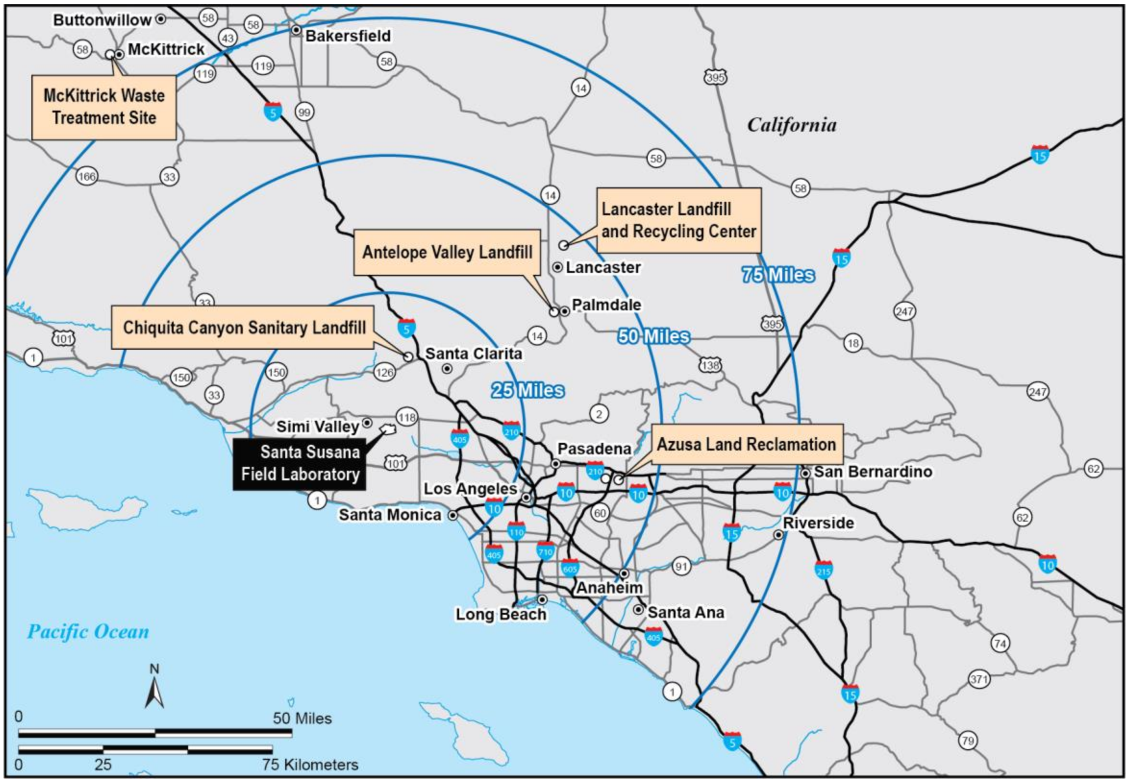


Figure 3–41 Candidate Nonhazardous Waste Landfills in the Vicinity of the Santa Susana Field Laboratory

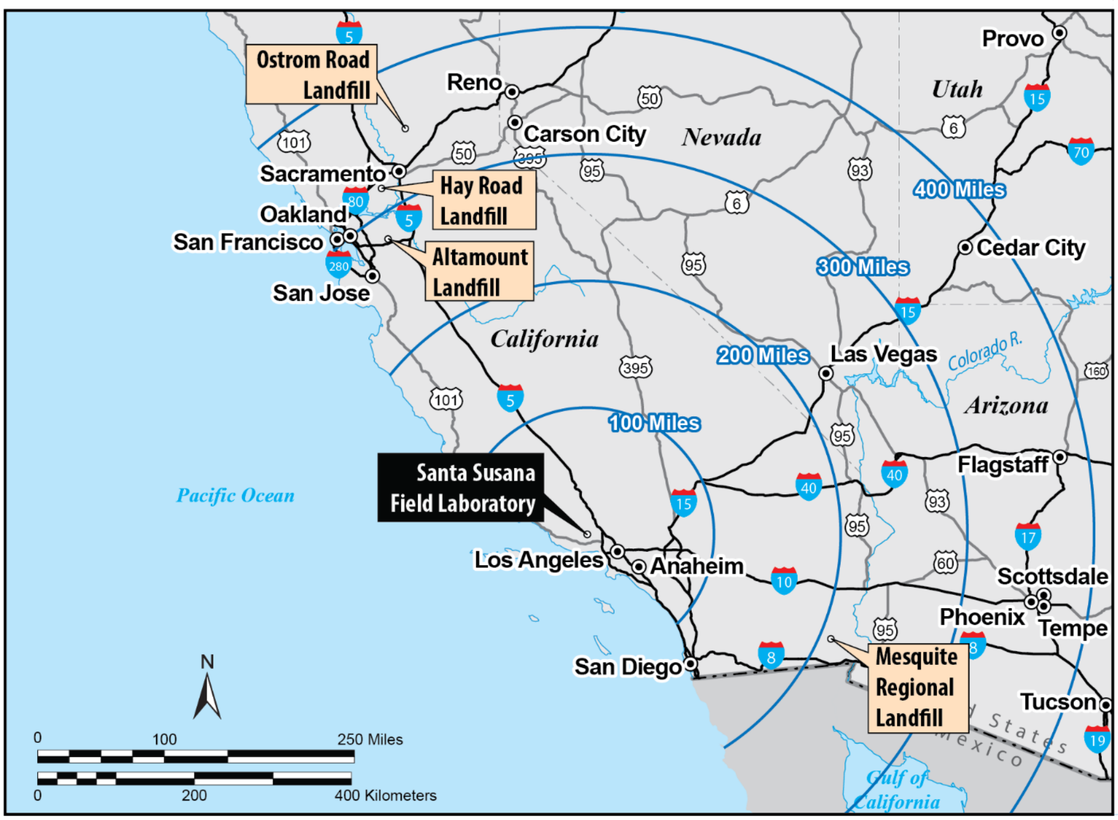


Figure 3–42 Candidate Nonhazardous Waste Landfills beyond the Vicinity of the Santa Susana Field Laboratory

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 3–28 also provide recycling services for this material; a number of standalone recycling facilities also exist in the vicinity of SSFL. **Table 3–29** 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 3–29 Candidate Nonhazardous Material Recycling Facilities[a]

Site	*Location*	*Approximate Road Distance (miles)*	*Materials Recycled*
Kramer Metals	Los Angeles, California	44	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	19	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 or large quantities of LLW or MLLW. **Table 3–30** lists three candidate hazardous waste landfills located in California, one of which is currently not operating and another that is currently unable to accept waste from SSFL; and five additional candidate hazardous waste landfills located in nearby states within 1,100 miles of SSFL. **Table 3–31** lists four candidate radioactive waste disposal facilities, all located outside California.[23] The tables also indicate the representative facilities selected for detailed analysis. The candidate landfills and disposal facilities are shown in **Figures 3–43** and **3–44**. 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.[24]

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 3–30 and 3–31. 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 3–30). 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. 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.

[23] In Table 3–28, the Waste Control Specialists facility in Andrews, Texas, accepts hazardous waste for disposal as well as LLW and MLLW.

[24] 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 3–30 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.	1.0 million cubic yards are available as of July 2017, 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 waste, TENORM waste, and waste containing radium that is not defined as NORM or TENORM under Colorado regulations. 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	1,160	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 under 10 CFR 20.2002 or compatible Agreement State regulation it can be disposed of at a facility not licensed by the U.S. Nuclear Regulatory Commission or an Agreement State under 10 CFR Part 61 or compatible 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, 2017; Florer 2017; Gordon 2014; Halstrom 2014; Hubbard 2014; WCS 2016.

Table 3–31 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 originally licensed/permitted capacity, with a remaining space as of August 24, 2016, of about 4,172,000 cubic yards of LLW and about 358,000 cubic yards of MLLW. 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	350	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. 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]
Waste Control Specialists	Andrews, Texas	1,160	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 "Waste Control Specialists" listing in Table 3-30, Candidate Hazardous Waste Facilities).	2,100,000 cubic yards in the DOE LLW and MLLW facility, including 1,200,000 cubic yards of bulk waste and 900,000 cubic yards of waste in containers.
Additional LLW or MLLW Facilities				
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).

[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; Rogers 2016; WCS 2016.

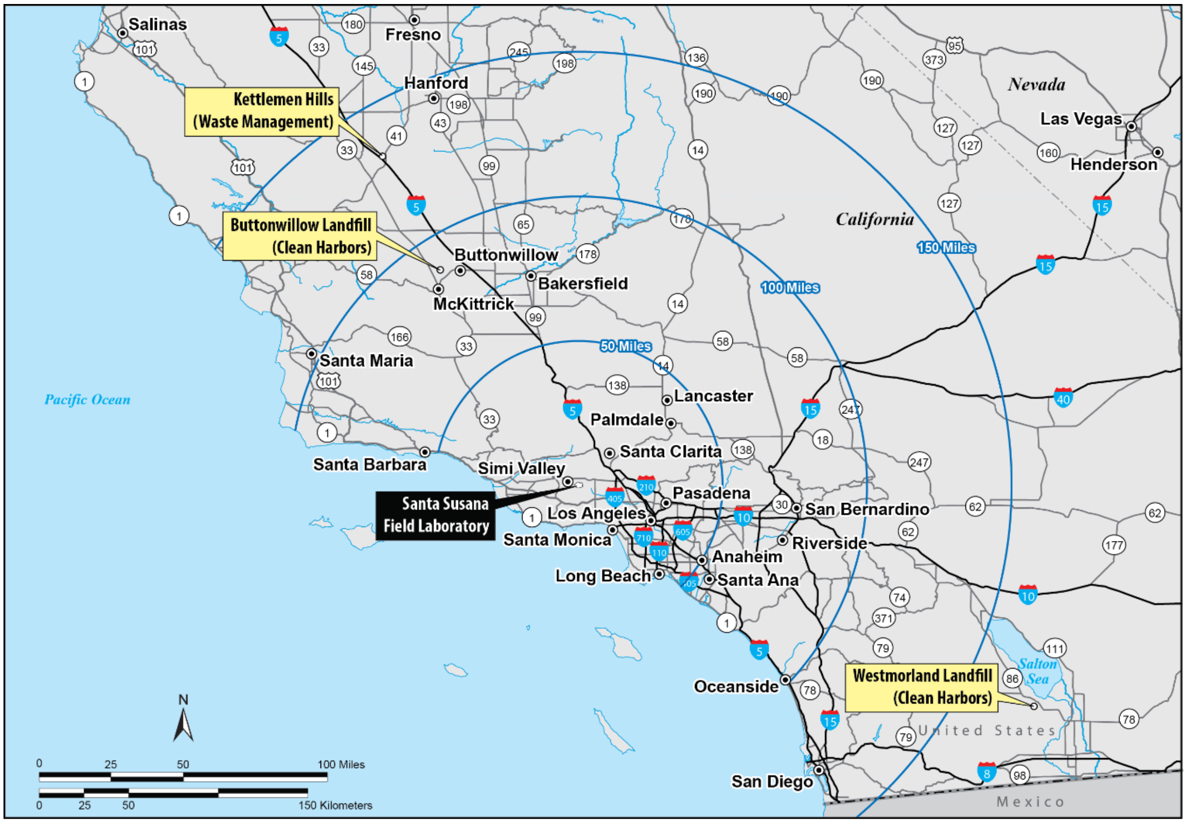


Figure 3–43 Candidate Hazardous Waste Landfills in California

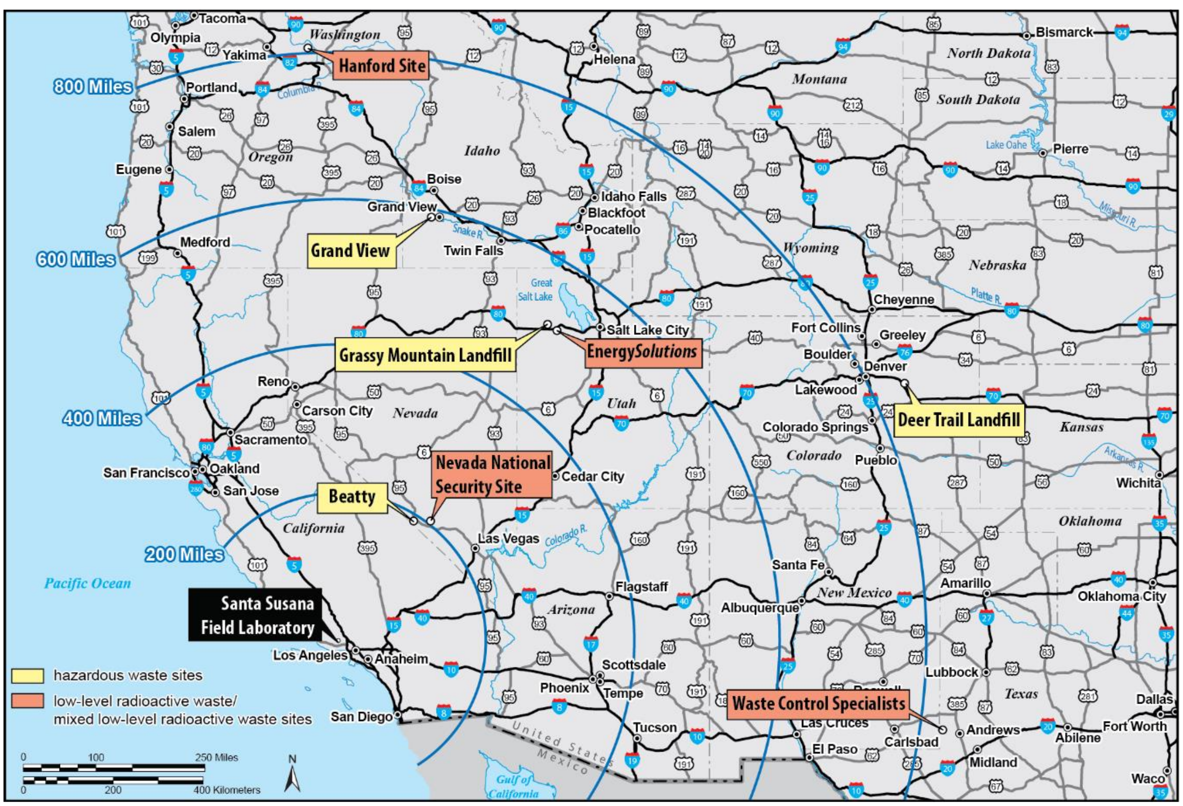


Figure 3–44 Candidate Hazardous Waste Landfills and Radioactive Waste Disposal Sites Located Outside of California

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[25] of a proposed Federal undertaking[26] 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.

[25] 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).

[26] 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 Order 13007, *Indian Sacred Sites*; 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 3–45**, SSFL is located near the boundary of the Chumash, Fernandeño Tataviam, and Gabrielino Tongva ethnographic groups. Each tribe had its own language with multiple dialects. The APE appears to be located within what is commonly considered Chumash territory, near the borders of Fernandeño Tataviam and Gabrielino Tongva territories (NAHC 2015), but the boundaries depicted in Figure 3–45 are conceptual, based in part on linguistic divisions and are disputed by some tribes. Spanish mission settlements disrupted and displaced tribes, making the reconstruction of boundaries a complex task beyond the scope of this EIS. 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 a common 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).

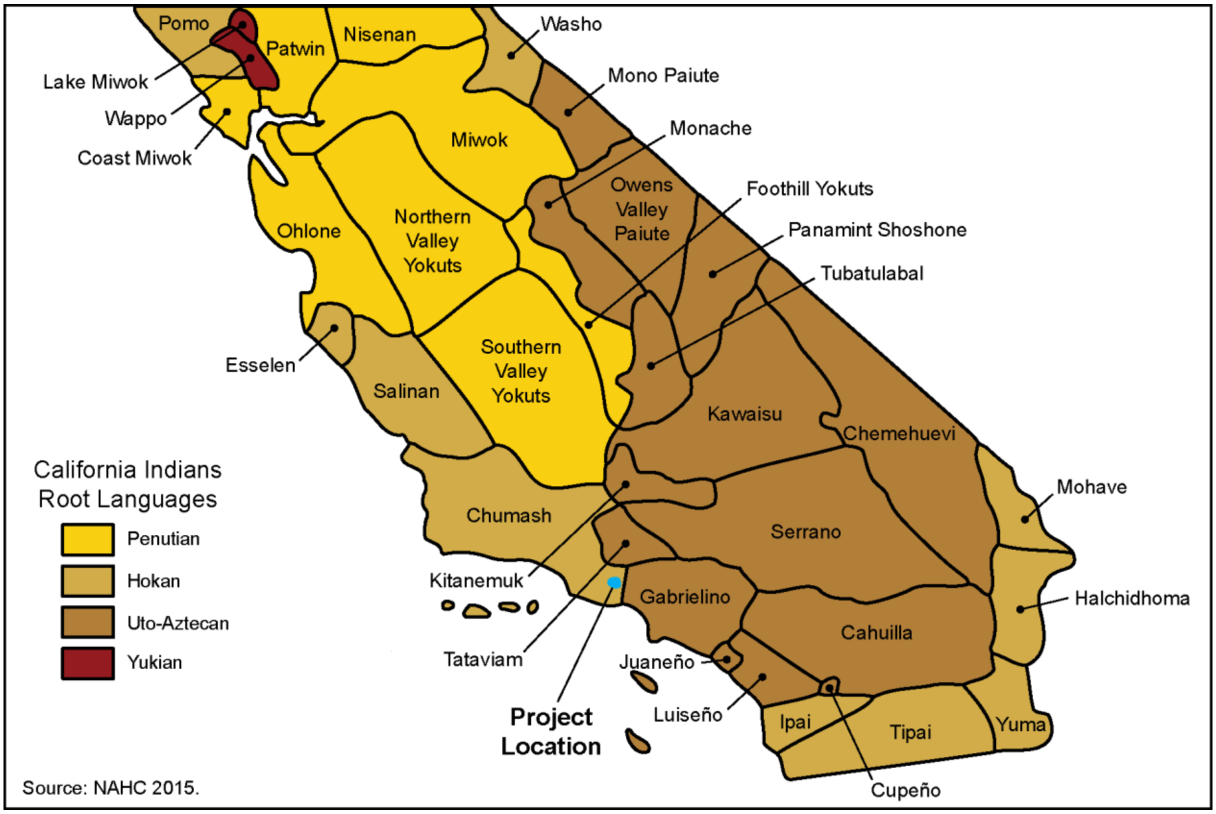


Figure 3–45 Historic Linguistic Boundaries in Relation to Santa Susana Field Laboratory

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 the Tongva 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 (Mealey 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, funded nuclear energy research that primarily involved testing of small pilot-scale reactors on a 90-acre portion of Area IV owned by Rocketdyne. 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 272 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 (except for the portion owned by the Federal Government), 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 review of cultural resources, 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 3–32**, cultural resources at SSFL have been the subject of many investigations by cultural anthropologists, archaeologists, and cultural resource managers since the 1950s.

Table 3–32 Summary of Previous Studies within the Region of Influence

Resource summaries directly relevant to SSFL cultural resources	5 studies, from 1985 to 2017
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	11 studies, from 1953 to 2016
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 3–33**, archaeological evidence is common in the vicinity of SSFL (Appendix F contains a complete listing of archaeological sites). Numerous archaeological sites have been located within the ROI, which includes SSFL and land within a 1-mile radius of SSFL. Prehistoric-era rockshelters with artifacts, features, or rock art dominate the recorded sites, but other prehistoric-era site types include lithic scatters, lithic quarries, bedrock milling stations, and midden[27] deposits. Historic (post-contact) sites are not as common in the ROI, but there are a few sites with the remnants of historic structures and/or historic debris (e.g., bottles, ammunition).

[27] A midden is a deposit containing shells, animal bones, and/or other refuse that indicates an area of past human activity.

A survey of the APE (Area IV and the NBZ) yielded 26 archaeological sites and 53 prehistoric-era isolates (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 in the APE reflects the rugged nature of the topography. Isolated artifacts found throughout Area IV and the NBZ indicate the widespread use of the area during pre-contact times. Only one site recorded in the APE has a historic component, consisting of a rock shelter with historic-era artifacts, which suggests a more limited use of the area during post-contact times.

DOE developed and implemented an extended phase 1 testing program to evaluate the NRHP eligibility of 10 archaeological sites in the APE. The 10 sites were chosen based on: (1) the extent of the contamination known at the time the testing program was designed; (2) sites where NRHP eligibility was unclear; and (3) consultation with Native American representatives. This program of limited subsurface excavation was developed in consultation with SHPO and EIS cooperating agencies, including the federally recognized Santa Ynez Band of Chumash Indians, as well as non-federally recognized tribes. Based on this evaluation program DOE determined that 8 of the 10 archaeological sites were individually eligible for inclusion on the NRHP and 2 sites were individually ineligible for listing on the NRHP.

Table 3–33 Summary of Known Archaeological Sites and Isolates within the Region of Influence[a]

Cultural Resource Type [b]	*Area IV*	*NBZ*	*Other SSFL Locations*	*Outside SSFL*
Native American, eligible	7 [c]	–	20 [d]	–
Native American, not eligible	2 [c]	–	–	–
Native American, unevaluated	6	10	81	18
Native American isolate, not eligible	15	38	60	5
Historic, eligible	1 [c, e]	–	–	–
Historic, not eligible	–	–	–	–
Historic, unevaluated	–	–	7 [c]	1
Historic isolate, not eligible	–	–	–	–
Traditional	See note f	See note f	See note f	Unknown
Total Recorded Resources [b]	**16 sites 15 isolates**	**10 sites 38 isolates**	**108 sites 60 isolates**	**19 sites 5 isolates**

"–" = no resources currently recorded; NBZ = Northern Buffer Zone.

[a] The region of influence consists of SSFL and land within a 1-mile radius of SSFL. This summary is based on a June 2014 record search, augmented by research on file at SSFL through 2017; refer to Appendix F for a complete listing of known cultural resources.

[b] Resource identification, determination of *National Register of Historic Places* eligibility (including State Historic Preservation Officer consultation), and description of traditional cultural resources is ongoing.

[c] DOE determined that 8 sites are individually eligible and 2 sites are individually ineligible for listing on the NRHP based on limited subsurface testing (Leidos 2015).

[d] Burro Flats Painted Cave and associated locations and features are listed on the *National Register of Historic Places*.

[e] Some historic sites also contain Native American artifacts.

[f] The Santa Susana Sacred Sites and Traditional Cultural Property 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, the NRHP-listed Burro Flats Painted Cave site complex (CA-VEN-1072; NRHP #76000539, listed May 5, 1976) encompasses 25 acres in Area II, which is administered by NASA. This site complex 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, multiple crude grooves, and cupules[28] (Knight 2001). The pictographs include motifs such as circles, segmented worms or centipedes, and stick-like human and animal 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.

Efforts are currently ongoing to further define the relationship of archaeological resources at the SSFL. NASA is developing a proposal for an NRHP-eligible Burro Flats Archaeological District to the California SHPO that includes several archaeological sites in Area IV, and DTSC discussed the NRHP-eligibility of an SSFL-wide archaeological district, the Simi Hills Archaeological District, in its *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California* (DTSC 2017a).

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 demolition of most of the original research facilities has significantly diminished its ability 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 Resources

The Santa Ynez Band of Chumash Indians, a federally recognized tribe, has identified the entire SSFL as a Native American sacred site (referred to herein as the Santa Susana Sacred Sites and 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), and also notified DOE of its identification of a portion of SSFL as an Indian sacred site for consideration consistent with Executive Order 13007, *Indian Sacred Sites*. 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.

[28] A cupule is a humanly-made depression or circular hollow on the surface of a rock.

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 the Santa Susana Sacred Sites and Traditional Cultural Property, by the State of California.

There have been additional efforts by NASA, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and others related to documenting SSFL's special significance to Native Americans. These efforts may result in the designation of one or more NRHP-eligible traditional cultural properties.

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 as required by law. 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. DOE has engaged in consultation with the Santa Ynez Band of Chumash Indians, as well as non-federally recognized tribes regarding the cleanup of SSFL since 2009. In January 2014, nonetheless, informal consultation has been ongoing between DOE and tribes that are not federally recognized throughout the NEPA and NHPA, Section 106, processes. DOE initiated Government-to-Government consultation with the Santa Ynez Band of Chumash Indians and 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 2014a). Additionally, DOE is continuing to conduct informal consultation with non-federally recognized tribes throughout the NEPA and NHPA, Section 106, processes.

3.11.3.2 Federal, State, and Local Agency Consultation and Public Involvement

In compliance with Section 106 of the NHPA, 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. DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Programmatic Agreement that will establish procedures for addressing adverse effects on historic properties; the Programmatic Agreement will satisfy DOE's responsibilities under Section 106.[29]

[29] A Programmatic Agreement pursuant to 36 CFR 800.14(b) is the most suitable agreement document for DOE's remediation at SSFL because the effects on historic properties cannot be fully determined prior to approval of the undertaking.

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 Idaho; Nye County in Nevada; Andrews County in Texas; 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 3–34 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 2016, the population of Los Angeles County was estimated to be 10,057,155 and the population of Ventura County was 843,110 (Census 2016a).

Table 3–34 Population and Population Projections for Los Angeles and Ventura Counties, 2000 to 2030

County	Population (persons)				
	2000 [a]	2010 [b]	2016 [c]	2020 [d]	2030 [e]
Los Angeles	9,519,338	9,818,605	10,057,155	10,435,036	10,868,614
Ventura	753,197	823,318	843,110	869,486	919,527
Total	**10,272,535**	**10,641,923**	**10,900,265**	**11,304,522**	**11,788,141**

[a] Census 2000.
[b] Census 2010a.
[c] Census 2016a.
[d] California Department of Finance 2018.

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.

3.12.1.2 Industry and Employment

Figure 3–46 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 3–35** shows the number of establishments[30] by industry in areas of Los Angeles along these local truck routes and the total number of employees. There are 6,944 establishments within these zip codes (Census 2017a, 2017b). Professional, scientific, and technical services have the most establishments within the area, with a total of 1,051 (Census 2017a, 2017b). Retail trade is second, with 786 establishments (Census 2017a, 2017b).

Tables 3–36 and **3–37** 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 2015, in Los Angeles County, there were 335 site preparation establishments employing 4,025 workers (Census 2017c). In 2015, in Ventura County, there were 81 site preparation establishments employing 766 workers (Census 2017c).

[30] An establishment is a single physical location at which business is conducted or services or industrial operations are performed.

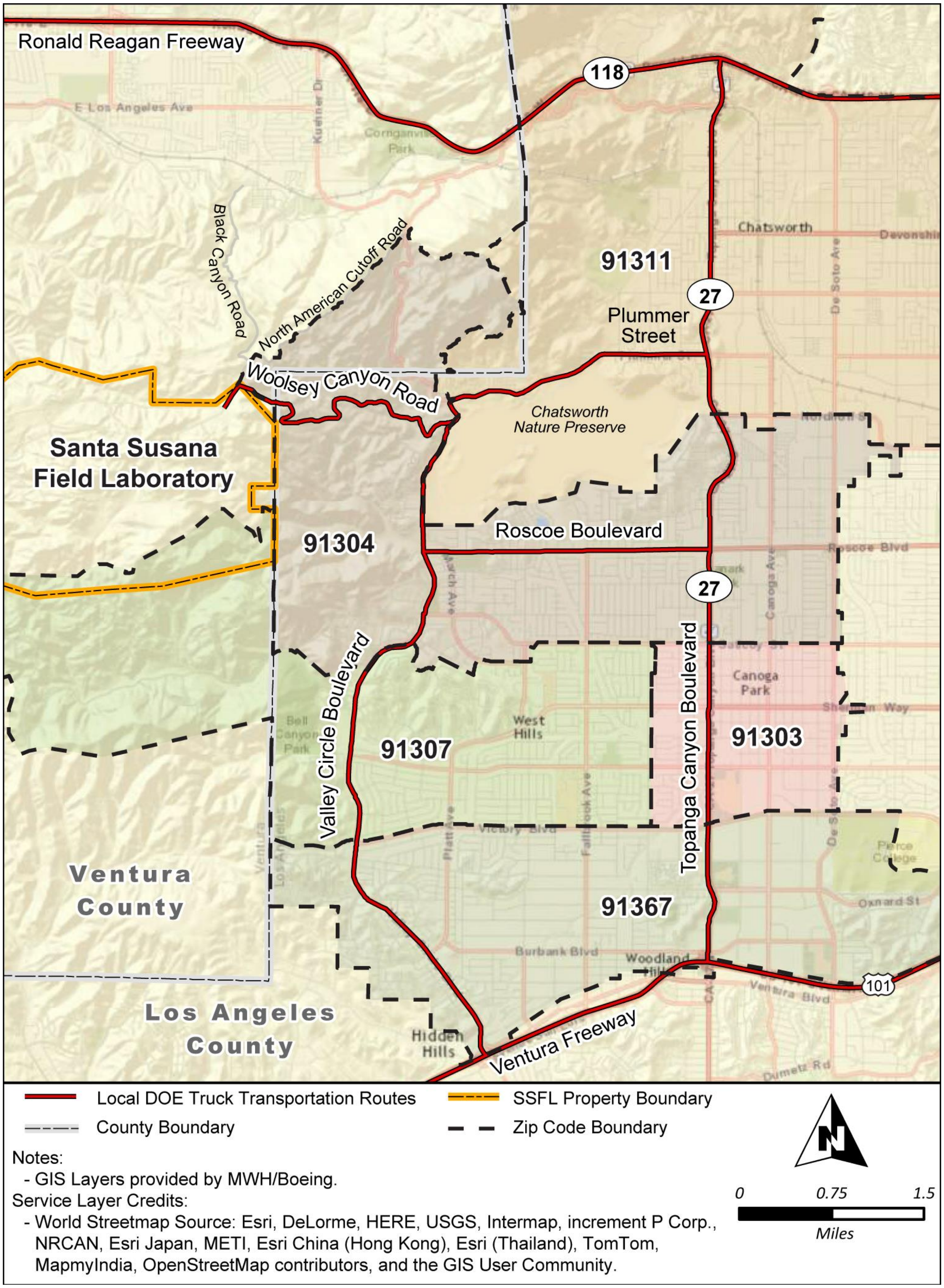


Figure 3–46 Zip Codes along Proposed Local Truck Routes

Table 3–35 Number of Establishments by Industry and Total Employees along Local Truck Routes, 2015

	Zip Code					
	91311 (Chatsworth)	***91304 (Canoga Park)***	***91303 (Canoga Park)***	***91307 (West Hills)***	***91367 (Woodland Hills)***	***Total Establishments (number)***
Agriculture, Forestry, Fishing and Hunting	3	–	–	2	–	5
Mining, Quarrying and Oil and Gas Extraction	3	–	–	–	1	4
Utilities	1	1	–	–	1	3
Construction	171	121	78	79	143	592
Manufacturing	324	88	34	6	25	477
Wholesale Trade	315	96	41	23	89	564
Retail Trade	181	98	300	64	143	786
Transportation and Warehousing	32	14	12	5	12	75
Information	57	17	20	23	141	258
Finance and Insurance	81	33	51	26	315	506
Real Estate and Rental and Leasing	85	54	44	16	132	331
Professional, Scientific, and Technical Services	212	76	92	87	584	1,051
Management of Companies and Enterprises	15	1	10	1	19	46
Administrative and Support and Waste Management and Remediation Services	106	49	37	37	119	348
Educational Services	20	16	17	16	33	102
Health Care and Social Assistance	108	75	94	175	190	642
Arts, Entertainment, and Recreation	57	22	9	36	188	312
Accommodation and Food Services	104	54	102	41	90	391
Other Services (except Public Administration)	133	61	107	38	93	432
Industries not classified	7	2	1	1	8	19
Total establishments for all sectors	**2,015**	**878**	**1,049**	**676**	**2,326**	**6,944**
Total employees for all sectors	**35,761**	**11,895**	**11,882**	**6,830**	**44,056**	**110,424**

Source: Census 2017a, 2017b.

Table 3–36 Construction and Transportation and Warehousing Employment, Payroll and Establishments in Los Angeles County, 2015

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**	120,007	1,522,271	6,840,253	13,721
237	Heavy and Civil Engineering Construction	10,369	194,069	874,325	464
238	Specialty Trade Contractors	80,650	935,589	4,246,670	8,398
2389	Other Specialty Trade Contractors	10,562	127,186	544,962	843
23891	Site Preparation Contractors	4,025	49,273	214,155	335
23892	All Other Specialty Trade Contractors	6,537	77,913	330,807	508
48	**Transportation and Warehousing**	159,167	2,072,148	8,685,909	7,389
484	Truck Transportation	27,737	294,661	1,304,283	3,007
4842	Specialized Freight Trucking	7,050	72,049	313,257	703
48422	Specialized Freight (except Used Goods) Trucking, Local	2,791	29,676	131,922	304
48423	Specialized Freight (except Used Goods) Trucking, Long-Distance	1,834	23,518	96,774	129

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 2017c.

Table 3–37 Construction and Transportation and Warehousing Employment, Payroll and Establishments in Ventura County, 2015

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**	13,901	148,641	692,653	1,967
237	Heavy and Civil Engineering Construction	1,283	17,462	84,165	65
238	Specialty Trade Contractors	9,671	99,673	462,791	1,324
2389	Other Specialty Trade Contractors	1,451	17,630	84,117	179
23891	Site Preparation Contractors	766	9,559	45,377	81
23899	All Other Specialty Trade Contractors	685	8,071	38,740	98
48	**Transportation and Warehousing**	5,036	47,577	203,504	385
484	Truck Transportation	1,504	16,298	70,265	179
4842	Specialized Freight Trucking	549	6,038	27,837	83
48422	Specialized Freight (except Used Goods) Trucking, Local	284	3,542	15,183	46
48423	Specialized Freight (except Used Goods) Trucking, Long-Distance	133	1,742	8,244	10

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 2017c.

Transport of materials under the proposed alternatives would require freight trucking. In Los Angeles County, there were 3,007 truck transportation establishments with 27,737 workers in 2015 (Census 2017c). In Ventura County, there were 179 truck transportation establishments with 1,504 workers in 2015 (Census 2017c). Tables 3–36 and 3–37 also show specialized freight trucking establishments in Los Angeles and Ventura Counties, which includes trucking of hazardous waste over long distances.

Figures 3–47 and **3–48** display the employment trends for specialty trade contractors and general freight trucking in Los Angeles and Ventura Counties from 2011 to 2015, respectively. As shown, specialty trade contractor employment increased in both counties during this time. However, general freight trucking in both counties experienced little change in employment from 2011 to 2015 (Census 2013, 2014, 2015, 2016b, 2017c).

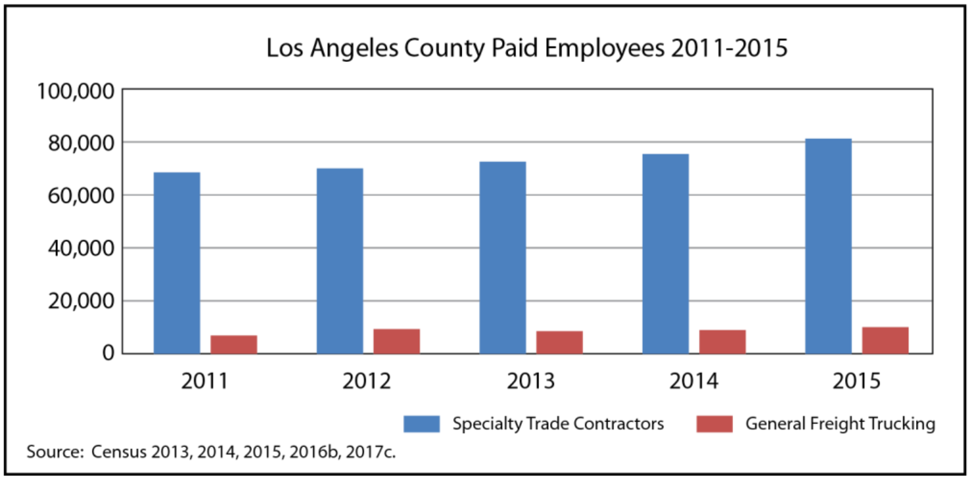


Figure 3–47 Specialty Trade Contractors and General Freight Trucking Employees in Los Angeles County, 2011 to 2015

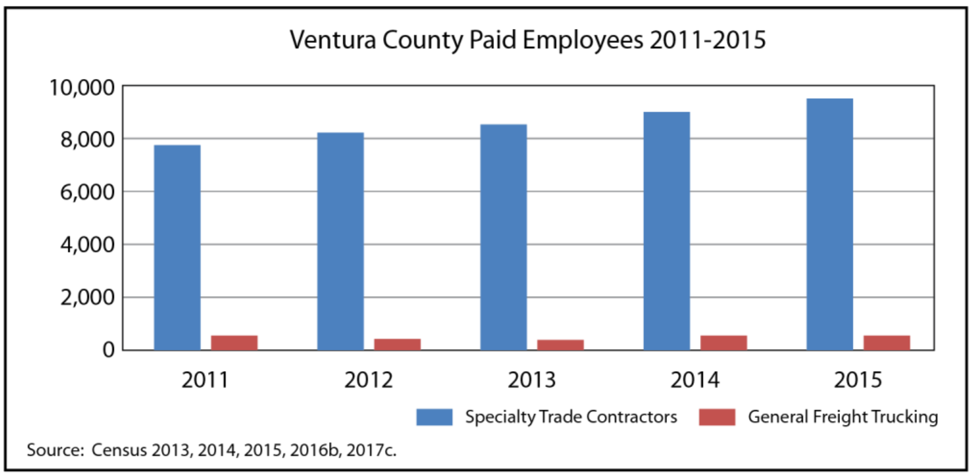


Figure 3–48 Specialty Trade Contractors and General Freight Trucking Employees in Ventura County, 2011 to 2015

3.12.1.3 Housing

From 2012 to 2016, Los Angeles County had over 3.4 million housing units, with 208,273 vacant units (Census 2016c). The homeowner vacancy rate was 1.1 percent, and the rental vacancy rate was 3.3 percent (Census 2016c). Homeowners occupied over 1.4 million units, and renters occupied over 1.7 million units (Census 2016c). In Los Angeles County, 49 percent of houses were single family residences, 49 percent were multi-family residences, and 2 percent were mobile homes (Census 2016c).

From 2012 to 2016, Ventura County had 284,759 housing units, with 15,421 vacant units (Census 2016c). The homeowner vacancy rate was 0.8 percent, and the rental vacancy rate was 3.4 percent (Census 2016c). Homeowners occupied over 180,000 units, and renters occupied over

104,000 units (Census 2016c). In Ventura County, 64 percent of houses were single family residences, 32 percent were multi-family residences, and 4 percent were mobile homes (Census 2016c).

Table 3–38 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 $465,000, $481,400, and $409,300, respectively (Census 2016c).

Table 3–38 Number of Owner-Occupied Houses by Value along Local Truck Routes, 2012 to 2016

	Zip Code				
	91311 (Chatsworth)	*91304 (Canoga Park)*	*91303 (Canoga Park)*	*91307 (West Hills)*	*91367 (Woodland Hills)*
Total Owner-Occupied Houses (number)	9,342	8,578	2,388	7,287	9,083
Less than $50,000	408	340	75	109	224
$50,000 to $99,000	209	356	0	70	63
$100,000 to $149,000	39	70	48	11	32
$150,000 to $199,000	157	207	154	8	251
$200,000 to $299,000	802	410	470	190	685
$300,000 to $499,000	3,235	3,038	1,278	2,230	1,987
$500,000 to $999,000	4,034	3,925	322	4,010	5,139
$1,000,000 or more	458	232	41	659	702
Median Value	$489,100	$492,300	$366,600	$578,600	$593,900

Source: Census 2016d, 2016e.

3.12.1.4 Local Government Finances

Based on the Year-End Financial Status Report for fiscal year 2016 to 2017, the city of Los Angeles had a revised general fund revenue budget of $5,610.9 million (City of Los Angeles 2017). Property tax is the largest portion of the general fund revenue, contributing $1,794.3 million, or about 32 percent. Other major revenue sources were Licenses, Permits, Fees and Fines ($898.5 million); Utility Users' Tax ($631.5 million); Sales Tax ($520.0 million); Business Tax ($517.0 million); Power Revenue Transfers ($264.4 million); and Transient Occupancy Tax ($264.0 million). The City's reserve fund balance at the end of fiscal year 2016 to 2017 was $273.4 million, including $153.4 million emergency reserve and $120.0 million contingency reserve (City of Los Angeles 2017). The City of Los Angeles Bureau of Street Services has an annual pavement preservation program with total funding in 2015 to 2016 of $98 million (Bureau of Street Services 2018).

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 3–39**. 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 3–39 Population near Representative Recycle and Disposal Facilities, 2016

Facility	Location (city, county, state)	County Population	City Population
Recycle Facilities in California [a]			
Standard Industries	Ventura, Ventura County	843,110	109,067
P.W. Gillibrand, Inc.	Simi Valley, Ventura County	843,110	126,126
Kramer Metals	Los Angeles, Los Angeles County	10,057,155	3,918,872
Waste Disposal Facilities in California			
Chiquita Canyon Sanitary Landfill	Castaic, Los Angeles County	10,057,155	19,529
Antelope Valley Recycling and Disposal Facility	Palmdale, Los Angeles County	10,057,155	156,823
Mesquite Regional Landfill	El Centro, Imperial County	178,807	43,699
Westmorland Landfill	Westmorland, Imperial County	178,807	2,014
Buttonwillow Landfill	Buttonwillow, Kern County	871,337	1,324
McKittrick Waste Treatment Site	McKittrick, Kern County	871,337	121
Waste Disposal Facilities Outside California			
US Ecology	Grand View, Owyhee County, ID	11,356	1,167
Nevada National Security Site	Nye County, NV	43,198	Not applicable
Waste Control Specialists	Andrews, Andrews County, TX	17,215	13,087
Energy*Solutions*	Tooele County,[b] UT	61,986	9,862

ID = Idaho; NV = Nevada; TX = Texas; 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 2016f.

3.12.2.1 Population

Table 3–39 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 3–40 summarizes industry employment, and **Table 3–41** provides the median household income in 2016 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 55,730 workers with 51,805 employed; Simi Valley had a civilian labor force of 69,144 workers with 64,837 employed (Census 2016g). 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 3–40 Employment by Industry near Representative Recycle and Disposal Facilities, 2016

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	403,177	22,900	23,595	42,477	12,948	44,170	12,878	9,938	31,496	48,073	76,677	37,910	20,692	19,423
	Percent	–	5.7%	5.9%	10.5%	3.2%	11.0%	3.2%	2.5%	7.8%	11.9%	19.0%	9.4%	5.1%	4.8%
Ventura *Standard Industries* [a]	Estimate	51,805	1,524	3,280	4,093	1,421	6,096	2,000	1,071	2,539	6,192	11,530	5,589	2,879	3,591
	Percent	–	2.9%	6.3%	7.9%	2.7%	11.8%	3.9%	2.1%	4.9%	12.0%	22.3%	10.8%	5.6%	6.9%
Simi Valley *P.W. Gillibrand, Inc.* [a]	Estimate	64,837	487	4,288	7,782	1,509	7,893	2,357	2,187	8,043	7,517	11,783	5,389	3,353	2,249
	Percent	–	0.8%	6.6%	12.0%	2.3%	12.2%	3.6%	3.4%	12.4%	11.6%	18.2%	8.3%	5.2%	3.5%
Los Angeles County	Estimate	4,709,319	23,123	268,351	476,943	165,120	501,212	256,614	209,651	292,365	595,169	968,020	515,900	288,080	148,771
	Percent	–	0.5%	5.7%	10.1%	3.5%	10.6%	5.4%	4.5%	6.2%	12.6%	20.6%	11.0%	6.1%	3.2%
Castaic *Chiquita Canyon Sanitary Landfill*	Estimate	9,511	42	457	1,272	292	839	843	502	636	905	1,971	714	428	610
	Percent	–	0.4%	4.8%	13.4%	3.1%	8.8%	8.9%	5.3%	6.7%	9.5%	20.7%	7.5%	4.5%	6.4%
Los Angeles *Kramer Metals* [a]	Estimate	1,903,882	8,690	115,797	161,733	53,472	197,190	82,018	113,393	116,985	268,676	369,068	239,935	134,523	42,402
	Percent	–	0.5%	6.1%	8.5%	2.8%	10.4%	4.3%	6.0%	6.1%	14.1%	19.4%	12.6%	7.1%	2.2%
Palmdale *Antelope Valley Recycling and Disposal Facility*	Estimate	58,633	499	4,560	6,973	1,411	7,641	3,172	1,227	3,184	5,389	12,886	5,122	3,336	3,233
	Percent	–	0.9%	7.8%	11.9%	2.4%	13.0%	5.4%	2.1%	5.4%	9.2%	22.0%	8.7%	5.7%	5.5%
Imperial County	Estimate	58,456	5,464	2,724	2,626	1,562	8,492	3,926	534	2,003	3,786	14,673	4,381	2,384	5,901
	Percent	–	9.3%	4.7%	4.5%	2.7%	14.5%	6.7%	0.9%	3.4%	6.5%	25.1%	7.5%	4.1%	10.1%
El Centro *Mesquite Regional Landfill*	Estimate	15,682	1,159	704	585	373	2,280	889	214	751	1,188	4,193	979	569	1,798
	Percent	–	7.4%	4.5%	3.7%	2.4%	14.5%	5.7%	1.4%	4.8%	7.6%	26.7%	6.2%	3.6%	11.5%
Westmorland *Westmorland Landfill*	Estimate	614	153	14	17	0	57	41	9	0	30	116	100	45	32
	Percent	–	24.9%	2.3%	2.8%	0.0%	9.3%	6.7%	1.5%	0.0%	4.9%	18.9%	16.3%	7.3%	5.2%

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	330,594	55,742	20,894	19,022	10,215	35,569	17,383	3,300	12,317	26,337	64,901	28,053	14,353	22,508
	Percent	–	16.9%	6.3%	5.8%	3.1%	10.8%	5.3%	1.0%	3.7%	8.0%	19.6%	8.5%	4.3%	6.8%
Buttonwillow *Buttonwillow Landfill*	Estimate	437	175	27	24	7	72	25	5	0	18	21	44	19	0
	Percent	–	40.0%	6.2%	5.5%	1.6%	16.5%	5.7%	1.1%	0.0%	4.1%	4.8%	10.1%	4.3%	0.0%
McKittrick *McKittrick Waste Treatment Site*	Estimate	41	9	14	0	0	7	0	0	0	6	0	5	0	0
	Percent	–	22.0%	34.1%	0.0%	0.0%	17.1%	0.0%	0.0%	0.0%	14.6%	0.0%	12.2%	0.0%	0.0%
Idaho															
Owyhee County	Estimate	4,484	1,276	230	611	79	441	282	20	97	199	658	224	179	188
	Percent	–	28.5%	5.1%	13.6%	1.8%	9.8%	6.3%	0.4%	2.2%	4.4%	14.7%	5.0%	4.0%	4.2%
Grand View US Ecology	Estimate	479	263	24	21	0	8	35	0	1	6	35	26	35	25
	Percent	–	54.9%	5.0%	4.4%	0.0%	1.7%	7.3%	0.0%	0.2%	1.3%	7.3%	5.4%	7.3%	5.2%
Nevada															
Nye County *Nevada National Security Site*	Estimate	14,446	1,335	1,067	565	167	1,850	709	234	805	1,180	2,099	2,393	872	1,170
	Percent	–	9.2%	7.4%	3.9%	1.2%	12.8%	4.9%	1.6%	5.6%	8.2%	14.5%	16.6%	6.0%	8.1%
Texas															
Andrews County	Estimate	7,887	2,317	591	502	179	596	645	42	360	630	1,166	462	253	144
	Percent	–	29.4%	7.5%	6.4%	2.3%	7.6%	8.2%	0.5%	4.6%	8.0%	14.8%	5.9%	3.2%	1.8%
Andrews *Waste Control Specialists*	Estimate	5,862	1,735	413	333	129	486	425	31	301	518	879	303	211	98
	Percent	–	29.6%	7.0%	5.7%	2.2%	8.3%	7.3%	0.5%	5.1%	8.8%	15.0%	5.2%	3.6%	1.7%

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
Utah															
Tooele County	Estimate	27,167	686	1,945	3,328	583	3,702	1,574	483	1,402	2,958	4,693	2,166	1,298	2,349
	Percent	–	2.5%	7.2%	12.3%	2.1%	13.6%	5.8%	1.8%	5.2%	10.9%	17.3%	8.0%	4.8%	8.6%
Grantsville [b] Energy*Solutions*	Estimate	4,175	145	296	700	95	597	214	81	178	477	816	194	169	213
	Percent	–	3.5%	7.1%	16.8%	2.3%	14.3%	5.1%	1.9%	4.3%	11.4%	19.5%	4.6%	4.0%	5.1%

[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 2016g.

Table 3–41 Median Household Income near Representative Recycle and Disposal Facilities (2016 inflation-adjusted dollars)

Counties and Cities where Representative Recycle and Disposal Facilities are Located	*Median Household Income (dollars)*
California	
Ventura County	$78,593
Ventura, *Standard Industries* [a]	$70,541
Simi Valley, *P.W. Gillibrand, Inc.* [a]	$91,196
Los Angeles County	$57,952
Castaic, *Chiquita Canyon Sanitary Landfill*	$107,200
Los Angeles, *Kramer Metals* [a]	$51,538
Palmdale, *Antelope Valley Recycling and Disposal Facility*	$52,801
Imperial County	$42,560
El Centro, *Mesquite Regional Landfill*	$41,849
Westmorland, *Westmorland Landfill*	$27,083
Kern County	$49,788
Buttonwillow, *Buttonwillow Landfill*	$34,352
McKittrick, *McKittrick Waste Treatment Site*	443,125
Idaho	
Owyhee County	$34,785
Grand View, *US Ecology*	$37,888
Nevada	
Nye County, *Nevada National Security Site*	$42,266
Texas	
Andrews County	$70,121
Andrews, *Waste Control Specialists*	$69,303
Utah	
Tooele County	$64,149
Grantsville, Energy*Solutions* [b]	$64,652

[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 2016f.

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 4.7 million, of which approximately 1.9 million workers were employed in the city of Los Angeles (Census 2016g). 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 10,096 workers, with 9,511 employed; Palmdale had a civilian labor force of 66,344 workers, with 58,633 employed (Census 2016g). 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 542 individuals with 437 employed. McKittrick had a civilian labor force of 51 individuals with 41 employed. The majority of these workers were employed in agriculture and construction (Census 2016g).

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 614, with a total civilian labor force of 718. 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 18,487 individuals, with 15,682 employed (Census 2016g).

Four 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 511 individuals, with 479 employed (Census 2016g). 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. Waste Control Specialists Texas Compact Waste Facility is in Andrews County, Texas. Andrews County had a civilian labor force of 8,319 individuals, with 7,887 employed (Census 2016g). 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 4,463, with a total labor force of 6,755 (Census 2016g). 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, Sensitive-aged Populations.

> **U.S. 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 2016c.

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 American Community Survey, 2016 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. 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. Therefore, data used to characterize the ROIs reflect a date from 2011 through 2016.

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 3–49** and **3–50**. The census tracts are shown in Figure 3–49 and the block groups in Figure 3–50. The total population of these 69 block groups is 134,856 persons (Census 2016h). 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 49.5 percent (Census 2016h). For this analysis, "meaningfully greater" is also defined as any census tract or block group with a total minority population that exceeds 50 percent.

Twenty-seven of the 69 block groups in the ROI meet the 50 percent total minority threshold (Census 2016h). Twenty-six of those block groups are located in Los Angeles County and the other block group is located in Ventura County (Census 2016h). Several of the block groups identified as minority communities have total minority populations well above the 50 percent threshold, including seven block groups with total minority populations of at least 80 percent (Census 2016h). 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 40 percent minority (Census 2016h). **Table 3–42** 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.

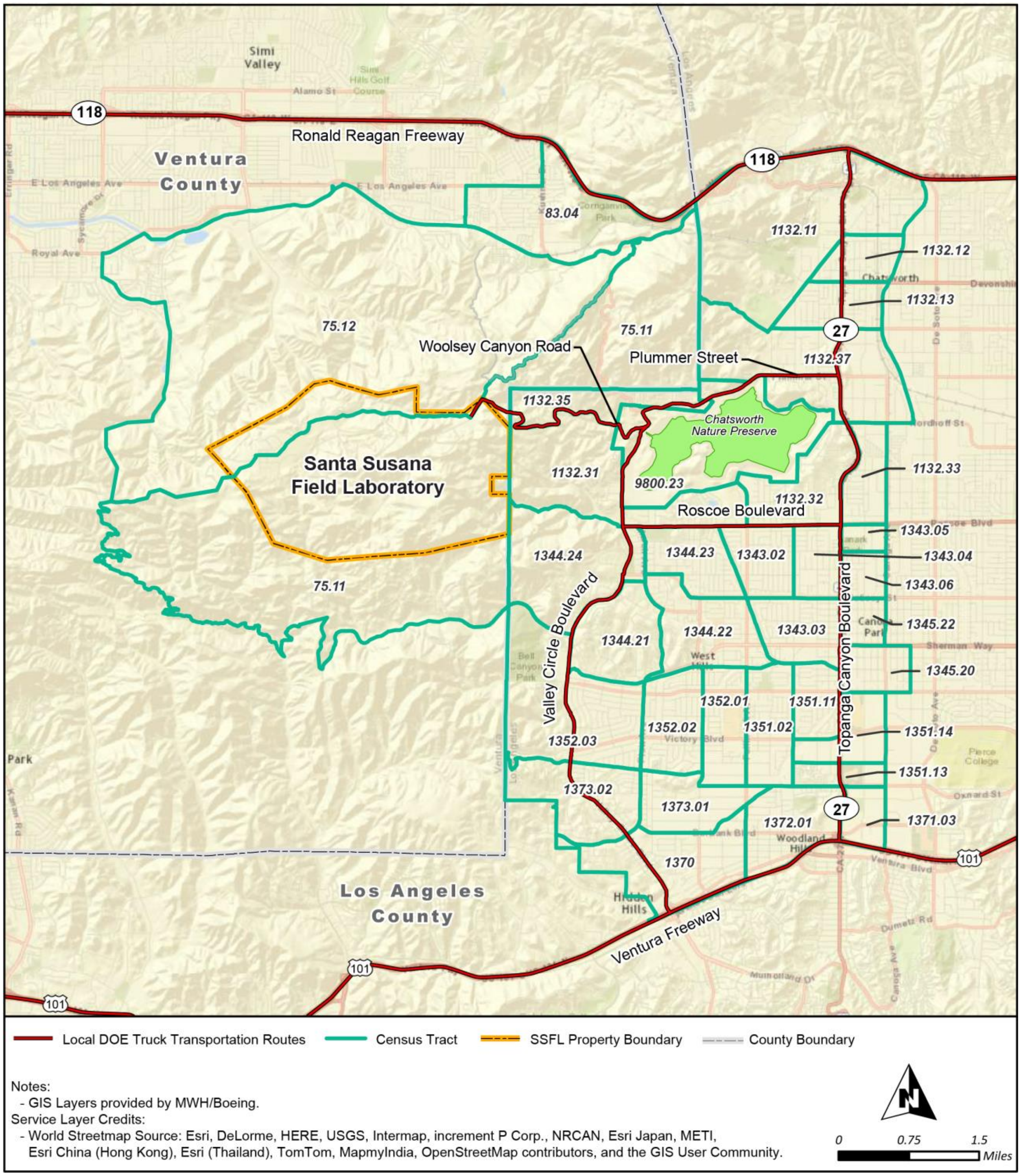


Figure 3–49 Site-Specific Region of Influence Census Tracts

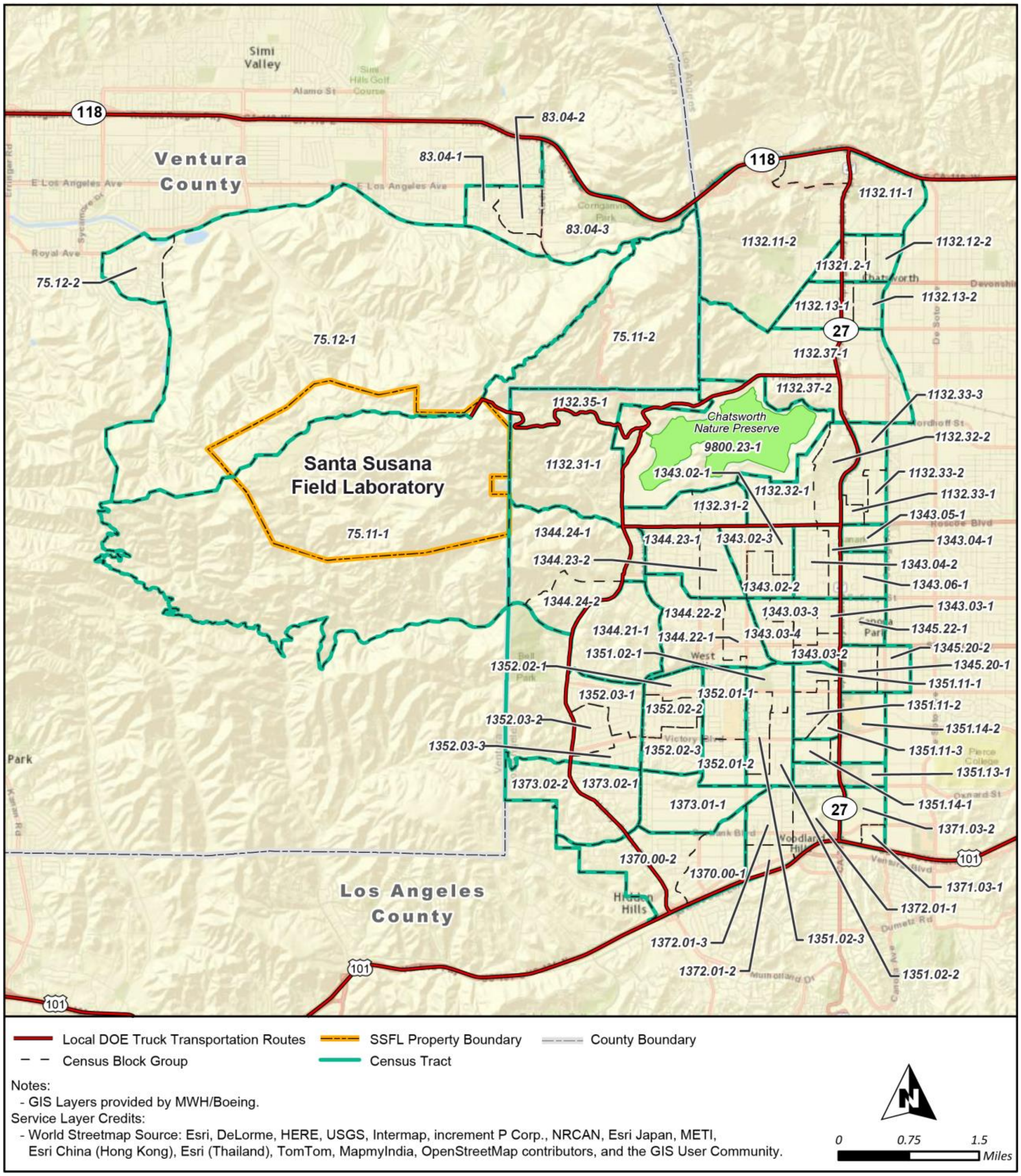


Figure 3–50 Site-Specific Region of Influence Block Groups

Table 3–42 Demographic Characteristics for the Site-Specific Region of Influence, 2010 to 2016

Location		Total Population	White Alone, Non-Hispanic [a] (percent)		Total Minority Population [b,c] (percent)	
Ventura County						
CT 75.11	BG 1	1,911	1,297	(67.9)	614	(32.1)
	BG 2	493	370	(75.1)	123	(24.9)
CT 75.12	BG 1	3,335	2,019	(60.5)	1,316	(39.5)
CT 83.04	**BG 3**	**1,517**	**683**	**(45.0)**	**834**	**(55.0)**
Los Angeles County						
CT 1132.11	BG 1	1,895	1,137	(60.0)	758	(40.0)
	BG 2	1,993	1,482	(74.4)	511	(25.6)
CT 1132.12	BG 1	1,260	653	(51.8)	607	(48.2)
	BG 2	**2,089**	**922**	**(44.1)**	**1,167**	**(55.9)**
CT 1132.13	**BG 1**	**2,755**	**1,273**	**(46.2)**	**1,482**	**(53.8)**
	BG 2 [d]	**1,990**	**695**	**(34.9)**	**1,295**	**(65.1)**
CT 1132.31	BG 1	1,602	1,124	(70.2)	478	(29.8)
	BG 2	**637**	**295**	**(46.3)**	**342**	**(53.7)**
CT 1132.32	BG 1	2,059	1,506	(73.1)	553	(26.9)
	BG 2	**2,033**	**889**	**(43.7)**	**1,144**	**(56.3)**
CT 1132.33	**BG 1 [d]**	**1,679**	**126**	**(7.5)**	**1,553**	**(92.5)**
	BG 2 [d]	**3,122**	**719**	**(23.0)**	**2,403**	**(77.0)**
	BG 3 [d]	**3,305**	**840**	**(25.4)**	**2,465**	**(74.6)**
CT 1132.35	BG 1	1,815	1,094	(60.3)	721	(39.7)
CT 1132.37	BG 1	2,646	1,440	(54.4)	1,206	(45.6)
	BG 2	**1,191**	**536**	**(45.0)**	**655**	**(55.0)**
CT 1343.02	BG 1	863	484	(56.1)	379	(43.9)
	BG 2	**1,383**	**644**	**(46.6)**	**739**	**(53.4)**
	BG 3	1,410	885	(62.8)	525	(37.2)
CT 1343.03	**BG 1 [d]**	**1,433**	**107**	**(7.5)**	**1,326**	**(92.5)**
	BG 2 [d]	**1,336**	**611**	**(45.7)**	**725**	**(54.3)**
	BG 3 [d]	**1,321**	**453**	**(34.3)**	**868**	**(65.7)**
	BG 4	1,864	1,165	(62.5)	699	(37.5)
CT 1343.04	**BG 1 [d]**	**994**	**305**	**(30.7)**	**689**	**(69.3)**
	BG 2 [d]	**1,934**	**933**	**(48.2)**	**1,001**	**(51.8)**
CT 1343.05	**BG 1 [d]**	**4,451**	**368**	**(8.3)**	**4,083**	**(91.7)**
CT 1343.06	**BG 1 [d]**	**3,830**	**1,142**	**(29.8)**	**2,688**	**(70.2)**
CT 1344.21	BG 1	3,860	2,637	(68.3)	1,223	(31.7)
CT 1344.22	BG 1	1,835	1,157	(63.1)	678	(36.9)
	BG 2	3,106	2,000	(64.4)	1,106	(35.6)
CT 1344.23	BG 1	1,778	1,172	(65.9)	606	(34.1)
	BG 2	1,694	1,019	(60.2)	675	(39.8)
CT 1344.24	BG 1	1,612	1,190	(73.8)	422	(26.2)
	BG 2	1,072	722	(67.4)	350	(32.6)
CT 1345.20	**BG 1 [d]**	**3,325**	**492**	**(14.8)**	**2,833**	**(85.2)**
	BG 2 [d]	**2,176**	**88**	**(4.0)**	**2,088**	**(96.0)**
CT 1345.22	**BG 1 [d]**	**3,757**	**518**	**(13.8)**	**3,239**	**(86.2)**
CT 1351.02	BG 1	1,656	908	(54.8)	748	(45.2)
	BG 2	1,227	698	(56.9)	529	(43.1)
	BG 3	1,241	846	(68.2)	395	(31.8)
CT 1351.11	**BG 1**	**986**	**447**	**(45.3)**	**539**	**(54.7)**
	BG 2	1,298	769	(59.2)	529	(40.8)
	BG 3	**970**	**385**	**(39.7)**	**585**	**(60.3)**
CT 1351.13	BG 1	2,880	1,617	(56.1)	1,263	(43.9)

Location		***Total Population***	***White Alone, Non-Hispanic*** [a] ***(percent)***		***Total Minority Population*** [b,c] ***(percent)***	
CT 1351.14	**BG 1** [d]	3,520	1,850	(52.6)	1,670	(47.4)
	BG 2	**1,178**	**520**	**(44.1)**	**658**	**(55.9)**
CT 1352.01	BG 1	2,078	1,103	(53.1)	975	(46.9)
	BG 2	744	586	(78.8)	158	(21.2)
CT 1352.02	BG 1	1,183	695	(58.7)	488	(41.3)
	BG 2	1,680	1,021	(60.8)	659	(39.2)
	BG 3	1,709	1,097	(64.2)	612	(35.8)
CT 1352.03	BG 1	2,640	1,689	(64.0)	951	(36.0)
	BG 2 [d]	1,081	638	(59.0)	443	(41.0)
	BG 3	1,499	932	(62.2)	567	(37.8)
CT 1370	BG 1	2,188	1,672	(76.4)	516	(23.6)
	BG 2	2,755	1,958	(71.1)	797	(28.9)
CT 1371.03	**BG 1**	**2,352**	**1,144**	**(48.6)**	**1,208**	**(51.4)**
	BG 2	2,873	2,119	(73.8)	754	(26.2)
CT 1372.01	BG 1	2,943	1,568	(53.3)	1,375	(46.7)
	BG 2	**1,624**	**391**	**(24.1)**	**1,233**	**(75.9)**
	BG 3	1,436	1,190	(82.9)	246	(17.1)
CT 1373.01	BG 1	2,356	1,555	(66.0)	801	(34.0)
CT 1373.02	BG 1	1,825	1,526	(83.6)	299	(16.4)
	BG 2	2,564	1,945	(75.9)	619	(24.1)
CT 9800.23	**BG 1** [d]	**9**	**0**	**(0.0)**	**9**	**(100.0)**
Total for Region of Influence		134,856	68,061	(50.5)	66,795	(49.5)
Total for Ventura County		**843,110**	**393,301**	**(46.6)**	**449,809**	**(53.4)**
Total for Los Angeles County		**10,057,155**	**2,687,787**	**(26.7)**	**7,369,368**	**(73.3)**
Total for California		**38,654,206**	**14,837,242**	**(38.4)**	**23,816,964**	**(61.6)**

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** denotes areas with meaningfully greater total minority proportion (more than 50 percent).

Source: Census 2016h.

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 2016i). **Table 3–43** 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 3–43 Economic Characteristics for the Site-Specific Region of Influence, 2012 to 2016

Location	*Percent of Population Below Poverty [a] Threshold*	*Location*	*Percent of Population Below Poverty [a] Threshold*
Ventura County			
CT 75.11	4.1	CT 83.04	3.3
CT 75.12	5.1		
Los Angeles County			
CT 1132.11	5.4	CT 1344.24	2.4
CT 1132.12	7.9	CT 1345.20	**22.8**
CT 1132.13	10.0	CT 1345.22	27.0
CT 1132.31	4.5	CT 1351.02	8.5
CT 1132.32	6.6	CT 1351.11	7.1
CT 1132.33	**22.1**	CT 1351.13	5.2
CT 1132.35	14.9	CT 1351.14	21.2
CT 1132.37	8.3	CT 1352.01	9.2
CT 1343.02	4.9	CT 1352.02.	7.9
CT 1343.03	10.4	CT 1352.03.	6.5
CT 1343.04	16.3	CT 1370.	6.3
CT 1343.05	**33.2**	CT 1371.03	8.6
CT 1343.06	18.2	CT 1372.01	12
CT 1344.21	5.6	CT 1373.01	3.8
CT 1344.22	4.2	CT 1373.02	5.3
CT 1344.23	6.7	CT 9800.23	– [c]
Region of Influence			10.7
Ventura County			10.6
Los Angeles County			17.8
California			15.8

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 2016i.

Of the 35 census tracts in the ROI, census tracts 1132.33, 1343.05 and 1345.20 in Los Angeles County exceeds the 20 percent poverty rate threshold (Census 2016i). These census tracts are located along the eastern side of North Topanga Canyon Boulevard, bordered by Nordoff Street to the north, Hartland Street to the south, and on the eastern edge by Canoga Avenue for census tracts 1132.33, 1343.05 and Variel Avenue for 1345.20. None of the census tracts in Ventura County exceeds the 20 percent poverty rate threshold (Census 2016i). As a whole, the ROI has an average poverty level of 10.7 percent (Census 2016i).

3.13.2 Region of Influence for Representative Recycle and Waste Disposal Facilities

Table 3–44 lists the 13 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, Texas, 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 but one 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 3–51** shows the locations of these facilities.

Table 3–44 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	8,457
Standard Industries	Ventura, CA	28	13.01	8,491
Kramer Metals	Los Angeles, CA	44	5327	3,077
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill	Castaic, CA	32	9201.06	3,291
Antelope Valley	Palmdale, CA	38	9104.01	6,985
McKittrick Waste Treatment Site	McKittrick, CA	88	33.04	4,568
Buttonwillow Landfill	Buttonwillow, CA	120	33.04	– [b]
Westmoreland Landfill	Westmorland, CA	230	123.01	5,273
Mesquite Regional Landfill [c]	El Centro, CA	250	124	887
Waste Disposal Facilities Outside California				
Nevada National Security Site	Nye County, NV	330	9603	2,223
			9604.01	5,664
			9805	0
Waste Control Specialists	Andrews County, TX	1,079	9501	2,162
Energy*Solutions*	Clive, UT	710	1306	2,037
US Ecology	Grand View, ID	900	9502	3,673
			Total Population	**56,788**

< = less than; CA = California, ID = Idaho, NV = Nevada, TX = Texas; 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.

[c] The Mesquite Regional Landfill is not currently in operation by the Sanitation District's Los Angeles County and its opening has been suspended indefinitely due to lack of demand from the sanitation district's service areas (San Gabriel Valley Tribune 2017).

Source: Census 2016a.

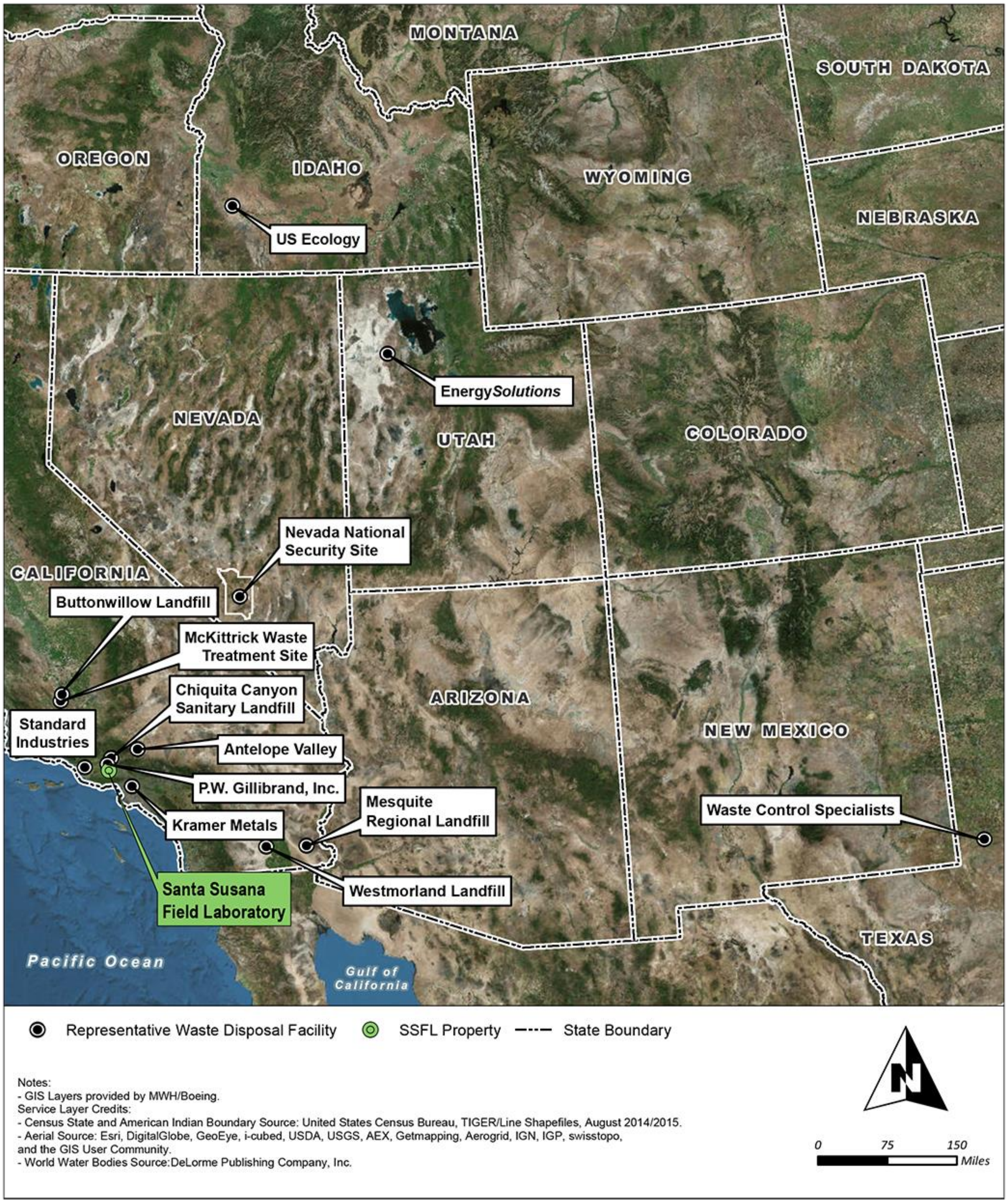


Figure 3–51 Representative Waste Disposal Facilities

The total population of these census tracts is 56,788 persons (Census 2016a). 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 (Census 2016a). 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 3–45 summaries the minority characteristics for the areas surrounding the representative recycle and waste disposal facilities. Census tracts 13.01, 5327, 9201.06, 9104.01, 123.01, and 1306 have minority population exceeding the 50 percent minority threshold (Census 2016i). Census tract 5327 has a minority population of 98.4 percent (Census 2016i).

Table 3–45 Demographic Characteristics for the Areas Surrounding the Representative Recycle and Waste Disposal Facilities, 2016

Facility	*Census Tract*	*Total Population* [a]	*White Alone, Non-Hispanic* [b,c]	*Total Minority Population* [d]
Recycle Facilities in California [e]				
P.W. Gillibrand, Inc.	85	8,450	6,144 (72.7)	2,306 (27.3)
Standard Industries [f]	**13.01**	**8,451**	**4,114 (48.7)**	**4,337 (51.3)**
Kramer Metals [f]	**5327**	**3,077**	**48 (1.6)**	**3,029 (98.4)**
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill [f]	**9201.06**	**3,291**	**917 (27.9)**	**2,374 (72.1)**
Antelope Valley [f]	**9104.01**	**6,896**	**2,382 (34.5)**	**4,514 (65.5)**
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	2,276	1,602 (70.4)	674 (29.6)
Westmoreland Landfill [f]	**123.01**	**1,242**	**517 (41.6)**	**725 (58.4)**
Mesquite Regional Landfill	124	879	767 (87.3)	112 (12.7)
Waste Disposal Facilities Outside California				
Nevada National Security Site	9603	2,223	1,140 (51.3)	1,083 (48.7)
	9604.01	5,452	4,265 (78.2)	1,187 (21.8)
Waste Control Specialists	9501	2,162	1,406 (65)	756 (35)
Energy*Solutions* [f]	**1306**	**1,993**	**675 (33.9)**	**1,318 (66.1)**
US Ecology	9502	3,622	2,667 (73.6)	955 (26.4)

[a] Presents total population for whom poverty status is determined.

[b] 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.

[c] 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.

[d] 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.

[e] Waste disposal does not occur at the three listed recycle facilities; some of the listed waste disposal facilities also conduct recycle operations.

[f] **Boldface** denotes areas with meaningfully greater total minority proportion (more than 50 percent).

Source: Census 2016i.

3.13.2.2 Low-income

Table 3–46 shows poverty levels by census tract in the ROIs of the representative recycle and waste disposal facilities. Census tracts 5327, 123.01, and 1306 are considered poverty areas (Census 2016i). There are no extreme poverty areas within the ROIs of the representative recycle and waste disposal facilities.

Table 3–46 Economic Characteristics of the Areas Surrounding the Representative Recycle and Waste Disposal Facilities, 2016

Facility	*Census Tract*	*Percent of Population Below Poverty [a] Threshold*
Recycle Facilities in California [b]		
P.W. Gillibrand, Inc.	85	2.4
Standard Industries	13.01	17.9
Kramer Metals [c]	**5327**	**22.4**
Waste Disposal Facilities in California		
Chiquita Canyon Sanitary Landfill [c]	9201.06	12.5
Antelope Valley	9104.01	6.8
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	18.0
Westmoreland Landfill [c]	**123.01**	**20.9**
Mesquite Regional Landfill [c]	124	19.2
Waste Disposal Facilities Outside California		
Nevada National Security Site	9603	12.1
	9604.01	16.8
Waste Control Specialists	9501	4.2
Energy*Solutions* [c]	**1306**	**25.3**
US Ecology	9502	19.7

[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).
Source: Census 2016i.

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 American Community Survey, 2016 5-Year Estimates, were used to identify children and persons 65 years and over within the ROIs. 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. Therefore, data used to characterize the ROIs reflect a date from 2012 through 2016.

3.14.1 Site-Specific Region of Influence

3.14.1.1 Children

Table 3–47 shows the number of children residing in the ROI by block group. Approximately 29,165 children under the age of 18 live in the site-specific ROI (Census 2016j). Of these, 7,917 are younger than 5 years (Census 2016j). The block group containing the Summit and Mountain View Mobile Home Communities (and other conventional housing) occupies the entire Census Tract 1132.35 and is home to 385 children under the age of 18, including 122 children younger than 5 years (Census 2016j).

Figure 3–52 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.

3.14.1.2 Persons 65 Years and Over

Table 3–48 shows the number of persons 65 years and over residing in the site-specific ROI by census block group, based on the 2016 America Community Survey (Census 2016j). Approximately 19,768 persons aged 65 years and over, representing 14.6 percent of the population, reside in the ROI (Census 2016j).

The block group (Census Tract 1132.35) containing the Summit and Mountain View Mobile Home Communities (and other conventional housing) is home to 240 persons aged 65 years and over (Census 2016j), representing 13.2 percent of the population in that block group and 0.2 percent of the total ROI population (Census 2016j).

3.14.2 Region of Influence for Representative Recycle and Waste Disposal Facilities

Table 3–49 lists the 13 representative recycle and waste disposal facilities analyzed in this EIS and their locations, distance from SSFL, census tracts, and total populations (Census 2016a). 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 3–51 shows the locations of these facilities.

Table 3–47 Children Residing in the Site-Specific Region of Influence, 2012 to 2016

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	448	57	CT 75.12	BG 1	769	86
	BG 2	48	0	CT 83.04	BG 3	355	26
Los Angeles County							
CT 1132.11	BG 1	329	170	CT 1345.20	BG 1	873	330
	BG 2	335	115		BG 2	499	172
CT 1132.12	BG 1	271	0	CT 1345.22	BG 1	1,191	238
	BG 2	321	41	CT 1351.02	BG 1	299	32
CT 1132.13	BG 1	394	25		BG 2	271	97
	BG 2	472	181		BG 3	242	81
CT 1132.31	BG 1	333	60	CT 1351.11	BG 1	265	56
	BG 2	143	15		BG 2	264	11
CT 1132.32	BG 1	335	73		BG 3	243	142
	BG 2	322	85	CT 1351.13	BG 1	605	220
CT 1132.33	BG 1	658	328	CT 1351.14	BG 1	481	290
	BG 2	1,042	294		BG 2	138	15
	BG 3	710	172	CT 1352.01	BG 1	404	93
CT 1132.35	BG 1	385	122		BG 2	163	0
CT 1132.37	BG 1	396	55	CT 1352.02	BG 1	173	27
	BG 2	210	80		BG 2	514	167
CT 1343.02	BG 1	164	65		BG 3	396	51
	BG 2	202	10	CT1352.03	BG 1	628	228
	BG 3	250	63		BG 2	239	36
CT 1343.03	BG 1	280	64		BG 3	371	28
	BG 2	259	117	CT 1370	BG 1	329	84
	BG 3	289	291		BG 2	692	204
	BG 4	262	252	CT 1371.03	BG 1	255	34
CT 1343.04	BG 1	191	86		BG 2	710	242
	BG 2	399	83	CT 1372.01	BG 1	781	494
CT 1343.05	BG 1	1,376	109		BG 2	460	140
CT 1343.06	BG 1	859	97		BG 3	253	7
CT 1344.21	BG 1	958	89	CT 1373.01	BG 1	544	83
CT1344.22	BG 1	381	60	CT 1373.02	BG 1	329	69
	BG 2	708	32		BG 2	500	71
CT 1344.23	BG 1	438	330	CT 9800.23	BG 1	0	0
	BG 2	237	172		**Total**	**29,165**	**7,917**
CT 1344.24	BG 1	283	238				
	BG 2	241	32				

BG = block group; CT = census tract.
Source: Census 2016j.

