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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

Volume 1 Book 1
(Chapters 1 through 4)

NNSA

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office

Availability of 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 (NNSS SWEIS)

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Location: Nye and Clark Counties, Nevada

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Abstract: This *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 (NNSS SWEIS)* analyzes the potential environmental impacts of proposed alternatives for continued management and operation of the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) and other U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA)-managed sites in Nevada, including the Remote Sensing Laboratory (RSL) on Nellis Air Force Base in North Las Vegas, the North Las Vegas Facility (NLVF), the Tonopah Test Range (TTR), and environmental restoration areas on the U.S. Air Force Nevada Test and Training Range. The purpose and need for agency action is to provide support for meeting NNSA's core missions established by Congress and the President and to satisfy the requirements of Executive Orders and comply with Congressional mandates to promote, expedite, and advance the production of environmentally sound energy resources, including renewable energy resources such as solar and geothermal energy systems.

The NNSS has a long history of supporting national security objectives by conducting underground nuclear tests and other nuclear and nonnuclear activities. Since the October 1992 moratorium on nuclear testing, NNSA's mission at the NNSS has evolved from one that focuses on active nuclear weapons tests to one that maintains readiness and the capability to conduct underground nuclear weapons tests; such a test would be conducted only if so directed by the President in the interest of national security. Resources have been reallocated to introduce and expand other mission activities/programs at the NNSS, RSL, NLVF, and TTR to support three DOE/NNSA core missions: National Security/Defense, Environmental Management, and Nondefense. The National Security/Defense Mission includes the Stockpile Stewardship and Management,

Nuclear Emergency Response, Nonproliferation and Counterterrorism, and Work for Others Programs. The Work for Others Program supports other DOE programs and Federal agencies such as the U.S. Department of Defense, U.S. Department of Justice, and U.S. Department of Homeland Security. The Environmental Management Mission includes the Waste Management and Environmental Restoration Programs. The Nondefense Mission includes the General Site Support and Infrastructure, Conservation and Renewable Energy, and Other Research and Development Programs.

The NNSS, RSL, NLVF, and TTR support DOE/NNSA's core missions by providing the capabilities to process and dispose of a damaged nuclear weapon or improvised nuclear device and to conduct high-hazard experiments involving special nuclear material and high explosives, nonnuclear experiments, and hydrodynamic testing. Nuclear stockpile stewardship activities at the NNSS include dynamic plutonium experiments that provide technical information to maintain the safety and reliability of the U.S. nuclear weapons stockpile and research and training in areas such as nuclear safeguards, criticality safety, and emergency response. Special nuclear materials are also stored at the NNSS. In addition, in accordance with the amended Record of Decision (ROD) (DOE/EIS-0243) for the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS*), DOE/NNSA receives low-level and mixed low-level radioactive waste for disposal at the NNSS.

This *NNSS SWEIS* analyzes the potential environmental impacts of three reasonable alternatives for continued operations at the NNSS, RSL, NLVF, and TTR. These alternatives include a No Action Alternative and two action alternatives: Expanded Operations and Reduced Operations. The No Action Alternative, which is analyzed as a baseline for evaluating the two action alternatives, would continue implementation of the *1996 NTS EIS* ROD (DOE/EIS-0243) and subsequent amendments (61 FR 65551and 65 FR 10061), as well as other decisions supported by separate NEPA analyses completed since issuance of the final *1996 NTS EIS*. The No Action Alternative reflects activity levels consistent with those seen since 1996. The Expanded Operations Alternative considers adding new work at the NNSS in the areas of nonproliferation and counterterrorism, high-hazard and other experiments, research and development, and testing. Such expanded operations could include developing test beds for concept testing of sensors, mitigation strategies, and weapons effectiveness. The Reduced Operations Alternative would reduce the overall level of operations and close specific buildings and structures. NNSA would also consider allowing the development of solar power generation facilities under each alternative.

Public Comments: In preparing this *Final NNSS SWEIS*, NNSA considered comments received during the scoping period (July 24, 2009, to October 16, 2009) and during the public comment period on the *Draft NNSS SWEIS* (July 29, 2011, to December 2, 2011), as well as those received after the close of the public comment period on the *Draft NNSS SWEIS*. Five public hearings on the *Draft NNSS SWEIS* were held to provide interested members of the public with opportunities to learn more about NNSA missions, programs, and activities and the content of the *Draft NNSS SWEIS* from exhibits, factsheets, and discussion with NNSA subject matter experts. From September 20 through 28, 2011, public hearings were held in Las Vegas, Pahrump, Tonopah, and Carson City, Nevada, and St. George, Utah. An additional hearing was conducted for the Consolidated Group of Tribes and Organizations on October 6, 2011. All comments received were considered during preparation of this *Final NNSS SWEIS*.

This *Final NNSS SWEIS* contains revisions and new information based in part on comments received on the *Draft NNSS SWEIS*. Vertical change bars in the margins indicate the locations of these revisions and new information. Volume 3 contains the comments received on the *Draft NNSS SWEIS* and DOE/NNSA's responses to those comments. DOE/NNSA will use the analysis presented in this *Final NNSS SWEIS*, as well as other information, in preparing a ROD regarding the continued operation of the NNSS and offsite locations in Nevada. DOE/NNSA will issue a ROD no sooner than 30 days after the U.S. Environmental Protection Agency publishes a Notice of Availability of this *Final NNSS SWEIS* in the *Federal Register*.

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ACRONYMS, ABBREVIATIONS, AND CONVERSION CHARTS

ACRONYMS, ABBREVIATIONS, AND CONVERSION CHARTS

ACEC	Area of Critical Environmental Concern
AEA	Atomic Energy Act
AFVs	Alternate Fuel Vehicles
AIWS	American Indian Writers Subgroup
ALARA	as low as is reasonably achievable
ALOHA	Areal Locations of Hazardous Atmospheres
AMS	Aerial Measuring System
ARG	Accident Response Group
ASSESS	Analytical System and Software for Evaluating Safeguards and Security
ATLAS	Adversary Time-Line Analysis System
BEEF	Big Explosives Experimental Facility
BLM	Bureau of Land Management
BMP	best management practice
CAA	Clean Air Act
CAPP	Chemical Accident Prevention Program
CARE	Communities Against a Radioactive Environment
CAS	corrective action sites
CAU	corrective action unit
CEMP	Community Environmental Monitoring Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CERT	Community Emergency Response Team
CFR	*Code of Federal Regulations*
CGTO	Consolidated Group of Tribes and Organizations
CSP	Concentrated Solar Power
CY	calendar year
D&D	decontamination and decommissioning
DAF	Device Assembly Facility
DAQEM	Department of Air Quality and Environmental Management
DARE	Drug Abuse Resistance Education
DART	days away, restricted, or transferred
dBA	decibels A-weighted
DHS	U.S. Department of Homeland Security
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/NNSA	U.S. Department of Energy/National Nuclear Security Administration
DOT	U.S. Department of Transportation
DTRA	Defense Threat Reduction Agency
DU	depleted uranium
EA	Environmental Assessment
EIS	environmental impact statement
EMAC	Ecological Monitoring and Compliance

E-MAD	Engine Maintenance, Assembly, and Disassembly
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ERPG	Emergency Response Planning Guideline
ETDS	E-Tunnel Waste Water Disposal System
FAA	Federal Aviation Administration
FACE	Free-Air Carbon Dioxide Enrichment
FBI	Federal Bureau of Investigation
FFACO	Federal Facility Agreement and Consent Order
FLPMA	Federal Land Policy and Management Act
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FRMAC	Federal Radiological Monitoring and Assessment Center
FTE	full-time equivalent
FY	fiscal year
GBUAPCD	Great Basin Unified Air Pollution Control District
GCD	greater confinement disposal
GHG	greenhouse gas
gpd	gallons per day
GTCC	greater-than-Class C [waste]
GWP	global warming potential
HABS	Historic American Buildings Survey
HAER	Historic American Engineering Record
HAP	hazardous air pollutant
HAZMAT	hazardous materials
HLW	high-level radioactive waste
INL	Idaho National Laboratory
ISO	International Organization for Standardization
JASPER	Joint Actinide Shock Physics Experimental Research
JCATS	Joint Conflict and Tactical Simulations
KLF	Kistler Launch Facility
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LCF	latent cancer fatality
LLW	low-level radioactive waste
LOS	level of service
MCL	maximum contaminant level
MEI	maximally exposed individual
MGCF	Mojave Global Change Facility
MGD	million gallons per day
MLLW	mixed low-level radioactive waste
MSHCP	Multi-Species Habitat Conservation Plan
NAAQS	National Ambient Air Quality Standards

NAC	*Nevada Administrative Code*
NAGPRA	Native American Graves Protection and Repatriation Act
NASA	National Aeronautics and Space Administration
NDEP	Nevada Division of Environmental Protection
NEPA	National Environmental Policy Act of 1969
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NEST	nuclear emergency support team
NHPA	National Historic Preservation Act
NLVF	North Las Vegas Facility
NSO	Nevada Site Office
NNSS	Nevada National Security Site
NOI	Notice of Intent
NPDES	National Pollutant discharge Elimination System
NPS	National Park Service
NPTEC	Nonproliferation Test and Evaluation Complex
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NRS	Nevada Revised Statute
NSO	Nevada Site Office
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
NUREG	U.S. Nuclear Regulatory Commission Regulation
OSHA	Occupational Safety and Health Act
OST	Office of Secure Transportation
P.L.	Public Law
PCB	polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
pH	a measure of acidity or basicity
PM_n	particulate matter with an aerodynamic diameter less than or equal to $_n$ micrometers
PSD	Prevention of Significant Deterioration
PWS	public water system
QAPP	Quality Assurance Program Plan
rad	radiation absorbed dose
RADTRAN	Radioactive Material Transportation Risk Assessment Code 6
RAP	Radiological Assistance Program
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RIMS II	Regional Input-Output Modeling System II
RISKIND	Risks and Consequences of Radioactive Material Transport computer code
RNCTEC	Radiological/Nuclear Countermeasures Test and Evaluation Complex
ROD	Record of Decision
ROI	region of influence
RREM	Routine Radiological Environmental Monitoring
RSL	Remote Sensing Laboratory
RTG	radioisotope thermoelectric generator

RWAP	Radioactive Waste Acceptance Program
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
SA	Supplement Analysis
SARA	Superfund Amendments and Reauthorization Act
SEZ	solar energy zones
SNM	special nuclear materials
SNWA	Southern Nevada Water Authority
SPA	Specific Planning Area
SSO	Sandia Site Office
SWAT	special weapons and tactics
SWEIS	site-wide environmental impact statement
TCE	tetrachloroethene
TNT	2,4,6-trinitrotoluene
TPH	total petroleum hydrocarbons
TRAGIS	Transportation Routing Analysis Geographic Information System
TRC	total recordable cases
TRU	transuranic waste
TSCA	Toxic Substances Control Act
TSD	treatment, storage, and disposal
TTR	Tonopah Test Range
TRUPACT	Transuranic Package Transporter
TYSP	Ten-Year Site Plan
UGTA	Underground Test Area
USAF	United States Air Force
U.S.C.	*United States Code*
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	unexploded ordnance
VOC	volatile organic compound
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant
ZPPR	zero power plutonium reactor
ºC	degrees Centigrade
ºF	degrees Fahrenheit
μS	microsiemens

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	16,025.6	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
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	3.78533	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	35.315	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 AND PURPOSE AND NEED FOR AGENCY ACTION

1.0 INTRODUCTION AND PURPOSE AND NEED FOR AGENCY ACTION

1.1 Introduction

This *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 (NNSS SWEIS)* analyzes potential environmental impacts of continued management and operation of the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) and other sites managed by the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) in Nevada. The primary purpose of continuing operation of the NNSS is to provide support for DOE/NNSA's nuclear weapons stockpile stewardship missions. DOE/NNSA also supports other DOE programs and Federal agencies such as the U.S. Department of Defense (DoD), U.S. Department of Justice, and U.S. Department of Homeland Security. This site-wide environmental impact statement (SWEIS) analyzes the potential environmental impacts of reasonable alternatives for current and reasonably foreseeable missions, programs, capabilities, and projects at the NNSS and offsite locations in Nevada during a 10-year period.

Established by Congress through the National Nuclear Security Administration Act (Title XXXII of the National Defense Authorization Act for Fiscal Year 2000, Public Law [P.L.] 106-65), DOE/NNSA is a separately organized, semiautonomous agency within DOE. The DOE/NNSA Nevada Site Office (NSO) operates programs at the NNSS and at offsite locations in Nevada, including the North Las Vegas Facility (NLVF), the Remote Sensing Laboratory (RSL) on Nellis Air Force Base in North Las Vegas, the Tonopah Test Range (TTR), and environmental remediation areas on the U.S. Air Force Nevada Test and Training Range (formerly the Nellis Air Force Range). These facilities and sites are shown in **Figure 1–1**. The NNSS and the TTR are located in Nye County; NLVF and RSL are located in Clark County; and the Nevada Test and Training Range is located in Nye, Lincoln, and Clark Counties in southern Nevada.

DOE's "National Environmental Policy Act Implementing Procedures" (10 *Code of Federal Regulations* [CFR] Part 1021) require preparation of a SWEIS, a broad-scope document that identifies and assesses the individual and cumulative impacts of ongoing and reasonably foreseeable future actions for certain large multiple-facility DOE sites such as the NNSS (10 CFR 1021.330c). In accordance with 10 CFR Part 1021, an evaluation of a SWEIS is required every 5 years. DOE/NNSA determines whether an existing SWEIS remains adequate or a new SWEIS or supplement to the existing SWEIS is needed. DOE/NNSA prepared this SWEIS to comply with National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500–1508) and DOE NEPA Implementing Procedures (10 CFR Part 1021).

In 1996, DOE issued the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)* (DOE 1996c) and an associated Record of Decision (ROD) (61 *Federal Register* [FR] 65551). DOE selected the *1996 NTS EIS* Expanded Use Alternative for most activities, but decided to manage low-level radioactive waste (LLW) and mixed low-level radioactive waste (MLLW) at levels described under the No Action Alternative, pending decisions on the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (WM PEIS)* (DOE 1997). In the February 2000 *WM PEIS* ROD (65 FR 10061), DOE announced that the NNSS would be one of two regional sites to be used for LLW and MLLW disposal. At the same time, DOE amended the *1996 NTS EIS* ROD to select the Expanded Use Alternative for waste management activities at the NNSS (65 FR 10061).

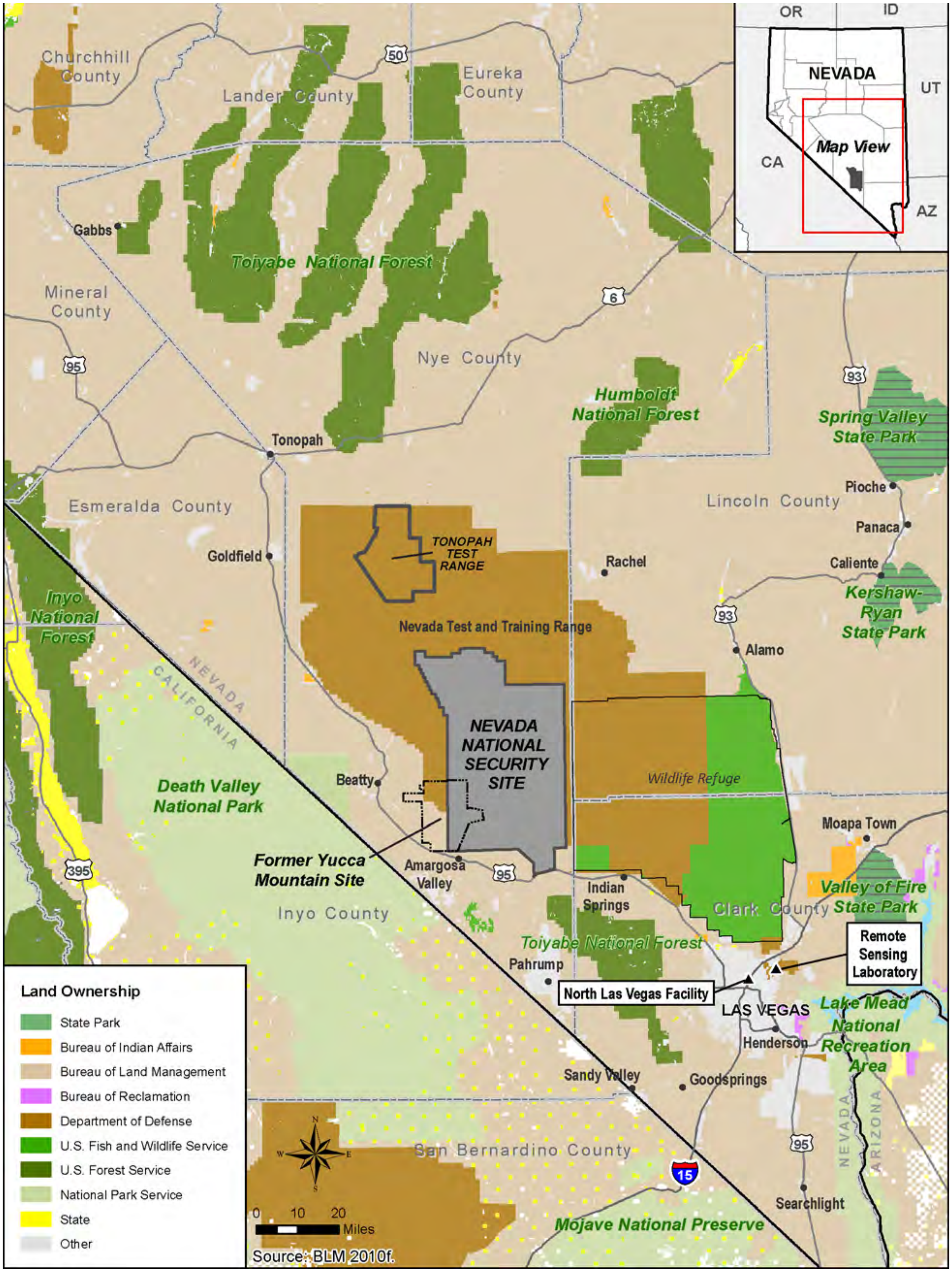

Figure 1–1 Location of the Nevada National Security Site and Offsite Locations

Subsequently, as required by DOE regulations (10 CFR 1021.330(d)), DOE/NNSA conducted the first 5-year review of the *1996 NTS EIS*, as documented in the 2002 *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2002 NTS SA)* (DOE 2002g). The review found that there were no substantial changes to the actions proposed in the *1996 NTS EIS* and no significant new circumstances or information relevant to environmental concerns. Thus, DOE/NNSA determined that no further NEPA analysis was required (i.e., the existing *1996 NTS EIS* remained adequate based on the supplement analysis [SA], in accordance with 10 CFR 1021.330(d)).