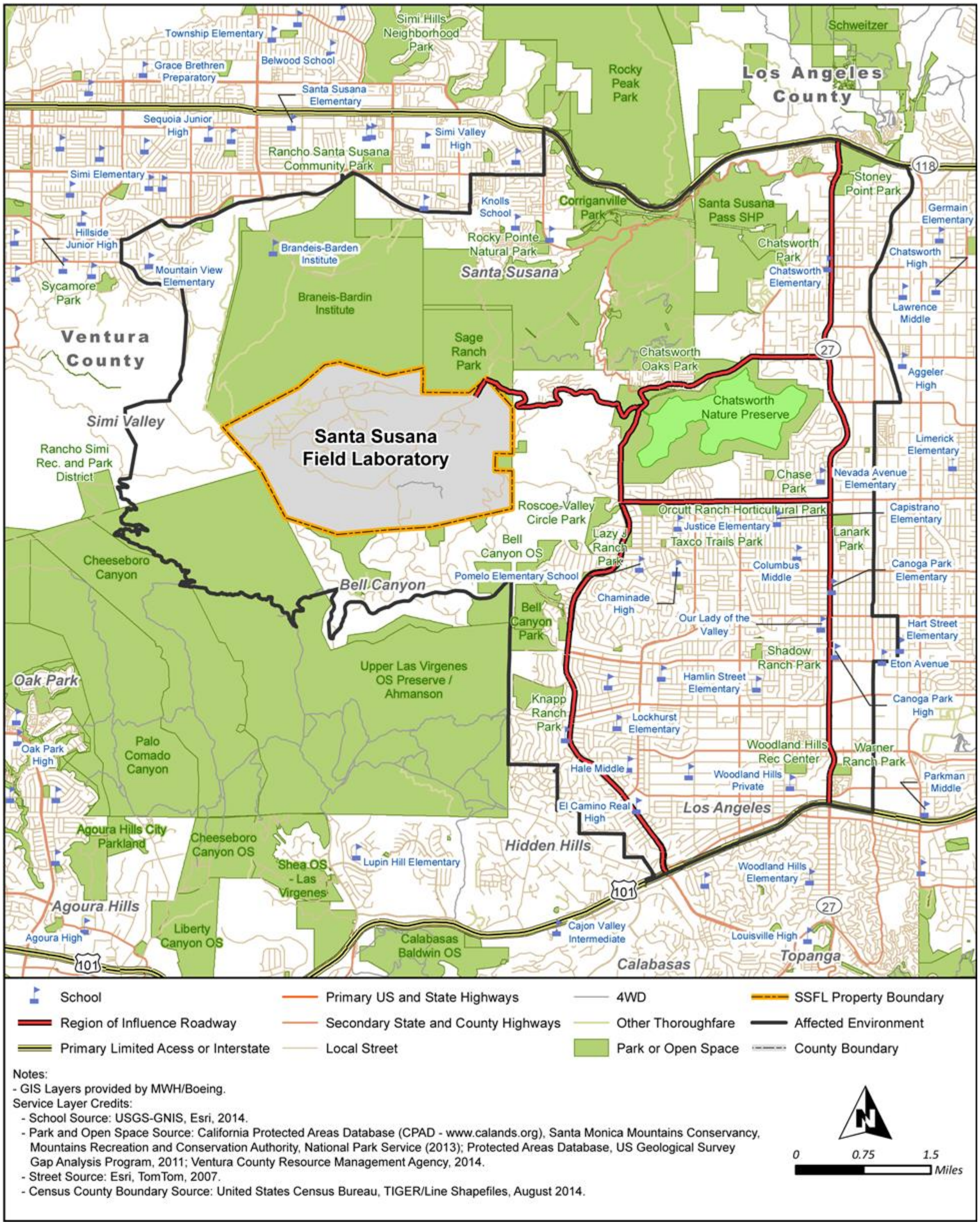


Figure 3–52 Schools, Parks, and Open Space within and Adjacent to the Site-Specific Region of Influence

Table 3–48 Persons 65 Years and Over Residing in the Site-Specific Region of Influence, 2012 to 2016

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	1,911	301	15.8	CT 75.12	BG 1	3,335	138	4.1
	BG 2	493	63	12.8	CT 83.04	BG 3	1,805	194	10.7
Los Angeles County									
CT 1132.11	BG 1	1,895	389	20.5	CT 1345.20	BG 1	3,325	369	11.1
	BG 2	1,993	601	30.2		BG 2	2,176	153	7
CT 1132.12	BG 1	1,260	140	11.1	CT 1345.22	BG 1	3,757	212	5.6
	BG 2	2,089	381	18.2	CT 1351.02	BG 1	1,656	316	19.1
CT 1132.13	BG 1	2,755	586	21.3		BG 2	1,227	271	22.1
	BG 2	1,990	172	8.6		BG 3	1,241	119	9.6
CT 1132.31	BG 1	1,602	321	20	CT 1351.11	BG 1	986	118	12
	BG 2	637	180	28.3		BG 2	1,298	146	11.2
CT 1132.32	BG 1	2,059	583	28.3		BG 3	970	45	4.6
	BG 2	2,033	425	20.9	CT 1351.13	BG 1	2,880	455	15.8
CT 1132.33	BG 1	1,679	113	6.7	CT 1351.14	BG 1	3,520	495	14.1
	BG 2	3,122	118	3.8		BG 2	1,178	303	25.7
	BG 3	3,305	284	8.6	CT 1352.01	BG 1	2,078	370	17.8
CT 1132.35	BG 1	1,815	240	13.2		BG 2	744	136	18.3
CT 1132.37	BG 1	2,646	567	21.4	CT 1352.02	BG 1	1,183	288	24.3
	BG 2	1,191	330	27.7		BG 2	1,680	119	7.1
CT 1343.02	BG 1	863	106	12.3		BG 3	1,709	207	12.1
	BG 2	1,383	175	12.7	CT 1352.03	BG 1	2,640	339	12.8
	BG 3	1,410	169	12		BG 2	1,081	101	9.3
CT 1343.03	BG 1	1,433	107	7.5		BG 3	1,499	209	13.9
	BG 2	1,336	96	7.2	CT 1370	BG 1	2,188	437	20
	BG 3	1,321	167	12.6		BG 2	2,755	449	16.3
	BG 4	1,864	468	25.1	CT 1371.03	BG 1	2,352	164	7
CT 1343.04	BG 1	994	255	25.7		BG 2	2,873	521	18.1
	BG 2	1,934	296	15.3	CT 1372.01	BG 1	2,943	446	15.2
CT 1343.05	BG 1	4,451	206	4.6		BG 2	1,624	28	1.7
CT 1343.06	BG 1	3,830	476	12.4		BG 3	1,436	209	14.6
CT 1344.21	BG 1	3,860	671	17.4	CT 1373.01	BG 1	2,356	369	15.7
CT 1344.22	BG 1	1,835	255	13.9	CT 1373.02	BG 1	1,825	463	25.4
	BG 2	3,106	607	19.5		BG 2	2,564	548	21.4
CT 1344.23	BG 1	1,778	259	14.6	CT 9800.23	BG 1	9	9	100
	BG 2	1,694	430	25.4	**Total**			**135,144**	**19,768**
CT 1344.24	BG 1	1,612	353	21.9	**Percent of Population**				**14.6**
	BG 2	1,072	132	12.3					

BG = block group; CT = census tract.
Source: Census 2010b, 2016j.

Table 3–49 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	8,457
Standard Industries	Ventura, CA	28	13.01	8,491
Kramer Metals	Los Angeles, CA	44	5327	3,077
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill	Castaic, CA	32	9201.06	3,291
Antelope Valley	Palmdale, CA	38	9104.01	6,985
McKittrick Waste Treatment Site	McKittrick, CA	88	33.04	4,568
Buttonwillow Landfill	Buttonwillow, CA	120	33.04	–b
Westmoreland Landfill	Westmorland, CA	230	123.01	5,273
Mesquite Regional Landfill	El Centro, CA	250	124	887
Waste Disposal Facilities Outside California				
Nevada National Security Site	Nye County, NV	330	9603	2,223
			9604.01	5,664
			9805	0
Waste Control Specialists	Andrews County, TX	1,079	9501	2,162
Energy*Solutions*	Clive, UT	710	1306	2,037
US Ecology	Grand View, ID	900	9502	3,673
			Total Population	**56,788**

< = 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 2016a.

The combined population nearby the representative recycle and waste disposal facilities is 56,788 persons (Census 2016a). 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 (Census 2016a). 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 3–50 shows that approximately 12,642 children under the age of 18 reside in the census tracts near the representative recycle and waste disposal facilities (Census 2016j). Of these, 3,532 are younger than 5 years (Census 2016j).

Table 3–50 Children Residing in Areas Surrounding the Representative Recycle and Waste Disposal Facilities, 2016

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	1,580	266
Standard Industries	13.01	2,223	718
Kramer Metals	5327	1,031	219
Waste Disposal Facilities in California			
Chiquita Canyon Sanitary Landfill	9201.06	883	223
Antelope Valley	9104.01	1,854	607
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	573	129
Westmoreland Landfill	123.01	426	122
Mesquite Regional Landfill	124	40	10
Waste Disposal Facilities Outside California			
Nevada National Security Site	9603	800	165
	9604.01	936	363
Waste Control Specialists	9501	754	199
Energy*Solutions*	1306	646	200
US Ecology	9502	896	311
	Total	**12,642**	**3,532**

[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 2016j.

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 3–51 shows that approximately 7,172 persons aged 65 years and over, representing 13.5 percent of the population, reside in the census tracts near the representative recycle and waste disposal facilities (Census 2016a, Census 2016j).

Table 3–51 Persons 65 Years and Over Residing in Areas Surrounding the Representative Recycle and Wastes Disposal Facilities, 2016

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	8,457	1,526	18.0
Standard Industries	13.01	8,491	771	9.1
Kramer Metals	5327	3,077	228	7.4
Waste Disposal Facilities in California				
Chiquita Canyon Sanitary Landfill	9201.06	3,291	244	7.4
Antelope Valley	9104.01	6,985	774	11.1
McKittrick Waste Treatment Site and Buttonwillow Landfill	33.04	4,568	320	7.0
Westmoreland Landfill	124	5,273	124	2.4
Mesquite Regional Landfill	123.01	887	634	71.5
Waste Disposal Facilities Outside California				
Nevada National Security Site	9603	2,223	399	17.9
	9604.01	5,664	1,847	32.6
Waste Control Specialists	9501	2,162	197	9.1
Energy*Solutions*	1306	2,037	108	5.3
US Ecology	9502	3,673	624	17.0
Percent of Population				**13.7**
Total		**56,788**	**7,796**	

[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 2016a, 2016j.

Chapter 4
Environmental Consequences

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter of the *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final 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. In addition, two remediation scenarios – a Residential and an Open Space Scenario – are evaluated for one of the soil remediation action alternatives, namely the Conservation of Natural Resources Alternative. This means there are eight combinations of action alternatives, as summarized in the text box below, assuming each combination includes *one* soil remediation action alternative or option, *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 (Open Space Scenario), 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 (Residential Scenario) + Building Removal + Groundwater Monitored Natural Attenuation	–
Conservation of Natural Resources (Residential Scenario) + Building Removal + Groundwater Treatment	–
Conservation of Natural Resources (Open Space Scenario) + Building Removal + Groundwater Monitored Natural Attenuation	Action Alternative Combination with the Smallest Potential Environmental Consequences (Low Impact Combination)
Conservation of Natural Resources (Open Space Scenario) + 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 DTSC *Draft Program EIR*, which was published in September 2017 (DTSC 2017a), 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 is included in the 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.

Sensitivity Evaluation

A sensitivity evaluation was performed for each resource area to assess the analytical assumptions uncertainties. The results of those evaluations are not included in this chapter because they are hypothetical variations of the alternatives analyzed in this chapter. These sensitivity evaluations are documented in Appendix L of this EIS. This appendix addresses three potentially significant sources of analytical assumptions uncertainties for this *Final SSFL Area IV EIS*.

The first area of uncertainty involved sensitivity evaluation of the effect of remediating more area and a larger volume of soil than is addressed under the alternatives in this chapter. This sensitivity evaluation is referred to as the Increased Soil Volume Scenario. This scenario addresses comments received on the *Draft SSFL Area IV EIS* concerned with uncertainty in the volume of contaminated soil and the consequence of under-estimating the volume of soil that would require removal. It also addresses comments concerned with excluding from the cleanup area and soil volumes those soils that were characterized as exceeding the AOC LUT value of only chemicals that are detected as total petroleum hydrocarbons and areas designated for the protection of biological and cultural resources.

A second area of uncertainty is the speed with which cleanup would occur. Sensitivity analyses were performed to evaluate the effect of a slower soil cleanup than assumed for the alternatives in this chapter. Cleanup could proceed at a slower rate for a number of reasons, for example, budgetary constraints, limitations caused by weather, or as a DOE response to concerns about the level of truck traffic associated with cleanup. For purposes of reference, these are referred to as Constrained Scenarios. A Constrained Scenario was evaluated for each soil remediation action alternatives.

The third area of uncertainty addresses the speed of remediation of the demolition and removal of buildings. A sensitivity evaluation was performed to determine the effects on environmental resources of accelerating the Building Removal Alternative, referred to as the Accelerated Building Removal Scenario.

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, zoning ordinances, or easements. • 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 current 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 3–6):

- **Viewing Point 1** is northwest of SSFL on top of a ridge overlooking Area IV and the Simi Hills (see Figure 3–7).
- **Viewing Point 2** is at the former L85 site and offers direct east-to-west views of the existing Area IV infrastructure (see Figure 3–8).
- **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 3–9).

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

Land use for Area IV and the NBZ under the Soil No Action Alternative 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). In addition to the existing general plan designation and zoning on site, in 2017, The Boeing Company (Boeing) and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreement (conservation easements) recorded with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site.

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. Although traffic is heavy in the SSFL area, 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	*Cleanup to Revised LUT Values*	*Conservation of Natural Resources*
Land use	Land use for Area IV and the NBZ would be consistent with the existing Ventura County general plan designation and zoning, and with the landowner's (Boeing's) two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).	Land use would be consistent with Ventura County's general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative for both scenarios

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
Recreation	No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity.	During 26 years of soil removal, the average daily traffic on Woolsey Canyon Road would increase by up to 3.3 percent above baseline conditions. About 62 percent of this increase is due to site worker vehicles. Delays or perception of delays resulting from the presence of slow-moving trucks on this road, delays or the perception of delays at its intersection with Valley Circle Boulevard, could discourage weekday use of Sage Ranch Park. Traffic on other evaluated roads is expected to increase by no more than 1.5 percent above baseline conditions with no expected discouragement of 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 6 years.	Similar to the Cleanup to Revised LUT Values Alternative, except that increased traffic due to soil removal would last for 2 years or less under both scenarios, with less time likely required for remediation under the Open Space Scenario than for the Residential Scenario.
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 1.75 million gallons of water from CMWD would be annually used (about 46 million gallons total), representing about 0.004 percent of CMWD's projected combined imported and local water supply. Water use is an important consideration because of California's drought conditions which have resulted in local and State-wide measures to significantly reduce water consumption.	Electricity use would be minimal. About 1.75 million gallons of water from CMWD would be annually used, representing about 0.004 percent of CMWD's projected combined imported and local water supply (about 11 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. Under both scenario about 1.75 million gallons of water from CMWD would be annually used, representing about 0.004 percent of CMWD's projected combined imported and local water supply. Although the total water use (up to 3.5 million gallons for both scenarios) 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 26 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 Cleanup to AOC LUT Values Alternative, but the impact duration would be less because soil removal would last for 6 years rather than 26 years.	Under both scenarios, 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 or less rather than 6 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, land use during and after remediation of Area IV and the NBZ would be consistent with Ventura County's general plan designation and zoning. The remediation activities would also be consistent with the landowner's (Boeing's) two Grant Deeds of Conservation Easement and Agreement (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ.

Recreation

The alternative would require approximately 101,000 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–17). There would be an average of about 16 daily round trips. Consistent with the Transportation Agreement between DOE, the National Aeronautics and Space Administration (NASA), and 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 2.4.4).

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 3–29).

As discussed in Section 4.8.2.1.2, the largest increase in traffic compared with baseline conditions would occur on Woolsey Canyon Road. The weekday average daily traffic on this winding, two-lane road would increase over baseline conditions by up to 3.3 percent above baseline conditions. About 62 percent of this increase would be due to site worker vehicles. Motorists on Woolsey Canyon Road could experience or perceive 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 or the perception of 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 1.5 percent above baseline conditions) (see Section 4.8.2.1.2).

Traffic delays or the perception of delays on Woolsey Canyon Road, or at its intersection with Valley Circle Boulevard, could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park, although once arriving at Sage Ranch Park or another recreation area, 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. There is less potential for discouraged weekday use of other recreational areas, such as Chatsworth Nature Preserve, because the projected increases in traffic on roads past these recreation areas would be no more than 1.5 percent above baseline conditions (see Appendix H, Table H–22), 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. Once arriving at any recreation area, no reduction in the quality of recreational activities would be expected. 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 7,000 gallons of water per day, 250 days per year, would result in an annual water use of about 1.75 million gallons and a total water use of about 46 million gallons. This annual water use also equates to about 5.4 acre-feet of water per year, which would represent about 0.004 percent of the Calleguas Municipal Water District's (CMWD) projected (to 2020) combined imported and local water supply (123,695 acre-feet per year, 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 9 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 drought conditions and the need, as expressed by California and CMWD officials, to significantly reduce water consumption, as well as California law. 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). 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).

The return of wet conditions in the 2016-2017 rain season and above-normal conditions in the 2017-2018 rain season did not change the potential for future drought conditions, and the continued need to implement conservation and water use efficiency efforts. Hence, in June 2018, Governor Brown signed into law a set of efficiency goals for water suppliers throughout the State (see Section 3.1). Water use under the alternative, if implemented in a year when drought conditions and resulting water use restrictions or limits are present, could be potentially reduced through measures such as surfactant application to assist in dust control, or in the most extreme case the curtailment of soil cleanup activities until water supply conditions improve.

Aesthetics and Visual Quality

Approximately 881,000 cubic yards of soil would be removed from SSFL. Soil would be backfilled at the excavated areas and re-graded and recontoured as necessary. Disturbed areas would be stabilized

[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).

and revegetated. Potential impacts from this alternative are summarized in **Table 4–6** and described below.

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 26 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, land use would be consistent with Ventura County's general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ.

Recreation

The alternative would require about 22,000 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–17). 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 6 years rather than 26 years. Daily heavy-duty truck round trips under this alternative would average about 16 during the first 5 years and about 7 during the last year. The weekday average daily traffic on Woolsey Canyon Road would increase by up to 3.3 percent above baseline conditions during the first 5 years of soil removal, and by about 2.2 percent during the last year;; other evaluated roads would experience increases of up to 1.5 percent above baseline conditions (see Section 4.8.2.1.3). About 63 percent of this increase would be due to site worker vehicles.

Similar to the Cleanup to AOC LUT Values Alternatives, traffic delays or their perception during the years of soil of removal could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park. There is less potential for discouraged weekday use of other recreational areas, such as Chatsworth Nature Preserve, for the same reason as that for the Cleanup to AOC LUT Values Alternative (Section 4.1.1.2). Once arriving at a recreation area, no reduction in the quality of recreational activities would be expected. 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 6 years rather than 26 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 1.75 million gallons, which would equate to about 5.4 acre-feet of water per year and would represent about 0.004 percent of CMWD's projected combined imported and local water supply (123,695 acre-feet, see Chapter 3, Section 3.1.1.2). However, this annual water use would occur over 6 years, and the total water use would be about 11 million gallons.

As discussed in Section 4.1.1.2, water use is an important consideration because of California's drought conditions which culminated in measures to significantly reduce water consumption in the State. As previously discussed, water use under this alternative could be potentially reduced through measures such as application of surfactants to assist in dust control, or in the most extreme case the curtailment of soil cleanup activities until water supply conditions improve.

Aesthetics and Visual Quality

Aesthetics and visual quality impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except that about 190,000 cubic yards of soil would be removed rather than 881,000 cubic yards; therefore, less native vegetation would be disturbed, and visual impacts during soil removal would last for 6 years rather than 26 years.

4.1.1.4 Conservation of Natural Resources Alternative

Land Use

As under the Cleanup to AOC LUT Values Alternative, land use would be consistent for both scenarios with Ventura County's general plan designation and zoning. Remediation would also be consistent with Boeing's two Grant Deeds of Conservation Easement and Agreement (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ.

Recreation

Under the Residential Scenario, this alternative would require about 6,000 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, about 4,400 round trips would be required under the Open Space Scenario (see Appendix H, Table H–17). 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 years required for soil removal, which would be 2 years or less for both scenarios, daily heavy-duty truck round trips would average up to 16 per day. The weekday average daily traffic on Woolsey Canyon Road would increase over baseline conditions by up to 3.3 percent above baseline conditions; other evaluated roads would experience increases of up to 1.5 percent above baseline conditions (see Section 4.8.2.1.4). About 68 percent of this increase would be due to site worker vehicles under the Residential Scenario; while about 74 percent of this increase would be due to site worker vehicles under the Open Space Scenario.

Similar to the Cleanup to AOC LUT Values Alternatives, traffic delays or their perception during the years of soil removal could discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park. There is less potential for discouraged weekday use of other recreational areas, such as Chatsworth Nature Preserve, for the same reason as that for the Cleanup to AOC LUT Values Alternative (Section 4.1.1.2). Once arriving at a recreation area, no reduction in the quality of recreational activities would be expected. 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 or less rather than 26 years, total electricity use would be much less than that for the Cleanup to AOC LUT Values Alternative and 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 1.75 million gallons for both scenarios) is the same as that for the Cleanup to AOC Values Alternative and would thus represent the same annual percentage of CMWD's projected combined imported and local water supply (see Section 4.1.1.2). However, this annual water use would occur over 2 years or less; total water use under both scenarios would be up to about 3.5 million gallons.

Nonetheless, water use is an important consideration as discussed in Section 4.1.1.2; because California's drought conditions which culminated in measures to significantly reduce water consumption in the State. As previously discussed, water use under the alternative could be potentially reduced through measures such as using surfactants to assist in dust control, or in the most extreme case the curtailment of soil cleanup activities until water supply conditions improve.

Aesthetics and Visual Quality

Aesthetics and visual quality impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, except that 38,200 cubic yards (Open Space Scenario) to 53,000 cubic yards (Residential Scenario) of soil would be removed rather than 881,000 cubic yards; therefore, less native vegetation would be disturbed, and short-term visual impacts would last for up to 2 years.

4.1.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–7**.

Table 4–7 Land Resources Impacts under the Building Demolition Alternatives

Resource	Building No Action Alternative	Building Removal Alternative
Land use	Land use would be consistent with Ventura County's general plan designation for SSFL as open space; although it is zoned rural agriculture and open space, a special use permit currently allows industrial uses (Ventura County 2011a, 2015a). Land use would also be consistent with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).	Land use before and after building demolition would be consistent with Ventura County's existing general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).
Recreation	No impacts are expected on use of Sage Ranch Park or other recreation areas in the SSFL vicinity.	During the 2 to 3 years required for building demolition, the average daily traffic on Woolsey Canyon Road would increase by up to 5.2 percent above baseline conditions. However, about 94 percent of this increased traffic would be due to site worker vehicles rather than transport of waste, backfill, and equipment by heavy-duty truck. The traffic associated with this alternative could result in traffic delays or the perception of delays that could discourage weekday use of Sage Ranch Park, but the potential for delays or perception of delays would likely be less than that for any of the soil remediation action alternatives. There is less potential for discouraged weekday use of other recreational areas in the SSFL vicinity; 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. Up to about 250,000 gallons of water from CMWD would be annually used (630,000 gallons total). Water use is an important consideration because of California's drought conditions which culminated in local and State-wide measures to significantly reduce water consumption.
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 to 3 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.

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

Land use for Area IV would be consistent with Ventura County's general plan designation for SSFL as open space; although it is zoned rural agriculture and open space a special use permit currently allows industrial uses (Ventura County 2011a, 2015a). Land use would also be consistent with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).

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. Although traffic is heavy in the SSFL area, there would be no increase in traffic to or from SSFL due to DOE activities.

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). Land use for Area IV before and after building demolition would be consistent with Ventura County's existing general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).

Recreation

During the 2- to 3-year period of building demolition, the alternative would require about 2,400 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–17). There would also be about 37,500 round trips by workers in light-duty vehicles. Waste and backfill shipments were assumed to occur throughout each working year. There would be an average of up to five daily heavy-duty truck round trips, although shipments during some days could be larger than five 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 2.4.4).

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 about 5.2 percent, of which about 94 percent of this increase would be due to worker commutes. Given these scheduling assumptions, motorists on Woolsey Canyon Road could experience delays or the perception of 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 or the perception of delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. Traffic delays or their perception could potentially discourage weekday use of Woolsey Canyon Road to access Sage Ranch Park, although likely to less of an extent than that for the soil remediation alternatives, because there would be, on average, about a third as many daily slow-moving heavy-duty trucks entering or leaving SSFL as those for the soil remediation alternatives (see Section 4.1.1.2). There is less potential for discouraged weekday use of other recreational areas, such as Chatsworth Nature Preserve, because projected increases in traffic on roads in the SSFL area, including roads past these recreation areas, would be no more than about 2.4 percent above baseline conditions (see Appendix H, Table H–22), 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. Once arriving at a recreation area, no reduction in the quality of recreational activities would be expected.

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 to 3 years. The annual volume of water would be up to about 250,000 gallons per year during the first two years and about 130,000 gallons during the final year (totaling about 630,000 gallons), which is equivalent to the annual water use of approximately 1.3 households in the Los Angeles area in 2010 (see Section 4.1.1.2). This also equates to an annual use of up to about 0.77 acre-foot of water, which would represent about 0.0006 percent of CMWD's combined imported and local water supply (123,695 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 drought conditions which culminated in local and State-wide measures 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, or in the most extreme case the curtailment of building removal activities until water supply conditions improve.

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 to 3 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 to 3 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 to 3 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	Land use would be consistent with Ventura County's general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).	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 discourage weekday access to 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 be expected to discourage weekday access to 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 1×10^{-5} percent of CMWD's combined imported and local water supply.	Electricity requirements would be minimal. A total of 24,000 gallons of water from CMWD would be used to support bedrock removal, which would represent about 6×10^{-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 the few weeks required to install each treatment system (2 systems are projected) followed by 5 years of treatment system operation. There would also be visual impacts associated with removal of contaminated bedrock in Area IV. 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

Land use for Area IV and the NBZ would be consistent with the Ventura County's general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b). (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. Activities under this alternative would not change the land use designation from that for the No Action Alternative.

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 shipments of well installation water in tanker trucks, and 5 offsite shipments of well installation cuttings (nonhazardous waste) in medium-duty trucks. In addition there would be 5 shipments of wastewater from well installation, which could be likely require only light-duty vehicles such as pickup trucks, plus an annual shipment of purge water from groundwater monitoring activities, assumed to occur using medium-duty trucks. Traffic to and from SSFL due to well monitoring activities at Area IV would also include 20 annual deliveries in light-duty trucks or cars of monitoring samples to offsite laboratories. This minimal increase in traffic would not discourage weekday 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 (about 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 a few weeks, and would represent about 1×10^{-5} percent of CMWD's projected 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. Activities under this alternative would not change the land use designation from that for the No Action Alternative.

Recreation

During one year, there would be about 530 heavy-duty truck round trip shipments of waste bedrock and backfill, plus 15 deliveries of water treatment equipment in heavy-duty trucks (see Appendix H, Table H–17). Shipments or deliveries in heavy-duty trucks would be constrained in accordance with the Transportation Agreement between DOE, NASA, and Boeing (Boeing 2015a). There would be about 9 daily heavy-duty truck round trips assuming all waste and backfill was shipped over the projected operational period of bedrock removal, about 2 daily heavy-duty truck round trips assuming all waste and backfill was shipped over the working year. In addition, over 5 years, there would be about 16 annual deliveries of groundwater treatment system supplies in light-duty trucks and 24 annual round trips of trucks (assumed to be medium-duty) transporting exchanged treatment system media. Because of the small projected increase in average daily traffic on Woolsey Canyon Road above baseline conditions (about 0.80 percent), no significant delays or perceived delays would be expected on Woolsey Canyon Road, or at its intersection with Valley Circle Boulevard. This alternative would thus be unlikely to discourage 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 24,000 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 1.5 months (see Section 4.1.1.2). This water use equates to about 0.07 acre-feet of water, which would represent about

6×10^{-5} percent of CMWD's projected 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 for Area IV and the NBZ. Before and after remediation, land use would be consistent with the Ventura County's general plan designation and zoning, and with Boeing's two Grant Deeds of Conservation Easement and Agreement with North American Land Trust that permanently preserves most of SSFL as open space and prohibits the use of the site for agricultural or residential development (Ventura County 2017a, 2017b).

Recreation

The High Impact Combination would result in heavy-duty truck traffic over 28 years. The number of average daily waste and backfill heavy-duty truck round trips would range from about 2 to 5 during the first 2 years, would be about 21 or 25 respectively, during the next 2 years, and about 16 during most of the remaining 24 years. The estimate of 21 daily truck trips for waste and backfill reflects the assumption that shipments during the last year of the Building Removal Alternative overlapped with shipments during the first year of soil and backfill shipment under the Cleanup to AOC LUT Values Alternative. The estimate of 25 daily truck trips for waste and backfill reflects the assumption that shipments of strontium-90-contaminated bedrock and backfill under the Groundwater Treatment Alternative overlapped with shipments during the second year of soil and backfill under the Cleanup to AOC LUT Values Alternative, and that the bedrock and backfill shipments all occurred during the projected operational period of bedrock removal rather than over a 250-day working year. 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. The weekday average daily traffic on Woolsey Canyon Road would conservatively increase by 4.1 to 8.6 percent above baseline conditions during the first 4 years and about 3.3 percent during most of the remaining 24 years (see Appendix H, Table H–23). The maximum increase would occur assuming the overlaps in waste shipments as discussed above. There would be smaller increases in traffic on other evaluated roads (up to 3.9 percent). 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 5 to 21, and the weekday average daily traffic on Woolsey Canyon Road during these years would increase by about 2.2 to 8.6 percent above baseline conditions. The peak daily number of heavy duty trucks reflects the assumption that waste and backfill shipments of soil under the Conservation of Natural Resources Alternative, Open Space Scenario, would overlap between the last year of building demolition under the Building Removal Alternative and the first year of soil removal. There would be smaller increases in traffic on other evaluated roads (up to 3.9 percent). Following these 4 years, there would be minor increases in average daily traffic (e.g., about 0.5 percent above baseline conditions on Woolsey Canyon Road), primarily associated with shipments of monitoring well purge water and environmental monitoring samples.

Under both 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. Motorists could also experience or perceive delays at the intersection of Woolsey Canyon Road and Valley Circle Boulevard, which could also reduce its weekday use during the years of site remediation. Increased traffic, however, would occur for about seven 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 28 years, about 46 million gallons of water would be used under the High Impact Combination. The maximum annual water use would be about 1.9 million gallons, representing about 0.005 percent of CMWD's projected 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 4.1 million gallons of water would be used under the Low Impact Combination. The maximum annual water use would be about 1.9 million gallons, representing about 0.005 percent of CMWD's projected combined imported and local water supply.

Under either combination of action alternatives, water use is an important consideration because of California's drought conditions which culminated in local and State-wide measures to significantly reduce water consumption Water use could be potentially reduced through measures such as using surfactants to assist in dust control, or in the most extreme case the curtailment of soil cleanup activities until water supply conditions improve.

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 recontoured 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 and particularly the presence of heavy-duty trucks on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard 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 drought conditions which culminated in measures to significantly reduce water consumption in the State.

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 root crowns; 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.

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

		Soil Remediation Action Alternatives		
Resource	***Soil No Action Alternative***	***Cleanup to AOC LUT Values***	***Cleanup to Revised LUT Values***	***Conservation of Natural Resources (Residential and Open Space Scenarios)***
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 for both the Residential and Open Space Scenarios.

[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.

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)
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 areas where the 2010 AOC exemption process would be applied.[a] As required based on an assessment of potential risk to humans and biota, remediation within the areas where the exemption process would be applied would occur using focused removal actions that would minimize soil disturbance. Some impacts could occur in locations containing the Santa Susana Formation that are outside the areas where the exemption process would be applied.	Same as the Cleanup to AOC LUT Values Alternative for areas where the exemption process would be applied. There would be less potential for impacts in locations outside the areas where the exemption process would be applied because of the smaller scope of soil remediation compared to the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative for areas where the exemption process would be applied. There would be much less potential for impacts in locations outside the areas where the exemption process would be applied because of the much smaller scope of soil remediation compared to the Cleanup to AOC LUT Values Alternative
Seismic risk to workers	No activities would take place in zones where earthquake-induced landslides could occur.	Some activities in in the NBZ could take place in zones where earthquake-induced landslides could occur, leading to worker risks. However, because the total area in the NBZ to be potentially remediated is only about 0.6 acres, the potential risks to workers would be small. 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 areas where the exemption process would be applied; remediation activities in these areas would be reduced and worker presence restricted. Nonetheless, DOE would minimize worker risks as needed using the 2010 AOC (DTSC 2010a) exemption process. No work would take place in areas of seismic landslide risk unless concentrations in soil present a risk to human health or the environment.	Similar to the Cleanup to AOC LUT Values Alternative, but with reduced risk to workers, because of the lesser potential for work within these zones.	Similar to the Cleanup to AOC LUT Values Alternative, but with much reduced risk to workers, because of the little potential for work within these zones.
Soil erosion	No impacts are expected above baseline conditions.	Erosion is possible because of disturbance of about 90 acres of lands, 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 38 acres).	Under the Residential Scenario the impacts would be similar to those for the Cleanup to Revised LUT Values Alternative except the size of the area subject to disturbance is smaller (about 10 acres) Under the Open Space Scenario the area subject to disturbance would be about 9 acres.

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources (Residential and Open Space Scenarios)
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 lesser need for backfill. The impact would be less under the Open Space Scenario than that under the Residential Scenario because less backfill would be needed.
Backfill requirement	No backfill would be required	About 661,000 cubic yards of backfill would be required with chemicals and radionuclides in concentrations meeting AOC LUT values.	About 143,000 cubic yards of backfill would be required with concentrations of chemicals meeting revised LUT values and radionuclides meeting AOC LUT values.	About 39,000 cubic yards of backfill would be required with chemicals and radionuclides in concentrations meeting risk-assessment-based values for the Residential Scenario. About 29,000 cubic yards would be required with chemicals and radionuclides in concentrations meeting risk-assessment-based values for the Open Space Scenario.

AOC = *Administrative Order on Consent for Remedial Action*; BMP = best management practice; LUT = Look-Up Table; NBZ = Northern Buffer Zone.

[a] The areas where the 2010 AOC exemption process would be applied would be subject to a risk-based cleanup process which targets locations with elevated concentrations of contaminants posing a risk to human health and/or environmental receptors. DOE would use focused soil cleanup methods, designed to minimize soil disturbance, to remove soils that have levels of chemical or radioactive constituents posing 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 protection of endangered species using an exemption process involving removal of soil that poses a risk to human and/or ecological receptors. As discussed in Chapter 2, Section 2.3.2, DOE would refrain from soil removal actions in the areas where the exemption process would be applied 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. Considering areas inside and outside of the areas where the exemption process would be applied, the potential for impacts would be greater under the Cleanup to AOC LUT Values Alternative (0.7 acres) than that for the Cleanup to Revised LUT Values Alternative (0.5 acres), which in turn would be greater than that for the Conservation of Natural Resources Alternative (under both scenarios) (0.3 acres). 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.

Under the Cleanup to AOC LUT Values Alternative, there could be increased risk to workers in some locations in the unlikely event that an earthquake occurs during soil remediation. These at-risk locations are zones where earthquake-induced landslides could occurs are shown in blue on **Figure 4–4**, are generally on steep hillsides, and overwhelmingly occur in the NBZ. Because the total area in the NBZ to be potentially remediated is only about 0.6 acres, the potential risks to workers would be small. 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 (both scenarios), 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.

[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.

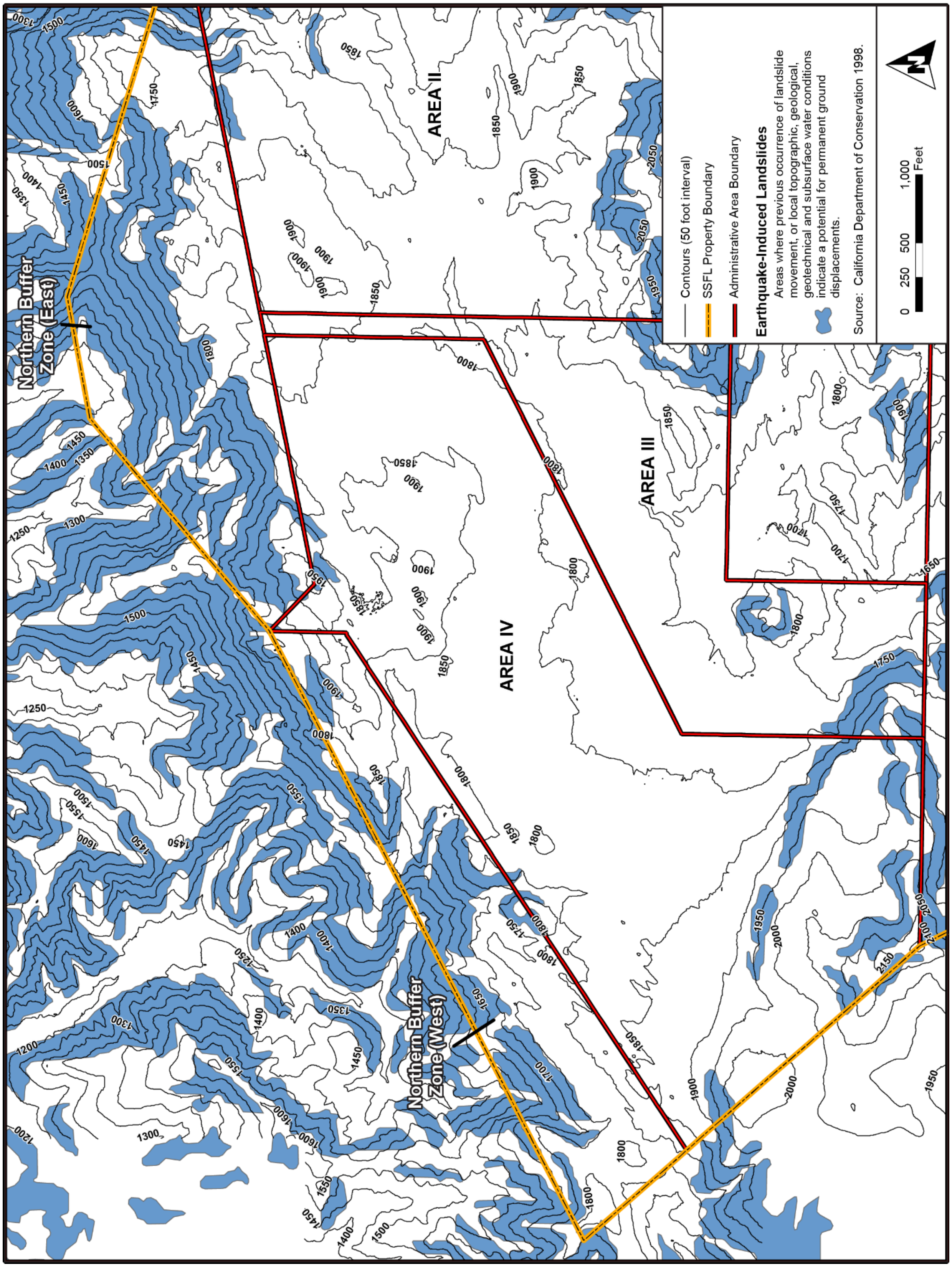


Figure 4–4 Calabasas Quadrangle Seismic Hazard Zones

Nonetheless, DOE fully considers the importance of worker health and safety during soil remediation. As addressed in Section 4.9.2.7, 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

		Soil Remediation Action Alternatives			
				Conservation of Natural Resources	
Parameter	*Soil No Action Alternative*	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Residential Scenario*	*Open Space Scenario*
Volume of soil removed (cubic yards)	NA	881,000	190,000	52,000	38,200
Area of disturbed soil (acres)[a]	NA	90	38	10	9

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table; NA = not applicable.

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 soil 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 (both scenarios). 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 unique characteristics would represent a resource that would be less available to other users in Ventura or other counties.

A source of 661,000 cubic yards of backfill that addresses the LUT values for SSFL would be difficult to find. 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 the U.S. Environmental Protection Agency (EPA) would enter into a consultation process, and DTSC would determine the best available source of backfill (DTSC 2010a). In addition, if the backfill is substantially different in structure, nutrient and biological characteristics than the original soil, it may not be able to support vegetation similar to that present before remediation.

Under the Cleanup to Revised LUT Values Alternative, 143,000 cubic yards of backfill would be needed that meets revised LUT values for chemicals and AOC LUT values for radionuclides. Under the Residential Scenario of the Conservation of Natural Resources Alternative, 39,000 cubic yards of backfill would be required with concentrations of chemicals and radionuclides meeting risk-assessment-based values. Under the Open Space Scenario, the necessary volume of backfill would be 29,000 cubic yards. 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.

[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. There are no buildings within the Santa Susana Formation.
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 building removal 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). If used at Area IV, backfill with these unique 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 of backfill with these characteristics has not been identified and may be difficult to find. In addition, if the backfill is substantially different in structure, nutrient and biological characteristic than the original soil, it may not be able to support vegetation similar to that present before remediation.

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 up to 3,000 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 installation of the treatment system (projected to be up to 2 weeks for each system) followed by 5 years of treatment system operation.
Backfill requirement	No backfill would be required.	Same as the Groundwater No Action Alternative.	About 3,000 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 about 3,000 cubic yards of bedrock at the RMHF leach field site 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 unique 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 3,000 cubic yards of backfill that addresses the LUT values for SSFL would be difficult to find. In addition, if the backfill is substantially different in structure, nutrient and biological characteristics than the original soil, it may not be able to support vegetation similar to that present before remediation.

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 new groundwater storage tanks. 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 2–12. 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 (up to) 2 weeks that could be required to install a system followed by the 5 years that the system is 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 2–12) if groundwater extraction and treatment or related systems were installed and operated for a period of approximately 5 years.

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 about 3,000 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 where only focused soil removal would be implemented if necessary. 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.

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 (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.

Up to 99 acres of land could be disturbed under the High Impact Combination, while about 17 acres could be disturbed under the Low Impact Combination. Disturbed land under the Low Impact Combination 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 677,000 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, 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). In addition, if the backfill is substantially different in structure, nutrient and biological characteristics than the original soil, it may not be able to support vegetation similar to that present before remediation.

About 42,000 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 the availability of soil with unique biological characteristics. These impacts 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 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 4.9.2.7.

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 about 90 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 52 fewer acres would be disturbed (about 38 acres 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 (10 acres under the Residential Scenario or 9 acres under the Open Space Scenario).
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 have 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 881,000 cubic yards of soil and disturb about 90 acres of land. 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 (see Chapter 6, Table 6–2) would be implemented in areas excavated to bedrock; this mitigation measure requires excavation and backfill activities to be completed prior to or following the primary rainfall season of December through March.

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 (see Chapter 6, Table 6–2) includes the addition of stormwater retention structures (such as catch basins or retention basins) and additional erosion control measures if runoff studies indicates 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 removed soil volume and the size of the disturbed area 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 this alternative than that under the Cleanup to AOC LUT Values Alternative.

4.3.1.4 Conservation of Natural Resources Alternative

Under both scenarios for 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 both scenarios for this alternative than that 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, the 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 Construction General Permit to be prepared for the overall project will include a SWPPP (described in Section 4.3.1.2) that will address measures to protect surface water resources during building demolition operations. 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 would determine whether additional soil excavation was needed. Once these areas have been shown to meet the prescribed remediation 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 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.

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.

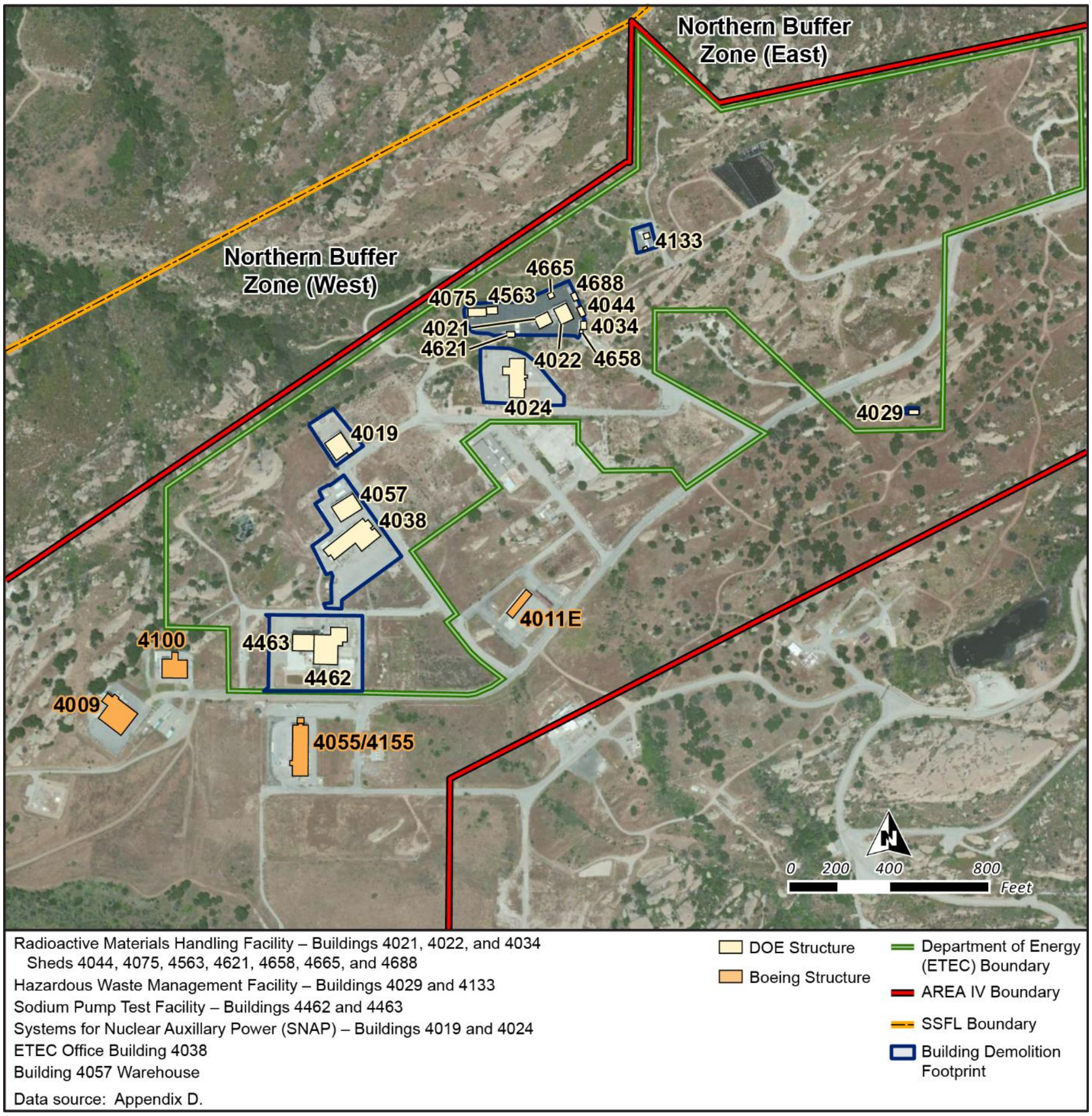

Figure 4–5 Locations of DOE Buildings in Area IV

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.

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 (groundwater seeps).	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 (up to 99 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 17 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 requires that, in areas excavated to bedrock, excavation and backfill activities would be completed prior to or following the primary rainfall season of December through March. Mitigation Measure SW-2 requires 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 primary rainfall season of December through March. 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 requires 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 secondarily 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 2014). 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.

Per the 2007 CO (DTSC 2007), specific cleanup levels for groundwater were developed as part of the *Draft Area IV Groundwater Corrective Measures Study, Santa Susana Field Laboratory, Ventura County, California (Draft Corrective Measures Study)* (CDM Smith 2018c). As described in this *Draft Corrective Measures Study*, maximum contaminant levels (MCLs) will be used as indicators of water quality goals. 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. 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 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**.

Table 4–20 Groundwater 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*
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 for both the Residential and Open Space Scenarios.
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 for both the Residential and Open Space Scenarios.

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

[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.

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; the extent to which the impacted soil represents a source of contaminants to groundwater is under investigation.

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, the extent to which the impacted soil represents a source of contaminants to groundwater is under investigation. 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 may 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 Demolition 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. If the work is performed in a wet year this alternative may require dewatering of the Building 4024 basement. Any contaminants removed during dewatering would result in a small improvement in water quality at the Building 4024 location.
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 mainly 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 water table rises and the basement of Building 4024 (about 40 feet deep) 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 but under different timeframes. Under all three alternatives, radionuclide concentrations would continue to decrease due to natural radioactive decay regardless of any action taken. 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. The geology and hydrogeology at each plume is described in Chapter 3, Section 3.4.3, and are significant factors in the ultimate effectiveness of some active technologies. For example, the contaminant mass at the FSDF is in both the groundwater in the bedrock fractures and the groundwater in the bedrock matrix. The ability to pump out the fractures is dependent on the frequency and interconnectiveness of the fractures. In addition the effectiveness will be dependent on the rate of diffusion of trichloroethylene (TCE) from the rock matrix back into the fractures. The rate of back-diffusion is not known. All groundwater remediation operations would undergo a 5-year review to determine if the selected technologies are effectively reducing contaminant concentrations (as EPA does at RCRA sites nationwide). Based on the 5-year review evaluation, the selected remedy and technologies could be modified to enhance the remedy effectiveness.

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 plume	Monitor for more than 20 years	– 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 4100/56 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 2015c). 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 2015c).

[c] MNA is the only technology evaluated for the RMHF TCE plume, the tritium plume, and the Metals Clarifier TCE plume because concentrations in 2017 were approaching the respective MCLs.

[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 if water is treated and released on site. Off-site disposal would reduce local quantity by the amount transported.

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 TCE and other organic compounds in groundwater would decrease due to attenuation, diffusion into the bedrock 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 the presence of chemicals in groundwater samples indicates decomposition of TCE is slowly occurring, it may require 30 to 50 years before the TCE concentrations in the FSDF area decrease below the TCE MCL. Low levels of TCE in 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 200 gallons of purge water (see Appendix D), which would be transported to a permitted hazardous waste treatment facility in accordance with its waste acceptance criteria.

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 and organic compounds in the groundwater plumes. Under the Groundwater Monitored Natural Attenuation Alternative, the current groundwater monitoring sample analysis program could be expanded to confirm that the chemical and biological conditions of the groundwater remain conducive to natural breakdown of organic chemicals. Monitored natural attenuation would only be considered for groundwater plumes with established degradation rates, such as for the Tritium plume, RMHF TCE plume, and Metals Clarifier/Leach Field 3 plume.

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. About 100 gallons of well installation wastewater would be generated for each well. The annual generation of monitoring well purge water would be essentially the same (200 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) on 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 remedies being considered for Area IV are assessed in the *Draft Corrective Measures Study* (CDM Smith 2018c) for groundwater remediation. The *Draft Corrective Measures Study* is subject to approval by DTSC. The effectiveness of the selected technologies to reduce contaminant concentration would be evaluated in 5-year reviews, based on the standard practice under RCRA to review remedy effectiveness on a 5-year timeframe. Based on the 5-year review evaluation, the selected remedy and technologies could be modified to enhance the remedy effectiveness. 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. If bedrock is excavated, existing overburden would be used to partially backfill the excavation if the overburden meets contaminant concentration limits.
- FSDF Area TCE Plume – Pump and treat to levels below MCLs before re-injecting treated water back into the aquifer would result in reducing groundwater contaminants at the FSDF. 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 Plume – Pumping followed by treatment of groundwater would be a way to decrease TCE concentrations in the near-surface groundwater. Soil vapor extraction, enhanced *in situ* treatment through chemical injection, and treatment through biological enhancement may be viable technologies, but would require field testing to design.
- Building 4100/56 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, or other technologies, 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, 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 (both scenarios), 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 (both scenarios), 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, if any, is relatively low because the most highly impacted soil has already been removed. The remaining contaminants in soil may have naturally decayed, and may not be mobile due to their chemical and physical properties. 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 improvement over time in the quality of groundwater at Area IV and the NBZ, with no exceedance of an impact threshold, as summarized in Table 4–2. Implementing the soil remediation action alternatives and groundwater remediation alternatives would improve the quality of groundwater at Area IV and the NBZ as contaminants in soil and bedrock would no longer threaten groundwater quality. Because the primary source of water for Area IV remediation activities would be the CMWD rather than onsite wells, only the groundwater treatment alternative would have the potential to impact the quantity of groundwater available at Area IV; however, 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.

[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:

- Native habitats, 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 56 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 56 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 3–23).

- 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, including for example species protected under California Fish and Game Code Sections 3503 and 3503.5, and habitats of migratory birds (EO 13186).

Assumptions for Areas Within Which the Exemption Process Would be Applied

Areas within which the exemption process would be applied under the 2010 AOC (DTSC 2010a) are shown in Chapter 2, Figure 2–2, and include areas containing sensitive biological resources. Information about these biological resources is provided in Chapter 3, Section 3.5. Biological resources considered for this analysis in this section are listed in **Table 4–24**. **Figure 4–6** shows the areas within which the exemption process would be applied. In addition to identifying areas within which the exemption process would be applied, potential suitable habitat for two federally listed species, the coastal California gnatcatcher (Threatened) and least Bell's vireo (Endangered) has been identified in Area IV or the NBZ (USFWS 2018), and are shown in **Figure 4–7**. Neither species has been documented recently (within the last 5 years) in Area IV or the NBZ, but due to the possible long duration of the proposed project, habitat conditions that may change and these species may use

[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.

the site at some point during project implementation. As a result, potentially suitable habitat for these species has been identified and mapped (see Chapter 3, Section 3.5). If the areas identified as potential suitable habitat are occupied by federally listed species in the future, DOE would propose that those areas also be subject to the exemption process in order to avoid or minimize impacts on these species (USFWS Biological Opinion 2018, in Appendix J).

Table 4–24 Sensitive Biological Resources Documented in the Areas Where the Exemption Process Would Be Applied

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*) [a]
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*) [b]
Catalina mariposa lily (*Calochortus catalinae*)	CRPR 4.2
California red-legged frog (*Rana draytonii* [*Rana aurora ssp. 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 (vernal pool fairy shrimp or Riverside fairy shrimp may occur there)

CESA = California Endangered Species Act; CRPR = California Rare Plant Rank; ESA = Endangered Species Act.
[a] Analyzed as slender flowered mariposa lily (*C. clavatus* var. *gracilis*) which has the higher CRPR of the two.
[b] Analyzed as late-flowering mariposa lily (*C. fimbriatus*), which has the highest CRPR of the three.

Impact Threshold Criteria

Applying Council on Environmental Quality (CEQ) guidelines for NEPA (40 CFR 1508.27), impact significance for a biological resource is assessed based on intensity of the impact (how severely the resource is affected) and context (what proportion of the resource is affected). Context takes into account 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.

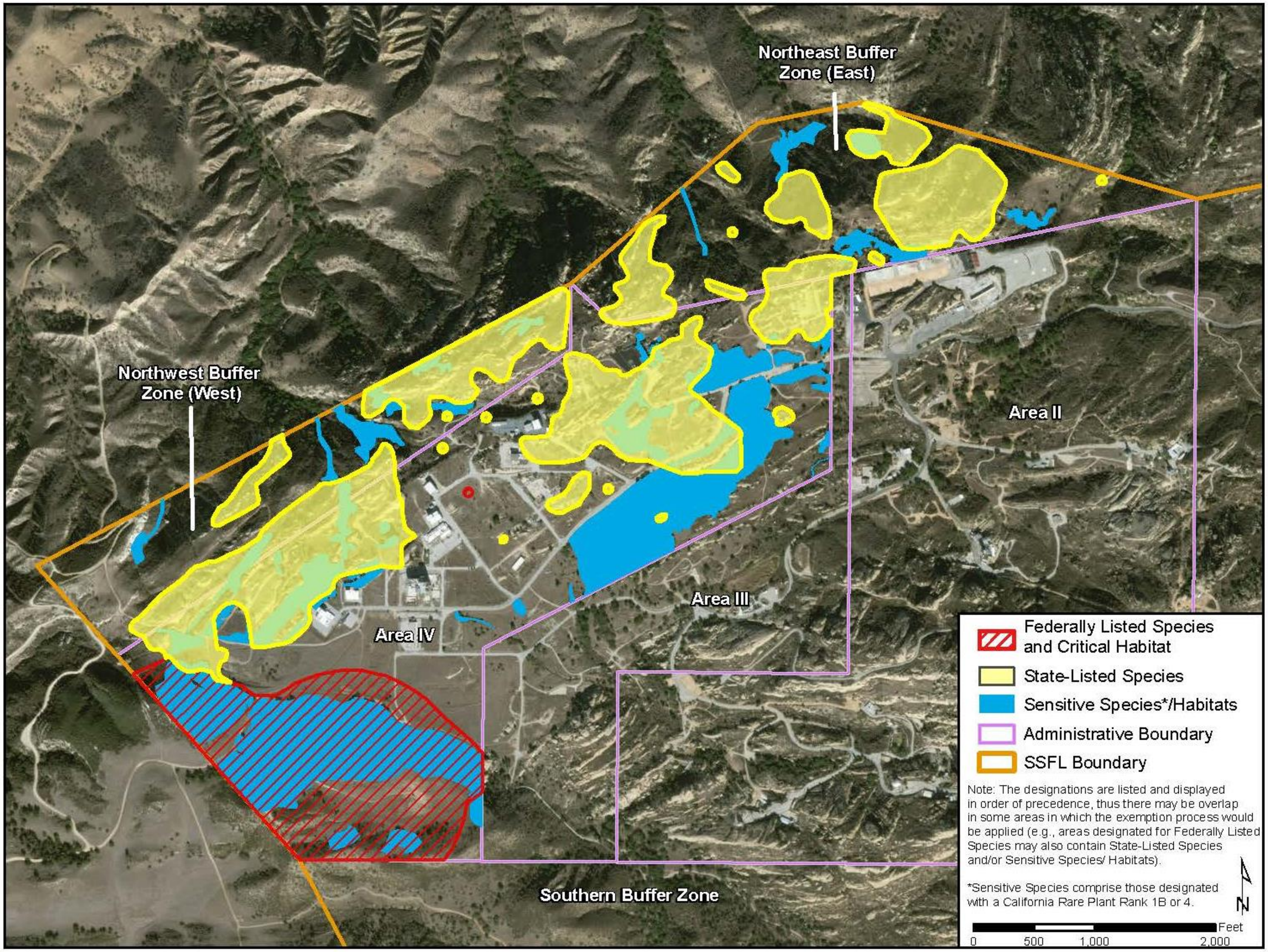

Figure 4–6 Areas Subject to the Exemption Process due to Federally Listed Species and Critical Habitat, State-Listed Species, and Sensitive Species/Habitats

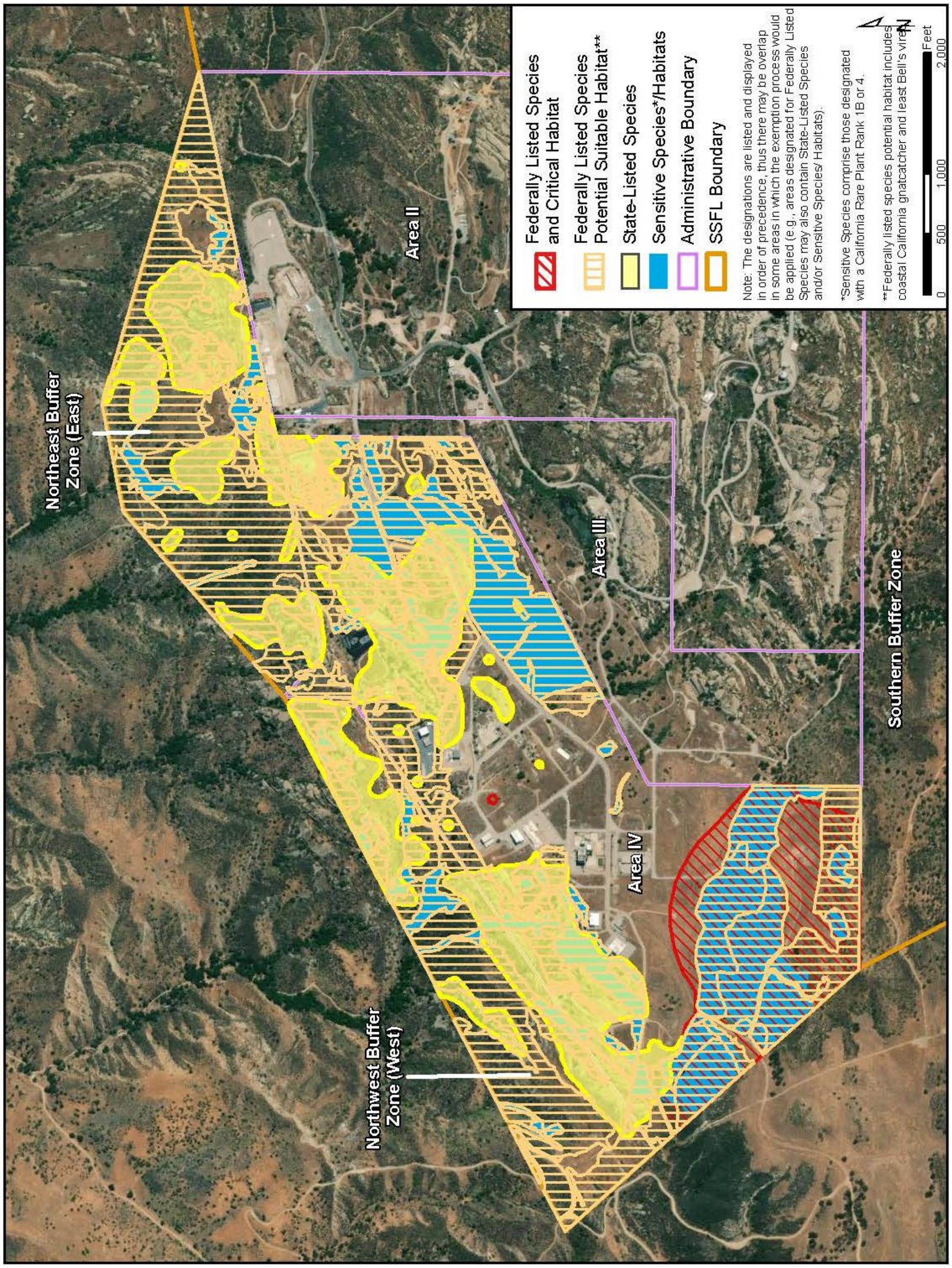

Figure 4–7 Areas Subject to the Exemption Process (based on known occurrence of Federally Listed Species and Critical Habitat, State-Listed Species, and Sensitive Species/Habitat Federally) and Areas Potentially Subject to the Exemption where Federally Listed Potential Suitable Habitat Occur (shown in orange)

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 movement 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 initiated formal ESA Section 7 Consultation with the USFWS and the California Department of Fish and Wildlife (CDFW) on January 31, 2018 (DOE 2018a). Informal consultation had been ongoing over the past few years amongst DOE, USFWS, and CDFW. DOE concluded in its Biological Assessment that the proposed action (including the Cleanup to AOC LUT Values Alternative, proposed building removal and proposed groundwater remediation and monitoring) may affect and is likely to adversely affect six species (Braunton's milk-vetch and its designated critical habitat, California red-legged frog, coastal California gnatcatcher, least Bell's vireo, vernal pool fairy shrimp, and Riverside fairy shrimp). In addition, DOE concluded that the proposed action may affect but is not likely to adversely affect designated critical habitat for the California red-legged frog. The USFWS issued a Biological Opinion concurring that the proposed action, including cleanup to risk-based standards protective of human health and the environment in areas where the exemption process would be applied, would not likely jeopardize the continued existence of a federally listed species or result in adverse modification of critical habitat. The Biological Opinion is contained in Appendix J.

For State-listed species in the project area DOE concluded in its Biological Assessment (DOE 2018a) that the proposed action would have regionally significant direct and indirect long-term impacts that are not fully mitigable on two species (Santa Susana tarplant and Malibu baccharis); locally significant direct, long term impacts that are not fully mitigable on two species (Slender mariposa lily and late-flowering mariposa lily); and locally significant direct, long term impacts that may not be fully mitigable on one species (California screw moss) should it occur on the site. Because of its focus on compliance with the Federal and California endangered species acts, the Biological Assessment focused on listed endangered, threatened, rare, and California Rare Plant Rank (CRPR) 1B species. For completeness, the Biological Assessment addressed other sensitive species listed in Table 4–24 (e.g., species having a CRPR of 4.2 or 4.3 and California fully-protected species) in an appendix and did not include them in the summary determinations identified above.

In response to DOE's request for technical assistance, CDFW (letter to John Jones December 8, 2016) stated "…it would be reasonable and prudent to establish exemption areas to protect Santa Susana tarplant habitat and focus soil remediation efforts using risk-based criteria, which would restrict soil excavation to the minimum amount necessary to protect human health." An Incidental Take Permit to be issued by CDFW will establish the controls for protection of the Santa Susana tarplant.

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 and CDFW.

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 in areas that had been previously disturbed, 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 fostering percolation of rainfall into the soil.

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.

No new adverse effects on vegetation or wildlife from leaving chemical and radiological constituents in place are expected because these substances have been present for many decades under similar environmental conditions. Outside of previously developed sites in Area IV where the habitat is slowly recovering from the physical disturbance associated with development and use of facilities in Area IV, the habitat and biota which occupy most of Area IV appear to have normal species composition and normal ecological function, which reflects ongoing recovery from the 2005 Topanga Fire that affected most of Area IV and the NBZ and several years of drought. There are buffering mechanisms in the environment that suggest leaving in place some soil with chemical levels above background would not have widespread detrimental effects. To some degree, and this is chemical- and species-specific, plants and wildlife can tolerate or adapt to chemical levels that are elevated above background. Additionally, plants and wildlife unable to tolerate elevated levels may already have been replaced by species with reduced sensitivity. In some cases chemicals might have limited or no bioavailability (e.g., most of the mercury on-site). Thus, these chemicals might be present above LUTs or screening levels but essentially unavailable to biological resources. Other substances are extremely localized on site and would not be expected to cause adverse effects at the population level due to the limited areal extent of the elevated concentrations. Based on review to date of the abundant chemical and radiological sample data for Area IV, the exceedance locations within most of the previously undeveloped portions of the site are much more limited than those in the previously developed portions of the site, as would be expected. Under the Soil No Action Alternative, it is expected that vegetation and habitat would continue to gradually recover from past disturbance, a process that could take decades depending on the nature and severity of the past disturbance.

Table 4–25 Biological Resources Impacts under the Soil Remediation Alternatives

		Soil Remediation Action Alternatives			
				Conservation of Natural Resources	
Resource	*Soil No Action Alternative*	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Residential Scenario*	*Open Space Scenario*
Vegetation and wildlife habitat and biota	No adverse impacts are expected.	Removal of existing vegetation and wildlife habitat from about 90 acres would result in the difficult reestablishment of native plant species and wildlife habitat because of the extent of vegetation and soils removed. 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 33 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 areas where the exemption process would be applied because remediation would occur via focused removal actions that would minimize soil and habit disturbance. Focused removal actions according to the exemption process would affect an estimated 4 acres of the 90 acres removed under this alternative.	Substantially reduced impacts on vegetation and wildlife habitat and on biota because the removal of vegetation and wildlife habitat (about 38 acres) would be less than half of 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 14 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected. Impacts within the areas where the exemption process would be applied would affect an estimated 4 acres of the 38 acres that would be removed.	Substantially reduced impacts on vegetation and wildlife habitat and on biota because the removal of vegetation and wildlife habitat would affect about 10 acres, 80 fewer acres than under the Cleanup to AOC LUT Values Alternative and 28 fewer acres than under the Cleanup to Revised LUT Values Alternative. Because substantially less topsoil would be concurrently removed, the feasibility of restoration would be increased 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 5 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected. Impacts in the areas where the exemption process would be applied would affect an estimated 4 acres of the 10 acres that would be removed.	Substantially reduced impacts on vegetation and wildlife habitat and on biota because the removal of vegetation and wildlife habitat would affect about 9 acres, 81 fewer acres than under the Cleanup to AOC LUT Values Alternative and 29 fewer acres than under the Cleanup to Revised LUT Values Alternative. Because substantially less topsoil would be concurrently removed, the feasibility of restoration would be increased 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 5 acres of relatively undisturbed native habitat (including coast live oak woodland and northern mixed chaparral) would be affected. Impacts in the areas within which the exemption process would be applied would affect an estimated 4 acres of the 9 acres that would be removed.
Aquatic and wetland habitats and biota	No adverse impacts are expected.	Less than 0.4 acres 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 wetlands and ephemeral drainages directly affected would be would be about 0.2 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 wetlands and ephemeral drainages directly affected would be less than 0.06 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 wetlands and ephemeral drainages directly affected would be less than 0.06 acres. Use of BMPs and mitigation measures would minimize potential indirect impacts.

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives			
				Conservation of Natural Resources	
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Residential Scenario	Open Space Scenario
Threatened, endangered, and rare species	No adverse impacts are expected.	Remediation in Area IV and the NBZ would affect about 90 acres of vegetation and wildlife habitat some of which may support endangered or threatened species while remediation activities are ongoing. The area affected by soil removal includes an estimated 4 acres within the areas where the exemption process would be applied and where most threatened, endangered, and rare species in Area IV and the NBZ are located, including Braunton's milk-vetch, as well as critical habitat for two federally listed species (Braunton's milk-vetch and California red-legged frog). Focused removal actions would minimize the remediation impacts.	Generally similar to impacts under the Cleanup to AOC LUT Values Alternative, but much less habitat would be affected (38 acres) some of which may support endangered or threatened species while remediation activities are ongoing. Impacts of focused removal actions in the estimated 4 acres where the exemption process would be applied would be as described 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 (10 acres) some of which may support endangered or threatened species while remediation activities are ongoing. Impacts of focused removal actions in the estimated 4 acres where the exemption process would be applied would be as described 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 (9 acres) some of which may support endangered or threatened species while remediation activities are ongoing. Impacts of focused removal actions in the estimated 4 acres where the exemption process would be applied would be as described 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.

4.5.1.1.2 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.

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 value. Initial emphasis would be on removal of soil containing radionuclides in concentrations above AOC LUT values and soil classified as hazardous waste. A total of 90 acres would be affected and vegetation and soils would be removed from Area IV and the NBZ; 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 in the vicinity of RMHF and north of the SRE area and along some of the drainages. **Table 4–26** summarizes the vegetation and wildlife habitat areas directly affected under each soil remediation action alternative.

Areas that contain chemical or radioactive constituents exceeding AOC LUT values within the areas where the exemption process would be applied, an estimated 4 acres, 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 areas where the exemption process would be applied would vary from one such area to another, depending on the nature and extent of the removal actions required.

Management measures, including conducting pre-construction surveys, identifying impact-minimizing access routes, deploying biological monitors during work activities, avoiding nesting season for birds or incorporating adequate setbacks, and implementing soil stabilization and restoration techniques would help to further minimize impacts in the areas where the exemption process would be applied. DOE would take action in these areas in locations where soil chemical or radionuclide levels would 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 90 acres of vegetation and wildlife habitat would be removed, representing about 19 percent of the total habitat in Area IV and the NBZ. 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 areas where the exemption process would be applied have more-heavily disturbed vegetation and soil than those within the areas where the exemption process would be applied. 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.

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		Cleanup to Revised LUT Values		Conservation of Natural Resources (Residential Scenario)		Conservation of Natural Resources (Open Space Scenario)		
	Acres	% of Total	Acres	% of Total	Acres	% of Total	Acres	% of Total	
Nonnative Annual Grassland	17.8	40	9.7	21	1.4	3	0.9	2	44.9
Northern Mixed Chaparral – Burned	26.2	14	10.4	5	2.4	1	2.2	1	192
Northern Mixed Chaparral – Sandstone Outcrops	1.8	3	0.7	1	0.3	1	0.3	1	61.1
Northern Mixed Chaparral – Unburned	1.1	12	0.0	0	0.0	0	0	0	8.8
Coast Live Oak Woodland/Savanna	3.5	5	2.8	4	2.3	4	2.3	4	63.3
California Walnut Woodland	0.0	0	0.0	0	0.0	0	0.0	0	9.4
Riparian	0.4	16	0.2	8	0.1	4	0.1	4	2.5
Mulefat-dominated Formerly Disturbed	0.2	22	0.1	11	0.1	12	0.1	12	0.9
Revegetated Formerly Disturbed	10.8	51	2.3	11	0.5	2	0.4	2	21.4
Steep Dipslope Grassland	0.0	0	0.0	0	0.0	0	0.0	0	7.7
Unvegetated Disturbed/Developed	20.3	48	8.6	20	2.3	5	2.0	5	42.4
Venturan Coastal Scrub	<0.1	<0.1	<0.1	1	0.0	0	0.0	0	3.1
Weed-dominated Formerly Disturbed	8	57	3.2	23	0.6	4	0.6	4	14.0
Total [b]	**90**	**19**	**38**	**8**	**10**	**2**	**9**	**2**	**472**

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

[a] This analysis includes the areas within which the exemption process would be applied. About 4 acres of the total disturbance for each alternative would occur in the areas within which the exemption process would be applied. 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 3–4 and Figure 3–22, respectively.

[b] Percentages in the "Total" rows are based on the ratio of the total acreage affected by the alternative or option and the total acreage on site.

Note: Totals have been rounded.

Under the Cleanup to AOC LUT Values Alternative, soil removal would occur in relatively undisturbed native habitats (including coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub) covering about 33 acres, or 37 percent of the total area directly affected by soil removal. In these native habitats, 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 had been washed away and where it had 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 to the direct loss of habitat, habitat would also be temporarily lost due to avoidance of remediation activity by wildlife. The degree of the loss would depend on the behavioral response of the individual species. Avoidance of the remediation activity could affect the regional movement of wildlife species in the vicinity of SSFL. However, because remediation activities would likely cease at night when most mammal species, including mountain lion, bobcat, gray fox, coyote, and ringtail, are active and moving about, and because there would be unaffected habitat in the region able to support wildlife movement, the effects on regional wildlife movement and wildlife migration corridors would be limited. 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 (including, for example, species protected by the California Fish and Game Code) 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 90 acres, which includes an estimated 4 acres within the areas where the exemption process would be applied, causing mortality and disturbance of wildlife within and adjacent to the affected areas. The profound soil disturbance caused by remediation will require special measures to accomplish restoration of a self-sustaining native vegetation cover; however, sources of suitable clean soil for backfill have not been identified (see Chapter 2, Section 2.3.2). 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 4–8 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 0.4 acres of wetland habitats and aquatic features:

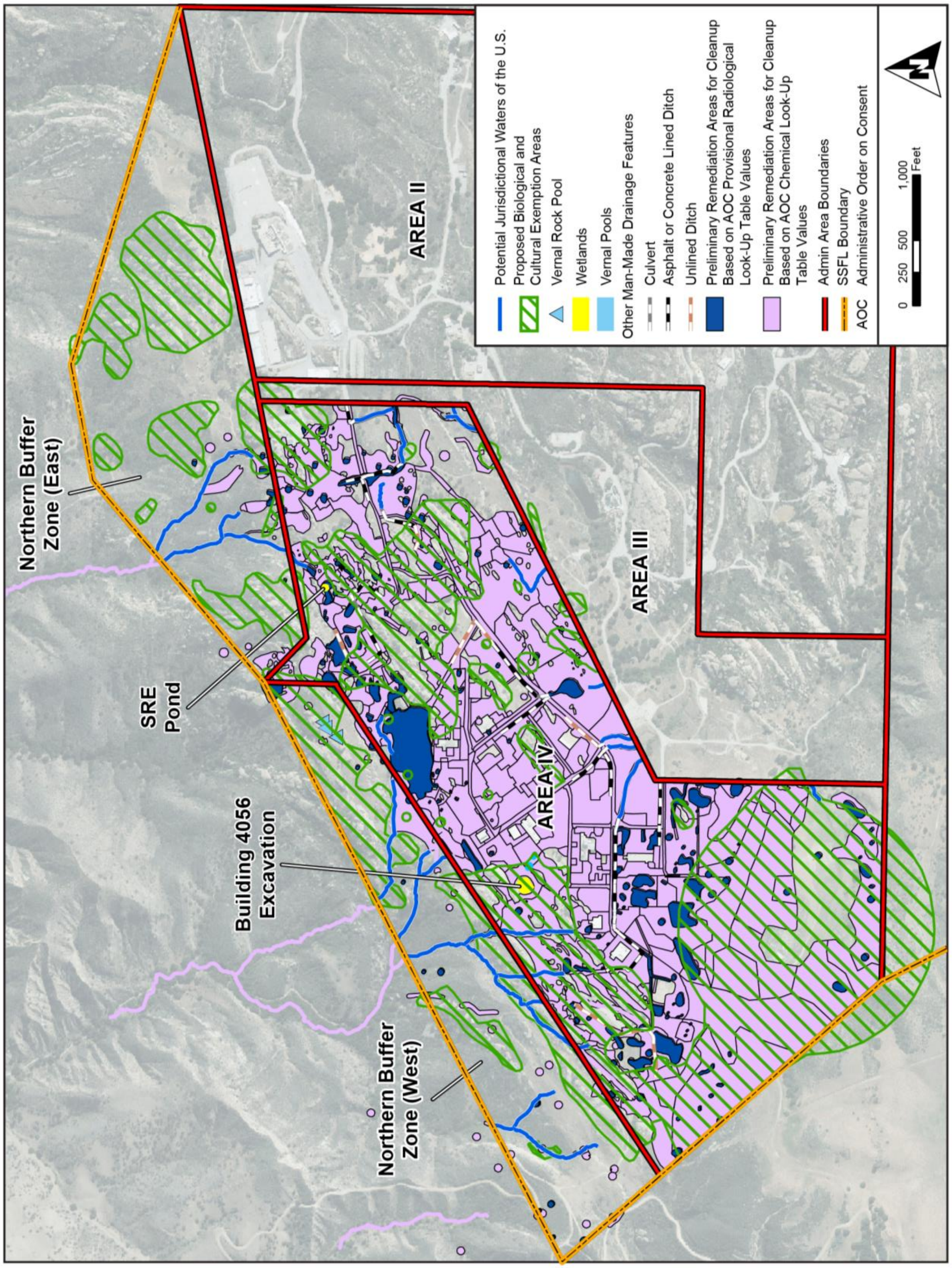

Figure 4–8 Wetlands and Waters of the U.S. under the Cleanup AOC LUT Values Alternative

- Jurisdictional Wetlands – 0.02 acres (the SRE[9] wetland near Outfall 4). The Building 56 excavation and the adjacent vernal pools are in an area where the exemption process would be applied.
- Jurisdictional Waters of the U.S. – 0.16 acres, 3,430 linear feet (natural ephemeral streams in Area IV and parts of the NBZ adjacent to Area IV).
- Non-jurisdictional Waters of the U.S. – 0.16 acres, 4,890 linear feet (man-made asphalt and concrete lined and unlined drainage ditches in Area IV).

The removal actions for areas where the exemption process would be applied would avoid direct impacts on aquatic and wetland habitats and biota to the extent feasible, including the Building 56 excavation and adjacent vernal pools. Limited indirect impacts to these aquatic and wetland habitats 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 (e.g., vernal pool surveys, sensitive species 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.

The rock vernal pools in the NBZ are on top of a large sandstone outcrop and are outside any proposed remediation area. Because of their elevated location and distance from any remediation areas in addition to BMPs and mitigation measures to stabilize soils and minimize wind erosion they are unlikely to experience any appreciable impacts from the remediation activities.

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

The majority of soil would be removed from portions of Area IV outside the areas where the exemption process would be applied, and in some locations in the NBZ as well. Restricting the scope of removal activities within the areas where the exemption process would be applied, as described below, would reduce direct impacts on federally or State-listed and other special-status species, and on critical habitat for Braunton's milk-vetch and California red-legged frog, though the disturbance caused by vegetation and soil removal surrounding the proposed areas where the exemption process would be applied would be substantial and could impact any sensitive species outside these areas.

Remediation within areas where the exemption process would be applied would occur via focused removal actions. A total of 4 acres is estimated to be directly affected by 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. Overall, impacts within the areas where the

[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.

exemption process would be applied would 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 could directly impact and damage individuals or habitat of listed plant species, although there would be some 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, presence of biological monitors, protection or removal of individuals (as appropriate) prior to soil removal and restoration or transplanting of species, and measures to restore the habitat and reestablish the species.

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 implementing an agency-approved invasive species/weed management plan, employing a combination of approaches to minimize entry of invasives onto the site, minimizing their spread, and establishing 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 areas where the exemption process would be applied would minimize 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 on plants would likely be localized, and any sensitive plant species located adjacent to or downwind of soil removal areas would likely recover quickly. Indirect impacts on wildlife could affect larger areas due to the avoidance by wildlife of noise and activity of humans and equipment associated with remediation activities, the area affected depending on the behavioral response of the species. Golden eagles, for example, which have nested adjacent to the NBZ, would be expected to avoid nearby remediation activities. 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 on special-status species or their habitat.

Section 7 Consultation with USFWS under the ESA and consultation with CDFW under CESA has been conducted for the Cleanup to AOC LUT Values Alternative. Informal consultation between DOE, USFWS, and CDFW had been ongoing since 2009 in face-to-face meetings and telephone conferences and a biological assessment was prepared and submitted to both agencies in support of the consultation. The Biological Opinion from USFWS is included in Appendix J of this 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. Examples include implementation of pre-construction surveys, identification of access routes, presence of biological monitors, protection or removal of individuals (as appropriate) prior to soil removal, measures to restore the habitat and reestablish the species, and other measures discussed in Section 4.5.1.2.3.

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 more localized than the areas exceeding AOC LUT values. About 38 acres of vegetation and wildlife habitat would be removed, or 8 percent of the total area of Area IV and the NBZ. This total includes an estimated 4 acres of vegetation and soils removal in areas within which the exemption process would be applied. About 14 acres of relatively undisturbed native habitat, including coast live oak woodland and northern mixed chaparral, would be affected by remediation under this alternative.

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 less than half as much 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 (including, for example, bird species protected under the California Fish and Game Code) 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. Potential effects on regional wildlife movement and wildlife migration corridors would be as described in Section 4.5.1.2.1, but substantially reduced given the reduction in habitat disturbed under the Cleanup to Revised LUT Values Alternative. 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 4–9 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 0.2 acres of wetland habitats and aquatic features:

- Jurisdictional Wetlands – 0.02 acres (the SRE wetland near Outfall 4);
- Jurisdictional Waters of the U.S. – 0.07 acres, 1,570 linear feet (natural ephemeral streams); and
- Non-jurisdictional Waters of the U.S. – 0.09 acres, 3,030 linear feet (man-made asphalt-lined, concrete-lined, and unlined drainage ditches).

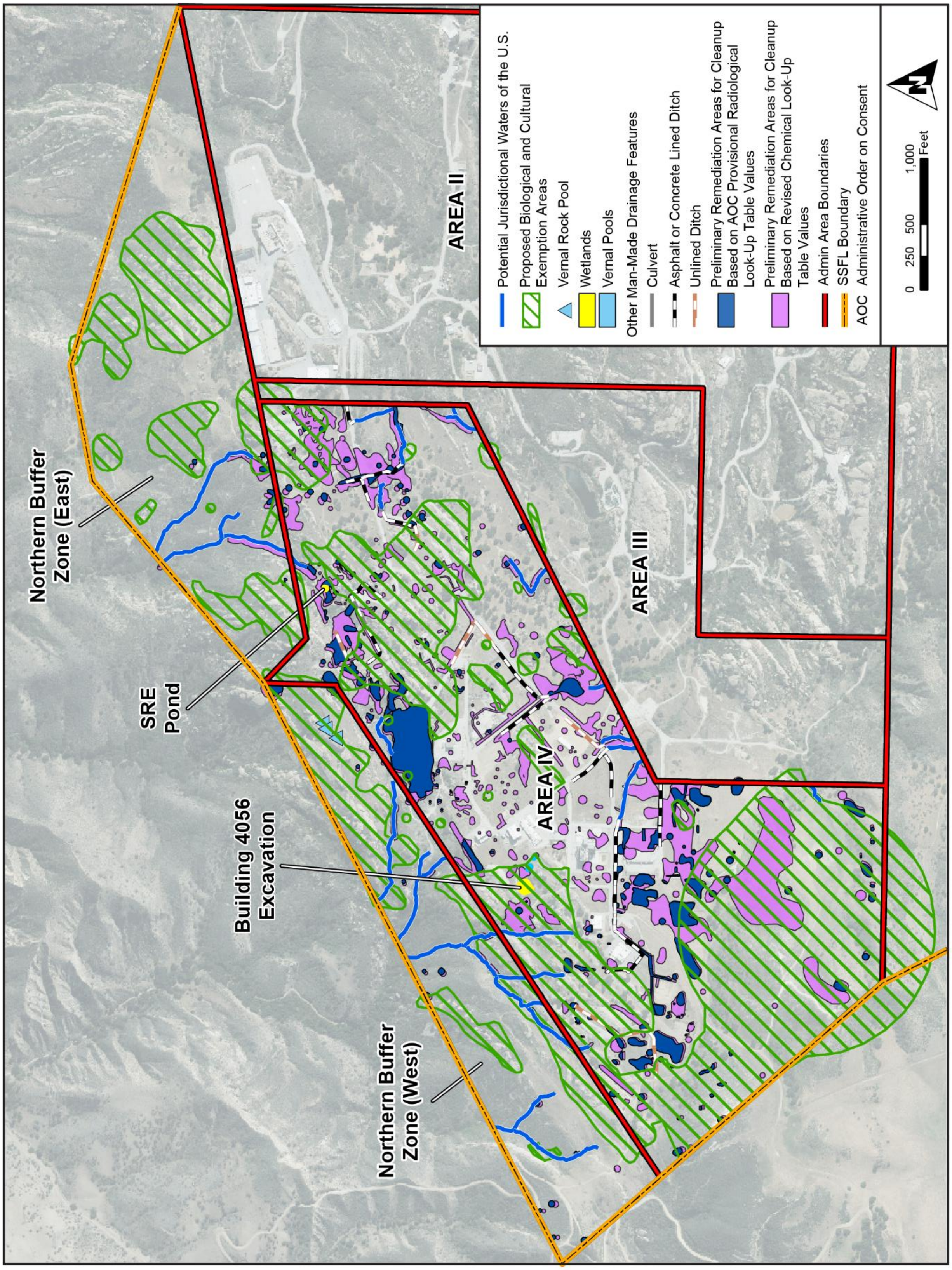

Figure 4–9 Impacts to Wetlands and Waters of the U.S. under the Cleanup to Revised LUT Values Alternative

Impacts on remediated areas would be similar to those described under the Cleanup to AOC LUT Values Alternative, but the area of drainages affected under this alternative would be about 50 percent of that under the Cleanup to AOC LUT Values Alternative. Direct impacts to the Building 56 excavation wetland and vernal pools within the areas where the exemption process would be applied would be avoided to the extent feasible. As under the cleanup to AOC LUT Values 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 the same as those under the Cleanup to AOC LUT Values Alternative, because most individuals of these species are contained within the areas where the exemption process would be applied, which are applicable under all three soil remediation action alternatives.

As described in Section 4.5.1.2.3, remediation within the areas where the exemption process would be applied is estimated to be 4 acres and would occur via focused removal actions, so that direct and indirect impacts within these 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. 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. Examples include implementation of pre-construction surveys, identification of access routes, presence of biological monitors, protection or removal of individuals (as appropriate) prior to soil removal, measures to restore the habitat and reestablish the species, and other measures discussed in Section 4.5.1.2.3.

4.5.1.4 Conservation of Natural Resources Alternatives

Compared with the Cleanup to LUT Values and Revised LUT Values alternatives, the Conservation of Natural Resources Alternative would have dramatically reduced effects as a result of using a risk-based approach in which soil is removed where it represents a risk to human health or ecological resources as determined by application of risk assessments. Two scenarios are evaluated: a Residential Scenario and an Open Space Scenario. The human health risk assessment differs between the two scenarios, resulting in different cleanup levels. However, under both scenarios, the same ecological risk assessment was performed to evaluate the potential effects of chemical and radionuclides in the soil on biotic receptors. Cleanup is determined by whichever risk assessment (human health or ecological) results in the lower concentration allowed to remain in the soil. Note that the Open Space Scenario is consistent with the landowner's (Boeing's) future land use.

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. Under the Residential or Open Space Scenarios, respectively, about 10 and 9 acres of vegetation and wildlife habitat would be removed, or about 2 percent of the habitat of Area IV and the NBZ. These totals include about 5 acres of relatively undisturbed native habitat including coast live oak woodland and northern mixed chaparral. About 4 acres of the 10 or 9 acres total that would be removed under each scenario would be removed from within areas where the exemption process would be applied.

The Conservation of Natural Resources Alternative would have qualitatively similar impacts on the areas remediated as those under the Cleanup to AOC LUT Values Alternative, but would impact 88 to 90 percent less vegetation and soil. In addition, restoration and revegetation would be facilitated because more extensive areas 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 (including, for example, those protected under the California Fish and Game Code) 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. Potential effects on regional wildlife movement and wildlife migration corridors would be as described in Section 4.5.1.2.1, but substantially reduced given the reduction in habitat disturbed under the Conservation of Natural Resources Alternative. 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 would avoid many of the locations with aquatic features including wetlands, potential jurisdictional Waters of the U.S., and other drainage features. Under both scenarios, soil removal would directly impact less than 0.06 acres of wetland habitats and aquatic features:

- Jurisdictional Wetlands – 0.02 acres (the SRE wetland near Outfall 4);
- Jurisdictional Waters of the U.S. – 0.02 acres, 330 (Residential Scenario); 320 (Open Space Scenario) linear feet (natural ephemeral streams); and
- Non-jurisdictional Waters of the U.S. – 0.02 acres, 1,010 (both scenarios) linear feet (man-made asphalt-lined, concrete-lined, and unlined drainage ditches).

Impacts on remediated areas would be similar to those under the Cleanup to AOC LUT Values Alternative, but the area of aquatic features affected would be about 15 percent of that under the Cleanup to AOC LUT Values Alternative. Direct impacts to the Building 56 excavation wetland and vernal pools within the areas where the exemption process would be applied 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 and California red-legged frog, would be qualitatively similar to those under the Cleanup to AOC LUT Values Alternative because most individuals of these species are contained within the areas where the exemption process would be applied, which are applicable for all three soil remediation alternatives.

As described in Section 4.5.1.2.3, remediation within areas where the exemption process would be applied would occur via focused removal actions, so that direct and indirect impacts within these 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 and Cleanup to Revised LUT Values Alternatives, but reduced in magnitude. 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. Examples include implementation of pre-construction surveys, identification of access routes, presence of biological monitors, protection or removal of individuals (as appropriate) prior to soil removal, measures to restore the habitat and reestablish the species, and other 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 nesting bird species. There would be offsetting beneficial impacts on native wildlife from elimination of habitat for nuisance species (e.g., starlings, pigeons, and rats) and creation of restored habitat after buildings are removed. If backfill is substantially different from soils present 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 would be 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 and, may be mitigated or avoided; project implementation 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 and parking lots 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.

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 directly investigated for wildlife use due to safety concerns, 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 their 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, 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 buildings with subgrade vaults would leave holes requiring backfilling. A source is needed for soil for use in 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, and are not considered jurisdictional. Removal of the ditches and subsequent re-grading and restoration to natural conditions would have minimal impacts on natural drainage at Area IV and the 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 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

[10] For example, inducing perching birds to leave by human activity in proximity to the birds.

to support building removal, designated biologist-approved access routes, or 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. Potential 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 3–24) or California red-legged frog (Figure 3–26) is not located in or near the building removal areas; thus, there would be no impacts on critical habitat for these species. Buildings were not directly entered during biological surveys due to safety concerns; however, field and literature studies for wildlife, including birds and bats, on SSFL do not suggest that federally or State-listed endangered or threatened wildlife would be present in the buildings. The State-listed rare 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.

Where feasible, impacts to listed or sensitive 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 avoided, minimized or compensated for through measures described above in Section 4.5.2.2.1 and 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 of the habitat and measures to promote reestablishment of species such as the Santa Susana tarplant., if affected. 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 mobile 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 but mitigable 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 the RMHF could 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 an area where the exemption process would be applied, BMPs and impact avoidance 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 areas where the exemption process would be applied.	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. Small-scale, longer-term impacts would be associated with the actual site occupied by the wells and any new access roads. 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 generally short-term, and would be reduced with implementation of mitigation measures.

Plumes could 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 an area where the exemption process would be applied, adverse impacts on threatened, endangered, and rare species would be avoided or minimized through use of BMPs and impact avoidance and mitigation measures. No adverse impacts on these species are expected from monitoring activities outside the areas where the exemption process would be applied. The biological assessment submitted to USFWS and CDFW for Federal and State endangered species act consultation coupled with the Biological Opinion (see Appendix J) 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 could 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 (e.g., vernal pool 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 56 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 could 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, and would disturb up to 99 acres. 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 99 acres of land, including about 33 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 within or 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 affect approximately 17 acres and have the smallest overall impacts. The Conservation of Natural Resources Alternative, Open Space Scenario, would remove vegetation and wildlife habitat from about 10 acres (Residential Scenario) or 9 acres (Open Space Scenario) including about 4 acres affected by focused removals within the areas in which the exemption process would be applied. 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 between 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 effects on critical habitat, impacts on listed 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 areas where the exemption process would be applied. 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 areas where the exemption process would be applied, 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 would 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 all the 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 2018a).

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 3–26, 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 2014b);
- 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 (BREEZE Software 2017).

Emissions from equipment and vehicle fleets were based on California average fleets for years 2019 and 2021. These years coincide with the expected initiation of proposed building removal and soil remediation activities, respectively. This approach accounted for the projected evolution of the average truck fleet to newer and lower-emitting models in compliance with EPA and California Air Resources Board regulations, including the "2007 Highway Rule" and the "Truck and Bus Regulation."[11] The analysis estimated emissions for proposed activities that extend beyond 2021 with the use of year 2021 fleet emission factors. This is a conservative approach, as emissions from the average equipment and vehicle fleets would continue to decrease to below 2021 levels after this time.

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

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[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/. Information about California's Truck and Bus regulation is athttps://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm.

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 2018a):

- for off-road equipment, the use of EPA Nonroad Tier 4 emission standards, and,
- for on-road trucks, a fleet with individual 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 (VOCs) 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 ranges of total, 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.	For the Residential Scenario, emissions of the same types of pollutants as those under the Cleanup to Revised LUT Values Alternative, but in smaller total quantities. For the Open Space Scenario, emissions of the same types of pollutants as those under the Residential Scenario, but in slightly smaller total quantities.
Greenhouse gases	No additional emissions compared to existing conditions.	A total of 30,000 to 80,000 metric tons of CO_2 would be emitted, primarily from vehicles.[a]	A total of 12,000 to 34,000 metric tons of CO_2 would be emitted, primarily from vehicles.[a]	For the Residential Scenario, a total of 1,500 to 4,000 metric tons of CO_2 would be emitted, primarily from vehicles. For the Open Space Scenario, a total of 1,100 to 3,000 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. These emissions would occur during a period of 26 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 for PM_{10} and $PM_{2.5}$) than those under the Building Removal Alternative (see Section 4.6.2.2).

EIS Soil Categories

Soil Category	Description
1	Soil with chemical constituents in concentrations that exceed AOC LUT values, but are below risk-based levels; is not a radioactive waste.
2	Soil with chemical constituents in concentrations that exceed human or ecological risk based levels, but do not quality as hazardous or radioactive waste.
3	Soil with chemicals exceeding hazardous waste standards; radionuclides at or below provisional LUT values.
4	Soil with radioactive constituents that exceed AOC LUT values; includes soil with the full range of chemical constituent concentrations, from below AOC LUT values through hazardous waste.

Table 4–32 presents estimates of peak annual emissions from implementing the Cleanup to AOC LUT Values Alternative. Peak annual emissions of combustive emissions would occur in year 2021 and would be slightly higher compared to year 2022 activities. This is the case, as the further distances to disposal sites designated for the associated soil categories would cause haul trucks to drive more miles compared to year 2022 activities. In addition, average emission factors for project off-road equipment and haul truck fleets would be higher in year 2021 and would slowly decrease each subsequent year. Peak annual emissions of PM_{10} and $PM_{2.5}$ would occur in years 2025 through 2045 in association with maximum annual levels of soil categories 1 and 2 removed during this period, which would produce the largest amount of fugitive dust per unit of soil for any soil category.

4.6.1.3 Cleanup to Revised LUT Values Alternative

Table 4–31 presents total emissions from implementing the Cleanup to Revised LUT Values Alternative. These emissions from the alternative would occur during a period of 6 years. 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 (soil category 1 with chemicals that exceed AOC LUT values, but are below risk-based levels, and radionuclides at or below AOC LUT values) would be removed compared to the Cleanup to AOC LUT Values Alternative.

As shown in Table 4–32, peak annual emissions would be the same from implementing either the Cleanup to Revised LUT Values Alternative or Cleanup to AOC LUT Values Alternative. Annual emissions would be the same from both alternatives for the first 5 years of activities, as they would remediate the same amounts of soils during this time. However, emissions for the Cleanup to Revised LUT Values Alternative would be lower than the Cleanup to AOC LUT Values Alternative in year 2026 and then would end after this year.

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	6.00	41.18	50.10	0.09	2.28	2.18	6,852
On-road Vehicles – Nearby Disposal Site	2.32	15.07	71.07	0.25	1.84	0.96	23,433
On-road Vehicles – Distant Disposal Site	6.25	31.19	221.83	0.77	6.23	3.21	72,771
Fugitive Dust					213.01	45.06	
Total – Nearby Disposal Site	**8.32**	**56.25**	**121.18**	**0.34**	**217.13**	**48.20**	**30,284**
Total – Distant Disposal Site	**12.25**	**72.38**	**271.94**	**0.86**	**221.52**	**50.45**	**79,622**
Cleanup to Revised LUT Values Alternative							
Off-road Equipment	1.35	9.10	10.84	0.02	0.51	0.48	1,462
On-road Vehicles – Nearby Disposal Site	0.95	5.17	32.43	0.11	0.89	0.46	10,681
On-road Vehicles – Distant Disposal Site	2.66	12.22	98.37	0.34	2.81	1.45	32,258
Fugitive Dust					41.01	9.25	
Total – Nearby Disposal Site	**2.30**	**14.28**	**43.27**	**0.13**	**42.41**	**10.20**	**12,143**
Total – Distant Disposal Site	**4.02**	**21.33**	**109.20**	**0.36**	**44.32**	**11.18**	**33,720**
Conservation of Natural Resources Alternative – Residential Scenario							
Off-road Equipment	0.36	2.48	3.03	0.01	0.14	0.13	414
On-road Vehicles – Nearby Disposal Site	0.11	0.90	3.23	0.01	0.08	0.04	1,100
On-road Vehicles – Distant Disposal Site	0.31	1.71	10.85	0.04	0.30	0.16	3,596
Fugitive Dust					12.57	2.70	
Total – Nearby Disposal Site	**0.48**	**3.38**	**6.26**	**0.02**	**12.79**	**2.87**	**1,514**
Total – Distant Disposal Site	**0.67**	**4.19**	**13.88**	**0.04**	**13.01**	**2.98**	**4,010**
Conservation of Natural Resources Alternative – Open Space Scenario							
Off-road Equipment	0.27	1.86	2.27	0.00	0.10	0.10	309
On-road Vehicles – Nearby Disposal Site	0.08	0.78	2.31	0.01	0.06	0.03	827
On-road Vehicles – Distant Disposal Site	0.23	1.38	7.94	0.03	0.22	0.11	2,670
Fugitive Dust					9.69	2.03	
Total – Nearby Disposal Site	**0.36**	**2.63**	**4.58**	**0.01**	**9.85**	**2.15**	**1,136**
Total – Distant Disposal Site	**0.50**	**3.23**	**10.21**	**0.03**	**10.01**	**2.24**	**2,979**
Building Removal Alternative							
Off-road Equipment	2.11	16.05	17.76	0.03	1.00	0.99	2,504
On-road Vehicles – Nearby Disposal Site	0.19	1.92	5.77	0.02	0.14	0.08	1,878
On-road Vehicles – Distant Disposal Site	0.48	2.98	16.83	0.05	0.41	0.24	4,604
Fugitive Dust					5.95	1.48	
Total – Nearby Disposal Site	**2.30**	**17.97**	**23.54**	**0.05**	**7.10**	**2.55**	**4,381**
Total – Distant Disposal Site	**2.59**	**19.03**	**34.59**	**0.08**	**7.37**	**2.71**	**7,107**
Groundwater Treatment Alternative							
Off-road Equipment	0.01	0.12	0.13	0.00	0.01	0.01	27
On-road Vehicles – Nearby Disposal Site	0.04	0.18	1.42	0.00	0.04	0.02	463
On-road Vehicles – Distant Disposal Site	0.13	0.57	5.04	0.02	0.15	0.07	1,649
Fugitive Dust					0.67	0.17	
Total – Nearby Disposal Site	**0.05**	**0.31**	**1.55**	**0.01**	**0.72**	**0.19**	**489**
Total – Distant Disposal Site	**0.15**	**0.69**	**5.17**	**0.02**	**0.82**	**0.25**	**1,675**

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.

Notes:

- Emissions under each alternative include options to transport waste by truck to nearby and distant disposal sites.
- 0.00 = emissions are less than 0.005 tons.
- Calculated values and totals have been rounded.

Table 4–32 Peak Annual Emissions for Soil Remediation Alternatives

Alternative/Source	Emissions (tons per year)						
	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2 (MT)
Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative							
Off-road Equipment	0.25	1.69	1.99	0.00	0.09	0.09	267
On-road Vehicles – Nearby Disposal Site	0.21	1.09	7.49	0.03	0.21	0.11	2,463
On-road Vehicles – Distant Disposal Site	0.62	2.76	23.10	0.08	0.66	0.34	7,582
Fugitive Dust [a]					8.69	1.81	
Total – Nearby Disposal Site	**0.47**	**2.78**	**9.48**	**0.03**	**8.99**	**2.01**	**2,730**
Total – Distant Disposal Site	**0.87**	**4.45**	**25.09**	**0.08**	**9.45**	**2.24**	**7,849**
Conservation of Natural Resources Alternative, Residential Scenario							
Off-road Equipment	0.24	1.63	1.99	0.00	0.09	0.09	273
On-road Vehicles – Nearby Disposal Site	0.08	0.53	2.26	0.01	0.06	0.03	747
On-road Vehicles – Distant Disposal Site	0.22	1.12	7.81	0.03	0.22	0.11	2,566
Fugitive Dust					8.43	1.81	
Total – Nearby Disposal Site	**0.31**	**2.16**	**4.26**	**0.01**	**8.58**	**1.93**	**1,020**
Total – Distant Disposal Site	**0.46**	**2.76**	**9.80**	**0.03**	**8.74**	**2.01**	**2,839**
Conservation of Natural Resources Alternative, Open Space Scenario							
Off-road Equipment	0.24	1.63	1.99	0.00	0.09	0.09	273
On-road Vehicles – Nearby Disposal Site	0.07	0.51	2.11	0.01	0.05	0.03	695
On-road Vehicles – Distant Disposal Site	0.21	1.08	7.35	0.03	0.20	0.11	2,415
Fugitive Dust					8.88	1.86	
Total – Nearby Disposal Site	**0.31**	**2.15**	**4.10**	**0.01**	**9.02**	**1.97**	**969**
Total – Distant Disposal Site	**0.45**	**2.71**	**9.34**	**0.03**	**9.17**	**2.05**	**2,689**

AOC = Administrative Order on Consent; 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] Peak annual fugitive dust emissions from the Cleanup to AOC LUT Values Alternative would be greater than those for the Cleanup to Revised LUT Values Alternative by 0.37 tons per year of PM_{10} and 0.03 tons per year of $PM_{2.5}$.

Notes:
- Emissions under each alternative include options to transport waste by truck to nearby and distant disposal sites.
- 0.00 = emissions less than 0.005 tons per year.
- Calculated values and totals have been rounded.

4.6.1.4 Conservation of Natural Resources Alternative

4.6.1.4.1 Residential Scenario

Table 4–31 presents total emissions from implementing the Conservation of Natural Resources Alternative, Residential Scenario. Total emissions under the Alternative would be substantially smaller than those under the Cleanup to Revised LUT Values Alternative. The Conservation of Natural Resources Alternative, Residential Scenario would excavate substantially smaller quantities of soils in soil categories 1 and 2 and 4 compared to the Cleanup to Revised LUT Values Alternative. The Alternative would take up to 2 years to remove soil from Area IV and the NBZ.

Table 4–32 presents estimates of peak annual emissions from implementing the Conservation of Natural Resources Alternative, Residential Scenario. Peak annual emissions under this alternative would occur in year 2021. Peak annual combustive emissions would be less than those for the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternatives. While all three alternatives would remove the same amount of total soils in 2021, the Conservation of Natural Resources

Alternative, Residential Scenario, mainly would remove soils during this year in soil categories 1 and 2, whereas the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternatives mainly would remove soils in soil category 4. The distances between SSFL and nearby/distant disposal sites for soil categories 1 and 2 soils would be much less than for soil category 4 soils. As a result, peak annual vehicles miles travelled by haul trucks and their resulting emissions for the Conservation of Natural Resources Alternative, Residential Scenario, would be less compared to those for the Cleanup to AOC LUT Values or the Cleanup to Revised LUT Values Alternatives. Peak annual emissions of PM_{10} and $PM_{2.5}$ for this alternative/option would be slightly less than for the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternatives, as it would remove slightly smaller amounts of categories 1 and 2 soils in 2021 compared to those removed by the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternatives in 2025.

4.6.1.4.2 Open Space Scenario

Table 4–31 presents total emissions from implementing the Conservation of Natural Resources Alternative, Open Space Scenario. Total emissions under the Alternative would be slightly smaller than those under the Conservation of Natural Resources Alternative, Residential Scenario. The Conservation of Natural Resources Alternative, Open Space Scenario, would excavate slightly smaller quantities of soils in soil categories 1 and 2 and 4 compared to the Conservation of Natural Resources Alternative, Residential Scenario. The Alternative would take a little over a year to remove soil from Area IV and the NBZ.

Table 4–32 presents estimates of peak annual emissions from implementing the Conservation of Natural Resources Alternative, Open Space Scenario. Peak annual emissions would occur in year 2021 under this scenario. Peak annual combustive emissions for the Alternative would be slightly less than for the Conservation of Natural Resources Alternative, Residential Scenario. While both scenarios would remove the same amount of total soils in 2021, the Conservation of Natural Resources Alternative, Open Space Scenario would remove slightly less Category 4 soils compared to the Conservation of Natural Resources Alternative, Residential Scenario, which would generate slightly less annual haul truck vehicles miles travelled and resulting emissions. Peak annual emissions of PM_{10} and $PM_{2.5}$ for this alternative/option would be slightly higher than for the Conservation of Natural Resources Alternative, Residential Scenario, as it would remove slightly larger amounts of categories 1 and 2 soils in 2021 compared to those removed by the Conservation of Natural Resources Alternative, Residential Scenario.

4.6.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–33**.

Table 4–33 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 4,400 to 7,100 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 to 3 years to complete.

Table 4–31 presents total emissions that would result from implementing this alternative. The largest contributors to combustive emissions would be diesel-powered generators that could provide electricity to administrative facilities and 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 4–34**.

Table 4–34 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 500 to 1,700 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 primarily 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. Bedrock removal and backfilling would occur during the second year of soil removal and would require less than a year to complete. Activities under this alternative would also include operation of 2 groundwater treatment systems which after being established would each operate for a projected 5-year period. For analysis the systems are assumed to consist of pump and treat systems which in addition to a source of electricity to operate the systems would require periodic replacement of filter media. Monthly replacement of the two projected systems would require access to the site by medium-duty truck, with 24 projected truck round trips for each of 5 operational years.

Table 4–31 presents total emissions from implementing the Groundwater Treatment Alternative. The overwhelming majority of these emissions would occur during the second year of activities when strontium-90 contaminated bedrock would be removed. 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. The data in Table 4–31 show that the Groundwater Treatment Alternative would generate the least amount of emissions for any remediation alternative.

4.6.4 Air Quality and Climate Change Impacts under All Action Alternative Combinations

The air quality analysis evaluated four 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; (3) Conservation of Natural Resources, Residential Scenario, Building Removal, and Groundwater Treatment Alternatives, and (4) Conservation of Natural Resources, Open Space Scenario, 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 four 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]

The primary focus of this subsection is to evaluate emissions that simultaneously would occur from the combined action alternatives against annual emission thresholds and to determine the potential for peak daily emissions to contribute to an exceedance of an ambient air quality standard within each analysis domain. Each action alternative combination would generate an annual average of about 16 daily truck trips, although there could be a larger number of truck trips during some days, provided the total number of heavy duty truck trips was consistent with the Transportation Agreement with Boeing and NASA (Boeing 2015a). For the peak daily analysis, it is assumed that during some days DOE could generate twice as many truck trips, or up to 32 truck trips per day, and the estimation of peak daily emissions for each analysis domain is based on this level of production. Since numerous combinations of proposed activities could generate 32 truck trips per day, the analysis focused on a reasonable worst-case scenario of activities with the highest emission rates per unit of material

[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 annual emissions against annual emission thresholds and daily emissions in regard to their potential to contribute to exceedances of 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. Four potential action alternative combinations are addressed to ensure comparison of the ranges in emissions from these combinations against the annual thresholds and ambient air quality standards.

throughput, which included 8 truck trips per day each for (1) Demolition – Radioactive Metal and Building Debris, (2) Demolition – Soil Backfilling, (3) Soil Excavation – Soil Categories 1 and 2, and (4) Soil Remediation – Soil Backfilling. This translates essentially to the peak year combination of any soil remediation action alternative and the Building Removal Alternative. Very little emissions would result from implementation of the Groundwater Monitored Natural Attenuation Alternative, and the peak emissions for the Groundwater Treatment Alternative would not occur in the same year as that for the combination of the soil remediation action alternatives and the Building Removal Alternative.

4.6.4.1 Ventura County Domain

Unmitigated Impacts

Table 4–35 presents the range in peak annual emissions that would occur within Ventura County from the groups of combined action alternatives summarized above. The range in emissions reflects the implementation schedule and intensity of proposed activities for each action alternative. Annual emissions would peak during the first year of soil removal and in combination with the third and final year of building removal (year 2021) due to maximum annual activity levels and average emission rates for the proposed off-road and on-road vehicle fleets. Annual combustive emissions 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. Peak annual emissions of PM_{10} and $PM_{2.5}$ would occur for one year in combination with the Conservation of Natural Resources Open Space Scenario and Building Removal Alternatives due to maximum levels of categories 1 and 2 soil removed during this period, which would produce the largest amount of fugitive dust per unit of soil for any soil category. The second highest peak for annual emissions of PM_{10} and $PM_{2.5}$ would occur in 2025 or 2025 to 2045 under the Cleanup to Revised LUT Values or Cleanup to AOC LUT Values Alternatives, respectively.

Table 4–35 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. Table 4–35 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 nearly identical, with the only difference occurring from the longer distance travelled within Ventura County by trucks hauling clean building demolition material to the Gillibrand site under the nearby (for soil and not building demolition material) disposal site scenario versus the shorter distances to the distant (for soil and not building demolition material) disposal sites. For most pollutants, the largest contributors to combustive emissions would be off-road construction equipment that would remove soils and building materials 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 shows that peak annual emissions generated from each unmitigated combination of action alternative within Ventura County would remain below the applicable conformity *de minimis* thresholds (50 tons per year of VOCs and nitrogen oxides). As a result, the proposed combinations of action alternatives would not require a conformity determination under the General Conformity Rule and they would conform to the State Implementation Plan for Ventura County.

Table 4–35 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)*
All Soil Remediation Alternatives							
Off-road Equipment	0.24–0.25	1.63–1.69	1.99	0.00	0.09	0.09	267–273
On-road Vehicles – Nearby Disposal Site	0.04	0.25	0.77	0.00	0.01	0.01	217-219
On-road Vehicles – Distant Disposal Site	0.04	0.25	0.77	0.00	0.01	0.01	217-219
Fugitive Dust					8.32–8.88	1.78–1.86	
Subtotal – Nearby Disposal Site	**0.27–0.29**	**1.88–1.94**	**2.76**	**0.01**	**8.43–8.98**	**1.88–1.95**	**486–491**
Subtotal – Distant Disposal Site	**0.27–0.29**	**1.82–1.88**	**2.76**	**0.01**	**8.43–8.98**	**1.88–1.95**	**486–491**
Building Removal Alternative							
Off-road Equipment	0.70	5.36	5.93	0.01	0.34	0.33	837
On-road Vehicles – Nearby Disposal Site	0.01	0.24	0.21	0.00	0.00	0.00	119
On-road Vehicles – Distant Disposal Site	0.01	0.24	0.19	0.00	0.00	0.00	114
Fugitive Dust					1.99	0.49	
Subtotal – Nearby Disposal Site	0.72	5.60	6.14	0.01	2.33	0.83	956
Subtotal – Distant Disposal Site	0.72	5.60	6.12	0.01	2.33	0.83	951
Total – Nearby Disposal Site	**0.99–1.01**	**7.48–7.54**	**8.90**	**0.02**	**8.43–11.31**	**1.88–2.35**	**1,442–1,447**
Total – Distant Disposal Site	**0.99–1.01**	**7.48–7.54**	**8.87–8.88**	**0.02**	**8.43–11.31**	**1.88–2.35**	**1,437–1,442**
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.

Notes:

- The highest total annual emissions would occur during the first year of soil remediation and the third and final year of building removal (year 2021). Annual combustive emissions would be nearly identical for each of the four combinations of action alternatives. However, peak annual PM_{10} and $PM_{2.5}$ emissions would occur during the combined Conservation of Natural Resources, Open Space Scenario, and Building Removal Alternatives.
- 0.00 = emissions less than 0.005 tons per year.
- 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 4–36 presents the peak daily emissions that would occur within Ventura County from the four combined action alternatives summarized above. The evaluated combinations of action alternatives would generate relatively moderate levels of daily combustive emissions such as carbon monoxide (up to 82 pounds per day) and nitrogen oxides (up to 92 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 (including diesel particulate matter [DPM] from equipment and haul trucks within Ventura County).

Table 4–36 Peak Daily Emissions under the Combined Action Alternatives – Ventura County

Activity/Source	*Emissions (pounds per day)*					
	VOC	*CO*	*NO_x*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
All Soil Remediation Alternatives						
Off-road Equipment	1.6	11.3	13.8	0.0	0.6	0.6
On-road Vehicles – Nearby Disposal Site	0.3	2.0	6.2	0.0	0.1	0.1
On-road Vehicles – Distant Disposal Site	0.3	2.0	6.2	0.0	0.1	0.1
Fugitive Dust					50.9	9.3
Subtotal – Nearby Disposal Site	**1.9**	**13.3**	**20**	**0.0**	**51.7**	**9.9**
Subtotal – Distant Disposal Site	**1.9**	**13.3**	**20**	**0.0**	**51.7**	**9.9**
Building Removal Alternative						
Off-road Equipment	7.0	58.2	64.1	0.1	3.0	2.9
On-road Vehicles – Nearby Disposal Site	0.5	10.2	7.3	0.1	0.1	0.1
On-road Vehicles – Distant Disposal Site	0.5	10.1	6.5	0.0	0.1	0.1
Fugitive Dust					41.7	23.6
Subtotal – Nearby Disposal Site	**7.5**	**68.4**	**71.4**	**0.2**	**44.9**	**26.6**
Subtotal – Distant Disposal Site	**7.5**	**68.3**	**70.7**	**0.2**	**44.9**	**26.6**
Total – Nearby Disposal Site	**9.4**	**81.7**	**91.4**	**0.2**	**96.5**	**36.6**
Total – Distant Disposal Site	**9.4**	**81.6**	**90.7**	**0.2**	**96.5**	**36.6**

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:

- Based on a production rate that would generate 32 truck trips of material per day. Peak day emissions would be identical for each of the four combinations of action alternatives.
- Emissions for each alternative include options to transport materials by truck to nearby and distant disposal sites.
- 0.0 = emissions less than 0.05 pounds per day.
- Calculated values and totals have been rounded. 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.

Table 4–36 also shows that the combined action alternatives would result in relatively moderate levels of daily PM_{10} emissions (up to 97 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 (see Chapter 6, Section 6.1, Air Quality Minimization Measure 6-1). 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.

The impact of air emissions to sensitive members of the population is a special concern. The above analyses demonstrate that combustive and fugitive dust emissions generated from the proposed cleanup activities would cause minimal increases to ambient air pollutant levels beyond the SSFL boundary. The nearest sensitive receptors to the project site are residences located about 1 mile south-southeast of Area IV in the Bell Canyon area. Transport of proposed emissions to a distance of nearly one mile to the nearest residence or farther would further dilute these pollutant concentrations to well below any level of health concern.

Green Cleanup Impacts

The total peak annual and daily emissions presented in Tables 4–35 and 4–36 are based on California average off-road and on-road vehicle fleets for the years 2019 and 2021. 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 4 and 2007 EPA Heavy Duty Highway standards, respectively. For example, implementing the green cleanup fleets proposed by DOE as Mitigation Measure AQ-1 would reduce emissions from the average calendar year 2021 fleets by the following amounts, as averaged over emissions of volatile organic compounds, carbon monoxide, nitrogen oxides, and PM_{10}: (1) 51 percent for off-road equipment that meet EPA Nonroad Tier 4 emission standards; and (2) 66 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 4–37 presents the range in peak annual emissions that would occur within the South Coast Air Basin from the four combined action alternatives summarized above. Annual emissions for all of the combined action alternative scenarios would peak during the first year of soil removal and the third and final year of building removal (year 2021) due to maximum (1) emission rates for the proposed on-road vehicle fleets, and (2) annual activity levels and resulting miles traveled by proposed haul trucks within this domain. 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 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	0.03–0.06	0.26–0.38	1.2–2.4	0.00-0.01	0.04–0.07	0.02–0.04	445–823
On-road Vehicles – Distant Disposal Site	0.12	0.60	4.46	0.02	0.13	0.07	1,501
Building Removal Alternative							
On-road Vehicles – Nearby Disposal Site	0.02	0.27	0.42	0.00	0.01	0.01	189
On-road Vehicles – Distant Disposal Site	0.02	0.30	0.69	0.00	0.02	0.01	256
Total – Nearby Disposal Site	**0.05–0.08**	**0.53–0.65**	**1.66–2.81**	**0.01**	**0.05–0.08**	**0.02–0.04**	**634–1,012**
Total – Distant Disposal Site	**0.14**	**0.90**	**5.15**	**0.02**	**0.15**	**0.08**	**1,757-1,758**
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.

Notes:

- The highest total annual emissions would occur during the first year of soil remediation and the third and final year of Building removal (year 2021).
- Emissions under each alternative include options to transport materials by truck to nearby and distant disposal sites.
- 0.00 = emissions less than 0.005 tons per year. Calculated values and totals have been rounded.

Table 4–37 shows that none of the air pollutants would exceed the South Coast Air Basin indicator emission thresholds under either the nearby or distant disposal site scenario. Peak annual emissions under the nearby disposal site scenario would occur under the combination of the Cleanup to AOC LUT Values and Building Removal Alternatives or Cleanup to Revised LUT Values and Building Removal Alternatives. The combination of the Conservation of Natural Resources, Open Space Scenario, and the Building Removal Alternatives would generate the least amount of annual emissions under the nearby disposal site scenario. Peak annual emissions under the distant disposal site scenario would be the same for all combined action alternatives. This is the case, as each combined action alternative would generate the same number of truck trips during the peak year of activity. In addition, while some of the soil remediation alternatives would remove different amounts of soil categories to different disposal sites under this peak annual scenario, the distances to these sites through the South Coast Air Basin and the resulting total vehicles miles travelled for haul trucks would be the same for each alternative. The variation in emissions between the near and distant disposal site scenarios also reflects, for each combination of action alternatives, the transport of materials between different disposal facility locations, and the lengths of the truck routes within or through the South Coast Air Basin between the locations.

Table 4–37 shows that peak annual emissions generated from each unmitigated combination of action alternative within the South Coast Air Basin would remain below the applicable conformity *de minimis* thresholds (10 tons per year of VOCs and nitrogen oxides and 100 tons per year for carbon monoxide, PM_{10}, and $PM_{2.5}$). As a result, the proposed combinations of action alternatives would not require a conformity determination under the General Conformity Rule and they would conform to the State Implementation Plan for the South Coast Air Basin.

Table 4–38 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. Each of the combined action alternatives could result in the same amount of peak day emissions under a nearby or distant disposal site scenario, as each combined action alternative could conceivably generate 32 truck trips per day to the same disposal facilities under each scenario. Except for nitrogen oxides, both the nearby and the distant disposal site scenarios would result in relatively low levels of daily emissions of any evaluated pollutant (less than 15 pounds per day).

Table 4–38 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	0.8	3.2	30.3	0.1	0.9	0.5
On-road Vehicles – Distant Disposal Site	1.5	6.1	56.9	0.2	1.7	0.8
Building Removal Alternative						
On-road Vehicles – Nearby Disposal Site	0.8	3.2	30.3	0.1	0.9	0.5
On-road Vehicles – Distant Disposal Site	1.5	6.1	56.9	0.2	1.7	0.8
Total – Nearby Disposal Site	**1.6**	**6.5**	**60.6**	**0.2**	**1.8**	**0.9**
Total – Distant Disposal Site	**3.0**	**12.2**	**114**	**0.4**	**3.3**	**1.7**

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.

Notes:

- Based on a production rate that would generate 32 truck trips of material per day.
- Emissions under each alternative include options to transport materials by truck to nearby and distant disposal sites.
- 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.
- 0.0 = emissions less than 0.05 pounds per day. Calculated values and totals have been rounded.

Under the nearby disposal site scenario, moderate levels of daily nitrogen oxides emissions (61 pounds per day) would be generated under each of the combined action alternatives. Elevated emissions of nitrogen oxides (114 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 32 daily haul truck round trips and would extend over several hundred 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.

For the reasons mentioned above, the combined alternatives also would cause minimal ambient impacts of hazardous air pollutants and toxic air contaminants (such as DPM emissions) within the South Coast Air Basin. For example, the analysis estimates that DPM emissions generated by a 2021 average California truck fleet within the entire South Coast Air Basin analysis domain under the nearby soil disposal site scenario would amount to about 31 pounds per year, or 0.4 pounds during a peak day (based on 32 truck round trips per day) (see Leidos 2018a, Tables 1.A-23 and 1.A-24; [DPM is about 20 percent of the PM_{10} values in these tables]). These emissions would occur over 160 miles of roadway that span a large portion of the South Coast Air Basin. As a result, populations adjacent to roadways proposed for the transport of materials from the SSFL would be exposed to very low DPM emissions from project haul trucks and likely would experience no noticeable health effects from these emissions.

Many sensitive receptors exist along roadways that project haul trucks would use to transport materials through the South Coast Air Basin, as identified in Section 3.14 of this Final EIS. The above analyses demonstrate that emissions generated from project haul trucks would cause minimal increases to ambient air pollutant levels adjacent to these roadways. Therefore, the proposed cleanup activities would not expose sensitive receptors to any level of air quality health concern 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 2021 truck fleet by 71 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 81 percent compared to those from an average calendar year 2021 truck fleet. As a result, implementing the green cleanup truck fleet proposed by DOE would cause substantial emission reductions to the project truck fleet within the South Coast Air Basin, compared to use of a California average truck fleet.

4.6.4.3 Outside Ventura County/South Coast Air Basin Domain

Unmitigated Impacts

Table 4–39 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 and the third and final year of building removal (year 2021) due to maximum (1) emissions rates for the proposed on-road vehicle fleets, and (2) annual activity levels and resulting miles traveled by proposed haul trucks within this domain. All emissions outside Ventura County and the South Coast Air Basin would occur from trucks hauling waste to offsite disposal facilities.

Table 4–39 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	0.00–0.11	0.01–0.46	0.10–4.33	0.00–0.01	0.00–0.13	0.00–0.06	33–1,421
On-road Vehicles – Distant Disposal Site	0.06–0.47	0.23–1.91	2.13–17.9	0.01–0.06	0.06–0.52	0.03–0.27	697–5,862
Building Removal Alternative							
On-road Vehicles – Nearby Disposal Site	0.02	0.06	0.66	0.00	0.02	0.01	164
On-road Vehicles – Distant Disposal Site	0.07	0.25	2.62	0.01	0.07	0.04	646
Total – Nearby Disposal Site	**0.02–0.13**	**0.07–0.53**	**0.76–5.00**	**0.00–0.02**	**0.02–0.14**	**0.01–0.07**	**197–1,585**
Total – Distant Disposal Site	**0.12–0.53**	**0.48–2.16**	**4.74–20.5**	**0.01–0.07**	**0.13–0.59**	**0.07–0.30**	**1,343–6,508**
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.

Notes:

- The highest total peak annual emissions would occur during the first year of soil removal and the third and final year of building removal (year 2021).
- Emissions under each alternative include options to transport materials by truck to nearby and distant disposal sites.
- 0.00 = emissions less than 0.005 tons per year.
- Calculated values and totals have been rounded.

As shown in Table 4–39, 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. Peak annual emissions under a nearby or distant disposal facility scenario would occur under the combination of the Cleanup to AOC LUT Values and Building Removal Alternatives, or the combination of the Cleanup to Revised LUT Values and Building Removal Alternatives. The Conservation of Natural Resources, Open Space Scenario, and Building Removal Alternatives would generate the least amount of annual emissions under both a nearby and a distant disposal site scenario.

Table 4–39 shows that peak annual emissions generated from each unmitigated combination of action alternative outside of Ventura County and the South Coast Air Basin would remain below the applicable conformity *de minimis* thresholds (10 to 100 tons per year, depending on the pollutant and location). As a result, the proposed combinations of action alternatives would not require a conformity determination under the General Conformity Rule and they would conform to the State Implementation Plans for all areas outside of Ventura County and the South Coast Air Basin.

Table 4–40 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. Each of the combined action alternatives could result in the same amount of peak day emissions under a nearby or distant disposal site scenario, as each combined action alternative could conceivably generate 32 truck trips per day to the same disposal sites under each scenario. As with peak annual emissions, emissions of the listed pollutants are relatively low, except for nitrogen oxides. Under the nearby and distant disposal site scenarios, relatively high levels of daily nitrogen oxides emissions would occur under all evaluated combinations of action alternatives (152 and 592 pounds per day, respectively). These emissions would occur intermittently from up to 32 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.

Table 4–40 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	2.0	8.2	76	0.2	2.2	1.1
On-road Vehicles – Distant Disposal Site	7.7	32	296	1.0	8.6	4.4
Building Removal Alternative						
On-road Vehicles – Nearby Disposal Site	2.0	8.2	76	0.2	2.2	1.1
On-road Vehicles – Distant Disposal Site	7.7	32	296	1.0	8.6	4.4
Total – Nearby Disposal Site	**4.0**	**16**	**152**	**0.5**	**4.4**	**2.3**
Total – Distant Disposal Site	**15**	**63**	**592**	**2.0**	**17**	**8.8**

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.

Notes:

- Based on a production rate that would generate 32 daily heavy-duty truck trips.
- Emissions under each alternative include options to transport materials by truck to representative nearby and distant disposal sites.
- 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.
- 0.0 = emissions less than 0.05 pounds per day.
- Calculated values and totals have been rounded.

For the reasons mentioned above, the combined alternatives also would cause minimal ambient impacts of hazardous air pollutants and toxic air contaminants (such as DPM emissions) outside of Ventura County and the South Coast Air Basin. Based on a 2021 average California truck fleet, the project haul trucks would generate about 0.004 pounds per day (at 32 round trips per day) or about 0.5 pounds per year (at 4000 truck trips per year) along a given mile of roadway (see Leidos 2018a, Table 1.A-14; [DPM is about 20 percent of the PM_{10} values in these tables]). As a result, populations adjacent to roadways proposed for the transport of materials from the SSFL would be exposed to very low DPM emissions from project haul trucks and likely would experience no noticeable health effects from these emissions.

Sensitive receptors exist along roadways that project haul trucks would use to transport materials outside of Ventura County and the South Coast Air Basin. The above analyses demonstrate that emissions generated from project haul trucks would cause minimal increases to ambient air pollutant levels adjacent to these roadways. Therefore, the proposed cleanup activities would not expose sensitive receptors to any level of air quality health concern outside of Ventura County and 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 2021 truck fleet by 71 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 81 percent, compared to those from an average calendar year 2021 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 4–41** 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 (88,000 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 and recycle 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 4–41 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	4,000 to 9,700	35,000 to 88,000
Cleanup to Revised LUT Values + Building Removal + Groundwater Treatment Alternatives	4,000 to 9,700	17,000 to 42,000
Conservation of Natural Resources, Residential Scenario + Building Removal + Groundwater Treatment Alternatives	2,300 to 4,700	6,400 to 13,000
Conservation of Natural Resources, Open Space Scenario + Building Removal + Groundwater Treatment Alternatives	2,300 to 4,500	6,000 to 12,000

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 2017). 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. In addition, under all evaluated combinations of action alternatives, proposed emissions would not contribute to an 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.

The above analyses show that peak annual emissions generated from each unmitigated combination of action alternative within all analysis domains would remain below the applicable conformity *de minimis* thresholds (10 to 100 tons per year, depending on the pollutant and location). As a result, the proposed combinations of action alternatives would not require a conformity determination under the General Conformity Rule and they would conform to the State Implementation Plans for all analysis areas, including Ventura County, the South Coast Air Basin, and locations outside of Ventura County and the South Coast Air Basin.

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 text box.

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 a 24-hour period) and including decibel "penalties" applied to account for the added annoyance caused by evening and night noise events (see text box above). 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.

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.

4.7.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–42**.

4.7.1.1 Soil No Action Alternative

Under the Soil No Action Alternative, there would be no soil remediation at Area IV and the NBZ, with no noise impacts above baseline conditions (see Chapter 3, Section 3.7).

Table 4–42 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: Residential Scenario	Conservation of Natural Resources: Open Space Scenario
Noise from onsite activities	No impacts are expected above baseline conditions.	Noise levels at the closest residence (5,000 feet from proposed activity) are expected to be less than 50 dB $L_{eq\text{-}workday}$ (which equates to approximately 47 dB CNEL) during the 26 years of soil removal. Noise generated by equipment may be audible at nearby residences at certain times, but would be well below 65 dBA CNEL and would increase by less than 5 dBA CNEL (thresholds 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 soil removal would be about 6 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of soil removal would be about 2 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of soil removal would be less than 2 years, and likely less than that for the Residential Scenario.
Noise from heavy-duty truck traffic to and from SSFL	No impacts are expected above baseline conditions.	Assuming 16 heavy-duty truck trips per day during the 26 years of soil removal, the average daily noise levels at residences near the evaluated roads could increase by up to 1.3 dBA CNEL, where the final noise level would be below 65 dBA CNEL. Along road segments where the noise level exceeds 65 dBA CNEL, the increase would be up to 1.2 dBA CNEL. Assuming the maximum number of daily round trips from Area IV (32 round trips), time-averaged noise levels in residential areas would increase by no more than 1.4 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 road segments where the noise level exceeds 65 dBA CNEL, the increase would be up to 1.2 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 26 years of soil removal, noise impacts would be reduced through application of the measures discussed in Chapter 6, Table 6–1.	Similar to the Cleanup to AOC LUT Values Alternative except the duration of soil removal would be about 6 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of soil removal would be about 2 years.	Similar to the Cleanup to AOC LUT Values Alternative, except the duration of soil removal would be less than 2 years.

AOC = *Administrative Order on Consent for Remedial Action*; CNEL = Community Noise Equivalent Level; dBA = decibels A-weighted; LUT = Look-Up Table.

4.7.1.2 Cleanup to AOC LUT Values Alternative

Noise from Soil Remediation

Table 4–43 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 $L_{eq\text{-}workday}$. Therefore, CNEL at the closest residence would be approximately 47 dBA. The hilly terrain surrounding SSFL would provide additional sound reduction, which was not considered when determining the noise levels shown in Table 4–43. As noted in Section 3.7.3, baseline noise levels measured in residential areas near SSFL are between 44 and 57 dBA $L_{eq\text{-}1/2\ hr.}$ Noise generated by equipment may be audible at nearby residences at certain times and under certain atmospheric conditions, but would be well below 65 dBA CNEL and would increase by less than 5 dBA CNEL (thresholds for potential adverse noise impacts established for this EIS per the *L.A. CEQA Thresholds Guide* [LA 2006]). 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 4–43 Noise Levels of Construction and Demolition Equipment

Equipment Type	*Noise Level (in dBA) at Distance*	
	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 (all equipment types operating at one location during a workday)	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

During soil removal operations, DOE is expected to conduct an average of 16 heavy-duty truck round trips per day. On some days, however, DOE could make a larger-than-average number of heavy-duty truck round trips (32 round trips), as discussed in Chapter 2, Section 2.4.4. The modeled scenarios (see below) reflect baseline traffic counts based on a 2017 Traffic Study (DTSC 2017b). No truck trips would occur during hours for which a noise penalty would be applied during the calculation of CNEL (7 PM to 7 AM).

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, except along Woolsey Canyon Road, where the steep grade is outside the algorithm's acceptable modeling parameters. On Woolsey Canyon Road the Federal Highway Administration's Traffic Noise Model, which has the ability to model steep road grades, was used. 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.

Assuming 16 heavy-duty truck round trips per day, **Table 4–44** lists existing and projected noise levels along segments of five roads on haul routes in the SSFL vicinity. The projected noise levels and existing noise levels were evaluated at a distance of 100 feet from each road, except at the two Woolsey Canyon Road segments where noise levels were calculated to reflect unusual distances to the closest residence. At Woolsey Canyon and Facility Roads, the closest residence is 1,300 feet from the roadway; and on Woolsey Canyon Road between Valley Circle Boulevard and Knapp Ranch Road, the closest residence is 30 feet from the roadway. These values differ from the noise levels listed in Chapter 3, Table 3–12, which were measured at variable distances from the road centerline. The largest increases in noise would be on Woolsey Canyon Road at Facility Road (a 1.3 dB increase from 32.1 to 33.4 dBA CNEL) and on Woolsey Canyon Road between Valley Circle Boulevard and Knapp Ranch Road (an increase of 1.3 dBA CNEL from 57.4 dBA CNEL to 58.7 dBA CNEL).

Table 4–44 Traffic Noise Levels under Two Heavy-Duty Truck Scenarios

Road and Road Segment	*Existing CNEL*	*Heavy-Duty Truck Scenario Noise Levels (dBA)*			
		16 Round Trips		*32 Round Trips*	
		CNEL	*Increase*	*CNEL*	*Increase*
Woolsey Canyon Road [a]					
Between Valley Circle and Knapp Ranch Road [b]	57.4	58.7	1.3	58.8	1.4
At Facility Road [b]	32.1	33.4	1.3	33.5	1.4
Valley Circle Boulevard					
Between Box Canyon and Woolsey Canyon Road	53.6	54.6	1.0	54.6	1.0
Between Plummer Street and Schumann Road	58.4	59.3	0.9	59.3	0.9
Between Woolsey Canyon Road and Chatlake Drive	58.9	60.1	1.2	60.2	1.3
Between Vanowen Street and Victory Boulevard	68.2	68.9	0.7	68.9	0.7
Between Burbank Boulevard and US 101 Freeway	69.1	69.8	0.7	69.8	0.7
Plummer Street					
Between Valley Circle Boulevard and Farralone Avenue	60.5	61.4	0.9	61.4	0.9
Roscoe Boulevard					
Between Woodlake Avenue and Shoup Avenue	64.5	65.7	1.2	65.7	1.2
Between Shoup Avenue and Farralone Avenue	68.6	69.5	0.9	69.5	0.9
Topanga Canyon Boulevard					
North of Plummer Street	71.3	72.2	0.9	72.2	0.9
Between Plummer Street and Roscoe Boulevard	71.7	72.5	0.8	72.5	0.8
South of Roscoe Boulevard	69.0	69.9	0.9	69.9	0.9

[a] The noise level was calculated using Federal Highway Administration's Traffic Noise Model because the grade of Woolsey Canyon Road is outside of parameters of the Federal Highway Administration's Highway Noise Prediction Model FHWA-RD-77-108.

[b] The noise levels on Woolsey Canyon Road at Facility Road were calculated for a distance of 1,300 feet and noise levels on Woolsey Canyon Road between Valley Circle and Knapp Ranch Road were calculated at 30 feet reflecting the distance to the closest residence; all other road segments noise levels were calculated for a distance of 100 feet.

Table 4–44 also lists projected noise levels along the five roads assuming a maximum of 32 daily heavy-duty truck round trips from DOE's soil removal activities during a limited number of days. The largest increase in noise would be along two road segments. On Woolsey Canyon Road at Facility Road, noise levels could experience a 1.4 dBA increase from 32.1 dBA to 33.5 dBA. The traffic noise levels at this location were calculated for the closest residence which is 1,300 feet from the roadway. The same decibel increase would occur along Woolsey Canyon Road between Knapp Ranch Road and Valley Circle Boulevard, where noise would increase by 1.4 dBA from 57.4 dBA to 58.8 dBA. The calculated noise levels along this segment of Woolsey Canyon Road were calculated assuming the closest residence is approximately 30 feet from the road.

Under the Cleanup to AOC LUT Values Alternative, soil would be removed and backfill delivered over a 26-year period, with a daily average of approximately 16 heavy-duty daily heavy-duty truck round trips (see Appendix H, Table H–18). As shown in Table 4–44, the largest increase in noise (1.3 dBA CNEL) would result from a daily average of 16 heavy-duty truck round trips along two road segments: on Woolsey Canyon Road at Facility Road where noise levels would increase from 32.1 to 33.4 dBA CNEL and on Woolsey Canyon Road between Valley Circle Boulevard and Knapp Ranch Road, where noise levels could increase from 57.4 dBA to 58.7 dBA CNEL. The highest projected noise levels would be along Topanga Canyon Boulevard between Plummer Street and Roscoe Boulevard (72.5 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 1.3 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL, and would increase by 1.2 dBA CNEL or less along roads where baseline noise levels exceed 65 dBA CNEL. During days with the maximum DOE allotment of truck traffic (up to 32 trucks per day), the time-averaged noise levels in residential areas along all roads where noise levels would remain below 65 dBA CNEL would increase by no more than 1.4 dBA CNEL on road segments where the final noise level exceeds 65 dBA. On larger highways such as US 101 or State Route 118, 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.

4.7.1.3 Cleanup to Revised LUT Values 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), but with a much shorter duration (about 6 years rather than 26 years). No adverse noise impacts are expected.

Under the Cleanup to Revised LUT Values Alternative, soil would be removed and backfill delivered to the site over a 6-year period, with a daily average of approximately 16 heavy-duty daily truck round trips (see Appendix H, Table H–18). The tempo of shipments could briefly increase to the maximum DOE allotment of up to 32 heavy-duty truck round trips per day. 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 would increase by no more than 1.3 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL, and would increase by 1.2 dBA CNEL or less along roads where baseline noise levels exceed 65 dBA CNEL. This is expected to be the case during average days, assuming 16 daily heavy-duty truck round trips. Assuming there are days when shipments from DOE activities would briefly increase to the maximum daily DOE allotment of up to 32 daily heavy-duty truck round trips, the time-averaged noise levels in residential areas along all roads where noise levels would remain below 65 dBA CNEL would increase by no more than 1.4 dBA CNEL on road segments where the final noise level exceeds 65 dBA. On larger highways such as US 101 and State Route 118, 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 – Residential Scenario

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 16 average daily heavy-duty truck round trips during the less than 2 years required for soil removal and delivery of backfill (see Appendix H, Table H–18). The tempo of shipments could briefly increase to the maximum DOE allotment of up to 32 heavy-duty truck round trips per day. 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 would last for no more than 2 years rather than 26. No adverse noise impacts are expected.

4.7.1.5 Conservation of Natural Resources Alternative – Open Space Scenario

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), but soil removal would require less than 2 years. There would be no expected adverse noise impacts on nearby residents.

There would be an average of 16 heavy duty truck trips during the less than 2 years required for soil removal and delivery of backfill (see Appendix H, Table H–18). The tempo of shipments could briefly increase to the maximum DOE allotment of up to 32 heavy-duty truck round trips per day. 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 would last for less than 2 years rather than 26. No adverse noise impacts are expected.

4.7.2 Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–45**.

Table 4–45 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.	Assuming 16 daily heavy-duty truck round trips, which would bound the expected number of daily shipments, the average daily noise levels along the evaluated roads could increase by up to 1.3 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 lower (1.2 dBA or less).

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, haul away waste and recycle material, and deliver and place backfill over a 2 to 3 year period. 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 4–43. 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 to 3 years of building demolition activities, DOE's transportation activities are expected to be episodic. Over the duration of the demolition project, the average is about 5 truck round trips per day, although depending on the type of waste being transported (e.g., nonhazardous demolition debris) there could be periods when there would be up to 12 heavy-duty truck round trips per day. In no case would the number of truck round trips per day exceed 32. Noise levels generated by 12 heavy-duty truck round trips per day would be similar to or slightly less than noise levels generated by 16 round trips per day, which are listed in Table 4–44. Traffic noise levels at residences along the haul routes that are below 65 dBA CNEL would increase by no more than 1.3 dBA CNEL, or at locations where noise levels exceed 65 dBA CNEL, would increase by no more than 1.2 dBA CNEL. In the event that daily shipments exceeded 16 heavy-duty truck round trips, traffic noise impacts would be similar or less than those shown in Table 4–44 for 32 truck round trips per day. Traffic noise levels would increase by no more than 1.4 dBA CNEL along road segments where the final noise level would be below 65 dBA CNEL, and would increase by less than 1.2 dBA along road segments where the final noise level would exceed 65 dBA CNEL. No adverse impacts are expected because the traffic noise would not rise by more than 5 dBA at any location and would not rise by more than 3 dBA ending at a level that is considered "unacceptable" at a sensitive location 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 4–46**.

Table 4–46 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 and increase by less than 5 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 and increase by less than 5 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 5 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 less than 1.2 dBA CNEL. At residences along roads where baseline noise levels exceed 65 dBA CNEL, traffic noise levels would increase by 1.1 dBA CNEL or less. No adverse traffic-related noise impacts are expected.

CNEL = Community Noise Equivalent Level; dBA = decibels A-weighted.

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 and increase by less than 5 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, five shipments of well installation water in tanker trucks, and five shipments of well installation waste water from SSFL in medium duty trucks. Shipments would occur at different times during the year. Well monitoring activities would result in about the same annual number (one) of trucks transporting monitoring well purge water to hazardous waste treatment facilities as that under the Groundwater No Action Alternative.

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 less than a single year. 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 20 deliveries of equipment in heavy-duty trucks, and then approximately 530 shipments of excavated bedrock and backfill. Assuming shipments of waste and bedrock were made throughout the working year, during these days there would be a little over 2 average daily truck round trips between SSFL and major highways. Assuming all shipments were made during the 60 days projected for source removal operations, there could be up to 9 daily truck round trips during this period. 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). Along roads where noise levels would not exceed 65 dBA CNEL, time-averaged noise levels would increase by no more than 1.3 dBA CNEL along these roads. At residences along roads where baseline levels exceed 65 dBA CNEL, traffic noise levels would increase by than 1.2 dBA CNEL or less. 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 16 average daily heavy-duty truck round trips, with a possible period of 21 to 25 round trips, assuming soil shipments during the beginning of any of the soil remediation action alternatives overlapped with shipments under the final year of the Building Removal Alternative or shipments of contaminated bedrock under the Groundwater Treatment Alternative. Assuming a peak of 32 daily heavy-duty truck round trips, time-averaged noise levels in residential areas would increase by no more than 1.4 dBA CNEL along all roads where noise levels would remain below 65 dBA CNEL, and would increase by no more than 1.2 dBA CNEL along the roads where noise levels exceed 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 could be annoying to persons in the vicinity of the evaluated roads, the increased noise would not rise by more than 5 dBA at any location and would not rise by more than 3 dBA ending at a level that is considered "unacceptable" at a sensitive location in accordance with the *L.A. CEQA Thresholds Guide* (LA 2006).

The combination of action alternatives having the longest noise duration (about 28 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 could 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 and not be increased by more than 5 dBA CNEL 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 reasonably foreseeable 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).

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,

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, Waste Control Specialists (WCS) in Texas, 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 50 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;
- WCS in Texas 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. Similar actions would be necessary for shipments to US Ecology in Idaho, where the waste would be transferred to trucks at the US Ecology Intermodal Facility at Mountain Home, Idaho, and then driven to the disposal facility.

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.

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[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.

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 foreseeable 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.

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.

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 roentgen equivalent man (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.[13] 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.

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 for 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 4–47 shows the route characteristics for offsite transport of low-level radioactive waste (LLW), mixed low-level radioactive waste (MLLW), and hazardous waste.

Table 4–47 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	350
Truck	Waste Control Specialists, Texas	1,160
Truck/Rail	Energy*Solutions*, Utah	840 [b]
Truck/Rail	US Ecology, Idaho	1,200 [b]
Truck/Rail	NNSS, Nevada	380 [b]
Truck/Rail	Waste Control Specialists, Texas	1,160 [b]

NNSS = Nevada National Security Site.

[a] The Energy*Solutions* facility, NNSS, and Waste Control Specialists 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).

[13] 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 and US Ecology in Idaho lack a direct rail connection for waste delivery, additional truck transports were evaluated to account for shipments from second intermodal facilities by truck to NNSS or US Ecology. 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 for NNSS shipments was assumed to be the rail yard at Barstow, California. For US Ecology, the US Ecology intermodal facility at Mountain Home, Idaho, was assumed.

Table 4–48 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.[14] The accident impacts presented in the table are those that could result from all reasonably foreseeable accidents during transport of radioactive waste. Details are presented in Appendix H.

Table 4–48 Risks to Crew Members and Populations from Transporting Radioactive Waste under each Action Alternative

Destination	Number of Shipments [a]	One-way Miles Traveled	Incident-Free				Accident	
			Crew		Population		Radiological Risk (LCFs) [b, c]	Non-radiological Risk (traffic fatalities) [b]
			Dose (person-rem)	LCFs [b]	Dose (person-rem)	LCFs [b]		
Cleanup to AOC LUT Values Alternative [a]								
Truck								
Energy*Solutions*	7,170	5,560,000	1.3	8×10^{-4}	0.35	2×10^{-4}	5×10^{-9}	3×10^{-1}
NNSS	7,170	2,490,000	0.60	4×10^{-4}	0.16	1×10^{-4}	3×10^{-10}	5×10^{-2}
WCS	7,170	8,328,000	2.0	1×10^{-3}	0.54	3×10^{-4}	6×10^{-9}	6×10^{-1}
Truck/Rail [d]								
Energy*Solutions*	450	702,000	0.21	1×10^{-4}	0.23	1×10^{-4}	3×10^{-10}	2×10^{-1}
NNSS	450	1,910,000	0.46	3×10^{-4}	0.19	1×10^{-4}	3×10^{-10}	9×10^{-2}
WCS	450	845,000	0.25	2×10^{-4}	0.31	2×10^{-4}	3×10^{-10}	2×10^{-1}
Cleanup to Revised LUT Values Alternative (Values are the same as those for the Cleanup to AOC LUT Values Alternative above) [a]								
Conservation of Natural Resources Alternative (Residential Scenario) [a]								
Truck [a]								
EnergySolutions	65	50,000	0.012	7×10^{-6}	0.0032	2×10^{-6}	4×10^{-11}	2×10^{-3}
NNSS	65	23,000	0.0054	3×10^{-6}	0.0015	9×10^{-7}	3×10^{-12}	4×10^{-4}
WCS	65	75,000	0.018	1×10^{-5}	0.0049	3×10^{-6}	6×10^{-11}	5×10^{-3}
Truck/Rail [d]								
EnergySolutions	5	8,000	0.0023	1×10^{-6}	0.0026	2×10^{-6}	3×10^{-12}	2×10^{-3}
NNSS	5	21,000	0.0052	3×10^{-6}	0.0021	1×10^{-6}	3×10^{-12}	1×10^{-3}
WCS	5	9,000	0.0028	2×10^{-6}	0.0035	2×10^{-6}	4×10^{-12}	3×10^{-3}
Conservation of Natural Resources Alternative (Open Space Scenario)								
Truck								
Energy*Solutions*	13	10,000	2.4×10^{-3}	1×10^{-6}	6.3×10^{-4}	4×10^{-7}	8×10^{-12}	5×10^{-4}
NNSS	13	4,500	1.1×10^{-3}	7×10^{-7}	2.9×10^{-4}	2×10^{-7}	5×10^{-13}	9×10^{-5}
WCS	13	15,100	3.6×10^{-3}	2×10^{-6}	9.8×10^{-4}	6×10^{-7}	1×10^{-11}	1×10^{-3}
Rail/Truck [d]								
Energy*Solutions*	1	1,600	4.7×10^{-4}	3×10^{-7}	5.2×10^{-4}	3×10^{-7}	6×10^{-13}	5×10^{-4}
NNSS	1	4,200	1.0×10^{-3}	6×10^{-7}	4.2×10^{-4}	2×10^{-7}	6×10^{-13}	2×10^{-4}
WCS	1	1,900	5.7×10^{-4}	3×10^{-7}	7.0×10^{-4}	4×10^{-7}	8×10^{-13}	5×10^{-4}
Building Removal Alternative								
Truck								
Energy*Solutions*	1,030	808,000	0.19	1×10^{-4}	0.05	3×10^{-5}	6×10^{-10}	4×10^{-2}
NNSS	1,030	360,000	0.086	5×10^{-5}	0.023	1×10^{-5}	4×10^{-11}	7×10^{-3}

[14] 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.

Destination	Number of Shipments [a]	One-way Miles Traveled	Incident-Free: Crew Dose (person-rem)	Incident-Free: Crew LCFs [b]	Incident-Free: Population Dose (person-rem)	Incident-Free: Population LCFs [b]	Accident: Radiological Risk (LCFs) [b, c]	Accident: Non-radiological Risk (traffic fatalities) [b]
WCS	1,030	1,193,000	0.28	2×10^{-4}	0.078	5×10^{-5}	9×10^{-10}	8×10^{-2}
Truck/Rail [d]								
Energy*Solutions*	65	101,000	0.03	2×10^{-5}	0.034	2×10^{-5}	3×10^{-11}	3×10^{-2}
NNSS	65	275,000	0.067	4×10^{-5}	0.027	2×10^{-5}	4×10^{-11}	1×10^{-2}
WCS	65	122,000	0.037	2×10^{-5}	0.045	3×10^{-5}	5×10^{-11}	3×10^{-2}
Groundwater Treatment Alternative [f]								
Truck								
Energy*Solutions*	340	263,400	6.4×10^{-2}	4×10^{-5}	1.7×10^{-2}	1×10^{-5}	2×10^{-10}	1×10^{-2}
NNSS	340	118,700	2.8×10^{-2}	2×10^{-5}	7.7×10^{-3}	5×10^{-6}	1×10^{-11}	2×10^{-3}
WCS	340	394,000	9.4×10^{-2}	6×10^{-5}	2.6×10^{-2}	2×10^{-5}	3×10^{-10}	3×10^{-2}
Truck/Rail [d]								
Energy*Solutions*	30	46,700	1.4×10^{-2}	8×10^{-6}	1.6×10^{-2}	9×10^{-6}	2×10^{-11}	1×10^{-2}
NNSS	30	127,200	2.2×10^{-2}	1×10^{-5}	1.2×10^{-2}	7×10^{-6}	2×10^{-11}	6×10^{-3}
WCS	30	56,000	1.7×10^{-2}	1×10^{-5}	2.1×10^{-2}	1×10^{-5}	2×10^{-11}	2×10^{-2}

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; WCS = Waste Control Specialists.

[a] The number of shipments was rounded to the nearest ten when greater than 100 and to the nearest 5 when less than 100; if less than 10, the actual number is cited. 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 4–48, 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 about 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 0.6 among the in-route population, which would occur under the truck option for the Cleanup to AOC LUT Values or the Cleanup to Revised LUT Values Alternative, assuming delivery to WCS in Texas using trucks with about 8,328,000 miles traveled. This risk may be conservatively rounded up to 1 fatality.

Table 4–49 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[15] 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. Because the operational date for the Mesquite Regional Landfill is uncertain, transportation impacts for shipment to this facility 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.

Table 4–49 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	**93,430**	**NA**	**28,000,000**	**6.17**	**0.26**
Hazardous	130	NA	265,520	0.18	0.01
Nonhazardous	50,150	NA	23,061,700	5.05	0.21 [b]
Backfill/Equipment/Supplies	43,140	NA	4,286,960	0.94	0.04
Cleanup to Revised LUT Values	**14,560**	**NA**	**3,500,000**	**0.90**	**0.04**
Hazardous	130	NA	265,520	0.18	0.01
Nonhazardous	5,090	NA	2,339,190	0.51	0.02 [b]
Backfill/Equipment/Supplies	9,340	NA	926,530	0.20	0.01
Conservation of Natural Resources (Residential Scenario)	**5,920**	**NA**	**2,000,000**	**0.56**	**0.02**
Hazardous	130	NA	265,520	0.18	0.01
Nonhazardous	3,200	NA	1,469,640	0.32	0.01 [b]
Backfill/Equipment/Supplies	2,590	NA	255,420	0.06	2.3×10^{-3}
Conservation of Natural Resources (Open Space Scenario)	**4,400**	**NA**	**1,500,000**	**0.46**	**0.02**
Hazardous	130	NA	265,520	0.18	0.01
Nonhazardous	2,350	NA	1,079,700	0.24	0.01 [b]
Backfill/Equipment/Supplies	1,920	NA	188,300	0.04	1.7×10^{-3}
Building Removal	**1,400**	**NA**	**201,000**	$\mathbf{5.5 \times 10^{-2}}$	$\mathbf{2.3 \times 10^{-3}}$
Hazardous	10	NA	23,400	1.6×10^{-2}	7.1×10^{-4}
Nonhazardous	120	NA	54,300	1.2×10^{-2}	4.9×10^{-4} [b]
Building Recycle Material	340	NA	34,000	7.5×10^{-3}	3.1×10^{-4}
Backfill/Equipment/Supplies	920	NA	89,200	2.0×10^{-2}	8.1×10^{-4}

[15] 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.

Alternative	*Number of Truck Shipments* [a]	*Number of Rail Shipments* [a]	*Two-way Miles Traveled*	*Number of Accidents*	*Number of Traffic Fatalities*
Groundwater Monitored Natural Attenuation [c]	**620**	**NA**	**34,000**	**7.5×10^{-3}**	**3.1×10^{-4}**
Hazardous	0	NA	0	0	0
Nonhazardous	40	NA	5,580	1.2×10^{-3}	5.1×10^{-5}
Equipment/Supplies	580 [d]	NA	28,830	6.3×10^{-3}	2.6×10^{-4}
Groundwater Treatment	**320**	**NA**	**145,400**	**9.0×10^{-2}**	**3.9×10^{-3}**
Hazardous [e]	60	NA	122,550	8.5×10^{-2}	3.7×10^{-3}
Nonhazardous	0	NA	0	0	0
Backfill/Equipment/Supplies	260	NA	22,820	5.0×10^{-3}	2.1×10^{-4}
Truck/Rail					
Cleanup to AOC LUT Values	**93,430**	**3,150**	**19,700,000**	**10.1**	**2.3**
Hazardous	130	10	41,800	0.025	6.3×10^{-3}
Nonhazardous	50,150	3,140	15,375,000	9.1	2.2
Backfill/Equipment/Supplies [f]	43,140	NA	4,287,000	0.94	0.039
Cleanup to Revised LUT Values	**14,560**	**330**	**2,530,000**	**1.15**	**0.24**
Hazardous	130	10	41,800	0.025	6.3×10^{-3}
Nonhazardous	5,090	320	1,559,500	0.92	0.23
Backfill/Equipment/Supplies [f]	9,340	NA	926,500	0.20	8.4×10^{-3}
Conservation of Natural Resources (Residential Scenario)	**5,920**	**210**	**1,280,000**	**0.66**	**0.15**
Hazardous	130	10	41,800	0.025	6.3×10^{-3}
Nonhazardous	3,200	200	980,300	0.56	0.14
Backfill/Equipment/Supplies [f]	2,590	NA	255,420	0.056	2.3×10^{-3}
Conservation of Natural Resources (Open Space Scenario)	**4,400**	**160**	**950,000**	**0.49**	**0.11**
Hazardous	130	10	41,800	0.025	6.3×10^{-3}
Nonhazardous	2,350	150	720,300	0.43	0.10
Backfill/Equipment/Supplies [f]	1,920	NA	188,300	0.041	1.7×10^{-3}
Building Removal	**1,400**	**10**	**165,000**	**5.2×10^{-2}**	**7.4×10^{-3}**
Hazardous	10	1	4,100	2.5×10^{-3}	6.8×10^{-4}
Nonhazardous	120	8	37,600	2.2×10^{-2}	5.6×10^{-3}
Building Recycle Material [f]	340	NA	34,000	7.5×10^{-3}	3.1×10^{-4}
Backfill/Equipment/Supplies [f]	920	NA	89,200	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, if less than 10, the actual number is cited.

[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 4–50**.

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 above baseline conditions from waste and material transport (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 7,170 truck shipments of soil with radionuclides exceeding LUT values to offsite radioactive waste disposal facilities. These shipments would occur over 4 years. Under the truck/rail option, there would be the same number of truck shipments to an intermodal facility, and then then about 450 rail shipments to the radioactive waste disposal facilities. Three facilities (Energy*Solutions* in Utah, Nevada National Security Site (NNSS), and Waste Control Specialists (WCS) in Texas) were evaluated for treatment or disposal of LLW or MLLW, two of which have been used for managing waste from SSFL (Energy*Solutions* in Utah and NNSS). For shipments to NNSS, there would be an additional 7,170 truck shipments from a second intermodal facility.

Additionally, under the truck option, there would be about 93,430 truck shipments of hazardous and nonhazardous wastes, backfill, equipment, and supplies. Under the truck rail/option, there would be about 50,280 truck shipments of hazardous and nonhazardous waste to an intermodal facility, and an additional 50,280 truck shipments from a second intermodal facility to a disposal facility.[16] There would also be about 43,140 truck deliveries of backfill, equipment, and supplies to SSFL.[17]

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 4–48. The table includes the results of shipping all radioactive waste to each of the two 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 WCS in Texas) would be 1×10^{-3}, or 1 chance in 1,000 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^{-4}, or 1 chance in about 3,300 of a single LCF among the transportation crews.

[16] The assumed disposal facility, US Ecology in Grand View Idaho, does not have a direct rail access; therefore, the wastes would be transferred to truck in a second intermodal facility operated by US Ecology in Mountain Home Idaho.

[17] 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.