In 2007, DOE/NNSA initiated its second 5-year review of the *1996 NTS EIS* and, in April 2008, issued the *Draft Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2008 Draft NTS SA)* (DOE 2008f). Based on consideration of comments received on the *2008 Draft NTS SA*, potential changes to the NNSS program work scope, and changes to the environmental baseline, DOE/NNSA decided to prepare this SWEIS to update its analysis of the NNSS and offsite location operations in Nevada.

This chapter provides information on the purpose and need for agency action and introduces the alternatives analyzed for DOE/NNSA operations in Nevada and potential decisions to be supported by this SWEIS. This chapter also includes descriptions of related NEPA reviews and a summary of the public involvement process and stakeholder scoping comments, as well as American Indian perspectives prepared by the American Indian Writers Subgroup (AIWS). The AIWS input is in text boxes identified with a Consolidated Group of Tribes and Organizations (CGTO) feather icon.

Introduction—American Indian Perspective

C G T O Information provided by the Consolidated Group of Tribes and Organizations (CGTO) for inclusion in the chapters of this site-wide environmental impact statement (SWEIS) is presented in text boxes such as this to distinguish it from U.S. Department of Energy (DOE) text. The full text of American Indian perspective and concerns related to the resources and alternatives evaluated in this SWEIS is presented in Appendix C.

Since the beginning of time, the area encompassing the Nevada National Security Site (NNSS) and the offsite locations has been essential to the lives of American Indian tribes. These lands contain traditional gathering, ceremonial, and recreational areas for the American Indian people. They contain ecological resources and power places that are crucial for the continuation of American Indian culture, religion, and society.

In consideration of our ties to these lands and their resources, and to comply with DOE Order 144.1 and Executive Order 13127, DOE invited the CGTO to contribute to the development of this SWEIS. Specifically, DOE provided the CGTO with the opportunity to develop text summarizing our perspective and concerns regarding the resources and alternatives presented in this SWEIS.

The CGTO has had a long-standing relationship with DOE since 1987. We are comprised of 17 tribes and organizations, representing the Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone people. Each of these groups has substantiated cultural and historic ties to the NNSS and the surrounding areas.

1.2 Purpose and Need for Agency Action

The purpose and need for agency action is to support DOE/NNSA's core missions established by Congress and the President. These include meeting its obligations to ensure a safe and reliable nuclear weapons stockpile, support other national security programs, characterize and/or remediate areas of the NNSS and offsite locations previously contaminated as a result of the Nation's nuclear weapons testing program, and provide for the disposal of LLW and MLLW from across the DOE complex.

DOE/NNSA also must meet the mandates of Executive Orders 13212, *Actions to Expedite Energy-Related Projects*, and 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, as well as the Energy Independence and Security Act of 2007 (P.L. 109-58). Accordingly, DOE/NNSA's purpose and need also is to satisfy the requirements of these Executive Orders and comply with congressional mandates to promote, expedite, and advance the production of environmentally sound energy resources, including renewable energy resources such as solar and geothermal energy systems.

The NNSS has a long history of supporting national security objectives by conducting underground nuclear tests and other nuclear and nonnuclear activities. Since October 1992, there has been a moratorium on underground nuclear testing (a brief description of underground nuclear testing is provided in Appendix H). Thus, NNSS's role has evolved from an active nuclear testing program to maintaining readiness and the capability to conduct underground nuclear weapons tests; such a test would be conducted only if so directed by the President in the interest of national security. DOE/NNSA's primary mission at the NNSS is supporting nuclear weapons stockpile reliability through subcritical experiments. Changes in national security priorities have resulted in resource reallocation and the introduction and expansion of other national security missions, programs, and activities at the NNSS and offsite locations in Nevada. In addition, the NNSS supports DOE/NNSA waste management activities, including disposal; environmental restoration activities; and research, development, and testing programs related to national security. The NNSS also provides opportunities for various environmental research projects and the development of commercial-scale solar energy projects, as well as development of innovative solar and other renewable energy technologies.

Purpose and Need for Agency Action—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) knows American Indian people are charged by the Creator to interact with the environment and its resources in culturally appropriate ways to maintain balance, regardless of the U.S. Department of Energy's (DOE's) stated purpose and need for agency action. American Indians further believe these lands and their resources contain life-sustaining characteristics that must be properly respected and cared for to ensure harmony.

The CGTO does not support harmful land-disturbing activities currently conducted and proposed within the Nevada National Security Site (NNSS) area and offsite locations. These lands are part of the traditional holy lands of the Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone people. Harmful land disturbing activities threaten the health and welfare of Indian people through possible contamination and resource destruction.

As Indian people, we are obligated to manage the land and its resources for seven generations. This means we evaluate and guide our actions in terms of what they could do for or to the next seven generations. The CGTO takes this obligation very seriously and has provided information throughout the site-wide environmental impact statement (SWEIS) so we can continue to fulfill our purpose and need to care for these lands.

See Appendix C for more details.

1.3 Alternatives Analyzed

The proposed action in this SWEIS is the continued operation of the NNSS, other DOE/NNSA sites in Nevada, and environmental restoration sites in Nevada. The alternatives in this SWEIS are structured to provide information regarding current and future use of DOE/NNSA facilities in Nevada. The following three alternatives are analyzed: (1) No Action, (2) Expanded Operations, and (3) Reduced Operations. These alternatives were developed to reflect current operations and reasonably foreseeable future operations and to allow DOE/NNSA to analyze and compare the potential environmental effects of a wide range of use options. Chapter 3, Table 3–1, provides a summary of the alternatives analyzed in this SWEIS. In addition, in this *Final NNSS SWEIS*, DOE/NNSA has identified a Preferred Alternative. The Preferred Alternative is discussed briefly in Section 1.3.4 and is fully presented in Chapter 3, Section 3.6, of this SWEIS.

DOE NEPA Implementing Procedures (10 CFR Part 1021) define site-wide NEPA documents as broad-scope environmental impact statements (EISs) or environmental assessments (EAs) that are programmatic in nature and identify and assess the individual and cumulative impacts of ongoing and reasonably foreseeable future actions at a DOE site. This SWEIS considers ongoing and proposed programs, capabilities, and projects (i.e., activities) at DOE/NNSA facilities in Nevada over the next 10 years.

The nature of ongoing activities and their relationship to associated environmental impacts are well-understood. In contrast, however, the nature of some proposed activities is less well known. In the interest of disclosing potential environmental impacts that could occur at the NNSS and offsite locations over the next 10 years, this SWEIS includes ongoing activities as well as activities that are more conceptual in nature. Some examples are commercial solar power development, etc.

To assess potential environmental impacts from all such activities, it was necessary for DOE/NNSA to estimate at a programmatic level certain aspects of the more conceptual proposed activities, such as potential area of land disturbance or amount of groundwater that may be required. DOE/NNSA incorporated these programmatic-level estimates along with more detailed information on ongoing and better-understood proposed activities into the analysis of impacts. For instance, estimated areas of land disturbance, for both potential future activities and well-defined activities, were used in estimating impacts on resources such as soils (area of disturbance and erosion), cultural resources (number of sites potentially affected), and biology (vegetation/habitat loss, number of desert tortoises affected).

DOE/NNSA understands that the level of NEPA analysis conducted for some proposed future activities may not be sufficient to permit implementation, and such activities could require additional NEPA analysis. These activities are identified in Chapter 3. DOE/NNSA will conduct NEPA review for these activities, as appropriate, in the future. DOE/NNSA'S NEPA review procedures are described in Section 9.1.1.

The alternative descriptions are organized under the three NNSS missions. Each mission includes two or more associated programs. The missions and associated programs are (1) the National Security/Defense Mission, which includes the Stockpile Stewardship and Management, Nuclear Emergency Response, Nonproliferation, Counterterrorism, and Work for Others Programs; (2) the Environmental Management Mission, which includes the Waste Management and Environmental Restoration Programs; and (3) the Nondefense Mission, which includes the General Site Support and Infrastructure, Conservation and Renewable Energy, and Other Research and Development Programs. More information about the NNSS missions and programs; their associated capabilities, projects, and facilities; and the levels of operations under each alternative can be found in Chapter 3 of this SWEIS.

Terminology Used in this *NNSS SWEIS*

Missions. In this site-wide environmental impact statement (SWEIS), the term "missions" refers to the major responsibilities assigned to the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) (described in Section 1.1). DOE/NNSA accomplishes these major responsibilities by assigning groups or types of activities to DOE's system of security laboratories, production facilities, and other sites.

Programs. DOE and NNSA are organized into program offices, each of which has primary responsibilities within the set of DOE and NNSA missions. Funding and direction for activities at DOE/NNSA facilities are provided through these program offices, and similarly coordinated sets of activities to meet program office responsibilities are often referred to as "programs." Programs are usually long-term efforts with broad goals or requirements.

Capabilities. This term refers to the combination of facilities, equipment, infrastructure, and expertise necessary to undertake types or groups of activities and implement mission assignments. Capabilities at the Nevada National Security Site (NNSS) have been established over time, principally through mission assignments and activities directed by program offices.

Projects. This term is used to describe activities with a clear beginning and end that are undertaken to meet a specific goal or need. Projects can vary in scale from very small (such as a project to undertake one experiment or a series of small experiments) to major (such as a project to construct and start up a new nuclear facility). Projects are usually relatively short-term efforts and can cross multiple programs and missions, although they are usually "sponsored" by a primary program office. In this SWEIS, "project" is usually used more narrowly to describe construction activities, including facility modifications (such as a project to build a new office building or to establish and demonstrate a new capability). Construction projects considered reasonably foreseeable at the NNSS over about a 10-year period are discussed and analyzed in this SWEIS.

Activities. In this SWEIS, activities are those physical actions used to implement missions, programs, capabilities, or projects.

1.3.1 No Action Alternative

As defined in this *NNSS SWEIS*, the No Action Alternative reflects the use of existing facilities and ongoing projects to maintain operations consistent with those experienced in recent years at the NNSS and offsite locations in Nevada. For each of the three mission areas and their supporting programs, the level of operation for associated capabilities, projects, and activities is determined by operational levels actually realized since 1996. Examples include the number of experiments performed at the Joint Actinide Shock Physics Experimental Research Facility (JASPER) or the U1a Complex; reasonable expectations for recently implemented projects, such as the number of shots for the Large-Bore Powder Gun; or the nature and number of activities, such as training undertaken for the Office of Secure Transportation.

Accordingly, under the No Action Alternative, Stockpile Stewardship and Management Program activities would continue at DOE/NNSA facilities in Nevada under the conditions of the ongoing nuclear testing moratorium. These activities would emphasize U.S. science-based stockpile stewardship tests, experiments, and projects to maintain the safety and reliability of the Nation's nuclear weapons stockpile without underground nuclear testing. By Presidential Decision Directive 15 (November 1993), DOE/NNSA must be able to resume underground nuclear weapons tests within 24 to 36 months if so directed by the President. This capability is maintained at the NNSS. However, conducting such a test is not included or analyzed under any of the alternatives in this SWEIS. A brief description of underground nuclear test phenomenology is included for informational purposes in Appendix H.

In support of the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs, under the No Action Alternative, DOE/NNSA would continue its responsibilities regarding (1) support for the Nuclear Emergency Support Team, the Federal Radiological Monitoring and Assessment Center, the Accident Response Group, and the Radiological Assistance Program; (2) Aerial Measuring System activities; (3) weapons of mass destruction emergency responder training; (4) disposition of improvised nuclear devices and radiological dispersion devices; (5) support for DOE/NNSA's Emergency Communications Network; and (6) integration of existing activities and facilities to support U.S. efforts to control the spread of weapons of mass destruction.

Under the No Action Alternative, the Work for Others Program, which is hosted by DOE/NNSA, would entail the shared use of certain facilities, such as the Big Explosives Experimental Facility (BEEF), the Nonproliferation Test and Evaluation Complex, and the T-1 Training Area, with other agencies, such as DoD, as well as the shared use of resources at the NNSS, RSL, NLVF, and the TTR. DOE/NNSA would continue to host the projects of other Federal agencies, such as DoD and the U.S. Department of Homeland Security, as well as state and local government agencies and some nongovernmental organizations.

Under the No Action Alternative, in support of the Environmental Management Mission and Waste Management Program, the NNSS would continue accepting and disposing LLW and MLLW from approved generators as long as such wastes meet the NNSS waste acceptance criteria (WAC). The projected LLW volume analyzed is based on the average annual disposal of LLW from 1997 to 2010. The volume of MLLW analyzed is the permitted capacity of the Mixed Waste Disposal Unit (Cell 18) at the Area 5 Radioactive Waste Management Complex. The Environmental Restoration Program would continue to ensure compliance with the Federal Facility Agreement and Consent Order (FFACO) to characterize, monitor, and, if necessary, remediate locations that have sustained adverse environmental impacts from past DOE/NNSA activities. These impacts include hazardous material and radioactively contaminated areas, facilities, soils, and groundwater.

Under the No Action Alternative, the Nondefense Mission includes those activities that are necessary to support mission-related programs, such as construction and maintenance of facilities, provision of supplies and services, and warehousing. Activities related to supply and conservation of energy, including renewable energy and other research and development projects, are also conducted under the Nondefense Mission. DOE/NNSA would continue to identify and implement energy conservation measures and projects related to energy efficiency, renewable energy, water conservation, transportation/fleet management, and high-performance and sustainable buildings.

Federal Facility Agreement and Consent Order

The Nevada National Security Site Environmental Restoration Program includes activities to comply with the Federal Facility Agreement and Consent Order, which was entered into in 1996 by the U.S. Department of Energy, the U.S. Department of Defense, and the State of Nevada. The Federal Facility Agreement and Consent Order provides a process for identifying sites having potential historic contamination, implementing state-approved corrective actions, and instituting closure actions for remediated sites.

1.3.2 Expanded Operations Alternative

The Expanded Operations Alternative includes the level of operations under the No Action Alternative, plus the level of operations associated with additional capabilities at the NNSS and offsite locations in Nevada. The additional level of operations would include modification and/or expansion of existing facilities and construction of new facilities. An example of an additional level of operations would be the increased number of experiments that would be conducted at the NNSS with conventional high explosives (100 experiments within limited areas of the NNSS) compared with the number that would be conducted under the No Action Alternative (20 experiments in the same areas). An example of facility expansion would be adding a new firing table at BEEF. As with the No Action Alternative, the Expanded Operations Alternative reflects continued implementation of previous NEPA decisions (see Section 1.5) and retains the necessary capabilities from those decisions. The key differences from the No Action Alternative are shown in Chapter 3, Table 3–1, of this SWEIS, and a detailed description of the Expanded Operations Alternative is provided in Chapter 3, Section 3.2.

1.3.3 Reduced Operations Alternative

The Reduced Operations Alternative analyzed in this SWEIS reflects diminished activity levels, as well as decommissioned facilities and areas at the NNSS and other offsite locations in Nevada. The Reduced Operations Alternative includes continued implementation of previous NEPA decisions (see Section 1.5), but may not retain all capabilities from those decisions. Operational levels would be reduced relative to the No Action Alternative, and geographical and organizational constraints would be placed upon some activities under the Reduced Operations Alternative. Using the same example used for the Expanded Operations Alternative, the number of conventional high-explosives experiments under the Reduced Operations Alternative would be 10 experiments compared with the 20 experiments proposed under the No Action Alternative. A geographical constraint example would be the cessation of most activities in the northwest portion of the NNSS (although activities such as security, monitoring, environmental restoration, and military exercises would continue). The key differences from the No Action Alternative are shown in Chapter 3, Table 3–1, of this SWEIS, and a detailed description of the Reduced Operations Alternative is provided in Chapter 3, Section 3.3.

1.3.4 Preferred Alternative

CEQ regulations for implementing NEPA (40 CFR 1502.14(e)) require an agency to identify its preferred alternative or alternatives, if one or more exists, in the draft EIS. At the time the *Draft NNSS SWEIS* was published, DOE/NNSA had not selected a preferred alternative. Since publication of the *Draft NNSS SWEIS*, DOE/NNSA evaluated the agency's and other users' needs over the next 10 years, the information presented in this *NNSS SWEIS*, and the comments received on the draft SWEIS and has identified its Preferred Alternative.

DOE/NNSA's Preferred Alternative is based on the preferences expressed by commentors, the needs of DOE/NNSA and other users as reflected by contemporary priorities given anticipated funding, and a goal of minimizing potential environmental impacts to the extent practicable. DOE/NNSA's Preferred Alternative is a "hybrid" alternative comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Section 3.4 and Table 3–3 describe the Preferred Alternative in greater detail and provide a comparison of mission-based program activities under the three alternatives and the Preferred Alternative.

1.3.5 Relationship to *1996 NTS EIS*

In 1996, DOE issued the final *NTS EIS* and its associated ROD. The *1996 NTS EIS* (DOE 1996c) evaluated four alternatives: (1) Continue Current Operations (No Action Alternative), (2) Discontinue Operations, (3) Expanded Use, and (4) Alternate Use of Withdrawn Lands. These alternatives are described below.

- Alternative 1, Continue Current Operations (No Action) – DOE and interagency programs, activities, and operations at the NNSS associated with five program areas would continue in the same manner and to the same degree (level of operations) as during the 3 to 5 years previous to 1996. For example, at the NNSS, DOE would continue nuclear weapons stockpile and stewardship experiments and operations; environmental restoration would continue in the form of characterization and remediation of contaminated areas and facilities; and waste would be disposed at then-current yearly rates or levels.

- Alternative 2, Discontinue Operations – DOE and interagency programs, activities, and operations at the NNSS would be terminated. Facilities would be placed in cold standby after operations cease. Only those environmental monitoring and security functions necessary for human health, safety, and security would be maintained at the NNSS.

- Alternative 3, Expanded Use – DOE and interagency programs, activities, and operations at the NNSS associated with the five program areas would be maintained, but in a manner and at a level above that of the 3 to 5 years previous to 1996. Defense Program activities associated with stockpile stewardship would increase, as would waste management and environmental restoration activities.

- Alternative 4, Alternate Use of Withdrawn Lands – All defense-related activities and most interagency programs would discontinue at the NNSS.

In its 1996 ROD, DOE selected the Expanded Use Alternative, which provided for increasing the level of operations of most programs, activities, and operations, but decided to manage LLW and MLLW at levels described under the No Action Alternative. However, in a 2000 amendment to the 1996 ROD, DOE selected the Expanded Use Alternative for waste management activities at the NNSS.