Table 4–50 Transportation Impacts under the Soil Remediation Alternatives

		Soil Remediation Action Alternatives			
	Soil No Action Alternative		***Cleanup to Revised LUT Values***	***Conservation of Natural Resources***	
Resource		***Cleanup to AOC LUT Values***		***Residential Scenario***	***Open Space Scenario***
Incident-free shipment of radioactive waste	No impacts are expected above baseline conditions.	Under the truck option, there would be about 7,170 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 450 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 4×10^{-4} to 1×10^{-3} under the truck option or from 1×10^{-4} to 3×10^{-4} under the truck/rail option. Calculated population LCF risks range from 1×10^{-4} to 3×10^{-4} under the truck option or 1×10^{-4} to 2×10^{-4} under the truck/rail option.	Same as the Cleanup to AOC LUT Values Alternative.	Under the truck option, there would be about 65 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 5 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 3×10^{-6} to 1×10^{-5} under the truck option or from 1×10^{-6} to 3×10^{-6} under the truck/rail option. Calculated population LCF risks range from 9×10^{-7} to 3×10^{-6} under the truck option or from 1×10^{-6} to 2×10^{-6} under the truck/rail option.	Under the truck option, there would be about 13 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 1 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 7×10^{-7} to 2×10^{-6} under the truck option or from 3×10^{-7} to 6×10^{-7} under the truck/rail option. Calculated population LCF risks range from 2×10^{-7} to 6×10^{-7} under the truck option or from 2×10^{-7} to 4×10^{-7} 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 foreseeable accidents, calculated radiological risks range from 3×10^{-10} to 6×10^{-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 for the Cleanup to AOC LUT Values Alternative.	No LCFs are expected among the exposed population. Considering all reasonably foreseeable accidents, calculated radiological risks range from 3×10^{-12} to 6×10^{-11} under the truck option or 3×10^{-12} to 4×10^{-12} under the truck/rail option.	No LCFs are expected among the exposed population. Considering all reasonably foreseeable accidents, calculated radiological risks range from 5×10^{-13} to 1×10^{-11} under the truck option or 6×10^{-13} to 8×10^{-13} under the truck/rail option.
		The consequences of a maximum reasonably foreseeable truck accident would be about 3.0×10^{-4} person-rem, resulting in no (2×10^{-7}) additional LCFs among the exposed population. The consequences from a truck/rail accident would be 7.4×10^{-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 1.2×10^{-6} and 2.5×10^{-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 1×10^{-12}.	The consequences of maximum reasonably foreseeable truck and truck/rail accidents are similar to those for the Cleanup to Revised LUT Values Alternative, because the waste would have similar characteristics.	The likelihood and consequences of a maximum reasonably foreseeable truck accident would be similar to those for the Cleanup to AOC LUT Values Alternative, with the likelihood that has 30 times lower frequency due to smaller number of shipments in comparison to those for the Cleanup to the AOC LUT Values Alternative.	The consequences of a maximum reasonably foreseeable truck accident would be similar to those for the Cleanup to AOC LUT Values Alternative, but has 100 times lower frequency due to very smaller number of shipments in comparison to those for the Cleanup to the AOC.LUT Values Alternative

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives			
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources	
				Residential Scenario	Open Space Scenario
		Calculated nonradiological (traffic accident) fatality risks while transporting radioactive waste range from 0.05 to 0.6 (or 1 fatality) under the truck option or 0.09 to 0.2 under the truck/rail option.	Calculated nonradiological (traffic accident) fatality risks while transporting radioactive waste are similar to those for the Cleanup to Revised LUT Values Alternative.	Calculated nonradiological (traffic accident) fatality risks while transporting radioactive waste range from 4×10^{-4} to 5×10^{-3} under the truck option or 1×10^{-3} to 3×10^{-3} under the truck/rail option.	Calculated nonradiological (traffic accident) fatality risks while transporting radioactive waste range from 9×10^{-5} to 1×10^{-3} under the truck option or 2×10^{-4} to 5×10^{-4} 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 93,430 shipments under the truck option. About 6 traffic accidents are expected leading to no traffic fatality (0.26). Under the truck/rail option, about 50,280 shipments of waste from SSFL to an intermodal facility, and then about 3,200 rail shipments; plus about 43,140 truck shipments of backfill, equipment, and supplies to SSFL, leading to about 2 (2.3) traffic fatalities.	About 14,560 shipments under the truck option. About 1 (0.90) traffic accidents are expected leading to no traffic fatalities (0.04). Under the truck/rail option, about 5,220 shipments of waste from SSFL to an intermodal facility, and then 330 rail shipments; plus 9,30 truck shipments of backfill, equipment, and supplies to SSFL, leading to no traffic fatalities (0.24).	About 5,920 shipments under the truck option. About 1 (0.56) traffic accidents are expected leading to no traffic fatalities (0.02). Under the truck/rail option, about 3,330 shipments of waste from SSFL to an intermodal facility, and then 210 rail shipments; plus 2,590 truck shipments of backfill, equipment, and supplies to SSFL, leading to no traffic fatalities (0.15).	About 4,400 shipments under the truck option. About 0 (0.46) traffic accidents are expected leading to no traffic fatalities (0.02). Under the truck/rail option, about 2,480 shipments of waste from SSFL to an intermodal facility, and then 160 rail shipments; plus 1,920 truck shipments of backfill, equipment, and supplies to SSFL, leading to no traffic fatalities (0.11).

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.

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 WCS in Texas) would be 3×10^{-4}, or 1 chance in about 3,300 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 WCS in Texas) would be 2×10^{-4}, or 1 chance in 5,000 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 7,170 radioactive waste truck shipments over the duration of the project, would be about 3.5×10^{-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 for the per shipment risk).[18] Assuming that shipments would occur over 4 years, the average annual dose would be 8.8×10^{-4} millirem, representing 8.8×10^{-4} percent of DOE's limit in DOE Order 458.1 of 100 millirem in a year for exposure to a member of the public.

Impacts of Transportation Accidents involving Radioactive Waste

Two sets of analyses, all reasonably foreseeable 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 4–48. 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 WCS in Texas. The likelihood of occurrence of a maximum reasonably foreseeable accident involving truck transport of this waste would be about 1.2×10^{-6} per year in an urban area, or approximately 1 chance in 830,000 per year. The consequences of the truck transport accident, if it occurred, in terms of population and MEI dose would be about 3.0×10^{-4} person-rem and 3.0×10^{-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 of a single LCF in the exposed population would be approximately 2×10^{-13}, or 1 chance in 5 trillion.

For truck/rail transport, the likelihood of occurrence of a maximum reasonably foreseeable accident involving rail transport of this waste to WCS in Texas would be about 2.5×10^{-7} per year in an urban area, or approximately 1 chance in 4 million each year. The consequences of the truck/rail transport accident, if it occurred, in terms of population and MEI dose would be about 7.4×10^{-3} person-rem and 4.8×10^{-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 (3×10^{-9} [1 chance in about 330 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 approximately 1×10^{-12}, or 1 chance in 1 trillion.

Therefore, no LCFs are expected as a result of truck or truck/rail transport accidents involving these shipments.

[18] The dose is calculated by multiplying the per trip dose listed in Table H–7 by the number of truck 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 4.7×10^{-4} person-rem, resulting in no (3×10^{-7} [1 chance in about 3.3 million]) additional LCFs among the exposed population. The frequency of this accident would be about 2.1×10^{-7} per year in an urban area, or approximately 1 chance in 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. 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 4–49, under the truck option, no traffic fatalities are expected (0.26 [0.01 for hazardous waste, 0.21 for nonhazardous waste, and 0.04 for backfill, equipment, and supplies]). Under the truck/rail option, 2 traffic fatalities are expected (2.3 [0.006 for hazardous waste, 2.2 for nonhazardous waste, and 0.039 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). Also similarly, the shipments would occur over 4 years.

Additionally, under the truck option, there would be 14,560 truck shipments of hazardous/nonhazardous wastes, backfill, equipment, and supplies. Under the truck/rail option, there would be about 5,220 truck shipments of hazardous and nonhazardous waste to an intermodal facility, and then about 330 rail shipments of hazardous and nonhazardous wastes and an additional 5,220 truck shipments from a second intermodal facility to a disposal facility. There would also be about 9,340 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 4–48. 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.

Under the Cleanup to Revised LUT Values Alternative, the impacts of transportation accidents would be the same as those under the Cleanup to AOC LUT Values Alternative (Section 4.8.1.1.2.1).

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 4–49, under both the truck and truck/rail options, no traffic fatalities are expected (0.04 and 0.24, respectively). Similar to the discussions under the AOC LUT Alternative, 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.

4.8.1.1.2.3 Conservation of Natural Resources Alternative – Residential Scenario

Under the truck option, there would be a total of 65 truck shipments of soil with radionuclides above risk-assessment-based values sent to offsite radioactive waste disposal facilities. These shipments would occur over 1 year. Under the truck/rail option, there would be the same number of truck shipments to an intermodal facility, and then about 5 rail shipments to the radioactive waste disposal facilities. For shipments to NNSS, there would be an additional 65 truck shipments from a second intermodal facility.

Additionally under the truck option, there would be about 5,920 truck shipments of hazardous/nonhazardous wastes, backfill, equipment, and supplies. Under the truck/rail option, there would be about 3,330 truck shipments of hazardous and nonhazardous waste to a nearby intermodal facility, and then about 210 rail shipments of hazardous and nonhazardous wastes, and additional 3,330 truck shipments from a second intermodal facility to disposal facilities (assuming shipment of hazardous waste to US Ecology in Idaho). There would also be about 2,500 truck deliveries of backfill, equipment, and supplies to SSFL.

Impacts of Incident-Free Transportation of Radioactive Waste

The impacts of transporting radioactive waste would be less than those under the Building Removal and Groundwater Treatment Alternatives, which in turn are 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 4–48. 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 WCS in Texas) 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 about 333,000 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 WCS in Texas) would be 3×10^{-6}, or 1 chance in about 330,000 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, or WCS in Texas) would be 2×10^{-6}, or 1 chance in 500,000 of a single LCF in the exposed population.

The total radioactive dose received by a hypothetical MEI (a resident along the route near SSFL), assumed to be exposed to all 65 radioactive waste truck shipments over the duration of the project, would be about 3.2×10^{-5} millirem, resulting in an increased risk of developing a fatal cancer of 2×10^{-11}, or 1 chance in 50 billion (see Appendix H, Table H–7 for the per shipment risk). Assuming that shipments would occur in a single year, the dose would be about 3.2×10^{-5} percent of DOE's limit in DOE Order 458.1 of 100 millirem in a year for exposure to a member 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 4–48. Transport activities under the Conservation of Natural Resources Alternative, Residential Scenario, 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 consequences are similar to those presented in Section 4.8.1.1.2.1 under the Cleanup to AOC LUT Values Alternative, with a lower likelihood due to the smaller number of shipments.

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 4–49, no traffic fatalities are expected under both the truck and truck/rail options (0.02 and 0.15, respectively).

4.8.1.1.2.4 Conservation of Natural Resources Alternative – Open Space Scenario

For the Conservation of Natural Resources Alternative, Open Space Scenario, under the truck option, there would be a total of about 13 truck shipments of soil with radionuclides above risk-assessment-based values sent to offsite radioactive waste disposal facilities. These operations would occur over 1 year. Under the truck/rail option, there would be the same number of truck shipments to an intermodal facility, and then about 1 rail shipments to the radioactive waste disposal facilities. For shipments to NNSS, there would be an additional 13 truck shipments from a second intermodal facility.

Additionally under the truck option, there would be about 4,400 truck shipments of hazardous/nonhazardous wastes, backfill, equipment, and supplies. Under the truck/rail option, there would be about 2,480 truck shipments of hazardous and nonhazardous waste to a nearby intermodal facility, and then about 160 rail shipments of hazardous and nonhazardous wastes and an additional 2,480 truck shipments from a second intermodal facility to disposal facilities. There would be also about 1,920 truck deliveries of backfill, equipment, and supplies to SSFL.

Impacts of Incident-Free Transportation of Radioactive Waste

Under the Conservation of Natural Resources Alternative, Open Space Scenario, the impacts of transporting radioactive waste would be less than those under the Building Removal or Groundwater Treatment Alternative. The potential radiological impacts on the crews and population are shown in Table 4–48. 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 WCS in Texas) would be 2×10^{-6}, or 1 chance in 500,000 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 6×10^{-7}, or 1 chance in about 1.7 million of a single LCF among the transportation crews.

Public. The cumulative dose to the general population likely would not result in any 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 WCS in Texas) would be 6×10^{-7}, or 1 chance in about 1.7 million 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 WCS) would be 4×10^{-7}, or 1 chance in 25 million of a single LCF in the exposed population.

The total radioactive dose received by a hypothetical MEI (a resident along the route near SSFL), assumed to be exposed to all 13 radioactive waste truck shipments over the duration of the project, would be about 6.0×10^{-6} millirem (one-fifth of the dose for the Conservation of Natural Resources Alternative – Residential Scenario), resulting in an increased risk of developing a fatal cancer of

3.6×10^{-12}, or 1 chance in about 280 billion (see Appendix H, Table H–7 for the per shipment risk). Assuming that shipments would occur in a single year, the dose would be about 6.0×10^{-6} percent of DOE's limit in DOE Order 458.1 of 100 millirem in a year for exposure to a member 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 4–48. Transport activities under the Conservation of Natural Resources Alternative-Open Space Scenario 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 consequences are similar to those presented in Section 4.8.1.1.2.1 under the Cleanup to AOC LUT Values Alternative, with a likelihood that is 100 times lower due to the very small number of shipments.

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 4–49, no traffic fatalities are expected under both the truck and truck/rail options (0.02 and 0.11, respectively).

4.8.1.2 Transportation Impacts under the Building Demolition Alternatives

Impacts under the building demolition alternatives are summarized and compared in **Table 4–51**. Under either the truck or truck/rail option, the same number of waste trucks would leave SSFL.

Table 4–51 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 2×10^{-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 5×10^{-5} under the truck option or from 2×10^{-5} to 3×10^{-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 foreseeable accidents, calculated LCF risks range from 4×10^{-11} to 9×10^{-10} under the truck option and from 3×10^{-11} to 5×10^{-11} under the truck/rail option. As shown in Table H–8, the consequences of a maximum reasonably foreseeable truck accident under the truck/rail option would be about 4.7×10^{-4} person-rem, resulting in no (3×10^{-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 1×10^{-13}. Calculated nonradiological fatality risks (traffic accident fatalities) range from 7×10^{-3} to 8×10^{-2} under the truck option or from 1×10^{-2} to 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: 7.4×10^{-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 above baseline conditions from waste and material transport (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 and nonhazardous wastes (10 and 120 shipments, respectively) 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 4–49).

Impacts from Incident-Free Transportation of Radioactive Waste

Under the Building Removal Alternative, impacts from transporting radioactive waste would be smaller than those under the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative, but greater than those for either scenario under the Conservation of Natural Resources Alternative and either of the groundwater remediation action alternatives. The potential radiological impacts among transport crews and populations along the routes are shown in Table 4–48. The table includes the results of shipping all radiological waste to each of the 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 WCS in Texas) would be 2×10^{-4}, or 1 chance in 5,000 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 WCS in Texas) 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 is disposed of at WCS in Texas) would be 3×10^{-5}, or 1 chance in about 33,000 of a single LCF in the exposed population.

The total radioactive dose received by a hypothetical MEI (a resident along the route near SSFL) exposed to all of the radioactive waste truck shipments (1,030 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 about 3.3 billion (see Appendix H, Table H–7 for the per shipment risk). 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 reasonably foreseeable 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 4–48, considering all reasonably foreseeable accidents, transport of radioactive waste would likely not result in any LCFs or nonradiological fatalities due to traffic accidents.

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 maximum 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 1.7×10^{-7} per year in a suburban area, or approximately 1 chance in 5.9 million per year. The consequences of the truck/rail transport accident, if it occurred, in terms of population and MEI dose would be about 1.3×10^{-3} person-rem and 3.1×10^{-6} rem, respectively. These doses would likely result in no (8×10^{-7} [1 chance in 1.25 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 (1×10^{-13} [1 chance in 7 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 4–49, no traffic fatalities are expected due to these activities. The calculated traffic fatality risks are essentially zero (0.0023 for the truck option and 0.0074 for the truck/rail option).

4.8.1.3 Transportation Impacts under the Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–52**.

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 620 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 wastewater from well installation and environmental sampling; these wastes would be shipped by truck to authorized facilities. No rail shipments would occur under this alternative.

Table 4–52 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 340 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 30 rail shipments to the facilities. No LCFs are expected among the transport crews or the public. Calculated crew LCF risks range from 2×10^{-5} to 6×10^{-5} under the truck option or from 8×10^{-6} to 1×10^{-5} under the truck/rail option. No LCFs are expected among the public. Calculated population LCF risks range from 5×10^{-6} to 2×10^{-5} under the truck option or from 7×10^{-6} to 1×10^{-5} 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 foreseeable accidents, calculated population radiological risks range from 1×10^{-11} to 3×10^{-10} under the truck option or 2×10^{-11} 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 2×10^{-3} to 3×10^{-2} under the truck option or from 6×10^{-3} to 2×10^{-2} 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 620 shipments by truck. No traffic fatalities (3.1×10^{-4}) are expected among the public.	About 320 shipments by truck. No traffic fatalities (3.9×10^{-3}) 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 Groundwater Treatment Alternative and the truck option, there would be about 340 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 30 rail shipments to disposal facilities. Under the truck/rail option, for shipments to NNSS, there would be an additional 340 truck shipments from a second intermodal facility to NNSS.

Under the Groundwater Treatment Alternative and the truck option, there would be about 320 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 the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternative. The potential radiological impacts on the crew and population are shown in Table 4–48. 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 WCS in Texas) would be 6×10^{-5}, or 1 chance in about 17,000 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 1×10^{-5}, or 1 chance in 100,000 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 WCS in Texas) would be 2×10^{-5}, or 1 chance in 50,000 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 WCS in Texas) would be 1×10^{-5}, or 1 chance in 100,000 of a single LCF in the exposed population.

The total radioactive dose received by a hypothetical MEI (a resident along the route near SSFL), assumed to be exposed to all of the radioactive waste truck shipments over the duration of the project, would be about 1.7×10^{-4} millirem, resulting in an increased risk of developing a fatal cancer of 1×10^{-10} or 1 chance in 10 billion (see Appendix H, Table H–7 for the per shipment risks). Assuming all shipments occurred within a single year, the annual dose would be 1.7×10^{-4} millirem, representing 1.7×10^{-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

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 4–48. 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 4–49, no traffic fatalities are expected from these activities.

4.8.1.4 Transportation Impacts under Action Alternative Combinations

Table 4–53 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 – that is, the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. The lowest risks would occur under the Low Impact Combination – that is, the combination of the Conservation of Natural Resources Alternative, Open Space Scenario, the Building Removal Alternative, and the Groundwater Monitored Natural Attenuation Alternative. 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 4 percent of all shipped radioactive waste.

Table 4–53 Total Doses and Risks from Transporting Radioactive Waste under the Combined Action Alternatives

Destination	Number of Shipments [a]	One-way Miles Traveled	Incident-Free				Accident	
			Crew		Population			
			Dose (person-rem)	LCFs [b]	Dose (person-rem)	LCFs [b]	Radiological Risk (LCFs) [b, c]	Nonradiological Risk (traffic fatalities) [b]
Combinations with the Highest Impacts [d]								
Truck								
Energy*Solutions*	8,540	6,631,000	1.6	1×10^{-3}	0.42	2×10^{-4}	5×10^{-9}	3×10^{-1}
NNSS	8,540	2,969,000	0.71	4×10^{-4}	0.19	1×10^{-4}	4×10^{-10}	6×10^{-2}
WCS	8,540	9,915,000	2.36	1×10^{-3}	0.65	4×10^{-4}	7×10^{-9}	7×10^{-1}
Truck/Rail [e]								
Energy*Solutions*	550	850,000	0.25	2×10^{-4}	0.28	2×10^{-4}	3×10^{-10}	3×10^{-1}
NNSS	550	2,310,000	0.55	3×10^{-4}	0.23	1×10^{-4}	3×10^{-10}	1×10^{-1}
WCS	550	1,020,000	0.31	2×10^{-4}	0.38	2×10^{-4}	4×10^{-10}	3×10^{-1}
Combination with the Lowest Impacts [f]								
Truck								
Energy*Solutions*	1,380	1,081,400	0.26	2×10^{-4}	0.07	4×10^{-5}	9×10^{-10}	5×10^{-2}
NNSS	1,380	483,200	0.12	7×10^{-5}	0.03	2×10^{-5}	5×10^{-11}	1×10^{-2}
WCS	1,380	1,602,100	0.38	2×10^{-4}	0.10	6×10^{-5}	1×10^{-9}	1×10^{-1}
Rail/Truck [e]								
Energy*Solutions*	100	149,300	0.04	3×10^{-5}	0.05	3×10^{-5}	5×10^{-11}	5×10^{-2}
NNSS	100	406,400	0.09	5×10^{-5}	0.04	2×10^{-5}	6×10^{-11}	2×10^{-2}
WCS	100	179,900	0.05	3×10^{-5}	0.07	4×10^{-5}	7×10^{-11}	5×10^{-2}

LCF = latent cancer fatality; NNSS = Nevada National Security Site; WCS = Waste Control Specialists.

[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 combination of the Cleanup to AOC LUT Values or 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, Open Space Scenario, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives.

Under the High Impact Combination, 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 WCS in Texas,[19] with potential LCF risks of 1×10^{-3} (1 chance in 1,000) and 4×10^{-4} (1 chance in 2,500), respectively. Assuming the truck/rail option, the maximum risks to truck/rail crews would occur for

[19] The total crew dose from transports to the WCS in Texas is greater than that to the Energy*Solutions* in Utah, even though the rounded cited risk is the same.

shipment to NNSS, with an LCF risk of 3×10^{-4} (1 chance in about 3,300); and the maximum risks to populations would occur for shipment to WCS in Texas, 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 reasonably foreseeable accidents from minor to severe, would be 7×10^{-9} (1 chance in about 140 million), assuming all shipments were sent by truck to WCS in Texas or 4×10^{-10} (1 chance in 2.5 billion)by the truck/rail option to WCS in Texas. These risks are extremely low and are essentially equivalent to zero. 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. The maximum risk of a traffic accident fatality resulting from the mechanical forces of the assumed accidents would be 1 (0.7), assuming all shipments were sent by truck to WCS in Texas.

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 WCS in Texas, with LCF risks of 2×10^{-4} (1 chance in 5,000) and 6×10^{-5} (1 chance in about 17,000), respectively. Assuming the truck/rail option, the maximum LCF risks to truck/rail crews would occur for shipment to NNSS (5×10^{-5} LCF, or 1 chance in 20,000); and the maximum LCF risks to populations would occur for shipment to WCS in Texas (4×10^{-5} LCF, or 1 chance in 25,000). The maximum radiological risk from an accident, considering all reasonably foreseeable accidents from the minor to the severe, would be 1×10^{-9} LCF (1 chance in 1 billion), assuming all shipments were sent by truck to WCS in Texas or 7×10^{-11} (1 chance in 15 billion) under the truck/rail option for the either the WCS in Texas or NNSS facility. The maximum risk of a traffic accident fatality resulting from the mechanical forces of the assumed accidents would be 0 (0.1), assuming all shipments were sent by truck to WCS in Texas or NNSS facility.

Table 4–54 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 6 (6.3) accidents and 0 (0.26) traffic fatality. If both groundwater remediation action alternatives were implemented, no traffic facility would again be projected (the calculated risk would increase from 0.26 by 3.1×10^{-4} [an additional risk of 1 chance in about 3,200]). Under the truck/rail option, there would be about 10 accidents and 2 (2.3 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 1 (0.61) and 0 (0.026), respectively, under the truck option and 1 (0.63) and 0 (0.12), respectively, under the truck/rail option.

Table 4–54 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*
Combination with the Highest Impacts [a]					
Truck	95,000	NA	28,346,400	6.3	0.26
Truck/Rail [b]	95,000	3,850	20,010,400	10.0	2.3
Combination with the Lowest Impacts [c]					
Truck	6,100	NA	1,846,400	0.61	0.026
Truck/Rail [b]	6,100	170	1,260,400	0.63	0.12

[a] Impacts if DOE implemented the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives.
[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, Open Space Scenario, Building Removal, and Groundwater Treatment 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.[20]

Waste from soil remediation would be transported using heavy-duty trucks carrying an average of 23 tons of waste per truck,[21] and backfill would be delivered to SSFL also using heavy-duty trucks carrying 23 tons of backfill per truck. Waste from building demolition under the Building Removal Alternative or from removal of contaminated bedrock under the Groundwater Treatment Alternative would be heterogeneous (chunks of material) that would likely require shipment in containers. Shipment of this waste would occur using heavy-duty trucks but the trucks would generally contain payloads smaller than 23 tons.

Equipment for soil remediation, building removal, 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 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.

Routes Evaluated in the SSFL Vicinity

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 3–32. 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-

[20] 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.

[21] Soil classified as LLW/MLLW or hazardous waste may require shipments in containers that would potentially result in average payloads that are less than 23 tons. In this case, the number of trucks required for offsite shipment would be fractionally increased under all soil remediation action alternatives, with slightly increased traffic.

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 traffic signals at this 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 Valley Circle Blvd
Route 4					
Road	Woolsey Canyon Road	Valley Circle Blvd [a]	Roscoe Blvd	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.

As summarized in Chapter 6, Table 6–1, of this EIS (Minimization Measure 8-1), a Traffic Management/Haul Route Plan would be prepared for implementation during remediation of Area IV and the NBZ. The plan would 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 plan would 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.

Intermodal Transfer of Waste to Railcars

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,[22] Energy*Solutions* in Utah, US Ecology in Idaho,[23] WCS in Texas, and the Mesquite Regional Landfill in California (see Section 4.8.1). Both the truck and the truck/rail option were evaluated for all waste from the soil remediation action alternatives, and also for all waste from the Building Removal Alternative. Only the truck option was assumed for shipment of recycle material from the Building Removal Alternative, because none of the evaluated recycle facilities have direct rail access. Both the truck and the truck/rail option were evaluated for waste from bedrock removal under the Groundwater Treatment Alternative. Only the truck option was considered for other waste from the two groundwater remediation action alternatives, because only small quantities of waste would be generated that would be shipped to offsite facilities using light-duty or medium-duty trucks.

The Puente Hills Intermodal Facility 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 ship two trains per day to an offsite disposal facility, 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 on local traffic, assuming any identified mitigation measures were implemented. Shipments from SSFL to the Puente Hills Intermodal Facility (up to 15 per working day under the High Impact Combination of action alternatives) would be within the total daily or annual number of trucks evaluated and authorized for the facility.

Traffic Congestion

The potential for DOE and cumulative activities to increase traffic congestion on roads and intersections in the SSFL vicinity was evaluated in two ways. First, impacts were evaluated by examining the percent increases compared to year 2018 baseline conditions that SSFL remediation activities could have on the average daily traffic on roads in the SSFL vicinity. Appendix H, Table H–18, summarizes the forecasted 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.

Second, impacts were analyzed as the potential for changes to the level of service (LOS) ratings and volume-to-capacity (V/C) ratios for selected roads and intersections. LOS is a qualitative measurement of operating conditions that ranges from A to F, as summarized in **Table 4–56**. Volume-to-capacity ratio is the ratio of the traffic demand to signal cycle capacity for signalized intersections, or for road segments, the ratio of the traffic demand to the road lane capacity. A V/C ratio greater than 1 indicates that the cycle capacity or road segment capacity is fully utilized (approaching unstable conditions). The analysis was performed using the guidance and procedures contained in the Highway Capacity Manual issued by the Transportation Research Board (TRB 2010).

[22] NNSS does not have onsite rail access, so waste would be transported by rail to an intermodal facility in the region, assumed for analysis to be located in Barstow, California, and then by truck to NNSS.

[23] For US Ecology in Idaho, waste on rail cars would be transported to the dedicated US Ecology intermodal facility at Mountain Home, Idaho, where the waste would be transferred to trucks for delivery to the disposal facility.

Table 4–56 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.

DOE performed the second analysis using the Highway Capacity Software (Highway Capacity Software Version 7, University of Florida McTrans Center). This software enables analysis of control delay, LOS, and V/C ratio for intersections and road segments. Control delay is the component of delay that results from the type of control at the intersection, such as a traffic signal or a stop sign, as measured by comparison with the uncontrolled condition. It is the difference between the travel time that would have occurred in the absence of the intersection control, and the travel time that results because of the presence of the intersection control. Capacity is the maximum rate of flow that can pass through an intersection under prevailing traffic and road conditions. The sum of all critical movements (that is, left turns, right turns, or through movements) on a critical lane basis is used to determine the total intersection V/C ratio and corresponding LOS. (See Table 4–56 for definitions of LOS.) An intersection or road is at capacity (V/C ratio of 1.0) when flow decreases due to congested conditions. This V/C ratio is based on traffic volumes by lane, signal phase timing patterns, and approach lane configuration.

The City of Los Angeles guidelines on transportation impact studies (LADOT 2016) include guidance on determining transportation impact thresholds of significance. For signalized intersections, a determination of significance depends on the LOS for that intersection, the V/C ratio, and the project-related increase in the V/C ratio (see Appendix H, Section H.13.3.2.2). Unsignalized intersections can also be evaluated to determine LOS based on minor street delay. A proposal for installation of a new traffic signal would include a traffic signal warrant analysis prepared in accordance with Los Angeles County Department of Transportation procedures (LADOT 2016). The Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices, which can be found at https://mutcd.fhwa.dot.gov/pdfs/ 2009r1r2/pdf_index.htm, also outlines criteria for evaluating the need for converting an unsignalized intersection to a signalized intersection based on warrant analysis.

Except for Woolsey Canyon Road (see below), the intersections and road segments evaluated in this EIS were selected from those intersections and road segments that showed existing (year 2018) or future year LOS levels of E or F as determined in the 2017 Traffic Study included as an appendix in the 2017 DTSC *Draft Program EIR* (DTSC 2017a) (see text box).

2017 Traffic Study

The 2017 Traffic Study (DTSC 2017b) evaluated traffic impacts during AM and PM peak traffic conditions for 16 intersections and 11 road segments. Six intersections and four road segments were determined to operate at LOS ratings of E (near or at capacity) or F (above capacity) under 2018 baseline traffic conditions:

Intersections:

- Topanga Canyon Boulevard and the SR-118 eastbound ramps (LOS F, AM and PM peaks)
- Valley Circle Boulevard and Woolsey Canyon Road (LOS E, AM peak)
- Topanga Canyon Boulevard and Victory Boulevard (LOS E, AM peak)
- Topanga Canyon Boulevard and Burbank Road (LOS E, PM peak)
- Topanga Canyon Boulevard and US 101 northbound off ramp (LOS F, AM and PM peaks)
- Valley Circle Boulevard and US-101 northbound off ramp (Long Valley Road) (LOS F, AM peak)

Road segments:

- Valley Circle Boulevard, Box Canyon Road to Woolsey Canyon Road (LOS F, AM peak)
- Valley Circle Boulevard, Woolsey Canyon Road to Chatlake Drive (LOS F, AM peak; LOS E, PM peak)
- Roscoe Boulevard, Shoup Avenue to Farralone Avenue (LOS F, AM peak)
- Valley Circle Boulevard, Burbank Boulevard to US-101 (LOS F, AM and PM peaks)

To assess the potential impacts of SSFL project activities, the study used the Transportation Research Board's Circular 212 Planning or Critical Movement Analysis, assuming 96 daily heavy-duty truck round trips plus 250 round trips in light-duty vehicles by site personnel, reflecting the combined daily truck traffic and worker commutes assumed in the DTSC *Draft Program EIR* for DOE, NASA, and Boeing (DTSC 2017a). Under these conditions, the LOS rating for the intersection of Woolsey Canyon Road with Valley Circle Boulevard would degrade from E to F during AM and PM peak traffic conditions; the LOS for Valley Circle Boulevard from Box Canyon Road to Woolsey Canyon Road would degrade from D to E during the PM peak, the LOS rating for Roscoe Boulevard from Shoup Avenue to Farralone Avenue would degrade from D to E during AM peak traffic conditions, and the LOS rating for Valley Circle Boulevard from Vanowen Street to Victory Boulevard would degrade from D to E during AM peak traffic conditions.

The study also projected traffic conditions in the year 2032 assuming a 1 percent ambient traffic growth rate. Without considering additional traffic from SSFL activities, 4 additional intersections and 1 additional road segment (compared to 2018 baseline conditions) would experience an LOS rating of E or F during AM or PM peak traffic conditions:

- Topanga Canyon Boulevard and SR-118 westbound ramps (LOS F, AM and PM peaks)
- Topanga Canyon Boulevard and Roscoe Boulevard (LOS E, PM peak)
- Topanga Canyon Boulevard and Sherman Way (LOS E, AM and PM peaks)
- Valley Circle Boulevard and Calabasas Road/Avenue San Luis (LOS E, PM peak)
- Valley Circle Boulevard from Vanowen Street to Victory Boulevard (LOS F, AM peak)

Assuming 96 daily heavy duty truck and 250 employee round trips, the LOS rating for AM peak traffic conditions for the intersection of Topanga Canyon Boulevard with Roscoe Boulevard would further degrade to D. The LOS rating for PM peak traffic conditions for Valley Circle Boulevard from Box Canyon Road to Woolsey Canyon Road would further degrade to F.

Four intersections and four road segments are evaluated in this EIS:

- Intersections:

  I1 – Woolsey Canyon Road with Valley Circle Boulevard (unsignalized)

  I2 – Topanga Canyon Boulevard with SR-118 westbound ramps (signalized)

  I3 – Topanga Canyon Boulevard with SR-118 eastbound ramps (signalized)

  I4 – Topanga Canyon Boulevard with Roscoe Boulevard (signalized)

- Road Segments:

  RS1 – Woolsey Canyon Road from Valley Circle to Knapp Ranch Road

  RS2 – Valley Circle Blvd from Box Canyon Road to Woolsey Canyon Road

  RS 3 – Valley Circle Blvd from Woolsey Canyon Road to Chatlake Drive

  RS4 – Roscoe Blvd from Shoup Avenue to Farralone Avenue

The evaluated intersections and road segments are shown in **Figure 4–10**, where the intersection and road segment designators indicated above correspond to those in the figure.

All of the evaluated intersections and roads are present on the projected truck routes evaluated in this EIS (see Table 4-55). The Woolsey Canyon Road segment was not projected to experience LOS levels of E or F at any time in the 2017 Traffic Study (DTSC 2017a), but was evaluated in this EIS because it is the road most heavily traveled by trucks. The intersection of Valley Circle Boulevard with Woolsey Canyon Road is unsignalized but was evaluated in this EIS because all trucks entering or leaving SSFL would use this intersection. Trucks leaving SSFL would turn either north or south on Valley Circle Boulevard. To further assess the potential traffic impacts near this intersection, the analysis addresses Valley Circle Road segments immediately north and south of this intersection (Woolsey Canyon Road to Box Canyon Road and Woolsey Canyon Road to Chatlake Drive). Roscoe Boulevard and its intersection with Topanga Canyon Boulevard were evaluated because of the potential use of Roscoe Boulevard as a haul route; and the intersections of Topanga Canyon Boulevard with the State Route 118 ramp were evaluated because State Route 118 lies on the most direct route between SSFL and offsite waste management facilities.

For analysis in this EIS, two scenarios for heavy-duty truck traffic were considered: (1) an average of 16 daily truck round trips (or 2 round trips per hour assuming an 8 hour working day), and (2) an average of 32 daily truck round trips (or 4 round trips per hour assuming an 8 hour working day). For both scenarios traffic from an assumed 25 site workers was included.[24] The average of 16 daily truck roundtrips corresponds to the daily average expected shipping rate of any of the soil remediation action alternatives (see Chapter 2, Section 2.4.4). This average rate would be bounding for all soil remediation action alternatives as well as the Building Removal Alternative and both groundwater remediation action alternatives.

[24] Under the Building Removal Alternative, there may be as many as 60 workers per day in Area IV; however, worker commuter traffic would typically be before and after the working hours evaluated for truck traffic.

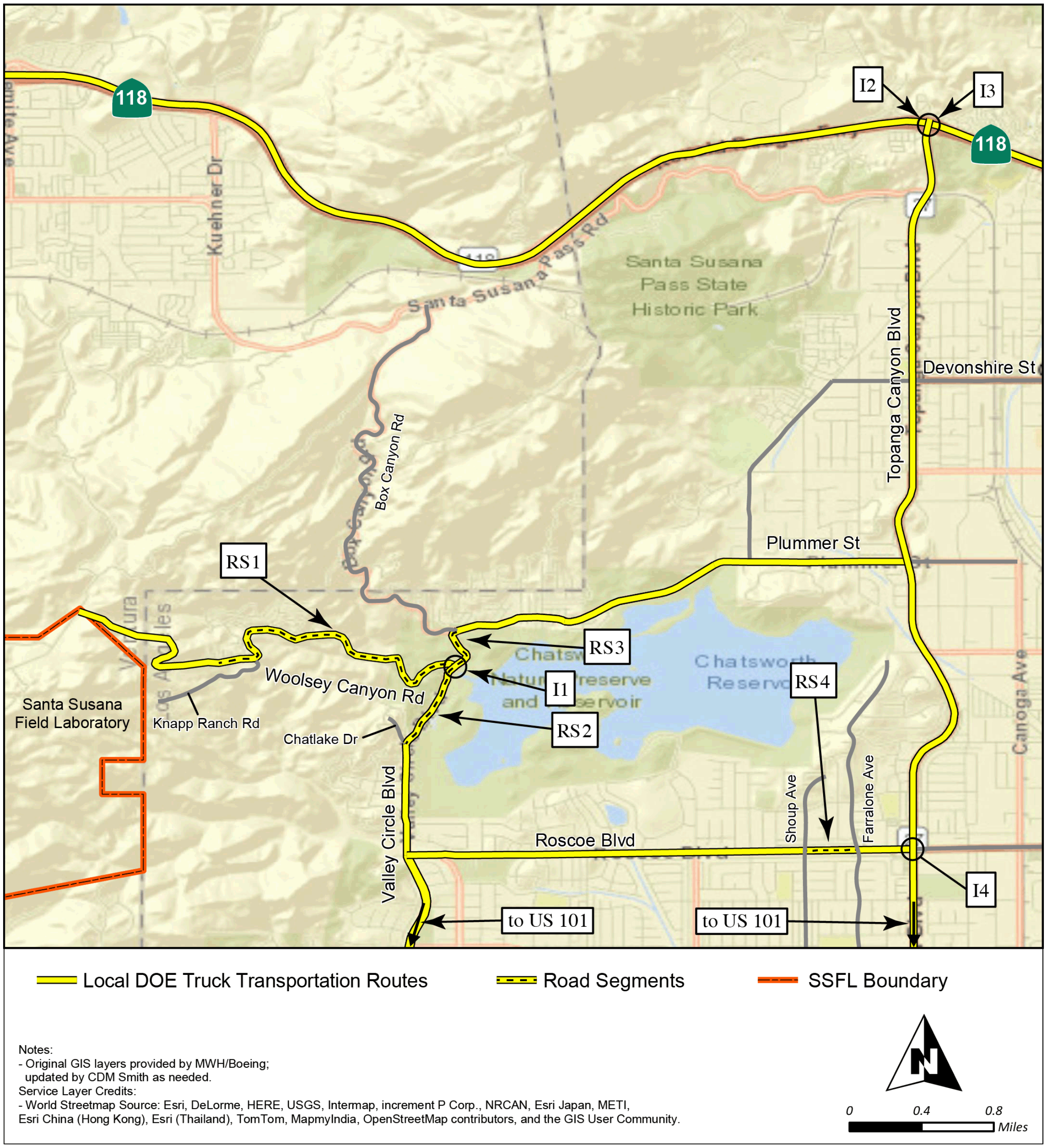

Figure 4–10 Evaluated Intersections and Road Segments in the SSFL Vicinity

Under the Building Removal Alternative, the average daily heavy-duty truck shipment rate would be 5 per day, although it could spike to 12 per day on some days. Under the Groundwater Remediation Action Alternatives, average heavy-duty truck shipments would be much less than 1 per day for the Groundwater Monitored Natural Attenuation Alternative and only a few per day for the Groundwater Treatment Alternative. An average of 32 daily truck roundtrips (4 round trips per hour) reflects a hypothetical assumption that over the course of a year, DOE could achieve a shipping rate for soil remediation that on some days is twice the maximum expected sustained shipping rate. This assumption is made to provide an upper bound on impacts that could result from DOE activities (see Chapter 2, Section 2.4.4).

As shown in the 2017 Traffic Study (see text box), traffic congestion exists in the SSFL area at intersections and road segments at some times of the day. In addition, if the population in the SSFL area grows during the time required for SSFL remediation, then the degree of traffic congestion would also increase in the SSFL area independent of any remediation activity. Therefore, the analysis was performed assuming traffic corresponding to the above scenarios was added to 2018 baseline conditions, as well as to future traffic in the SSFL area assuming an annual increase in traffic in accordance with a 1 percent growth rate until the year 2032. The assumptions of 2018 baseline conditions, a 1 percent traffic growth rate, and a cutoff of the analysis in 2032 are the same assumptions as those in the 2017 Traffic Study (DTSC 2017b).

The 1 percent traffic growth rate assumed for this EIS is conservative. As noted in DTSC's 2017 *Draft Program EIR* (DTSC 2017a) and Traffic Study (DTSC 2017b), the traffic growth projection for the West San Fernando Valley area in the County of Los Angeles Congestion Management Program (as of 2010) is 0.41 percent per year (DTSC 2017a). In addition, the California Department of Finance has projected that the populations in Los Angeles and Ventura Counties would increase by 9 percent from 2016 through 2030 (California Department of Finance 2018), which is equivalent to an annual growth rate of about 0.6 percent.

DOE assumed a 2032 cutoff of analysis in the interest of consistency with the 2017 Traffic Study and because DOE believes that traffic projections to 2032 would be sufficient to reach meaningful conclusions from the analysis. Under the Cleanup to AOC LUT Values Alternative, remediation activities and the traffic associated with these activities are projected to continue for several years past 2032. Nonetheless, DOE believes the number of years evaluated (from 2018 through 2032) is sufficient to analyze the effects of the traffic associated with this alternative. Also, DOE doubts the utility of extending a 1 percent growth rate over all 28 years of soil removal that are projected for this alternative. At some point in time the growth assumption must become invalid because if it actually occurred, without modifications to the overall area transportation system in response to traffic growth, there could be gridlock throughout the SSFL area.[25]

The results of the analysis are shown in **Tables 4–57** and **4–58**, respectively, for the 16 daily truck roundtrips and the 32 daily truck roundtrips scenarios. LOS values and V/C ratios are shown for baseline 2018 conditions as well as for the addition of DOE traffic to the 2018 baseline conditions. The results of the analysis for the years 2022, 2026, and 2032 are also shown. In both Table 4–57 and 4–58, LOS ratings and V/C ratios for AM traffic conditions are shown above LOS ratings and V/C ratios for PM traffic conditions. The listed AM and PM traffic conditions are peaks for these time periods.

Table 4–57 shows that to the extent that traffic conditions would worsen in the SSFL area, these conditions would primarily have less to do with traffic associated with DOE activities and more to do with traffic growth in the area independent of these activities. In comparison to baseline traffic conditions in 2018, the addition of 16 daily DOE truck round trips during this year would increase the V/C ratio for the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard by 0.07 during PM traffic conditions, although there would be no change in the LOS rating for either AM or PM traffic conditions. The LOS rating for AM traffic conditions for this intersection would degrade to an E level in 2022 and an F level in 2026, mainly due to assumed 1 percent traffic growth rate in the SSFL vicinity.

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[25] DTSC's *Draft Program EIR* and Traffic Study evaluated a 15-year period of SSFL remediation by DOE, NASA, and Boeing, beginning in 2015 and ending in 2032. DTSC assumed this 15-year period based on the remediation plans and waste projections estimated by DOE, NASA, and Boeing at the time of preparation of the *Draft Program EIR* and Traffic Study. Since that time, these remediation plans and waste projections have changed. DTSC selected the year 2032 for analysis because DTSC believed it to represent the furthest point in the future within the remediation timeline that would provide the greatest amount of background traffic growth (DTSC 2017a, 2017b).

Table 4–57 Intersection and Road Segment Level of Service and Volume-to-Capacity Ratio Assuming 16 Heavy-Duty Trucks Round Trips Per Day

Intersection or Road Segment	*Time Period*	*Analysis Year* [a]									
		2018 (Baseline)		*2018*		*2022*		*2026*		*2032*	
		LOS	*V/C Ratio* [b]	*LOS*	*V/C Ratio* [b]	*LOS*	*V/C Ratio* [b]	*LOS*	*V/C Ratio* [b]	*LOS*	*V/C Ratio* [b]
Intersection											
Woolsey Canyon Rd and Valley Circle Blvd (unsignalized)	AM PM	D C	0.58 0.25	D C	0.60 0.32	E C	0.67 0.35	F C	0.74 0.38	F C	0.86 0.43
Topanga Canyon Blvd and SR-118 Westbound Ramp	AM PM	F F	1.59 1.25	F F	1.60 1.25	F F	1.67 1.30	F F	1.73 1.35	F F	1.84 1.44
Topanga Canyon Blvd and SR-118 Eastbound Ramp	AM PM	D D	1.03 1.12	D D	1.03 1.14	D D	1.07 1.18	E D	1.10 1.23	F E	1.21 1.31
Topanga Canyon Blvd and Roscoe Blvd	AM PM	C D	0.95 0.90	C D	0.97 0.90	D D	1.05 0.97	D D	1.13 1.05	D E	1.27 1.13
Road Segment											
Woolsey Canyon Rd from Valley Circle Blvd to Knapp Ranch Rd	AM PM	A B	0.09 0.10	B B	0.10 0.12	B B	0.10 0.12	B B	0.11 0.13	B B	0.11 0.13
Valley Circle Blvd from Box Canyon Rd to Woolsey Canyon Rd	AM PM	D D	0.49 0.37	D D	0.51 0.38	D D	0.52 0.39	D D	0.54 0.41	D D	0.57 0.43
Valley Circle Blvd from Woolsey Canyon Rd to Chatlake Dr	AM PM	D D	0.53 0.41	D D	0.54 0.42	D D	0.56 0.43	D D	0.58 0.45	D D	0.61 0.48
Roscoe Blvd from Shoup Ave to Farralone Ave	AM PM	B B	0.36 0.44	B B	0.37 0.45	B C	0.38 0.46	B C	0.39 0.48	B C	0.42 0.51

Ave = Avenue; Blvd = Boulevard; Dr = Drive; LOS = level of service; Rd = Road; SR = State Route; V/C = volume-to-capacity.
[a] The 2018 baseline columns refer to existing traffic conditions without the addition of DOE traffic; the columns for the year 2018 refer to 2018 baseline conditions with the addition of DOE traffic. The columns for 2022 through 2032 reflect the traffic conditions projected for these years assuming DOE traffic is added to an annual 1 percent increase in traffic in the SSFL area.
[b] Representing the highest lane group V/C ratio (left turns, right turns, or through movements).
Note: AM and PM traffic conditions are peaks for these time periods.

Regarding the remaining three signalized intersections, the baseline AM and PM V/C ratios for the intersection of Topanga Canyon Boulevard with both State Route 118 ramps exceed 1.0 (capacity conditions) under 2018 baseline conditions, and the V/C ratio for the intersection of Topanga Canyon Boulevard with Roscoe Boulevard equals or exceeds 0.90. The addition of 16 daily truck round trips during this year increases the V/C ratios by 0.02 at two intersections, and by 0.01 at one intersection, during AM or PM traffic conditions. Still, the magnitude of, or the projected increases in V/C ratios for the intersection of Topanga Canyon Boulevard with the State Route 118 westbound and eastbound ramps, and Topanga Canyon Boulevard with Roscoe Boulevard, during AM or PM traffic conditions would be considered significant under City of Los Angeles guidance (LADOT 2016). Over the following years, the LOS rating for the intersection of Topanga Canyon Boulevard with Roscoe Boulevard would change by 2032 from D to E during PM traffic conditions. The V/C ratios would increase for all four intersections, and by 2022, the V/C ratio for the three signalized intersections (i.e., all those except the intersection of Woolsey Canyon Road with Valley Circle Boulevard) would exceed 1.0 for AM and PM traffic conditions. These increases in V/C ratios are primarily due to projected growth in the SSFL area and would be considered significant under City of Los Angeles guidance (LADOT 2016).

Table 4–58 Intersection and Road Segment Level of Service and Volume-to-Capacity Ratio Assuming 32 Heavy-Duty Truck Round Trips Per Day

Intersection or Road Segment	Time Period	Analysis Year [a]									
		2018 (Baseline)		2018		2022		2026		2032	
		LOS	V/C Ratio [b]	LOS	V/C Ratio [b]	LOS	V/C Ratio [b]	LOS	V/C Ratio [b]	LOS	V/C Ratio [b]
Intersection											
Woolsey Canyon Rd and Valley Circle Blvd (unsignalized)	AM PM	D C	0.58 0.25	E C	0.61 0.33	E C	0.67 0.36	F C	0.74 0.39	F C	0.87 0.44
Topanga Canyon Blvd and SR-118 Westbound Ramp	AM PM	F F	1.59 1.25	F F	1.60 1.25	F F	1.67 1.30	F F	1.73 1.35	F F	1.84 1.44
Topanga Canyon Blvd and SR-118 Eastbound Ramp	AM PM	D D	1.03 1.12	D D	1.03 1.14	D D	1.07 1.19	E D	1.12 1.23	F E	1.21 1.31
Topanga Canyon Blvd and Roscoe Blvd	AM PM	C D	0.95 0.90	C D	0.98 0.90	D D	1.05 0.97	D D	1.13 1.05	D E	1.28 1.13
Road Segment											
Woolsey Canyon Rd from Valley Circle Blvd to Knapp Ranch Rd	AM PM	A B	0.09 0.10	B B	0.10 0.12	B B	0.10 0.12	B B	0.11 0.13	B B	0.11 0.13
Valley Circle Blvd from Box Canyon Rd to Woolsey Canyon Rd	AM PM	D D	0.49 0.37	D D	0.51 0.38	D D	0.52 0.39	D D	0.54 0.41	D D	0.58 0.43
Valley Circle Blvd from Woolsey Canyon Rd to Chatlake Dr	PM PM	D D	0.53 0.41	D D	0.54 0.42	D D	0.56 0.43	D D	0.58 0.45	D D	0.61 0.48
Roscoe Blvd from Shoup Ave to Farralone Ave	AM PM	B B	0.36 0.44	B B	0.37 0.45	B C	0.38 0.46	B C	0.39 0.48	B C	0.42 0.51

Ave = Avenue; Blvd = Boulevard; Dr = Drive; Rd = Road; SR = State Route; V/C = volume-to-capacity.

[a] The 2018 baseline columns refer to existing traffic conditions without the addition of DOE traffic; the columns for the year 2018 refer to 2018 baseline conditions with the addition of DOE traffic. The columns for 2022 through 2032 reflect the traffic conditions projected for these years assuming DOE traffic is added to an annual 1 percent increase in traffic in the SSFL area.

[b] Representing the highest lane group volume-to-capacity ratio (left turns, right turns, or through movements).

Note: AM and PM traffic conditions are peaks for these time periods.

In comparison to 2018 baseline conditions, the addition of 16 daily truck round trips would change the LOS rating for Woolsey Canyon Road from an A to a B rating during AM traffic conditions, and would increase the V/C ratio for this road segment by 0.02 during PM traffic conditions. The V/C ratio for Valley Circle Boulevard from Box Canyon Road to Woolsey Canyon Road would increase by 0.02 during AM traffic conditions, but there would be no change in the LOS rating. The V/C ratios for other road segments would increase by 0.01 to 0.02 during AM or PM traffic conditions. Considering the projected area traffic for the years 2022, 2026, and 2032, there would be some additional increases in V/C ratios, but no additional changes in the LOS rating of any evaluated road segment. Over all years, no road segment would have a V/C ratio approaching 1.0.

Table 4–58 shows similar results as Table 4–57. In comparison to 2018 baseline conditions and assuming 32 daily truck round trips, the LOS rating for the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard would degrade from a D to an E rating during 2018 AM traffic conditions, rather than maintaining a D rating which is the case assuming 16 daily round trips (see Table 4–57). In addition, the V/C ratio for both AM traffic conditions would increase by 0.03. The LOS for PM traffic conditions would be maintained at a C rating but the V/C ratio would increase by 0.08.

Regarding the three signalized intersections, the baseline AM and PM V/C ratios for the intersection of Topanga Canyon Boulevard with both State Route 118 ramps exceed 1.0 under 2018 baseline conditions, and V/C ratio for the intersection of Topanga Canyon Boulevard with Roscoe Boulevard equals or exceeds 0.90. The addition of 32 daily truck round trips during this year increases the V/C ratios by 0.01 to 0.02 at the three intersections during AM or PM traffic conditions. Still, the magnitude of, or the projected increases in, V/C ratios for the intersection of Topanga Canyon Boulevard with the State Route 118 westbound and eastbound ramps, and Topanga Canyon Boulevard with Roscoe Boulevard, during AM or PM traffic conditions would be considered significant under City of Los Angeles guidance (LADOT 2016). In the following years, the LOS rating for the intersection of Topanga Canyon Boulevard with Roscoe Boulevard would change by 2032 from D to E during PM traffic conditions. The V/C ratios would increase for all four intersections, and by 2022, the V/C ratio for the three signalized intersections would exceed 1.0 for AM or PM traffic conditions. These increases in V/C ratios are primarily due to projected growth in the SSFL area and would be considered significant under City of Los Angeles guidance (LADOT 2016).

Comparing Table 4–57 with Table 4–58, the addition of 32 daily truck round trips during 2018 would not change the LOS rating for AM or PM traffic conditions for any of the evaluated road segments except for Woolsey Canyon Road. Similar to Table 4–57, there could be a change in the LOS rating for Woolsey Canyon Road from an A rating to a B rating during PM traffic conditions. In comparison to 2018 baseline conditions, the addition of DOE traffic assuming 32 daily truck round trips during this year would result in increased V/C ratios for all road segments by at least 0.01 for both AM and PM traffic conditions. There would be an increase of 0.02 in the V/C ratio for Woolsey Canyon Road under PM traffic conditions and for Valley Circle Boulevard from Box Canyon Road to Woolsey Canyon Road under AM traffic conditions. Considering the projected area traffic for the years 2022, 2026, and 2032, and in comparison with 2018 baseline traffic conditions, the LOS rating for Roscoe Boulevard in 2018 would not change from a B rating with the addition of 32 daily truck round trips, but could change in 2022, 2026, and 2032 to a C rating assuming the growth of traffic in the SSFL Area. There would be additional increases in V/C ratios for some road segments. Over all evaluated years, no road segment would have a V/C ratio approaching 1.0 (capacity conditions).

Pavement Deterioration

The 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. 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.[26]

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.13.3.3, for additional information.

[26] 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.

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.

4.8.2.1 Traffic Impacts under the Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–59**.

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 3–15).

4.8.2.1.2 Cleanup to AOC LUT Values Alternative

Under the Cleanup to AOC LUT Values Alternative, about 101,600 heavy-duty truck round trips would be required to transport waste, backfill, equipment, and supplies (see Appendix H, Table H–17). In addition, there would be about 163,000 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 up to 3.3 percent above baseline conditions during 26 years of soil removal. If all traffic traversed Plummer Street between Valley Circle Boulevard and Topanga Canyon Boulevard, the average daily traffic would increase on this road by 1.5 percent above baseline conditions. 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 1.3 percent above baseline conditions. The largest increase in average daily traffic on the remaining evaluated roads would be 1 percent or less (see Appendix H, Table H–22).

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 or perceive 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 increased traffic congestion 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.

Table 4–59 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 up to 3.3 percent above baseline conditions during 26 years of soil removal. Traffic increases on other evaluated roads would be smaller. Weekday motorist delays or perceived delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard traffic volumes on roads and intersections 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 up to 3.3 percent above baseline conditions 6 years of soil removal. Traffic increases on other evaluated roads would be smaller. Weekday motorist delays or perceived delays could occur on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard, but these impacts would last for about a fourth as many years as those under the Cleanup to AOC LUT Values Alternative. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways.	Under the Residential Scenario, the weekday average daily traffic on Woolsey Canyon Road would increase by up to 3.3 percent above baseline conditions during 2.6 years of soil removal. Under the Open Space Scenario, the weekday average daily traffic on Woolsey Canyon Road would increase by up to 3.3 percent above baseline conditions during 2 years of soil removal. Under both scenarios, increases on other evaluated roads would be smaller. Weekday motorists could experience or perceive delays on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard, but the duration of these impacts would be shorter than that for the Cleanup to Revised LUT Values or cleanup to Revised LUT Values Alternative. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on roads and intersections may be reduced by use of multiple routes between SSFL and major highways.
LOS	No changes due to DOE actions to the LOS ratings of intersections and roads in the SSFL vicinity are expected above baseline conditions. However, traffic congestion exists in the SSFL area, and growth in the SSFL area could result in additional traffic congestion in future years, with degradation of the LOS ratings for some intersections and roads in the SSFL Area.	Compared with 2018 baseline conditions, the LOS rating for Woolsey Canyon Boulevard could change from A to B during AM traffic conditions. The V/C ratio for the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard could increase by 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years. For example, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic conditions during most of the 26 years of soil removal.	Similar to the Cleanup to AOC LUT Values Alternative, except that because soil removal would require only 6 years, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete. However, the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic conditions during some of the 6 years of soil removal.	Similar to the Cleanup to Revised LUT Values Alternative, except that because soil removal would require up to 2 years, fewer intersections in the SSFL area would have LOS ratings of E or F by the time remediation is complete.

Resource	Soil No Action Alternative	Soil Remediation Action Alternatives		
		Cleanup to AOC LUT Values	Cleanup to Revised LUT Values	Conservation of Natural Resources
ESALs	No ESALs on roads in the SSFL vicinity are expected, with no damage to road pavement.	Traffic would impose about 258,000 ESALs on the evaluated roads, which would likely have adverse impacts on road pavement and result in the affected roads needing repair sooner than currently anticipated.	Traffic would impose about 56,000 ESALs on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but could still result in the affected roads needing repair sooner than currently anticipated.	Under the Residential and Open Space Scenarios, traffic would impose about 15,000 and 11,000 ESALs, respectively, on the evaluated roads, which would likely cause less road pavement damage than that under the Cleanup to AOC LUT Values Alternative, but could still result in the affected roads needing repair sooner than currently anticipated.

AOC = *Administrative Order on Consent for Remedial Action*; ESAL = equivalent single-axle load; LOS = level of service; LUT = Look-Up Table; V/C = volume-to-capacity.

The expectation of delays or perceived delays for motorists traveling on Woolsey Canyon Road is supported by the LOS and V/C analyses performed for this EIS. Assuming an average of 16 to 32 heavy-duty truck round trips per day, the addition of these round trips hypothetically in 2018, compared to 2018 baseline conditions, would change the LOS rating for Woolsey Canyon Road from A to B during AM traffic conditions (see Tables 4–57 and 4–58). This rating may not significantly change in future years.

The presence of slow-moving, heavy-duty trucks could also cause motorists to experience or perceive delays at the unsignalized 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 delays during weekdays at this intersection.

The expectation of traffic delays at the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard is supported by the LOS and V/C analyses performed for this EIS. The LOS rating for this intersection could degrade during AM traffic conditions from D to E assuming 16 to 32 heavy-duty trucks per day, and the V/C ratio could increase by 0.07 to 0.08. Further degradation of LOS under AM traffic conditions would occur in future years, with additional increases in the V/C ratio. This is of interest because soil removal under the alternative is projected to begin by 2021. Assuming 16 to 32 heavy-duty truck trips per day, the LOS for this intersection would degrade by 2026 to an F level during AM traffic conditions.

Traffic congestion would also be expected at other intersections in the SSFL area. One example is the intersection of Topanga Canyon Boulevard with the westbound ramps for State Route 118, which is evaluated as having (i.e., under baseline conditions) an LOS rating of F for both AM and PM traffic conditions in 2018 and future years (see Tables 4-57 and 4-58). The eastbound ramp may be less affected, which is of interest because truck traffic using State Route 118 as part of delivering waste and recycle material to offsite facilities would generally turn east. Still, by 2032 the LOS for the eastbound ramp could be at an E or F rating during AM or PM traffic conditions.

To the extent that traffic conditions would worsen in the SSFL area, these conditions would generally have less to do with DOE activities and more to do with traffic growth in the area independent of DOE activities. There would be further degradation of the LOS ratings for the roads and intersections in the SSFL area, as well as increases in V/C ratios. Implementation of the Cleanup to AOC LUT

Values Alternative would occur for more than a decade beyond 2032, the last year for which traffic was quantitatively analyzed in the 2017 DTSC traffic study (DTSC 2017a) and this EIS. To some extent, traffic in the SSFL area due to DOE remediation activities may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways. Similarly, distributing traffic between SSFL and major highways would reduce the impacts of this increased traffic on intersections other than Woolsey Canyon Road with Valley Circle Boulevard. Delays at this intersection may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6-2).[27]

The movement of large numbers of heavy-duty trucks could 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 258,000 ESALs on the evaluated routes between SSFL and major highways (see Appendix H, Table H–28). These ESALs were determined assuming each 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 22,000 heavy-duty truck round trips would be required to transport waste, backfill, equipment, and supplies (see Appendix H, Table H–17). In addition, there would be about 38,000 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 up to 3.3 percent above baseline conditions during the 6 years of soil removal. The percent increases in traffic levels for other evaluated roads in the SSFL area would be the same as those for the Cleanup to AOC LUT Values Alternative (see Appendix H, Table H–22).

During the years of soil removal, motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to and from SSFL could experience or perceive 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 6 years rather than 26.

As with the Cleanup to AOC LUT Values Alternative, to the extent that traffic conditions would worsen in the SSFL area, these conditions would generally have less to do with DOE activities and more to do with traffic growth in the area independent of DOE activities. Assuming soil removal began in 2021, these activities would occur until approximately 2026, by which time the LOS for AM traffic conditions could degrade to an F level at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. The LOS ratings for the westbound ramp at the intersection of Topanga Canyon Boulevard with State Route 118 would be at F levels for the entire period of soil removal. The eastbound ramp could be at an E (PM) or F (AM) level by 2032.

To some extent, traffic in the SSFL area due to DOE remediation activities may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways. Similarly, distributing traffic between SSFL and major highways would reduce the

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[27] The installation of a traffic signal would be in accordance with a transportation impact study per City of Los Angeles Department of Transportation procedures that would include a traffic signal warrant analysis (LADOT 2016). Such a study is beyond the scope of the EIS.

impacts of this increased traffic on intersections other than Woolsey Canyon Road with Valley Circle Boulevard. Delays at this intersection may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6-2).

Traffic associated with the alternative would impose about 56,000 ESALs on the evaluated routes between SSFL and major highways (see Table H–28). These ESALs were determined assuming each route received all traffic. These ESALs are less than those for the Cleanup to AOC LUT Values Alternative, but some roads could still be adversely affected and require repairs sooner than currently anticipated.

4.8.2.1.4 Conservation of Natural Resources Alternative

Under the Conservation of Natural Resources Alternative, about 6,000 heavy-duty truck round trips would be required to transport waste, backfill, equipment, and supplies under the Residential Scenario or about 4,400 heavy-duty truck round trips would be required under the Open Space Scenario. In addition, for both scenarios there would be about 13,000 round trips by cars or light-duty trucks, primarily for worker commutes (see Appendix H, Table H–17). The largest increase in weekday traffic would occur on Woolsey Canyon Road, where under the Residential Scenario the average daily traffic would increase by up to 3.3 percent above baseline conditions during the 2 years of soil removal. Under the Open Space Scenario, the average daily traffic would increase on Woolsey Canyon Road by up to 3.3 percent above baseline conditions during the 2 years of soil removal, and where removal operations would likely require only a portion of the second year. Considering both scenarios, the percent increases in traffic levels for other evaluated roads in the SSFL area would be the same as those for the Cleanup to AOC LUT Values Alternative (see Appendix H, Table H–22). Particularly for the Open Space Scenario, 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), motorists on Woolsey Canyon Road during week days when heavy-duty trucks would be traveling to and from SSFL could experience or perceive delays compared to baseline conditions; motorists could also experience or perceive 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 26.

As with the Cleanup to AOC LUT Values Alternative, to the extent that traffic conditions would worsen in the SSFL area, these conditions would generally have less to do with DOE activities and more to do with traffic growth in the area independent of DOE activities. There would be less projected traffic growth in the SSFL area, and there could be moderately less congestion at the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard; this is because during the period of soil removal, the AM LOS rating for this intersection could be at a D or E level rather than an F level which would be the case for some of the years required for implementing the Cleanup to AOC LUT Values or Cleanup to Revised LUT Values Alternatives. The LOS ratings for the westbound ramp at the intersection of Topanga Canyon Boulevard with State Route 118 would be at F levels for the entire period of soil removal. During this period, the eastbound ramp could operate at a D level during AM and PM traffic conditions.

To some extent, the impacts of traffic growth on implementation of the alternative, and the contribution of DOE to traffic congestion in the area, may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways. Similarly, distributing traffic between SSFL and major highways would reduce the impacts of this increased traffic on intersections other than Woolsey Canyon Road with Valley Circle Boulevard. Delays at this intersection may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6-2).

Traffic associated with the alternative would impose about 15,000 and 11,000 ESALs, respectively, for the Residential and Open Space Scenarios on the routes between SSFL and major highways (see Table H–28). These ESALs were determined assuming each route received all traffic. These ESALs are less than those for either the Cleanup to AOC LUT Values Alternative or the Cleanup to Revised LUT Values Alternative, but some roads could still be adversely affected and require 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 4–60**.

Table 4–60 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 up to 5.2 percent above baseline conditions during the 2 to 3 years required for building removal. There could be weekday motorist delays or perceived delays on this road and its intersection with Valley Circle Boulevard. Traffic increases on other evaluated roads would be smaller. Except for Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic on the evaluated roads and intersections may be reduced by distributing traffic among multiple routes between SSFL and major highways.
LOS	No changes due to DOE actions to the LOS ratings of intersections and roads in the SSFL vicinity are expected above baseline conditions. However, traffic congestion exists in the SSFL area, and growth in the SSFL area could result in additional traffic congestion in future years, with degradation of the LOS ratings for some intersections and roads in the SSFL Area.	There could be a change in the LOS rating for Woolsey Canyon Road from A to B during AM traffic conditions. This may be more likely on a limited number of days when the daily number of truck shipments could spike to 12. Because the Building Removal Alternative would be initiated early in the remediation of Area IV and the NBZ (in 2018 or 2019) and because of the 2 to 3 year duration of the activity, it may be completed before most of the assumed 1 percent growth in SSFL area traffic would occur (see Section 4.8.2, "Traffic Congestion"). During the period of building removal, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at a D to E rating during AM traffic conditions and a C rating during PM traffic conditions.
ESALs	No ESALs on roads in the SSFL vicinity are expected, with no damage to road pavement.	Traffic would impose about 6,200 ESALs on the evaluated roads, with some adverse impacts on road pavement resulting in the impacted roads needing repair sooner than currently anticipated.

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 3–15).

4.8.2.2.2 Building Removal Alternative

There would be a total of about 2,400 heavy-duty truck round trips during the years of building removal to transport waste, backfill, and equipment (see Appendix H, Table H–17). In addition, there would be about 38,000 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 3-year period, the average daily traffic on this road would increase by 5.2 percent, mostly (about 94 percent) due to worker commuter vehicles. The average daily traffic on all other evaluated routes between SSFL and major highways would increase by 1 percent or less (see Appendix H, Table H–22).

Motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to and from SSFL could experience or perceive delays compared to baseline conditions; there could also be delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard.

As with the soil remediation alternatives, to the extent that traffic conditions would worsen in the SSFL area, these conditions would generally have less to do with DOE activities and more to do with traffic growth in the area independent of DOE activities. However, because the Building Removal Alternative would be initiated early in the remediation of Area IV and the NBZ (in 2018 or 2019) and because of the 2- to 3-year duration of the activity, it could be completed before most of the growth assumed for the traffic impacts evaluation would occur (see Section 4.8.2, "Traffic Congestion"). Transportation during building demolition is expected to be episodic, with periods of higher truck activity and periods of no or low truck activity. During the periods of higher truck activity, estimated to be up to 12 truck round trips per day, the LOS for Woolsey Canyon Road could degrade from A to B during AM traffic conditions. Also during AM traffic conditions, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an LOS rating of D to E, while the LOS rating for PM traffic conditions would be at a C level. The LOS ratings for the westbound ramp at the intersection of Topanga Canyon Boulevard with State Route 118 would be at F levels for the entire period of soil removal. The eastbound ramp could operate at a D level during AM and PM traffic conditions.

To some extent, the impacts of traffic growth on implementation of the alternative, and the contribution of DOE to traffic congestion in the area, may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways. Similarly, distributing traffic between SSFL and major highways would reduce the impacts of this increased traffic on intersections other than Woolsey Canyon Road with Valley Circle Boulevard. Delays at this intersection may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6-2).

Traffic associated with the alternative would impose about 6,200 ESALs on the evaluated routes between SSFL and major highways (see Appendix H, Table H–28). These ESALs were determined assuming each route received all traffic. Although these ESALs are less than those of any of the soil remediation action alternatives, some roads could nonetheless be adversely impacted and require repairs sooner than currently anticipated.

4.8.2.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–61**.

4.8.2.3.1 Groundwater No Action Alternative

Under the Groundwater No Action Alternative, current groundwater monitoring would continue. There would be 1 annual round trip of medium-duty 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 3–15).

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 300 round trips of light-duty vehicles (primarily worker commuter vehicles). In other years, there would be 1 medium-duty truck shipment and 140 round trips of light-duty vehicles (see Appendix H, Table H–17). The largest increase in weekday traffic would occur on Woolsey Canyon Road. The average daily traffic in the peak year would increase by about 0.10 percent (see Table H–22), which would not cause a noticeable increase in traffic volumes on any of the evaluated roads (see Chapter 3, Table 3–15).

Table 4–61 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 about 0.10 percent above baseline conditions during 1 year. Traffic increases on other roads or during other years would be smaller.	The weekday average daily traffic on Woolsey Canyon Road would increase by about 0.80 percent above baseline conditions during 1 year. Traffic increases on other roads or during other years would be smaller.
LOS	No changes due to DOE actions to the LOS ratings of intersections and roads in the SSFL vicinity are expected above baseline conditions. However, traffic congestion exists in the SSFL area, and growth in the SSFL area could result in additional traffic congestion in future years, with degradation of the LOS ratings for some intersections and roads in the SSFL Area.	Although there would be only a small annual number of truck shipments and other traffic, with only one annual truck shipment during most years evaluated for this alternative, these small numbers of shipments would occur in a heavily trafficked area. During the peak year of shipment of waste, equipment, and supplies, the LOS for the intersection of Woolsey Canyon Road with Valley Circle Boulevard could be operating at an E level during AM operating conditions. Assuming the continuation of well water sampling for up to two decades, these truck shipments and worker commutes would occur during years having increasing traffic congestion, with this and other intersections operating at an E or F rating during AM or PM traffic conditions.	Truck shipments under this alternative would be larger than those under the Groundwater Monitored Natural Attenuation Alternative, but still small compared to the soil remediation alternatives and Building Removal Alternative. Nonetheless, the shipments would occur in a heavily trafficked area. For example, during peak year of shipment of waste, equipment, and supplies, the LOS rating for the intersection of Woolsey Canyon Road with Valley Circle Boulevard could be operating at an E rating during AM traffic conditions.
ESALs	No ESALs on roads in the SSFL vicinity are expected, with no damage to road pavement.	No routes would experience significant ESALs, with little or no damage to road pavement.	Traffic under this alternative would impose about 1,700 ESALs on the evaluated roads, with minimal potential for damage to road pavement.

ESAL = equivalent single-axle load; LOS = level of service.

Nonetheless, the shipments would occur in a heavily trafficked area. During the peak year of shipment of waste, equipment, and supplies, the AM LOS for the unsignalized intersection of Woolsey Canyon Road with Valley Circle Boulevard could be operating at an E level. Assuming the continuation of well water sampling for up to two decades, these truck shipments and worker commutes would occur during years having increasing traffic congestion. For example, the LOS for the intersection of Topanga Canyon Boulevard with both ramps of State Route 118 could by 2032 be at an F level during AM or PM peak traffic conditions.

Because the number of additional vehicle trips under this alternative is so small compared to baseline conditions, there would be minimal ESALs imposed on the evaluated roads (see Appendix H, Table H–28). Little or no damage on these roads is expected.

4.8.2.3.3 Groundwater Treatment Alternative

Under this alternative, the maximum increase in traffic would occur during a single year when DOE would remove approximately 3,000 cubic yards of bedrock from Area IV, transport the bedrock for offsite disposal, and install and operate groundwater treatment equipment. About 560 heavy- and medium-duty truck round trips would be required to transport waste, backfill, equipment, and supplies. In addition, there would be about 240 round trips of light-duty vehicles (primarily worker commuter vehicles). During 3 following years there would be 24 annual shipments of waste in medium-duty trucks and about 140 round-trips of light-duty vehicles. The largest increase in weekday traffic would occur on Woolsey Canyon Road, where the average daily traffic would increase by

0.80 percent (see Appendix, Table H–22). There would not be a noticeable change to traffic volumes on any of the other evaluated roads (see Chapter 3, Table 3–15).

Similar to the Groundwater Monitored Natural Attenuation Alternative, the shipments would occur in a heavily trafficked area. During the peak year of shipment of waste, equipment, and supplies, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could be operating at an E rating during AM traffic conditions. The intersection of Topanga Canyon Boulevard with the westbound ramp of State Route 118 could operate at an F rating during AM and PM traffic conditions. The eastbound ramp would be less affected.

Because the number of additional vehicle trips under this alternative is small, there would be a small increase in ESALs (about 1,700 ESALs) on the routes between SSFL and major highways (see Appendix H, Table H–28), 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 4–62**.

Under the High Impact Combination, there would be about 104,000 heavy- and medium-duty truck round trips, including truck shipments of backfill, equipment, and supplies. In addition, there would be about 201,000 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 28 years, the average daily traffic would increase by about 4.1 to 8.6 percent above baseline conditions during the first 4 years of project activities, and by about 3.3 percent above baseline conditions during the remaining years (see Appendix H, Table H–23). The maximum increase (8.6 percent) was determined assuming the start of soil removal, which is assumed for analysis to occur in 2021, overlapped with the end of building demolition under the Building Removal Alternative. Because of the presence of slow-moving heavy duty trucks, motorists on Woolsey Canyon Road during weekdays when heavy-duty trucks would be traveling to and from SSFL could experience or perceive delays compared to baseline conditions; there could also be delays or perceived delays at the intersection of Woolsey Canyon Road with Valley Circle Boulevard. These delays or perceived delays would be similar to those under the Cleanup to AOC LUT Values Alternative (Section 4.8.2.1.2), but would last for 28 years rather than 26 years.

Potential impacts on the LOS rating of roads and intersections in the SSFL vicinity would be similar to those under the Cleanup to AOC LUT Values Alternative. Compared to 2018 baseline conditions, the LOS rating of Woolsey Canyon Road could change from an A rating to a B rating during AM traffic conditions. In addition and compared to 2018 baseline conditions, the V/C ratio for the unsignalized intersection of Woolsey Canyon Road and Valley Circle Boulevard could increase by 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years, with some intersections operating at an E or F rating during AM or PM traffic conditions. For example, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an F LOS rating during AM traffic conditions during most of the 26 years of soil removal. To some extent, traffic in the SSFL area due to DOE remediation activities under the High Impact Combination may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways. Similarly, distributing traffic between SSFL and major highways would reduce the impacts of this increased traffic on intersections other than Woolsey Canyon Road with Valley Circle Boulevard. Delays at this intersection may be mitigated through installation of a traffic signal (see Mitigation Measure TR-2, Chapter 6, Table 6-2).

Table 4–62 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, ranging from about 4.1 to 8.6 percent above baseline conditions during the first 4 years of this action alternative combination, and by about 3.3 percent during the remaining 24 years. The maximum increase (8.6 percent) was determined assuming the start of soil removal overlapped with the end of building demolition. Motorists could experience or perceive 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, ranging from about 2.2 to 8.6 percent above baseline conditions during the first 4 years of this action alternative combination. The maximum increase (8.6 percent) was determined assuming the start of soil removal overlapped with the end of building demolition Increases for subsequent years would be about 0.05 percent, primarily due to shipments of well monitoring purge water and environmental samples and worker commutes. Motorists could experience or perceive delays on Woolsey Canyon Road and at its intersection with Valley Circle Boulevard. However, the great bulk of the heavy-duty truck shipments would occur for only 4 years. Other than Woolsey Canyon Road, traffic volumes on roads near SSFL may be reduced by use of multiple routes between SSFL and major highways.
LOS	Potential impacts on the LOS rating of roads and intersections in the SSFL vicinity would be similar to those under the Cleanup to AOC LUT Values Alternative. The LOS rating of Woolsey Canyon Road could change from an A to a B rating during AM traffic conditions. In addition and compared to 2018 baseline conditions, the V/C ratio for the intersection of Woolsey Canyon Road and Valley Circle Boulevard could increase by 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion, with some intersections operating at an E or F rating during AM or PM traffic conditions. For example, the intersection of Valley Circle Boulevard with Woolsey Canyon Road would operate at an F rating during AM traffic conditions during most of the 26 years of soil removal. Congestion at this intersection may be mitigated through installation of a traffic signal.	Potential impacts on the LOS rating of roads and intersections in the SSFL vicinity would be similar to those under the Cleanup to Revised LUT Values Alternative, except that major truck traffic would occur over a 4-year period rather than 6. The LOS rating of Woolsey Canyon Road could change from an A to a B rating during AM traffic conditions. In addition, the V/C ratio for the intersection of Woolsey Canyon Road and Valley Circle Boulevard could increase by 0.07 to 0.08 above 2018. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion, with some intersections operating at an E or F rating during AM or PM traffic conditions. But fewer intersections in the SSFL area could have LOS ratings of E or F at the end of the 4-year period of major traffic for the Low Impact Combination than would be the case for the 28 years required for the High Impact Combination. During these four years, the intersection of Woolsey Canyon Road with Valley Circle Boulevard could operate at an E LOS rating during AM traffic conditions. Congestion at this intersection may be mitigated through installation of a traffic signal.
ESALs	Traffic would impose about 266,000 ESALs on the evaluated roads. These ESALs would likely adversely impact on road pavement and result in affected roads needing repair sooner than currently anticipated.	Traffic would impose about 18,000 ESALs on the evaluated roads. These ESALs would likely adversely impact on road pavement and result in affected roads needing repair sooner than currently anticipated.

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 266,000 ESALs on the evaluated routes between SSFL and major highways. These ESALs were determined assuming each route received all traffic. Some of the evaluated roads already need repair, and the ESALs could cause additional damage to the 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 28-year period by about 58 round trips compared to the High Impact Combination estimate of 104,000. 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 6,900 heavy- and medium-duty truck round trips. In addition, there would be about 51,000 round trips of cars or light-duty trucks, primarily from worker commutes. The largest increase in weekday traffic would occur on Woolsey Canyon Road, where the average daily traffic would increase by about 2.2 to 8.6 percent above baseline conditions during the first 4 years of project activities, and by about 0.05 percent during remaining years (see Appendix H, Table H–23). The maximum increase (8.6 percent) was determined assuming the start of soil removal overlapped with the end of building demolition under the Building Removal Alternative.

Similar to the High Impact Combination, there could be delays or perceived delays for motorists on Woolsey Canyon Road or its intersection with Valley Circle Boulevard due to the presence of slow-moving heavy duty trucks. However, the great bulk of the heavy-duty truck shipments would last for 4 years rather than 28.