For the most part, the level of operations envisioned and analyzed in the *1996 NTS EIS* (DOE 1996c) has not been realized. **Table 1–1** provides a comparison of the *1996 NTS EIS* Expanded Use Alternative and the current *NNSS SWEIS* No Action Alternative. As shown in Table 1–1, under the Expanded Use Alternative, DOE proposed undertaking approximately 110 dynamic experiments (i.e., experiments designed to improve knowledge of plutonium properties and assess performance and safety of nuclear weapons) each year. Since then, however, fewer than 10 such experiments have occurred each year. Also, the Expanded Use Alternative analyzed the transport and disposal of about 37 million cubic feet of LLW and 11 million cubic feet of MLLW at the NNSS. At the end of 2010, however, almost 22 million cubic feet of LLW and 370,000 cubic feet of MLLW had been disposed.

This *NNSS SWEIS* includes three alternatives: (1) No Action, (2) Expanded Operations, and (3) Reduced Operations. The No Action Alternative reflects the DOE/NNSA and interagency programs, activities, and operations in the program areas addressed in the *1996 NTS EIS* Expanded Use Alternative, but at the historic or baseline level of operations experienced since 1996. For example, under the No Action Alternative in this *NNSS SWEIS*, DOE/NNSA analyzed 10 dynamic experiments per year and the transport and disposal of 15 million cubic feet of LLW and 900,000 cubic feet of MLLW.

The No Action Alternative also includes the level of operations associated with missions, programs, capabilities, and projects analyzed in other NEPA documents. For example, DOE/NNSA completed the *Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory* (DOE 2002h; DOE/EIS-319) and its ROD (67 FR 79906) and then relocated materials and equipment associated with criticality experiments to the NNSS. Consistent with the baseline level of operations, under the No Action Alternative, the National Criticality Experiments Research Center is expected to conduct up to 500 criticality operations for training, experiments, and other purposes each year.

As described in Section 1.3.2, the Expanded Operations Alternative includes a higher level of operations than under the No Action Alternative, plus operations associated with proposed additional capabilities, which is a similar concept to the Expanded Use Alternative considered in the *1996 NTS EIS*. The Reduced Operations Alternative reflects diminished levels of operation, as well as geographic restrictions on some activities at the NNSS. There is no clear equivalent to the Reduced Operations Alternative in the *1996 NTS EIS.*

Table 1–1 Comparison of the *1996 NTS EIS* Expanded Use Alternative and the *NNSS SWEIS* No Action Alternative

Mission, Program, Project, or Activity Analyzed	*Analyzed in the* **1996 NTS EIS** [a]	*Analyzed in this* **NNSS SWEIS** [a]
General		
Mission/program	Five program areas: Defense, Waste Management, Environmental Restoration, Nondefense Research and Development, and Work for Others	Three mission areas: National Security/Defense Mission, Environmental Management Mission, and Nondefense Mission
NATIONAL SECURITY/DEFENSE MISSION		
Stockpile Stewardship and Management Program		
Maintain readiness to conduct an underground nuclear test	Addressed as overarching mission	Addressed as overarching mission
Conduct dynamic experiments	110 per year	10 per year
Conduct high-explosives tests and experiments	100 per year at BEEF, up to 70,000 pounds of high explosives per detonation, including limited use of certain hazardous materials; no SNM would be used in any experiment	To support Stockpile Stewardship and Management Program: 20 per year at BEEF (70,000 pounds TNT-equivalent maximum per event) and 10 per year at other locations within the Nuclear Test Zone and Nuclear and High Explosives Test Zone; explosives experiments at BEEF may include limited use of certain hazardous materials To support Work for Others Program: 40 experiments using up to 2,000 pounds TNT-equivalent of explosives at various locations on the NNSS No SNM would be used in any experiment
Disposition damaged U.S. nuclear weapon(s) on an as-needed basis	Disposition damaged U.S. nuclear weapon(s) on an as-needed basis	Disposition damaged U.S. nuclear weapon(s) on an as-needed basis
Reserve land and infrastructure for a large, heavy-industrial facility and/or next generation nuclear weapons simulators	Consistent with analyses in other NEPA documents that considered the NNSS as an alternative location, such as the *Pantex Plant Site-Wide EIS* and the National Ignition Facility in the *Stockpile Stewardship and Management PEIS*	Not analyzed
Conduct underground nuclear test, if so directed by the President of the United States	Yes	Not analyzed
Reserve land and infrastructure for nuclear weapons assembly/disassembly operations and/or long-term storage and disposition of weapons-usable fissile material	Yes	Not analyzed
Shock physics experiments	Not analyzed [b]	12 per year at JASPER and 10 per year at the U1a Complex
Criticality experiments at DAF	Not analyzed [b]	500 operations per year
Pulsed-power experiments at the Atlas Facility	Not analyzed [b]	Facility maintained on standby with capability to conduct up to 12 experiments per year
Plasma physics and fusion experiments	Not analyzed [b]	Conduct up to 600 per year at NLVF and 50 per year at Area 11 of the NNSS
Conduct drillback operations	Yes, as part of maintaining readiness to conduct or as part of actual conduct of an underground nuclear test	Up to five over the next 10 years as part of maintaining readiness to test

Mission, Program, Project, or Activity Analyzed	***Analyzed in the* 1996 NTS EIS** [a]	***Analyzed in this* NNSS SWEIS** [a]
Stage SNM, including nuclear weapons pits	Yes	Yes
Training for the Office of Secure Transportation	Yes, as part of conducting unspecified exercises and training	Yes, up to six times per year
Conduct stockpile stewardship activities at the TTR, including experiments using SNM, where containment is assured	Yes	Yes, but SNM use not expected
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs		
Support various DOE/NNSA nuclear emergency response activities, including FRMAC, NEST, ARG, RAP, and AMS	Yes	Yes
Disposition improvised nuclear devices	Not analyzed [a]	Yes
Support U.S. efforts to control the spread of WMDs, including arms control, nonproliferation activities, nuclear forensics, and counterterrorism capabilities	Partial; counterproliferation and nonproliferation activities, treaty verification, and training and exercises were addressed	Yes; counterterrorism activities [b] are also included
Work for Others Program		
Support U.S. Department of Homeland Security testing and evaluation of detection devices for use in transportation-related applications at RNCTEC and other locations on the NNSS	Not analyzed [b]	Yes
Experiments using releases of chemicals and/or biological simulants	Partial; chemical releases at NPTEC (Liquefied Gaseous Fuels Spill Test Facility in the *1996 NTS EIS*) were addressed	Yes; an unspecified number of release experiments at NPTEC and up to 20 experiments using releases of low concentrations of chemicals and biological simulants per year NNSS-wide [a]
Support development of capabilities to detect and defeat assets in deeply buried/hardened targets	Yes	Yes
Host the use of various aerial platforms for tests, experiments, training, and exercise	Yes	Yes
ENVIRONMENTAL MANAGEMENT MISSION		
Waste Management Program		
LLW disposal MLLW disposal	Almost 36,800,000 cubic feet About 10,600,000 cubic feet	15,000,000 cubic feet 900,000 cubic feet [c]
Manage onsite-generated TRU and TRU mixed wastes pending shipment to offsite treatment and disposal facilities	Yes	About 9,600 cubic feet over the next 10 years
Generate and temporarily store hazardous waste pending shipment to a permitted treatment, storage, and disposal facility	Yes	About 190,400 cubic feet over the next 10 years
Operate the Area 11 Explosives Ordnance Disposal Unit	Yes	Yes
Operate the Area 6 hydrocarbon landfill	Yes	Yes
Operate the Area 23 and the U10c Solid Waste Disposal Sites	Yes	About 3,810,000 cubic feet of sanitary solid waste and construction/ decontamination and demolition debris
Environmental Restoration Program		
Underground Test Area Project to characterize, monitor, and remediate, as necessary, groundwater contaminated by underground nuclear testing	Yes	Yes, in accordance with the FFACO; analyze up to 50 additional characterization and/or monitoring wells over the next 10 years

Mission, Program, Project, or Activity Analyzed	***Analyzed in the* 1996 NTS EIS [a]**	***Analyzed in this* NNSS SWEIS [a]**
Soils Project to investigate and characterize soil contamination at non-industrial sites on the NNSS, TTR, and Nevada Test and Training Range and perform corrective actions, as necessary	Yes	Yes, in accordance with the FFACO
Industrial Sites Project to identify, characterize, and remediate, as necessary, industrial sites at the NNSS and TTR	Yes	Yes, in accordance with the FFACO
Conduct environmental restoration activities at Defense Threat Reduction Agency sites on the NNSS	Yes	Yes
Conduct environmental characterization and monitoring at two former offsite underground nuclear weapons test sites: Central Nevada Test Area and Project Shoal	Yes	No; stewardship of both sites has been assumed by the DOE Office of Legacy Management
NONDEFENSE MISSION		
General Site Support and Infrastructure Program		
Infrastructure	Upgrade, renovate, replace, and construct new common site support facilities to support ongoing and additional activities	Maintain, repair, and replace current infrastructure; the only new “infrastructure” would be LLW cells, as needed, and construction of the Underground Test Area Project wells, in consultation with the Nevada Division of Environmental Protection
Conservation and Renewable Energy Program		
Energy conservation	Not addressed	Reduce energy consumption and improve efficiency of energy use
Renewable energy	Up to 1,000 megawatts of solar power generation in one of two Solar Enterprise Zones on the NNSS: Area 22/23 and Area 25 Also considered solar power generation facilities at three non-DOE sites outside of the NNSS	“Solar Enterprise Zone” renamed “Renewable Energy Zone” Allow commercial entity to construct and operate up to 240 megawatts of solar power generation in the Renewable Energy Zone in Area 25
Other Research and Development Program		
Support nondefense research and development	Yes	Yes

AMS = Aerial Measuring System; ARG = Accident Response Group; BEEF = Big Explosives Experimental Facility; DAF = Device Assembly Facility; EIS = environmental impact statement; FFACO = Federal Facility Agreement and Consent Order; FRMAC = Federal Radiological Monitoring and Assessment Center; JASPER = Joint Actinide Shock Physics Experimental Research Facility; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NEPA = National Environmental Policy Act; NEST = Nuclear Emergency Support Team; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; NPTEC = Nonproliferation Test and Evaluation Complex; NTS = Nevada Test Site; PEIS = Programmatic Environmental Impact Statement; RAP = Radiological Assistance Program; RNCTEC = Radiological/Nuclear Countermeasures Test and Evaluation Complex: SNM = special nuclear material; SWEIS = site-wide environmental impact statement; TNT = 2,4,6 trinitrotoluene; TRU = transuranic; TTR = Tonopah Test Range; WMD = weapon of mass destruction.

[a] Quantitative bases for analyses used in this table were derived from the published *1996 NTS EIS* and assumptions used in this *NNSS SWEIS*. For some activities, such as training and exercises, the bases for impact assessment were not derived from the number of events but from the potential to disturb previously undisturbed land.

[b] Addressed in other NEPA documentation.

[c] Actual permitted capacity of the Mixed Waste Disposal Unit (Cell 18) is 899,996 cubic feet.

1.4 Potential Decisions Supported by this Site-Wide Environmental Impact Statement

This SWEIS analyzes and evaluates the potential impacts of existing and proposed capabilities and projects. The results documented in this SWEIS will provide the basis for DOE/NNSA to determine the nature of these capabilities, projects, and activities, as well as their associated level of operations, over about a 10-year period at the NNSS and offsite locations in Nevada. Where information is insufficient to support an implementing decision for more conceptual activities, implementation would require an appropriate level of new or additional NEPA analysis.

DOE/NNSA may choose to implement any alternative in its entirety or to select a hybrid that incorporates parts of the different proposed alternatives. DOE/NNSA may make the following decisions regarding its operations:

- *Implement the No Action Alternative, either wholly or in part.* Under the No Action Alternative, DOE/NNSA operations in Nevada would continue in accordance with previous decisions made pursuant to NEPA reviews.
- *Implement the Expanded Operations Alternative, either wholly or in part.* The Expanded Operations Alternative includes planned and proposed capabilities and projects and an overall increase in the level of operations, relative to the No Action Alternative, that could be implemented over about a 10-year period.
- *Implement the Reduced Operations Alternative, either wholly or in part.* The Reduced Operations Alternative involves reductions of operations. Choosing to implement this alternative in whole or in part would result in reductions of affected capabilities and projects.

DOE/NNSA capabilities and projects at the NNSS are located in seven land use zones that were developed and designated following decisions made in the *1996 NTS EIS* ROD. Implementation of any of the alternatives analyzed in this SWEIS, either in whole or in part, could result in changes to the name, size, or location of these land use zones, or in the location of proposed capabilities and projects within these zones.

Although an analysis of environmental restoration activities' impacts is included in this SWEIS, environmental restoration activities at the NNSS, the TTR, and sites on the Nevada Test and Training Range are driven by the FFACO. The State of Nevada, through the Nevada Division of Environmental Protection (NDEP), oversees FFACO compliance and enforces its provisions. Therefore, DOE/NNSA would not make any decisions regarding environmental restoration activities that are inconsistent with the FFACO without consultation with NDEP.

Although an analysis of LLW/MLLW shipping routes is included in this SWEIS, decisions on routing would not be made as part of this NEPA process. DOE/NNSA sought to understand the differences in potential environmental effects between different routing options, which incorporated changes to local transportation infrastructure since the *1996 NTS EIS*; communicate those differences to the public; and seek stakeholder comments on the range of transportation routes. The analysis of a Constrained (current routing protocol) and an Unconstrained Case (utilizing all routes within the Las Vegas Valley), as well as increased use of rail transport and rail-to-truck transfer stations, was undertaken to develop a greater understanding of the potential environmental consequences of shipping such waste through metropolitan Las Vegas. Any changes to existing routing would be made through revisions to the NNSS WAC. Revisions to the WAC are undertaken in coordination with NDEP, pursuant to the Agreement in Principle between the State of Nevada and DOE/NNSA NSO (State of Nevada 2011). While DOE/NNSA's environmental analyses showed no meaningful differences in potential environmental effects between the Constrained and Unconstrained Cases, the preponderance of stakeholder comments recommended that DOE/NNSA retain highway routing restrictions to avoid shipments of LLW/MLLW through greater metropolitan Las Vegas (Constrained Case). In consideration of the environmental analyses and stakeholder comments, and after consultation with NDEP as part of the WAC revision process, DOE/NNSA determined that it would retain the highway routing restrictions for shipments of LLW/MLLW in the greater Las Vegas metropolitan area and, therefore, there would be no need to revise the WAC in this regard (DOE 2012). DOE/NNSA is not proposing to construct or cause to be constructed any new rail-to-truck transfer facilities to accommodate shipments of radioactive waste or materials under any of the alternatives considered in this SWEIS.

1.5 Relationship Between this Site-Wide Environmental Impact Statement and Other National Environmental Policy Act Analyses

Decisions made in the *1996 NTS EIS* ROD (61 FR 65551) and various subsequent NEPA documents have defined implementation of projects at the NNSS. This section summarizes past and ongoing NEPA compliance reviews and associated decisions (i.e., RODs and Findings of No Significant Impact [FONSIs]) that are germane to the estimation of direct, indirect, and cumulative environmental impacts resulting from the implementation of the projects and activities under each of the three alternatives.

***Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)* (DOE/EIS-0243) (DOE 1996c) –** As discussed in Section 1.3.4, the *1996 NTS EIS* evaluated four alternatives for the continued operation of the Nevada Test Site (now called the NNSS): (1) Continue Current Operations (No Action Alternative), (2) Discontinue Operations, (3) Expanded Use, and (4) Alternate Use of Withdrawn Lands. Included in the *1996 NTS EIS* was an assessment of reasonable alternatives for flight testing for gravity weapons (bombs) at the TTR. DOE published a ROD on December 13, 1996 (61 FR 65551), selecting the Expanded Use Alternative plus the public education activities from the Alternate Use of Withdrawn Lands Alternative. Under that decision, DOE/NNSA continued the multipurpose, multiprogram use of the NNSS and a continuation and diversification of the DOE Nevada Operations Office (the predecessor of the DOE/NNSA NSO) and interagency programs and operations at the NNSS. The Expanded Use Alternative included support for ongoing DOE Nevada Operations Office program categories defined under the Continue Current Operations (No Action) Alternative and increased the use of the NNSS and its related resources and capabilities. The Expanded Use Alternative also made the NNSS more available to both public and private institutions for demonstration of new technologies.

A subsequent amendment to the *1996 NTS EIS* was included in a February 2000 ROD (65 FR 10061) for the *WM PEIS* (discussed below). This ROD announced DOE's decision to implement LLW and MLLW activities in accordance with the *1996 NTS EIS* Expanded Use Alternative.

***Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (WM PEIS)* (DOE/EIS-0200) (DOE 1997) –** The *WM PEIS* examined the potential environmental impacts of strategic alternatives for managing five types of radioactive and hazardous wastes resulting from nuclear defense and research activities at DOE sites around the United States. When the *1996 NTS EIS* (DOE 1996c) was issued, the NNSS was under consideration in the *Draft WM PEIS* as a site for centralized or regional management of certain DOE wastes. In its 1996 ROD for the *1996 NTS EIS*, DOE selected the Expanded Use Alternative, but decided to manage LLW and MLLW at levels described under the No Action Alternative. However, in a 2000 amendment to the 1996 ROD (as a result of the third amended ROD for the *WM PEIS*), DOE selected the Expanded Use Alternative for waste management activities at the NNSS.

DOE published four RODs associated with the *WM PEIS*, three of which are relevant to the NNSS. In its ROD for the treatment and management of transuranic waste, published January 23, 1998 (63 FR 3629), and subsequent revisions to this ROD, published December 9, 2000, July 25, 2001, and September 6, 2002 (65 FR 82985, 66 FR 38646, and 67 FR 56989, respectively), DOE decided (with one exception) that each DOE site that either had or might generate transuranic waste would prepare the waste for disposal and store it on site until it could be shipped to the Waste Isolation Pilot Plant near Carlsbad, New Mexico, for disposal. In the second ROD, published August 5, 1998 (63 FR 41810), DOE decided to continue using offsite facilities for the treatment of major portions of nonwastewater hazardous wastes generated at DOE sites.

In the third ROD, which addressed the management and disposal of LLW and MLLW and was published February 25, 2000 (65 FR 10061), DOE decided to perform minimal treatment of LLW at all sites and to continue, to the extent practicable, onsite disposal of LLW at Idaho National Laboratory, Los Alamos National Laboratory, Oak Ridge Reservation, and the Savannah River Site. DOE decided to establish regional disposal capacity at the Hanford Site and the NNSS. Specifically, in addition to disposing their own LLW, the Hanford Site and the NNSS would dispose LLW generated at other DOE sites, provided the waste met their respective WAC. DOE decided to treat MLLW at the Hanford Site, Idaho National Laboratory, Oak Ridge Reservation, and the Savannah River Site, with disposal at either the Hanford Site or the NNSS.[1]

***Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site* (DOE/EIS-0359) (DOE 2004d) –** This EIS, tiered from the *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DOE/EIS-0269) (DOE 1999c), considered the potential environmental impacts of construction, operation, maintenance, and decontamination and decommissioning of a proposed facility for converting depleted uranium hexafluoride to a more stable chemical form at alternative locations within the Paducah Site. DOE evaluated transportation of the depleted uranium conversion product to a commercial facility or the NNSS for disposal as LLW. The July 27, 2004, ROD (69 FR 44654) stated that DOE planned to decide the specific disposal location(s) after further NEPA review.

***Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site* (DOE/EIS-0360) (DOE 2004e) –** This EIS, tiered from the *Final Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (DOE/EIS-0269) (DOE 1999c), considered the potential environmental impacts of construction, operation, maintenance, and decontamination and decommissioning of a proposed facility for converting depleted uranium hexafluoride to a more stable chemical form at alternative locations within the Portsmouth Site. DOE evaluated transportation of the depleted uranium conversion product to a commercial facility or the NNSS for disposal as LLW. The July 27, 2004, ROD (69 FR 44649) stated that DOE planned to decide the specific disposal location(s) after further NEPA review.

***Draft Supplement Analysis for Location(s) to Dispose of Depleted Uranium Oxide Conversion Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride* (DOE 2007d) (DOE/EIS-0359-SA1 and DOE/EIS-0360-SA1) –** DOE issued a Notice of Availability for this draft SA on April 3, 2007 (72 FR 15869). DOE is proposing to amend the two site-specific RODs (69 FR 44649 and 69 FR 44654) for depleted uranium hexafluoride conversion to decide whether the depleted uranium conversion product would be disposed at the NNSS or at the EnergySolutions (formerly Envirocare of Utah, Inc.) LLW disposal facilities.

[1] DOE has established a moratorium on the receipt of offsite waste at the Hanford Site until 2022 or until the Waste Treatment Plant at the Hanford Site is operational. This facility is currently under construction and is designed to treat radioactive waste from the Hanford Site's underground storage tanks.

Final Environmental Assessment for the Site Launch, Reentry and Recovery Operations at the Kistler Launch Facility, Nevada Test Site (NTS) **(FAA 2000) –** The Federal Aviation Administration (FAA) prepared an EA and issued a FONSI on May 3, 2002 (67 FR 22479), for the Kistler Launch Facility (KLF) which included proposed space launch and reentry activities. This EA analyzed preflight processing activities, launch/flight operations, and reentry and recovery operations. To conduct operations, Kistler Aerospace Corporation proposed to construct a base of operations consisting of a private launch site (including a vehicle processing facility); a vehicle reentry, landing, and recovery area; and a payload processing facility. KLF operations and activities were to occur in Area 18 and at an adjacent location in Area 19. The proposed launch site was on the southern slopes of Pahute Mesa, south of Rattlesnake Ridge and north of Stockade Wash, at an elevation of about 5,800 feet. FAA proposed to license Kistler's proposed space launch and reentry activities. FAA issued a FONSI, but the KLF project was subsequently cancelled.

The Nevada Test Site Development Corporation's Desert Rock Sky Park at the Nevada Test Site Environmental Assessment **(DOE/EA-1300) (DOE 2000) –** This EA analyzed the potential environmental effects of developing, operating, and maintaining a commercial/industrial park in Area 22 of the NNSS, between Mercury and U.S. Route 95, east of Desert Rock Airport. DOE issued a FONSI in March 2000, but the project was not implemented.

Aerial Operations Facility, Nevada Test Site Environmental Assessment **(DOE/EA-1334) (DOE 2001a) –** This EA analyzed the potential environmental effects of developing, operating, and maintaining an aerial operations facility for testing and operating aerial vehicles at an existing facility located at the southern end of Yucca Lake in Area 6 of the NNSS. DOE issued a FONSI based on this EA in 2001. The facility is in operation.

Final Environmental Assessment for Aerial Operations Facility Modifications, Nevada Test Site **(DOE/EA-1512) (DOE 2004g) –** This EA evaluated the potential impacts of constructing a new runway, hangars, and operations buildings and performing infrastructure upgrades to accommodate an increase in Aerial Operations Facility operations and personnel. DOE/NNSA issued a FONSI based on this EA in October 2004. The facility is in operation.

Atlas Relocation and Operation at the Nevada Test Site Final Environmental Assessment **(DOE/EA-1381) (DOE 2001b) –** This EA analyzed the relocation of the Atlas pulsed-power machine from Los Alamos National Laboratory to the NNSS. DOE/NNSA issued a FONSI based on this EA in May 2001. At the NNSS, the Atlas Facility was reassembled in a newly constructed building within a designated industrial, research, and support site in Area 6. The facility is currently in a standby status.

Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2002 NTS SA) **(DOE/EIS-0243-SA-01) (DOE 2002g) –** In 2002, DOE/NNSA completed the first of three SA reviews of the *1996 NTS EIS* (DOE 1996c). The *2002 NTS SA* provided a 5-year review of the *1996 NTS EIS* to determine whether there were sufficient changes to either the NNSS operations or environmental impacts to warrant a new SWEIS, a supplemental EIS, or whether no further NEPA action was warranted. DOE/NNSA found that there were no substantial changes to the actions proposed in the *1996 NTS EIS* and no significant new circumstances or information relevant to environmental concerns; thus, no further NEPA documentation was required (i.e., the existing *1996 NTS EIS* remained adequate based on the SA, in accordance with 10 CFR 1021.332(d)).

Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory **(DOE/EIS-0319) (DOE 2002h) –** This EIS addressed the potential impacts of relocating criticality missions and materials from Technical Area 18 at Los Alamos National Laboratory to several sites, including the NNSS. In a December 31, 2002, ROD

(67 FR 79906), DOE/NNSA made the decision to relocate Security Category I/II missions and materials to the Device Assembly Facility at the NNSS. The relocation has been completed.

***Hazardous Materials Testing at the Hazardous Materials Spill Center, Nevada Test Site Environmental Assessment* (DOE/EA-0864) (DOE 2002i) –** This EA established potential environmental impacts from planned releases of hazardous and toxic materials at the Hazardous Materials Spill Center (formerly the Liquefied Gaseous Fuels Spill Test Facility and now the Nonproliferation Test and Evaluation Complex). DOE/NNSA issued a FONSI based on this EA in September 2002. The facility is in operation.

***Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (Yucca Mountain EIS)* (DOE/EIS-0250-F) (DOE 2002e) –** Published in 2002, the *Yucca Mountain EIS* analyzed a proposed action to construct, operate, monitor, and eventually close a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain in Nye County, Nevada. Following issuance of the *Yucca Mountain EIS* in 2002, DOE modified its approach to repository design and operational plans. In 2008, DOE published the *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1) (DOE 2008g). This supplemental EIS evaluated the potential environmental impacts of DOE's modified repository design and operational plans. As reflected in the Administration's fiscal year 2010, 2011, and 2012 budget requests, however, the Administration has determined that a repository at Yucca Mountain is not a workable option and has called for all funding and activities related to development of a repository at Yucca Mountain to be eliminated.

***Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada to Address the Increase in Activities Associated with the National Center for Combating Terrorism and Counterterrorism Training and Related Activities* (DOE/EIS-0243-SA-02) (DOE 2003e) –** This second SA to the *1996 NTS EIS* was prepared to determine whether impacts of DOE/NNSA operations, which include activities and potential facility and infrastructure improvements proposed for the NNSS related to combating terrorism and performing counterterrorism training, would be within the limits of impacts identified in the *1996 NTS EIS.* DOE/NNSA determined that there were no significant new circumstances or information relevant to environmental concerns that would require preparation of a supplemental EIS or a new EIS (i.e., the existing *1996 NTS EIS* remained adequate based on the SA, in accordance with 10 CFR 1021.332(d)).

***Final Environmental Assessment for Activities Using Biological Simulants and Releases of Chemicals at the Nevada Test Site* (DOE/EA-1494) (DOE 2004c) –** This EA analyzed the potential environmental effects of conducting experiments, training, and other similar activities involving controlled releases of biological simulants (noninfectious bacteria, fungi, killed viruses, and similar materials) and low concentrations of various chemicals at the NNSS. DOE/NNSA issued a FONSI based on this EA in June 2004. These activities are ongoing at the NNSS.

***Radiological/Nuclear Countermeasures Test and Evaluation Complex, Nevada Test Site Final Environmental Assessment* (DOE/EA-1499) (DOE 2004f) –** This EA evaluated the potential effects of constructing and operating a Radiological/Nuclear Countermeasures Test and Evaluation Complex at the NNSS for post-bench-scale testing and evaluation of radiological and nuclear detection devices that may be used in transportation-related facilities. The new facility would be used by the U.S. Department of Homeland Security. DOE/NNSA issued a FONSI based on this EA in September 2004. The facility was constructed and is operational.

Final West Valley Demonstration Project Waste Management Environmental Impact Statement, West Valley Area Office, West Valley, NY (DOE/EIS-0337F) (DOE 2003) – This EIS evaluated the potential effects of the Department of Energy's proposed action to ship radioactive wastes that are either in storage, or that will be generated from operations over the specified 10-year period, to offsite disposal locations, and to continue its ongoing onsite waste management activities. The June 16, 2005, ROD (70 FR 35073) stated that DOE has decided to ship LLW and MLLW off site for disposal in accordance with all applicable regulatory requirements, including permit requirements, WAC, and applicable DOE Orders. DOE will dispose of LLW and MLLW at commercial sites (such as Envirocare, a commercial radioactive waste disposal site in Clive, Utah), one or both of two DOE sites (the Nevada Test Site [NTS] in Mercury, Nevada; or the Hanford Site in Richland, Washington), or a combination of commercial and DOE sites, consistent with DOE's February 2000 decision regarding LLW and MLLW disposal.

***Draft Revised Environmental Assessment, Large-Scale, Open-Air Explosive Detonation, DIVINE STRAKE, at the Nevada Test Site* (DOE/EA-1550) (DOE 2006e) –** This draft revised EA was published in December 2006 to document an analysis of the potential impacts of a proposal by the Defense Threat Reduction Agency, a DOE/NNSA customer, to conduct a single large-scale, open-air explosive detonation of up to 700 tons of an ammonium nitrate and fuel oil mixture above an existing tunnel complex in Area 16 at the NNSS. This draft revised EA modified an earlier 2006 EA to include additional data and analyses. The proposed experiment was known as DIVINE STRAKE. The Defense Threat Reduction Agency cancelled the project.

***Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (GTCC EIS)* (DOE/EIS-0375-D) –** On February 25, 2011, the U.S. Environmental Protection Agency issued a Notice of Availability (76 FR 10583) for this *Draft GTCC EIS* that addressed disposal of LLW generated by activities licensed by the U.S. Nuclear Regulatory Commission or an Agreement State that contains radionuclides in concentrations exceeding Class C limits, as defined in 10 CFR Part 61 (referred to as "greater-than-Class C [GTCC] LLW"), as well as disposal of DOE's GTCC-like waste. Currently, there is no location for disposal of GTCC LLW, although the Federal Government is responsible for such disposal under the Low-Level Radioactive Waste Policy Amendments Act (P.L. 99-240). The NNSS is being considered as one of seven candidate disposal sites in the *Draft GTCC EIS*. DOE is evaluating several disposal technologies in the *Draft GTCC EIS*, including above-grade vaults, intermediate-depth boreholes, and enhanced near-surface disposal facilities.

***Draft Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2008 Draft NTS SA)* (DOE/EIS-0243-SA-03) (DOE 2008f) –** The *2008 Draft NTS SA* is the third SA and 5-year comprehensive review of the *1996 NTS EIS* (DOE 1996c). In preparation of the *2008 Draft NTS SA*, a systematic environmental impacts review was conducted to determine whether there were substantial changes in the actions considered in the *1996 NTS EIS* or significant new circumstances or information relevant to environmental concerns. Projects and activities introduced since the *1996 NTS EIS* ROD or proposed for the next 5 years were screened. The *2008 Draft NTS SA* was not finalized; instead, DOE/NNSA elected to proceed with a new SWEIS (this *NNSS SWEIS*) to provide an updated analysis of DOE/NNSA operations in Nevada. All comments from the *2008 Draft NTS SA* were considered in the scoping of this SWEIS.

***Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS)* (DOE/EIS-0236-S4) (DOE 2008l) –** In the *Complex Transformation SPEIS*, alternatives were analyzed for the potential environmental impacts of transforming the nuclear weapons complex into a smaller, more-efficient enterprise that can respond to changing national security challenges and ensure the long-term safety, security, and reliability of the nuclear weapons stockpile. The

NNSS was evaluated, but not selected, as a potential location for a consolidated plutonium center or a consolidated nuclear production center, both of which would entail consolidation of Category I/II special nuclear material. The NNSS was also evaluated, but not selected, as a potential site for consolidated hydrotesting, high-explosives research and development, and environmental testing.[2] In addition, existing DoD and DOE/NNSA test ranges (such as White Sands Missile Range in New Mexico and the NNSS) were considered as alternatives to continued use of the TTR for DOE/NNSA flight test operations. Two RODs were issued on December 19, 2008. In the ROD for Tritium Research and Development, Flight Test Operations, and Major Environmental Test Facilities (December 19, 2008, 73 FR 77656), DOE/NNSA decided to continue to conduct flight testing at the TTR in Nevada under a reduced footprint (i.e., 1 square mile) permit using a campaign mode of operations. The "campaign mode of operations" would continue operations at the TTR but reduce permanent staff and conduct tests and experiments by deploying DOE/NNSA and national laboratory personnel from other locations, as needed. In the ROD for Operations Involving Plutonium, Uranium, and the Assembly and Disassembly of Nuclear Weapons (December 19, 2008, 73 FR 77644), DOE/NNSA decided to transform the plutonium and uranium aspects of the complex into smaller and more-efficient operations while maintaining the capabilities DOE/NNSA needs to perform its national security missions.

***Environmental Assessment for a Solar Demonstration Project at the Nevada National Security Site* (DOE/EA-1842) –** DOE's Office of Energy Efficiency and Renewable Energy was preparing this EA in 2011 on its proposal to support the demonstration of concentrating solar power (CSP) technologies in Area 25 of the NNSS. The intent was to demonstrate technology advancements that are proven at a prototype level, but have not yet been demonstrated at a scale or for a sufficient period for deployment in a commercial setting. This proposed action has been indefinitely postponed and is no longer being addressed as a reasonably foreseeable action in this SWEIS.

1.6 Cooperating Agencies/Tribal Involvement

DOE/NNSA is the lead agency for this SWEIS. Under CEQ NEPA regulations, other Federal agencies, as well as state and local agencies and American Indian tribes, may request designation as cooperating agencies in the preparation of an EIS if they can offer special, relevant expertise or have legal jurisdiction over one of the affected areas being studied (40 CFR 1501.6 and 1508.5). Three government agencies requested cooperating agency status for this SWEIS: the U.S. Bureau of Land Management; the U.S. Air Force; and Nye County, Nevada. DOE/NNSA, as the lead agency, has designated these three organizations as cooperating agencies.

As mentioned in Section 1.1, American Indian groups were invited to participate in the preparation of this SWEIS, in accordance with DOE Order 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy*. As a result of consultation with the CGTO, the AIWS prepared the summary assessments and recommendations that appear in text boxes placed throughout this SWEIS. The text boxes are shaded light brown and have a CGTO feather logo. The AIWS also prepared the text provided in Appendix C, "The American Indian Assessment of Resources and Alternatives Presented in the SWEIS." Appendix C summarizes the beliefs expressed by the CGTO regarding this SWEIS and contains (a) general concerns regarding long-term impacts of DOE/NNSA operations on the NNSS and (b) a synopsis of specific comments made by the AIWS for various chapters of this SWEIS. Although the consultation focused specifically on the three alternatives analyzed in this *NNSS SWEIS*, the CGTO responses in the text boxes and Appendix C also integrate relevant recommendations made by American Indian people regarding previous DOE/NNSA projects in which American Indians participated.

[2] *In this context, "environmental testing" refers to subjecting a test unit to specified, controlled environments such as vibration, shock, or static acceleration.*

1.7 Public Involvement Process in this *NNSS SWEIS*

During development of an EIS, the two main opportunities for public involvement occur during scoping and after issuance of the draft EIS (see **Figure 1–2**). This section describes the public involvement processes during scoping and after the *Draft NNSS SWEIS* was issued, as well as how the comments received from the public were incorporated into the development of this *Final NNSS SWEIS*.

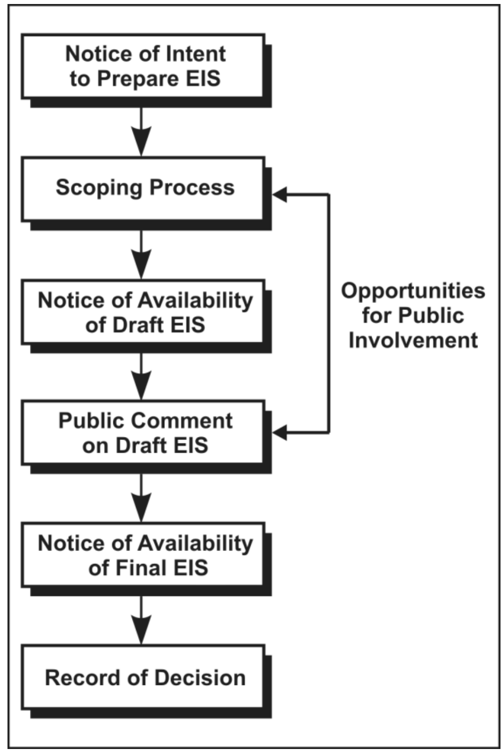

Figure 1–2 The National Environmental Policy Act Process

1.7.1 Scoping

As an early step in the development of an EIS, the regulations established by CEQ (40 CFR 1501.7) and DOE require "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a Proposed Action." The purpose of the scoping process is (1) to inform the public about a proposed action and the alternatives being considered and (2) to identify and clarify issues relevant to the EIS by soliciting public comments.