Potential impacts on the LOS rating of roads and intersections in the SSFL vicinity would be similar to those under the Cleanup to Revised LUT Values Alternative, except that major truck traffic would occur over a 4-year period rather than 6. (After this 4-year period, there would be only minor traffic including 1 medium-duty truck shipment per year.) Compared to 2018 baseline conditions, the LOS rating of Woolsey Canyon Road could change from an A rating to a B rating during AM traffic conditions. In addition, the V/C ratio for the intersection of Woolsey Canyon Road and Valley Circle Boulevard could increase by 0.07 to 0.08. Traffic growth in the SSFL area independent of DOE activities could result in increased traffic congestion in future years, with some intersections operating at an E or F rating during AM or PM traffic conditions. Nonetheless, fewer intersections in the SSFL area could have LOS ratings of E or F at the end of the 4-year period of major traffic for the Low Impact Combination, than would be the case for the 28 years required for the High Impact Combination. During these four years, the intersection of Valley Circle Boulevard with Woolsey Canyon Road could operate at an E LOS rating during AM traffic conditions. To some extent, traffic in the SSFL area due to DOE remediation activities under the Low Impact Combination may be reduced on roads other than Woolsey Canyon Road by distributing traffic among multiple routes between SSFL and major highways. Similarly, distributing traffic between SSFL and major highways would reduce the impacts of this increased traffic on intersections other than Woolsey Canyon Road with Valley Circle Boulevard. Delays at this intersection may be mitigated through installation of a traffic signal. (see Mitigation Measure TR-2, Chapter 6, Table 6-2).

Traffic associated with the Low Impact Combination would impose about 18,000 ESALs on the evaluated routes between SSFL and major highways. These ESALs were determined assuming each route received all traffic.

Some of the evaluated roads already need repair, and the ESALs could cause additional damage to the 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 be exceeded 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 action alternatives would result in increased traffic. Compared to 2018 baseline conditions, the LOS rating of Woolsey Canyon Road could change from an A to a B rating during AM traffic conditions. In addition, the V/C ratio for the unsignalized intersection of Woolsey Canyon Road and

Valley Circle Boulevard would increase by up to 0.08 above 2018 baseline conditions. Traffic congestion exists in the SSFL area independent of DOE activities, and growth in the SSFL area could result in additional traffic congestion in future years, with additional intersections operating at an E or F rating during AM or PM traffic conditions.

Implementing any of the soil remediation action alternatives, the Building Removal Alternative, or any combination of action alternatives could result in 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. Installation of a traffic signal at this intersection would also mitigate the projected traffic delays at this intersection.

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

This EIS presents potential human health impacts associated with exposure to chemical and radiological constituents. Potential impacts associated with exposure to chemicals or radiological constituents can be reported as morbidity (cancer incidence) or mortality (an LCF). In the field of site remediation and restoration, the EPA has established risk thresholds and ranges that are used to evaluate whether a remedial action is necessary and if so, how much of a contaminant must be removed from a site to render it acceptable for its intended use. The values established by EPA are for incidence of cancer. Therefore, unless specifically noted otherwise, reference to cancer risk in this EIS means the risk of cancer incidence, that is, the risk of developing a cancer. This measure of cancer risk provides a broad set of health impacts, which encompasses those that result in fatalities. Thus, the potential cancer risk impacts on an onsite or offsite resident or recreational user presented in this EIS are the risk of developing a cancer.

The exception to presenting cancer risks as the incidence of cancer occurs for reporting potential radiological impacts from transporting radioactive material. Health impacts from transporting radioactive materials have been presented as LCFs by DOE and the Nuclear Regulatory Commission for decades. This EIS maintains this reporting protocol which allows comparison to other transportation risks (fatalities from traffic accidents) and, in the cumulative impacts analysis, comparison with the reported radiological risks from other radioactive material transport actions.

4.9.1.1 Evaluated Receptors

Impacts are considered possible for hypothetical receptors representing members of the public and workers involved in monitoring and maintenance or removal and remediation activities. The receptors include:

> **Human Health Impact Assessment Terms**
>
> *Cancer incidence* – also referred to as cancer morbidity, is the occurrence of a 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.

- 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 26 years (ages 0 to 26) as recommended per current the EPA guidance (EPA 2014) and used as EPA risk calculator defaults (EPA 2018a). The resident is assumed to be exposed to contaminants via the following pathways: inhalation of volatiles and fugitive dust for chemicals and radionuclides, incidental ingestion of soil for chemicals and radionuclides, dermal contact with soil for chemicals, and external exposure to radiation.

  The 2014 version of the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (SRAM) (MWH 2014) 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. Including an analysis of the direct exposure pathways on an onsite resident already provides a conservative analysis of potential impacts. This is because future use of the property for residential development has been restricted by the landowner, Boeing, who has made legally binding commitments to conservation easements held by North American Land Trust. These easements permanently preserves as open-space habitat nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ, forever prohibiting residential, agricultural, or commercial development or use of the site (Ventura County 2017a, 2017b). Additionally, the models for making exposure point calculations in plants are associated with significant uncertainty as discussed in the SRAM (MWH 2014). 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.

- Offsite suburban resident – a resident who establishes or has an established residence off site from Area IV or the NBZ in an area where particulate concentrations in the air may contain chemical or radioactive constituents from airborne releases from the site and where those particulates from the site may be deposited in the soil. The offsite suburban resident was assumed to be exposed 24 hours a day, 350 days per year, for 26 years (ages 0 to 26) as recommended per the current EPA guidance (EPA 2014) and used as EPA risk calculator defaults (EPA 2018a). The resident is assumed to be exposed to contaminants via the following pathways: inhalation of volatiles and fugitive dust for chemicals and radionuclides, incidental ingestion of soil for chemicals and radionuclides, dermal contact with soil for chemicals, and external exposure to radiation.

The SRAM also includes an indirect exposure pathway for the suburban resident, recognizing that local residents may get some portion of their food from a home garden. Therefore, for the offsite suburban resident, it is assumed that the resident ingests fruits and vegetables raised in a home garden in an area with soil containing deposited chemical or radioactive constituents from on site. The regional-specific plant uptake and consumption factors provided in the SRAM have been used for these calculations. However, because the models for making exposure point calculations in plants are associated with significant uncertainty, it should be realized that the SRAM factors are based on upper extremes of the expected ranges for conservatism and result in risk values that are unlikely to be exceeded (MWH 2014).

- 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 26 years. Exposure pathways include inhalation and incidental ingestion of chemical and radioactive constituents, dermal absorption of chemicals; and direct radiation exposure. The onsite recreational user was evaluated under the Soil No Action Alternative and the Conservation of Resources Alternative, Open Space Scenario. Impacts on an onsite recreational user under the Residential Scenario and other soil remediation action alternatives would be lower than those calculated for the Open Space Scenario because more of the chemical and radioactive constituents would be removed under those alternatives and scenarios. Under the Soil No Action Alternative, site access was assumed in spite of institutional controls that would make the recreational user a trespasser. The offsite recreational user was considered under both the Soil No Action Alternative and the soil remediation action alternatives.
- 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. Cancer risk impacts on members of the public from carcinogenic chemical and radioactive constituents were evaluated with respect to the target risk range for remediation alternatives 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. Cleanup that results in incidence of cancer that falls within the risk range would be well below DOE's radiological dose constraint for real property of 25 millirem per year (plus ALARA [as low as reasonably achievable]) in DOE Order 458.1. For radioactive constituents, dose impacts on members of the public were compared to the DOE dose constraint of 10 millirem per year from air emissions (DOE Order 458.1). Dose impacts on workers are limited to 5 rem per year and 25 rem over a lifetime (10 CFR 835).

4.9.1.2 Risk Assessment Assumptions

Estimates of risk and dose are conditional, based on a number of assumptions concerning exposure. The 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. The detailed assumptions used in calculating the risks and hazard impacts are presented in Appendix G for workers and offsite receptors and in Appendix K for other onsite receptors.

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 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. The final list of contaminants of concern (COCs) for soil data for Area IV included 66 chemicals and 10 radionuclides. The COC list was based on screening a list of 290 chemical contaminants of potential concern (COPCs) and 55 radionuclide COPCs against frequency of detection and background comparison criteria as documented in the *Chemical Data Summary Report* (CDM Smith 2017), and the *Radionuclide Data Assessment Report* (Leidos 2018b). Uncertainties are associated with all such assumptions. However, COCs may vary by exposure unit. The background concentrations are also subject to uncertainty. See Appendix G for further discussion of uncertainties.

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 risk-based screening level (RBSL) calculations. 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 preliminary remediation goals (PRGs) (radionuclides) were used. For the indirect garden pathway, the SRAM ingestion rates and ingestion fractions were used as conservative, upper-bound assumptions. 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 such as intake rates and population characteristics (i.e., weight, life span, and activities) that were assumed to be representative of the exposed population.

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 incorporated into each 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 RBSL/PRG values 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, resulting in increased uncertainty in the risk evaluation process. The exposure parameters based on the current default values used in online/software risk calculators, as referenced in Appendices G and K were used when site-specific values were unavailable. 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).

4.9.1.2.4 Exposure Area Development

Soil contamination within Area IV by chemicals and radionuclides is not uniform and consists of localized hot spots (locations with elevated concentrations). For example, EPA as part of its radiological survey of Area IV determined that 70 percent of the soil samples exceeding its field action levels occurred at five Area IV locations: RMHF complex, SRE complex, 17th Street Drainage, Former Fuel Element Storage Facility (Building 4064), and the New Conservation Yard Drainage (HGL 2012b). Although there are other locations with chemical soil contamination, the locations are localized and primarily associated with the sites of former buildings.

The performance of risk assessments under EPA guidance is normally based on exposure areas reflective of future land use considerations. For the Area IV risk assessment, Area IV and the NBZ was divided into two-hundred, 10,000-square-meter (2.47-acre) exposure units. The 10,000-square-meter units were deemed representative of a future suburban resident home lot size and for activities by a recreational user. DOE then identified the exposure unit areas that exhibited the highest soil concentrations, which included the areas identified by EPA in its study findings. Nineteen areas representing the higher soil concentrations were then individually used to calculate chemical and radionuclide risks based on EPA risk assessment protocols. Appendix K provides the details on how the data were pooled and statistically analyzed to develop the exposure point concentrations and subsequent risk determinations.

4.9.2 Soil Remediation Alternatives

Table 4–63 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 for the No Action Alternative scenario, two onsite scenarios involving hypothetical public receptors were analyzed: an onsite suburban resident and an onsite recreational user. Under the No Action Alternative, site access was assumed to occur in spite of institutional control. Evaluation of impacts on the hypothetical onsite suburban resident and recreational user also did not account for natural processes, such as wind erosion or soil accretion, which might change the availability of the chemical and radioactive constituents or for chemical degradation. These processes all tend to reduce the exposure to contaminants an unknown amount, and therefore, it is conservative to not account for them.

Table 4–63 Summary of Human Health Impacts[c] under the Soil Remediation Alternatives

Receptors	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
Onsite suburban resident (direct pathways)	Based on 19 example exposure areas; Cancer risk: 5×10^{-6} to 2×10^{-3} Hazard index: 0.1 to 100.[b]	Following soil cleanup; Cancer risk: 4×10^{-7} to 5×10^{-5} Hazard index: 0.05 to 0.9	Following soil cleanup; Cancer risk: 5×10^{-7} to 5×10^{-5} Hazard index: 0.06 to 0.9	Following soil cleanup based on EPA risk assessment protocols for 19 example exposure areas; Cancer risk: 1×10^{-6} to 5×10^{-5} Hazard index: 0.06 to 1.0
Onsite recreational user	Based 19 example exposure areas; Cancer risk: 1×10^{-6} to 2×10^{-4} Hazard index: 0.02 to 30. [b]	Impacts would fall between those calculated for the No Action Alternative and the Conservation of Natural Resources Alternative and would be comparable to those associated with background.	Impacts would fall between those calculated for the No Action Alternative and the Conservation of Natural Resources Alternative and would slightly higher than those associated with background.	*Residential Scenario* – risks would be similar to, but slightly less than those calculated for the Open Space Scenario. *Open Space Scenario* – Following soil cleanup based on EPA risk assessment protocols for 19 example exposure areas; Cancer risk: 3×10^{-7} to 1×10^{-5} Hazard index: 0.01 to 0.3
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 26 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 about 6 years and workers would have less exposure to chemical and radionuclide constituents than for the Cleanup to AOC LUT Alternative and therefore less cancer risk; maximum annual dose from 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 up to 2 years for both scenarios 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.
Offsite suburban resident (direct and indirect pathways)	Cancer risk: 1.2×10^{-11} Hazard index: 2.0×10^{-7}	Cancer risk: 9.8×10^{-11} Hazard index: 1.8×10^{-6}	Cancer risk: 3.0×10^{-11} Hazard index: 1.4×10^{-6}	*Residential Scenario* Cancer risk: 1.4×10^{-11} Hazard index: 2.3×10^{-6} *Open Space Scenario* Cancer risk: 1.1×10^{-11} Hazard index: 3.4×10^{-6}
Offsite recreational user	Cancer risk: 5.0×10^{-12} Hazard index: 4.8×10^{-8}	Cancer risk: 4.8×10^{-11} Hazard index: 5.0×10^{-7}	Cancer risk: 1.3×10^{-11} Hazard index: 7.4×10^{-7}	*Residential Scenario* Cancer risk: 5.8×10^{-12} Hazard index: 1.5×10^{-6} *Open Space Scenario* Cancer risk: 4.5×10^{-12} Hazard index: 2.4×10^{-6}

AOC = *Administrative Order on Consent for Remedial Action*; EPA = U.S. Environmental Protection Agency; LUT = Look-Up Table.

[a] All impacts for soil constituents are based on the 95% Upper Confidence Limit (UCL95) on the mean concentration for al constituents that had a frequency of detection greater than 2.5 percent for chemicals or 5 per cent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018b).

[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.

[c] All cancer risks presented in this summary table are combined risks from chemicals and radionuclides. The contributions from each are shown in the tables below. See cautions about combining chemical and radionuclide risks in Section 4.9.5.1.

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 onsite soil would be reduced. The risk assessment process described in Appendix K illustrates how soil removal reduces the risk. 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 within the target risk range for remediation alternatives of 1×10^{-6} to 1×10^{-4} under the Conservation of Natural Resources Alternative scenarios. 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, and within the target risk range of 1×10^{-6} to 1×10^{-4} for remediation alternatives (and well below the DOE dose limit of 25 millirem per year) for the Conservation of Natural Resources Alternative scenarios.

Onsite Public Exposures

Following completion of soil remedial actions, members of the public could be exposed to any contaminants left onsite after remediation. The near-term onsite suburban resident was considered under all the soil remediation action alternatives after remediation. The onsite recreational user was considered under the No Action Alternative and the Conservation of Natural Resources Alternative-Open Space Scenario. The recreator impacts for other action alternatives are bounded by the impacts to a resident.

Under both the No Action Alternative and the soil remediation action alternatives, the onsite suburban resident and recreational user pathways of exposure to residual contaminants include: inhalation, and incidental ingestion of soil, dermal absorption of chemicals, and direct radiation exposure. For the onsite suburban resident, the indirect pathway of ingestion of fruits and vegetables from a garden is not included (see Section 4.9.1.1, Evaluated Receptors).

Worker Exposures

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. Under all action alternatives, workers would be protected in accordance with applicable 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 would 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 hazardous effects.

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, 9.8 TRCs and 4.6 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, up to 2.3 TRC and 1.1 DART cases are expected to occur for these alternatives.

Offsite Public Exposures

An offsite suburban resident or offsite recreational user may be exposed to chemical or radioactive constituents from airborne releases from the site and to airborne particulates from the site that get deposited in the offsite soil. An offsite resident located at reasonably maximum exposed residential location and a recreational user located at the fenceline were considered for both exposures from wind scour for the No Action Alternative, and from particulate airborne release due to mechanical actions associated with remedial activities for the soil remediation action alternatives.

Under the Soil No Action and Soil Remediation Action Alternatives, the offsite suburban resident and recreational user pathways of exposure include direct inhalation of air and submersion in air containing contaminants emitted from the site and exposure to soil containing contaminants deposited from emissions from the site through dermal absorption of chemicals, direct radiation exposure, inhalation, and incidental ingestion of soil. For the offsite suburban resident, the indirect pathway of ingestion of fruits and vegetables from a garden is also included.

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 that reduce the particulate concentration in air by a factor of approximately 2 (50 percent efficiency) (EPA 1996) were not assumed for soil remediation but were assumed for the demolition of buildings under the Building Removal Alternative and for bedrock removal under the Groundwater Treatment Alternative for both worker and offsite impact calculations based on calculated values indicating the need for such actions.

Potential impacts under the Soil No Action Alternative and the soil remediation action alternatives are discussed in the following subsections.

4.9.2.1 Soil No Action Alternative

Potential impacts of the Soil No Action Alternative are summarized in **Table 4–64**. 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 4–66. The background impacts were calculated based on all chemicals and radionuclides for which a background values was determined. This background for all chemicals and radionuclides indicates the total impact from background and is provided for reference. However, the health impacts for remediation alternatives are evaluated only for the COCs that remain after background and frequency of detection screening and thus removing contaminants that were only in background soil and not considered site related. Therefore, background health impacts have also been calculated only for the COCs for comparison to the remediation alternative risks. The difference between the background impacts for COCs and the impacts for remediation alternatives indicates the contribution to health impacts from site activity related concentrations remaining onsite for each alternative. Since many of the chemicals and radionuclides were eliminated as contaminants of concern based on low frequency of detection above the background threshold values, onsite impacts were calculated based only on contaminants of concern with backgrounds as determined for the 19 example exposure units (21 chemicals and 4 radionuclides) for comparison with the calculated onsite impacts. Table 4–64 shows the results of the analysis for the contaminants of concern for chemicals and radionuclides.

Table 4–64 Human Health Impacts under the Soil No Action Alternative[a]

Receptors [c]	Annual Radiological Impact (millirem)	Excess Lifetime Cancer Risk [b]		Hazard Index
		Radiological Incidence	Chemical Incidence	
Impacts from Average Background Soil Contaminants of Concern [d]				
Onsite suburban resident	0.54	1.4×10^{-6}	5.6×10^{-7}	0.04
Recreational user	0.048	2.8×10^{-7}	1.4×10^{-7}	0.04
Onsite Impacts from SSFL Soil Contaminants of Concern				
Onsite suburban resident [e]	0.63	2×10^{-8} to 2×10^{-3}	2×10^{-6} to 3×10^{-4}	0.1 to 100
Recreational user [e]	0.11	2×10^{-9} to 2×10^{-4}	5×10^{-7} to 1×10^{-4}	0.02 to 30
Offsite Incremental Impacts from No Action Alternative [f]				
Offsite suburban resident	2.2×10^{-7}	1.4×10^{-13}	1.2×10^{-11}	2.0×10^{-7}
Offsite recreational user	1.9×10^{-7}	1.2×10^{-13}	4.9×10^{-12}	4.8×10^{-8}

[a] All impacts for soil constituents are based on the 95 percent upper confidence limit (UCL95) on the mean concentration for all constituents that had a frequency of detection of greater than 2.5 percent for chemicals or 5 percent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018b). The direct pathways addressed for this table include inhalation, ingestion, dermal contact, and external radiation exposure. Indirect exposure pathway from a suburban resident garden is only included for the offsite resident.

[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 the onsite suburban resident only address direct exposure pathways.

[d] Current conditions for baseline exposures without radioactive decay.

[e] The range of risks and hazards is based on the minimum and maximum values determined in the 19 example exposure areas. The 19 example areas were selected based on exceedances of 10 times RBSL values, so risks and hazards at the rest of the site are expected to be less than those for the 19 example exposure areas. The annual radiological dose is based on sitewide averages for all radionuclide COCs.

[f] Assumes background contributions on site are the same as for any non-impacted area. Therefore the incremental impacts are calculated only from contaminants of concern identified based on frequency of detection above background based on any subarea of the site.

The excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident who was exposed to all chemicals in background soil through direct pathways would be 1.6×10^{-4} (1 chance in 6,300). The cumulative hazard index for the onsite suburban resident from exposure to background soil was calculated to be 3.5, implying the threshold for non-cancer hazardous effects from chemical concentrations in background soil (a hazardous index of 1) could be exceeded. A hypothetical onsite suburban resident who is exposed to all radionuclides 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 onsite suburban resident would be 1.5×10^{-4} (1 chance in 6,700).

As shown in Table 4–64, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident who was exposed to chemical COCs in background soil through direct pathways would be 5.6×10^{-7} (1 chance in 1.8 million). The cumulative hazard index for onsite suburban resident from exposure to background soil COCs was calculated to be 0.04, implying that no non-cancer hazardous effects would be expected. A hypothetical onsite suburban resident who is exposed to radionuclide COCs in background soil would potentially receive an annual radiation dose of 0.54 millirem through direct pathways; the excess lifetime risk of cancer incidence from radionuclide contaminants of concern would be 1.4×10^{-6} (1 chance in 710,000).

The excess lifetime risk of cancer incidence for a hypothetical recreational user who was exposed to all 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 non-cancer hazardous effects from all toxic chemicals combined was not exceeded and no non-cancer hazardous effects would be expected. The hypothetical onsite recreational user exposed to all radionuclides in background soil through direct pathways would potentially receive an annual radiation dose of 1.2 millirem; 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).

As shown in Table 4–64, the excess lifetime risk of cancer incidence for a hypothetical recreational user who was exposed to chemical COCs in background soil through direct pathways would be 1.4×10^{-7} (1 chance in 7.1 million). The cumulative hazard index for the recreational user from background COCs was calculated to be 0.04, implying that no non-cancer hazardous effects would be expected. The hypothetical onsite recreational user would potentially receive an annual radiation dose of 0.048 millirem from background soil COCs through direct pathways; the excess lifetime risk of cancer incidence from background soil COCs for a hypothetical recreational user from radionuclides would be 2.8×10^{-7} (1 chance in 3.6 million).

As shown in Table 4–64, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident from exposure to chemical COCs under the No Action Alternative ranges from 2×10^{-6} to 3×10^{-4} (1 chance in 500,000 to 1 chance in 3,300) for the 19 exposure unit areas. The cumulative hazard index for the hypothetical onsite suburban resident from exposure to chemical COCs ranged from 0.1 to 100 under the No Action Alternative. As also shown in Table 4–64, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident for exposure to COC radionuclides soil would range from 2×10^{-8} to 2×10^{-3} (1 chance in 50 million to 1 chance in 500) based on results from the 19 example exposure areas. The 19 example areas were selected based on exceedances of 10 times RBSL values so risks and hazards at the rest of the site are expected to be less than the 19 example exposure areas. The average annual dose for a hypothetical onsite suburban resident from exposure to COC radionuclides in soil was estimated to be 0.63 millirem.

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 4–64, the excess lifetime risk of cancer incidence for a hypothetical recreational user (or site visitor) from exposure to chemical COCs in soil would range from 5×10^{-7} to 1×10^{-4} (1 chance in 2 million to 1 chance in 10,000). The cumulative hazard index for the hypothetical recreational user (or site visitor) from concentrations of chemical COCs in soil was calculated to range from 0.02 to 30. As also shown in Table 4–64, the excess lifetime risk of cancer incidence would range from 2×10^{-9} to 2×10^{-4} (1 chance in 500 million to 1 chance in 5,000). The average annual dose for a hypothetical recreational user (or site visitor) from exposure to COC radionuclides in soil was estimated to be 0.11 millirem.

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.

An offsite suburban resident was evaluated for the Soil No Action Alternative. As shown in Table 4–64, the excess lifetime risk of cancer incidence for an offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil would be 1.2×10^{-11} (1 chance in 83 billion). The cumulative hazard index for the offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil was calculated to be 2.0×10^{-7}, implying the threshold for non-cancer hazardous effects from all toxic chemicals combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–66, the offsite suburban resident would potentially receive an incremental radiation dose of 2.2×10^{-7} millirem in a year from emissions from COC radionuclides in onsite soil; the excess lifetime risk of cancer incidence for an offsite suburban resident for exposure to COC radionuclides in soil would be 1.4×10^{-13} (1 chance in 7.1 trillion).

An offsite recreational user was evaluated for the Soil No Action Alternative. As shown in Table 4–64, the excess lifetime risk of cancer incidence for an offsite recreational user from exposure to chemical COCs that are from emissions from onsite soil would be 4.9×10^{-12} (1 chance in 200 billion). The cumulative hazard index for the offsite recreational user from background concentrations of chemicals in soil was calculated to be 4.8×10^{-8}, implying the threshold for non-cancer hazardous effects from all toxic chemicals combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–64, an offsite recreational user would potentially receive an incremental radiation dose of 1.9×10^{-7} millirem in a year from radionuclides in soil at concentrations above average background levels; the excess lifetime risk of cancer incidence would be 1.2×10^{-13} (1 chance in 8.3 trillion).

4.9.2.2 Cleanup to AOC LUT Values Alternative

Under the Cleanup to AOC LUT Values Alternative, soil containing chemical and radioactive constituents would be excavated and removed from the site. Concentrations of radionuclides remaining on site and any backfill brought to the site[28] would be below AOC LUT values. The post-remediation residual chemical and radionuclide average concentrations were estimated by removing all soil samples within an exposure area with concentrations of contaminants of concern above their respective AOC LUT values and replacing those values with their respective background values (i.e., AOC LUT values).

Potential human health impacts of the Cleanup to AOC LUT Values Alternative are summarized in **Table 4–65**. 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) of COCs in background soil, as shown in Table 4–65. Table 4-65 provides the range of cancer risks and hazard indices values calculated using the soil data for 19 example exposure areas under the Cleanup to AOC LUT Values Alternative. The 19 example exposure areas were selected based on exceedances of 10 times RBSL values so risks and hazards at the rest of the site are expected to be less than those for the 19 example exposure areas.

As shown in Table 4–65, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident from exposure to chemical COCs after completion of the Cleanup to AOC LUT Values would range from 2×10^{-7} to 5×10^{-6} (1 chance in 5 million to 1 chance in 200,000). The cumulative hazard index for the hypothetical onsite suburban resident from exposure to chemical COCs that are left in soil was calculated to range from 0.05 to 0.9 in the 19 example exposure areas, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–65, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident for exposure to radionuclide COCs would be 2×10^{-8} to 5×10^{-5} (1 chance in 50 million to 1 chance in 20,000).

[28] On December 21, 2016, DOE sent a letter to DTSC describing DOE's efforts and difficulty in locating backfill soil that meets the 2010 AOC requirements and requesting initiation of the consultation process (DOE 2016). See Chapter 2 for further discussion.

Table 4–65 Human Health Impacts under the Cleanup to AOC LUT Values Alternative[a]

Receptors [c]	Annual Radiological Impact (millirem)	Excess Lifetime Cancer Risk [b]		Hazard Index
		Radiological Incidence	Chemical Incidence	
Impacts from Average Background Soil Contaminants of Concern				
Onsite suburban resident	0.54	1.4×10^{-6}	5.6×10^{-7}	0.04
Onsite Impacts from SSFL Soil Contaminants of Concern After Cleanup				
Onsite suburban resident [d]	-	2×10^{-8} to 5×10^{-5}	2×10^{-7} to 5×10^{-6}	0.05 to 0.9
Offsite Incremental Impacts from Soil Cleanup Activities [e]				
Offsite suburban resident	1.1×10^{-7}	1.8×10^{-12}	9.6×10^{-11}	1.8×10^{-6}
Offsite recreational user	1.0×10^{-7}	1.6×10^{-12}	4.6×10^{-11}	5.0×10^{-7}

a All impacts for soil constituents are based on the 95 percent upper confidence limit (UCL95) on the mean concentration for all constituents that had a frequency of detection of greater than 2.5 percent for chemicals or 5 percent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018b). The direct pathways addressed for this table include inhalation, ingestion, dermal contact, and external radiation exposure. Indirect exposure pathway from a suburban resident garden is only included for the offsite resident.

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 the onsite resident only address direct exposure pathways.

d The range of risks and hazards is based on the minimum and maximum values determined in the 19 example exposure areas. The 19 example areas were selected based on exceedances of 10 times RBSL values so risks and hazards at the rest of the site are expected to be less than the 19 example exposure areas.

e Assumes background contributions from on site are the same as for any non-impacted area. Therefore the incremental impacts are calculated only from contaminants of concern.

Worker exposures would be higher for the Cleanup to AOC LUT Values Alternative during 26 years of soil remediation than those for the Soil No Action Alternative. 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. 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.

An offsite suburban resident was evaluated for the Cleanup to AOC LUT Values Alternative. As shown in Table 4–65, the excess lifetime risk of cancer incidence for an offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil would be 9.6×10^{-11} (1 chance in 10 billion). The cumulative hazard index for the offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil was calculated to be 1.8×10^{-6}, implying the threshold for non-cancer hazardous effects from all non-cancer hazardous chemicals combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–65, the offsite suburban resident would potentially receive an incremental radiation dose of 1.1×10^{-7} millirem in a year from emissions from radionuclide COCs in onsite soil; the excess lifetime risk of cancer incidence for an offsite suburban resident for exposure to radionuclide COCs would be 1.8×10^{-12} (1 chance in 560 billion).

An offsite recreational user was evaluated for the Cleanup to AOC LUT Values Alternative. As shown in Table 4–65, the excess lifetime risk of cancer incidence for an offsite recreational user from exposure to chemical COCs that are from emissions from onsite soil would be 4.6×10^{-11} (1 chance in 22 billion). The cumulative hazard index for the offsite recreational user from concentrations of chemical COCs in soil was calculated to be 5.0×10^{-7}, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–65, an offsite recreational user would potentially receive an incremental radiation dose of 1.0×10^{-7} millirem in a year from radionuclide COCs in soil at concentrations above average background levels; the excess lifetime risk of cancer incidence would be 1.6×10^{-12} (1 chance in 630 billion).

4.9.2.3 Cleanup to Revised LUT Values Alternative

Under the Cleanup to Revised LUT Values Alternative, soil containing chemicals above risk-based levels (that is, soil with chemicals exceeding suburban resident RBSL values or with chemicals having a hazard quotient of 1, whichever is less)[29] 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 radionuclide. The post remediation residual chemical and radionuclide average concentrations was calculated based on the 95 percent upper confidence limit on the mean (UCL95) of sample results that were less than the Revised LUT values in 19 example 10,000 square meter exposure unit areas.

Potential impacts of the Cleanup to Revised LUT Values Alternative are summarized in **Table 4–66**. 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) of COCs in background soil, as shown in Table 4–64. The range of the chemical cancer risks and hazard indices indicate the minimum and maximum values calculated in the 19 example exposure areas under the Cleanup to Revised LUT Values Alternative. The 19 example exposure areas were selected based on exceedances of 10 times RBSL values so risks and hazards across the rest of the site are expected to be less than those for the 19 example exposure areas.

As shown in Table 4–66, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident from exposure to chemical COCs after completion of the Cleanup to Revised LUT Values Alternative would be 2×10^{-7} to 5×10^{-6} (1 chance in 5 million to 1 chance in 200,000). The cumulative hazard index for the hypothetical onsite suburban resident from exposure to chemical COCs remaining in the soil was calculated to be 0.06 to 0.9, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–66, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident for exposure to radionuclide COCs would be 2×10^{-8} to 5×10^{-5} (1 chance in 50 million to 1 chance in 20,000).

Worker exposures would be higher for the Cleanup to Revised LUT Values Alternative during 6 years of soil remediation than those for the Soil No Action Alternative. 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. Workers would be protected from chemical and radiation exposure through the compliance with applicable DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders developed to ensure protection of worker health and safety.

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[29] Or above AOC LUT values, if greater.

Table 4–66 Human Health Impacts under the Cleanup to Revised LUT Values Alternative[a]

Receptors [c]	Annual Radiological Impact (millirem)	Excess Lifetime Cancer Risk [b]		Hazard Index
		Radiological Incidence	Chemical Incidence	
Impacts from Average Background Soil Contaminants of Concern				
Onsite suburban resident	0.54	1.4×10^{-6}	5.6×10^{-7}	0.04
Onsite Impacts from SSFL Soil Contaminants of Concern After Cleanup				
Onsite suburban resident [d]	-	2×10^{-8} to 5×10^{-5}	2×10^{-7} to 5×10^{-6}	0.06 to 0.9
Offsite Incremental Impacts from Soil Cleanup Activities [e]				
Offsite suburban resident	5.2×10^{-8}	5.1×10^{-13}	2.9×10^{-11}	1.4×10^{-6}
Offsite recreational user	4.5×10^{-8}	4.7×10^{-13}	1.3×10^{-11}	7.4×10^{-7}

[a] All impacts for soil constituents are based on the 95 percent upper confidence limit (UCL95) on the mean concentration for all constituents that had a frequency of detection of greater than 2.5 percent for chemicals or 5 percent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018b). The direct pathways addressed for this table include inhalation, ingestion, dermal contact, and external radiation exposure. Indirect exposure pathway from a suburban resident garden is only included for the offsite resident.

[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 the onsite resident only address direct exposure pathways.

[d] The range of risks and hazards is based on the minimum and maximum values determined in the 19 example exposure areas. The 19 example areas were selected based on exceedances of 10 times RBSL values so risks and hazards at the rest of the site are expected to be less than the 19 example exposure areas.

[e] Assumes background contributions from on site are the same as for any non-impacted area. Therefore the incremental impacts are calculated only from contaminants of concern.

An offsite suburban resident was evaluated for the Cleanup to Revised LUT Values Alternative. As shown in Table 4–66, the excess lifetime risk of cancer incidence for an offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil would be 2.9×10^{-11} (1 chance in 34 billion). The cumulative hazard index for the offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil was calculated to be 1.4×10^{-6}, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–66, the offsite suburban resident would potentially receive an incremental radiation dose of 5.2×10^{-8} millirem in a year from emissions from radionuclide COCs in onsite soil; the excess lifetime risk of cancer incidence for an offsite suburban resident for exposure to radionuclide COCs would be 5.1×10^{-13} (1 chance in 2.0 trillion).

As shown in Table 4–66, the excess lifetime risk of cancer incidence for an offsite recreational user from exposure to chemical COCs that are from emissions from onsite soil would be 1.3×10^{-11} (1 chance in 77 billion). The cumulative hazard index for the offsite recreational user from concentrations of chemical COCs in soil was calculated to be 7.4×10^{-7}, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–64, an offsite recreational user would potentially receive an incremental radiation dose of 4.5×10^{-8} millirem in a year from radionuclide COCs in soil at concentrations above average background levels; the excess lifetime risk of cancer incidence would be 4.7×10^{-13} (1 chance in 2.1 trillion).

4.9.2.4 Conservation of Natural Resources Soil Remediation Alternative – Residential Scenario

Under the Conservation of Natural Resources Alternative, Residential Scenario, cleanup would be targeted at locations posing risk based on the outcome of a risk assessment. For a residential receptor, the cleanup would result in the remaining soil containing average chemical and radionuclide concentrations for each exposure unit that would be less than concentrations equal to the upper end of the risk in target risk range for remediation alternatives of an excess lifetime cancer risk of 1×10^{-4} or a cumulative hazard index of 1 (whichever is less). Soil with average chemical and radionuclide concentrations below a risk- or toxicity-based concentration would be left in place.

Potential impacts of the Conservation of Natural Resources Alternative, Residential Scenario, are summarized in **Table 4–67**. 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) of COCs in background soil, as shown in Table 4–67. The range of cancer risks and hazard indices indicate the minimum and maximum values calculated in the 19 example exposure areas under the Conservation of Natural Resources Soil Remediation Alternative – Residential Scenario. The 19 example areas were selected based on exceedances of 10 times RBSL values so risks and hazards at the rest of the site are expected to be less than those for the 19 example exposure areas.

Table 4–67 Human Health Impacts under the Conservation of Natural Resources Alternative – Residential Scenario[a]

Receptors [c]	*Annual Radiological Impact (millirem)*	*Excess Lifetime Cancer Risk* [b]		*Hazard Index*
		Radiological Incidence	*Chemical Incidence*	
Impacts from Average Background Soil Contaminants of Concern				
Onsite suburban resident	0.54	1.4×10^{-6}	5.6×10^{-7}	0.04
Onsite Impacts from SSFL Soil Contaminants of Concern After Cleanup				
Onsite suburban resident [d]	0.0026 to 6.4	2×10^{-8} to 5×10^{-5}	2×10^{-7} to 7×10^{-6}	0.06 to 1
Offsite Incremental Impacts from the Soil Cleanup Activities [e]				
Offsite suburban resident	4.3×10^{-8}	3.8×10^{-13}	1.4×10^{-11}	2.3×10^{-6}
Offsite recreational user	2.9×10^{-8}	5.1×10^{-13}	5.3×10^{-12}	1.5×10^{-6}

[a] All impacts for soil constituents are based on the 95 percent upper confidence limit (UCL95) on the mean concentration for all constituents that had a frequency of detection of greater than 2.5 percent for chemicals or 5 percent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018b). The direct pathways addressed for this table include inhalation, ingestion, dermal contact, and external radiation exposure. Indirect exposure pathway from a suburban resident garden is only included for the offsite resident.

[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 the onsite resident only address direct exposure pathways.

[d] The range of risks and hazards is based on the minimum and maximum values determined in the 19 example exposure areas. The 19 example areas were selected based on exceedances of 10 times RBSL values so risks and hazards at the rest of the site are expected to be less than the 19 example exposure areas.

[e] Assumes background contributions from on site are the same as for any non-impacted area. Therefore the incremental impacts are calculated only from contaminants of concern.

As shown in Table 4–67, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident from exposure to chemical COCs after implementing the Conservation of Natural Resources Alternative, Residential Scenario, would be 2×10^{-7} to 7×10^{-6} (1 chance in 5 million to 1 chance in

140,000). The cumulative hazard index for the hypothetical onsite suburban resident from exposure to chemical COCs left in soil was calculated to be 0.06 to 1 in the 19 example exposure areas, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was only exceeded in 1 exposure unit and non-cancer hazardous effects would not be expected in most areas and still unlikely in the one exposure unit due to the inherent conservatism in the calculation. As also shown in Table 4–67, the excess lifetime risk of cancer incidence for a hypothetical onsite suburban resident for exposure to radionuclide COCs would be 2×10^{-8} to 5×10^{-5} (1 chance in 50 million to 1 chance in 20,000).

Worker exposures would be higher for the Conservation of Natural Resources Alternative, Residential Scenario, during 2 years of soil remediation than those for the Soil No Action Alternative. 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. Workers would be protected from chemical and radiation exposure through the compliance with applicable DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders developed to ensure protection of worker health and safety.

An offsite suburban resident was evaluated for the Conservation of Natural Resources Alternative, Residential Scenario. As shown in Table 4–67, the excess lifetime risk of cancer incidence for an offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil would be 1.4×10^{-11} (1 chance in 71 billion). The cumulative hazard index for the offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil was calculated to be 2.3×10^{-6}, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–67, the offsite suburban resident would potentially receive an incremental radiation dose of 4.3×10^{-8} millirem in a year from emissions from radionuclide COCs in onsite soil; the excess lifetime risk of cancer incidence for an offsite suburban resident for exposure to radionuclide COCs would be 3.8×10^{-13} (1 chance in 2.6 trillion).

An offsite recreational user was evaluated for the Conservation of Natural Resources Alternative, Residential Scenario. As shown in Table 4–67, the excess lifetime risk of cancer incidence for an offsite recreational user from exposure to chemical COCs that are from emissions from onsite soil would be 5.3×10^{-12} (1 chance in 190 billion). The cumulative hazard index for the offsite recreational user from concentrations of chemical COCs in soil was calculated to be 1.5×10^{-6}, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–67, an offsite recreational user would potentially receive an incremental radiation dose of 2.9×10^{-8} millirem in a year from radionuclide COCs in soil at concentrations above average background levels; the excess lifetime risk of cancer incidence would be 5.1×10^{-13} (1 chance in 2.0 trillion).

4.9.2.5 Conservation of Natural Resources Alternative – Open Space Scenario

Under the Conservation of Natural Resources Alternative, Open Space Scenario, cleanup would be targeted at locations posing risk based on the outcome of a risk assessment. The final cleanup would result in the remaining soil containing average chemical and radionuclide concentrations that are less than a concentration equal to the upper end of the target risk range for remediation alternatives for excess lifetime cancer risk of 1×10^{-4} or a cumulative hazard index of 1 (whichever is less) for a recreational user receptor and meet ecological risk objectives. Soil with average chemical and radionuclide concentrations below a risk- or toxicity-based concentration would be left in place.

Potential impacts of the Conservation of Natural Resources Alternative, Open Space Scenario, are summarized in **Table 4–68**. 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) of COCs in background soil, as shown in Table 4–68. The range of cancer risks and hazard indices indicate the minimum and maximum values calculated in the 19 example exposure areas under the Conservation of Natural Resources Soil Remediation Alternative – Open Space Scenario. The 19 example areas were selected based on exceedances of 10 times RBSL values, so risks and hazards at the rest of the site are expected to be less than those for the 19 example exposure areas.

Table 4–68 Human Health Impacts under the Conservation of Natural Resources Alternative – Open Space Scenario[a]

Receptors [c]	*Annual Radiological Impact (millirem)*	*Excess Lifetime Cancer Risk* [b]		*Hazard Index*
		Radiological Incidence	*Chemical Incidence*	
Impacts from Average Background Soil Contaminants of Concern				
Onsite recreational user	0.048	2.8×10^{-7}	1.4×10^{-7}	0.04
Onsite Impacts from SSFL Soil Contaminants of Concern After Cleanup				
Onsite recreational user [d]	0.00021 to 0.59	2×10^{-9} to 5×10^{-6}	2×10^{-7} to 9×10^{-6}	0.01 to 0.3
Offsite Incremental Impacts from Soil Cleanup to Activities [e]				
Offsite suburban resident	1.7×10^{-8}	3.1×10^{-13}	1.1×10^{-11}	3.4×10^{-6}
Offsite recreational user	2.4×10^{-8}	4.2×10^{-13}	4.1×10^{-12}	2.4×10^{-6}

[a] All impacts for soil constituents are based on the 95 percent upper confidence limit (UCL95) on the mean concentration for all constituents that had a frequency of detection of greater than 2.5 percent for chemicals or 5 percent for radionuclides (based on expected frequency of false detection) for analytes that passed data validation and data quality assessment screening (Leidos 2018b). The direct pathways addressed for this table include inhalation, ingestion, dermal contact, and external radiation exposure. Indirect exposure pathway from a suburban resident garden is only included for the offsite resident.

[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 the onsite resident only address direct exposure pathways.

[d] The range of risks and hazards is based on the minimum and maximum values determined in the 19 example exposure areas. The 19 example areas were selected based on exceedances of 10 times RBSL values so risks and hazards at the rest of the site are expected to be less than the 19 example exposure areas.

[e] Assumes background contributions from on site are the same as for any non-impacted area. Therefore the incremental impacts are calculated only from contaminants of concern.

A hypothetical onsite recreational user (or site visitor) was evaluated for the Conservation of Natural Resources Alternative, Open Space Scenario. Impacts were evaluated for a recreational user accessing the site. As shown in Table 4–68, the excess lifetime risk of cancer incidence for a hypothetical onsite recreational user from exposure to chemical COCs left in soil would be 2×10^{-7} to 9×10^{-6} (1 chance in 5 million to 1 chance in 110,000). The cumulative hazard index for a hypothetical onsite recreational user from concentrations of chemical COCs in soil was calculated to be 0.01 to 0.3, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–68, the excess lifetime risk of cancer incidence from exposure to radioactive COCs in soil would be 2×10^{-9} to 5×10^{-6} (1 chance in 500 million to 1 chance in 200,000).

Worker exposures would be higher for the Conservation of Natural Resources Alternative, Open Space Scenario, during less than 2 years of soil remediation than those for the Soil No Action Alternative. 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. Workers would be protected from chemical and radiation exposure through the compliance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders developed to ensure protection of worker health and safety

An offsite suburban resident was evaluated for the Conservation of Natural Resources Alternative, Open Space Scenario. As shown in Table 4–68, the excess lifetime risk of cancer incidence for an offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil would be 1.1×10^{-11} (1 chance in 91 billion). The cumulative hazard index for the offsite suburban resident from exposure to chemical COCs that are from emissions from onsite soil was calculated to be 3.4×10^{-6}, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–68, the offsite suburban resident would potentially receive an incremental radiation dose of 1.7×10^{-8} millirem in a year from emissions from radionuclide COCs in onsite soil; the excess lifetime risk of cancer incidence for an offsite suburban resident for exposure to radionuclide COCs would be 3.1×10^{-13} (1 chance in 3.2 trillion).

An offsite recreational user was evaluated for the Conservation of Natural Resources Alternative, Open Space Scenario. As shown in Table 4–68, the excess lifetime risk of cancer incidence for an offsite recreational user from exposure to chemical COCs that are from emissions from onsite soil would be 4.1×10^{-12} (1 chance in 240 billion). The cumulative hazard index for the offsite recreational user from concentrations of chemical COCs in soil was calculated to be 2.4×10^{-6}, implying the threshold for non-cancer hazardous effects from all toxic chemical COCs combined was not exceeded and no non-cancer hazardous effects would be expected. As also shown in Table 4–68, an offsite recreational user would potentially receive an incremental radiation dose of 2.4×10^{-8} millirem in a year from radionuclide COCs in soil at concentrations above average background levels; the excess lifetime risk of cancer incidence would be 4.2×10^{-13} (1 chance in 24 trillion).

4.9.2.6 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 Cleanup to Revised LUT Values Alternative is about 20 percent of that under the Cleanup to AOC LUT Values Alternative, the potential for exposure to the fungus that causes valley fever would be 20 percent of that for the Cleanup to AOC LUT Values Alternative. Likewise, the potential for exposure under the Conservation of Natural Resources Alternative – Residential Scenario would be about 6 percent of that under the Cleanup to AOC Values Alternative. The least potential for exposure would occur under the Conservation of Natural Resources Alternative – Open Space Scenario.

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 encloses 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.

4.9.2.7 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 4–69**.

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.

Table 4–69 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. Radiological cancer risk: 1.2×10^{-4} Radiological Dose: 250 millirem per year
Offsite suburban resident (direct and indirect pathways)	Impacts are less than the threshold for comparison.	Impacts are less than the threshold for comparison. Radiological cancer risk: 1.0×10^{-7} Radiological dose: 5.0×10^{-7} millirem per year
Offsite recreational user	Impacts are less than the threshold for comparison.	Impacts are less than the threshold for comparison. Radiological risk: 8.2×10^{-9} Radiological dose: 2.7×10^{-1} millirem per year

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,[30] 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

[30] 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.

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 the same rate used to project incidences for DOE activities as that assumed in Section 4.9.2, 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 103,200 worker-hours, assuming 60 workers were engaged in demolition activities for 8 hours per working day during the 2 to 3 years required for this alternative. 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. Impacts on workers are shown in **Table 4–70**. 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 to 3 years during which building removal would occur was estimated to be 250 millirem. The excess lifetime risk of cancer incidence for the worker from the years of building removal would be 1.2×10^{-4} (1 chance in 8,300).

Table 4–70 Human Health Impacts under the Building Removal Alternative[a]

Receptors [c]	*Annual Radiological Impact (millirem)*	*Excess Lifetime Cancer Risk*		*Hazard Index*
		Radiological Incidence	*Chemical Incidence*	
Building Remediation Workers	250	1.2×10^{-4}	0	0
Offsite suburban resident	5.0×10^{-1}	10×10^{-7}	0	0
Offsite recreational user	2.7×10^{-1}	8.2×10^{-9}	0	0

[a] All impacts for building radionuclide constituents are based on the median concentration for all constituents as determined from survey data and available radionuclide inventories. The direct pathways addressed for this table include external radiation exposure, dermal contact, inhalation, and ingestion. Indirect exposure pathway from a suburban resident garden is only include for the offsite resident.

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, 2.3 TRCs and 1.1 DART cases are expected for this activity.

An offsite suburban resident or offsite recreational user may be exposed to radioactive constituents from airborne releases during building demolition and to airborne particulates from the buildings that get deposited in the offsite soil. An offsite suburban resident was evaluated for the Building Removal Alternative. As shown in Table 4–70, the offsite suburban resident would potentially receive an incremental radiation dose of 0.50 millirem in a year from emissions of radionuclides in onsite buildings during demolition; the excess lifetime risk of cancer incidence for an offsite suburban resident for exposure to radionuclides would be 1.0×10^{-7} (1 chance in 10 million).

An offsite recreational user was evaluated for the Building Removal Alternative. As shown in Table 4–70, an offsite recreational user would potentially receive an incremental radiation dose of 0.27 millirem in a year from radionuclides in buildings and the excess lifetime risk of cancer incidence would be 8.2×10^{-9} (1 chance in 120 million).

4.9.4 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–71**.

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 would 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.

Table 4–71 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. Radiological cancer risk: 2.8×10^{-5} Radiological dose: 35.5 millirem per year
Offsite suburban resident (direct and indirect pathways)	No impact is expected as groundwater migration offsite is not expected.	Same as the Groundwater No Action Alternative.	Impacts are less than the threshold for comparison. Radiological cancer risk: 5.0×10^{-10} Radiological dose: 6.8×10^{-4} millirem per year
Offsite recreational user	No impact is expected as groundwater migration offsite is not expected.	Same as the Groundwater No Action Alternative.	Impacts are less than the threshold for comparison. Radiological cancer risk: 2.3×10^{-10} Radiological dose: 2.9×10^{-4} millirem per year

[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.

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 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: 0.2 TRCs and 0.009 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 non-cancer hazardous effects.

During excavation and packaging, workers are assumed to wear respirators that would be 99 percent efficient in filtering respirable particles.

The impact on workers from the bedrock removal task under the Groundwater Treatment Alternative are shown in **Table 4–72**. An involved worker would receive a dose of 35.5 millirem during the removal activity; the excess lifetime risk of cancer incidence is 2.8×10^{-5} (1 chance in 36,000).

Table 4–72 Human Health Impacts under the Bedrock Removal Groundwater Alternative[a]

Receptors [c]	*Annual Radiological Impact (millirem)*	*Excess Lifetime Cancer Risk*		*Hazard Index*
		Radiological Incidence	*Chemical Incidence*	
Remediation Workers	35.5	2.8×10^{-5}	0	0
Offsite suburban resident	6.8×10^{-4}	5.0×10^{-10}	0	0
Offsite recreational user	2.9×10^{-4}	2.3×10^{-10}	0	0

[a] All impacts for bedrock radionuclide constituents are based on the median concentration for all constituents as determined from available bedrock sampling data. The direct pathways addressed for this table include external radiation exposure, dermal contact, inhalation, and ingestion. Indirect exposure pathway from a suburban resident garden is only include for the offsite resident.

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 0.06 TRCs and 0.028 DART cases.

An offsite suburban resident or offsite recreational user may be exposed to chemical or radioactive constituents from airborne releases during bedrock removal and to airborne particulates from the bedrock that get deposited in the offsite soil. An offsite suburban resident was evaluated for the bedrock removal task under the Groundwater Treatment Alternative. As shown in Table 4–72, the offsite suburban resident would potentially receive an incremental radiation dose of 6.8×10^{-4} millirem in a year from emissions of radionuclides in the bedrock during removal; the excess lifetime risk of cancer incidence for an offsite suburban resident for exposure to radionuclides would be 5.0×10^{-10} (1 chance in 2.0 billion).

An offsite recreational user was evaluated for potential impacts for the bedrock removal task under the Groundwater treatment Alternative. As shown in Table 4–72, an offsite recreational user would potentially receive an incremental radiation dose of 2.9×10^{-4} millirem in a year from radionuclides in the bedrock and the excess lifetime risk of cancer incidence would be 2.3×10^{-10} (1 chance in 4.3 billion).

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 removal. 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 have the lowest residual risk as represented by the Cleanup to AOC LUT Values Alternative (see Table 4–65). The Low Impact Combination, under which soil with concentrations meeting risk-assessment-based values would remain on site, would have a higher residual risk as represented by the Conservation of Natural Resources, Residential Scenario (see Table 4–68).

Individual receptors listed in Table 4–63 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 on an onsite receptor after remediation activities from chemicals and radionuclides for each soil exposure unit would vary and would be a function of the remaining chemicals and radionuclides in the various locations. A conservative estimate of the highest combined impact is provided by summing the upper end of the range of impacts presented for the chemicals and radionuclides for the soil remediation action alternatives. The combined risk residual chemicals and radionuclides to a hypothetical onsite residential receptor for the highest impact alternative (Conservation of Natural Resources, Residential Scenario) would be 5×10^{-5} (1 chance in 20,000). The highest risk to an onsite recreational user for the highest impact alternative (Conservation of Natural Resources, Open Space Scenario) would be 1×10^{-5} (1 chance in 100,000).

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 (soil remediation, building remediation, and groundwater remediation), potential risks to onsite receptors would be primarily associated with residual chemical and radioactive constituents in the site soil, as discussed in Section 4.9.5.1. Offsite receptors would have a combined impact from all action alternative groups. The potential offsite impacts from the soil remediation alternatives and the strontium-90 removal activity are 2 to 4 orders of magnitude less than those for the Building Removal Alternative. Combined risks to an offsite resident and offsite recreational user would be 1.0×10^{-7} and 8.4×10^{-9}, respectively for the AOC LUT Values Alternative, which is the alternative with the highest offsite impact.

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 26-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). The potential offsite impacts from the soil remediation alternatives and the strontium-90 removal activity are 2 to 4 orders of magnitude less than those for the Building Demolition. Likewise, the impacts on remediation workers are estimated to be significantly less than those for D&D workers, and 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 3–20). 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 throughout 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 3–21 and 3–22). 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:

- excess lifetime cancer incidence 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);
- a hazard index of 1 for members of the public and workers from exposure to noncarcinogenic chemical constituents;
- radiological dose to members of the public from DOE air emissions of 10 millirem per 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; and
- radiological dose to workers of 5 rem in a year and 25 rem from lifetime exposures (average of 1 rem per year over a 25 year worker exposure time).

The COC radiological dose range for current or future onsite resident and recreator receptors after any remediation is less than the public dose limit for all soil remediation alternatives, including the No Action Alternative. The total COC cancer risk ranges in the 19 example exposure units from within the target risk range for remediation alternatives to less than the threshold for comparison for all soil remediation alternatives except the No Action Alternative, which ranges from 2.3×10^{-3} to less than the threshold for comparison. All soil remediation action alternatives have the same total cancer upper bound of the risk range rounded to 1 significant figure except for the Conservation of Resources Alternative – Residential Scenario, which is only slightly higher for the upper end of the range. The hazard index ranges from just below (0.9) or equal to (1.0 for the Conservation of Natural Resources – Resident Scenario) the impact threshold to 0.06 or 0.1 of the threshold for all soil remediation alternatives except the no action alternative, which ranges from 100 to 1/10 of the impact threshold.

Building demolition and groundwater remediation (bedrock removal) combined provide a combined risk of cancer to workers close to the impact threshold and a dose well less than the DOE worker dose limit (5 rem per year). In all cases, workers would be protected in accordance with DOE regulations (e.g., 10 CFR Parts 835 and 851) and DOE Orders.

The impacts on the offsite resident and recreator receptors from soil remediation activities are 5 to 6 orders of magnitude less than all thresholds for impact comparison for all soil remediation alternatives, including the no action alternative. The impacts on the offsite resident and recreator receptors from groundwater remediation (bedrock removal) activities are 3 to 4 orders of magnitude less than all thresholds for impact comparison for all soil remediation alternatives, including the no action alternative. The impacts on the offsite resident and recreator receptors from building demolition activities are 1 to 3 orders of magnitude less than all thresholds for impact comparison for all soil remediation alternatives, including the no action alternative.

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 recyclable materials at the evaluated recycle facilities were assessed. The facilities are representative of those that would be reasonably considered for disposition of waste and recycle material from Area IV and the NBZ. 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 4–73** 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, NNSS in Nevada, or WCS in Texas. 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 vehicles into and out of a disposal facility. As shown in Table 4–73, 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 4–73 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, Energy*Solutions* in Utah, or WCS in Texas. 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 Appendix D, Section D.4).

Table 4–73 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 3.5 million tons of disposal capacity as of September 2017.	3,500 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	1.0 million cubic yards as of July 2017, 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	Of the approximately 8 million cubic yards of permitted capacity, about 4,172,000 cubic yards of LLW and 358,000 cubic yards of MLLW disposal space remains as of August 2016; 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]
WCS	Andrews, TX	LLW/MLLW	2,100,000 cubic yards in the DOE LLW and MLLW facility, including 1,200,000 cubic yards of bulk waste and 900,000 cubic yards of waste in containers.	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; TX = Texas; WCS = Waste Control Specialists.

[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. Because the Mesquite Regional Landfill is not currently accepting waste for disposal, impacts for shipment to this facility were determined by assuming a distance equal to that for shipment to US Ecology in Idaho, which can also accept nonhazardous waste by rail delivery.

[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 hazardous and not radioactive 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, ROD (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 ROD.

Note: The data is derived from Chapter 3, Section 3.10.

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.

All wastes generated under the activities evaluated in this EIS will be managed in accordance with State and Federal requirements applicable to each type of waste.

4.10.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–74**.

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 4–74 Waste Management Impacts under the Soil Remediation 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 110,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Assuming the truck option, there could be minor logistical concerns that could require additional coordination with facility operators. Assuming the truck/rail option, there would be no logistical concerns at Energy*Solutions* in Utah or WCS in Texas because both have direct rail access.	Same as the Cleanup to AOC LUT Values Alternative.	Generation of about 1,000 cubic yards of waste under the Residential Scenario or about 200 cubic yards of waste under the Open Space Scenario. No impacts on total waste capacity are expected at any facility under either scenario. No logistical concerns are expected under either the Residential or Open Space Scenarios, assuming either the truck or truck/rail option.
Hazardous soil	No impacts are expected on offsite waste capacity.	Generation of about 2,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Assuming either the truck or the truck/rail option, no exceedance of any daily or annual receipt limit is expected at any facility.	Same as the Cleanup to AOC LUT Values Alternative.	Same as the Cleanup to AOC LUT Values Alternative under both the Residential and Open Space Scenarios.
Non-hazardous soil	No impacts are expected on offsite waste capacity.	Generation of about 769,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Assuming either the truck or the truck/rail option, no exceedance of any daily or annual receipt limit is expected at any facility.	Generation of about 78,000 cubic yards of waste. No impacts on total waste capacity are expected at any facility. Assuming either the truck or the truck/rail option, no exceedance of any daily or annual receipt limit is expected at any facility.	Generation of about 49,000 cubic yards of waste under the Residential Scenario and 36,000 cubic yards of waste under the Open Space Scenario. No impacts on total waste capacity are expected at any facility. Assuming either the Residential or Open Space Scenarios, and either the truck or the truck/rail option, no exceedance of any daily or annual receipt limit is expected at any facility.

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

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 4–75 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. Considering all three classifications of waste soil, remediation is projected to require 26 years under the Cleanup to AOC LUT Values Alternative or 6 years under the Cleanup to Revised LUT Values Alternative. Remediation under the Conservation of Natural Resources Alternative is projected to require 2 years under both the Residential and Open Space Scenarios, although the final year of remediation under the Open Space Scenario would likely require considerably less than an entire year to complete.

Table 4–75 Soil Remediation Volumes (cubic yards) by Action Alternative[a]

Waste Characteristics		*Soil Remediation Action Alternatives*					
				Conservation of Natural Resources			
EIS Soil Category [b]	*Description*	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Residential Scenario*	*Open Space Scenario*	*Analyzed Disposition Method*	*Evaluated Facilities* [c]
Nonhazardous Soil Not Exceeding Provisional Radiological LUT Values							
1	Chemicals above AOC LUT values, but below risk-based screening levels. Radionuclides at or below provisional AOC LUT values	718,000	27,000	0	0	CA Class I, II, or III waste facility	McKittrick, Buttonwillow, Westmorland, Chiquita Canyon, Antelope Valley, Mesquite [d]
2	Chemicals above risk-based screening levels, but is not expected to be a RCRA hazardous waste. Radionuclides at or below provisional AOC LUT values.	51,000	51,000	49,000	36,000		
Subtotal		**769,000**	**78,000**	**49,000**	**36,000**		
Hazardous Soil Not Exceeding Provisional Radiological LUT Values							
3	Chemicals above standards expected to require disposal as a RCRA hazardous waste. Radionuclides Cat or below provisional AO LUT values.	2,000	2,000	2,000	2,000	CA Class I or hazardous waste facility	Buttonwillow, Westmorland, US Ecology in Idaho [e]
Soil Exceeding Provisional Radiological LUT Values							
4	Radionuclides above provisional AOC LUT values. Any concentration of chemicals.	110,000	110,000	1,000	200	LLW/MLLW facility	NNSS, Energy*Solutions* in Utah, WCS
Total		**881,000**	**190,000**	**52,000**	**38,200**		

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; RCRA = Resource Conservation and Recovery Act; WCS = Waste Control Specialists.

[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 the truck/rail option was considered for shipment to the Mesquite Regional Landfill.

[e] Only waste determined to be hazardous and not radioactive 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 110,000 cubic yards of soil would be removed that would exceed provisional radiological LUT values (Soil Category 4). About 4 years would be required for removal of soil exceeding provisional radionuclide LUT values under both the Cleanup to AOC Values and Cleanup to Revised LUT Values Alternatives. Under the Conservation of Natural Resources Alternative, about 1,000 cubic yards of soil would be removed assuming the Residential Scenario that would exceed risk-assessment-based values for radionuclides. About 200 cubic yards would be removed under the Open Space Scenario. Radioactive soil removal would require less than 1 year under both the Residential and Open Space Scenarios. Excavated soil under all action alternatives would be a combination of LLW and MLLW.

Under any of the soil remediation action alternatives, about 2,000 cubic yards of soil would be classified as hazardous waste (Soil Category 3). This soil would require disposition at permitted California Class I or out-of-state hazardous waste facilities. One year or less would be required for removal of this hazardous soil waste under the Cleanup to AOC LUT Values, Cleanup to Revised LUT Values, and Conservation of Natural Resources (both scenarios) Alternatives.

Under the Cleanup to AOC LUT Values Alternatives, about 769,000 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 718,000 cubic yards of this soil (or 93 percent) would contain chemicals in concentrations below risk-based levels (Soil Category 1), and the remaining 51,000 cubic yards would contain chemicals in concentrations above risk-based levels (Soil Category 2). Twenty-six years would be required for removal of this soil waste from Area IV and the NBZ.

Under the Cleanup to Revised LUT Values Alternative, about 78,000 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. About 27,000 cubic yards would contain chemicals in concentrations below risk- based levels (Soil Category 1), and 51,000 cubic yards would contain chemicals in concentrations above risk-based levels (Soil Category 2). About 6 years would be required to remove this soil from Area IV and the NBZ. Under the Conservation of Natural Resources Alternative, about 49,000 cubic yards of soil would be generated that would be classified as nonhazardous waste assuming the Residential Scenario while about 36,000 cubic yards of soil would be generated assuming the Open Space Scenario. About 2 years would be required to remove this soil under the Residential or Open Space Scenario; the second year of soil removal under the Open Space Scenario could require only a portion of that year.

Excavated soil would be shipped to offsite facilities in compliance with DOT regulations. 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 transported to the designated intermodal location using containers or other delivery methods that would allow for rapid transfer to railcars. Excavated soil for delivery to an LLW or MLLW disposal facility would be similarly transported by a method that precludes emissions of dust, such as containment within steel boxes, lift-liners or similar soft-sided waste containers, or lined intermodal containers. Soil classified as hazardous waste may be similarly contained for transport. Use of containers to transport the radioactive or hazardous soil may reduce the average truckload for offsite delivery of this material; and thus slightly increase the time required for removal of the soil from Area IV and the NBZ.

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 4–76 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 4–73), with the comparison expressed as the percentage of the disposal capacities for the facilities.

Under the Cleanup to AOC LUT Values and Cleanup to Revised LUT Values Alternatives, shipment of LLW and MLLW would represent 2.4 percent of the waste capacity at Energy*Solutions* in Utah, 5.6 percent of the waste capacity at NNSS, or 5.2 percent of the waste capacity of WCS in Texas. Assuming the Residential or Open Space Scenario under the Conservation of Natural Resources Alternative, shipment of LLW and MLLW would represent 0.22 or 0.44 percent of the waste capacity at Energy*Solutions* in Utah, 0.051 or 0.010 percent of the waste capacity at NNSS, or 0.048 or 0.010 percent of the waste capacity at WCS in Texas.

Under the Cleanup to AOC LUT Values and Cleanup to Revised LUT Alternatives, shipment of LLW and MLLW would require about 4 years, with 7 average daily truck deliveries to an authorized disposal facility, assuming all waste was sent to a single facility. There are no permit limits on the annual or daily quantities to be received at Energy*Solutions* in Utah, NNSS, or WCS in Texas; 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 and WCS in Texas.[31] Waste deliveries at this rate would represent about 23 percent of 30 daily deliveries assumed as the upper limit for LLW and MLLW disposal. Deliveries at this daily rate could require coordination with the disposal facility operators to eliminate any logistical concerns, although any such concerns are expected to be minor. Logistical concerns regarding receipt of waste and any facility may be reduced by sending waste to multiple authorized facilities.

Under the Conservation of Natural Resources Alternative, shipment of LLW and MLLW from SSFL would require less than 1 year assuming either the Residential or Open Space Scenario. Assuming either scenario, there would be less than 1 average daily truck delivery to an authorized disposal facility, assuming all LLW and MLLW were sent to a single facility. No logistical concerns are expected.

There would be many fewer deliveries of LLW and MLLW to Energy*Solutions* in Utah or WCS in Texas 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.

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[31] Standard operating hours for the Energy*Solutions* and WCS facilities are longer than those for NNSS; however, arrangements may be made at both facilities to receive waste outside of normal operating hours.

Table 4–76 Percent of Disposal Facility Capacities under the Soil Remediation, Building Demolition, and Groundwater Remediation Action Alternatives

			Action Alternatives						
			Soil Remediation				*Building Demolition*	*Groundwater Remediation*	
					Conservation of Natural Resources				
Facility	*Waste Accepted*	*Available or Projected Waste Capacity (cubic yards)*	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Residential Scenario*	*Open Space Scenario*	*Building Removal*	*Groundwater Monitored Natural Attenuation*	*Groundwater Treatment*
Antelope Valley	Non-hazardous	20,050,000	3.8	0.39	0.24	0.18	0.0061	5.0×10^{-5}	-[a]
Chiquita Canyon	Non-hazardous	96,000,000	0.80	0.081	0.051	0.038	0.0013	1.0×10^{-5}	-[a]
Mesquite	Non-hazardous	400,000,000[b]	0.19	0.020	0.012	0.0090	0.00031	-[c]	-[a]
McKittrick	Non-hazardous	2,300,000[d]	33	3.3	2.1	1.5	0.052	4.3×10^{-4}	-[a]
Buttonwillow	Non-hazardous [e]	10,000,000	7.7	0.78	0.49	0.36	NA	NA	NA
Westmorland	Non-hazardous [e]	5,000,000	15	1.6	0.98	0.72	NA	NA	NA
Buttonwillow	Hazardous [e]	10,000,000	0.020	0.020	0.020	0.020	0.0012	-[f]	0.00013
Westmorland	Hazardous [e]	5,000,000	0.040	0.040	0.040	0.040	0.0024	-[f]	0.00026
US Ecology in Idaho [g]	Hazardous	10,000,000	0.020	0.020	0.020	0.020	0.0012	-[f]	0.00013
Energy*Solutions*	LLW/MLLW	4,530,000	2.4	2.4	0.022	0.044	0.23	-[f]	0.10
NNSS	LLW/MLLW	1,950,000	5.6	5.6	0.051	0.010	0.55	-[f]	0.23
WCS in Texas	LLW/MLLW	2,100,000	5.2	5.2	0.048	0.010	0.51	-[f]	0.21

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-up Table; MLLW = mixed low-level radioactive waste; NA = not applicable; NNSS = Nevada National Security Site; WCS = Waste Control Specialists.

[a] Nonhazardous waste would not be generated under the Groundwater Treatment Alternative, and 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] Converted from about 3,500,000 tons of remaining permitted capacity assuming a waste density of 1.5 tons per cubic yard.

[e] The Buttonwillow and Westmorland Landfills are hazardous waste facilities but can accept nonhazardous waste. Under the soil remediation action alternatives, the Buttonwillow and Westmorland Landfills were evaluated for receipt of both hazardous and nonhazardous soil.

[f] 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.

[g] Only waste determined to be hazardous and not radioactive would be sent to US Ecology in Idaho.

Under all action alternatives, the projected volume of hazardous soil would represent less than 1 percent or less of the disposal capacity of any of the evaluated facilities (see Table 4–76). Waste deliveries to the facilities would require 1 year under all soil remediation action alternatives and scenarios. Considering all action alternatives, the daily shipment of hazardous soil from SSFL would average about 12 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 4–76). 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 26 years under the Cleanup to AOC LUT Values Alternative. About 6 years would be required under the Cleanup to Revised LUT Values Alternative. Assuming either the Residential or Open Space Scenario, about 2 years would be required under the Conservation of Natural Resources Alternative. (Remediation during the second year of the Open Space Scenario would likely require less time than that for the second year of the Residential Scenario.) Assuming all nonhazardous soil was sent to a single disposal facility, waste in the projected quantities would not exceed the total landfill capacities at any evaluated facility (see Table 4–76). The projected soil volume would represent about 33 percent of the projected disposal capacity at the McKittrick Waste Treatment Site under the Cleanup to AOC LUT Values Alternative, or 3.3 percent of the projected disposal capacity at this facility under the Cleanup to Revised LUT Values Alternative. Under the Conservation of Natural Resources Alternative, the projected soil volume would represent about 2.1 percent of the disposal capacity of this facility assuming the Residential Scenario, or about 1.5 percent assuming the Open Space Scenario. The projected soil volume would represent less than 1 percent of the disposal capacity at any of the other evaluated facilities assuming either the Residential or Open Space Scenario.

Assuming that this nonhazardous soil was disposed of in a California Class I or hazardous waste facility rather than a California Class II or Class III disposal facility, the largest impact would be on the Westmorland Landfill, where the projected volume would represent about 15 percent of the projected capacity under the Cleanup to AOC LUT Values Alternative. However, impacts on any individual facility may be alleviated by distributing the waste among multiple nonhazardous or hazardous waste disposal facilities.

Under the Cleanup to AOC LUT Values Alternative, the average daily shipment of nonhazardous soil from SSFL could range up to about 210 tons. If all waste was delivered to a single facility, it would represent about 6 percent of the McKittrick Waste Treatment Site's permitted daily limit of 3,500 tons and smaller fractions of the permitted daily limit of the other evaluated facilities (see Table 4–76). Deliveries at this daily rate should be readily 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 4–77**.

Table 4–77 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.[32] Radioactive waste from building removal may include strontium-90, cesium-137, cobalt-60, nickel-63, plutonium-239, plutonium-241, or americium-241 (see Appendix H, Table H–3). **Table 4–78** 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. 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.

About 120 cubic yards of hazardous waste would be generated and transported to California Class I or out-of-state hazardous waste facilities.[33] 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

[32] 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.

[33] The California classification system for nonhazardous and hazardous waste landfills is summarized in Chapter 3, Section 3.10.

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.

Table 4–78 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,* WCS
Nonhazardous debris [f]	7,220	LLW/MLLW facility	NNSS, Energy*Solutions,* WCS
Total evaluated as LLW:	**10,500**		
MLLW	18	LLW/MLLW facility	NNSS, Energy*Solutions,* WCS
Hazardous debris [g]	130	LLW/MLLW facility	NNSS, Energy*Solutions,* WCS
Total evaluated as MLLW:	**145**		
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; WCS = Waste Control Specialists.

[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 2–6).

[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 hazardous and not radioactive 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.

Impacts on Waste Capacities

Table 4–78 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 4–73), with the comparison expressed as the percentage of the disposal capacities for the facilities.[34] The projected LLW and MLLW volume would represent only fractions of the disposal capacities of Energy*Solutions* in Utah, NNSS, or WCS in Texas. No impacts on disposal capacity are expected.

Assuming all LLW and MLLW were delivered by truck over a duration of 2 to 3 years to a single disposal facility, waste deliveries could occur at an average rate of less than 2 daily trucks for each of 2 years, and a similar rate for the final year. If all shipments were made under the truck/rail option to Energy*Solutions* in Utah or WCS in Texas, 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.[35] 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 2 daily trucks under the Building Removal Alternative would represent only about 7 percent of the approximate limit (30 daily trucks) assumed for receipt of LLW or MLLW at a licensed facility, there should be few logistical concerns, if any, with accepting the waste at either evaluated disposal facility. Furthermore, any potential concerns 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 much less than 1 average daily delivery to an assumed single hazardous waste facility and less than 1 average daily delivery to an assumed single nonhazardous waste facility. Whether shipment occurred by the truck or truck/rail option, wastes from building removal would represent only small fractions of the daily or yearly acceptance limits and total disposal capacities at any of the evaluated waste disposal facilities (see Table 4–73). No impacts on disposal capacity are expected.

Assuming all shipments were by truck, there would be less than 1 average daily shipment 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 4–79**.

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. A *Draft Corrective Measures Study* has been prepared (CDM Smith 2018c). The principal and minor groundwater plumes from DOE activities are described in Chapter 2, Section 2.6. **Table 4–80** summarizes the expected wastes from

[34] No disposal capacity comparisons are made for the evaluated recycle facilities because waste disposal would not occur at these facilities.

[35] 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).

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 wastewater during well installation and purge water (wastewater) during groundwater sampling activities, nonhazardous cuttings from well installation, and groundwater treatment media such as granulated activated carbon, filter media, or ion-exchange resins. Table 4–80 additionally summarizes waste from excavation of about 3,000 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 4,500 cubic yards.

Table 4–79 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 4,500 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 13 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 200 gallons of purge water annually from Area IV.	Generation of about 500 gallons of wastewater from well installation plus about 200 gallons per year of purge water (wastewater) during groundwater sampling activities.[a] No impacts are expected on the capacity of the permitted facility 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.

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 200 gallons of purge water from groundwater monitoring operations to a permitted facility for treatment, annually requiring 1 truck. No impacts are expected on plant capacity.

Table 4–80 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 wastewater. The cuttings would be transported by medium-duty truck to a nonhazardous waste facility, and well installation wastewater would be shipped by light-duty trucks to a permitted facility for treatment.[a] Installation of five wells would generate approximately 10 cubic yards of soil and rock cuttings plus about 500 gallons of waste 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 hazardous waste treatment facility. Under the current sampling regime, 1 medium-duty truck shipment would be annually required to transport about 200 gallons of purge water to a permitted facility for treatment.
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."
Bedrock 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 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 3,000 cubic yards; the containerized volume shipped for disposal would total about 4,500 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 wh generated would be transported to appropriate facilities for disposition.

Source: Appendix D.

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 500 gallons of wastewater from well installation that would be collected within onsite tanks pending shipment in trucks to a permitted facility for treatment 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 shipments of wastewater from well installation (assuming 100 gallons per shipment) using light-duty trucks.

Groundwater monitoring and shipments of purge water would continue; there would be 1 shipment of groundwater monitoring purge water per year, using medium-duty trucks, with each shipment consisting of about 200 gallons of wastewater in 55-gallon drums. The duration of groundwater monitoring would vary, depending on the plume, from approximately 10 years to 150 years. (Monitoring for most plumes would range from 10 to 50 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 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 60 working days, have a disposal volume after containerization of about 4,500 cubic yards (see Appendix D), and require about 340 heavy-duty truck shipments from SSFL (see Chapter 2, Table 2–6).
- For the FSDF-Area TCE, the HMSA TCE, Building 4100/56 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. Considering the information in Table 4–80, 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 two 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 two plumes would annually generate about 2,000 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 10,000 pounds of treatment media would result in an annual hazardous waste volume of about 2.65 cubic yards and a total hazardous waste volume of about 13 cubic yards.[36]
- 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 200 gallons per year of purge water).

[36] Assuming a treatment media density equivalent to granulated activated carbon, approximately 28 pounds per cubic foot (Target 2015).

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 4–73). 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 4,500 cubic yards of containerized bedrock containing strontium-90. This waste volume would have no impact on the total disposal capacity at Energy*Solution*s in Utah, NNSS, or WCS in Texas (see Table 4–73). 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). Contaminated bedrock would be delivered to an assumed single LLW/MLLW disposal facility at an average of less than 2 shipments per day. Shipment at this rate would be unlikely to result in logistical concerns at the disposal facility. Any concerns, however could 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 4–81 summarizes waste generation and truck shipment under the combined action alternatives. Considering all waste, the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives is considered the High Impact Combination; while the combination of the Conservation of Natural Resources, Open Space Scenario, Building Removal, and Groundwater Monitored Natural Attenuation Alternatives is considered the Low Impact Combination. **Table 4–82** compares the projected waste volumes from Table 4–81 against the disposal capacities of the evaluated facilities, with the comparison expressed as the percentage of the disposal capacities for the facilities (considering either the Residential or Open Space Scenario for the Conservation of Natural Resources Alternative).

Over all combinations of action alternatives, the total LLW/MLLW volume would range from about 10,800 under the Low Impact Combination to 125,000 cubic yards under the High Impact Combination or the combination of the Cleanup to Revised LUT Values, Building Removal, and Groundwater Treatment Alternatives. The largest volume over this range would not impact the total waste disposal capacity at Energy*Solutions* in Utah, NNSS, or WCS in Texas (see Table 4–82). There would be about 1,040 to 8,500 truck shipments from SSFL that would occur over 3 to 6 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 1 to about 13. 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. Thirteen daily trucks would represent about 43 percent of this assumed limit, indicating a potential for logistical concerns at that facility to ensure that personnel, equipment, and active disposal space are available at that facility 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 or WCS in Texas. However, any concerns may be alleviated through careful scheduling and coordination with the disposal facility operators. Note that delivery at a frequency of up to 13 daily shipments reflects the conservative assumption that there is overlap between soil remediation under the Cleanup to AOC LUT Values or Cleanup to Revised AOC LUT Values Alternative and removal of strontium-90-

contaminated bedrock under the Groundwater Treatment Alternative, all LLW from bedrock removal was shipped during the projected working period for the activity rather than throughout the year the bedrock was removed. This overlap especially affects the delivery frequency for LLW/MLLW because the operational plan is to remove the radioactive and hazardous soil as quickly as possible, so removal of soil with these constituents is front-loaded. Little hazardous soil is projected, so the effect of this front-loading modus of operation falls principally on radioactive soil.

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 or WCS in Texas compared to those under the truck option.

The total hazardous waste volume (about 2,100 cubic yards for all action alternative combinations) would not impact the total disposal capacity at any evaluated hazardous waste facility (see Table 4–82). There would be about 140 to 260 truck shipments from SSFL that would occur over 3 to 7 years, depending on the combination of action alternatives, with an average daily number of offsite shipments of less than 1. Average daily tonnages would range from less than 1 ton to about 12 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 37,200 under the Low Impact Combination or the combination of the Conservation of Resources (Open Space Scenario), Building Removal, and Groundwater Monitored Natural Resources Alternatives to 770,000 cubic yards under the High Impact Combination or the combination of the Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives. As shown in Table 4–82, the high end of the range would represent about 33 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 2,500 to 50,300 truck shipments from SSFL over 4 to 28 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 9 shipments, and the average daily tonnage would range from about 3 tons to about 210 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 about 6 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 1 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 about 2 to 3 years under all combinations of action alternatives. There would be less than one average shipment per day. There is adequate recycle capacity in the vicinity of SSFL, and 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.