The *NNSS SWEIS* public scoping process began with issuance of a Notice of Intent (NOI) (74 FR 36691) on July 24, 2009, and concluded on October 16, 2009. In the NOI, DOE/NNSA invited public comment on the scope of this SWEIS and described four alternatives (No Action, Expanded Operations, Reduced Operations, and Renewable Energy Operations) and environmental issues to be considered. As discussed in Table 1–2, the components of the Renewable Energy Operations Alternative were incorporated as part of the three other alternatives in response to public comments, and Renewable Energy Operations was removed as a separate alternative. Public scoping meetings for this SWEIS were conducted in Las Vegas, Nevada (September 10, 2009); Pahrump, Nevada (September 14, 2009); Tonopah, Nevada (September 16, 2009); and St. George, Utah (September 18, 2009). DOE/NNSA received approximately 150 scoping comment documents regarding this *NNSS SWEIS*, submitted by email, fax, U.S. mail, telephone message, written comment forms at public meetings, or transcribed oral statements at public meetings. In addition, comments provided on the *2008 Draft NTS SA* were considered in developing the scope of this SWEIS.

While many of the comment documents were from private individuals, comment documents were also received from government and nongovernmental organizations, including the U.S. Environmental Protection Agency, the State of Nevada (Office of the Attorney General, State Historic Preservation Officer, Commission on Minerals, and Division of State Lands), Nye County, the Western Shoshone National Council, Tri-Valley Communities Against a Radioactive Environment (Tri-Valley CAREs), the Western States Legal Foundation, Citizens for Dixie's Future, and Nuclear Watch New Mexico. Comments on similar or related topics were grouped into common categories as a means of summarizing them. After the issues were identified, they were evaluated to determine whether they were appropriately relevant to the SWEIS. Relevent issues are addressed in the appropriate chapters or appendices of this SWEIS.

Scoping comments are summarized in **Table 1–2**, including DOE/NNSA's response and how the comments were incorporated into this SWEIS.

Table 1–2 Summary of Major Scoping Comments and DOE/NNSA Responses

General Topic	***Issue and Response***
Land Withdrawal	Commentors asked DOE/NNSA to identify concrete steps to reconcile the current uses of the NNSS with the uses identified in existing land withdrawals (i.e., to assure that ongoing or proposed activities at the NNSS will be lawful and permitted under existing Federal law). One commentor also recommended that DOE/NNSA consider each of its activities within the context of the land withdrawals and make a judgment as to whether it meets the purpose for which the withdrawal was issued. One commentor was concerned about the status of the land withdrawal. ***Response:*** *DOE/NNSA believes the land withdrawals are not restrictive with respect to NNSS activities in support of its three missions (National Security/Defense, Environmental Management, and Nondefense). As part of a Settlement Agreement (April 1997) between the State of Nevada and DOE, consultation with the U.S. Department of the Interior was initiated concerning the status of existing land withdrawals with regard to LLW storage and disposal. The consultation process concluded in November 2009, when DOE/NNSA accepted custody and control of the approximately 740 acres constituting the NNSS Area 5 Radioactive Waste Management Complex. Land withdrawal is discussed in Chapter 4, Section 4.1.1.3.*
Alternatives	DOE/NNSA received several comments related to the range of reasonable alternatives and the recommended scope of those alternatives. One commentor requested that this SWEIS be a programmatic document, given the range of decisions intended to be supported by the proposed EIS. Some commentors favored the cessation of all defense-related activities at the NNSS and the removal of associated infrastructure, with only environmental remediation and monitoring activities allowed to continue. One commentor specifically favored expansion of programs aimed at controlling the illicit use and transportation of nuclear materials. Another commentor provided a detailed recommendation for a "curatorship" approach in lieu of the current Stockpile Stewardship and Management Program. A commentor also requested that DOE/NNSA evaluate an alternative whereby the NNSS lands would be withdrawn permanently and DOE/NNSA would take responsibility for environmental impacts far into the future. In addition, commentors supported the inclusion of renewable energy development projects under the No Action, Expanded Operations, and Reduced Operations Alternatives, as opposed to under a separate alternative. One commentor stated that the Expanded Operations Alternative and the Renewable Energy Operations Alternative described in the "Alternatives for the SWEIS" section of the *Federal Register* NOI should be combined into a single Expanded Operations Alternative. ***Response:*** *This SWEIS tiers from DOE/NNSA and DOE programmatic EISs that have facilitated decisionmaking regarding the assignment of missions to the NNSS, such as supporting stockpile stewardship, maintaining nuclear testing capability, and disposing LLW and MLLW. These NEPA documents and related decisions are described in Section 1.5 of this chapter. This* NNSS SWEIS *would not provide the basis for a DOE complex-wide programmatic decision, but would provide the basis for site-specific implementation of those decisions that have already been made in existing programmatic EISs and other NEPA documents. DOE NEPA regulations (10 CFR 1021.330(c)) require that large, multiple-facility DOE sites, such as the NNSS, prepare SWEISs. This* NNSS SWEIS *addresses the full range of missions, programs, capabilities, projects, and activities under the purview of DOE/NNSA in Nevada.* *In response to public comments, conservation and renewable energy projects are addressed under each of the SWEIS alternatives (No Action, Expanded Operations, and Reduced Operations), and the Renewable Energy Operations Alternative was eliminated from consideration as a separate alternative. A curatorship approach, or cessation of NNSS' primary activities in support of DOE/NNSA's Defense Mission would be counter to national security policy as established by the Congress and the President. Therefore, ending these activities at NNSS (including switching to a curatorship approach) is not being considered in the SWEIS. Expansion of programs aimed at controlling the illicit use and transportation of nuclear materials is evaluated under the Expanded Operations Alternative (see Section 3.2.1.1). Chapter 3, Section 3.5, of this SWEIS provides further discussion of alternatives eliminated from detailed study.*

General Topic	*Issue and Response*
Alternatives (continued)	A commentor stated that the only actions that should be considered within the No Action Alternative are actions that are currently ongoing or in existence at the NNSS. ***Response:*** *In response to this comment, SWEIS alternatives were restructured. The No Action Alternative now reflects the current missions, programs, capabilities, projects, and activities. It includes reasonably foreseeable actions not yet implemented, but analyzed and approved under previous NEPA decisions.* Commentors showed preferences for particular alternatives. One commentor stated that the Nation's pressing needs in the areas of defense technology testing and counterterrorism preparedness, along with the suitability of the NNSS to support such programs, make the Expanded Operations Alternative the preferred choice. Another commentor favored the Reduced Operations Alternative, with a focus on phasing out unnecessary defense programs in light of changing national policies to focus more on remediation and alternative energy research. ***Response:*** *DOE/NNSA has selected a Preferred Alternative and included it in this* Final NNSS SWEIS. *The Preferred Alternative is a hybrid that incorporates programs and projects from all three of the analyzed alternatives. Additional information on the Preferred Alternative is included in Chapter 3, Section 3.6, of this SWEIS. Renewable energy projects have been consolidated into the Conservation and Renewable Energy Program under the Nondefense Mission and have been incorporated into each of the three alternatives considered in this NNSS SWEIS: No Action, Expanded Operations, and Reduced Operations.* A commentor stated that this SWEIS should evaluate a potential future scenario in which DOE/NNSA must maintain sole control of vast areas of the NNSS that must remain perpetually isolated from other uses. This alternative would require DOE/NNSA to seek congressional legislation to establish a perpetual withdrawal of land and would have significant implications in terms of long-term stewardship, costs, etc. Additionally, a commentor stated that this SWEIS should consider closing the NNSS in its entirety (Discontinued Operations Alternative). ***Response:*** *Closure of the NNSS with or without perpetual control and isolation would not meet the purpose and need for agency action as identified in Section 1.2 of this chapter. Should the missions of the NNSS change such that perpetual control and isolation is a valid scenario during the 10-year planning period, either through presidential decision directives or congressional direction, DOE/NNSA would determine through the supplement analysis process whether additional NEPA analysis is warranted.* A commentor stated that this SWEIS should describe how each alternative was developed, how it addresses each project objective, and how it would be implemented. ***Response:*** *Chapter 3 of this SWEIS describes how each alternative was developed and presents information on programs supporting the missions, as well as specific information on the implementation of the projects (such as the number of tests, experiments, or training activities; location/facility; and purpose of activity).*

<table>
<tr><th>General Topic</th><th>Issue and Response</th></tr>
<tr><td>Transportation</td><td>DOE/NNSA received comments regarding how analyses such as transportation of waste and other materials should be addressed. Commentors stated that this SWEIS should evaluate impacts associated with the transportation of wastes on communities along the shipping routes within Nevada and in corridor states. In addition, a commentor asked for assurances that shipments from offsite waste generators would continue to be prohibited from routes through the Las Vegas metropolitan area. One commentor asked that the waste disposal analysis identify waste volumes by specific generator or origin location, as well as specific transportation routes and times.

Response: This SWEIS presents the potential transportation impacts on communities along shipping routes in Nevada including routes through Las Vegas and representative routes in corridor states (see Chapter 5, Section 5.1.3.1, and Appendix E, “Evaluation of Human Health Effects from Transportation”). DOE/NNSA sought to understand the differences in potential environmental effects between different routing options, which incorporated changes to local transportation infrastructure since the 1996 NTS EIS; communicate those differences to the public; and seek stakeholder comments on the range of transportation routes. Specific LLW/MLLW waste generators tied to specific waste streams are not addressed in the transportation analysis; instead, reference routes were used. Existing waste generators are identified in Appendix A, “Detailed Description of Alternatives.” Total estimated waste volumes by waste type were used to calculate transportation impacts.

A commentor stated that this SWEIS should contain an analysis of how intermodal transport (rail-to-truck transfer) would be done (if planned) and a comprehensive evaluation of risks and impacts, regardless of where the intermodal transfer(s) would take place.

Response: An analysis of rail-to-truck transport is included in the transportation analysis of this SWEIS (see Chapter 5, Section 5.1.3.1).</td></tr>
<tr><td>Contamination</td><td>DOE/NNSA received comments requesting that this SWEIS contain the following analyses:
• A comprehensive analysis of contamination from all activities that have occurred and are ongoing at the NNSS and offsite locations
• An assessment of what has been “cleaned up” since the inception of DOE’s Environmental Management Mission and what remains to be assessed and remediated for industrial sites, contaminated soils, and groundwater under the Environmental Management Mission programs at the NNSS and all offsite locations for the foreseeable future
• An extensive analysis of groundwater contamination within the NNSS to determine to what extent and where contamination is or could be migrating off site

Response: Impacts from contamination (including impacts to groundwater) are analyzed in Chapter 5, “Environmental Consequences,” and Chapter 6, “Cumulative Impacts.” A description of the Environmental Restoration Program, (including an update on Environmental Restoration Program projects and activities and remaining projects and activities to clean up the NNSS) is included in Chapter 3, Section 3.1.2.2, and in more detail in Appendix A, Section A.1.2.2.</td></tr>
<tr><td>Nye County Impacts</td><td>DOE/NNSA received the following comments from Nye County, in summary: (1) Nye County believes that significant adverse impacts and losses of natural resources have occurred that must be mitigated; (2) environmental monitoring will not suffice as a mitigation measure; and (3) this SWEIS must address the legacy of environmental insult that has occurred and define appropriate measures to mitigate the massive loss of natural resources.

Response: Groundwater resources at the NNSS, including groundwater groundwater monitoring and quality and known contamination, are described in Chapter 4, Section 4.1.6.2, of this SWEIS. Section 4.1.5.4 describes soil contamination at the NNSS. Impacts from previous activities at the NNSS and offsite locations are included in the analysis of cumulative impacts presented in Chapter 6, “Cumulative Impacts,” of this SWEIS. Chapter 6 analyses of potential environmental impacts generally encompass the impacts of past, present, and reasonably foreseeable actions. Text provided by Nye County describing its perspective on cumulative impacts of primarily Federal actions has been included in its entirety in Chapter 6. Programs to identify contamination from previous activities are ongoing and the results made public when available.</td></tr>
</table>

General Topic	*Issue and Response*
Waste Disposal	Commentors requested that this SWEIS contain a comprehensive and thorough evaluation of all current and potential waste disposal activities at the NNSS, including LLW, MLLW, transuranic waste, GTCC waste, depleted uranium, and any other existing or foreseeable waste stream. ***Response:*** *The Waste Management Program is part of the Environmental Management Mission performed at the NNSS. Chapter 3 describes the Waste Management Program activities to be performed under each of the alternatives analyzed in this SWEIS. Under all of the alternatives, the NNSS would continue to receive LLW and MLLW, including depleted uranium waste streams, for disposal. Transuranic waste would not be disposed at the NNSS, but would be transferred off site for disposal at the Waste Isolation Pilot Plant. DOE has prepared the* Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste *(DOE/EIS-0375) to evaluate the potential environmental impacts of siting and operating a GTCC disposal facility or facilities. The GTCC facility is included in the cumulative impacts analysis in Chapter 6. Chapter 5, Section 5.1.11, of this SWEIS contains a thorough analysis of the capacity of the waste management system to manage all current and potential NNSS waste streams.* Commentors requested that this SWEIS also identify waste volumes by generator/origin location, where such waste would be disposed, the facilities required (existing and new), the transportation requirements for moving various waste streams from generator locations to the NNSS for disposal, the interrelationships of waste disposal activities, and the cumulative impacts associated with all of the current and future NNSS onsite and offsite waste disposal activities. ***Response:*** *Consistent with the* 1996 NTS EIS *Record of Decision and the 2000 amended 1996 ROD, this SWEIS does not evaluate specific generators tied to specific waste streams because of the variability that can occur in both waste stream characteristics and future waste volumes. Instead, this SWEIS evaluates the potential impacts of transporting and disposing LLW and MLLW that meet the NNSS WAC based on transportation from various regions of the country. The list of waste generators used in the analysis of potential impacts is included in Appendices A and E.*
	Commentors requested that this SWEIS discuss the following topics and assess their programmatic, environmental, and legal ramifications: disposal of various waste streams; the interrelationships of waste disposal activities; and the cumulative impacts associated with all of the current and future on- and offsite NNSS waste disposal activities, and, in particular, plans to accept new LLW streams, including any that may be of commercial origin. ***Response:*** *Chapter 5, Section 5.1.11, of this SWEIS contains a thorough analysis of all current and potential NNSS waste disposal activities and waste streams. Additionally, cumulative impacts of waste management activities are evaluated in Chapter 6, "Cumulative Impacts." See the next response concerning waste of commercial origin.* A commentor requested that this SWEIS address DOE's proposal for taking LLW from commercial entities, subsequently declaring it to be DOE waste, and disposing it at the NNSS. ***Response:*** *In reference to activities performed by DOE's Office of Global Threat Reduction, the goal of the Offsite Source Recovery Project is to recover excess, unwanted, or abandoned sealed (radioactive material) sources that pose a potential risk to health, safety, and national security. DOE/NNSA takes ownership of some sealed sources under its Global Threat Reduction Initiative. If no reuse of these sealed sources is identified, they may be declared waste and be disposed as LLW. Within this SWEIS these sealed sources are included in the waste management and transportation analyses, representing less than 0.03 percent of the volume of LLW for the No Action and Reduced Operations Alternatives and less than 0.02 percent of the Expanded Operations Alternative LLW volume.*

<table>
<tr><th>General Topic</th><th>Issue and Response</th></tr>
<tr><td rowspan="3">Coordination and Consultation</td><td>
A commentor stated that this SWEIS should acknowledge Nevada’s important role in overseeing aspects of NNSS activities that are of special concern to the state and the importance of the Agreement in Principle framework for cooperative efforts. In addition, commentors stated that this SWEIS should evaluate the potential for more formal state regulatory oversight of LLW activities, such as the application of the state’s authority (delegated by the U.S. Nuclear Regulatory Commission) to oversee LLW disposal operations at the NNSS.
Response: LLW is managed solely under DOE directives pursuant to DOE’s Atomic Energy Act authority. The U.S. Nuclear Regulatory Commission does not have regulatory authority over DOE’s LLW program. However, DOE and NDEP have an Agreement in Principle whereby NDEP participates in the Low-Level Waste Acceptance Program. The discussion of the Agreement in Principle, under which the State of Nevada provides enhanced oversight of DOE’s management of MLLW is included in Section 9.1.1 of this SWEIS.
DOE/NNSA received several comments addressing outreach and consultations. Commentors urged continued dialogue and collaborative planning efforts with local American Indian groups in the NEPA process. A commentor stressed the need for consultations with the State Historic Preservation Office on this SWEIS and recommended that the alternatives describe the consultation process for key issues, including cultural resources surveys and impact assessments. Commentors stated that the NNSS should pursue more partnerships with local organizations, including the University of Nevada at Las Vegas and Nye County businesses, for future research and testing projects. One commentor stated that DOE/NNSA should consider additional opportunities for training local first responder personnel at the NNSS.
Response: Outreach and consultations are discussed in Section 1.6 and Chapter 10, “Consultation and Coordination.” American Indian groups have been invited to participate in the preparation of this SWEIS. Text prepared by the Consolidated Group of Tribes and Organizations’ American Indian Writers Subgroup appears in text boxes throughout this SWEIS and as Appendix C. DOE/NNSA is carrying out consultations with the State Historic Preservation Office and the U.S. Fish and Wildlife Service, as appropriate. Descriptions of these consultation processes appear in the cultural resources and biological resources impacts sections of this SWEIS. DOE/NNSA will consider proposals for research and development projects from academic institutions, other government agencies, and private companies and individuals. First responder training is included under the Nuclear Emergency Response, Nonproliferation and Conterterrorism Programs, and the Work for Others Program described in Chapter 3.
Nye County requested that DOE/NNSA consider the benefits of partnering with Nye County for delivery of infrastructure services.
Response: Although this comment is not within the scope of this SWEIS, DOE/NNSA will take this under consideration.
</td></tr>
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Nye County suggested that it conduct the groundwater characterization program for DOE/NNSA. Nye County offered to provide a fully developed programmatic alternative for review in this SWEIS.
Response: DOE/NNSA conducts a robust Underground Test Area (UGTA) Project. DOE/NNSA will continue to interact with Nye County on this UGTA Project. Nye County did not prepare an alternative for the SWEIS.
</td></tr>
<tr><td>
Nye County suggested that the draft and final SWEIS incorporate text it prepared for inclusion in the discussion of cumulative impacts presenting the Nye County perspective.
Response: Nye County text has been included in its entirety in the cumulative impacts discussion in Chapter 6.
</td></tr>
</table>