Table 4–81 Waste Summaries under the Action Alternative Combinations

Waste	Action Alternative Combination	*Total Volume (cubic yards)* [a]		*Total Shipments* [a]		*Shipment Duration (years)* [a]		*Average Shipments per Day* [b]		*Average Tons per Day* [b]	
		Residential Scenario	*Open Space Scenario*	*Residential Scenario*	*Open Space Scenario*	*Residential Scenario*	*Open Space Scenario*	*Residential Scenario*	*Open Space Scenario*	*Residential Scenario*	*Open Space Scenario*
LLW/MLLW (building debris, soil, source removal material)	AOC LUT + BR + GWMNA	121,000		8,200		6		2 – 9		26 – 190	
	AOC LUT + BR + GWT [c]	125,000		8,500		6		2 – 13 [b]		26 – 190	
	Revised LUT + BR + GWMNA	121,000		8,200		6		2 – 9		26 – 190	
	Revised LUT + BR + GWT	125,000		8,500		6		2 – 13 [b]		26 – 190	
	C of NR + BR + GWMNA [d]	11,600	10,800	1,100	1,040	3	3	2	2	26 – 32	26 – 27
	C of NR + BR + GWT	16,100	15,500	1,400	1,400	4	4	1 – 2	1 – 2	18 – 32	18 – 27
Hazardous waste (building debris, soil, groundwater treatment media) [e]	AOC LUT + BR + GWMNA	2,100		140		3		<1		<1 – 12	
	AOC LUT + BR + GWT [c]	2,100		260		7		<1		<1 – 12	
	Revised LUT + BR + GWMNA	2,100		140		3		<1		<1 – 12	
	Revised LUT + BR + GWT	2,100		260		7		<1		<1 – 12	
	C of NR + BR + GWMNA [d]	2,100	2,100	140	140	3	3	<1	<1	<1 – 12	<1 – 12
	C of NR + BR + GWT	2,100	2,100	260	260	7	7	<1	<1	<1 – 12	<1 – 12
Nonhazardous waste (building debris, soil, well installation cuttings)	AOC LUT + BR+ GWMNA	770,000		50,300		28		<1 – 9		3 – 210	
	AOC LUT + BR + GWT [c]	770,000		50,300		28		<1 – 9		3 – 210	
	Revised LUT + BR + GWMNA	79,200		5,200		8		<1 – 9		3 – 210	
	Revised LUT + BR + GWT	79,200		5,200		8		<1 – 9		3 – 210	
	C of NR + BR + GWMNA [d]	50,200	37,200	3,300	2,500	4	4	<1 – 9	<1 – 9	3 – 200	3 – 200
	C of NR + BR + GWT	50,200	37,200	3,300	2,500	4	4	<1 – 9	<1 – 9	3 – 200	3 – 200
Recycle material	All combinations	3,540		340		2–3		<1		8	

< = less than; AOC = *Administrative Order on Consent for Remedial Action*; AOC LUT = Cleanup to AOC LUT Values Alternative; BR = Building Removal Alternative; C of NR = 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] Where applicable, the first value reflects the soil volume assuming the Residential Scenario whereas the second value reflects the soil volume assuming the Open Space Scenario. This table does not include the single annual shipment of purge water under the Groundwater Monitored Natural Attenuation Alternative.

[b] The maximum values for the number of shipments per day, as well as the maximum value for the average tons per day, reflects the assumption that there is overlap between soil remediation under the Cleanup to AOC LUT Values or the Cleanup to Revised LUT Values Alternative and removal of strontium-90-contaminated bedrock under the Groundwater Treatment Alternative.

[c] High Impact Combination.

[d] Low Impact Combination.

[e] Total waste volumes among the action alternative combinations differ by about 13 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.

Note: An average waste shipment is assumed to weigh 23 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 23 tons.

Table 4–82 Percentages of Waste Disposal Capacity under the Action Alternative Combinations

Facility	Waste Accepted	Available or Projected Waste Capacity (cubic yards)	Percent of Capacity [a]
Antelope Valley	Nonhazardous	20,050,000	0.19 to 3.8
Chiquita Canyon	Nonhazardous	96,000,000	0.039 to 0.80
Mesquite	Nonhazardous	400,000,000 [b]	0.0093 to 0.19
McKittrick	Nonhazardous	2,300,000 [c]	1.6 to 33
Buttonwillow	Hazardous	10,000,000	0.021/0.37 to 7.7 [d]
Westmorland	Hazardous	5,000,000	0.043/0.74 to 15 [d]
US Ecology in Idaho [e]	Hazardous	10,000,000	0.021
Energy*Solutions* in Utah	LLW/MLLW	LLW: 4,172,000 MLLW: 358,000	0.24 to 2.8
NNSS	LLW/MLLW	LLW: 1,800,000 MLLW: 150,000	0.56 to 6.4
WCS in Texas	LLW/MLLW	2,100,000 for combined LLW and MLLW	0.52 to 6.0

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site; WCS = Waste Control Specialists.

[a] The range over all action alternative combinations includes the range between the Residential and Open Space Scenarios for the Conservation of Natural Resources Alternative.

[b] Converted from a projected capacity of 600 million tons assuming a waste density of 1.5 tons per cubic yard.

[c] Converted from about 3,500,000 tons of remaining permitted capacity assuming a waste density of 1.5 tons per cubic yard.

[d] 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.

[e] Only waste determined to be only hazardous would be sent to US Ecology in Idaho.

Note: Calculations have been rounded.

4.10.5 Impact Threshold Analysis

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 (the State Historic Preservation Office), before making any decisions and 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.

DOE is preparing a Programmatic Agreement pursuant to 36 CFR 800.14(b) based on consultations with the California Office of Historic Preservation, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties.[37] This agreement will establish procedures for addressing adverse effects on historic properties and will satisfy DOE's responsibilities under Section 106. DOE will continue Government-to-Government consultation with the Santa Ynez Band of Chumash Indians.

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. There are no structures (architectural resources) in the NBZ, and no structures in Area IV are listed or eligible for listing on the National Register of Historic Places (NRHP) or the California Register of Historical Resources (California Register) (Post/Hazeltine Associates 2009). The State Historical Preservation Officer (SHPO) has concurred with the NRHP eligibility findings for the Area IV structures (OHP 2010).

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 10 archaeological sites in the area of potential effects (APE). The 10 sites were chosen based on: (1) the extent of the contamination known at the time the testing program was designed; (2) sites where NRHP eligibility was unclear; and (3) consultation with Native American representatives. This program of limited subsurface excavation was developed in consultation with SHPO and EIS cooperating agencies, including the federally recognized Santa Ynez Band of Chumash Indians, as well as non-federally recognized tribes. Based on this evaluation program DOE determined that 8 of the 10 archaeological sites were individually eligible for inclusion on the NRHP and 2 sites were individually ineligible for listing on the NRHP. Some of the archaeological sites in the APE could be included in or identified as contributing elements to archaeological districts that are currently under consideration for NRHP eligibility.

The Santa Ynez Band of Chumash Indians, a federally recognized tribe, has identified the entire SSFL as a Native American sacred site (referred to herein as the Santa Susana Sacred Sites and 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),[38] and also notified DOE of its identification of a portion of SSFL as an Indian sacred site for consideration consistent with Executive Order 13007, *Indian Sacred Sites*. There have been additional efforts by NASA, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and others related to documenting SSFL's special significance to Native Americans. These efforts may result in the designation of one or more NRHP-eligible traditional cultural properties.

The methodology for determining impacts on cultural resources is discussed in greater detail in Appendix B, Section B.11.

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[37] A programmatic agreement pursuant to 36 CFR 800.14(b) is the most suitable agreement document for DOE's remediation at SSFL for a number of reasons. For example, proposed soil remediation could result in effects that are similar and repetitive to archaeological resources across Area IV and the NBZ (36 CFR 800.14(b)(1)).

[38] 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).

4.11.1 Soil Remediation Alternatives

Impacts on historic 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 4–83**.

Table 4–83 Cultural 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
Archaeological	No historic properties would be affected.	Should a historic property not be exempted from cleanup requirements, including any unanticipated discovery made during soil remediation, appropriate avoidance, minimization, and/or mitigation measures will be implemented in accordance with the Section 106 Programmatic Agreement currently under development.	Similar to the Cleanup to AOC LUT Values Alternative, but with less likelihood of unanticipated discoveries during soil remediation.	Similar to the Cleanup to AOC LUT Values Alternative, but with less likelihood of unanticipated discoveries during soil remediation.
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.	Soil remediation would result in changes to the setting and general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Adverse impacts on the integrity of traditional cultural resources are possible from disturbance of landscape due to soil removal (881,000 cubic yards, 90 acres), increased human activity and equipment during 26 years of soil removal, augmented site access during remediation, and potential discovery of unanticipated resources during soil remediation.	Adverse impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced magnitude. There would be reduced changes in setting because there would be less soil removal (190,000 cubic yards, 38 acres), less human activity and equipment (for approximately 6 years rather than 26 years), reduced duration of site access during remediation, less potential for unanticipated discoveries.	Adverse impacts would be similar to those under the Cleanup to AOC LUT Values Alternative, but of reduced magnitude. There would be reduced changes in setting because there would be less soil removal (52,000 cubic yards and 10 acres under the Residential Scenario and 38,200 cubic yards and 9 acres under the Open Space Scenario), less human activity and equipment (for 2 years or less under both scenarios), reduced duration of site access during remediation, and less potential for unanticipated discoveries.

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. There are no ongoing activities or plans under this alternative that would affect archaeological sites in the APE. Archaeological and architectural resources would continue to be managed through existing management plans and operating procedures. Archaeological sites present on Area IV and the NBZ would continue to be protected from outside intrusion through restricted access to these areas. 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 established Government-to-Government consultation with the Santa Ynez Band of Chumash Indians and has also consulted other non-federally recognized tribes. Through these relationships, access to properties of traditional religious and cultural importance to the tribes would be maintained at the current landowner's (Boeing's) discretion. 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

Activities associated with remediation of chemicals and radionuclides in soil would remove 881,000 cubic yards of soil, disturbing about 90 acres of land within the APE. 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.

There are no structures (architectural resources) in the NBZ, and no structures in Area IV are listed or eligible for listing on the NRHP or the California Register. Therefore, no historic properties related to architectural resources would be affected by soil remediation.

Area IV and the NBZ have been surveyed for archaeological resources. DOE has identified 26 archaeological sites and 53 isolates in the APE, of which 8 archaeological sites were determined to be individually eligible for listing on the NRHP and 2 were individually ineligible for listing on the NRHP. Consistent with the 2010 AOC (DTSC 2010a), DOE has identified locations of known archaeological sites as areas in which the exemption process would be applied. In the soil remediation plan that DOE would submit for DTSC approval, DOE would propose that areas subject to the exemption process be cleaned of chemical and radioactive constituents if they pose a risk to human health or the environment. Therefore, some archaeological sites may be impacted by cleanup activities, including potentially five known archaeological sites that are on or near areas that risk assessments have shown require remediation (see **Table 4–84**).

Table 4–84 Cultural Resources Potentially Impacted under the Soil Remediation Action Alternatives

Primary Number	*Trinomial Site Number*	*Site Description*	*NRHP and California Register Eligibility*
56-001302	CA-VEN-1302	Lithic scatter	Eligible [a]
56-001415	CA-VEN-1415	Lithic scatter	Unevaluated
56-001416	CA-VEN-1416	Rockshelter with associated lithic scatter	Eligible [a]
56-001420	CA-VEN-1420	Lithic scatter	Ineligible [a]
56-001775	CA-VEN-1775	Rockshelter with midden and associated artifacts	Eligible [a]

NHRP = *National Register of Historic Places*.
[a] DOE determined eligibility based on limited subsurface testing (Leidos 2015).

Soil remediation activities could adversely impact any historic properties within the APE that cannot be exempted from cleanup requirements. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more Historic Properties Treatment Plan(s) (HPTP). The HPTP(s) will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation.

Staging for soil removal activities is unlikely to impact archaeological sites. Staging areas for soil remediation would be situated on existing concrete foundations or on flat ground where buildings have been removed. Temporary staging areas would be placed on asphalt, concrete, or previously disturbed ground. No historic properties would be affected.

If an unanticipated archaeological resource is encountered, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

Traditional Cultural Resources

The Cleanup to AOC LUT Values Alternative could have adverse impacts on traditional cultural resources. In addition to archaeological impacts discussed above, soil remediation would disturb about 90 acres of land which could change the general landscape associated with traditional cultural resources at Area IV and the NBZ. For example, soil replacement for the disturbed land would restore a semblance of natural contours, but the landscape would differ from the original topography, soil color, and vegetation. Improved access and increased traffic related to cleanup activities could impact traditional cultural resources by introducing more people, equipment, and the possibility for vandalism (Hedquist et al. 2014; Nickens et al. 1981) during the duration of the soil removal activities (approximately 26 years). DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for listing on the NRHP.

4.11.1.3 Cleanup to Revised LUT Values Alternative

Archaeological and Architectural Cultural Resources

Potential impacts on archaeological and architectural resources would be similar to those under the Cleanup to AOC LUT Values Alternative (Section 4.11.1.2). However, less soil would be removed (190,000 cubic yards) and fewer acres (38 acres) would be disturbed. Disturbance of 38 acres under this alternative would represent about 42 percent of the affected acreage under the Cleanup to AOC LUT Values Alternative.

Similar to the Cleanup to AOC LUT Values Alternative, soil remediation activities could adversely impact historic properties within areas in which chemicals or radionuclides in the soil pose a risk to human health or the environment as determined by a risk assessment. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more HPTP(s) that will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation.

If an unanticipated archaeological resource is encountered, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

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), but there would be less soil removal and land disturbance (190,000 cubic yards over 38 acres) and a shorter duration for cleanup activity (approximately 6 years). In addition to archaeological impacts discussed above, soil remediation would disturb about 38 acres of land which could change the general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Improved access and increased traffic related to cleanup activities could impact traditional cultural resources by introducing more people, equipment, and possible vandalism during the duration of cleanup activity. DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for listing on the NRHP.

4.11.1.4 Conservation of Natural Resources Alternative

Archaeological and Architectural Cultural Resources

Potential impacts on archaeological and architectural resources would be similar to 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). Under the Conservation of Natural Resources Alternative, Residential Scenario, less soil would be removed (52,000 cubic yards) and fewer acres would be disturbed (10 acres) compared to the other soil remediation action alternatives. Disturbance of 10 acres of land would represent about 11 percent of the affected acreage under the Cleanup to AOC LUT Values Alternative. Under the Conservation of Natural Resources Alternative, Open Space Scenario, even less soil would be removed (38,200 cubic yards) and fewer acres would be disturbed (9 acres) compared to the other soil remediation action alternatives. Disturbance of 9 acres of land would represent about 10 percent of the affected acreage under the Cleanup to AOC LUT Values Alternative.

Similar to the Cleanup to AOC LUT Values Alternative, soil remediation activities could adversely impact historic properties within areas in which chemicals or radionuclides in the soil pose a risk to human health or the environment as determined by a risk assessment. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more HPTP(s) that will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation.

If an unanticipated archaeological resource is encountered, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

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 a reduced area would be disturbed and there would be a shorter duration of cleanup activity (2 years or less under the Residential Scenario or Open Space Scenario). In addition to archaeological impacts discussed above, soil remediation would disturb between 9 and 10 acres of land which could change the general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Improved access and increased traffic related to cleanup activities could impact traditional cultural resources by introducing more people, equipment, and possible vandalism during the duration of cleanup activity. DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for listing on the NRHP.

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 4–85**.

Table 4–85 Cultural Resources Impacts under the Building Demolition Alternatives

Resource	*Building No Action Alternative*	*Building Removal Alternative*
Archaeological	No historic properties would be affected.	No adverse impacts are expected because no archaeological sites are located in the immediate vicinity of buildings to be demolished, and there is low likelihood of unanticipated discoveries during building removal.
Architectural	No historic properties would be affected.	Same as the Building No Action Alternative.
Traditional	No adverse impacts are expected, although buildings would remain that may be considered intrusive in the context of the viewscape of traditional cultural resources.	Removal of structures could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources.

4.11.2.1 Building No Action Alternative

Archaeological and Architectural Cultural Resources

Under the Building No Action Alternative, DOE would not remove any DOE-owned structures. There are no ongoing activities or plans under this alternative that would affect archaeological sites in the vicinities of DOE-owned buildings. Archaeological and architectural resources would continue to be managed through existing management plans and operating procedures. Archaeological sites present on Area IV and the NBZ would continue to be protected from outside intrusion through restricted access to these areas. No historic properties would be affected.

Traditional Cultural Resources

Under the Building No Action Alternative, ongoing activities would continue. Access to properties of traditional religious and cultural importance to the tribes would be maintained at the current landowner's (Boeing's) discretion. No impacts are expected on those portions of the traditional cultural resources present at SSFL that are located in Area IV or the NBZ, except buildings would remain that may be considered intrusive in the context of the viewscape of traditional cultural resources.

4.11.2.2 Building Removal Alternative

Archaeological and Architectural Cultural Resources

Under the Building Removal Alternative, all DOE-owned buildings within Area IV would be removed. There are no structures (architectural resources) in the NBZ, and no structures in Area IV are listed or eligible for listing on the NRHP or the California Register.[39] Therefore, no historic properties related to architectural resources would be affected by removal of DOE buildings. A summary description of the remaining DOE buildings is provided in Appendix D, Section D.1.

Known archaeological sites would not be affected because no sites are located in the immediate vicinity of buildings to be demolished. In the unlikely event that unexpected archaeological resources are present beneath existing foundations, subsurface vaults, or concrete slabs, DOE will comply with

[39] DOE has determined that the buildings proposed to be demolished are not eligible for listing on the NRHP, and the California SHPO concurred on July 15, 2010.

applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

Traditional Cultural Resources

Removal of built structures under the Building Removal Alternative could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources. No adverse impacts are expected, except as noted above for unlikely impacts on unanticipated archaeological resources.

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 resources under the groundwater remediation alternatives are summarized and compared in **Table 4–86**.

Table 4–86 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.	No adverse impacts are expected because installation of equipment would avoid identified archaeological sites, and there is low likelihood of unanticipated discoveries during installation of equipment.	Same as the Groundwater Monitored Natural Attenuation 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.	Above-ground elements would be designed to avoid adverse effects on the landscape.	Same as the Groundwater Monitored Natural Attenuation Alternative.

4.11.3.1 Groundwater No Action Alternative

Archaeological and Architectural Cultural Resources

Current groundwater monitoring activities would continue under the Groundwater No Action Alternative. There are no ongoing activities or plans under this alternative that would affect archaeological sites in the APE. Archaeological and architectural resources would continue to be managed through existing management plans and operating procedures. Archaeological sites present on Area IV and the NBZ would continue to be protected from outside intrusion through restricted access to these areas. No historic properties would be affected.

Traditional Cultural Resources

Current groundwater monitoring activities would continue under the Groundwater No Action Alternative. Access to properties of traditional religious and cultural importance to the tribes would be maintained at the current landowner's (Boeing's) discretion. No impacts are expected on those portions of the traditional cultural resources present at SSFL that are located in Area IV or the NBZ.

4.11.3.2 Groundwater Monitored Natural Attenuation Alternative

Archaeological and Architectural Cultural Resources

Ongoing monitoring activities could be augmented by installation of additional monitoring wells and by more frequent sampling under the Groundwater Monitored Natural Attenuation Alternative. There are no structures (architectural resources) in the NBZ, and no structures in Area IV are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected. Groundwater monitoring activities would also have no effect on archaeological resources because the APE has been surveyed for archaeological sites, and all new wells would avoid identified sites. In the unlikely event that an unexpected archaeological resource is present, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

Traditional Cultural Resources

Ongoing groundwater monitoring activities are unlikely to impact traditional cultural resources in Area IV and the NBZ, although the introduction of additional modern elements related to the new wells could have a minor, temporary impact during installation of the system and then during the operation of these systems. However, above-ground elements would be designed to avoid adverse effects on the landscape. No other impacts are expected, except as noted above for unlikely impacts on unanticipated archaeological resources.

4.11.3.3 Groundwater Treatment Alternative

Archaeological and Architectural Cultural Resources

Groundwater treatment activities are unlikely to impact archaeological or architectural resources under the Groundwater Treatment Alternative. There are no structures (architectural resources) in the NBZ, and no structures in Area IV are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected. Additionally, groundwater treatment is an unlikely source of impacts on archaeological resources. The strontium-90 bedrock source in the RMHF area is not near any known archaeological site, and the soil above bedrock is composed of fill material from prior cleanup activities. 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 pads 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. In the unlikely event that an unexpected archaeological resource is present, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

Traditional Cultural Resources

Groundwater treatment activities are unlikely to impact traditional cultural resources in Area IV and the NBZ, although introduction of additional modern elements (e.g., treatment systems, storage tanks, overland piping) could have a minor, temporary impact during installation of the system and then during the operation of these systems. However, above-ground elements would be designed to avoid adverse effects on the landscape. No other impacts are expected, except as noted above for unlikely impacts on unanticipated archaeological resources.

4.11.4 Cultural Resources Impacts under All Action Alternative Combinations

Archaeological and Architectural Cultural Resources

There are no structures (architectural resources) in the NBZ, and no structures in Area IV are listed or eligible for listing on the NRHP or the California Register; therefore, no historic properties related to architectural resources would be affected under any combination of action alternatives, and no impacts on this resource class have been determined under NEPA.

For archaeological resources, consistent with the 2010 AOC (DTSC 2010a), DOE has identified locations of known archaeological sites as areas in which the exemption process would be applied. In the soil remediation plan that DOE would submit for DTSC approval, DOE would propose that areas subject to the exemption process be cleaned of chemical and radioactive constituents if they pose a risk to human health or the environment. At this time, DOE risk assessments have identified soils that would need to be remediated that are on or near some archaeological sites. Therefore, some archaeological sites may be impacted by cleanup activities under any of the soil remediation action alternatives (see Table 4–84). In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more HPTP(s). The HPTP(s) will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, the manner in which these measures will be carried out, and a schedule for their implementation.

The overall potential adverse effects related to archaeological resources would be similar but would vary somewhat among the alternatives, depending on extent of cleanup. Under all alternatives, in the unlikely event that an unanticipated archaeological resource is encountered, DOE will comply with applicable regulations and the Section 106 Programmatic Agreement currently under development, which will include procedures for the discovery and treatment of unanticipated archaeological finds.

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 based on the prior disturbance associated with facility construction. Similarly, it is unlikely that the groundwater remediation action alternatives, implemented together or separately, would encounter unanticipated archaeological resources during installation of equipment.

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, Open Space Scenario, which would cause the least soil disturbance of any of the soil remediation action alternatives. As discussed above, the Building Removal Alternative and both groundwater remediation action alternatives would be unlikely to encounter unanticipated archaeological resources.

Traditional Cultural Resources

Under all alternatives, soil remediation could have adverse impacts on traditional cultural resources. In addition to potential impacts on specific archaeological resources, soil remediation could change the general landscape (e.g., topography, soil color, vegetation) associated with traditional cultural resources at Area IV and the NBZ. Improved access and increased traffic related to cleanup activities could impact traditional cultural resources by introducing more people, equipment, and possible vandalism during the duration of cleanup activity. DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for the NRHP.

The High Impact Combination would have the greatest potential to impact traditional cultural resources, primarily because this combination would have the most landscape alteration and longest cleanup duration. Removal of built structures under the Building Removal Alternative could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources. Groundwater remediation action alternatives, whether implemented together or separately, are unlikely to impact traditional cultural resources in Area IV and the NBZ because above-ground elements would be designed to avoid adverse effects on the landscape.

The Low Impact Combination would have the least potential to impact traditional cultural resources, primarily because this combination includes the Conservation of Natural Resources Alternative, Open Space Scenario, which would have the shortest cleanup duration and would result in the least landscape alteration of any of the soil remediation action alternatives. As discussed above, removal of built structures under the Building Removal Alternative could be considered beneficial because potentially intrusive structural elements would be eliminated from the viewscape of traditional cultural resources. Groundwater remediation action alternatives, whether implemented together or separately, are unlikely to impact traditional cultural resources in Area IV and the NBZ because above-ground elements would be designed to avoid adverse effects on the landscape.

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 or California Register criteria (refer to Appendix B, Section B.11). Because there would be no adverse effect on architectural resources, an impact threshold would not be crossed and no mitigation for architectural resources would be needed. For archaeological resources, DOE has determined that soil remediation activities could adversely impact historic properties within the APE and therefore, an impact threshold has been crossed. For traditional cultural resources, the threshold could be met, resulting in potential adverse impacts under all three of the soil remediation action alternatives. No adverse impacts on traditional cultural resources are expected under the Building Removal Alternative, groundwater remediation alternatives, or any no action alternative.

DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on historic properties.

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 or food stores 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. Future use of Area IV and the NBZ following remediation will be permanently constrained by two Grant Deeds of Conservation Easement and Agreements (conservation easements) recorded by Boeing and North American Land Trust with Ventura County in 2017 (Ventura County 2017a, 2017b). These grant deeds permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site. Following completion of site remediation activities, with the site's permanent management as open space there would be no long-term change to employment, truck traffic, infrastructure and municipal services, housing, and local government revenue in the SSFL ROI and in the ROIs for the facilities receiving recycle material and waste.

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 4–87**.

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 26 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 133,000 construction workers live in the region (see Chapter 3, Tables 3–36 and 3–36). 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). Because of the emphasis on early removal of soil having concentrations above provisional radionuclide LUT values and soil classified as hazardous, a larger number of truck trips would be necessary earlier in the project. Assuming wastes are shipped to the most distant evaluated facilities and considering shipment under both the truck and the truck/rail options, up to 34 truck drivers may be annually required during the first 4 years of soil removal. Following those first 4 years, 7 truck drivers would be required during most of the final years of soil removal. These requirements are small, and there is an adequate regional pool of truck drivers. Chapter 3, Tables 3–36 and 3–37, summarize truck transportation employment during 2012 in Los Angeles and Ventura Counties, respectively. In 2015, 5,400 employees were employed in specialized freight trucking in the two counties, plus approximately 29,200 employees in general truck transportation. Employment of local truck drivers would likely not generate new sales in the region because these workers would spend money in the region with or without the project.

Table 4–87 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 26 years, with minor beneficial socioeconomic impacts.	Soil remediation would increase Area IV employment by 25 workers over about 6 years, with minor beneficial socioeconomic impacts.	Under both the Residential and Open Space Scenarios, soil remediation would increase Area IV employment by 25 workers over 2 years for the Residential Scenario and less than 2 years for the Open Space Scenario. There would be minor beneficial socioeconomic impacts.
	Truck traffic	No socioeconomic impacts are expected.	Increased traffic during 26 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 and its intersection with Valley Circle Boulevard, 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 soil removal would last for about 6 years rather than 26 years.	Similar potential socioeconomic impact as those under the Cleanup to AOC LUT Values Alternative, except for both scenarios the duration of soil removal would last for up to 2 years rather than 26 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.	Similar to 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.	Similar to the Cleanup to Revised LUT Values Alternative, except for both scenarios there would be far 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 26 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 about 6 years.	Potential funding impacts and benefits would be reduced compared to the Cleanup to Revised LUT Values Alternative because of the shorter operational durations for both scenarios.
Disposal facilities	Truck traffic	No socioeconomic impacts are expected on businesses in the vicinities of the offsite disposal facilities.	Because there are few, if any, local businesses along the main access routes to the three evaluated LLW/MLLW disposal facilities, there would be no socioeconomic impacts on businesses in the vicinities of these facilities. Because of the small numbers of daily deliveries of soil to the evaluated hazardous waste facilities (daily average less than 1), no socioeconomic impacts are expected on businesses near these facilities For deliveries of nonhazardous soil to the evaluated facilities, which could occur up to 9 per day for most years, 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	Similar to the Cleanup to AOC LUT Values Alternative, with the same daily deliveries over the same delivery durations to the evaluated radioactive and hazardous waste facilities, and the same lack of potential for socioeconomic impacts on businesses near these facilities. There would be a similar peak delivery rate to the evaluated nonhazardous waste facilities (up to 9 per day), but this rate of waste delivery would last for only 1 year; over the other 5 years of delivery, the daily rate would range	Similar to the Cleanup to Revised LUT Values Alternative, except that the total number of shipments to radioactive waste facilities would be substantially reduced for both scenarios, 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 LLW/MLLW or hazardous waste facility. No or minimal socioeconomic impacts are expected on businesses near the evaluated nonhazardous waste facilities.

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
			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.	from 1 to 4. No or minimal socioeconomic impacts are expected on businesses near these facilities There would be reduced disposal fees at the evaluated hazardous waste facilities.	

AOC = *Administrative Order on Consent for Remedial Action*; LLW = low-level radioactive waste; LUT = Look-Up Table; MLLW = mixed low-level radioactive waste; 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 up to 0.19 percent above baseline conditions during the years of soil removal (see Appendix H, Table H–22). In addition, other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, 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 101,000 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 3–39, lists ten 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, one in Texas, 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.[40]

LLW and MLLW Facilities. The number of waste delivery trucks arriving at an LLW or MLLW disposal facility would average up to 7 per day over 4 years, assuming all LLW and MLLW would be sent to a single disposal facility. Neither Energy*Solutions* in Utah, nor NNSS, nor WCS in Texas are located near residential or urban areas, and there are few, if any, local businesses on local roads used to access the facilities. 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 2013a) and cited in its December 30, 2014, Record of Decision (ROD) (79 FR 78421). Therefore, no socioeconomic impacts on businesses are expected in the vicinities of the evaluated 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 less than 1 per day over about 1 year. 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 26 years, and these deliveries would average up to 9 per day. 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 expected to have no or minimal 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

[40] 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.

(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 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,[41] the additional truck traffic from SSFL to the McKittrick Waste Treatment Site or Buttonwillow Landfill would have no or 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 to significantly impact businesses, or there are no or insignificant numbers of local businesses on the main access routes to the evaluated facilities.

Shipments of nonhazardous soil to disposal facilities authorized to receive this waste would arrive at frequencies up to 9 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

[41] 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 9 trucks per day would result in an average frequency of 1 additional loaded truck, or less, every 53 minutes, to the site. This additional traffic is unlikely to be noticeable.

in the vicinities of the McKittrick Waste Treatment Site and Buttonwillow Landfill. 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.

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 about 6 years rather than 26 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 total heavy-duty truck round trips would occur over the implementation of this alternative 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 a larger number of truck trips would be necessary earlier in the project. During the first 4 years of soil removal up to 34 truck drivers may be required. This scenario assumes the shipment of waste to the most distant evaluated disposal facilities and considering shipment under both the truck and the truck/rail options. Truck driver requirements would be much smaller during the final 2 years 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 2015 in the two counties, approximately 5,400 employees were employed in specialized freight trucking and 29,200 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 (6 years rather than 26 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 22,000 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.

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 7 average daily truck deliveries would arrive at a single assumed LLW or MLLW disposal facility over 4 years. Neither Energy*Solutions* in Utah, nor NNSS, nor WCS in Texas are located near residential or urban areas, and there are few, if any, local businesses on local roads used to access the facilities. 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, ROD (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 less than 1 over a single year. 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. If all nonhazardous waste was shipped to a single disposal facility, there would be up to 9 deliveries to that facility. But this rate of waste delivery would last for only 1 year; over the other 5 years of delivery, the daily rate would range from 1 to 4. The increase in truck traffic to the evaluated disposal facilities would be comparable that for the Cleanup to AOC LUT Values Alternative, but the duration of waste delivery would be significantly less. No or minimal socioeconomic impacts would be expected on businesses in the vicinities of the facilities.

Summary. No or minimal 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 under both the Residential and Open Space Scenarios. Soil removal would require 2 years or less 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 much smaller total number of heavy-duty truck round trips would occur compared to the Cleanup to Revised LUT Values Alternative. The number of required truck drivers would be less, as well, principally because of the much smaller number of shipments to LLW/MLLW disposal facilities which are all located at relatively large distances from SSFL. Up to 9 drivers may be required during the first year of soil removal under both the Residential and Open Space Scenarios. There would a reduced requirement under both scenarios for truck drivers during the second 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 5,400 drivers employed in specialized freight trucking and 29,200 employees were engaged 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 (up to 2 years rather than 26 years). Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, 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 6,000 heavy-duty truck round trips (including backfill shipments) for soil remediation under the Residential Scenario, or about 4,400 shipments under the Open Space Scenario, there would be much less potential for road deterioration than that under the previous two action alternatives because of the much 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 less than 1 daily truck delivery to that facility under both scenarios during the single year of radioactive soil removal. Socioeconomic impacts for delivery of waste to hazardous and nonhazardous disposal facilities would be annually similar to those for the Cleanup to Revised LUT Values Alternative, although the duration of shipment would be much less. Although no or minimal 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 4–88**.

Table 4–88 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 up to 60 workers at SSFL with minor beneficial socioeconomic impacts.
	Regional truck traffic	No socioeconomic impacts are expected.	Increased traffic during the 2 to 3 years required for 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 60 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. Two to three years would be required for building demolition.

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 8 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 5.2 percent above baseline conditions. 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 no more than 2.4 percent above baseline conditions during weekdays, and, in the case of Topanga Canyon Boulevard, by no more than 0.30 percent above baseline conditions (see Appendix H, Table H–22). 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 2,400 heavy-duty truck round trips associated with building removal under this alternative, including 880 backfill shipments, 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 3–39, 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 2 daily waste delivery trucks would arrive at that facility over the 2 to 3 years required for building demolition. Because of the small number of local businesses, if any, on the main access routes to the evaluated facilities, and the small number of daily trucks trips, there would be no socioeconomic impacts on businesses in the vicinities of these facilities.

Hazardous Waste Facilities. Truck deliveries to an assumed single hazardous waste facility would average much less than 1 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. Truck deliveries to an assumed single nonhazardous waste facility would average less than 1 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. Truck deliveries to an assumed single recycle facility would average less than 1 per day. Three facilities near SSFL were evaluated: P.W. Gillibrand, Standard Industries, and Kramer Metals. These increased daily deliveries are small in number and 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 4–89**.

Table 4–89 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 little to 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 wastewater from well installation and 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, and little to no damage to pavement from additional traffic. There would be no socioeconomic impacts on businesses in the vicinities of the permitted hazardous waste treatment facilities receiving the well installation and 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 would require a few weeks per system, while removal of bedrock containing strontium-90 would require approximately 5 workers over approximately 60 working days. Monitoring the performance of the installed groundwater treatment systems would be largely done by the same workers conducting groundwater monitoring, although there a few additional workers could be required once a month if chemical enhancement is part of the operation of the groundwater treatment systems. That is, there would be little or no additional 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 a little more than 1 per day. Assuming all shipments occurred over the projected 60-day period required for bedrock removal, shipments would occur at an average rate of about 6 per day. Either shipment rate would have no socioeconomic impacts on businesses in the vicinities of the evaluated LLW/MLLW disposal facilities because all facilities are in isolated locations and there are few, if any, local businesses on the access routes to these facilities. In addition, there would be about two 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 60 workers over 28 years of operation. In addition, during 1 year there would be a need for an additional five workers over a few weeks to install groundwater treatment equipment, and in another year about 5 workers over about 60 working days to remove and ship offsite, bedrock containing strontium-90. Under the Low Impact Combination, the number of onsite workers would be 25 to 60 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 6 workers working an average of 20 days 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 28 years, with the most noticeable increase occurring on Woolsey Canyon Road (up to 8.6 percent). 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 about 3.9 percent above baseline conditions, 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 above baseline conditions (up to 0.5 percent) is not expected to have noticeable impacts on businesses along this road (see Appendix H, Table H–23).

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, where traffic would again increase by up to 8.6 percent, and average daily traffic on other evaluated roads would increase by no more than about 3.9 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 no more than about 0.5 percent above baseline conditions, which is not expected to have noticeable socioeconomic impacts on businesses along Topanga Canyon Boulevard (see Appendix H, Table H–23).

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 6,900 heavy- and medium-duty truck round trips under the Low Impact Combination to 104,000 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 28 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 4–81, LLW and MLLW would be delivered to an assumed single disposal facility at average daily rates ranging from 2 to 13 deliveries for any combination of action alternatives that includes the Cleanup to AOC LUT Values or Cleanup to Revised LUT Alternative, with deliveries occurring over 6 years. The high ends of these ranges were conservatively determined assuming that soil removal overlapped with bedrock removal under the Groundwater Treatment Alternative and all LLW from bedrock removal was shipped during the projected working period for the activity. For combinations of action alternatives that include the Conservation of Natural Resources Alternative, deliveries would range from 2 to 6 per day over a period of about 3 or 4 years, depending on whether the combination includes the Groundwater Monitoring Natural Attenuation or Groundwater Treatment Alternative. For the reasons given in Section 4.12.1.2, 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 13 cubic yards) might be generated under the Groundwater Treatment Alternative. As shown in Table 4–81, the largest average daily truck deliveries to a single assumed hazardous waste facility would be less than 1 delivery. For the reasons given in Section 4.12.1.2, 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 4–81, under the High Impact Combination, nonhazardous waste would be shipped to disposal facilities over 28 years, and the average number of heavy-duty trucks received at a single assumed waste disposal facility could range up to 9 per day for multiple years. Under the Low Impact Combination, nonhazardous waste would be shipped to disposal facilities over 4 years, and the average number of heavy-duty trucks could also range up to 9 per day. That level of waste delivery, however, would occur for only a single year; greatly reduced delivery rates would be expected during the other three years. 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 about 1 truck per day. The minimal daily deliveries would have no impacts on traffic volumes in the vicinities of any of the recycle facilities, and, thus, no socioeconomic impacts are expected 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 4–90** 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.

Table 4–90 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	**65.5**	6.8
Chiquita Canyon	Nonhazardous soil and debris	**72.1**	12.5
Mesquite [a]	Nonhazardous soil and debris	12.7	19.2
Buttonwillow	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	29.6	18.0
Westmorland	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	**58.4**	**20.9**
McKittrick	Nonhazardous soil and debris	29.6	18.0
Waste Disposal Facilities Outside California			
US Ecology in Idaho [b]	Hazardous waste and asbestos-containing material	26.5	19.7
Energy*Solutions* in Utah [b]	LLW and MLLW	**66.1**	**25.3**
NNSS [b]	LLW and MLLW	48.7/21.8 [c]	**32.1**/16.8 [c]
WCS in Texas	LLW and MLLW	35.0	4.2
Recycle Facilities in California [d]			
Kramer Metals	Nonhazardous recycle material	**98.4**	**22.4**
Standard Industries	Nonhazardous recycle material	**51.3**	17.9
P.W. Gillibrand	Nonhazardous recycle material	27.3	2.4

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: Chapter 3, Section 3.13.

As indicated in Table 4–90, neither minority nor low-income communities are present in the census tracts near the Mesquite, Buttonwillow, McKittrick, US Ecology in Idaho, WCS in Texas, and Kramer Metals facilities; therefore, no environmental justice impacts are expected in the populations near these facilities.

In addition, no minority communities live in the vicinities of two of the evaluated LLW/MLLW disposal facilities (WCS in Texas and NNSS). However, one of the census tracts near the WCS site in Texas is a low-income community. Neither of these facilities is located near heavily populated residential or urban area. 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, Energy*Solutions* in Utah, and P.W. Gillibrand; however, these facilities may be accessed directly from highways, which would minimize the potential for traffic impacts.

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 4–91**.

Table 4–91 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the SSFL ROI.	During the 26 years of soil removal, weekday traffic in the SSFL ROI would increase by up to 3.3 percent above baseline conditions on Woolsey Canyon and no more than 1.5 percent above baseline conditions on the other evaluated roads. 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 minority, low-income, or Native American populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI.	Same as the Cleanup to AOC LUT Values Alternative, except that soil removal and associated increased traffic would occur for 6 years.	Same as the Cleanup to AOC LUT Values Alternative, except that soil removal and associated increased traffic would occur for 2 years under the Residential Scenario or less than 2 years under the Open Space Scenario.

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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the regional ROIs.	Similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities compared to the Cleanup to AOC LUT Values Alternative. 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 minority or low-income populations, including Native American tribes, in the regional ROIs.	Under both scenarios, 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 the facilities would occur for shorter durations. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the regional ROIs.

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

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.

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 by up to 3.3 percent above baseline conditions, with weekday motorist delays (or the 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 no more than 1.5 percent above baseline conditions.

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 minority, low-income, or Native American 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 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. Deliveries to a LLW/MLLW facility would average about 7 per day, which would increase the average daily traffic along the main routes to any of the evaluated facilities by only about 0.20 to 0.55 percent above baseline conditions. Although the ROI for Energy*Solutions* in Utah has a low-income population exceeding 20 percent and a minority population exceeding 50 percent, and one of the census tracts in the NNSS ROI has a low-income population exceeding 20 percent, both facilities are directly accessible from access-controlled divided highways. Deliveries of hazardous soil to a hazardous waste facility would average less than 1 delivery per day, and would increase the average daily traffic along the main routes to any of the evaluated facilities by up to 0.22 percent above baseline conditions. 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.

Truck shipments of nonhazardous soil from SSFL would average 9 per day during most of the 26 years 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 4–90). 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 0.027 percent above baseline conditions. 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes.

Traffic

As indicated in Section 4.8.2.1.3, soil removal would increase weekday average daily traffic on Woolsey Canyon Road by 3.3 percent above baseline conditions during the first five years, and by 2.5 percent above baseline conditions in the final year. The largest increase in average daily traffic on the remaining evaluated roads would be 1.5 percent above baseline conditions.

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 minority or low-income populations, including Native American tribes, 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 7 daily shipments to an assumed single LLW/MLLW disposal facility during 4 years. Although the ROI for Energy*Solutions* in Utah has a low-income population exceeding 20 percent and a minority population exceeding 50 percent, and one of the census tracts in the NNSS ROI has a low-income population exceeding 20 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 1 year of less than 1 daily shipment 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 in duration compared to those evaluated under the Cleanup to AOC LUT Values Alternative (Section 4.13.1.2.2). Rather than up to 9 daily trucks arriving at a single assumed disposal facility over most of the 26 years required to implement the alternative, there would be an average of 9 daily trucks during only 1 year, with a range of 1 to 4 daily trucks during the additional five years required to implement the alternative. Therefore, possible increased traffic volume at the evaluated facilities would be less than 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 minority or low-income populations, including Native American tribes, 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

Under both the Residential and Open Space Scenarios and 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 minority or low-income populations, including Native American tribes.

Traffic

Under the Residential Scenario, soil removal could increase weekday average daily traffic on Woolsey Canyon Road by 3.3 percent above baseline conditions during a single year, and by 2.6 percent above baseline conditions in a subsequent year. Under the Open Space Scenario, soil removal could increase average daily traffic on Woolsey Canyon Road by 3.3 percent above baseline conditions in a single year and by 2.1 percent above baseline conditions in a subsequent year. The largest increase in average daily traffic on the remaining evaluated roads would be 1.5 percent above baseline conditions.

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 minority, low-income, or Native American 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 minority or low-income populations, including Native American tribes, 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 less than a fourth 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 7 daily truck deliveries during 4 years, under the Conservation of Natural Resources Alternative, this same facility would receive (under both scenarios) an average of less than 1 daily delivery for only 1 year. Average daily deliveries to a single assumed hazardous waste facility would be the same (less than 1 truck per day) as those for the Cleanup to Revised LUT Values Alternative. Average daily deliveries to a single assumed nonhazardous waste facility would be about 9 daily trucks for both scenarios during the first year, and 4 daily trucks during the second year for the Residential Scenario or 1 daily truck for the Open Space Scenario.

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 minority or low-income populations, including Native American tribes, 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 4–92**.

Table 4–92 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the SSFL ROI.	The average daily traffic on Woolsey Canyon Road could increase by up to 5.2 percent during the 2 to 3 years of building demolition, and no more than 2.4 percent on other evaluated roads. 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 minority, low-income or Native American populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the regional ROIs.

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. There would be no health impacts on members of the public in the SSFL ROI, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American.

Traffic

Traffic to and from Area IV would use Woolsey Canyon Road. As indicated in Section 4.8.2.2.2, the weekday average daily traffic could increase by about 5.2 percent above baseline conditions over the 2 to 3 years of building demolition, with some potential for weekday motorist delays or perception of delays during the hours of waste and backfill shipment. However, about 94 percent of this increased traffic would consist of worker vehicles rather than slow-moving heavy duty trucks, the potential for delay could be comparable to or less than that for the soil remediation action alternatives. The largest increase in weekday traffic on the remaining evaluated roads would be 2.4 percent above baseline conditions.

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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the regional ROIs.

4.13.3 Groundwater Remediation Alternatives

Impacts under the groundwater remediation alternatives are summarized and compared in **Table 4–93**.

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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the SSFL ROI and the regional ROIs.

Table 4–93 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the SSFL ROI.	Because the increase in average daily traffic on the evaluated roads is very small (much less than 1 percent above baseline conditions), no traffic impacts are expected. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI.	The increase in average daily traffic on the evaluated roads would be greater during 1 year than that under the Groundwater Monitored Natural Attenuation Alternative, but the peak-year increase would still average less than 1 percent above baseline conditions, with no expected traffic impacts. Therefore, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the SSFL ROI.
Regional (disposal facilities)	Traffic	No traffic is expected above baseline conditions. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the regional ROIs.	Shipments of waste under this alternative would primarily consist of excavated bedrock delivered to radioactive waste facilities. No noticeable increase in traffic is expected in the ROI of any evaluated facility, with no expected traffic-related impacts. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the regional ROIs.

ROI = regional of influence.

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 minority or low-income populations, including Native American tribes, in the SSFL ROI.

Traffic

The weekday average daily traffic on Woolsey Canyon Road would increase by about 0.10 percent above baseline conditions during 1 year (see Appendix H, Table H–22). Traffic volumes would increase by about 0.045 percent on this road during other years when implementing the alternative and even less 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 minority or low-income populations, including Native American tribes, in the SSFL ROI.

4.13.3.2.2 Regional Regions of Influence

Traffic

In additional to an annual shipment of groundwater monitoring purge waste, there would be five shipments of well installation cuttings to offsite nonhazardous waste facilities and five shipments of well installation wastewater to a permitted hazardous waste treatment plant in accordance with its waste acceptance criteria. Even if the latter shipments occurred within a single year, there would be no noticeable increase in traffic in the vicinity of any facility receiving nonhazardous waste or wastewater, with no traffic-related impacts. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes, in the SSFL ROI.

Traffic

The weekday average daily traffic on Woolsey Canyon Road would increase by about 0.80 percent above baseline conditions during 1 year (see Appendix H, Table H–22). Traffic volumes would increase by about 0.051 to 0.066 percent on this road during other years when implementing the alternative and even less 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 minority or low-income populations, including Native American tribes, 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. Deliveries to a single assumed LLW/MLLW facility would average about 6 per day, assuming all shipments occur during the projected operational period of bedrock removal, which is less than that evaluated under the soil remediation action alternatives (see Section 4.13.1). No noticeable increase in traffic is expected in the ROI of any evaluated facility (maximum of about 0.3 percent), with no traffic-related impacts. Therefore, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, in the regional ROIs.

Assuming groundwater treatment media were shipped periodically from SSFL to a hazardous waste facility, there would be approximately two 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes.

Traffic

Under the High Impact Combination, the largest increase in weekday traffic would occur on Woolsey Canyon Road, where over 28 years, the average daily traffic would increase by 4.1 to 8.6 percent above baseline conditions during the first 4 years, and up to 3.3 percent during the final 24 years (see Appendix H, Table H–23). The largest increase (8.6 percent) results from the assumption that soil removal is initiated during the same year that building demolition is completed under the Building Removal Alternative. 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 during 4 years, the average daily traffic would increase by 2.2 to 8.6 percent above baseline conditions (see Appendix H, Table H–23). 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. In addition, the largest increase (8.6 percent) results from the assumption that soil removal is initiated during the same year that building demolition is completed under the Building Removal Alternative. 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 minority, low-income, or Native American populations would be the same as those experienced by the general population. Other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on SSFL-area roads and intersections could be reduced by using multiple routes to major highway systems. No disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, 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 4–81, total volumes could range from 10,800 cubic yards under the Low Impact Combination to 125,000 cubic yards under the High Impact Combination, and the average daily deliveries to a single assumed LLW/MLLW facility could range from less than 1 to about 13. 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. The high end of the range (13 daily deliveries) reflect the assumption that soil removal overlaps with bedrock removal under the Groundwater Treatment Alternative, and that delivery of LLW from bedrock removal occurs during the projected period of bedrock removal operations.

There is almost no difference among the combinations of action alternatives regarding the total quantity of hazardous waste (about 13 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 (less than 1 truck delivery 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 4–81, under the High Impact Combination, about 770,000 cubic yards of nonhazardous waste (soil, debris, etc.) would be shipped to disposal facilities over 28 years. The average number of heavy-duty trucks received at nonhazardous disposal facilities could range up to 9 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.

Under the Low Impact Combination, about 37,200 cubic yards of nonhazardous waste would be generated that would be shipped to disposal facilities over about 4 years. The average number of heavy-duty trucks delivered to a single assumed nonhazardous waste facility could be up to 9 per day during 1 year; and 1 daily delivery during the other 3 years. This frequency of truck traffic likely would not result in significant traffic-related impacts in the ROI for that facility.

As shown in Table 4–81, under any combination of action alternatives, about 3,540 cubic yards of recycle material would be shipped to recycle facilities during the 2 to 3 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 minority or low-income populations, including Native American tribes, 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 minority or low-income populations, including Native American tribes. 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 minority, low-income, or Native American populations would be the same as those experienced by the general population. Thus, no disproportionately high and adverse impacts are expected on minority or low-income populations, including Native American tribes, 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 effects are expected on minority or low-income populations, including Native American tribes, 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.[42]

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. Consideration is given to truck transport routes in proximity to schools and recreation areas where children are likely to be present.

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. There are no schools on Valley Circle Boulevard north and east of its intersection with Woolsey Canyon Road, nor on Plummer Street from Valley Circle Boulevard to Tropaca Boulevard; the Chatsworth Natural Preserve and Chatsworth Oaks Park, however, are located next to Valley Circle Boulevard. There are no schools on Valley Circle Boulevard from its intersection with Woolsey Canyon Road to its intersection with Roscoe Boulevard. There are numerous schools and recreation areas on Valley Circle Boulevard south of its intersection with Roscoe Boulevard, and a recreation area (Orcutt Ranch) and a school on Roscoe Boulevard between Valley Circle Boulevard

42 The assessments of impacts to hypothetical receptors in Section 4.9 considered age-weighted exposure estimates including receptors under age 18.

and Topanga Canyon Boulevard. There are also a number of schools and recreation areas on Topanga Boulevard between State Route 118 and US Highway 101 (see Chapter 3, Figure 3–29).

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 4–94** 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.

As shown in Table 4–94, 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.

Table 4–94 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	607 (R)	11.1
Chiquita Canyon	Nonhazardous soil and debris	223	7.4
Mesquite [a]	Nonhazardous soil and debris	10	71.5
Buttonwillow	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	129	7.0
Westmorland	Hazardous waste, asbestos-containing material, and nonhazardous soil and debris	122	2.4
McKittrick	Nonhazardous soil and debris	129 (S)	7.0
Waste Disposal Facilities Outside California			
US Ecology in Idaho [b]	Hazardous waste and asbestos-containing material	311	5.3
Energy*Solutions* in Utah [b]	LLW and MLLW	200	9.1
NNSS [b]	LLW and MLLW	165/363 [c]	17.9/32.6 [c]
WCS in Texas	LLW and MLLW	199	NI
Recycle Facilities in California [d]			
Kramer Metals	Nonhazardous recycle material	219 (S, R)	7.4
Standard Industries	Nonhazardous recycle material	718 (S, R)	9.1
P.W. Gillibrand	Nonhazardous recycle material	266 (R)	18.0

< = less than; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NI = no information;
NNSS = Nevada National Security Site; R = recreation area within 1 mile; S = school within 1 mile; WCS = Waste Control Specialists.

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 2016j.

4.14.1 Soil Remediation Alternatives

Impacts under the soil remediation alternatives are summarized and compared in **Table 4–95**.

Table 4–95 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 26-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.	Similar to the Cleanup to AOC LUT Values Alternative, except that soil removal would occur for 6 years rather than 26 years. No disparate impacts are expected on sensitive-aged populations in the SSFL ROI.	Similar to the Cleanup to AOC LUT Values Alternative, except that soil removal would occur for about 2 years under the Residential Scenario or less than 2 years under the Open Space Scenario. 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.	Similar traffic increases in the regional ROIs for radioactive, hazardous, and nonhazardous waste disposal facilities compared to the Cleanup to AOC LUT Values Alternative, but soil removal and associated increased traffic would occur for a much shorter duration. No disparate impacts are expected on sensitive-aged populations in the regional ROIs.	Under both scenarios, 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 shorter durations. 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.

4.14.1.1 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.

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 3.3 percent above baseline conditions during the 26 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 1.5 percent above baseline conditions, or about a half or less than that for Woolsey Canyon Road. The largest increase in traffic on a route bordering a school would occur on Roscoe Boulevard between Valley Circle Boulevard and Topanga Canyon Boulevard, and would be about 1 percent above baseline conditions. Although there are numerous schools and recreation areas on Valley Circle Boulevard south of its intersection with Roscoe Boulevard, the projected increase in traffic on this road segment would be only about 0.40 percent above baseline conditions from Roscoe Boulevard to Victory Boulevard, and 0.18 percent above baseline conditions from Victory Boulevard to US Highway 101 (see Appendix H, Table H–22).

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 3–47 and 3–48, 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. Deliveries to a LLW/MLLW facility would average about 7 per day, which would increase the average daily traffic along the main routes to any of the evaluated facilities by only about 0.20 to 0.55 percent above baseline conditions. The closest populated area to WCS in Texas is Eunice, New Mexico, about 8 miles distance, and no school or recreation area is within a mile of the site. No schools or recreation areas are located within a mile of Energy*Solutions* in Utah or NNSS, and both facilities are directly accessible from divided highways.

Deliveries of hazardous soil to a hazardous waste facility would average less than 1 delivery per day, and would increase the average daily traffic along the main routes to any of the evaluated facilities by only about 0.22 percent above baseline conditions. 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 9 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 3.3 percent above baseline conditions during 5 years, and by 2.5 percent above baseline conditions in a subsequent year. The largest increase in average daily traffic on the remaining evaluated roads would be no more than 1.5 percent above baseline conditions.

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 4.14.1.2.1), there is not expected to be a significantly larger population of sensitive-aged persons in the group that could experience this risk 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 7 daily shipments during each of 4 years to an assumed single LLW/MLLW disposal facility. These shipments would increase the average daily traffic along the main routes to any of the evaluated facilities by only about 0.20 to 0.55 percent above baseline conditions. The closest populated area to WCS in Texas is Eunice, New Mexico, about 8 miles distance, and no school or recreation area is within a mile of the site. No schools or recreation areas are located within a mile of Energy*Solutions* in Utah or NNSS, 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 less than 1 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 considerably reduce in duration compared to those under the Cleanup to AOC LUT Values Alternative (see Section 4.14.1.2.2). Rather than an average of 9 daily trucks arriving at a single assumed disposal facility over multiple years, there would be an average of 9 daily trucks during 1 year and 1 to 4 daily deliveries over the remaining 5 years. Therefore, the possible increased traffic volume at the evaluated facilities would be less than that 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

Under both scenarios, 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 other two alternatives, and would occur for about 2 years for the Residential Scenario or less than 2 years for the Open Space Scenario.

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 both scenarios for the Conservation of Natural Resources Alternative, the projected increase in traffic in the ROI of a single assumed LLW/MLLW facility would occur over much less time as that under the Cleanup to Revised LUT Values Alternative. Rather than a single assumed LLW/MLLW facility receiving an average of 7 daily truck deliveries during 4 years, under the Conservation of Natural Resources Alternative, this same facility would receive an average of less than 1 daily delivery for only 1 year. Average daily deliveries to a single assumed hazardous waste facility would be the same as that for the Cleanup to Revised LUT Values Alternative. Average daily deliveries to a single assumed nonhazardous waste disposal facility would be up to 9 for a single year, and depending on the option, an average of 1 or 4 daily delivery during the second year. 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 4–96**.

Table 4–96 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 the 2- to 3-year period of building demolition, 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 all roads and intersections except Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on SSFL area roads and intersections could be reduced 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 3-year period, the weekday average daily traffic would increase by 5.2 percent above baseline conditions. The largest increase in average daily traffic on the remaining evaluated roads would be on Plummer Street, about 2.4 percent above baseline conditions.

Assuming waste and backfill was shipped to or from Area IV over a 2-to 3-year period, 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. In addition, other than Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic volumes on SSFL-area roads and intersections 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 4–97**.

Table 4–97 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 (no more than 0.1 percent above baseline conditions 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 hazardous waste treatment facility. In addition, each year there would be 1 shipment of groundwater monitoring purge water. Assuming the single year when 11 shipments could occur, 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 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 above baseline conditions. 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

Shipments of waste under this alternative would primarily consist of excavated bedrock delivered to radioactive waste facilities. Deliveries to a single assumed LLW/MLLW facility would average about 6 per day, assuming all shipments occur during the projected operational period of bedrock removal. No noticeable increase in traffic is expected in the ROI of any evaluated facility (maximum of about 0.43 percent), with no traffic-related impacts. And as noted in Section 4.14.1.3.2, there are no schools or recreation areas within the ROIs of Energy*Solutions* in Utah, NNSS, or WCS in Texas. Energy*Solutions* in Utah and NNSS 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 28 years, the weekday average daily traffic would increase by 4.1 to 8.6 percent above baseline conditions during the first 4 years, and by about 3.3 percent for the remaining 24 years (see Appendix H, Table H–23). 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 2.2 to 8.6 percent (see Appendix H, Table H–22). 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 4–94). Therefore, no disparate impacts are expected on sensitive-aged populations in the ROIs of these facilities.

As shown in Table 4–81,[43] the High Impact Combination would generate the most nonhazardous waste to be shipped to disposal facilities over 28 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.

Under the Low Impact Combination, nonhazardous waste would be shipped to disposal facilities over about 4 years, with a peak delivery during 1 year of 9 trucks per day. Assuming the Residential Scenario under the Conservation of Natural Resources Alternative, the delivery rate for the other 3 years would range from less than 1 to 4. Assuming the Open Space Scenario under the Conservation of Natural Resources Alternative, the delivery rate for the other three years would range from less than 1 to 1. These frequencies of truck traffic likely would not result in significant traffic-related impacts in the ROI for that facility.

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 there could be an increased risk to pedestrians in the vicinity of Woolsey Canyon Road due to 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 9 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.

[43] 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., localized 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 *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final 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 identified actions 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.

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. NASA's 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*. Based upon the decision in their ROD, NASA has been actively demolishing buildings in Areas I and II at SSFL. 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 has completed its soil and groundwater investigations and is currently waiting for the California Department of Toxic Substances Control (DTSC) to complete its program environmental impact report (EIR) (NASA 2018a). As required by the California Health and Safety Code, DTSC is preparing a program 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. The *Draft Program Environmental Impact Report for the Santa Susana Field Laboratory, Ventura County, California (Draft Program EIR)* (DTSC 2017a) was published in September 2017 after DOE's *Draft SSFL Area IV EIS*. Information from the *Draft Program EIR* was incorporated in this *Final SSFL Area IV EIS*. DTSC is working to address comments and publish the Final Program EIR. The CEQA process will conclude with a State-issued decision document outlining the cleanup remedy and actions they have selected. NASA then will be authorized to implement remediation actions in line with overall cleanup responsibilities (NASA 2018a). NASA plans to conduct additional National Environmental Policy Act (NEPA) analysis when the results of the additional studies are available. In the meantime, NASA is analyzing results from treatability studies to assess treatment in place (also known as in situ treatment) technologies, and other methods to achieve the required cleanup levels.

Boeing's remediation activities will be performed in accordance with the 2007 CO (DTSC 2007), as directed by 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 human health (consistent with future site plans)[1] 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 2015c).

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. In Figure 5–1, the main figure shows the area in Area IV and the NBZ that DOE would remediate under the Conservation of Natural Resources Alternative, Open Space Scenario (minimum area disturbed); the inset shows the area that DOE would remediate under the Cleanup to AOC LUT Values Alternative (maximum area disturbed). 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 126 other reasonably foreseeable actions in the ROI. Table D–8 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 2 miles northeast of SSFL Area IV.
- 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 3.5 mile east of Area IV.

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[1] In 2017, The Boeing Company (Boeing) and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements (conservation easements) with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or uses of the site.

- The Market Place – construction of 72 townhomes, 36 senior condominiums, and a commercial building 2.5 miles north of Area IV.
- 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 7.5 miles northeast of Area IV.
- 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 4 miles north of Area IV.
- 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 northeast of Area IV.
- Runkle Canyon Residential Project – Construction of 298 single-family homes, 25 custom homes, and 138 senior condominiums on 1,595 acres 3 miles northwest of Area IV.
- 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 8.5 miles southeast of Area IV.
- Lost Canyons – Master planned development for 364 single-family lots, infrastructure, streets, and common area improvements on 1,770 acres 5 miles north of Area IV.

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 (SMMNRA) 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 was 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 was to determine the suitability and feasibility of designating all or a portion of the corridor as a unit of the SMMNRA 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 ROTV EA was finalized with publication of the *Rim of the Valley Corridor Special Resource Study & Environmental Assessment Errata* in November 2015 (NPS 2015g), Finding of No Significant Impact (FONSI) in November 2015 (NPS 2015f), and the *Rim of the Valley Corridor Special Resource Study Final Summary* in February 2016 (NPS 2016).[2]

[2] The National Park Service did not issue a standalone final EA, but finalized the ROTV EA by issuing a companion document, the *Rim of the Valley Corridor Special Resource Study & Environmental Assessment, Errata* (NPS 2015g), as well as a FONSI (NPS 2015f).

Table 5–1 Information for the DOE, NASA, and Boeing Remediation Activities at the Santa Susana Field Laboratory

	Responsible Party			
Impacts Information	***NASA*** [a]	***Boeing*** [b]	***DOE*** [c]	***Totals***
Land Disturbed (acres)				
Area Disturbed for Soil Removal	144 – 245	17 [d]	9 – 90	**170 – 352**
Area Disturbed for Building Removal	Not applicable	3	8.4	**11.4**
Total	144 – 245	20	17 – 99 [e]	**181 – 364** [e]
Employment (persons)				
Onsite Employees	50 – 75	100	85 Building removal activities = 60 Soil excavation = 25 Groundwater treatment = <1 [f]	**235 – 260**
Truck Drivers – Truck drivers for deliveries and pickups that are not included in long-term employment.	Assume 22 to 113 truck drivers when the high value is for a scenario where hazardous waste disposal facilities are a 4-day truck roundtrip from SSFL.[g]	Assume 8 to 19 truck drivers when the maximum 96 daily heavy-duty truck round trips are split between NASA, Boeing and DOE	Assume up to 7 truck drivers under the Low Impact Combination (Conservation of Natural Resources [Open Space Scenario], Building Removal, and Groundwater Monitoring Natural Attenuation Alternatives) assuming soil removal starts during the last year of building removal, and minimum distances to the offsite facilities. Assume up to 41 truck drivers under the High Impact Combination (Cleanup to AOC LUT Values, Building Removal, and Groundwater Treatment Alternatives) assuming soil removal starts during the last year of building removal, and maximum distances to the offsite facilities.[g]	**37 – 173** [h]
Total	72 – 188	108 – 119	92 – 126	**272 – 433**
Resources Used				
Backfill for Soil Excavation (cubic yards)	206,000 – 290,000	50,000 [i]	29,000 – 661,000	**285,000 – 1,000,000**
Backfill for Building Removal (cubic yards)	Not applicable	1,300	13,500	**14,800**
Backfill for Bedrock Removal (cubic yards)	None expected	None expected	0 – 3,000	**0 – 3,000**
Total	206,000 – 290,000	51,300 [d]	42,500 – 678,000	**300,000 – 1,020,000**
Resources Used				
Water (gallons per day)	200,000	20,000	3,000 – 7,000	**223,000 – 227,000**
Water (gallons)	250,000,000 – 350,000,000	10,000,000	4,000,000 – 46,000,000	**264,100,000 – 406,000,000**
Waste Generated (cubic yards)				
Soil Excavation	626,000 – 870,000	150,000	38,200 – 881,000	**814,000 – 1,900,000**
Building Removal	66,100	112,000	15,500	**194,000**
Bedrock Removal and Groundwater Remediation	2,800	2,000 [j]	10 – 4,500	**4,810 – 9,300**
Total	695,000 – 939,000	264,000	53,700 – 901,000	**1,010,000 – 2,100,000**

Impacts Information	*Responsible Party*			*Totals*
	NASA [a]	*Boeing* [b]	*DOE* [c]	
Truck Trips				
Soil Disposal	40,000 – 57,000	9,800 [k]	2,500 – 57,500	**52,300 – 124,000**
Backfill, Equipment, and Supplies	13,100 – 19,100	3,700 [l]	2,700 – 44,200	**19,500 – 67,000**
Building Demolition Debris	3,970	1,000 [m]	1,500	**6,470**
Bedrock Disposal and Other Groundwater Remediation Waste	60 – 1,000	300 [j]	38 – 3,400	**400 – 4,700**
Total	57,100 – 81,000	14,800	6,740 – 107,000	**78,700 – 203,000**

< = less than; AOC = *Administrative Order on Consent for Remedial Action*; Boeing = The Boeing Company; LUT = Look-Up Table; NASA = National Aeronautics and Space Administration.

[a] Source: NASA 2017a.

[b] Source: Boeing 2017a.

[c] Source: Chapter 4 of this EIS.

[d] Boeing could obtain backfill from both onsite and offsite sources. Boeing has identified four potential soil borrow areas in the Southern Buffer Zone that could be used as onsite sources of clean backfill for Boeing remediation activities. The onsite areas are estimated to contain approximately 100,000 cubic yards of clean backfill and the use of the onsite areas would remove vegetation and habitat from 11 acres of undeveloped land. Possible offsite sources include Santa Paula Materials, Inc., Grimes Rock, Tapo Rock and Sand Inc., P.W. Gillibrand Company, and Simi Valley Landfill. It is assumed that offsite sources are operating under existing land use permits and therefore the biological impacts of obtaining backfill from offsite sources are not addressed in this EIS.

[e] DOE groundwater remediation activities would disturb less than 1 acre; this area is included in the rounded totals.

[f] A small number of workers would be required to install groundwater wells and treatment systems, where each installation would require much less than a year of work. Annual monitoring operations would also require a small number of workers that would each work for less than a year.

[g] 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.

[h] The ranges of DOE, NASA, and Boeing truck drivers have been added 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.

[i] Estimate assumes that approximately 33 percent of excavated soil volume will be needed as backfill obtained from other sources. Otherwise, soils surrounding disturbed areas will be used as backfill to restore the soil remediation area. Use of surrounding soils may disturb additional areas around the remediated area. Boeing is less constrained on its use of backfill because Boeing backfill must meet risk-based standards rather that the more restrictive AOC LUT values that DOE and NASA backfill must meet.

[j] Waste and trucking estimates for Boeing groundwater remediation work are based on remediation elements identified for implementation in the 2013 Draft Boeing Project Description; trucking estimates assume 1.5 cubic yards per ton of soil and 23 tons per truck.

[k] Estimate assumes 1.5 cubic yards per ton of soil, and 23 tons per truck.

[l] Truck trip estimate for backfill delivery is provided for conservative planning estimates. To minimize truck trips, Boeing plans to use the trucks that bring clean backfill to the site from offsite sources for subsequent off-haul of contaminated soil. Also, Boeing may use onsite sources of backfill. In both of these cases, the truck trips estimated for backfill delivery would be reduced or eliminated.

[m] Truck trip estimate for building debris removal is based on an average truck volume of 17 cubic yards based on prior Boeing demolition project experience.

Notes:

- Sums presented in the table may differ from those calculated from table entries due to rounding.
- Values rounded to three significant figures.

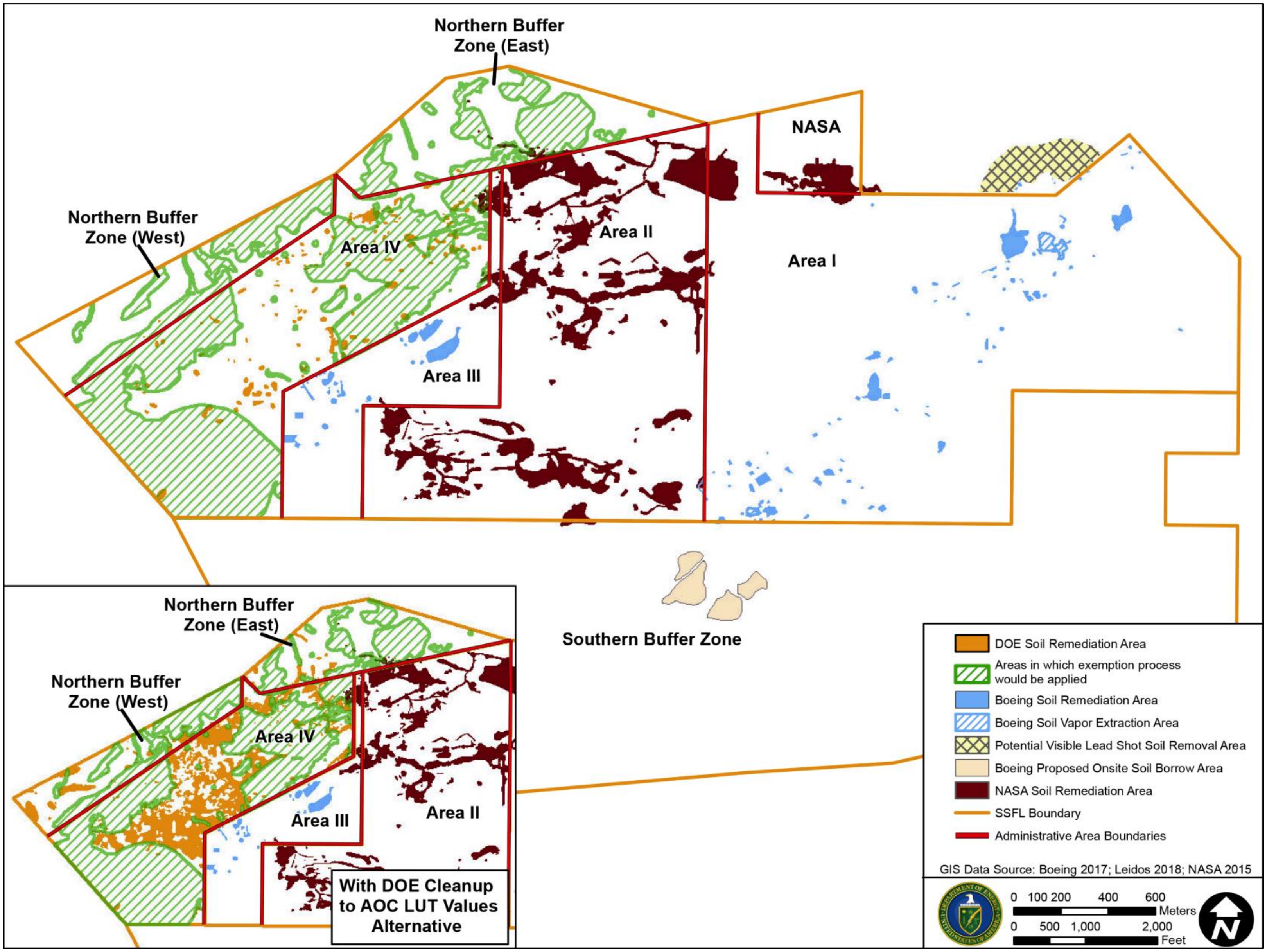

Figure 5–1 Estimated Areas Disturbed from DOE Conservation of Natural Resources Alternative – Open Space Scenario, NASA, and Boeing Soil Excavation

The *ROTV EA* includes alternatives to determine whether the study area would be suitable as an addition to the SMMNRA. 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 SMMNRA. In the FONSI for the ROTV EA (NPS 2015f), the National Park Service recommended expanding the existing SMMNRA boundary to include significant portions of the study area, more than doubling the SMMNRA. If implemented, 170,000 acres would be added to the SMMNRA to bring the total to 323,000 acres. Additional lands would only be acquired and incorporated from willing landowners.[3] Because this proposed action would result in preservation of existing open space, it is unlikely to contribute substantially to adverse cumulative environmental 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 2018a, 2018b; CPUC 2018a). The following transmission line and natural gas projects are within 10 miles of SSFL:

- Southern California Edison Presidential Substation Project – In March 2014, the Public Utilities Commission approved a project alternative that would upgrade existing Potrero and Royal substations with higher-capacity equipment and additional circuits. The substations are located in the Westlake Village and Simi Valley, 9 miles southwest and 6 miles northwest, respectively, of Area IV (Southern California Edison 2018a).
- 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 10 miles west of Area IV. 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. The project was completed in October 2017 and is in-service (Southern California Edison 2018b).
- 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 7.5 miles northeast of Area IV. The turbine-driven compressor station will be replaced with three variable frequency

[3] Boeing and North American Land Trust recorded two Grant Deeds of Conservation Easement and Agreements with Ventura County (Ventura County 2017a, 2017b) that permanently preserve as open space nearly 2,453 acres of land that Boeing owns at SSFL, including Area IV and the NBZ. Preservation of SSFL as open space would be consistent with the FONSI for the ROTV EA, although, Boeing has not committed to providing this land for the proposed expansion of the Santa Monica Mountains National Recreation Area.

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 2018b).

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 2018a). 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. Construction began in June 2018 and is estimated to take 18 to 24 months to complete (City of Agoura Hills 2018). This project is approximately 5.5 miles south of Area IV.
- 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. The project was completed in August 2018 and is in-service (City of Calabasas 2018). This project is approximately 6 miles south of Area IV.
- 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. Project construction started in March 2014 and finished in June 2017 (City of Thousand Oaks 2017). This project is approximately 7.5 miles southwest of Area IV.
- U.S. Highway 101 Liberty Canyon Wildlife Crossing Project – Caltrans proposes to build a wildlife crossing across U.S. Highway 101 just west of Liberty Canyon Road in the City of Agoura Hills, about 7 miles south-southwest of Area IV. The purpose of the project is to provide a safe and lasting passage across the freeway to help maintain wildlife populations that travel between the Santa Monica Mountains and Simi Hills, and ultimately to the Sierra Madre Mountain Range. This linkage has been identified in numerous county, city, and regional plans and publications as a critically important connection for wildlife. Without the project, the ecological impacts on wildlife movement would persist due to the original construction of U.S. Highway 101. The project would also help mitigate future effects of climate change on the current distributions of species across habitats (Caltrans 2018b).

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 2018b). 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 95 State of California sites within 10 miles of SSFL, including the various DOE, NASA, and Boeing remediation projects at SSFL (DTSC 2018b).

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 182 and 364 acres of land. Boeing has identified potential borrow areas for backfill in the Southern Buffer Zone. If soil is taken from these borrow areas, an additional 11 acres could be disturbed.

DOE remediation activities at SSFL would disturb between 9 and 90 acres of land via soil excavation and 8.4 acres of land via building removal. DOE's action alternatives would be consistent with the National Park Service's proposed expansion of SMMNRA (NPS 2015e, 2015f, 2015g, 2016). Ventura County Plans (Ventura County 2011a, 2015a) and the Boeing and North American Land Trust Grant Deeds and Conservation Easements permanently preserve about 2,453 acres of Boeing's land, including Area IV and the NBZ as open space (Ventura County 2017a, 2017b). The Conservation of Natural Resources Alternative would be most consistent with the conservation easements because it minimizes disturbance of habitat while removing chemical and radiological constituents that would pose a risk exceeding the target risk range of 1 in 10,000 to 1 in 1 million. The cleanup to AOC LUT Values Alternative would be the least consistent because it disturbs large areas of habitat that do not pose a risk requiring remediation. Under DOE's Preferred Alternative for Building Removal, no buildings would remain for future use. Thus, DOE actions would not contribute to adverse cumulative land use effects.

Recreation

As shown in Table 5–1, the combination of DOE remediation activities with NASA and Boeing remediation activities at SSFL would require between 78,700 and 203,000 heavy-duty truck round trips for waste disposal and deliveries. As described in Chapter 4, Section 4.1, there would be an average of 16 daily heavy-duty truck round trips for DOE. As described in Section 4.1, traffic would increase along routes to and from SSFL, especially during soil removal. As presented in Table 5–10, the combined weekday average daily traffic on Woolsey Canyon Road would conservatively increase by a maximum of 26 percent from baseline during Years 3 and 4 of the cumulative remediation efforts. Combined daily heavy-duty truck round trips would reach a maximum of 96 round trips in Year 3 of the cumulative remediation efforts and 92 average daily heavy-duty truck round trips in Year 4 (Table 5–9). The increased traffic on Woolsey Canyon Road could make weekday use of Sage Ranch Park less appealing. 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 daily number of heavy-duty truck round trips for DOE in combination with NASA and Boeing, would not exceed 96 (see Table 5–9). DOE's contribution to impacts from heavy-duty truck traffic would be about 20 to 25 percent of the cumulative impacts of DOE, NASA, and Boeing shipments in those years in which remediation activities overlap (see Table 5–8).

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 56 to 57 million gallons per year (223,000 to 227,000 gallons per day). Boeing is estimated to require about 20,000 gallons per day, DOE is estimated to require 3,000 to 7,000 gallons per day, and NASA is estimated to require about 200,000 gallons per day. This equates to total water use of approximately 10 million gallons for Boeing, 4.1 to 46 million gallons for DOE, and 250 to 350 million gallons for NASA. DOE water use would be approximately 1 to 3 percent of the total daily SSFL water use while DOE operations are underway and 2 to 11 percent of total water use for all SSFL cleanup activities.

Chapter 3, Table 3–1, provides CMWD's projections for its imported and local water supply. In an average water year, the district projects a combined imported and local water supply of 123,695 acre-feet in 2020 increasing to 126,614 acre-feet in 2040 (CMWD 2015). Maximum projected cumulative water use at SSFL (57 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 experienced drought conditions for several years. 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). 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). 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). In 2018, Southern California returned to a severe drought condition (NIDIS 2018). Governor Brown signed legislation in May 2018 (Senate Bill 606 and Assembly Bill 1668) that strengthens the State's water resiliency in the face of future droughts with provisions that include: (1) establishing an indoor, per person water use goal of 55 gallons per day until 2025, 52.5 gallons from 2025 to 2030, and 50 gallons beginning in 2030; (2) creating incentives for water suppliers to recycle water;

and (3) requiring both urban and agricultural water suppliers to set annual water budgets and prepare for drought (State of California 2018).

The projected cumulative water use may be controversial because of the continuing Southern 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 water use during drought conditions would create an increased cumulative demand 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–8, 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.

In 2015, NASA made the decision to defer the demolition of the historic Alfa, Bravo and Coca test stands and control houses as long as cleanup goals can still be met; this decision was re-affirmed in 2017. As demolition has progressed, NASA has retained a few additional structures of significance. For example, NASA decided to keep three observation bunkers located in the Alfa/Bravo, Coca, and Delta test areas. At the request of the Santa Ynez Band of Chumash Indians, NASA has also retained a blast wall in the service area. NASA believes it can meet its cleanup responsibilities with these structures still in place. However, the final decision to either maintain or demolish the test stands and other retained structures is dependent upon a number of factors. These factors include the impact to prospective future stewardship of the property, the long-term maintenance costs, and the risks to public health or public safety by maintaining the structures (NASA 2018b).

5.5.2 Geology and Soils

This analysis of cumulative impacts for geology and soils considers the same ROI described for the alternatives analysis. That is, 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 NASA and Boeing soil, building, and groundwater remediation activities identified in Table 5–1.

Loss of soil that has the mineralogical and biological composition to support the unique vegetation at SSFL would be generally proportional to the area of previously undisturbed soil that would be affected by remediation activities. 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 182 and 364 acres. The DOE activities would disturb approximately 17 to 99 acres, representing 9 to 27 percent of the total disturbed area. Best management practices (BMPs) would be used to slow the flow of runoff and thereby decrease its scouring action and associated erosion; however, 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 four potential soil borrow areas in the Southern Buffer Zone that could be used as sources of clean backfill for Boeing remediation activities. If soil is taken from these borrow areas, an additional approximately 11 acres could be disturbed.

Other construction activities in the region, such as those listed in Appendix D, Table D–8, 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 300,000 and 1,020,000 cubic yards of backfill could be required for all activities at SSFL. Most of this backfill is expected to come from local offsite sources. DOE activities would require 42,500 to 678,000 cubic yards of backfill, representing 14 to 66 percent of the total volume. For DOE and NASA, all backfill must meet specified values (e.g., AOC LUT values, revised LUT values, or risk assessment-based levels). It is unlikely that a source of backfill meeting all of the LUT values would 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 at SSFL (see Section 5.5.5). 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–8, also could require soil 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 demand for 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. As discussed in Chapter 4, Section 4.3, 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). 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 (see Chapter 6, Table 6–2) 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. Mitigation SW-1 limits excavation of soils down to bedrock in portions of the DOE remediation area that drain offsite during periods when heavy rainfall is expected. 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 on 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 on groundwater quantity.

A variety of technologies are being considered by DOE, NASA, and Boeing to address cleanup of chemical and radioactive constituents in groundwater. 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 offsite disposal or 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 and disposal options 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 contaminant concentrations, 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 chemical and radiological constituents during soil and groundwater cleanup.

At SSFL, the combined soil removal activities of DOE, NASA, and Boeing would cause profound disturbance (removal of vegetation and soils) over a minimum of 170 acres and a maximum of 352 acres (see **Table 5–2**), compared to a minimum of 9 acres and a maximum of 90 acres for DOE alone. Focused removal actions in areas within which the exemption processes would be applied 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 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 Soil Removal (acres)	170 – 352 [a]	9 – 90	5 – 26
Area Disturbed for Building Removal (acres)	11.4	8.4	74
Truck Trips	78,700 – 203,000	6,740 – 107,000	9 – 53

Boeing = The Boeing Company; NASA = National Aeronautics and Space Administration.