General Topic	*Issue and Response*
Land Use	A comment was made that this SWEIS should address the land transfer and all incidental activities contemplated for this area, including closure of Pit 3 and new state-imposed permitting requirements under RCRA. ***Response:*** *In November 2009, 740 acres in Area 5 of the NNSS were transferred for custody and control to DOE/NNSA. Chapter 5, Section 5.1.11, of this SWEIS contains a thorough analysis of all current and potential NNSS waste disposal activities, including establishment of a new mixed-waste cell under a new RCRA permit.*
Yucca Mountain	A commentor stated that this *NNSS SWEIS* must: • Fully evaluate the relationship between the potential repository and NNSS activities • Assess any potential cumulative impacts with respect to the former DOE Yucca Mountain Project • Identify, assess, and address the combined effects of these two facilities and related associated activities ***Response:*** *As indicated in the fiscal year 2010, 2011, and 2012 budget requests, the Administration decided to cease funding and activities related to development of a repository at Yucca Mountain while developing alternative storage and disposal approaches for spent nuclear fuel and high-level radioactive waste. Proposed actions associated with the former Yucca Mountain Project included construction, operation, monitoring, and eventual closure of a geologic repository at Yucca Mountain for disposal of spent nuclear fuel and high-level radioactive waste in storage or projected to be generated at 72 commercial and 5 DOE sites across the United States. In 1994, the DOE/Nevada Operations Office (the predecessor of the DOE/NNSA NSO) entered into a management agreement with the DOE Yucca Mountain Site Characterization Office for use of about 58,000 acres of NNSS land for site characterization activities related to the former Yucca Mountain Project. Under the agreement, the former Yucca Mountain Project was responsible for meeting the same environmental requirements that applied to the NNSS independent of, but in coordination with, the NNSS organizations. DOE/NNSA now maintains the infrastructure and buildings and provides security and support to DOE to remain compliant with Federal and state regulations pursuant to existing site permits.* *DOE recognizes that it has an obligation to remediate lands disturbed by past activities associated with the former Yucca Mountain Project. Accordingly, DOE has evaluated the potential cumulative impacts of remediating the lands and closing the infrastructure and buildings at Yucca Mountain (see Chapter 6 of this SWEIS). This analysis is based on the preliminary approach to remediating and closing the Yucca Mountain Site and facilities described under the No Action Alternative in the* Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada *(DOE 2002e). The preliminary approach analyzed in Chapter 6 of this SWEIS represents but one of many approaches. Upon receipt of appropriations, DOE plans to prepare a detailed proposal to remediate the lands and close the infrastructure and buildings, as required by law, regulations, and applicable agreements, and then undertake further NEPA review, as appropriate. After completion of site closure, DOE will initiate a long-term surveillance program.*
Cumulative Impacts	A commentor stated that the analysis of cumulative impacts in this SWEIS must include the following: • A comprehensive evaluation of the combined impacts of all activities, programs, and projects currently ongoing at the NNSS or reasonably foreseeable in the future • An assessment of impacts from past NNSS activities and an examination of how they interact with impacts from current and future activities • An assessment of the cumulative impacts on groundwater from past activities, in combination with potential additional contamination from current and future NNSS activities ***Response:*** *Chapter 6, "Cumulative Impacts," contains a comprehensive evaluation of cumulative impacts, including past, present, and reasonably foreseeable activities and cumulative groundwater impacts.*

General Topic	***Issue and Response***
Project Shoal, Central Nevada Test Area, and the Tonopah Test Range	A commentor stated that this SWEIS should contain an assessment of environmental conditions (surface and subsurface) for Project Shoal and the Central Nevada Test Area to establish environmental baselines against which any future impacts may be measured. ***Response:*** *Remediation of the surface contamination at the Project Shoal and Central Nevada Test Area sites was completed. Responsibility for the sites and ongoing characterization, monitoring, and/or remediation of subsurface impacts has been transferred to the DOE Office of Legacy Management for long-term stewardship. These sites are no longer under DOE/NNSA control and, by agreement with the DOE Office of Legacy Management, they are not addressed in this* NNSS SWEIS.
	A commentor stated that this SWEIS should address DOE/NNSA Environmental Management Mission and DOE/NNSA activities at the NNSS and NNSS-related sites and locations. Of particular concern is plutonium contamination on the Tonopah Test Range. ***Response:*** *DOE/NNSA Environmental Management Mission activities (under the Environmental Restoration Program) at the NNSS, Tonopah Test Range, and Nevada Test and Training Range are evaluated in this SWEIS.*
NEPA Implementation	A commentor requested that the period for comments on the draft SWEIS should be no less than 180 days. ***Response:*** *DOE/NNSA lengthened the comment period from 60 days (see NOI) to 126 days in response to commentors' requests.* A commentor requested that the public hearings be held in locations throughout Nevada and in other states affected by NNSS activities (including, but not limited to, the transportation of radioactive and hazardous materials to and from the NNSS). ***Response:*** *Public hearings were held in Las Vegas, Pahrump, Tonopah, and Carson City in Nevada and St. George in Utah.* A commentor requested that the hearings be structured so as to meaningfully facilitate public comments, i.e., in such a way that permits individuals to make comments for the record in a public forum. ***Response:*** *Comments were taken and recorded in a public hearing format. In addition, the open-house format was set up to allow the general public a better forum to ask questions and have one-on-one discussions with the DOE/NNSA subject matter experts.* A commentor requested that all related EISs, environmental assessments, categorical exclusions, and referenced documents be made publicly available online. ***Response:*** *Many DOE EISs and environmental assessments are available online at the DOE NEPA website (http://nepa.energy.gov). Occasionally, due to national security requirements, some NEPA documents are not available online. The references for this SWEIS are available at the public reading rooms listed on the cover page of this SWEIS, and copies also may be obtained by request.* A commentor stated that the purpose and need should be a clear, objective statement of the rationale for the proposed project. ***Response:*** *DOE/NNSA has provided a detailed description of the purpose and need in Section 1.2.*
Terrorism and Sabotage	A commentor requested that this SWEIS evaluate risks and impacts relating to acts of terrorism and sabotage against NNSS-related radioactive materials shipments. ***Response:*** *A classified appendix with this information was prepared in conjunction with this SWEIS. Pertinent unclassified data from the appendix are included in Chapter 5, Section 5.1.12.3.*

General Topic	*Issue and Response*
Renewable Energy	Commentors stated that renewable energy should be adopted as a secondary mission. ***Response:*** *Renewable energy research and development, as well as commercial development, are discussed in this SWEIS.* A commentor stated that the environmental consequences associated with reasonable buildout of renewable energy facilities should be evaluated in this SWEIS. ***Response:*** *DOE/NNSA concurs with the commentor and has included renewable energy projects in all alternatives evaluated in this SWEIS.* The U.S. Environmental Protection Agency commented that it supports increasing the development of renewable energy resources. ***Response:*** *DOE/NNSA acknowledges the U.S. Environmental Protection Agency's support for renewable energy.* Commentors asked for clarification of the renewable energy technologies considered in this SWEIS. ***Response:*** *Each of the three alternatives includes renewable energy projects. Each alternative includes a commercial solar power generation facility that varies among the alternatives in terms of electricity-generating capacity, as described in Chapter 3. All the commercial solar projects would be located in Area 25 of the NNSS. In addition, the Expanded Operations Alternative includes a project to install a photovoltaic system in Area 6 and a project to demonstrate the feasibility of enhanced geothermal electricity-generating systems in other locations on the NNSS. Because there are no proposals for the commercial-scale solar power generation facilities or geothermal electricity generation, additional NEPA review would be required if a specific proposal is considered by DOE/NNSA.*
Water Resources	Nye County stated that access limitations to water resources on withdrawn lands constitute a significant, adverse impact on the socioeconomic condition of Nye County. The impact is an indirect result of land access restrictions that have no demonstrated basis and must be recognized and identified as an impact on Nye County in this SWEIS. ***Response:*** *Access restrictions are an integral part of the security of the NNSS. Nye County text concerning lack of access to water resources on withdrawn lands is incorporated in its entirety in Chapter 6, "Cumulative Impacts."*
Potential Impacts	The U.S. Environmental Protection Agency requested that specific discussions and data regarding the following issues related to renewable energy projects be incorporated into this SWEIS: • Water supply and quality • Disposal of discharges • Clean Water Act, Sections 404 and 303(d) • Biological resources and habitat • Invasive species • Indirect and cumulative impacts • Implementation of adaptive management techniques for mitigation measures • Climate change • Air quality • Coordination with American Indian tribal governments • Environmental justice • Hazardous materials/hazardous waste/solid waste • Mitigation and pollution prevention • Coordination with land use planning activities ***Response:*** *The renewable energy projects in this SWEIS are not sufficiently defined to include this level of detail and would require additional NEPA review before being implemented.*

General Topic	*Issue and Response*
Potential Impacts (cont'd)	A commentor stated that this SWEIS should clearly describe the rationale used to determine whether impacts of an alternative are significant and suggested that thresholds of significance consider the context and intensity of an action and its effects. ***Response:*** *Wherever possible, impacts are quantified and compared with regulatory standards, system capacities, or other appropriate data. The criteria for determining whether the proposed alternatives impact each resource are identified in each of the Chapter 5 resource impacts sections.* A commentor requested that groundwater contamination from radionuclides or other materials, airborne pollutants, and the full range of other environmental impacts be evaluated in relation to their impacts on people and the environment in communities and areas surrounding the site and along transportation corridors leading to and from the NNSS. ***Response:*** *This SWEIS analyzes the potential direct and indirect impacts on people and the environment from groundwater contamination, transportation impacts, airborne pollutants, and all other emissions, as well as impacts on other resources (such as cultural resources and socioeconomic resources). These impacts are presented in Chapter 4, "Affected Environment," Chapter 5, "Environmental Consequences," and Chapter 6, "Cumulative Impacts."* A commentor stated that impacts must be considered in a global context. ***Response:*** *Global impacts such as the contribution of greenhouse gas emissions from activities at the NNSS and offsite locations and as a result of the transportation of radioactive materials and wastes are analyzed and included in Section 5.1.8, Air Quality and Climate. DOE/NNSA complex-wide impacts were analyzed in a separate programmatic EIS (*Final Complex Transformation Supplemental Programmatic Environmental Impact Statement *[DOE 2008l]).*
Treaty of Ruby Valley	A commentor was in favor of returning lands to the Western Shoshone. ***Response:*** *The U.S. Supreme Court ruled against claims by the Western Shoshone under the Ruby Valley Treaty. DOE/NNSA is aware of significant disagreement with the rulings of the U.S. Supreme Court by the Western Shoshone.*

CFR = *Code of Federal Regulations*; EIS = environmental impact statement; GTCC = greater-than-Class C; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NDEP = Nevada Division of Environmental Protection; NEPA = National Environmental Policy Act; NNSA = National Nuclear Security Administration; NNSS = Nevada National Security Site; NOI = Notice of Intent; NSO = Nevada Site Office; NTS = Nevada Test Site; RCRA = Resource Conservation and Recovery Act; SWEIS = site-wide environmental impact statement; UGTA = Underground Test Area; WAC = waste acceptance criteria.

1.7.2 *Draft NNSS SWEIS* Public Involvement

On July 29, 2011, DOE/NNSA published a notice in the *Federal Register* (76 FR 45548) announcing the availability of the *Draft NNSS SWEIS*, the duration of the period for the public to submit comments, the location and timing of the public hearings, and the various methods for submitting comments on the draft to DOE/NNSA (such as online, email, fax, telephone, U.S. postal service, or oral/written comments at public meetings). DOE/NNSA announced a 90-day comment period, from July 29, 2011, to October 27, 2011, to provide time for interested parties to review the *Draft NNSS SWEIS*. In response to requests for additional review time, the comment period was extended by 36 days, through December 2, 2011, giving commentors a total review and comment period of 126 days (76 FR 65508).

During the public comment period, five public hearings were held to provide interested members of the public with opportunities to learn more about DOE/NNSA missions, programs and activities and the content of the draft SWEIS from exhibits, factsheets, and discussion with DOE/NNSA subject matter experts. From September 20 through 28, 2011, public hearings were held in Las Vegas, Pahrump, Tonopah, and Carson City, Nevada and St. George, Utah. An additional SWEIS hearing was conducted for the CGTO on October 6, 2012. Members of the public provided oral and written comments during the hearings. Additional information on the public hearing and other stakeholder informational meetings is contained in the Comment Response Document (Volume 3 of this *NNSS SWEIS*).

Additionally, a website (www.nv.energy.gov/sweis) was established to further inform the public about the draft SWEIS, how to submit comments, and other pertinent information.

1.7.2.1 *Draft NNSS SWEIS* Comment Summary

In reviewing the comments on the *Draft NNSS SWEIS*, DOE/NNSA identified several topics that were of heightened interest or concern to stakeholders, or resulted in generally substantive changes to relevant information and analyses in this SWEIS. These topics include:

- ***Radioactive Waste Transportation***. Commentors were concerned that DOE/NNSA was considering changing routes for shipping radioactive waste to allow shipment of waste through Las Vegas, and indicated the analysis should address site-specific conditions along the routes in the vicinity of Las Vegas. Additionally, commentors stated that the analysis of rail transfer stations was incomplete because specific operations and accidents that could occur at the analyzed rail transfer stations were not addressed.
- ***Groundwater Quality and Use***. Commentors stated that groundwater contamination from historic nuclear weapons testing poses an unacceptable risk to human health, and that the *Draft NNSS SWEIS* did not characterize this risk adequately. Commentors allege that this groundwater contamination and restrictions on public access to other groundwater on the NNSS constituted a loss of a valuable resource, which contributed to a lack of economic development.
- ***Former Yucca Mountain Project Site***. Commentors believed that DOE/NNSA should analyze, as a reasonably foreseeable future action, either the construction and operation of a high-level radioactive waste repository at Yucca Mountain, or the remediation and reclamation of the Yucca Mountain Site.
- ***American Indian Rights***. Commentors expressed concern that the U.S. Government is not abiding by the terms of the Treaty of Ruby Valley, and the lands encompassing the NNSS rightfully belong to the Western Shoshone people.
- ***Use of the NNSS***. Commentors contended that ongoing and proposed activities at the NNSS were not consistent with the purposes for which the land was originally withdrawn from public use, and stated that DOE/NNSA should consider returning some or all of the lands to public use.
- ***Nuclear Weapons Testing***. Commentors were opposed to resumption of nuclear weapons testing, and were concerned that resumption of testing was possible, despite the current moratorium on such tests.
- ***Renewable Energy***. Commentors were generally supportive of using the NNSS for research- and commercial-scale renewable energy projects, but expressed concerns that such projects, particularly commercial-scale projects, have the potential to cause adverse environmental impacts on many resources.

DOE/NNSA has responded to each public comment in the Comment Response Document (Volume 3) of this *Final NNSS SWEIS*.

1.7.2.2 Changes from the Draft Site-Wide Environmental Impact Statement

DOE/NNSA revised the *Draft NNSS SWEIS* in response to public comments, and provided additional environmental baseline information and new and revised analyses, including, but not limited to, the following:

- DOE/NNSA added information (figures and supporting text) regarding current and projected levels of surface soil and groundwater contamination.
- DOE/NNSA enhanced its cumulative effects analysis by including the remediation of the former Yucca Mountain Project Site as a reasonably foreseeable future action.
- DOE/NNSA added a human health impacts analysis for an alternate maximally exposed individual based upon a "subsistence consumer" lifestyle pattern.
- DOE/NNSA added an analysis of potential impacts associated with wildland fire events.
- DOE/NNSA has included new information regarding existing environmental conditions based upon more-recent, routine sampling and field data collection (e.g., groundwater contaminant sampling).

DOE/NNSA also corrected inaccuracies, made editorial corrections, and clarified text.

1.7.3 Next Steps

DOE/NNSA will announce its decision regarding the selected alternative or alternatives in a ROD no sooner than 30 days after the U.S. Environmental Protection Agency Notice of Availability for this *Final NNSS SWEIS* is published. The ROD will be published in the *Federal Register* and explain all factors, including the potential environmental impacts, considered by DOE/NNSA in reaching its decision. The ROD will identify the environmentally preferred alternative or alternatives. If mitigation measures, monitoring, or other conditions are adopted as part of DOE/NNSA's decision, these will be summarized in the ROD, as applicable, and included in a mitigation action plan that would be prepared following issuance of the ROD. The mitigation action plan would explain how and when mitigation measures would be implemented and how DOE/NNSA would monitor the mitigation measures over time to judge their effectiveness.

After DOE/NNSA issues its ROD, both the ROD and the mitigation action plan will be posted on DOE's NEPA website (http://nepa.energy.gov), and copies will be placed in the DOE/NNSA Reading Room in Las Vegas, Nevada, and in public libraries in southern Nevada and southwestern Utah; they also would be made available to interested parties upon request.

CHAPTER 2
SITE OVERVIEW AND UPDATE

2.0 SITE OVERVIEW AND UPDATE

Among the responsibilities of the U.S. Department of Energy and National Nuclear Security Administration (DOE/NNSA) are continued stewardship of the Nation's nuclear weapons stockpile and maintenance of a nuclear weapons testing capability. Historically, the primary mission at the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) was to conduct nuclear weapons tests. Since the moratorium on nuclear weapons testing in October 1992, the focus at the NNSS has been to support the Stockpile Stewardship and Management Program. However, under a November 1993 Presidential Decision Directive, DOE/NNSA must be able to resume underground nuclear tests within 24 to 36 months if so directed by the President. The DOE/NNSA Nevada Site Office (NSO) maintains this test readiness at the NNSS. Because of its favorable environment and infrastructure, the NNSS also supports DOE waste management and disposal; DOE/NNSA counterterrorism training, research, and development; nuclear emergency response; nonproliferation; and other research related to national security and nondefense-related research, development, and testing programs.

This chapter of the *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 (NNSS SWEIS)* provides background on the NNSS and its main facilities, as well as other locations used to support DOE/NNSA missions. These facilities include the Remote Sensing Laboratory (RSL), the North Las Vegas Facility (NLVF), and the Tonopah Test Range (TTR) (see Chapter 1, Figure 1–1). While many programs and activities take place on the NNSS, several administrative and technical operations occur at other locations. Research, testing, and operations at RSL focus on conducting emergency response procedures and support, remote sensing, counterterrorism, and radiological incident response. RSL houses fabrication laboratories, shops, and advanced scientific equipment. The DOE/NNSA NSO's primary administrative offices are located at NLVF and house Federal and contractor personnel. In addition, facilities for engineering, fabrication, assembly, and calibration and laboratories are located at NLVF. Activities at the TTR support the Stockpile Stewardship and Management Program, as well as research and design of new weapons and weapon components. An overview of the changes that have occurred since DOE issued the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)* (DOE 1996c) is also provided. Some of the site descriptions include American Indian perspectives prepared by the American Indian Writers Subgroup (AIWS); the AIWS input is in text boxes identified with a Consolidated Group of Tribes and Organizations (CGTO) feather icon.

2.1 Nevada National Security Site

The NNSS occupies approximately 1,360 square miles of desert and mountain terrain in southern Nevada at the southern end of the Great Basin. Elevations range from 2,700 feet on Jackass Flats in the southern part of the NNSS to 7,680 feet on Rainier Mesa in the mountainous northern region (DOE/NV 2009d) (see **Figure 2–1**). Sparsely vegetated basins or flats, separated by low mountains, dominate the eastern side and southern end of the NNSS—Jackass Flats in the southwestern quadrant, Frenchman Flat and Mercury Valley in the southeastern quadrant, and Yucca Flat in the northeastern quadrant. Frenchman and Yucca Flats each contain a large playa. The northwestern quadrant of the site comprises mountains with a pinyon-juniper forest and sagebrush shrublands separated by canyons; the dominant topographic features in this area are the Shoshone and Timber Mountains near the center and western border and Rainier Mesa and Pahute Mesa in the northwestern region of the site (DOE 2002f; Wills and Ostler 2001).

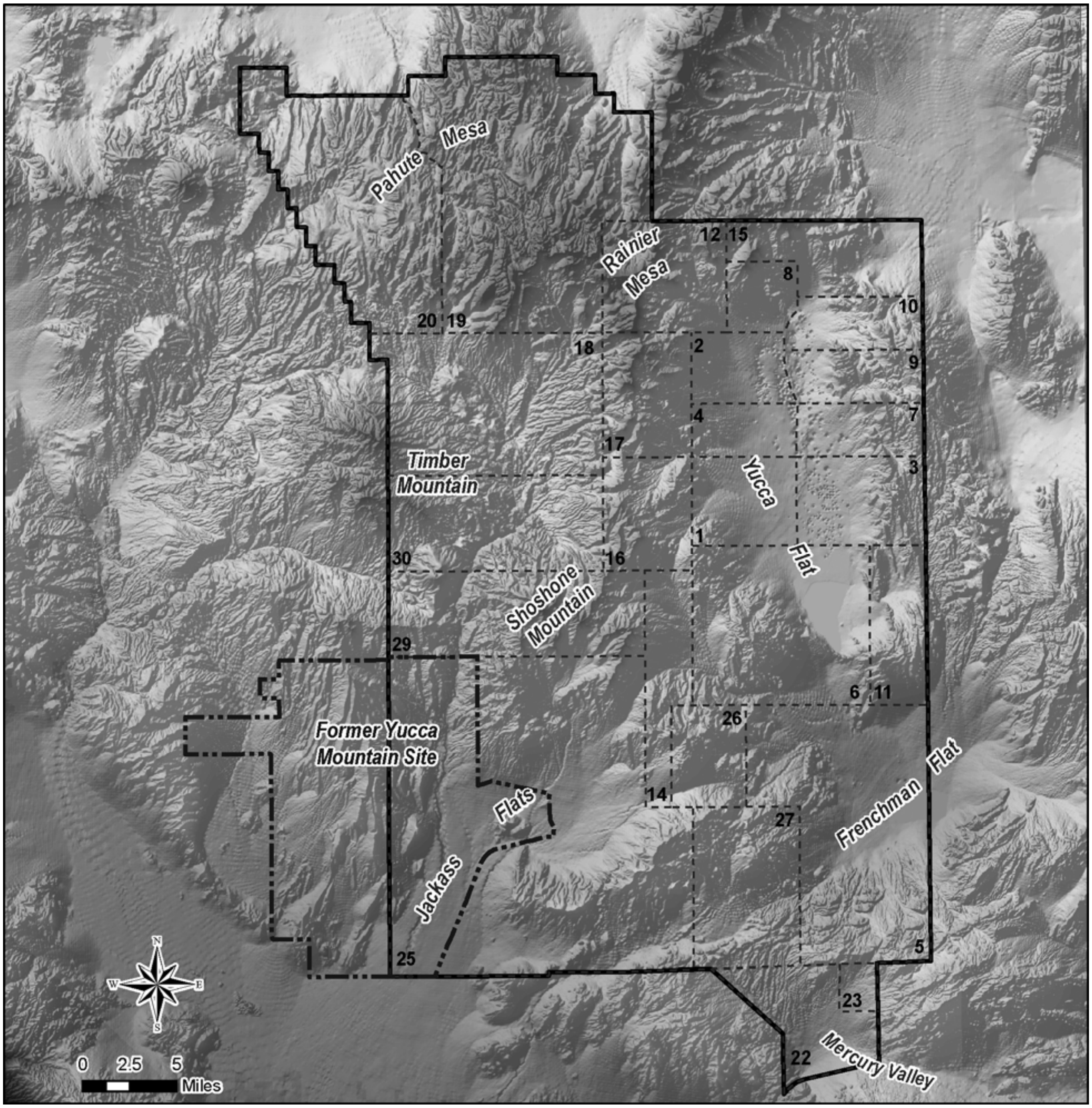

Figure 2–1 Geographic Areas of the Nevada National Security Site

About 6,500 square miles of the U.S. Air Force's (USAF's) Nevada Test and Training Range (formerly the Nellis Air Force Range) and the Desert National Wildlife Refuge surround the NNSS on the northern, western, and eastern sides. Most of the land adjacent to the NNSS is the Nevada Test and Training Range, which is used by the USAF for armament and high-hazard testing; aerial gunnery, rocketry, electronic warfare, and tactical maneuvering training; and equipment and tactics development and training. Public access to this land is restricted, so it serves as an additional buffer between NNSS activities and the general public. The overland distance from the southern edge of the NNSS (Gate 100 near Mercury) to downtown Las Vegas (the intersection of Interstate 15 and U.S. Route 95) is about 57 miles (NNSA 2007).

The NNSS is divided into numbered areas to facilitate management; communications; and the distribution, use, and control of resources (see **Figure 2–2**). The areas are numbered from 1 to 30, although four numbers are missing from the sequence (there are no Areas 13, 21, 24, or 28 on the NNSS). The numbering designations originated when the NNSS was part of the former Nellis Air Force Range (now called the Nevada Test and Training Range). The USAF has since changed the designations for the Nevada Test and Training Range, but the old numerical designations remain for the NNSS. The missing area numbers previously denoted areas on the range. The approximate size of each area (rounded to whole square miles) and a description of its function are provided in **Table 2–1**.

In addition to dividing the site into administrative areas, DOE/NNSA also categorizes the NNSS into land use zones. These zones are discussed in Chapter 4, Section 4.1.1.

American Indian Perspective of the NNSS Area and Offsite Locations

The Nevada National Security Site (NNSS) area and offsite locations are part of the traditional holy lands of the Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone people. We share this land for medicinal purposes, food, and culturally significant places necessary for traditional narratives and religious ceremonies.

The Consolidated Group of Tribes and Organizations (CGTO) knows these lands contain archaeological remains left by our ancestors. They are home to countless natural resources, such as plants, animals, water, and minerals which are critical to American Indian daily life and religious beliefs. Our ancestral lands contain natural landforms that mark important locations for keeping our history alive and for teaching our children about our culture in detailed Winter Stories. We use traditional sites within these lands to make doctoring tools, stone objects, and ceremonial items. They contain many sites associated with traditional healing ceremonies and power places necessary for our cultural survival. Despite the current physical separation of tribes from our ancestral lands stemming from the actions by the Federal Government, American Indians continue to value and recognize their meaningful role in our culture and continued survival.

Numerous sites have been identified within the NNSS boundaries that are important to American Indian People. For example, Fortymile Canyon is a significant crossroad where trails from distant places such as Owens Valley, Death Valley, and the Avawatz Mountain come together. Black Cone in Crater Flat is an important religious site that is considered an entry to the underworld. Prow Pass is a unique ceremonial site and, because of this religious significance, tribal representatives have recommended DOE avoid affecting this area. Oasis Valley is a known area for trade and doctoring ceremonies. Other locations throughout this area are considered important based on the abundance of artifacts, traditional-use plants and animals, rock art, and potential burial sites.

See Appendix C for more details.

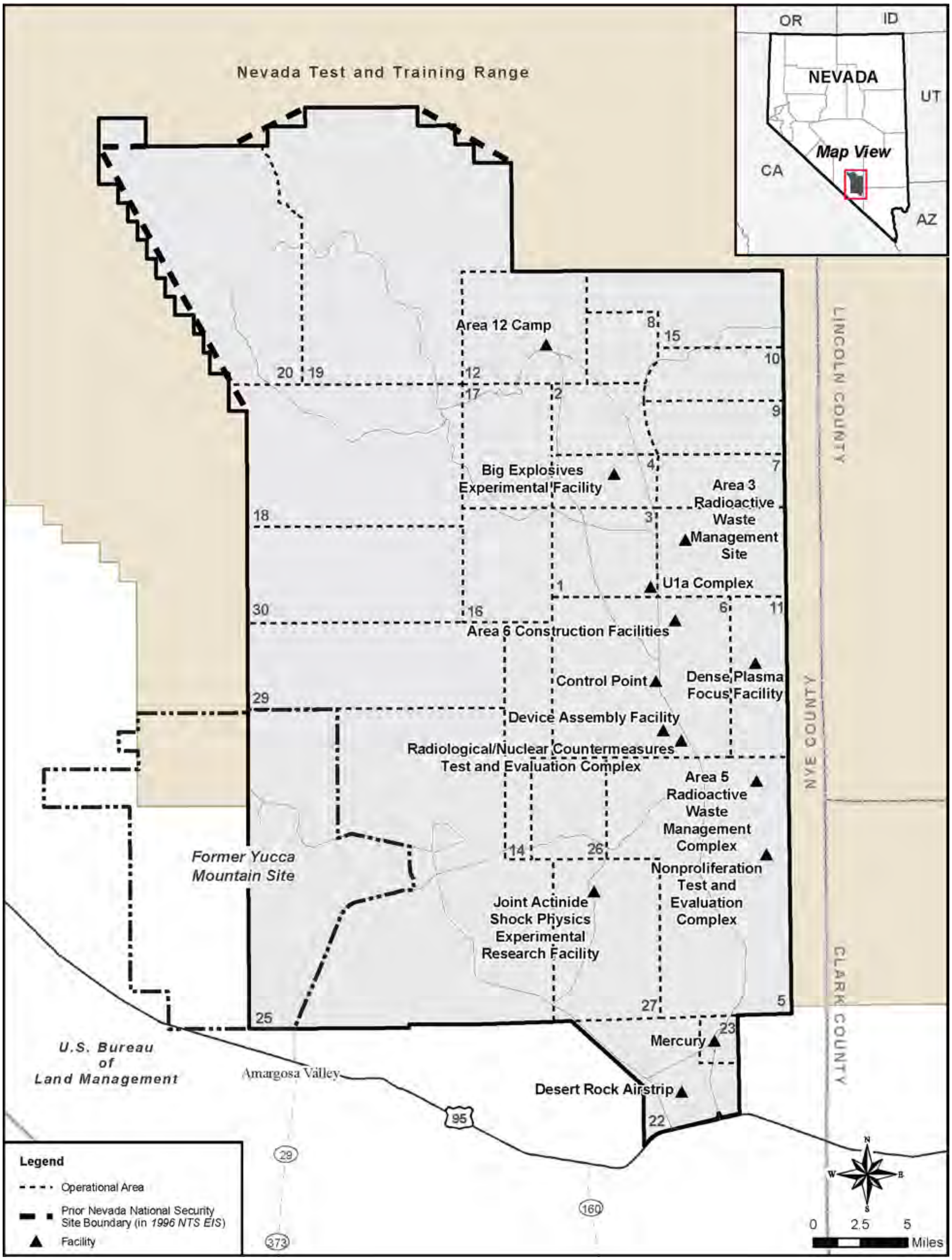

Figure 2–2 Nevada National Security Site Areas and Major Facilities

Table 2–1 Description and Historical Use of Nevada National Security Site Areas

Description of Nevada National Security Site (NNSS) Areas
Area 1—Area 1 occupies approximately 26 square miles of the Yucca Flat basin near the center of the site. The U1a Complex and the Area 1 Industrial Complex are located in Area 1. Area 1 was the site of four atmospheric nuclear tests between 1952 and 1955, and three underground tests (one in 1971 and two in 1990).
Area 2—Area 2 occupies approximately 19 square miles in the northern half of the Yucca Flat basin. The eastern portion of Area 2 was the site of 7 atmospheric nuclear tests conducted between 1952 and 1957. The first of 137 underground nuclear tests in Area 2 took place in late 1962, and tests continued through 1990.
Area 3—Area 3 occupies approximately 32 square miles near the center of the Yucca Flat basin. The Area 3 Radioactive Waste Management Site, which makes use of a group of subsidence craters for low-level radioactive waste disposal, is located in this area. Area 3 was the site of 17 atmospheric tests conducted between 1952 and 1958, and 251 underground nuclear tests from 1958 through 1992.
Area 4—Area 4 occupies approximately 16 square miles near the center of the Yucca Flat basin. The Big Explosives Experimental Facility is located in Area 4. Area 4 was the site of 5 atmospheric nuclear tests conducted between 1952 and 1957. From the mid-1970s through 1991, 35 underground nuclear tests were conducted in Area 4, mainly in the northeastern corner.
Area 5—Area 5 occupies approximately 111 square miles in the southeastern portion of the site and includes the Area 5 Radioactive Waste Management Complex, the Nonproliferation Test and Evaluation Complex, and the Nevada Desert Free Air Carbon Dioxide Enrichment and Mojave Global Change Facility environmental research sites. From 1951 through early 1962, 14 atmospheric tests were conducted at Frenchman Flat, in the northeastern portion of Area 5. Five underground nuclear weapons tests were conducted at Frenchman Flat between 1965 and 1968.
Area 6—Area 6 occupies approximately 81 square miles from the northern part of Frenchman Flat to the southern part of Yucca Flat, straddling Frenchman Mountain. Facilities in Area 6 include the Control Point Complex, Area 6 Construction Facilities, the Device Assembly Facility, the Radiological/Nuclear Countermeasures Test and Evaluation Complex, the Yucca Lake Aerial Operations Facility, and a Hydrocarbon Contaminated Soils Disposal Site. One atmospheric nuclear test was conducted in Area 6 (in 1957). Between 1968 and 1990, five underground nuclear tests were conducted in this area.
Area 7—Area 7 occupies approximately 19 square miles in the northeastern quadrant of the Yucca Flat basin. Twenty-six atmospheric tests were conducted in this area between 1951 and 1958. From 1964 through 1991, 62 underground nuclear tests were conducted in Area 7.
Area 8—Area 8 occupies approximately 14 square miles in the northern part of the Yucca Flat basin. Area 8 was the site of 3 atmospheric nuclear tests conducted in 1958. From 1966 through 1988, 10 underground nuclear tests were conducted in this area.
Area 9—Area 9 occupies approximately 20 square miles in the northeastern quadrant of the Yucca Flat basin. A construction and demolition debris landfill, using a subsidence crater, operates in Area 9. In Area 9, 17 atmospheric tests were conducted between 1951 and 1958, and 100 underground tests were conducted from 1961 to 1992.
Area 10—Area 10 occupies approximately 20 square miles in the northeastern quadrant of the Yucca Flat basin. Area 10 was the location of the Nation's first nuclear missile system test, an air-to-air rocket, detonated in mid-1957. There were 57 underground and shallow (called cratering) nuclear tests conducted in Area 10 between 1962 and 1991. The Sedan Crater, formed by a thermonuclear device in July 1962 as part of the Plowshare Program, is in Area 10. The Plowshare Program was designed as a research and development activity to explore the technical and economic feasibility of using nuclear explosives for industrial applications. The Sedan Crater is listed in the National Register of Historic Places.
Area 11—Area 11 occupies approximately 26 square miles along the central-eastern border of the NNSS. The Dense Plasma Focus Facility and an explosives ordnance disposal site are located in this area. Because of residual radioactive contamination from historic uses, this area is used intermittently for realistic drills in radiation monitoring and sampling. Four atmospheric safety tests were conducted in the northern portion of Area 11 in 1955 and 1956 in what is now known as Plutonium Valley. In addition to the aboveground safety tests, five underground nuclear weapons effects tests were conducted in Area 11 between 1966 and 1971.
Area 12—Area 12 occupies approximately 40 square miles along the northern boundary of the NNSS on Rainier Mesa. There are a number of tunnel complexes mined into Rainier Mesa that are used for experiments, including E-, G-, N-, P-, and T-Tunnel complexes. The Area 12 Camp was renovated and upgraded and will provide a secure base camp for military units and other government agencies for conducting counterterrorism and other exercises in the northern region of the NNSS. It provides an urban terrain setting, utilizing existing commercial, residential, and industrial buildings. The camp includes 200 dormitory rooms, a cafeteria, weapons and munitions storage, and numerous operations and support buildings. The DOE/NNSA Office of Secure Transportation currently uses it as a training facility. No atmospheric tests were conducted in Area 12; 61 underground nuclear tests were conducted in Area 12 between 1957 and 1992.