[a] Boeing has identified four potential soil borrow areas in the Southern Buffer Zone that could be used as sources of clean backfill for Boeing remediation activities. The areas total approximately 11 acres of undeveloped land that could add to the area disturbed.

Notes:

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

– Values rounded to three significant figures.

About 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 cleanup criteria 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. Boeing could obtain backfill from both onsite and offsite sources and, with use of the onsite sources could remove vegetation and habitat from up to 11 acres of soil from the Southern Buffer Zone. Possible Boeing offsite sources of backfill include Santa Paula Materials, Inc., Grimes Rock, Tapo Rock and Sand Inc., P.W. Gillibrand Company, and Simi Valley Landfill. 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 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) 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 78,700 and a maximum of 203,000 truck trips would be required, compared to a minimum of 6,740 and a maximum of 107,000 trips of similar-sized trucks for DOE remediation activities alone (see Table 5–2).

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, gray fox, coyote, and ringtail in an area recognized as a regionally important wildlife migration corridor. Habitat would be temporarily lost due to avoidance of construction-like activity by wildlife. The degree of the loss would depend on the behavioral response of the individual species. 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 364 acres, about 13 percent of the 2,850-acre site, leaving approximately 87 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, coyote, gray fox, 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 in Appendix D, 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. Impacts on these resources may be minimized by mitigation measures implemented as a result of CEQA review and applicable plans, policies, and regulations. The degree of cumulative impacts would depend on how the projects are ultimately designed and permitted.

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. Areas within which the exemption processes would be applied in Area IV and the NBZ contain some of these habitats. Remediation impacts to sensitive native habitats would be minimized within these exemption areas.

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. This species 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 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. Focused removal actions in areas within which the exemption processes would apply in Area IV and the NBZ would confer protection to some of the most sensitive biological resources because physical disturbance within these areas would be minimized to an estimated total of 4 acres. The land disturbances of the combined DOE, NASA, and Boeing remediation activities (up to 364 acres) would be considerably larger than those of the DOE activities alone (up to 99 acres) and would directly affect up to 13 percent of the 2,850-acre SSFL site. DOE soil removal activities (up to 90 acres) are estimated to be up to 26 percent of the total land disturbed for soil removal at SSFL.

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 3–27, 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 due to overlap of activities during the final year of building removal and the first year of soil removal. Assuming that excavation volumes are relative indicators of emissions, the Boeing emissions presented in Tables 5–3 and 5–4 were estimated by multiplying DOE emissions by the ratio of Boeing/DOE year 2021 annual excavation volumes (150,000/35,000 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 because 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.

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	0.9-1.0	7.0-7.1	7.9	0.0	0.4	0.4
On-road vehicles	0.1	0.5	1.0	0.0	0.0	0.0
Excavation					10.3-10.9	2.3–2.4
Annual Emissions Range	**1.0-1.1**	**7.5-7.6**	**8.9**	**0.0**	**10.7-11.3**	**2.67 – 2.78**
NASA Area I and II Alternatives						
Demolition – Year 1	2.0	11	20	0.0	2.0	1.0
Excavation – Years 2 and 3	1.0 – 1.7	9.0 – 16	14 – 26	0.0	850 – 2,000	180 – 420
Annual Emissions Range	**1.0 – 2.0**	**9.0 – 16**	**14 – 26**	**0.0**	**2.0 – 2,000**	**1 – 420**
Boeing Area I and III Alternatives						
Off-road equipment	1.1	7.3	8.5	0.0	0.4	0.4
On-road vehicles	0.2	1.1	3.3	0.0	0.1	0.0
Excavation					38.1	8.0
Annual Emissions Range	**1.2**	**8.3**	**11.8**	**0.0**	**38.5**	**8.4**
Total Annual SSFL Emissions Range	**3.2-4.3**	**25-32**	**35-47**	**0.0**	**51-2,050**	**12 – 431**
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.

Notes:

- Peak annual DOE emissions are for the third year of the remediation project and include the third and final year of building removal and the first year of soil removal activities.
- Peak annual emissions for excavation for the NASA alternatives multiplied by 870,000 cubic yards/500,000 cubic yards to estimate the most current estimate of activity (NASA 2015) versus what was considered in the *NASA FEIS* (NASA 2014a).
- Peak annual emissions for Boeing activities estimated by multiplying annual DOE emissions by the ratio of Boeing annual/DOE year 2021 annual excavation volumes (150,000 cubic yards/35,000 cubic yards).
- 0.0 = emissions less than 0.05 tons per year.
- Sums presented in the table may differ from those calculated from table entries due to rounding.

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	8.6	70	78	0.1	3.6	3.5
On-road vehicles	0.8	12	13-14	0.0-0.1	0.2	0.2
Excavation					93	33
Daily Emissions Range	**9.4**	**82**	**91-92**	**0.1-0.2**	**97**	**37**
NASA Area I and II Alternatives						
Demolition – Year 1	16	88	160	0.0	16	8.0
Excavation – Years 2 and 3	8.0 – 14	72 – 120	110 – 210	0.0	6,800 – 16,000	1,400 – 3,300
Daily Emissions Range	**8.0 – 16**	**72 – 120**	**110 – 210**	**0.0**	**16 – 16,000**	**8 – 3,300**
Boeing Area I and III Alternatives						
Off-road equipment	8.7	58	68	0.1	3.2	3.1
On-road vehicles	1.2	8.6	26	0.1	0.5	0.2
Excavation					305	64
Daily Emissions	**10**	**67**	**95**	**0.2**	**308**	**67**
Total Daily SSFL Emissions Range	**27-35**	**221-269**	**296-397**	**0.3-0.4**	**421-16,405**	**112-3,404**

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.

Notes:

- Based on 250 workdays per year.
- 0.0 = emissions less than 0.05 pounds per day.
- Sums presented in the table may differ from those calculated from table entries due to rounding.

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 would occur at the same time at SSFL.

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 3–28 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 if they were to occur at the same time. 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. Implementation of a green cleanup truck fleet, as proposed by mitigation measure AQ-1 (see Chapter 6) would minimize project cumulative air quality impacts within Ventura County.

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 during conditions of southeast winds. 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 Ventura County, which borders the South Coast Air Basin. Emissions within the South Coast Air Basin from proposed DOE activities would occur intermittently from up to 32 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–8, would cause additional emissions impacts within the South Coast Air Basin. Given that the region is currently 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 exacerbate existing exceedances of an ambient ozone standard within the South Coast Air Basin. Implementation of a green cleanup truck fleet proposed by DOE would minimize project air quality impacts within the South Coast Air Basin.[4]

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 up to 32 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 substantially 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 currently 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 exacerbate existing exceedances of the ambient ozone standard within this region. Implementation of a green cleanup truck fleet proposed by DOE would minimize project 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

[4] 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.

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 88,000 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 13,600 total metric tons of carbon dioxide, respectively. The total cumulative carbon dioxide emissions generated by SSFL cleanup activities would amount to 240,600 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 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) to DOE's remediation activities 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) (see Chapter 4, Section 4.7). 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 daily number of heavy-duty 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 average about 16 per day, but in any case, shipments would remain at or below 32 per day throughout all stages of the project. 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 the maximum of 96 heavy-duty truck round trips per day by all responsible parties along the designated haul routes are listed in **Table 5–5**. 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). Although cumulative noise levels would be greater than the levels from DOE activities alone, these higher levels would occur for a shorter period of time.

Table 5–5 Traffic Noise Levels with Combined Total Number of Daily Heavy-Duty Truck Round Trips

Road and Road Segment	*Existing CNEL*	*Heavy-Duty Truck Scenario Noise Levels (dBA)*			
		32 Daily Round Trips		*96 Daily Round Trips*	
		CNEL	*Increase*	*CNEL*	*Increase*
Woolsey Canyon Road [a]					
between Valley Circle and Knapp Ranch Road [b]	57.4	58.8	1.4	61.7	4.3
at Facility Road [b]	32.1	33.5	1.4	36.8	4.7
Valley Circle Boulevard					
between Box Canyon and Woolsey Canyon Road	53.6	54.6	1.0	54.7	1.1
between Plummer Street and Schumann Road	58.4	59.3	0.9	59.4	1.0
between Woolsey Canyon Road and Chatlake Drive	58.9	60.2	1.3	60.4	1.5
between Vanowen Street and Victory Boulevard	68.2	68.9	0.7	68.9	0.7
between Burbank Boulevard and US-101 Freeway	69.1	69.8	0.7	69.8	0.7
Plummer Street					
between Valley Circle Boulevard and Farralone Avenue	60.5	61.4	0.9	61.5	1.0
Roscoe Boulevard					
between Woodlake Avenue and Shoup Avenue	64.5	65.7	1.1	65.8	1.2
between Shoup Avenue and Farralone Avenue	68.6	69.5	0.9	69.5	1.0
Topanga Canyon Boulevard					
north of Plummer Street	71.3	72.2	0.9	72.2	0.9
between Plummer Street and Roscoe Boulevard	71.7	72.5	0.9	72.6	0.9
south of Roscoe Boulevard	69.0	69.9	0.9	69.9	0.9

CNEL = community noise equivalent level; dBA = decibels A-weighted.

[a] Noise level calculated using Federal Highway Administration's Traffic Noise Model because the grade of Woolsey Canyon Road is outside of parameters of the Federal Highway Administration's Highway Noise Prediction Model FHWA-RD-77-108.

[b] Noise levels on Woolsey Canyon Road at Facility Road were calculated for a distance of 1,300 feet and noise levels on Woolsey Canyon Road between Valley Circle and Knapp Ranch Road were calculated at 30 feet reflecting the distance to the closest residence; all other road segments noise levels were calculated for a distance of 100 feet.

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 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 approximately 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 ROD 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 5–6**).

As shown in Table 5–6, 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 28 years of remediation activities at SSFL (the maximum evaluated remediation period) would range from 0.71 to 3.3 person-rem for workers and 0.30 to 0.98 person-rem for the general population. No LCFs would be expected. 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. 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 5–6 Cumulative Transportation-Related Radiological Collective Doses and Latent Cancer Fatalities (1943 – 2073)

Category	Collective Worker Dose (person-rem)	Collective General Population Dose (person-rem)
DOE Transportation Impacts in this EIS [a]	0.12 – 2.4 [b] 0.04 – 0.55 [c]	0.03 – 0.65 [b] 0.04 – 0.38 [c]
NASA remediation activities [d]	0.50	0.19
Boeing remediation activities [e]	0.13	0.05
Subtotal	0.67 – 3.0	0.28 – 0.89
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 – 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 4–53.

b Transport by truck.

c Transport by truck/rail.

d For purposes of analysis of transportation impacts, the relevant characteristics of NASA LLW/MLLW were assumed to be the same as those of DOE LLW/MLLW. Impacts 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 expected to generate no or small quantities of LLW/MLLW. For purposes of transportation impacts analysis, the relevant characteristics of Boeing LLW/MLLW were assumed to be the same as those of DOE LLW/MLLW. Impacts were estimated using the per shipment risk factors for shipments to Energy*Solutions* used in Table H–4.

f From DOE 2015a; 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 person-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 5–6). These potential LCFs averaged over 131 years results in about 4 LCFs per year. Over this same period (131 years), about 78 million people would die from cancer, based on the average annual number of cancer deaths in the United States of about 598,000, with about 1 percent fluctuation year to year (CDC 2015, 2016a, 2016b, 2017, 2018). 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 5–7 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 28 years), up to 4 (3.6) additional traffic accident fatalities could result.

Table 5–7 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]	0.03 – 3.0
NASA remediation activities at SSFL [b]	0.26 – 0.34
Boeing remediation activities at SSFL [c]	0.24
Subtotal for SSFL	**0.53 – 3.6**
Estimated traffic fatalities occurring in California (2019 – 2046)	100,320
Estimated traffic fatalities occurring in the four neighboring counties (2019 – 2046) [d]	26,530

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 4–48 and 4–49.
[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.
Note: Sums presented in the table may differ from those calculated from table entries due to rounding.

To put this number of traffic fatalities into perspective, during this same 28-year time frame, an estimated 100,000 traffic fatalities could occur in California, and an estimated 26,540 traffic fatalities could occur in the four nearby 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 0.004 percent of the total number of traffic fatalities expected in California and about 0.014 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) and volume-to-capacity ratios (V/C ratios) for these roads, and potential pavement deterioration.

Average Daily Traffic Volumes in the SSFL Vicinity

Impacts from vehicle movements to and from SSFL were analyzed for the same four routes as summarized in Table 4–55 and illustrated in Chapter 3, Figure 3–31 and assuming for analysis that all traffic would traverse each evaluated route. Impacts were evaluated by examining the percent increases compared to year 2018 baseline conditions (see Chapter 3, Table 3–16) of the EIS that SSFL remediation activities could have on the average daily traffic on roads in the SSFL vicinity.

Table 5–8 summarizes the annual projected number of heavy-duty truck round trips each by DOE, Boeing, and NASA. **Table 5–9** summarizes the total annual average daily number of heavy-duty truck round trips by DOE, Boeing, and NASA. For both tables, these trips include shipments of waste and deliveries of backfill, equipment and supplies. In these tables, the low combination reflects the addition of the DOE Low Impact Combination (Conservation of Natural Resources Alternative [Open Space Scenario] + Building Removal Alternative + Groundwater Monitored Natural Resource Alternative) plus the low range of truck shipments from NASA remediation efforts plus truck shipments from Boeing. The high combination reflects the addition of the DOE

High Impact Combination (Cleanup to AOC LUT Values Alternative + Building Removal Alternative + Groundwater Treatment Alternative) plus the high range of truck shipments from NASA remediation efforts plus truck shipments from Boeing.

For analysis, it was assumed that DOE would begin soil remediation after focusing on building demolition and that NASA and Boeing would both begin their remediation work at the same time that DOE begins soil remediation (approximately 2021). This is a conservative assumption because it results in an analysis that assumes significant overlap among DOE, Boeing, and NASA shipments.[5] It is conservatively assumed that Boeing shipments would require 2 years to complete, and that NASA shipments would require 5 to 7 years to complete, depending on the quantity of waste material to be removed, and that equal quantities of waste would be annually shipped for Boeing and NASA, depending on the total quantities of waste projected for each entity. The total number of heavy-duty truck trips by DOE correspond to those for the Low Impact and High Impact Combinations as summarized in Chapter 4, Section 4.8.2.4. Total Boeing and NASA truck trips are summarized in Table 5–1. Tables 5–8 and 5–9 reflect an assumed overlap among DOE, Boeing, and NASA shipments during years 3 and 4. For the low combination, there is also an overlap between DOE and NASA shipments for years 5 through 7. For the high combination, there is also an overlap between DOE and NASA shipments for years 5 through 9.

The increased truck trips summarized in Tables 5–8 and 5–9 were used, along with the projected numbers of light-duty vehicles, to estimate the percent increase in average daily traffic above baseline conditions for each evaluated route in the SSFL vicinity. Most light-duty vehicles are worker commuter vehicles. The numbers of worker commuter vehicles were determined for DOE, Boeing, and NASA in accordance with the assumptions for each action alternative as summarized in Table 5–1, and considering the years when the workers would be transiting the roads for work performed for each entity. The percent increases in traffic above baseline conditions for the low and high combinations of truck trips by DOE, Boeing, and NASA are listed on an annual basis in **Table 5–10**. ("Low" and "high" combinations are defined above.)

An increase in traffic under both combinations would occur on Woolsey Canyon Road. This largest annual increase on this road (up to 26 percent) would occur during the years when there is overlap among DOE, Boeing, and NASA shipments. The second largest increase on this road (up to 13 percent) would occur during the years when there is overlap between DOE and NASA shipments. The largest increase in traffic on other roads would occur on Valley Circle Boulevard from Woolsey Canyon Road to Plummer Street. Traffic delays or the perception of delays could occur on these and potentially other roads in the SSFL vicinity.

The truck/rail option is not evaluated in this EIS for shipment by Boeing or NASA. Therefore, the potential traffic impacts at the evaluated intermodal facilities would be minimal and the same as those determined for the action alternative combination analysis in Section 4.8.2.4.

[5] For example, it is assumed for analysis that waste from building removal for both NASA and Boeing would be shipped offsite starting in year 3. If some or all of the building removal waste was shipped offsite in earlier years, when DOE is proposing to perform building demolition, then the shipments for NASA and/or Boeing could be spread over a larger number of years than those assumed, resulting in lower increases in traffic on the evaluated roads.

Table 5–8 Number of Heavy-Duty Truck Roundtrips per Year by DOE, Boeing, and NASA [a,b]

Perp	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Years 11 – 27*	*Year 28*	*Totals*
Low Combination: DOE C of NR (OS) + BR + GWMNA; NASA Low Projection; Boeing Projection													
DOE	620	1,200	4,600	390	1	1	1	1	1	1	1/year	1	6,800
Boeing			7,400	7,400									14,800
NASA			11,500	11,500	11,500	11,500	11,500						58,100
Total	620	1,200	24,000	19,000	12,000	12,000	12,000	1	1	1	1/year	1	79,600
High Combination: DOE AOC LUT + BR + GWT; NASA High Projection; Boeing Projection													
DOE	620	1,200	4,600	4,600	4,000	4,000	4,000	4,000	4,000	4,000	4,000/year	575	104,000
Boeing			7,400	7,400									14,800
NASA			11,600	11,600	11,600	11,600	11,600	11,600	11,5600				80,800
Total	620	1,200	24,000	24,000	16,000	16,000	16,000	16,000	16,000	4,000	4,000/year	575	199,000

BR = Building Removal Alternative; C of NR (OS) = Conservation of Natural Resources Alternative (Open Space Scenario); GWMNA = Groundwater Monitored Natural Attenuation Alternative; GWT = Groundwater Treatment Alternative.

[a] Includes heavy- and medium-duty truck shipments of waste, backfill, equipment, and supplies.

[b] This table shows annual roundtrips. The low combination in this table reflects the combination of the DOE Low Impact Combination (Conservation of Natural Resources Alternative [Open Space Scenario] + Building Removal Alternative + Groundwater Monitored Natural Resource Alternative) plus the low range of truck shipments from NASA remediation efforts plus truck shipments from Boeing. The high combination in this table reflects the combination of the DOE High Impact Combination (Cleanup to AOC LUT Values Alternative + Building Removal Alternative + Groundwater Treatment Alternative) plus the high range of truck shipments from NASA remediation efforts plus truck shipments from Boeing.

Note: Values have been rounded.

Table 5–9 Average Daily Number of Heavy-Duty Truck Roundtrips [a,b]

Year 1 [b]	*Year 2* [b]	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Year 11 - 27*	*Year 28*	*Maximum*
Low Combination: DOE C of NR (OS) + BR + GWMNA; NASA Low Projection; Boeing Projection												
2	5	96	96	76	48	48	0.0040	0.0040	0.0040	0.0040/day	0.0040	96
High Combination: DOE AOC LUT + BR + GWT; NASA High Projection; Boeing Projection												
2	5	96	96	64	64	64	64	64	16	16/day	2	96

BR = Building Removal Alternative; C of NR (OS) = Conservation of Natural Resources Alternative (Open Space Scenario); GWMNA = Groundwater Monitored Natural Attenuation Alternative; GWT = Groundwater Treatment Alternative.

[a] Includes heavy- duty truck shipments of waste, backfill, equipment, and supplies.

[b] This table shows average daily roundtrips for heavy-duty trucks. The low combination in this table reflects the combination of the DOE Low Impact Combination (Conservation of Natural Resources Alternative [Open Space Scenario] + Building Removal Alternative + Groundwater Monitored Natural Resource Alternative) plus the low range of truck shipments from NASA remediation efforts plus truck shipments from Boeing. The high combination in this table reflects the combination of the DOE High Impact Combination (Cleanup to AOC LUT Values Alternative + Building Removal Alternative + Groundwater Treatment Alternative) plus the high range of truck shipments from NASA remediation efforts plus truck shipments from Boeing.

Note: Values reflect rounded totals from Table 5–8.

Table 5–10 Percent Increase in Traffic Above Baseline Conditions for Cumulative Remediation Efforts by DOE, NASA, and Boeing [a,b]

Road	*Segment*	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 9*	*Year 10*	*Years 11 to 27*	*Year 28*
Low Combination: DOE C of NR (OS) + BR + GWMNA; NASA Low Projection; Boeing Projection													
Woolsey Canyon Rd	SSFL entrance to Valley Circle Blvd	5.1	5.2	26	22	10	10	10	0.039	0.039	0.039	0.039	0.039
Valley Circle Blvd	Woolsey Canyon to Plummer Street	2.0	2.1	10	8.7	3.9	3.9	3.9	0.015	0.015	0.015	0.015	0.015
	Woolsey Canyon to Roscoe Blvd	1.4	1.5	7.3	6.1	2.7	2.7	2.7	0.011	0.011	0.011	0.011	0.011
	Roscoe Blvd to Victory Blvd	0.62	0.64	3.2	2.7	1.2	1.2	1.2	0.0048	0.0048	0.0048	0.0048	0.0048
	Victory Blvd to U.S. Highway 101	0.35	0.36	1.8	1.5	0.68	0.68	0.68	0.0027	0.0027	0.0027	0.0027	0.0027
Roscoe Blvd	Valley Circle Blvd to Topanga Canyon Blvd	1.6	1.6	8.2	6.9	3.0	3.0	3.0	0.012	0.012	0.012	0.012	0.012
Plummer Street	Valley Circle Blvd to Topanga Canyon Blvd	2.3	2.4	12	10	4.5	4.5	4.5	0.018	0.018	0.018	0.018	0.018
Topanga Canyon Blvd	Plummer Street to SR 118 (Ronald Reagan Freeway)	0.30	0.31	1.5	1.3	0.57	0.57	0.57	0.0023	0.0023	0.0023	0.0023	0.0023
	Roscoe Blvd to SR 118 (Ronald Reagan Freeway)	0.30	0.31	1.5	1.3	0.57	0.57	0.57	0.0023	0.0023	0.0023	0.0023	0.0023
	Roscoe Blvd to U.S. Highway 101	0.27	0.28	1.4	1.2	0.53	0.53	0.53	0.0021	0.0021	0.0021	0.0021	0.0021
SR 118	Junction with Topanga Canyon Blvd	0.10	0.10	0.50	0.42	0.19	0.19	0.19	0.0007	0.0007	0.0007	0.0007	0.0007
U.S. Highway 101	Junction with Topanga Canyon Blvd	0.052	0.054	0.27	0.23	0.10	0.10	0.10	0.00040	0.0004	0.0004	0.0004	0.0004
High Combination: DOE AOC LUT + BR + GWT; NASA High Projection; Boeing Projection													
Woolsey Canyon Rd	SSFL entrance to Valley Circle Blvd	5.1	5.3	29	24	13	13	13	13	13	3.3	3.3	3.3
Valley Circle Blvd	Woolsey Canyon to Plummer Street	2.0	2.1	11	9.5	5.2	5.2	5.2	5.1	5.1	1.3	1.3	1.3
	Woolsey Canyon to Roscoe Blvd	1.4	1.5	7.9	6.7	3.6	3.6	3.6	3.6	3.6	0.9	0.9	0.9
	Roscoe Blvd to Victory Blvd	0.62	0.65	3.5	3.0	1.6	1.6	1.6	1.6	1.6	0.40	0.40	0.40
	Victory Blvd to U.S. Highway 101	0.35	0.36	2.0	1.7	0.90	0.90	0.90	0.90	0.90	0.23	0.23	0.23
Roscoe Blvd	Valley Circle Blvd to Topanga Canyon Blvd	1.6	1.6	8.9	7.5	4.1	4.1	4.1	4.1	4.1	1.0	1.0	1.0
Plummer Street	Valley Circle Blvd to Topanga Canyon Blvd	2.3	2.4	13	11	6.0	6.0	6.0	6.0	6.0	1.5	1.5	1.5

Road	Segment	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Years 11 to 27	Year 28
Topanga Canyon Blvd	Plummer Street to SR 118 (Ronald Reagan Freeway)	0.30	0.31	1.7	1.4	0.77	0.77	0.77	0.76	0.76	0.19	0.19	0.19
	Roscoe Blvd to SR 118 (Ronald Reagan Freeway)	0.30	0.31	1.7	1.4	0.77	0.77	0.77	0.76	0.76	0.19	0.19	0.19
	Roscoe Blvd to U.S. Highway 101	0.27	0.29	1.6	1.3	0.71	0.71	0.71	0.71	0.71	0.18	0.18	0.18
SR 118	Junction with Topanga Canyon Blvd	0.10	0.10	0.55	0.46	0.25	0.25	0.25	0.25	0.25	0.063	0.063	0.063
U.S. Highway 101	Junction with Topanga Canyon Blvd	0.052	0.055	0.30	0.25	0.14	0.14	0.14	0.14	0.14	0.034	0.034	0.034

Blvd = Boulevard; BR = Building Removal Alternative; C of NR (OS) = Conservation of Natural Resources Alternative (Open Space Scenario); GWMNA = Groundwater Monitored Natural Attenuation Alternative; GWT = Groundwater Treatment Alternative; NASA = National Aeronautics and Space Administration; Rd = Road; SR = State Route.

[a] Includes heavy- duty truck shipments of waste, backfill, equipment, and supplies, as well as light-duty vehicles such as worker vehicles.

[b] The low combination in this table reflects the combination of the DOE Low Impact Combination (Conservation of Natural Resources Alternative [Open Space Scenario] + Building Removal Alternative + Groundwater Monitored Natural Resource Alternative) plus the low range of truck shipments from NASA remediation efforts plus truck shipments from Boeing. The high combination in this table reflects the combination of the DOE High Impact Combination (Cleanup to AOC LUT Values Alternative + Building Removal Alternative + Groundwater Treatment Alternative) plus the high range of truck shipments from NASA remediation efforts plus truck shipments from Boeing.

Note: Values have been rounded

Level of Service and Volume-to-Capacity Ratios

As with the analysis in Chapter 4, Section 4.8.2, DOE performed an analysis of the cumulative impacts of traffic on the LOS and V/C ratio for four selected intersections and four selected road segments in the SSFL Area. Except for Woolsey Canyon Road, the intersections and road segments evaluated in this EIS were selected from those intersections and road segments that showed existing (year 2018) or future year LOS levels of E or F as determined in the 2017 Traffic Study prepared for the DTSC *Draft Program EIR* (DTSC 2017b):[6]

Intersections:

- Topanga Boulevard and State Route (SR)-118 westbound ramps (signalized)
- Topanga Canyon Boulevard and SR-118 eastbound ramps (signalized)
- Valley Circle Boulevard and Woolsey Canyon Road (unsignalized)
- Topanga Canyon Boulevard and Roscoe Boulevard (signalized)

Road Segments:

- Woolsey Canyon Road from Valley Circle Boulevard to Knapp Ranch Road
- Valley Circle Boulevard from Box Canyon Road to Woolsey Canyon Road
- Valley Circle Boulevard from Woolsey Canyon Road to Chatlake Drive
- Roscoe Boulevard from Shoup Avenue to Farralone Avenue

As discussed in Appendix H, DOE performed this additional analysis using the Highway Capacity Software (HCS) for selected road segments and signalized and unsignalized intersections (Highway Capacity Software Version 7, University of Florida McTrans Center).

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 heavy-duty truck round trips and an additional 260 auto round trips (for analysis purposes, the auto round trips were rounded to 250, making a total of about 692 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.

Table 5–11 shows the impacts on LOS and the V/C ratio for the four intersections and four road segments assuming a daily scenario of 96 heavy-duty truck round trips and 250 worker commutes per day. In this table, the difference in LOS and V/C ratio between the 2018 Baseline and 2018 columns show the impacts that this additional traffic would have on the evaluated roads. For subsequent years (e.g., 2022, 2026, and 2032), it was assumed that in addition to cumulative traffic, traffic in the SSFL area would grow at a rate of 1 percent per year, which is the same assumption used for the analysis in the 2017 DTSC Traffic Study (DTSC 2017b).[7] The analysis cutoff is at 2032, which is also consistent with the 2017 DTSC Traffic Study. This analysis is conservative because, as illustrated in Table 5–10, the duration of cleanup activities will not be constant at this high level over this entire time period. Consequently, even if there are periods of time that Boeing, NASA, and

[6] LOS is a qualitative measurement of operating conditions that ranges from A to F, as summarized in Chapter 4, Table 4–56. The V/C ratio is the ratio of the traffic demand to signal cycle capacity for signalized intersections, or for road segments, the ratio of the traffic demand to the road lane capacity. A V/C ratio greater than 1 indicates that the cycle capacity or road segment capacity is fully utilized (approaching unstable conditions).

[7] Note that in another study, the populations in Los Angeles and Ventura Counties were projected to increase by 9 percent from 2016 through 2030 (California Department of Finance 2018), which corresponds to a 9 percent increase over 14 years, or about 0.6 percent per year.

DOE are all operating at fairly high levels of activity, the impacts would not be expected during all of these years.

Table 5–11 Intersection and Segment Level of Service and Volume-to-Capacity Ratio for DOE, NASA, and Boeing Remediation Activities at the Santa Susana Field Laboratory[a]

Intersection	Time Period	Analysis Year									
		2018 (Baseline)		2018		2022		2026		2032	
		LOS	V/C Ratio[b]	LOS	V/C Ratio[b]	LOS	V/C Ratio[b]	LOS	V/C Ratio[b]	LOS	V/C Ratio[b]
Intersection											
Valley Circle Blvd and Woolsey Canyon Rd	AM PM	D C	0.58 0.25	F F	0.95 0.92	F F	1.07 0.97	F F	1.19 1.04	F F	1.44 1.15
Topanga Canyon Blvd and SR 118 Westbound Ramp	AM PM	F F	1.59 1.25	F F	1.72 1.25	F F	1.78 1.30	F F	1.85 1.35	F F	1.95 1.44
Topanga Canyon Blvd and SR 118 Eastbound Ramp	AM PM	D D	1.03 1.12	D E	1.03 1.23	E E	1.07 1.28	E E	1.12 1.33	F F	1.21 1.41
Topanga Canyon Blvd and Roscoe Blvd	AM PM	C D	0.95 0.90	D D	1.17 0.92	D D	1.26 0.99	E D	1.35 1.05	E E	1.52 1.13
Road Segment											
Woolsey Canyon Rd from Valley Circle to Knapp Ranch Rd	AM PM	A B	0.09 0.10	C C	0.20 0.22	C C	0.20 0.22	C C	0.21 0.22	C C	0.21 0.23
Valley Circle Blvd from Box Canyon Rd to Woolsey Canyon Rd	AM PM	D D	0.49 0.37	D D	0.61 0.48	E D	0.63 0.50	E D	0.65 0.51	E D	0.68 0.54
Valley Circle Blvd from Woolsey Canyon Rd to Chatlake Dr	AM PM	D D	0.53 0.41	E D	0.64 0.52	E D	0.66 0.54	E D	0.69 0.56	E D	0.72 0.58
Roscoe Blvd from Shoup Ave to Farralone Ave	AM PM	B B	0.36 0.44	B C	0.41 0.49	B C	0.42 0.50	B C	0.43 0.52	C C	0.46 0.55

Ave = Avenue; Blvd = Boulevard; Dr = Drive; LOS = level of service; Rd = Road; SR = State route; V/C ratio = volume-to-capacity ratio.

[a] Based on the maximum level of truck traffic (96 round trips per day) and about 250 worker vehicles per day.

[b] Representing the highest lane group V/C ratio (left turns, right turns, or through movements).

Note: Morning (AM) and afternoon (PM) traffic conditions are peaks for these time periods.

Table 5–11 shows that compared to 2018 baseline conditions, three intersections would experience a decrease in LOS –Woolsey Canyon Road with Valley Circle Boulevard (unsignalized) (which would degrade from LOS D during the AM peak traffic conditions and LOS C during PM peak traffic conditions to LOS F for both periods); Topanga Canyon Boulevard and State Route 118 Eastbound ramp (signalized) (which would degrade from LOS D to LOS E during PM peak traffic conditions is currently a LOS F (forced traffic flow with considerable delays); and Topanga Canyon Boulevard with Roscoe Boulevard (signalized) (which would degrade from LOS C to LOS D during AM peak traffic conditions). The intersection of Topanga Canyon Boulevard with the State Route 118 Westbound ramp (signalized) is already operating at LOS F under both AM and PM traffic conditions. The V/C ratio for two of the three signalized intersections exceeds 1.0 (capacity conditions) for both AM and PM peak traffic under 2018 baseline conditions. The scenario of 96 daily heavy-duty trucks significantly increases the V/C ratios for AM or PM traffic conditions for all three signalized intersections, with V/C ratios exceeding 1.0 for AM and/or PM traffic conditions. The magnitude of or projected increases in V/C ratios for the intersections would be considered significant under City of Los Angeles guidance (LADOT 2016). This level of traffic associated with

SSFL would also cause a reduction in LOS for some road segments, with one section, Valley Circle Boulevard from Woolsey Canyon Road to Chatlake Drive, falling from an LOS of D to E (unstable traffic flow and significant delays) during AM peak hours and increases in V/C ratios of 0.11 for both AM and PM peak traffic conditions. Of interest is the increased level of congestion from the year 2022 onward; by 2026, the LOS ratings are E or F for all four evaluated intersections for AM or PM peak traffic conditions with V/C ratios exceeding 1.0. DOE soil removal and remediation by Boeing and NASA are assumed to begin in approximately 2021, suggesting that remediation would begin and continue at a time of significant traffic congestion.

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 was assumed to use a single route. In reality, other than Woolsey Canyon Road, traffic volumes on roads near SSFL could be reduced by using a combination of routes that would diffuse traffic impacts over the road system. Similarly, distributing traffic between SSFL and major highways on multiple routes would reduce the impacts of this increased traffic on intersections other than Woolsey Canyon Road with Valley Circle Boulevard. Traffic delays at this intersection may be mitigated through installation of a traffic signal (see Chapter 6, Table 6–2, Mitigation Measure TR-2).

The traffic analysis in Chapter 4, Section 4.8.2, indicated that over time there would be a general increase in traffic congestion (i.e., a decrease in LOS and an increase in the V/C ratio) at the evaluated intersections and road segments. Based on an assumed 1 percent per year population growth, the worsening traffic conditions were associated with increased traffic, independent of SSFL remediation-related traffic. The cumulative impacts presented in Table 5–11 show that the assumed 96 heavy-duty truck round trips per day and 250 workers commutes would have an effect on the intersections and along road segments, causing the drop in LOS to occur sooner and be more severe than would occur with just the DOE traffic (i.e., as compared to Tables 4–57 and 4–58).

Pavement Deterioration

Pavement deterioration impacts were estimated using a low estimate of 78,800 cumulative truck shipments and a high estimate of 200,000 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. Estimated cumulative equivalent single axle loads (ESALs) associated with DOE, NASA, and Boeing truck trips at SSFL would range from approximately 165,000 to 462,000, depending on the remediation option and the route traveled. The results are summarized in **Table 5–12**. The increase in truck traffic results in a substantial number of ESALs, which would likely have negative impacts on some roads in the SSFL vicinity and result in their needing repair sooner than currently anticipated.

Table 5–12 Estimated Equivalent Single Axle Loads Associated with DOE, NASA, and Boeing Remediation Activities at the Santa Susana Field Laboratory

Combinations	*Total ESALs*
DOE low + Boeing + NASA low	165,000
DOE high + Boeing + NASA high	462,000

ESALs = equivalent single axle loads.

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. Consistent with EPA guidance (EPA 2014), the onsite resident scenario conservatively includes exposure for 24 hours a day, 350 days per year, for 26 years (for ages 0 to 26) (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 sufficiently separated (by 100s of yards) 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 onsite recreational user could travel across SSFL and be potentially exposed in SSFL areas currently controlled by NASA or Boeing; however, the assumption that the recreational user is exposed 8 hours per day for 75 days per year for 26 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 potential impacts on an onsite recreational user presented in Chapter 4, Table 4–63, are based on an analysis of 19 example exposure units in Area IV. Risks or hazards at other locations are expected to be less than the 19 evaluated exposure units because they were selected primarily for their higher concentrations of chemical and radiological constituents. Because there is a limit on the expected duration of exposure of the onsite recreational user and because a recreational user can only be in one area at a time, the recreational user could not be exposed in the DOE remediation area and either of the other two areas simultaneously. However, a recreational user could traverse the site and be exposed in Boeing or NASA remediation areas for part of the exposure duration. If time were spent in other areas, the cumulative effect would be a reduction in impacts if the concentrations of chemicals and/or radionuclides resulted in lower exposure or an increase in impacts if they resulted in a higher exposure. Because Boeing, NASA, and DOE are each remediating their respective areas of SSFL to be protective of human health, the cumulative effect would be expected to be similar to that calculated by DOE for Area IV and the NBZ.

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.

The offsite residential and recreational exposures would be cumulative for NASA, Boeing, and DOE remediation activities. Estimates of offsite impacts are not available for NASA and Boeing remediation activities. However, the offsite impacts shown in this *SSFL Area IV EIS* for DOE remediation activities are three to eight orders of magnitude below impact thresholds (see Section 4.9.7) and below the threshold for comparison of alternative impacts. Impacts from NASA and Boeing remediation activities would be expected to be in a similar range. Based on that expectation, offsite cumulative impacts would still be two to seven orders of magnitude below the acceptable risk range of 1 in 10,000 to 1 in 1 million.

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 (Open Space Scenario), 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 result in the excavation of up to 870,000 cubic yards of soil. 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 DTSC *Draft Program* EIR (DTSC 2017a), this soil waste was estimated to consist of approximately 3 percent LLW or mixed low-level radioactive waste (MLLW) (about 26,000 cubic yards); 80 percent hazardous waste (about 696,000 cubic yards); and 17 percent nonhazardous waste (about 148,000 cubic yards). For the low end of the range and consistent with the *NASA FEIS* (NASA 2014a), it was assumed that 28 percent of the affected soil (about 244,000 cubic yards) would be treated on site and would remain on site, and the remaining 72 percent (about 626,000 cubic yards) would be shipped off site for treatment or disposal. The 626,000 cubic yards to be shipped off site was assumed to consist of 26,000 cubic yards of LLW or MLLW; 148,000 cubic yards of nonhazardous waste; and 452,000 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).[8] Finally, NASA is projected to generate up to 2,800 cubic yards of nonhazardous waste from groundwater remediation activities.

Boeing expects its remediation waste to principally consist of about 150,000 cubic yards of excavated soil, of which about 24,200 cubic yards would contain hazardous constituents in sufficient concentrations to warrant classification as hazardous waste, about 119,000 would be classified as nonhazardous waste, and 6,500 cubic yards would be classified as LLW.

In addition, Boeing is projected to generate about 112,000 cubic yards of waste and recycle material from building demolition, consisting of about 5,600 cubic yards of hazardous waste, about 48,200 cubic yards of nonhazardous waste, and 58,200 cubic yards of recycle material. Finally, Boeing is

[8] Converted from tons, assuming 1.5 tons per cubic yards (see Appendix D).

projected to generate up to 2,000 cubic yards of nonhazardous waste from groundwater remediation activities.

Table 5–13 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 25 to 79 percent of the cumulative volume of LLW and MLLW, 0.29 to 0.43 percent of the cumulative volume of hazardous waste, 10 to 69 percent of the cumulative volume of nonhazardous waste (principally soil), and about 4 percent of the cumulative volume of recycle material.

Table 5–13 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	10,800 to 125,000	2,100	37,200to 770,000	3,540
NASA	26,000	455,000 – 699,000	177,000	34,200 [a]
Boeing	6,540	29,800	169,000	58,200
Total	43,400 to 158,000	487,000 – 731,000	383,000 to 1,120,000	96,000
DOE Percentage of Total	25 to 79	0.29 – 0.43	10 to 69	4

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 2017a; NASA 2014a, 2017a.

The impacts on waste management facilities from treatment and disposal of the wastes projected in Table 5–13 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:

- Chiquita Canyon Landfill in California for nonhazardous waste,
- Antelope Valley Landfill in California for nonhazardous waste,
- Buttonwillow Landfill in California for hazardous waste,
- Energy*Solutions* facility in Utah for LLW and MLLW, and
- 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 5–14**. 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 5–14 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	1.9 to 5.6
Chiquita Canyon	Nonhazardous	96,000,000	0.401 to 1.2
Buttonwillow	Hazardous	10,000,000	4.9 to 7.3
US Ecology in Idaho	Hazardous	10,000,000	4.9 to 7.3
Energy*Solutions*	LLW/MLLW	4,530,000	0.96 to 3.5

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste.
[a] Source: Chapter 4, Table 4-73.
[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 5–10. 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.
[c] Approximately 4.2 million cubic yards of LLW and 360,000 cubic yards of MLLW disposal space remains as of August 2016 (Chapter 4, Table 4-73).
Note: Values have been rounded.

For example, the maximum projected cumulative nonhazardous waste volume of approximately 1,116,000 cubic yards (Table 5–13) 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 5–13 would represent fractions of the permitted daily tonnage limits at the Chiquita Canyon, Antelope Valley, or Buttonwillow Landfills, as shown in **Table 5–15**. 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 5–15 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	17
Chiquita Canyon	Nonhazardous	6,500	9.2
Buttonwillow	Hazardous	10,500	6.5
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 4-73.
[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, assuming a waste payload of 23 tons per shipment for DOE, 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 126 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–8).

5.5.11.1 Archaeological Resources

Adverse impacts on the *National Register of Historic Places* (NRHP)-eligible sites in the DOE-administered portions of Area IV and the NBZ would be addressed through implementation of a Programmatic Agreement under Section 106 of the National Historic Preservation Act (NHPA). Consistent with the 2010 AOC (DTSC 2010a), DOE has identified locations of known archaeological sites as areas in which the exemption process would be applied. In the soil remediation plan that DOE would submit for DTSC approval, DOE would propose that areas subject to the exemption process be cleaned of chemical and radionuclide constituents if they pose a risk to human health or the environment. Therefore, some archaeological sites may be impacted by cleanup activities. In accordance with the Section 106 Programmatic Agreement currently under development, DOE will prepare one or more Historic Properties Treatment Plans. The plans will document which historic properties will be avoided, if any; describe the scope of the adverse effects on historic properties that cannot be avoided; and, as appropriate, include measures to minimize and mitigate such adverse effects, including the manner in which these measures will be carried out and a schedule for their implementation. NRHP-eligible sites would also be addressed under the NHPA on NASA's[9] areas.

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 data recovery of the site, including documentation, curation of artifacts, and ultimately removal (destruction) 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 without mitigation. Potential destruction of NRHP-eligible sites in Area IV would add to cumulative, regional impacts. However, this would be a small contribution to cumulative, regional impacts due to the small number of sites impacted and the implementation of mitigation measures through the Section 106 Programmatic Agreement. The overall number of archaeological sites in the region, particularly those that are not eligible for the NRHP, could continue to be reduced as a result of past, present, and reasonably foreseeable future actions.

5.5.11.2 Architectural Resources

No structures located in DOE-administered Area IV are individually eligible for listing on the NRHP. The remaining structures in Area IV have been evaluated for NRHP and California Register eligibility and are not contributing elements to a historic district (OHP 2010; 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 NRHP-eligible structures 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 Sites 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 may affect some archaeological resources in Area IV and

[9] NASA, the California SHPO and the Advisory Council on Historic Preservation executed a Programmatic Agreement under NHPA Section 106 that stipulates activities for the protection of NRHP-eligible sites in the areas being remediated by NASA (NASA/SHPO/ACHP 2014).

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 areas of religious and cultural importance 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 areas of religious and cultural importance.

5.5.12 Socioeconomics

SSFL Employment

As described in Table 5–1, DOE, NASA, and Boeing cleanup activities at SSFL would require up to 260 onsite workers during periods of maximum activity. DOE activities would require up to 85 workers (33 percent of the total workers). It was assumed that workers would originate primarily from Ventura and Los Angeles Counties because about 114,000 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–8, 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 heavy-duty truck round trips for DOE, NASA, and Boeing activities would be limited to 96. Some drivers would travel long distances on multi-day trips; therefore, additional drivers could be used. Assuming an average of 96 daily heavy-duty truck trips, a level of effort that would only be expected for a few years, from 42 to 187 truck drivers could be employed for DOE, NASA, and Boeing cleanup activities. In 2015, approximately 5,400 workers were employed in specialized freight trucking in the two counties, plus approximately 29,200 employees in general truck transportation (see Chapter 3, Section 3.12, Tables 3–37 and 3–38). Employment of 42 to 187 truck drivers would represent 0.78 to 3.5 percent of the available, specialized freight 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 would be assumed to spend money in the region with or without the SSFL remediation projects.

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 related to increased traffic. Because traffic conditions near businesses on this road would not increase substantially from existing conditions (up to 1.7 percent), customers would be 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 (from 26 to 29 percent during a few years) 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 2016 through 2030; average of less than 1 percent per year (California Department of Finance 2018). As described in Section 5.5.8.2, the traffic analysis in Chapter 4, Section 4.8.2, indicated that over time there would be a general increase in traffic congestion (i.e., a decrease in LOS and an increase in the V/C ratio) at the evaluated intersections and on the evaluated road segments. Based on an assumed 1 percent per year population growth, the worsening traffic conditions were associated with increased traffic independent of DOE's remediation-related traffic. The assumed 96 heavy-duty truck round trips per day and 250 workers commutes would have an effect on the intersections and along road segments, causing the drop in LOS to occur sooner and be more severe than would occur with just the population growth. Population growth could increase traffic levels, but also could increase spending by local and State government agencies on roadways and mass transit projects. This could serve to mitigate some of the negative effects of population growth and the remediation activities.

Infrastructure and Municipal Services

As shown in Table 5–1, cleanup activities by DOE, NASA, and Boeing would result in a minimum of 78,800 truck trips to a maximum of 200,000 truck trips to and from SSFL over a 28-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 could make a substantial incremental contribution to this cumulative impact because the DOE truck trips of 6,900 to 104,000 would be 9 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 9 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–8) 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 highest average daily truck deliveries to LLW or MLLW facilities would be 15 trucks (see Appendix D). Considering all DOE action alternative combinations, the highest average daily truck deliveries to facilities for other types of waste would be 30 at hazardous waste facilities, 35 at nonhazardous waste facilities, and 43 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 generally be small and multiple disposal facilities may be used.

With respect to LLW/MLLW facilities, Energy*Solutions* in Utah, NNSS, nor Waste Control Specialists (WCS) in Texas, the largest increase in traffic on the roads that would be used to access the facilities would be only about 1 percent, and all are located near residential or urban areas, and there are few, if any, local businesses on local roads used to access the facilities.

With respect to hazardous waste facilities, US Ecology in Idaho is located in a rural area. Although the average daily traffic on the highway used for facility access could increase by about 12 percent during a few years, there are few, if any, local businesses along this highway. Regarding the Buttonwillow Landfill, there would be increased traffic at the town of Buttonwillow (by about 3 percent during a few years); however, 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.

With respect to nonhazardous waste facilities, there would be an increase in traffic at the towns of Buttonwillow and McKittrick, although minimal impacts would be expected due to the same reasons as those above for the Buttonwillow Landfill. Because the Chiquita Canyon Sanitary Landfill is immediately adjacent to a four-lane highway with turning lanes, which would be used to access the facility, and the average daily traffic would increase by only about 0.2 percent during a few years, deliveries to this facility would not be expected to result in economic impacts. Trucks delivering waste to the Antelope Valley Landfill would not likely need to pass through major commercial areas, and the increase in average daily traffic on the main access road to this facility would be much less than 1 percent. Thus no socioeconomic impacts on businesses would be expected.

Truck traffic at the evaluated recycle facilities would be small; thus, no impacts on local businesses would be expected.

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 78,800 and 200,000 heavy-duty truck round trips for deliveries and waste transport, with the number of daily truck round trips for all activities limited to 96 heavy-duty trucks. As presented in Section 5.5.8.1, the radiation dose from all transportation activities at SSFL would range from 0.77 to 3.2 person-rem for workers and 0.26 to 0.93 person-rem for the general population (see Table 5–6). As identified in Section 5.5.8, 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 heavy-duty truck round trips and an additional 260 (rounded to 250) auto round trips, making a total of 346 daily round trips. As shown in Table 5–11 over the duration of soil removal, there could be a degradation of the LOS for the intersections and road segments analyzed. However, the routes between SSFL and major highways and continuing to the waste disposal facilities would traverse minority and non-minority communities, as well as low-income and non-low-income communities at the same frequency and volume 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. Therefore, there would be no disproportionately high and adverse effects on minority or low-income populations, including Native American tribes.

Potential traffic accident fatalities from SSFL activities would range from 1 (0.55) to 4 (3.7) (see Table 5–7) over the evaluated 28-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 0.004 percent of the total number of traffic fatalities expected in California (100,000) and about 0.01 percent of the total number of traffic fatalities expected in the four surrounding counties (26,500) during this period. Therefore, they are indistinguishable from the total 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 or low-income populations would be the same as those experienced by the general population. Therefore, no disproportionately high and adverse cumulative effects on minority or 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 or bicyclists along or crossing Woolsey Canyon Road, but this risk would be experienced by persons of all ages. Although the average daily traffic on this road could significantly increase during a few years (i.e., up to 29 percent assuming 96 daily truck round trips and 260 worker commutes – see Table 5–10), 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. Nonetheless, potential impacts on all persons of all ages may be minimized through preparation and implementation by DOE, Boeing, and NASA of traffic plans comparable to the Traffic Management/Haul Route Plan proposed by DOE and summarized in Chapter 6, Table 6–1 (Minimization Measure 8-1). In addition, about 73 percent of the increased traffic projected for Woolsey Canyon Road would be due to worker commutes, and this increased traffic could be reduced through implementation of worker ride sharing programs by DOE, Boeing, and NASA.

Traffic densities and therefore risks to pedestrians along other evaluated routes are expected to be larger during some years than those under baseline conditions and somewhat elevated during other years. For example, during years when DOE, NASA, and Boeing shipments are assumed to overlap (see Table 5–10), the average daily traffic on Valley Circle Boulevard between Woolsey Canyon Road and Plummer Street could increase by up to 11.3 percent; on Plummer Street between Valley Circle Boulevard and Topanga Canyon Boulevard by up to 13 percent; on Valley Circle Boulevard between Woolsey Canyon Road and Roscoe Boulevard by up to 7.9 percent; on Roscoe Boulevard between Valley Circle Boulevard and Topanga Canyon Boulevard by up to 8.9 percent; and on Valley Circle Boulevard south of Roscoe Boulevard by up to 3.5 percent. As shown in Chapter 3, Figure 3–29, it would not be possible to avoid schools, recreation areas, and/or retirement homes because each route would have to pass by one or more of these types of facilities.

The increased combined DOE, NASA, and Boeing traffic could result in risks to pedestrians or bicyclists, including sensitive aged individuals. These risks may be minimized, however, through preparation and implementation by DOE, NASA, and Boeing of traffic plans comparable to DOE's proposed Traffic Management/Haul Route Plan as discussed above. In addition, about 73 percent of the increased traffic in the SSFL area would be due to worker commutes, and this increased traffic could be reduced through implementation of worker ride sharing programs by DOE, NASA, and Boeing. Finally, except for Woolsey Canyon Road and its intersection with Valley Circle Boulevard, traffic on SSFL area roads and intersections can be reduced by distributing 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. No disparate impacts (markedly different than those on the general population) are would be expected on sensitive-aged populations in the SSFL ROI and the above measures would lessen those impacts.

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 *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final 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 Endangered Species Act, California Fish and Game Code Sections 3503 and 3503.5, and Executive Order 13186, 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. 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.

For biological resources, minimization measures were refined and developed as part of the consultation with Federal and State agencies. DOE coordinated and consulted 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 developed a biological assessment that covers the SSFL site and the remediation activities of DOE, with input from Boeing and the National Aeronautics and Space Administration (NASA). The results of the biological assessment, which covers the combined and cumulative impacts on biological resources, has been considered in this Final EIS to inform the final development of biological minimizations for Area IV and the NBZ. DOE will implement the minimization measures included in the biological opinion issued by the U.S. Fish and Wildlife Service (see Appendix J).

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, 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 through stakeholder comments on the *Draft SSFL Area IV EIS*, 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, 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 potential 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 cultural resources, mitigation measures were refined and developed as part of the consultation with State agencies and tribal organizations. DOE coordinated and consulted 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.

Adverse effects to historic properties are assessed through the National Historic Preservation Act (NHPA), Section 106 process. Where adverse effects are identified, 36 CFR 800.6(b) states, "[t]he agency official shall consult with the SHPO [State Historic Preservation Officer]/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 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. In compliance with Section 106 of the NHPA, DOE is consulting with federally and non-federally recognized tribes near SSFL. The consultation includes the SHPO, the federally recognized Santa Ynez Band of Chumash Indians, and other non-federally recognized tribes.

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.

DOE is preparing a Programmatic Agreement pursuant to 36 CFR 800.14(b) based on consultations with the California Office of Historic Preservation, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties.[1] This agreement will establish procedures for addressing adverse effects on historic properties and will satisfy DOE's responsibilities under Section 106.

[1] A Programmatic Agreement pursuant to 36 CFR 800.14(b) is the most suitable agreement document for DOE's remediation at SSFL because the effects on historic properties cannot be fully determined prior to approval of the undertaking.

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 the Ventura County Division of Building and Safety.
2-4	Soil backfilling	Backfilling will proceed in completed excavated areas within 2 weeks of DTSC/EPA verification that the cleanup meets appropriate levels 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] • DOE will take steps to prevent damage (scraping or gouging) of existing exposed bedrock features during the excavation of soil in Area IV and the NBZ. • 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. Land cleared for short-term storage will be kept to a minimum. • Sort debris at the site of removal using a suitable nearby area. • Establish re-contouring of land to protect drainages and prevent erosion.

Item Number	*Subtopic*	*Description*
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.
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, ECP, and Construction 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 soil 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 acknowledges that DOE's cleanup is complete. Periodic sampling to assess soil concentration during and following the natural degradation process applies only to soils impacted with TPH. 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. The frequency of groundwater monitoring reports may be modified as needed by DTSC.
Groundwater		
4-1	Water use reduction	If there is sufficient water volume withdrawn from the aquifer during remediation activities and if a discharge permit can be obtained from the California Regional Water Quality Control Board, the water would be treated and discharged on site through the permitted discharge point. If there is an insufficient volume of water withdrawn, or if a discharge permit cannot be obtained, the water will be transported off site for treatment and disposal. If groundwater remediation is concurrent with soil remediation, and sufficient water is generated, the treated water would be considered for use, for example, as a dust suppressant during soil remediation.
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.

Item Number	Subtopic	Description
		• 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 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. • Map potentially affected sensitive habitats prior to any activity.
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, replacement, or offset for the loss of protected trees and pre- and post-remediation monitoring of protected trees) 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: • Mapping and 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.

Item Number	***Subtopic***	***Description***
5-4	Revegetation and habitat restoration	A qualified biologist will prepare a site-specific 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 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 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.

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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).
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 vascular and non-vascular plants.	Ensure avoidance and minimization of impacts to Braunton's milk-vetch, Santa Susana tarplant, and other sensitive plant species(including non-vascular plants) 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, Plummer's mariposa-lily, and non-vascular plants including lichens and bryophytes. 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, Santa Susana tarplant, 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, Santa Susana tarplant, 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, Santa Susana tarplant, 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 bats, breeding/nesting	Due to the presence of habitat for nesting migratory bird species (including Federal, State, and other sensitive 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. Applicable survey protocols will be implemented. Building demolition will also be conducted outside the breeding/nesting seasons of birds (February 1 – August 31) and bats (May 1 through October 31) protected by California Fish and Game Code Sections 3503 and 3503.5, and Executive Order 13186, to the extent possible. For building demolition conducted during the bird 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

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		more than 10 days prior to site disturbance. A qualified biologist, hired by DOE, will perform a nesting bird survey and confirm that 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	Wildlife protection	Minimize direct impacts to general wildlife species, such as snakes, other reptiles, invertebrates, small mammals and wildlife movement during remediation. The Project Biologist (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 potential movement of wildlife, vehicles that have been sitting overnight, and any excavated areas that have been left unattended for long periods. 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.
5-12	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. If found, applicable plans (such as a Habitat Restoration and Monitoring Plan) would be developed for the species.
5-13	ESA and CESA	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 biological assessment addresses biological resource issues from the DOE at SSFL. After reviewing the site-wide biological assessment and the associated impact avoidance, impact minimization, and species conservation measures, USFWS rendered 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.
5-14	Jurisdictional Wetlands and Waters of the U.S.	*Mitigate for temporary disturbance to USACE jurisdictional wetlands and Waters of the United States.* In accordance with USACE requirements, terms and conditions and mitigation measures attached to the Section 404 Clean Water Act permit would be incorporated. 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.
5-15	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]

Item Number	***Subtopic***	***Description***
		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. Apply water at the end of the work day to areas of soils disturbed during the day. • 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. • <u>Demolition Activities</u>: Stabilize wind erodible surfaces with the use of water sprays to minimize dust. • <u>Inactive Areas</u>: Once remediation activities are complete in an area, stabilize disturbed soils in these areas within five working days with a non-toxic soil stabilizer or soil wetting agent. Prohibit vehicles from operating on these completed areas. • <u>Unpaved Roads</u>: 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. • <u>Material Loading</u>: Load materials carefully to minimize the potential for spills or dust creation. Minimize drop height from loader bucket. 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 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.

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		• 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 air monitoring (see Item Number 6-5) and dust control programs and 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). • To minimize Valley Fever risk during remediation activities, include valley fever mitigation measures found in the Ventura County Air Pollution Control District CEQA Guidelines (2003), where feasible.
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.
6-5	Air Monitoring	DOE operates an air monitoring system to establish a pre-remediation baseline and to monitor any potential air pollutant releases of concern during remediation activities. The system monitors ambient levels of particulates, volatile organic compounds, and radionuclides (NASA/Boeing/DOE 2017). The air monitoring program includes a meteorological station within Area IV and four air monitors along the perimeter of Area IV. The perimeter stations include three along the north border near the SRE, RMHF, and FSDF and one along the southern border.
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).

Item Number	Subtopic	Description
Transportation/Traffic		
8-1	Traffic Plan	Prior to the start of construction, the project contractor will prepare a 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 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; • Incident and emergency prevention and response procedures including those addressing wildfires; • 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; • Radiological 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.

Item Number	***Subtopic***	***Description***
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.
9-3	Radioactive materials transport	As needed, a licensed radioactive materials hauler will transport radioactive waste materials, in accordance with applicable regulations, to a commercial disposal facility possessing a radioactive materials license or an approved and permitted DOE low-level radioactive waste disposal site.
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	Pursuant to the National Historic Preservation Act, Section 106, DOE is consulting with SHPO, the Santa Ynez Band of Chumash Indians, non-federally recognized tribes, and other consulting parties to develop a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on historic properties, including appropriate actions to avoid, minimize, or mitigate any effects. The Programmatic Agreement currently being developed will include procedures for the development of a monitoring plan as well as a discovery plan that addresses unanticipated archaeological finds during cleanup activities.
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 adverse effects on traditional cultural resources, including development of a Section 106 Programmatic Agreement that will establish procedures for addressing adverse effects on traditional cultural properties eligible for the NRHP.

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

BMP = best management practice; Boeing = The Boeing Company; CDFW = California Department of Fish and Wildlife; CEQA = California Environmental Quality Act; CESA = California Endangered Species Act; CFR = *Code of Federal Regulations*; DTSC = Department of Toxic Substances Control; ECP = Erosion Control Plan; EPA = U.S. Environmental Protection Agency; ESA = Federal Endangered Species Act; FSDF = Former Sodium Disposal Facility; HASP = Health and Safety Plan; 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; RMHF = Radioactive Materials Handling Facility; SHPO = State Historic Preservation Officer; SRE = Sodium Reactor Experiment; SWPPP = Stormwater Pollution Prevention Plan; TPH = total petroleum hydrocarbons; TM/HRP = Traffic Management/Haul Route Plan; USACE = U.S. Army Corps of Engineers; 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, Environmental Justice, and Sensitive-Aged Individuals.	
Surface Water (SW)	
SW-1	Excavation of soils to bedrock and backfill to initiate revegetation in drainage areas leading off site would only be completed outside of the primary rainfall period of December through March 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. Soil excavation and backfill during this period could still occur in the Burro Flats area upslope from these drainages with the implementation of stormwater BMPs required by the SWPPP.
SW-2	If, as a result of selected alternative implementation, runoff observations indicate the landowner's (Boeing's) sitewide 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.
Air Quality and Climate (AQ)	
AQ-1	It is a goal that remediation contractors implement green vehicle fleets with the following specifications: • For off-road equipment, EPA Nonroad Tier 4 emission standards. • For on-road trucks, a fleet with individual trucks no more than 5 years old.
AQ-2	As analyzed in this EIS, power to temporary personnel and equipment structures to support building demolition activities would be supplied by diesel generators. In order to reduce air emissions associated with generator operations, DOE would evaluate accessing power from the electrical grid.
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. A flagger or a traffic signal would also improve traffic flow at this intersection that operates at a low level of service during peak traffic times.
TR-3	The level of commuter traffic on Woolsey Canyon Road will depend on DOE's activities in combination with activities of Boeing and NASA. Based on actual cleanup schedules and therefore, the expected level of commuter traffic, DOE would engage Boeing and NASA to determine if a ride-sharing program would be reasonable and effective.
Cultural Resources (CR)	
CR-1	Prior to commencement of ground disturbance related to cleanup activities, DOE will prepare a Monitoring Plan and Inadvertent Discovery Plan for Area IV and the NBZ of the SSFL for which DOE is responsible, per the NHPA Section 106 Programmatic Agreement currently being developed by DOE.
CR-2	DOE is currently consulting with SHPO, the Santa Ynez Band of Chumash Indians, and non-federally recognized tribes concerning potential impacts on traditional cultural resources, including sacred sites and a potential NRHP-eligible traditional cultural property. As necessary, DOE would evaluate the existing controls (e.g., the Programmatic Agreement currently under development) to determine if additional mitigation measures are needed to achieve compliance with relevant laws.
CR-3	*Reseeding and Restoration* Restoration measures will be outlined in DOE's ROD under NEPA and more fully defined in the soil remediation plan (referred to as a Soil Remedial Action Implementation Plan in the 2010 AOC), which will be prepared prior to soil cleanup. DOE will balance risk reduction with the intent to minimize harm to cultural resources, protecting habitat and cultural resources as an integrated whole, and will attempt to restore sites to the natural topography, including surface water drainages and native vegetative communities, according to historical documentation as regarding site conditions prior to the onset of operations.
CR-4	*Botanicals (plants) of Cultural Significance* DOE will institute measures for mitigating the loss of botanicals (plants) of cultural significance to Native Americans. These measures will be defined in the soil remediation plan. Any removal of botanicals (plants) of cultural significance will be mitigated through planting of native plants of similar age and type. For example, removal of an ancient oak tree should be mitigated through planting a mature oak tree (not young trees) or in accordance with Ventura County regulations.

ID Number	***Mitigation***
Socioeconomics (SE)	
SE-1	DOE will negotiate with the affected local governments to contribute its portion to the maintenance and repair of the affected roads.

AOC = *Administrative Order on Consent for Remedial Action*; BMP = best management practice; Boeing = The Boeing Company; D&D = decontamination and decommissioning; EIS = environmental impact statement; EPA = U.S. Environmental Protection Agency; NEPA = National Environmental Policy Act; NHPA = National Historic Preservation Act; NRHP = *National Register of Historic Places*; ROD = Record of Decision; SHPO = State Historic Preservation Officer; SWPPP = Stormwater Pollution Prevention Plan.

Chapter 7
Resource Commitments

7.0 RESOURCE COMMITMENTS

As required by the National Environmental Policy Act (NEPA) Section 102 (2)(C), this *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final 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. 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.

Since publication of the Draft EIS in 2017, Executive Order 13834, Efficient Federal Operations, was issued (May 2018). This Executive Order addresses setting water use and energy use goals for Federal facilities and vehicle fleets. Regulatory agencies, such as 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.

At the State level, in response to severe drought conditions, California 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). The Calleguas Board of Directors rescinded the Stage 3 Shortage that had been in effect for its service area (CMWD 2017). However, the Board continued to call for expanded water use efficiency measures by area water users in light of looming State mandates and urged State and Federal agencies to move forward on the implementation of the California WaterFix and EcoRestore programs (CMWD 2017) along with pursuing other water supply reliability programs. In 2018, Southern California remains in a severe drought condition (NIDIS 2018). California's Governor Brown signed legislation on May 31, 2018 that strengthens the State's water resiliency in the face of future droughts with provisions that include: (1) establishing an indoor, per person water use goal of 55 gallons per day until 2025, 52.5 gallons from 2025 to 2030 and 50 gallons beginning in 2030, (2) creating incentives for water suppliers to recycle water, and (3) requiring both urban and agricultural water suppliers to set annual water budgets and prepare for drought (State of California 2018).

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 continues to integrate sustainability in its projects, consistent with the requirements of Executive Order 13834, *Efficient Federal Operations*, and DOE Order 436.1, *Departmental Sustainability*, which 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 site management contracts and the operations of site facilities and fleets, for facility construction and demolition, and for infrastructure improvements.

Impacts on the natural environment are 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 states that 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 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 use of greener cleanup BMPs in Table 7–1 is not mandatory, but could 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.

Table 7–1 Applicability of ASTM International Greener Cleanup Best Management Practices to DOE Remediation Activities at the Santa Susana Field Laboratory

	Resource Conservation				*Protection of Environment*				*Waste Management*			*Optimizing Project Work*	
Green and Sustainable Remediation Best Management Practice	***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***	***Applicability to Area IV Cleanup Actions***
– 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 action, including use of native plant species that require minimal management and water, 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 that meet the cleanup requirements will be considered.
– 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 that meets DOE requirements for release 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.
– 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, consistent with DOE requirements, 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, as long as those products would not impact native plant species.
– 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.

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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”.

7.1.4 Benefits of Green and Sustainable Remediation

> **Water Resources**
>
> Approximately 1.75 to 1.9 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.

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.

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 would consume about one-quarter to one-third of the fuel of using distant disposal sites 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 expectations of the 2010 AOC LUT values 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 1.75 to 1.9 million gallons annually, largely due to the water needed for dust control for the soil remediation action alternatives. About 46 million gallons (142 acre-feet) of water would be used under the combinations of alternatives that include the Cleanup to AOC LUT Values Alternative for soil remediation. Combinations of alternatives that include the Cleanup to Revised LUT Values Alternative 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 11.3 million gallons (34 acre-feet). Up to 4.3 million gallons (13-acre-feet) of water would be used for combinations with the Conservation of Natural Resources Alternative (both scenarios).

Table 7–2 Summary of Fuel Usage by Action Alternative

Activity/Source	Totals by Alternative		
	Horsepower Hours	Vehicle Miles Travelled	Fuel (gallons)
Soil Cleanup to AOC LUT Values Alternative			
Off-road Equipment	13,600,000		679,000
Haul Trucks – Nearby Disposal Sites		13,100,000	2,130,000
Haul Trucks – Distant Disposal Sites		44,800,000	6,990,000
Total – Nearby Disposal Sites			2,800,000
Total – Distant Disposal Sites			7,670,000
Commuter Vehicles – Gasoline		7,390,000	261,000
Soil Cleanup to Revised LUT Values Alternative			
Off-road Equipment	2,880,000		144,000
Haul Trucks – Nearby Disposal Sites		6,430,000	1,000,000
Haul Trucks – Distant Disposal Sites		20,300,000	3,090,000
Total – Nearby Disposal Sites			1,140,000
Total – Distant Disposal Sites			3,230,000
Commuter Vehicles – Gasoline		1,710,000	60,200
Soil Conservation of Resources Alternative – Residential Scenario			
Off-road Equipment	818,000		40,900
Haul Trucks – Nearby Disposal Sites		568,000	94,400
Haul Trucks – Distant Disposal Sites		2,170,000	342,000
Total – Nearby Disposal Sites			135,000
Total – Distant Disposal Sites			383,000
Commuter Vehicles – Gasoline		569,000	28,400
Soil Conservation of Resources Alternative – Open Space Scenario			
Off-road Equipment	609,000		30,500
Haul Trucks – Nearby Disposal Sites		401,000	66,900
Haul Trucks – Distant Disposal Sites		1,590,000	250,000
Total – Nearby Disposal Sites			97,400
Total – Distant Disposal Sites			280,000
Commuter Vehicles – Gasoline		569,000	28,400
Building Removal Alternative			
Off-road Equipment	4,506,000		225,000
Haul Trucks – Nearby Disposal Sites		842,000	130,000
Haul Trucks – Distant Disposal Sites		2,560,000	387,000
Total – Nearby Disposal Sites			356,000
Total – Distant Disposal Sites			612,000
Commuter Vehicles – Gasoline		1,710,000	60,200
Groundwater Treatment Alternative			
Off-road Equipment	57,000		2,850
Haul Trucks – Nearby Disposal Sites		318,000	48,900
Haul Trucks – Distant Disposal Sites		1,300,000	195,000
Total – Nearby Disposal Sites			51,700
Total – Distant Disposal Sites			198,000
Commuter Vehicles – Gasoline		30,000	1,060
Groundwater Monitored Natural Attenuation Alternative			
Off-road Equipment	23,600		1,180
Haul Trucks		3,930	633
Total			1,810
Light Duty Trucks/Commuter Vehicles – Gasoline		172,000	6,040

Activity/Source	Totals by Alternative		
	Horsepower Hours	Vehicle Miles Travelled	Fuel (gallons)
High Impact Combination			
Off-road Equipment	18,100,000		907,000
Haul Trucks – Nearby Disposal Sites		14,300,000	2,300,000
Haul Trucks – Distant Disposal Sites		48,700,000	7,570,000
Total – Nearby Disposal Sites			3,140,000
Total – Distant Disposal Sites			8,400,000
Commuter Vehicles – Gasoline		9,130,000	322,000

AOC = *Administrative Order on Consent for Remedial Action*; LUT = Look-Up Table.
Notes: Round trip mileages range from 70 to 700 miles for nearby disposal sites and 466 to 2,320 miles for distant disposal sites. 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 example nearby and distant disposal sites. Calculated values and totals have been rounded.

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	1,750,000	5.4	0.004	45,500,000	140
Soil – Cleanup to Revised LUT Values	1,750,000	5.4	0.004	10,500,000	32
Soil – Conservation of Natural Resources (Residential Scenario)	1,750,000	5.4	0.004	3,500,000	11
Soil – Conservation of Natural Resources (Open Space Scenario)	1,750,000	5.4	0.004	3,500,000	2
Building Removal	252,000	1	0.0006	630,000	1.9
GW – MNA	5,000	0.02	0.00001	5,000	0.02
GW – GWT	24,000	0.07	0.00006	24,000	0.07
Water Use by Combination of Action Alternative					
AOC LUT + BR + MNA	1,881,000	5.8	0.005	46,135,000	142
AOC LUT + BR + GWT	1,900,000	5.8	0.005	46,154,000	142
Revised LUT + BR + MNA	1,881,000	5.8	0.005	11,135,000	34
Revised LUT + BR + GWT	1,900,000	5.8	0.005	11,154,000	34
CR (Res) + BR + MNA	1,881,000	5.8	0.005	4,135,000	13
CR (Res) + BR + GWT	1,900,000	5.8	0.005	4,154,000	13
CR (OS) + BR + MNA	1,881,000	5.8	0.005	4,135,000	13
CR (OS) + BR + GWT	1,900,000	5.8	0.005	4,154,000	13

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; OS = Open Space Scenario; Res = Residential Scenario.
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, water 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

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 7.2.6, 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 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 Water 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. The largest water use would result from implementing the Cleanup to AOC LUT Values Alternative, which could annually require 1,750,000 million gallons of water over 26 years, totaling 45.5 million gallons. Implementing either of the other two alternatives would also require an annual 1,750,000 million gallons per year, but this water use would be required for about 6 years under the Cleanup to Revised LUT Values Alternative, totaling 10.5 million gallons, and less than 2 years under the Conservation of Natural Resources Alternative (both scenarios), totaling 3.5 million gallons. The Building Removal Alternative would annually require about 252,000 gallons of water over 2 to 3 years (totaling 630,000 gallons assuming 2.5 years), and the Groundwater Monitored Natural Attenuation and Groundwater Treatment Alternatives would require totals of about 5,000 gallons and 24,000 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 recent drought conditions, especially in Southern California. In June 2018, Governor Brown signed into law a set of efficiency goals for water suppliers throughout the State (see Section 7.1.1). 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. There 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.

7.2.3 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 about 661,000 cubic yards under the Cleanup to AOC LUT Values Alternative to lesser amounts of 143,000 cubic yards under the Cleanup to Revised LUT Values Alternative, and under the Conservation of Natural Resources Alternative, 39,000 cubic yards for the Residential Scenario and 29,000 cubic yards for the Open Space Scenario. 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 sustains 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 7.2.4. 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.

7.2.4 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). Under the AOC LUT Values Alternative, removing vegetation or disrupting soil from 90[1] acres of land 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 90 acres, about 33 acres consist of relatively undisturbed native habitat, such as coast live oak woodland, northern mixed chaparral, and Venturan coastal scrub.

Both 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 described above (see Chapter 4, Sections 4.5.1.3 and 4.5.1.4). Under the Cleanup to Revised LUT Values Alternative, about 38 acres of land would be disturbed, or about 42 percent of the acreage disturbed

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[1] An estimated 4 acres of land that is within the areas in which the exemption process would be applied is included in the acreage reported for each of the soil remediation alternatives. Within the areas in which the exemption process would be applied, DOE proposes to use carefully planned and executed removal of soils that are determined through a risk assessment to pose a risk to human health or the environment.

under the Cleanup to AOC LUT Values Alternative. Of these 38 acres disturbed under cleanup to Revised LUT Values Alternative, about 14 acres of relatively undisturbed native habitat (such as coast live oak woodland and northern mixed chaparral) would be removed. Under the Conservation of Natural Resources Alternative, Residential Scenario, about 10 acres would be disturbed, while under the Conservation of Natural Resources Alternative, Open Space Scenario, approximately 9 acres would be disturbed. This represents about 11 or 10 percent or less, respectively, of the acreage disturbed under the Cleanup to AOC LUT Values Alternative. Under the latter two alternatives, of the land disturbed, approximately 5 acres consist of relatively undisturbed native habitat, including coast live oak woodland and northern mixed chaparral.

The Building Removal Alternative or groundwater remediation alternatives (involving about 8 to 9 acres of additional disturbance to the acreages above) 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.

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.

7.2.5 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. Actions 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 $PM_{2.5}$[3] 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.

7.2.6 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. Minimal 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 soil and recycle material from SSFL to offsite facilities, train transport of soil 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 risk of an LCF among populations, considering a range of accidents from minor to severe, was calculated to be 6×10^{-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 soil 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: 1) 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 28 years, compared to about 4 years for combinations that include the Cleanup to Revised LUT Values or Conservation

[3] PM_n = Particulate matter less than or equal to *n* microns in aerodynamic diameter.

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 7.2.9, this could result in increased expenses for local governments.

7.2.7 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 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.

7.2.8 Cultural Resources

Unavoidable impacts on archaeological resources could result from implementing any of the action alternatives because of the potential that portions of five known historical properties in Area IV and the NBZ may not be exempted from soil remediation due to an unacceptable health risk that requires environmental cleanup. Although adverse effects to NRHP-eligible sites in Area IV and the NBZ would be mitigated through implementation of the Section 106 Programmatic Agreement, the unavoidable impacts would remain, and, mitigation could include removal of the site.

Unavoidable impacts on historic properties could also result from implementing any of the action alternative combinations, primarily because all combinations would require removal of large quantities of soil.

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 have been 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 is complete, the affected areas will be re-contoured, which will change the setting of the traditional cultural resource.

7.2.9 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 7.2.6, 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.

Table 7–4 Irreversible and Irretrievable Commitments of Resources at the Santa Susana Field Laboratory

Resource	*Action Alternatives*						
		Soil Remediation				*Groundwater Remediation*	
				Conservation of Natural Resources			
	Building Removal	*Cleanup to AOC LUT Values*	*Cleanup to Revised LUT Values*	*Residential*	*Open Space*	*Monitored Natural Attenuation*	*Treatment*
Land Use							
Disturbed land (acres)	8.4	90	38	10	9	<1	<0.25
Labor							
Full-time equivalent (person-years) [a]	172	858 – 910	279 – 286	57 – 62	55 – 99	14	28
Utilities							
Water use – annual (million gallons) [b]	0.252	1.75	1.75	1.75	1.75	0.005 [c]	0.024
Water use – total (gallons)	630,000	45,500,000	10,500,000	3,500,000	3,500,000	5,000	24,000
Water use – total (acre feet)	2	140	32	11	11	0.02	0.07
Fuel (diesel and gasoline) (million gallons) [d]	0.3 – 0.6	2.8 – 7.7	1.1 – 3.2	0.1 – 0.4	0.1 – 0.3	0.002	0.03 – 0.1
Materials							
Backfill (cubic yards)	13,500	661,000	143,000	39,000	29,000	0	3,000
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	718,000	28,000	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 (truck option).

[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 = 2,000 worker hours.

The amount of land disturbed under the action alternative combinations (including building removal, soil remediation and groundwater remediation) could vary from a minimum of 18 to 19 acres (for combinations using the Conservation of Natural Resources Alternative for soil remediation) to 47 acres (for combinations using the Cleanup to Revised LUT Values Alternative for soil remediation) to a maximum of about 99 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 (Ventura County 2017a, 2017b), 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 85 (not including truck drivers), if the last year of building removal coincided with the first year soil removal. 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 soil and waste types that are generated are sent to the nearer or the more distant disposal facilities that are evaluated for each. Assuming all excavated soil was sent to the nearest evaluated disposal facilities, the lowest labor requirements for soil removal would be under the Conservation of Natural Resources Alternative, Open Space Scenario (50 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 (650 person-years). In addition to the labor required for soil remediation, about 180 person-years would be needed under the Building Removal Alternative and 4 to 14 person-years under 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.

The amount of water associated with implementing any of these alternatives would be approximately 1.75 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 46 million gallons (142 acre-feet) under the Cleanup to AOC LUT Values Alternative, to 11 million gallons (34 acre-feet) under the Cleanup to Revised LUT Values Alternative, to a low of about 4.1 million gallons (13 acre-feet) under the Conservation of Natural Resources Alternative (both scenarios). 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 Southern California, the need to reduce annual water use continues. Calleguas Municipal Water District continues to call for expanded water use efficiency measures by area water users and implementation of the California WaterFix and EcoRestore programs (CMWD 2017). Also, recent legislation signed by Governor Brown aims to reduce domestic water use, implement more use of recycled water, and to requires water budget planning for drought conditions by water suppliers and agricultural users to sustain critical supplies for all users (State of California 2108). DOE also recognizes that water is a precious resource, and is committed to limiting the use of water on this project to the extent practicable.

The amount of fuel associated with implementing any of these alternatives would range from approximately 2.8 million to 7.7 million gallons if the Cleanup to AOC LUT Values Alternative were implemented. The larger number would be required if it were determined that 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 the required amount of suitable backfill from nearby locations because the amount of soil required would be about 5 to 22 percent 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 661,000 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 718,000 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, 90 acres of land would be disturbed. Under the Cleanup to Revised LUT Values Alternative, about 38 acres would be disturbed. Under the Conservation of Natural Resources Alternatives, about 10 or 9 acres of land would be disturbed, respectively, under the Residential and Open Space Scenarios. Under either groundwater remediation action alternative, less than 1 acre of land would be disturbed.
- Placement of up to 718,000 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 1.75 million gallons of water would be required annually under any of the soil remediation alternatives. A total of about 142 acre-feet of water would be consumed over the lifetime of any action alternative combination (including building removal and soil and groundwater remediation) 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 Alternative would use substantially less water, totaling about 34 acre-feet. Action alternative combinations using the Conservation of Natural Resources Alternative (either scenario) would use even less water, totaling about 13 acre-feet. Water consumption is of concern because of Southern California's drought conditions and because it 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 7.2.5. 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 *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (Final 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 Policy 451.1 (December 21, 2017)
Protection and Enhancement of Environmental Quality	(Federal) Executive Order 11514 (March 5, 1970), amended by (Federal) 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
2013 Ventura County Building Code, Ordinance 4456	January 9, 2014

Law, Regulation, Order, or Other Requirement	***Citation/Date***
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
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.
Responsibility of Federal Agencies to Protect Migratory Birds	Memorandum of Understanding (MOU) Federal Executive Order 13186
"Compliance with Floodplain and Wetland Environmental Review Requirements"	10 CFR Part 1022
Floodplain Management	(Federal) Executive Order 11988 (May 24, 1977)
Protection of Wetlands	(Federal) Executive Order 11990 (May 24, 1977)
Invasive Species	(Federal) Executive Order 13112 (February 3, 1999), as amended by Executive Order 13751 (December 8, 2016)
California Endangered Species Act of 1984	*California Fish and Game Code*, Section 2050 et seq.
Protection of birds' nests	*California Fish and Game Code*, Sections 3503 and 3503.5
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
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 Global Warming Solutions Act of 2006	Assembly Bill 32 (September 27, 2006)
California Executive Order S-01-07	January 18, 2007
California Executive Order B-16-2012	March 23, 2012
California Truck and Bus Regulation	December 2008; amendments in 2011 and 2014
California Heavy-Duty Truck GHG Regulations	*California Code of Regulations*, Title 17, Sections 95300-95311, December 2009; amendments in 2010, 2012, and 2013
California Executive Order B-30-15	April 29, 2015
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	
Efficient Federal Operations	(Federal) Executive Order 13834 (May 17, 2018)
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)

Law, Regulation, Order, or Other Requirement	Citation/Date
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
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.
California Health and Safety Code	*California Government Code*, Section 7050.5
California Public Resources Code	*California Government Code*, Section 5097.99
Protection and Enhancement of the Cultural Environment	(Federal) Executive Order 11593 (May 13, 1971)
Indian Sacred Sites	(Federal) Executive Order 13007 (May 24, 1996)
Consultation and Coordination with Indian Tribal Governments	(Federal) Executive Order 13175 (November 6, 2000)
Preserve America	(Federal) Executive Order 13287 (March 3, 2003)
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
"Mandatory Commercial Organics Recycling Act"	*California Code of Regulations*, Public Resources Code, Division 30 Waste Management, Chapter 12.9 Recycling Organic Waste, Sections 42649.8-42649.87
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	(Federal) Executive Order 12898 (February 11, 1994)
Protection of Children from Environmental Health Risks and Safety Risks, as amended by Executive Order 13229	(Federal) 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

Law, Regulation, Order, or Other Requirement	*Citation/Date*
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	(Federal) 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*	(Federal) 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; GHG = greenhouse gas; 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 Policy 451.1, *National Environmental Policy Act Compliance Program*, establishes DOE expectations 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)

These Federal Executive Orders require 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) prepared 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) (DTSC 2017a). Impacts from DOE's proposed actions are evaluated in the draft program EIR as part of a larger proposed action of cleaning up the entire SSFL. DTSC also evaluated 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. In 2017, Boeing and the North American Land Trust entered into two Conservation Easements and Agreements to permanently preserve nearly 2,453 acres of land at SSFL, including Area IV and the NBZ and the Southern Buffer Zone of SSFL (Ventura County 2017a, 2017b). The conservation easements are legally enforceable documents that, among other restrictions, forever prohibit residential, agricultural, or commercial development or use of the site.

"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 is specified as open space in two conservation easements entered into by Boeing and the North American Land Trust in 2017 (Ventura County 2017a, 2017b). These agreements will endure forever and are legally enforceable.

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.

California Water Code, Division 7, Chapter 4, Establishment of Regional Water Quality Control Boards (13200-13286.9)

This code addresses the organization and membership of regional water quality control boards, and lays out the powers and duties of these boards. Chapter 4 specifies that each region prepare a plan and also specifies requirements for waste discharge and individual disposal systems.

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.

2013 Ventura County Building Code, Ordinance 4456, January 9, 2014

This code, implemented by the Ventura County Public Works Agency, governs the issuance of permits for projects that involve grading, temporary stockpiling of soil, removal of soil, and compacting of soil. The permit requirement is triggered by the degree of slope of the impacted area, height of the graded slope, relationship of the site to a designated waterway or wetland, the quantity of excavated soil or fill, and the number of truck trips to the site per day.

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, the California Department of Fish and Wildlife (formerly the California Department of Fish and Game), and DTSC concerning endangered species. DOE prepared a biological assessment of the entire SSFL site that addresses the potential effects of DOE and Boeing remediation activities on federally and State-listed rare, threatened, and endangered species. The completed biological assessment was submitted to USFWS along with a request for formal consultation under provisions of the Endangered Species Act. Ultimately, the consultation resulted in the issuance of a Biological Opinion from USFWS (see Appendix J). The biological assessment was also submitted for review and comment to the California Department of Fish and Wildlife, which participated in the coordination meetings with DOE, DTSC, and USFWS.

California Fish and Game Code (FGC) Section 3503 and 3503.5

These sections are for the protection of birds' nests and eggs. FGC Section 3503 states, "It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto." FGC Section 3503.5 states, "It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto." 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.

Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 et seq.)

The Migratory Bird Treaty Act, as amended, prohibits the taking of birds that have common migration patterns between the United States, Canada, Mexico, Japan, and Russia. The USFWS recently provided guidance noting that the "take of birds resulting from an activity is not prohibited by the MBTA when the underlying purpose of that activity is not to take birds" (USFWS 2018). 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." Potential impacts on migratory birds from implementation of the proposed alternatives are analyzed in Chapter 4, Section 4.5, of this EIS.

Memorandum of Understanding (MOU) for Section 3 of Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (September 12, 2013)

This MOU, pursuant to Executive Order 13186, between DOE and the USFWS promotes the conservation of migratory bird populations by ensuring DOE activities protect, enhance and manage habitats of migratory birds to the extent practicable. 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 nesting 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 Federal 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 Federal 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), as amended by Executive Order 13751 (December 8, 2016)

Federal Executive Order 13112 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. Executive Order 13751 amended Executive Order 13112 and included an updated definition of invasive species, which is "a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health." 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.

California Fish and Game Code, Sections 3503 and 3503.5, Protection of Birds' Nests

These sections make it unlawful to "take, possess, or needlessly destroy" the nest or eggs of any bird (Section 3503) or any bird-of-prey (Section 3503.5).

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 the State's stationary emission sources 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 2016 Air Quality Management Plan* (SCAQMD 2017), 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.

***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 State Executive Order establishes greenhouse gas (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.

California Executive Order S-01-07 (January 18, 2007)

This State 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.

California Executive Order B-16-2012 (March 23, 2012)

This State 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.

California Truck and Bus Regulation

The Truck and Bus Regulation, adopted by the ARB in December 2008 and amended in 2011 and 2014, requires that existing heavy-duty vehicles and buses that operate in California be upgraded to meet the latest best available control technology standards for nitrogen oxides and particulate matter. Newer heavier trucks and buses must meet particulate matter filter requirements beginning January 1, 2012. Lighter and older heavier trucks must be replaced starting January 1, 2015. By January 1, 2021, all model year 2007 trucks are required to meet best available control technology standards (i.e., 2010+ EPA Heavy-Duty Highway Rule Standards) for nitrogen oxides and particulate matter. Model year 2008 and 2009 heavy-duty vehicle engines must be replaced with 2010+ engines by January 1, 2022, and January 1, 2023, respectively. By January 1, 2023, nearly all trucks and buses will need to have 2010 model year engines or meet equivalent engines that comply with EPA Heavy-Duty Highway Rule Standards. The regulation applies to nearly all privately and federally owned diesel trucks and buses and to privately and publicly owned school buses with a gross vehicle weight rating greater than 14,000 pounds.

California Heavy-Duty Truck GHG Regulations

The California 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 State 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 13834, *Efficient Federal Operations* (May 17, 2018)

This Federal Executive Order focuses on meeting statutory requirements in a manner that improves efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the environment. DOE Order 436.1, Departmental Sustainability, described next, established 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 2.2.2, 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.

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.

California Health and Safety Code, Section 7050.5

This code requires that any discovery of human remains in any location other than a cemetery be examined by the county coroner and dealt with according to any applicable laws. During this time, no further excavation or disturbance can occur at the discovery site.

California Public Resources Code, Section 5097.99

This code directly addresses the discovery of Native American human remains, as determined by the county coroner pursuant to the California Health and Safety Code Section 7050.5. Unlike the Native American Graves Protection and Repatriation Act of 1990 that applies to actions on Federal land, this code applies to actions on any land, regardless of status of the land owner or action proponent (i.e., private entity or government agency). Section 5097.99 triggers protocols and a process for identification, notifications, and cessation of disturbance on the land where the remains are found. It specifically requires repatriation of the remains, appropriate coordination with descendants and following of their preferences for the handling of the remains.

Executive Order 11593, *Protection and Enhancement of the Cultural Environment* (May 13, 1971)

This Federal 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 Federal 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 Federal 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 Federal 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.

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 (Buildings 4021, 4022, and 4621) is permitted as an Interim Status (Part A) facility and is inactive pending closure plan approval. The Hazardous Waste Management Facility (Buildings 4029 and 4133) 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.

Mandatory Commercial Organics Recycling (MORe) Act

In October 2014, Governor Brown signed the Mandatory Commercial Organics Recycling Act, requiring businesses to recycle their organic waste on or after April 1, 2016, depending on the amount of waste they generate per week. Organic waste means food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed with food waste. A business for the purposes of this act means a commercial or public entity, including but not limited to, a firm, partnership, proprietorship, joint stock company, corporation or association that is organized as a for-profit or nonprofit entity, or a multifamily residential dwelling.

***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.

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 Federal 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 Federal 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."

8.1.12 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.

Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements* (August 3, 1993)

This Federal 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).

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 Federal 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.

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	Inactive
RCRA Closure Plan	Hazardous Waste Management Facility Buildings 4029 and 4133	Submitted to DTSC in 2015, it updates an original closure plan for Buildings T029 and T133 (now Buildings 4029 and 4133) that was approved by DTSC in December 2003. DTSC will approve a final closure plan, subsequent to completion of the DTSC EIR and DOE *SSFL Area IV EIS*.
RCRA Closure Plan	Radioactive Materials Handling Facility Buildings 4021, 4022, and 4621	Submitted to DTSC in 2015, it updates an original closure plan submitted to DTSC in 2006 (not approved as final). DTSC will approve a final closure plan subsequent to completion of the DTSC EIR and DOE *SSFL Area IV EIS*.
LARWQCB NPDES Permit CA0001309	SSFL	Current

APCD = Air Pollution Control District; DTSC = California Department of Toxic Substances Control; EIR = environmental impact report; 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. Army Corps of Engineers	• Clean Water Act Section 404 Permit
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 and the NBZ 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. • Streambed Alteration Agreement
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 71.2, Storage of Reactive Organic Compound Liquids • Rule 74.29, Soil Decontamination Operations requirements • Rule 1166, Volatile Organic Compound Emissions from Soil Decontamination • Authority to Construct, Permit to Operate

Agency	Permit/Approval
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	• Oak Tree Permit
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
Los Angeles Regional Water Quality Control Board	• Section 401 Water Quality Certification
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 (if applicable) 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
Other	
The Boeing Company	• Access Agreement between Boeing and DOE, December 20, 2013

8.2.1 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).

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 that was used for treatment of reactive metal such as sodium (Building 4133). The Hazardous Waste Management Facility is no longer used and awaits final closure (Boeing 2014c). These two facilities have the following pending RCRA closure plans:

RCRA Closure Plan, Hazardous Waste Management Facility: Buildings T029 and T133, ETEC, Santa Susana Field Laboratory, Area IV, Ventura County, California

This RCRA closure plan describes the closure tasks for decontamination, demolition, verification sampling, and remediation of nonradiological chemicals associated with the Hazardous Waste Management Facility (North Wind 2015b). This closure plan updates an original closure plan for Buildings T029 and T133 (now Buildings 4029 and 4133) that was approved by DTSC in December 2003. Subsequent to the completion of an EIR for the remediation of the SSFL by DTSC and an EIS for the remediation of Area IV of the SSFL by DOE, DTSC will approve a final closure plan for the Hazardous Waste Management Facility.

RCRA Closure Plan, Radioactive Materials Handling Facility, Buildings 4021, 4022, and 4621, ETEC, Santa Susana Field Laboratory, Area IV, Ventura County, California

This RCRA closure plan describes the closure tasks for decontamination, demolition, verification sampling, and remediation of radiological and chemical constituents associated with Radiological

Materials Handling Facility (North Wind 2015c). This closure plan addresses Buildings 4021, 4022, and 4621. DOE submitted the original close plan to DTSC in 2006, but it was not approved as final due to the requirement for DOE to complete an EIS for the remediation of Area VI. This revised RCRA closure plan addresses any concerns DTSC had with the original plan. Subsequent to the completion of the *Final SSFL Area IV EIS* by DOE and an EIR for the remediation of the SSFL by DTSC, DTSC will approve a final closure plan for the Radiological Materials Handling Facility.

8.2.3 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.

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.

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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. Sensitive site and cultural information will not be distributed in this document. The distinct community of the present-day Fernandeño Tataviam Band of Mission Indians (Band) (Figure 9–1) originated in the lineages, villages, and culture of the pre-Mission period. Mission San Fernando Rey (SFR) was established on September 8, 1797 at the village of *Achoicominga* in present-day Mission Hills and, for the years following, enslaved natives from the 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.

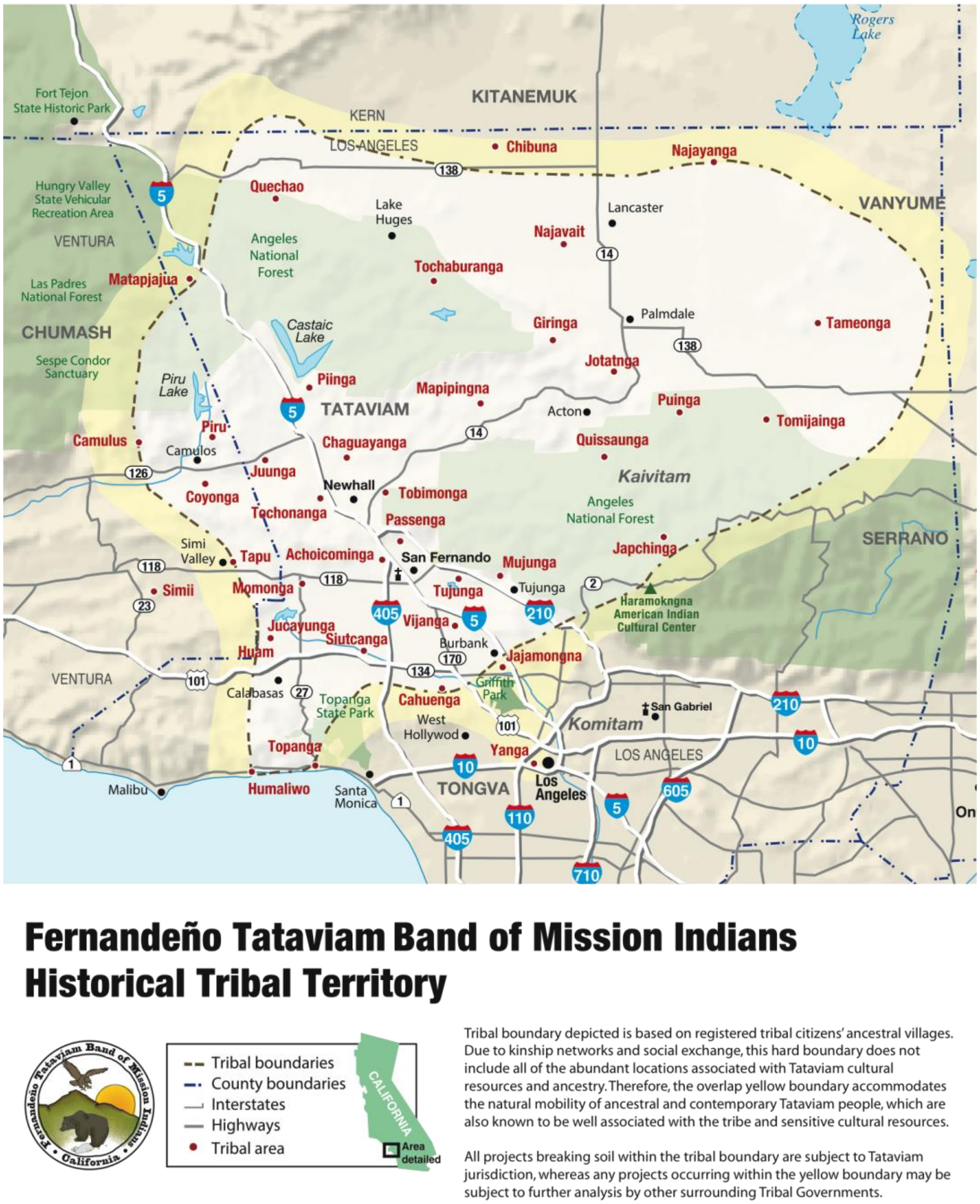

Figure 9–1 Tataviam (Band) Tribal Territory

Ancestral Regional Groups

Fernandeño is a Spanish regional term historically used to represent any individual located at Mission SFR. The Band uses Fernandeño as an all-encompassing term to represent the native people of diverse territories who were forced into indentured servitude by Mission SFR during the Spanish period. Of the distinct regional groups associated with Mission SFR, four are believed to have been associated with the land encompassed by this project: *Tatavitam, Pipimaram, Simivitam,* and *Sivavitam* (Figure 9–2).

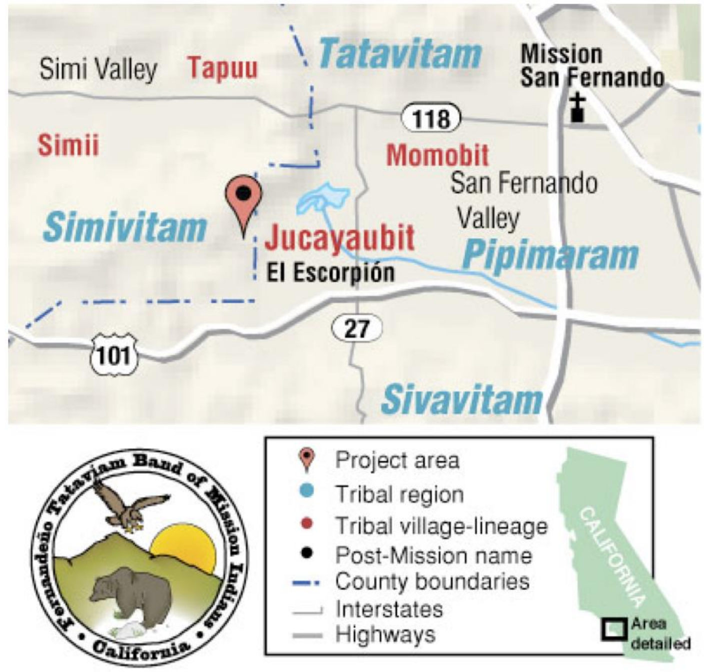

Figure 9–2 Village (Lineage) Map

Using the land encompassed by this project as the central point of reference positions the Pipimaram (western San Fernando Valley people) to the east, the Tatavitam to the north and northeast, and Simivitam to the immediate west. In the Spanish period, members of Pipimaram, Tatavitam, and Simivitam lineages were heavily recruited to Mission SFR, and will be collectively referred to as "Fernandeños". The Fernandeños referred to the regional group to the south as Sivavitam (Los Angeles Basin people), who were predominantly recruited to Mission San Gabriel (known as Gabrielino people).

The Tatavitam and Pipimaram maintained slightly distinct Takic languages, while coastal languages heavily influenced the latter group. Separately, the Simivitam were speakers of the Chumashan language, while the Sivavitam were both coastally influenced and speakers of Cupano languages. The Fernandeños referred to Sivavitam, the people of Los Angeles Basin, and the people inland/east of the Sivavitam and into the San Gabriel Valley, collectively known as Gabrielinos, as the *Komivitam*, while the Gabrielinos referred to the Fernandeños as *Pavasikwar*. Fernandeño and Gabrielino are also dialects of one language, and therefore, linguistic maps are often confused for territory maps. Although the Fernandeño and Gabrieleño are linguistically related, they represent two geographical areas that are mistakenly interchanged with one another, even though associations may overlap. For clarification, it is important to note that language types and marital patterns did not determine political or national organization. It is a fundamental error to conflate language groups with political and social groups, especially in California, where such groups are not the same.

Traditionally, the concept of "Tribe", as the general public conceives it, did not exist. The local indigenous history is unique in that there was no collective tribal entity *above* the lineage. Each village held a lineage that was autonomous and self-governing. Before the founding of Mission San Fernando, the natives in the region lived in lineages within villages that were associated with regional areas, or territories. The lineages, also called tribelets, consisted of speakers from the Takic branch of the Uto-Aztecan language, who intermarried with natives from other linguistic groups within the area, as well as strengthened economic, social, and cultural relations with those outside of their language and lineage groups by practicing exogamy. Each tribelet held territory and maintained political and economic sovereignty over its local area, but was also linked through social exchange to neighboring villages and lineages. The Band today uses "regional groups" as a term to collectively identify lineages, and the people within them, that are associated with specific areas for the purpose of tribal-centered ethnography.

The Fernandeños 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 natives were recruited to Mission SFR, but their lineages persisted. 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. The lineage system continued as the major form of social and political organization through the Spanish period, and is the primary form of indigenous organization among the present-day Fernandeños. Today, the Band represents the continuity of the regional pattern of politically independent lineages related through selected intermarriage and regional ceremonial participation. This coalition consists of three principle lineages traditionally known as *Siutcabit, Tujubit, and Cabuepet*. As the lineage members were forced to speak English in the late 19th Century, they adopted the surname of their lineage leader. Today, these three lineages are known as the Ortega (representing ancestor Maria Rita Alipas Ortega), Garcia (representing ancestor Josephine Leyvas Garcia), and Ortiz (representing ancestor Joseph Ortiz) lineages. Each lineage consists of members whose ancestors are part of the four diverse regional groups associated with this project.

Band's Link to Villages/Rancherías

The Fernandeño settlements in the immediate vicinity of the project are *Jucayaunga*, *Momonga*, and *Tapuu* (Figure 9–3). These lineages are associated with the Simivitam regional group, with some influence from the Tatavitam and Pipimaram. Mixed marriages among lineages and across linguistic lines were typical of the region before the establishment of Mission SFR, but did not necessarily impact the regional identity. The Band's Ortega and Garcia lineages can be traced to the three villages.

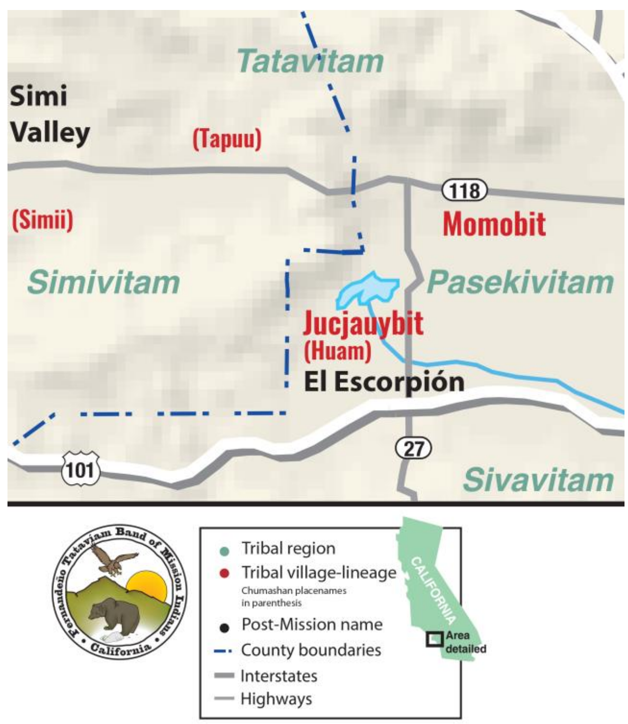

Figure 9–3 Village (Lineage) Map

<u>**Ortega Lineage**</u>

Village ties: Tapuu, Momonga

Regional groups ties: Tatavitam, Simivitam, Pipimaram

Maria Rita Alipas (Ortega) is the ancestor of the Ortega lineage and is well known as the caretaker of the Rancho Encino land grant, present-day Los Encinos State Historic Park. Her grandfather Juan Maria was born into the lineage of *Chaguayabit*, present-day Valencia, in 1778 and a first generation Mission SFR convert. Juan's son *Francisco Papabubaba*, was born at Mission SFR in 1806 and married Paula Cayo when she was of age. Paula, who was born at Mission SFR in 1813, was the daughter of Tiburcio Cayo, born 1793 into the lineage at *Tapuu*, present-day Tapo Canyon

(Figure 9–3). In short, Maria Rita Alipas' direct ancestors are associated with the lineages of Chaguayabit (Chaguayanga), Cabuebit (Cahuenga), Suitcabit (Siutcanga), and Tapuu, which are associated with the Tatavitam, Simivitam, and Pipimaram regional groups. Her ancestry contained members of the Takic and Chumashan linguistic groups, which was common due to the regularity of mixed marriages.

Moreover, on September 1, 1845, Maria Rita Alipas and Benigno were married at Mission SFR, but the list of witnesses for this marriage illustrates the breadth of community that continued to exist in the Mexican and American periods. 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 Tejon Indian Tribe (*see* "Garcia Lineage").

Today, members of the Ortega lineage are highly involved with the project and consult for the protection of the tribal cultural resources associated with the project property. Among Maria Rita Alipas' descendants is the late Rudy Ortega Sr., the spiritual leader and elected Tribal President of the Band who held deep ties with the project property and the Burro Flats pictographic site in the late 20th century, as well as Elders Council Chairman Alan Salazar, Elders Councilmember Beverly Salazar Folkes, and Tribal President Rudy Ortega Jr.

Garcia Lineage

Village: Tapuu

Regional Groups: Tatavitam, Simivitam

Josephine Leyvas (Garcia) is the progenitor of the Garcia lineage. Her mother Leandra Culeta was born at Mission San Fernando in 1840, and her maternal ancestor Amando was born into Chaguayabit, the Tatavitam lineage in present-day Valencia, CA. Ties to Chaguayabit, the lineage associated with the Ortega lineage, suggests that she is a direct relative to Francisco Papabubaba and his daughter Maria Rita Alipas (*see* "Ortega Lineage"). Josephine's mother's godmother was Rafaela, the wife of Vicente Francisco, the Alcalde who witnessed Benigno and Maria Rita Alipas' marriage in 1845 and also a great uncle to Leandra, since his sister Teofila married Leandra's maternal grandfather, Francisco del Espiritu Santo.

Rafaela was born at Mission SFR in 1819, and her parents Dionisio and Dionisia, were members of the Simivitam lineage at the village of Tapuu. The godparenting relationship of Rafaela to Leandra Culeta reaffirmed relations between Leandra and her Kitanemuk relatives to the north. In short, Josephine Leyvas' direct ancestors were associated with the lineages of Chaguayabit (Chaguayanga) and Tujubit (Tujunga), while her social relatives were tied to the lineage at Tapuu, which were associated with the Tatavitam, Simivitam, and Pipimaram regional groups.

Among Josephine Levya's descendants is the late Charlie Cooke, the spiritual leader and elder who held deep ties with the Burro Flats pictographic site in the late 20th century and had a large role in the involvement of tribes in the consultation process for the protection of sacred sites.

Village: Jucayaunga

Regional Group: Pipimaram

Rogerio Rocha, born 1824 at Mission SFR, was a well-known Fernandeño captain and blacksmith in San Fernando in the 19th Century, who represented his lineage in court for land dispute cases. Rocha held ties to the Garcia lineage, whose lineage leader in 1928 identified him as the previous captain of the lineage.

Rocha's grandfather, Mariano Antonio, and father Jerman, who was also a captain in the Spanish period, were members of the Simivitam village of *Quimisac*, located in the region north of present-day Simi Valley. Rocha's wife, Maria Manuela, was born at Mission SFR in 1826. Maria's mother, Nerea, was a member of the Tatavitam lineage of Pirubit and her father, Efren, was a member of the lineage located at Jucayaunga, later known as Rancho 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 ancestors (see "Garcia Lineage"). Both Leandra and Rocha lived and worked in the same village, as well as shared a common ancestral identity.

In the late 19th Century, Anglo-American settlers found the land, and the natural water sources in the land, increasingly valuable. By 1900, they had forcibly dispossessed Rocha from the land that he maintained for the collective benefit of his lineage. This act left him homeless on his ancestral lands at over 80 years old in Lopez Canyon, where he and his wife passed away shortly after. The Band has exhausted research on Rocha's family and is in the continued process of identifying his descendants. Today, the Band maintains a park called "Rudy Ortega Sr. Park" that encompasses 3.5 acres of Rocha's property in his honor.

20th Century Ties: Rudy Ortega Sr. and Charlie Cooke

The Simivitam lineage ancestrally located at the mouth of Bell Canyon was called *Jucayaubit* in the registers of Mission SFR (Johnson 2006:5). The village was identified in the period preceding Mission SFR as *El Escorpión* (Harrington 1917 Reel #106-152:1:7), which may have been occupied as recently as 1820 C.E. (Knight 2002, NASA 2010:22) with speakers of both Takic and Chumashan languages residing there, creating a multilingual community (Brown 1967:8; Forbes 1966:138; King and Johnson 1999:88-89, 91-92; Johnson 2006:7). Moreover, Jacjauybit was one of the largest lineages to be recruited to Mission SFR (King 2011:46).

Figure 9–4 Rudy Ortega, Sr. (Chief Little Bear) at Rocketdyne, 1971

The west San Fernando Valley was an area of religious and ceremonial prominence for the Simivitam, Tatavitam, Pipimaram, and Sivavitam. The importance of the land cannot be fully captured in the pages of this ethnography. In short, the polychrome pictographs located in the Simi Hills were places where ceremonial activities took place (Romani 1981:91) for centuries by natives from diverse lineages. Studies suggest that the northern component of Jucayaunga was the host village for the regional winter solstice festivals, in honor of the return of the sun (Romani 1981:92-93). Another important ceremonial location and pictographic site west of San Fernando Valley is part of the village of *Momonga* (Johnson 2006:15-23; NEA and King 2004:112). This sacred area contained fresh water and sulphur springs that remain active today (Knight 2002:265), while north of El Escorpión, at Chatsworth Lake Manor, are the multifaceted polychrome pictographs widely known as Burro Flats.

The pictographs are not definitively tied to just one regional group, lineage, or present-day tribe. As a sacred and ceremonial space, the land was visited, used, and cherished by indigenous peoples for centuries. With increased settler occupations came decreased access to the cultural sites for the Band, and thus, created a disruption in the spatial relationships between the land and people.

Figure 9–5 David Ortega (son of Rudy Ortega, Sr.) at Rocketdyne, 1971

In 1971, the great grandson of Maria Rita Alipas, the late Rudy Ortega, Sr. (Ortega lineage) (Figure 9–5), began his pursuit of preserving the sacred space on behalf of the Band. His contribution to the protection of Santa Susana led a petition drive that pushed for a portion of Rocketdyne's engine test site to be declared a historical monument. Contemporaneously, the great grandson of Josephine Leyvas, Charlie Cooke (Garcia lineage), also advocated for the landscape's protection. 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. Together, Cooke and Ortega Sr. planned a variety of events near the project property, since the actual locations of cultural sites were inaccessible. For years, the elders and members of the Band have planned private ceremonies to honor the sacred landscape (Figure 9–5).

Today, representatives of the Band's elected government and Council of Elders are intricately involved in the preservation of the land. The pictographs and surrounding terrain had been described by the late 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.

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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 direct descendants of those 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 their daughters to select and gather the vegetation that would provide additional sustenance.

The many rock hunting blinds found on the property suggest the land was vibrant for successful hunting. The exceptional hunter would have awoken before dawn and tracked their prey by following wildlife trails which still exist today across the property. 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.

Hunting thrived 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 the Catalina Islands (steatite) to straighten arrow shafts in order to make their weapon aerodynamic. Arrow tips were crafted from stone or bone. Regretfully, the arrows would only shoot as far as 30' demanding the hunter be expertly skilled. Some hunters 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 sounds 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

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[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 9–6). 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.

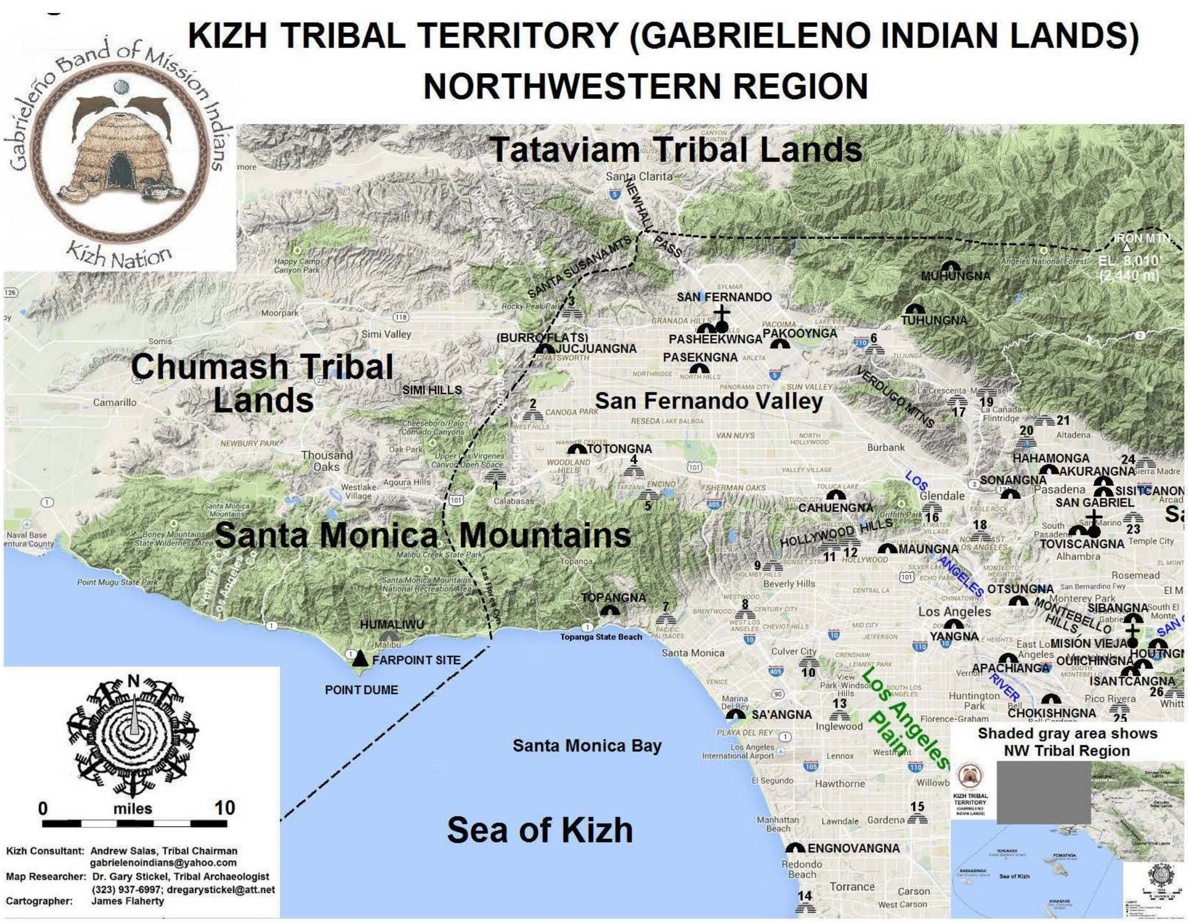
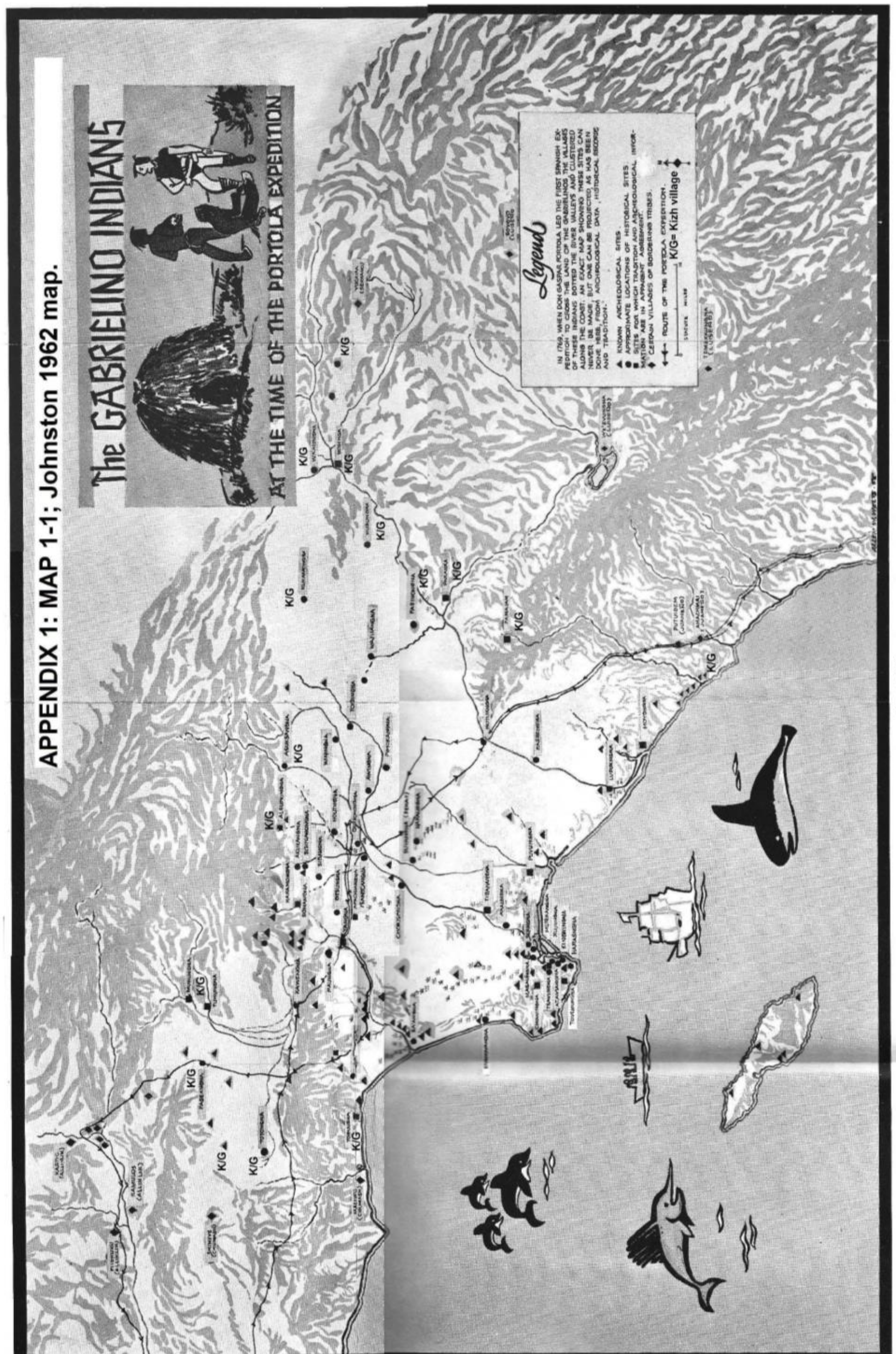


Figure 9–6 Kizh Tribal Territory (Gabrieleno Indian Lands) Northwestern Region

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 (găbrēəlˈēnō) 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

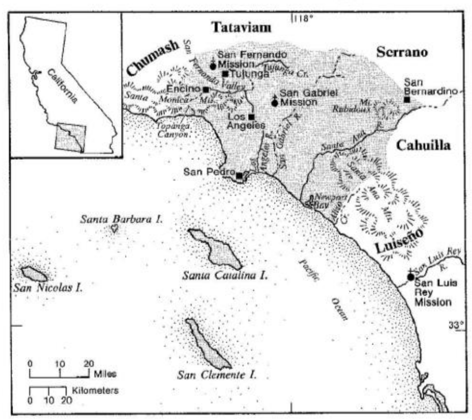


Fig. 1. Tribal territory.

* 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, c̣, k̜, kʷ, ʔ*; (fricatives) *s, ṣ, x, h*; (nasals) *m, n, ŋ*; (approximants) *v, ð, r, r̜, 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.

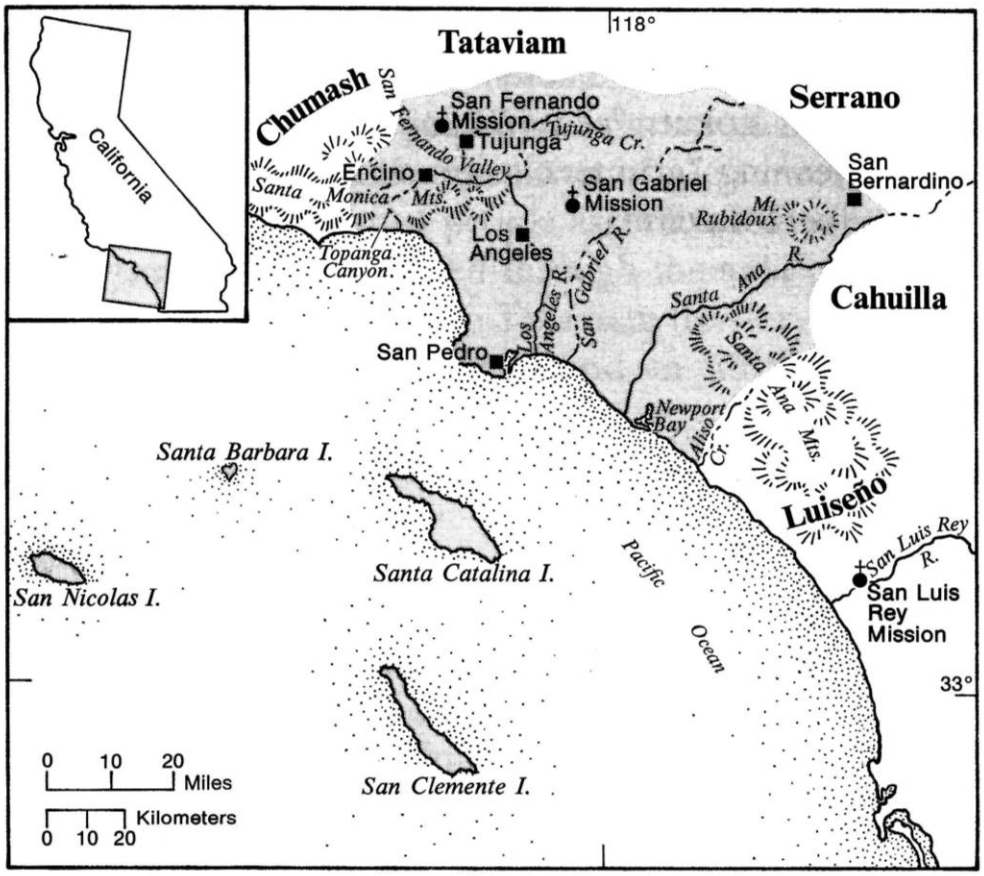
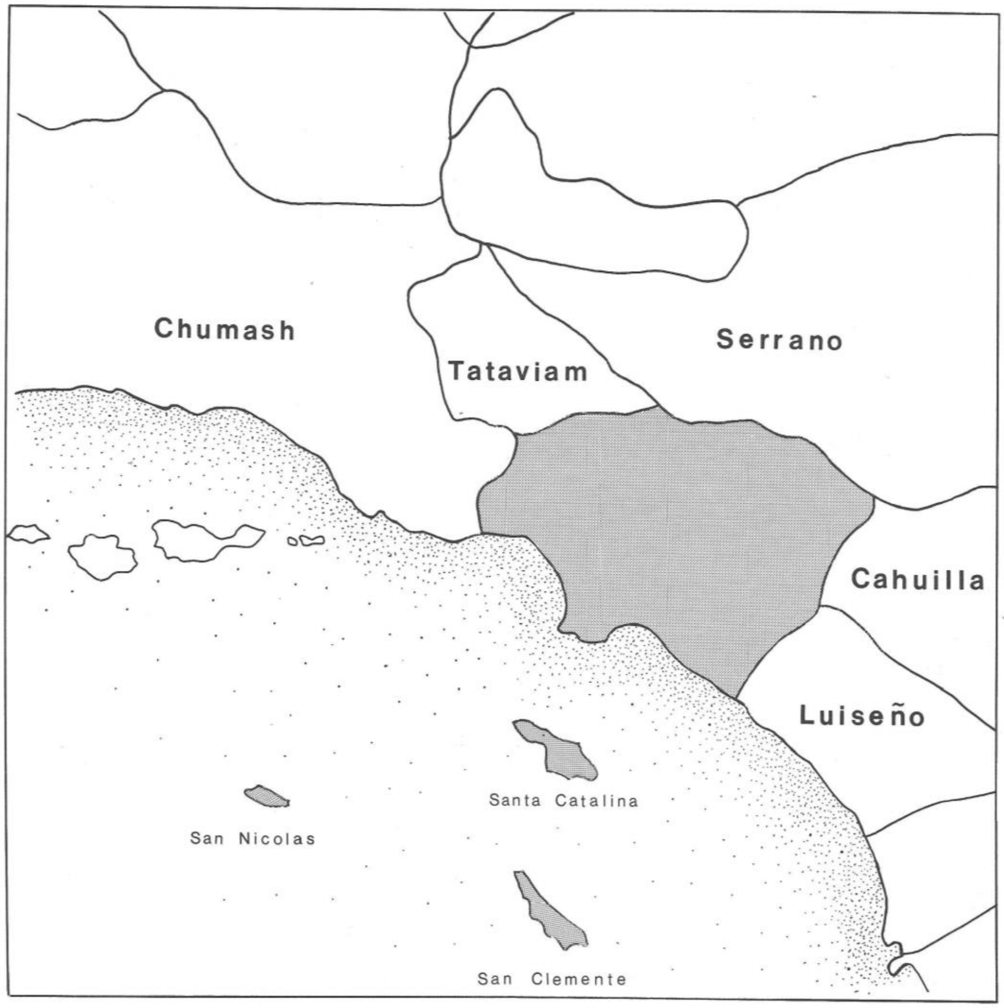


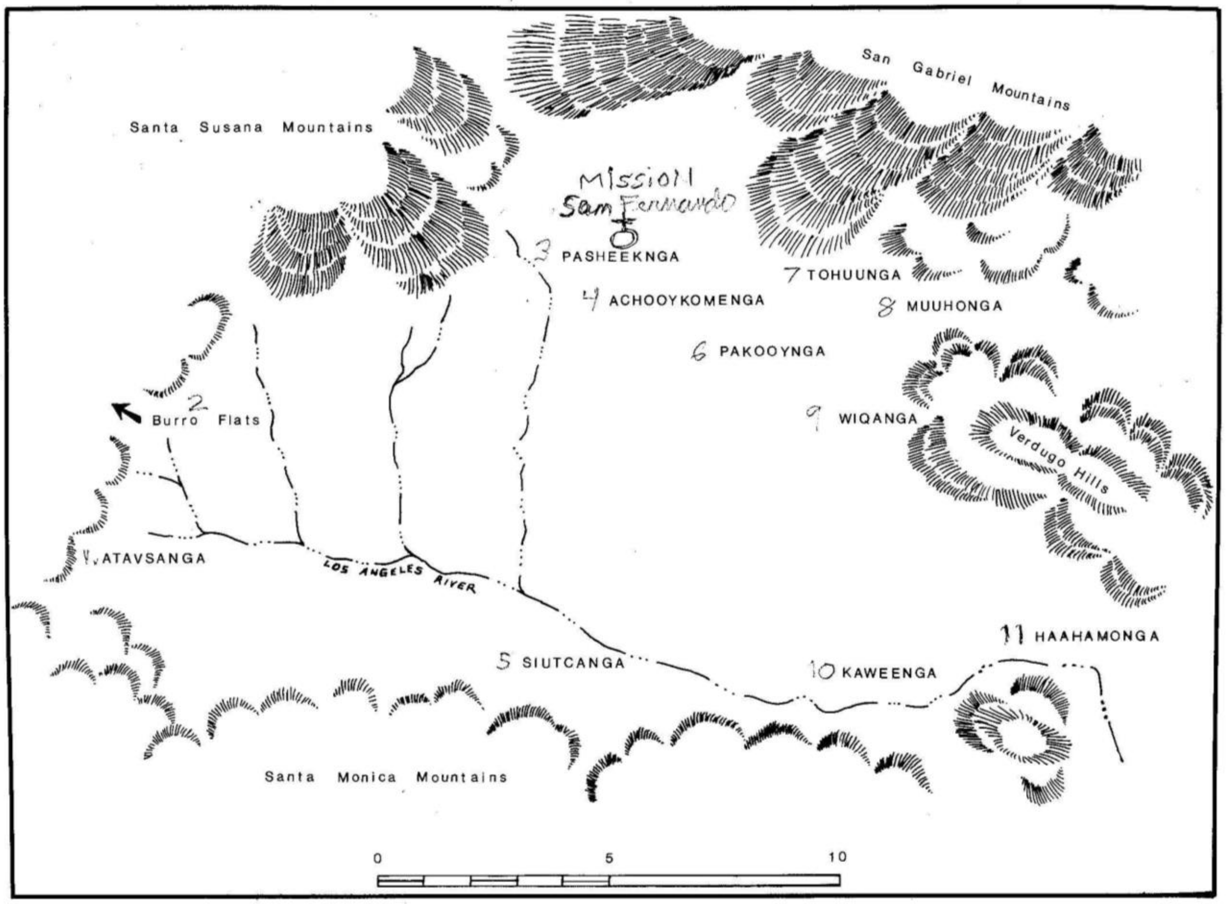
Fig. 1. Tribal territory.

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 milcs.

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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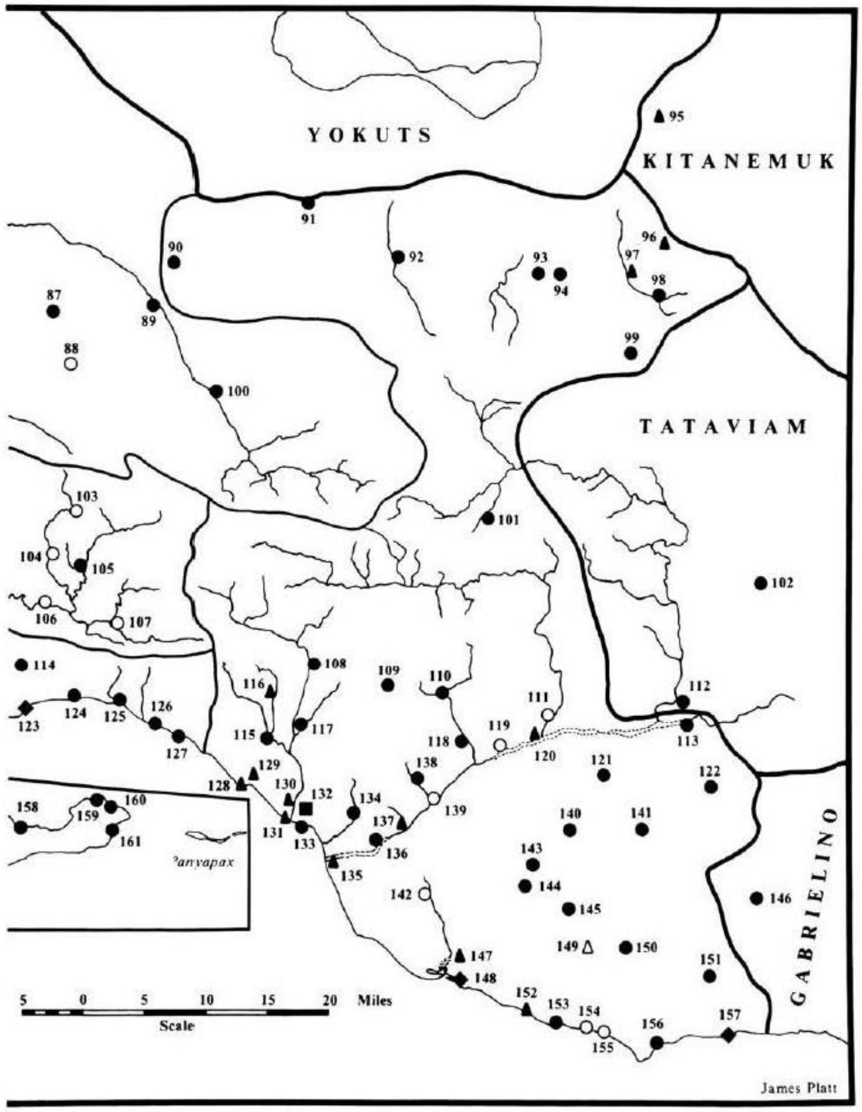

122 - Ta'apu; 146 - Huwam; 157 - Humaliwo

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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 be 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).
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- 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.
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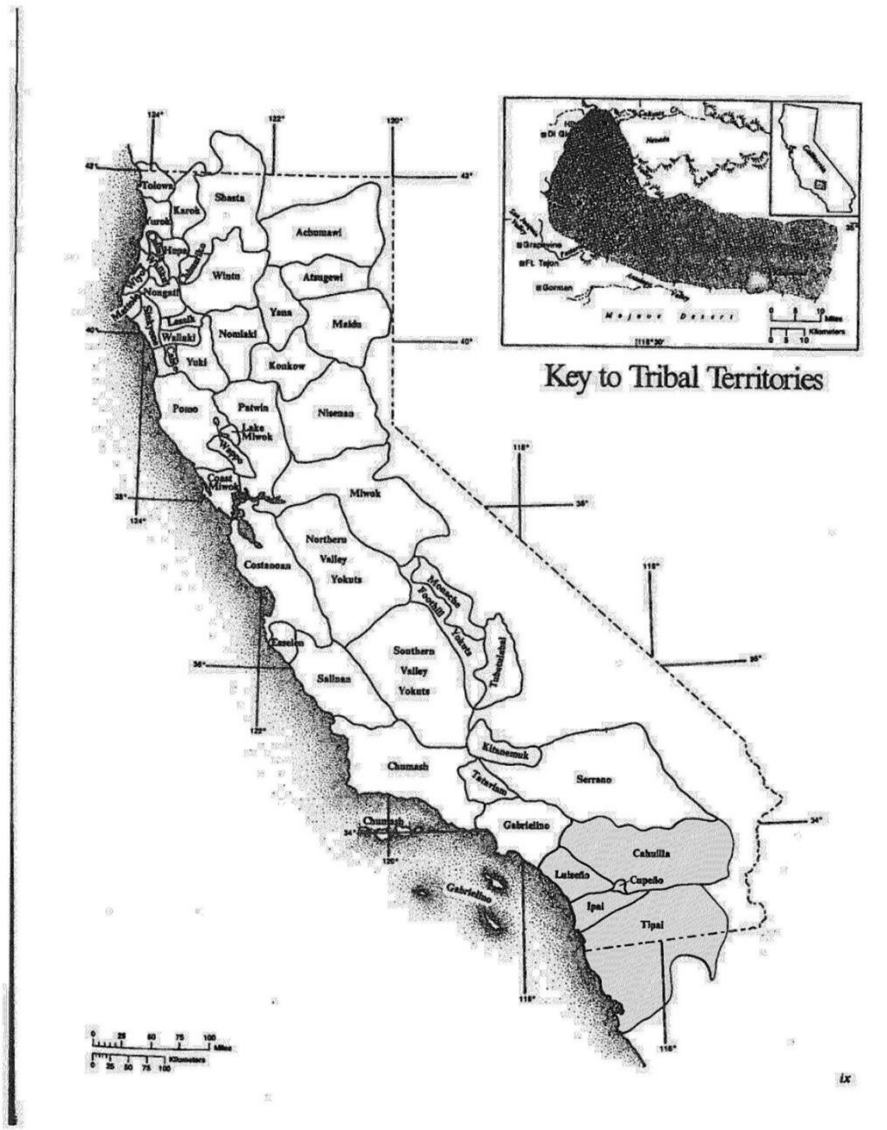
- Surface current patterns off southern California (map) from Kerr, S. L. and G. M. Hawley. Population Replacement on the Southern Channel Islands: New Evidence from San Nicolas Island. *Proceedings of the Fifth California Islands Symposium* (Santa Barbara, CA: Santa Barbara Museum of Natural History): 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 9–7 through 9–12, 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 9–7 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.

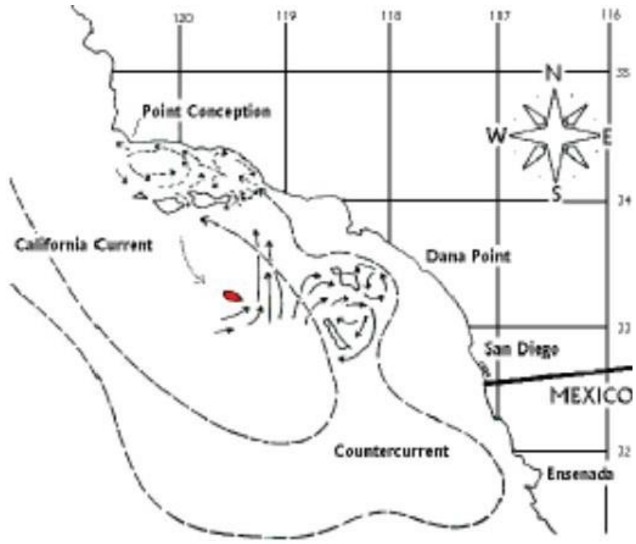

Figure 9–8 Surface current patterns off southern California

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.

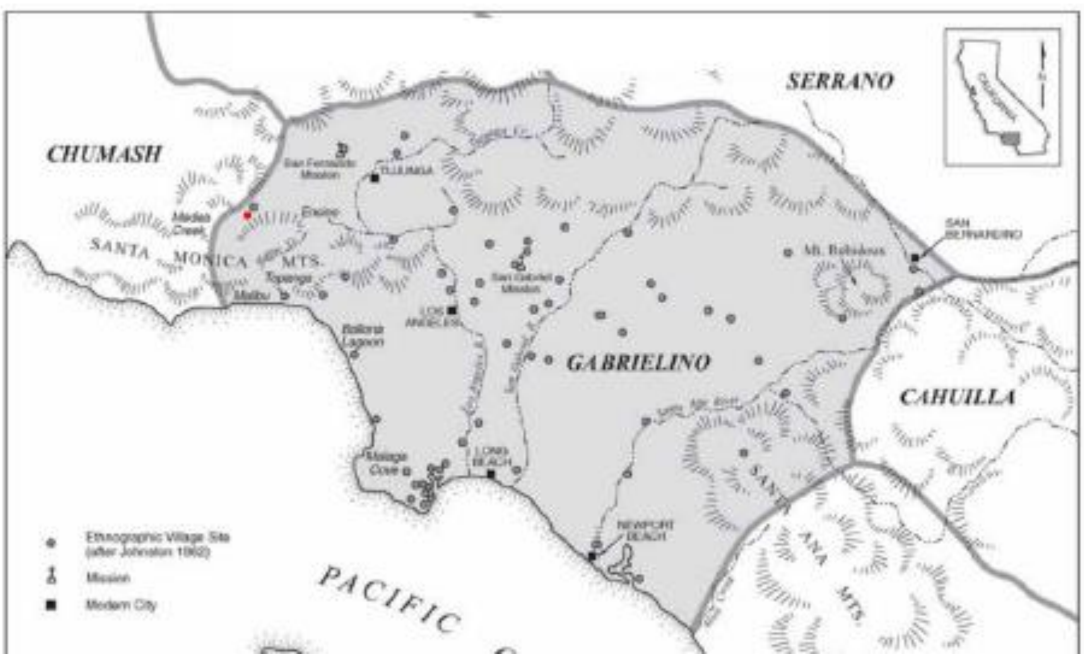

Figure 9–9 Map of Tongva territory showing ethnographic villages and Momonga (red dot)

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 9–10 Map from TATTN illustrating Tongva territory

Based on Google Earth Pro image. John Tommy Rosas 2015.

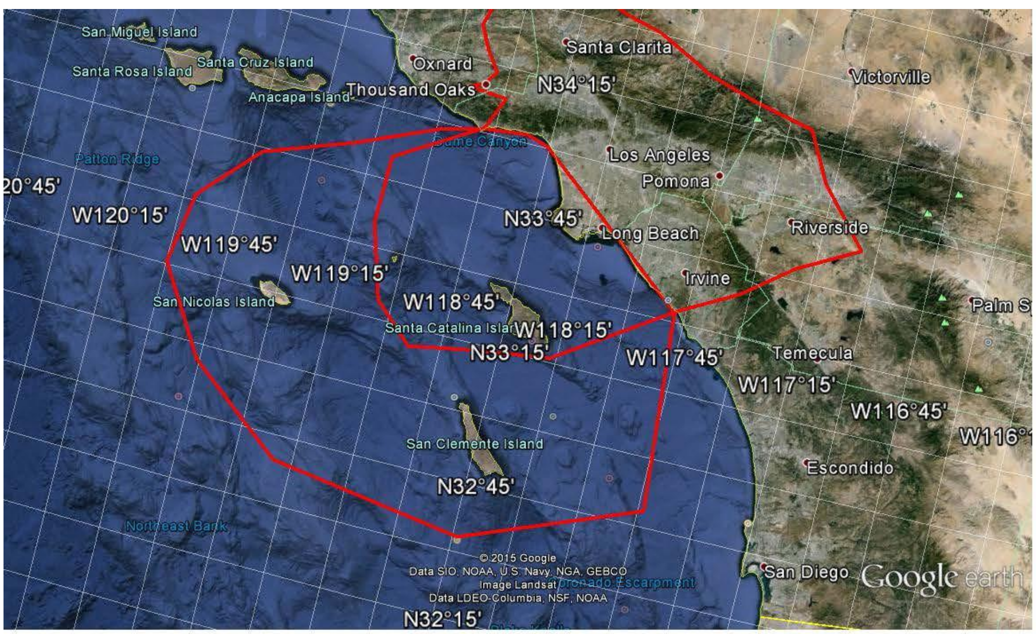

Figure 9–11 Map from TATTN illustrating Tongva territory, including indigenous sea rights

Based on Google Earth Pro image. John Tommy Rosas (2015).

Figure 9–12 Depiction of Tongva Territory. Original map source unknown.

Chapter 10
References

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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.

***contaminants of concern* —** A chemical or radionuclide that has been identified as site activity related and which have been shown through analysis and screening against background and frequency of detection criteria to likely cause health impacts.

***contaminants of potential concern* —** A chemical or radionuclide that has been identified as potentially site activity related based on an historical site assessment and which has been identified as possible posing health impacts.

***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.

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Chapter 13
List of Preparers

13.0 LIST OF PREPARERS

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Education: M.S., Zoology, University of Arizona
B.S., Biology, University of San Francisco

Experience/Technical Specialty:
Forty-two years. Project/program management for multidisciplinary environmental programs, including large facility cleanup and reuse, Federal facility management, water resource development and management, impact analysis, environmental restoration, and environmental regulatory compliance (NEPA/CEQA, CERCLA, RCRA, TSCA, CWA, and CAA).

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Education: B.S., Liberal Arts, University of New Mexico

Experience/Technical Specialty:
Twenty-four years. Program management, media relations, public participation and outreach; strategic and operational planning for programs in connection with nuclear weapons program support, environmental projects, emergency response, radioactive materials transportation.

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EIS RESPONSIBILITIES: EIS MANAGER

Education: B.S., Environmental Resource Management, The Pennsylvania State University

Experience/Technical Specialty:
Thirty-six years. Radioactive waste management, regulatory analysis, environmental compliance and assessment, and radiological impacts assessment.

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Sixteen years. Production of environmental and planning documents primarily for NEPA documents and Air Installation Compatible Use Zone reports. Noise modeling experience includes Noisemap, Advanced Acoustic Model, Rotorcraft Noise Model, Small-Arms Range Noise Model, BNoise2, PCBoom, and MOA-Range Noisemap.

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EIS RESPONSIBILITIES: SOIL VOLUME CALCULATION, RISK ASSESSMENT

Education: Ph.D., Civil Engineering, University of Texas at Austin
M.S., Civil Engineering, Carnegie Mellon University
B.S., Civil Engineering, University of Engineering and Technology Lahore

Experience/Technical Specialty:
Nine years. Environmental engineering with focus on soil and sediment remediation sites; research in bench- and pilot-scale sediment remediation studies, sediment and soil laboratory evaluation techniques, *in situ* sediment remediation techniques.

LAUREN BROWN, LEIDOS

EIS RESPONSIBILITIES: BIOLOGICAL RESOURCES

Education: B.S., Ecology and Systematic Biology, California Polytechnic State University, San Luis Obispo

Experience/Technical Specialty:
Twenty-two years. Biological surveys, environmental management plans, habitat restoration plans, and permit applications, habitat/vegetation mapping, and monitoring for sensitive species protection and habitat recovery as well as delineation of wetlands throughout California and western Washington State using the USACE 1987 *Wetland Delineation Manual*, the 2008 *Supplement for the Arid West Region*, and the 2010 *Supplement for Western Mountains, Valleys and Coast Region,* as well as State and local requirements.

STEPHEN BRYNE, LEIDOS

EIS RESPONSIBILITIES: CULTURAL RESOURCES

Education: M.S., Anthropology, Florida State University, Tallahassee
B.A., Anthropology, Florida State University, Tallahassee

Experience/Technical Specialty:
Twenty-one years. Archaeological surveys, site significance and evaluation testing, data recovery mitigation programs, and archaeological monitoring projects; qualified under Caltrans Professional Qualification Staff as Principal Investigator-Prehistoric Archaeology.

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EIS RESPONSIBILITIES: AIR QUALITY, CLIMATE CHANGE

Education: B.A., Environmental Studies, University of California Santa Barbara

Experience/Technical Specialty:

Twenty-six years. Source emission quantifications, dispersion modeling, health risk assessments, greenhouse gas and climate change analyses, mitigation evaluations, determination of project compliance with air pollution standards and regulations, including NEPA, CEQA, General Conformity Regulations, and regional air pollution agencies.

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EIS RESPONSIBILITIES: BIOLOGICAL RESOURCES

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Experience/Technical Specialty:

Eleven years. Wetland delineations, rare plant surveys, native plant restoration, GIS analyses, mapping, biological assessments, and multispecies habitat conservation plans.

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EIS RESPONSIBILITIES: ADMINISTRATIVE RECORD, REFERENCES, MITIGATIONS

Education: M.A., English, University of Maine
B.S., Geology, University of New Mexico
B.A., English, Rutgers College

Experience/Technical Specialty:

Ten years. Administrative record management and reference management for multiple NEPA documents, geology and earth resources, soil resources.

JOHN DIMARZIO, LEIDOS

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Education: M.S., Geology, George Washington University
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Experience/Technical Specialty:

Thirty years. Project management, NEPA compliance, geology, water resources, waste management, cumulative impacts, and environmental regulations, including NEPA, SDWA, RCRA, and CERCLA.

WILL DUVALL, LEIDOS

EIS RESPONSIBILITIES: AIR QUALITY, CLIMATE CHANGE

Education: B.S., Environmental Engineering, California State University, San Diego

Experience/Technical Specialty:

Eight years. Source emission quantifications, dispersion modeling, health risk assessments, compliance audits and data collection visits, and ambient air quality monitoring and testing.

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EIS RESPONSIBILITIES: SENIOR REVIEWER, FORMER EIS MANAGER, CHAPTER 1 AND 2 MANAGER

Education: B.S., Civil Engineering, Georgia Institute of Technology
Graduate Studies in Environmental Engineering, Georgia Institute of Technology
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Experience/Technical Specialty:
Forty-one years. NEPA management and impact analysis, including EIS/EA management, alternatives development, cumulative impacts, infrastructure, water resources, geology and soils, technical review (all resource areas), and environmental modeling; water resources planning, including stormwater protection plans, water resources plans, water resources procedures, emergency plans, and environmental monitoring plans.

SELENA EVANS, CDM SMITH
EIS RESPONSIBILITIES: LAND RESOURCES, ENVIRONMENTAL JUSTICE

Education: Master of Urban and Regional Planning, Environmental Planning emphasis, San Jose State University, California
B.A., Urban Sociology, Sacramento State University, California

Experience/Technical Specialty:
Seven years. NEPA and CEQA environmental analysis and assessment; water resources; hazard mitigation and remediation, including flood management and fire hazard reduction; multimodal transportation; environmental permitting; and general State planning policy.

REBECCA FARMER, CDM SMITH
EIS RESPONSIBILITIES: GIS

Education: B.S., Geography, James Madison University

Experience/Technical Specialty:
Ten years. Database management; creation, acquisition, conversion and maintenance of spatial data sets; data visualization, and map production.

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EIS RESPONSIBILITIES: HUMAN HEALTH

Education: B.S., Environmental Systems Engineering, Clemson University

Experience/Technical Specialty:
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ERIN FORMANEK, CDM SMITH
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Education: M.S. Environmental Science, University of Colorado
B.S. Environmental Biology/Zoology, Michigan State University

Experience/Technical Specialty:
Sixteen years. Experience in risk assessment and toxicology; human health and ecological risk assessment evaluating a wide range of contaminants, including asbestos, heavy metals, herbicides, pesticides, radionuclides, dioxins/furans/polychlorinated biphenyls, polycyclic aromatic hydrocarbons, volatile and semi-volatile organic compounds.

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Experience/Technical Specialty:
Twenty-five years. NEPA compliance, Federal natural and cultural resources regulations, all phases of archaeological fieldwork.

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EIS RESPONSIBILITIES: GEOLOGY AND SOILS, GROUNDWATER

Education: M.S., Geology, Queen's University
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Experience/Technical Specialty:
Twenty-seven years. Management and performance of remedial and pre-design investigations (including at several NPL sites), site characterizations, and hydrogeological and geological site acceptability studies.

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Thirty-seven years. Nuclear risk analysis.

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B.A., Psychology and Biological Sciences, U.C. Santa Barbara

Experience/Technical Specialty:
Thirteen years. NEPA management and impact analysis, including EA management, alternatives development, cumulative impacts, and technical review (all resource areas).

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B.A., Ethics/Archaeology, University of Cape Town

Experience/Technical Specialty:

Twenty-eight years. Environmental planning, project management, analysis of land use, recreation, visual, and other social resources, as well as project description development for complex investigations under NEPA; Certified Leader in Energy and Environmental Design Accredited Professional with specialty in Building Design and Construction (LEED AP BD+C).

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Education: M.S., Environmental Engineering Sciences, University of Florida
B.S., Zoology, Clemson University

Experience/Technical Specialty:

Thirty-one years. Project management; environmental and nuclear regulatory compliance; NEPA; National Pollutant Discharge Elimination System permitting; and radioactive and hazardous waste management.

LORRAINE GROSS, LEIDOS

EIS RESPONSIBILITIES: CULTURAL RESOURCES

Education: M.A., Anthropology, Washington State University
B.A., Anthropology, Pomona College
Register of Professional Archaeologists (RPA #10034)

Experience/Technical Specialty:

Thirty-six years. Cultural resource project management, NEPA analysis, *National Register of Historic Places* evaluations and nominations, Historic American Building Survey documentation review, Integrated Cultural Resource Management Plans, documentation for compliance with Section 106 and Section 110 of the National Historic Preservation Act; various aspects of field and laboratory archaeology, including performing project management and coordination, data collection, research, reporting, and writing.

ERNEST HARR, LEIDOS

EIS RESPONSIBILITIES: CHAPTER 2 SUMMARY OF IMPACTS AND CHAPTER 4 LEAD

Education: B.S., Zoology, University of Maryland

Experience/Technical Specialty:

Forty years. NEPA analysis; radiological analyses – normal operation, accidents and intentionally destructive acts; human health and safety – worker and public; radioactive and mixed waste management; transportation – radiological and nonradiological; remediation; decontamination and decommissioning; and regulatory and compliance analyses.

JOSEPH JIMENEZ, LEIDOS
EIS RESPONSIBILITIES: CULTURAL RESOURCES

Education: M.A., Anthropology, Idaho State University
B.A., Anthropology, Idaho State University
Register of Professional Archaeologists (RPA #15644)

Experience/Technical Specialty:
Thirty-three years. Cultural resource project management, NEPA analysis, *National Register of Historic Places* evaluations, Historic American Building Survey documentation review, Integrated Cultural Resource Management Plans, documentation for compliance with Section 110 of the National Historic Preservation Act; documentation and support for consultation in compliance with Section 106 of the National Historic Preservation Act; and various aspects of field and laboratory archaeology, including performing project management and coordination, data collection, research, reporting, and writing.

ROY KARIMI, LEIDOS
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M.S., Nuclear Engineering, Massachusetts Institute of Technology
B.S., Chemical Engineering, Abadan Institute of Technology

Experience/Technical Specialty:
Thirty-four years. Nuclear power plant safety, risk and reliability analysis, design analysis, criticality analysis, accident analysis, consequence analysis, spent fuel dry storage safety analysis, transportation risk analysis, and probabilistic risk assessment.

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Education: M.P.A., Public Administration, Indiana University
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Experience/Technical Specialty:
Twenty-nine years. Public participation, facilitation.

TIM LUTTRELL, P.E., LEIDOS
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Education: M.S., Civil Engineering, University of Tennessee
B.S., Civil Engineering, University of Tennessee

Experience/Technical Specialty:
Twenty years. Traffic engineering, transportation planning, traffic safety and operational analysis, environmental impact statement analysis, documentation, and report development; construction and work zone safety subject matter expert and course instructor.

BRIAN MINICHINO, LEIDOS
EIS RESPONSIBILITIES: TRANSPORTATION

Education: B.S., Chemistry, Virginia Polytechnic Institute and State University

Experience/Technical Specialty:
Seven years. Transportation, traffic, air quality impacts analysis, cumulative impacts, public comment response, and chapter management.

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Education: B.S., Communications, University of Tennessee

Experience/Technical Specialty:
Twenty-six years. Technical writing and editing.

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EIS RESPONSIBILITIES: BIOLOGICAL RESOURCES

Education: Ph.D., Ecology and Evolutionary Biology, University of California, Irvine
M.S., Biology, University of Arizona
B.A., Zoology, Pomona College
Certified Senior Ecologist, Ecological Society of America

Experience/Technical Specialty:
Thirty-nine years. Environmental impact analysis, mitigation planning and implementation, biophysical environment of central and southern California, wetland analysis and creation, habitat restoration and monitoring for large-scale projects as principal investigator, project manager, and interdisciplinary assessment team leader.

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EIS RESPONSIBILITIES: TECHNICAL REVIEWER

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Experience/Technical Specialty:
Two years. Environmental planning and natural resource management specializing in preparing NEPA and other environmental studies.

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Education: Master of City and Regional Planning, California Polytechnic State University San Luis Obispo
B.S., Natural Resources Planning, Humboldt State University

Experience/Technical Specialty:
Ten years. Planning and analysis of water resource projects and programs in California; certified planner (AICP) and a Leadership in Energy and Environmental Design Accredited Professional (LEED AP BD+C).

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B.S., Mechanical Engineering, Arizona State University

Experience/Technical Specialty:
Thirty-eight years. NEPA analysis; waste storage and disposal; waste inventories, manifesting, and transportation; performance and environmental assessment; institutional controls (stewardship); regulatory review; licensing authorization; and regulatory and compliance analyses.

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EIS RESPONSIBILITIES: HUMAN HEALTH

Education: Ph.D., University of Tennessee, Analytical Chemistry (Radiochemistry emphasis, Health Physics minor)
M.S., University of Tennessee, Environmental Chemistry (Analytical emphasis)
B.S., David Lipscomb University, Chemistry (Biochemistry emphasis)

Experience/Technical Specialty:
Forty-one years. Analytical chemistry, radiochemistry, radiological detection and measurement, dose and risk assessment, environmental and waste management; nuclear material disposition, control, accountability, and nonproliferation; analytical data evaluation, validation, and management.

TARA SCHOENWETTER, LEIDOS
EIS RESPONSIBILITIES: BIOLOGICAL RESOURCES

Education: Ph.D., Lincoln University Centre for Research Excellence and Ecology Division, PhD Program in Ecology
M.S., Frostburg State University Applied Ecology and Conservation Biology Master's Program
B.S., Biology (Ecology emphasis), University of California Irvine

Experience/Technical Specialty:
Fifteen years. Habitat Conservation Plans, Integrated Natural Resource Management Plans, and other environmental documents addressing sensitive species protection, mitigation, monitoring and recovery throughout California and in a variety of western States; assessment and management of sensitive environments, streams, natural resources permitting, project management on military installations, and Section 7 documentation and consultation support.

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EIS RESPONSIBILITIES: ENVIRONMENTAL LAWS, REGULATIONS, AND PERMITS; CUMULATIVE IMPACTS; CONSULTATION APPENDIX LEAD

Education: B.S., Biology, Indiana University

Experience/Technical Specialty:
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Education: Ph.D., Civil Engineering, University of Tennessee
M.S.P., Urban and Regional Planning, University of Tennessee
B.A., Geography, State University of New York College at Plattsburgh

Experience/Technical Specialty:
Thirty years. Intelligent Transportation System evaluation and program support; urban and statewide modeling and forecasting, transportation policy studies, and public transportation systems planning; interactions with U.S. Department of Transportation, Federal Highway Administration, Federal Transit Administration, and State departments of transportation.

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EIS RESPONSIBILITIES: SOCIOECONOMICS, ENVIRONMENTAL JUSTICE

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Experience/Technical Specialty:
Fifteen years. NEPA analysis, socioeconomics, environmental justice, social effects, regional economic analysis.

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Education: B.S., Retail Marketing and Management

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Experience/Technical Specialty:
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CHAPTER 14
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14.0 DISTRIBUTION LIST

The U.S. Department of Energy provided copies of the *Final Environmental Impact Statement for Remediation of Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory* (*Final 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 21 copies of the *Final SSFL Area IV EIS,* 750 copies of the Summary of the *Final SSFL Area IV EIS*, and 37 compact discs of the *Final SSFL Area IV EIS* were sent to interested parties. Copies will be provided to others upon request.

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National Aeronautics and Space Administration
National Institute for Occupational Safety & Health
National Marine Fisheries Services
Naval Facilities Engineering Service Center
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A complete copy of the *SSFL Area IV EIS* and references may be reviewed at any of the reading rooms and libraries listed below.

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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

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Arcadia Studio Landscape Architecture, Members of the Green Building Alliance
Shelly Backlar, Friends of the Los Angeles River
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California Public Interest Research (CALPIRG)
Mary Carr, Ventura County Medical Association
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Thomas Cochran, Natural Resources Defense Council - Washington Office
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Alec Uzemeck, SSFL Community Advisory Group
Marcos Vargas, Central Coast Alliance United for a Sustainable Society (CAUSE)
Christina Walsh, peoplepolicy.org
Mary Weisbrock, Save Open Space
Jane Williams, California Communities Against Toxics

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John Turziano
Gordon Twa
Alec Uzemeck
Samuel Valenza
Jose Valle de Leon
Jacob Van Buskirk
Pat Van Buskirk
Mark Van Dam
Andrew van der Valk
Andrew Varela
Ralph Vartabedian
Julie Vazquez
Lorna Veliz
Barry Verga
Dan Vicare
Darlene M. Villasenor
John R. Villegas
Daniel von Wetter
Amanda Wade
Connie Wade
Martha Waite
Peter Waldburger
Todd Wallbom
John Walter
John Walter
Kevin Wapner
Carole Wayne
Brian Webb
Larissa Webster
David & Barbara Wechter
David A. Weeshoff
Matt Weintraub
Edward Weisner
Abe Weitzberg
Abraham Weitzberg
Terry L. Wells
Ernest & Christine Westwiller
Rosemarie White
Rebecca Whitnall
Mary Wiesbrock
Hank Wieseneck
Robert Wilkinson
Bonnie Wilson
Kathleen Wilson
Dennis E. Wiltshire
Kenneth & Elaine Wolfe
John Wollard
Debra & Helen Womack
John Wondolleck
Kim Wong
K. Wong
Roger Woodruff
Lance Wurzbacher
Roque Ybarra
Jacqueline C. Young
Joanne Yvanek-Garb
Tanya Zeferjahn
Richard Zeimer
Abe Zeitoun
Mark Zeller
Ronald Ziman
Peter Zorba
George Zucco
Herbert R. Zweig