Table 2–1 Description and Historical Use of Nevada National Security Site Areas (continued)

Area 14—Area 14 occupies approximately 26 square miles in the central portion of the NNSS. Various outdoor experiments are conducted in this area. No atmospheric or underground nuclear tests were conducted in Area 14.
Area 15—Area 15 occupies approximately 35 square miles in the northeastern corner of the NNSS. No atmospheric tests were conducted in this area; between 1962 and 1966, three underground nuclear tests were carried out in Area 15. A facility that evaluated the effects of residual radiation on farm animals, called the EPA Farm, previously operated in this area.
Area 16—Area 16 consists of approximately 29 square miles in the central portion of the NNSS. Currently, DoD uses this area for high-explosives research and development in support of programs involving the detonation of conventional or prototype nonnuclear explosives and munitions and for developing tactics to defeat deeply buried and hardened targets. Area 16 was established in 1961 for DoD to conduct nuclear effects experiments. From mid-1962 through mid-1971, six underground nuclear weapons effects tests (all in the U16a Tunnel complex) were conducted in this area.
Area 17—Area 17 occupies approximately 31 square miles in the north-central portion of the NNSS. This area has been used primarily as a buffer between testing activities in other areas. No atmospheric or underground nuclear weapons tests were conducted in Area 17.
Area 18—Area 18 occupies approximately 88 square miles along the western border of the NNSS. The inactive Pahute Airstrip is located in the east-central portion of the area. The airstrip was used for the shipment of supplies and equipment for Pahute Mesa test operations. Area 18 was the site of five nuclear weapons tests from 1962 to 1964, two atmospheric tests, two cratering tests, and one underground test.
Area 19—Area 19 occupies approximately 146 square miles along the northern side of the NNSS. Area 19 was developed for high-yield underground nuclear tests. No atmospheric nuclear tests were conducted in Area 19. From the mid-1960s through 1992, 35 underground nuclear tests were conducted in this area.
Area 20—This area occupies approximately 97 square miles on Pahute Mesa in the northwestern corner of the NNSS. Area 20 was developed in the mid-1960s for high-yield underground nuclear tests. No atmospheric nuclear tests were conducted in Area 20. From the mid-1960s through 1992, 46 underground nuclear weapons tests were conducted in Area 20. In addition, 1 nuclear test detection experiment and 3 Plowshare Program tests were conducted in this area.
Area 22—Area 22 occupies approximately 31 square miles in the southernmost portion of the NNSS and serves as the main entrance (Gate 100) to the NNSS. Before 1958, this area included Camp Desert Rock, a U.S. Army installation used for housing troops taking part in military exercises at the NNSS. After 1958, the camp was removed, with the exception of the Desert Rock Airport. The airport is currently operational, but is only used by those authorized by DOE/NNSA.
Area 23—Area 23 occupies approximately 5 square miles near the southeastern corner of the NNSS. It is the location of Mercury, the largest operational support complex on the NNSS. Mercury was established in 1951 and serves as the main administrative and industrial support center at the NNSS. Mercury is located approximately 5 miles from U.S. Route 95. The Area 23 landfill, used to dispose nonhazardous solid waste, is located west of Mercury.
Area 25—Area 25, the largest area on the NNSS, occupies approximately 254 square miles in the southwestern corner of the site and includes an inactive entrance gate to the NNSS. Portions of Area 25 are used by the military for training exercises. The U.S. Army Ballistic Research Laboratory conducts open-air and X-tunnel tests using depleted uranium in Area 25. Research sites within Area 25 include the Treatability Test Facility (inactive) and Bare Reactor Experiment Nevada Tower, a 1,527-foot tower used by a number of organizations for a wide variety of research (e.g., sonic booms, meteorology, gravity drop tests, satellite infrared imaging). Located roughly in the center of Area 25, Jackass Flats was the site of ground experiments for reactors, engines, and rocket stages as part of a program to develop nuclear reactors for use in the Nation's space program.
Area 26—Area 26 occupies approximately 21 square miles in the south-central part of the NNSS. The southern portions of this area were used for nuclear-powered ramjet engine experiments, known as Project Pluto.
Area 27—Area 27 occupies approximately 49 square miles in the south-central portion of the NNSS. The Joint Actinide Shock Physics Experimental Research Facility is located in Area 27. Area 27 was used for weapons assembly and staging.
Area 29—Area 29 occupies approximately 62 square miles on the west-central border of the NNSS and includes portions of Fortymile Canyon. It is used primarily for military training and exercises. No nuclear weapons tests were conducted in Area 29.
Area 30—Area 30 occupies approximately 59 square miles at the center of the western edge of the NNSS. Area 30 has rugged terrain and includes the northern reaches of Fortymile Canyon. It is used primarily for military training and exercises. Area 30 had limited use in support of the Nation's nuclear weapons testing program, but was the site of Project Buggy, an experiment in the Plowshare Program.

DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; NNSA = National Nuclear Security Administration; NNSS = Nevada National Security Site.
Source: DOE 1996c; DOE/NV 2000e.

2.1.1 Major Facilities

The NNSS provides a large area remote from the public at which a broad variety of research, experimentation, and training can be performed. Some of the activities conducted take advantage of the expanses of land at the NNSS. However, a comparatively small part of the NNSS is developed and has facilities that are routinely occupied or visited by NNSS personnel. The following is a list of the more prominent facilities at the NNSS. The locations of these facilities are shown in Figure 2–2.

U1a Complex. The U1a Complex (formerly called the Lyner Complex) in Area 1 is an underground laboratory used for performing subcritical experiments (see text box) in support of the Stockpile Stewardship and Management Program. **Figure 2–3** shows the aboveground facilities at the U1a Complex. It consists of a series of underground alcoves and test chambers about 960 feet below the ground surface. Three vertical shafts connect to the underground tunnels to provide ventilation, as well as personnel, equipment, instrumentation, and utility access. At the surface are 27 support buildings and a mechanical hoist for accessing the belowground areas. Experiments with high explosives and special nuclear material, including dynamic plutonium experiments (see text box), are conducted in small alcoves mined into the sidewalls or floors of the underground tunnels (DOE/NV 2004b). A Large-Bore Powder Gun used for shock physics experiments is scheduled to be installed in an alcove of the U1a Complex in 2015.

Area 3 Radioactive Waste Management Site (RWMS). The Area 3 RWMS consists of five disposal cells that contain waste and two unused disposal cells located in subsidence craters created by previous nuclear weapons tests. The approximately 120-acre site has been used for disposal of bulk and containerized low-level radioactive waste (LLW). The Area 3 RWMS is maintained in a standby condition and could be activated if necessary to dispose nonhazardous solid waste or particular, usually large-volume, LLW streams.

Big Explosives Experimental Facility (BEEF). BEEF, located in Area 4, is an open-air hydrodynamic experimentation facility (see text box) where high-explosives-driven experiments are performed to provide data to support the Stockpile Stewardship and Management Program (DOE/NV 2005c). The facility consists of two earth-covered bunkers, a control bunker, a camera bunker, a gravel firing table, and other support facilities.

Subcritical Experiments

Subcritical experiments are performed using special nuclear material (for example, plutonium) in a manner that prevents it from achieving a nuclear explosion. Subcritical experiments are designed to improve knowledge of the dynamic properties of new or aged nuclear weapons parts and materials and to assess the effects of new manufacturing techniques on weapon performance. Subcritical experiments can vary any or all factors that influence criticality (mass, density, shape, volume, concentration, moderation, reflection, neutron absorption, enrichment, and interactions). Because there is no nuclear explosion, subcritical experiments are consistent with the U.S. nuclear testing moratorium.

Dynamic Plutonium Experiments

Dynamic plutonium experiments are designed to improve knowledge of plutonium material properties, including equation of state (an equation that expresses the relationship between temperature, pressure, and volume of a substance) and strength, over broad ranges of relevant pressures, temperatures, and time scales. They range from essentially static experiments to increasingly dynamic experiments. None of these experiments reaches nuclear criticality or involves a self-sustaining nuclear reaction.

Hydrodynamic Experiments

Hydrodynamic experiments are high-explosives-driven experiments to assess the performance and safety of nuclear weapons. During a nuclear weapon function test, the behavior of solid materials is similar to liquids, hence the term "hydrodynamic." These experiments do not use special nuclear material (plutonium or enriched uranium), but are conducted using test assemblies that are representative of nuclear weapons.

Hydrodynamic experimentation is a central component in maintaining nuclear weapons design and assessment capability. It is coupled with high-performance computer modeling and simulation to certify, without underground nuclear testing, the safety, reliability, and performance of the nuclear physics package of weapons.

Figure 2–3 Aboveground Facilities of the U1a Complex

Diagnostics equipment used to monitor explosions includes high-speed optics and x-ray radiography. Scientists conduct weapons physics experiments using explosives, pulsed laser power, and shaped charges. BEEF is certified to handle high-explosives loads up to 70,000 pounds. Materials used in explosives experiments may include beryllium and depleted uranium, among others.

Nonproliferation Test and Evaluation Complex (NPTEC). NPTEC (previously called the Liquefied Gaseous Fuels Spill Test Facility and the Hazardous Materials Spill Center) supports experimentation using open-air releases of chemical and biological simulants to create realistic environments for experiments and training (see **Figure 2–4**). The main NPTEC facility has the means of releasing materials from stacks or a wind tunnel, or on spill pads. Experimental data are collected using video cameras, sensors, arrays, and meteorological instrumentation. NPTEC is in Area 5, but experiments using low-concentration chemical or biological simulant releases and portable release systems can be performed at various locations at the NNSS. Public and private users perform experiments at NPTEC to independently analyze and evaluate sensor systems to determine their operational characteristics before their transition from the developmental to the operational phase (DOE/NV 2005e).

Figure 2–4 Large-scale Release Experiment Under Way at the Nonproliferation Test and Evaluation Complex

Area 5 Radioactive Waste Management Complex (RWMC). The Area 5 RWMC comprises about 740 acres, including about 160 acres of existing and proposed disposal cells for burial of LLW and mixed low-level radioactive waste. The Waste Examination Facility and Transuranic (TRU) Pad and TRU Pad Cover Building are also included in the Area 5 RWMC. Approximately 580 acres of land are available for future radioactive waste management facilities and disposal cells.

Control Point Complex. The Control Point Complex is located in Area 6 on the ridge between Yucca Flat and Frenchman Flat. The Control Point Complex consists of facilities to support testing and experiments in the forward areas of the NNSS (i.e., the experimental areas away from Mercury and areas of daily occupancy). It houses the command center used for nuclear tests and experiments (Control Point 1).

Device Assembly Facility (DAF). DAF, in Area 6, is a collection of more than 30 heavy-steel-reinforced concrete buildings connected by a common corridor (see **Figure 2–5**). The entire 100,000-square-foot complex is covered by compacted earth. Operational buildings in DAF include five assembly cells, three assembly bays (one with a downdraft table and one with a glovebox), four high bays, and two radiography bays. Support buildings include five bunkers for staging nuclear components or high explosives, two shipping/receiving bays, three small vaults, two decontamination areas, two laboratories, and an administration building (DOE/NV 2004c). Operations at DAF include staging and preparing special nuclear material for transportation and preparation of dynamic plutonium experiments and other unique experiments. DAF is approved for nuclear explosives operations and special nuclear material assemblies. DAF is also the home of the National Criticality Experiments Research Center, which was transferred from Technical Area 18 at Los Alamos National Laboratory in New Mexico and includes critical assemblies and machines used to conduct criticality experiments and training. In addition, DAF provides nuclear weapons assembly and disassembly capabilities; a damaged nuclear weapon could be sent to DAF for disassembly.

Figure 2–5 Device Assembly Facility at the Nevada National Security Site

Radiological/Nuclear Countermeasures Test and Evaluation Complex (RNCTEC). RNCTEC, in Area 6, is a facility constructed on behalf of the U.S. Department of Homeland Security for analyzing and evaluating countermeasures against potential terrorist attacks using radiological and/or nuclear weapons. The facility consists of several venues that simulate various transportation-related facilities (see **Figure 2–6**) (DOE 2004f).

Area 6 Construction Facilities. The Area 6 Construction Facilities provide craft and logistical support to activities performed in the forward areas of the NNSS (i.e., the experimental areas away from Mercury and areas of daily occupancy). The Area 6 Construction Facilities are also home to the Atlas Facility, a pulsed-power machine used to investigate the properties of nonnuclear materials under extreme conditions. The Atlas Facility can be used to conduct dynamic experiments and produce hydrodynamic data to validate computer models of material response for weapons applications; it was last used for such purposes in 2006. Since 2007, it has been maintained in cold standby, meaning that it can be reactivated, but may require repair and maintenance actions to ready it for use.

Figure 2–6 Radiological/Nuclear Countermeasures Test and Evaluation Complex Provides Capabilities for Evaluating Transportation Monitoring Equipment

Dense Plasma Focus Facility. The Dense Plasma Focus Facility in Area 11 supports research that provides active interrogation (a process that uses an external radiation source to interrogate an unknown object and induce a response) of special nuclear material and calibration of nuclear detection equipment. The focus of this research is enhancement of national security, with the goal of improving capabilities of detecting a smuggled nuclear device or material. The dense plasma focus machines use mixtures of deuterium and tritium.

Area 12 Camp. The Area 12 Camp is generally maintained in a standby condition, but can be reactivated for special projects. Most recently, DOE/NNSA activated the Area 12 Camp for use as a training facility by the Office of Secure Transportation. The camp includes 200 dormitory rooms, a full-service cafeteria, weapons and ammunition storage, and support buildings. Office of Secure Transportation training and exercises occur on roadways in Area 12 and throughout the NNSS.

The Area 12 Camp also supports activities at the tunnel complexes in Area 12. DOE/NNSA and the Defense Threat Reduction Agency use the various tunnels at the NNSS to conduct experiments and training in support of hard/deeply buried target location and defeat, conventional munitions effects and demilitarization, and other experiments and testing. Additionally, tunnel complexes in the northern area of the NNSS support DOE/NNSA programmatic activities, including safe management of improvised nuclear devices, if needed.

Desert Rock Airstrip. Desert Rock Airstrip in Area 22 supports operations of aircraft up to the size of a C-130 (about the length of a Boeing 727-200, but with a much larger wingspan). The airstrip is closed to public carriers, but is used by DOE/NNSA and others approved by DOE/NNSA for transport of material and personnel to the NNSS.

Mercury. Mercury (formerly called Base Camp Mercury), in Area 23 north of the entrance to the NNSS, is equivalent to a small town. It provides office facilities, dormitories, a cafeteria, classrooms, and various other support facilities for the NNSS. The Homeland Security and Defense Applications Operations and Coordination Center is located in Mercury. This center provides critical information exchange during exercises or real-world events and incidents.

Joint Actinide Shock Physics Experimental Research Facility (JASPER). JASPER, located in Area 27, houses a two-stage light-gas gun that is designed to propel a projectile into a target at extremely high velocities of up to 8 kilometers per second (see **Figure 2–7**). The JASPER gas gun is specifically designed to conduct research on plutonium and surrogate target materials. JASPER plays an integral role in the certification of the Nation's nuclear weapons stockpile by providing a means of generating and measuring data pertaining to the properties of materials (radioactive chemical elements) at high shock pressures, temperatures, and strain rates. These extreme laboratory conditions approximate those experienced in nuclear weapons. Data from the experiments are used to determine material equations of state (equations that express the relationship among temperature, pressure, and volume of a substance) and to validate computer models of material response for weapons applications. Experiment results are used for code refinement to provide better predictive capability and to ensure confidence in the U.S. nuclear stockpile.

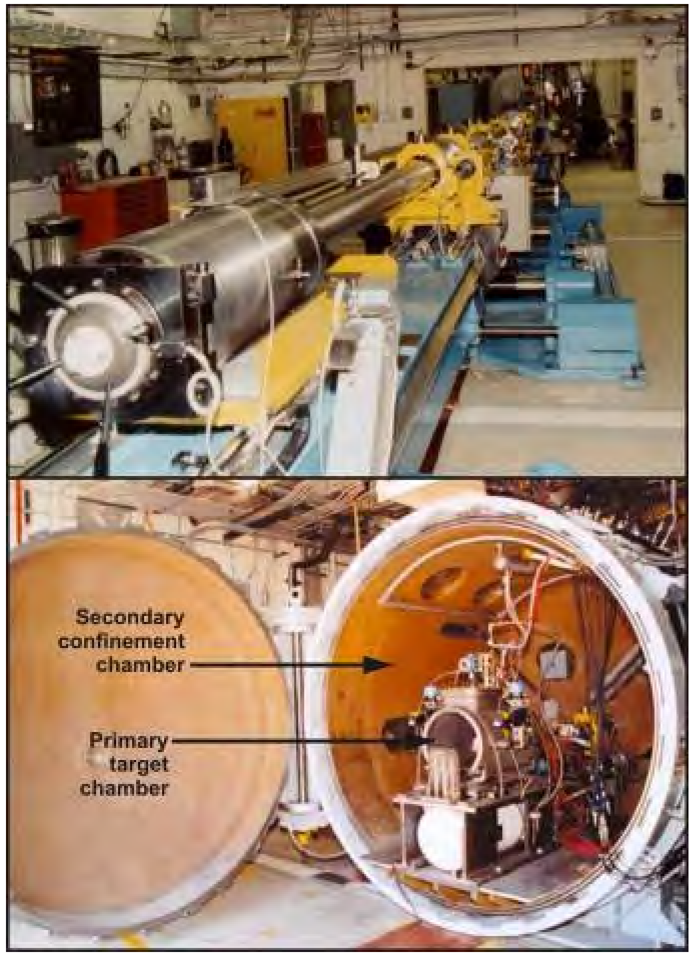

Figure 2–7 The Joint Actinide Shock Physics Experimental Research Facility Two-stage Gas Gun (top) and Target Chamber (bottom)

The nearby Baker Compound supports activities at JASPER, as well as other locations on the NNSS, by providing staging and storage necessary to support high-explosives experiments. The Baker Compound can receive shipments and safely store and transport explosives materials.

2.2 Remote Sensing Laboratory

RSL is located on 35 acres at Nellis Air Force Base in North Las Vegas, approximately 59 miles southeast of the nearest NNSS boundary (60 miles southeast of Gate 100, near Mercury, on the NNSS). RSL is adjacent to the Nellis Air Force Base runway and has seven permanent buildings. Radiological emergency response, the Aerial Measuring System, radiological sensor development and testing, Secure Systems Technologies, nuclear nonproliferation capabilities, and information and communication technologies are maintained at RSL.

2.3 North Las Vegas Facility

NLVF, located approximately 55 miles southeast of the nearest NNSS boundary (56 miles southeast of Gate 100, near Mercury, on the NNSS), comprises 29 buildings that support ongoing NNSS missions. The facility includes office buildings, a high bay, machine shop, laboratories, experimental facilities, and various other mission-support facilities. Among the NLVF buildings is the Nevada Support Facility, the location of most of the DOE/NNSA personnel offices.

2.4 Tonopah Test Range

The TTR, located approximately 12 miles north of the nearest NNSS boundary (73 miles north of Gate 100, near Mercury, on the NNSS), is a USAF facility. It consists of a 280-square-mile area north of the NNSS on the Nevada Test and Training Range. DOE/NNSA operations at the TTR are conducted pursuant to a land use permit from the USAF under the direction of Sandia National Laboratories and the DOE/NNSA Sandia Site Office. DOE/NNSA operations at the TTR include flight-testing of gravity weapons (bombs) and research, development, and evaluation of nuclear weapons components and delivery systems.

In its December 15, 2008, Record of Decision for the *Complex Transformation Supplemental Programmatic Environmental Impact Statement (Complex Transformation SPEIS)* (73 FR 77656), DOE/NNSA decided to implement a campaign mode of operations at the TTR, reducing its permitted operating area and upgrading its equipment. The "campaign mode of operations" would continue operations at the TTR but reduce permanent staff and conduct tests and experiments by deploying DOE and national laboratory personnel from other locations, as needed. The intent of reducing the footprint for the TTR and instituting a campaign mode of operations was to continue to meet mission and program requirements and reduce costs. After further review, DOE/NNSA, in consultation with the USAF, determined that maintaining the current footprint for the TTR would actually be the most cost-effective option. In addition, DOE/NNSA is reviewing implications of instituting a campaign mode of operations. The *Complex Transformation SPEIS* addresses operating with the existing TTR footprint in both campaign mode (Campaign Mode Operation of TTR, Option 2 – Campaign under existing Agreement) and in the existing (non-campaign) mode (No Action).

2.5 Overview of Changes Since the *1996 NTS EIS*

The *1996 NTS EIS* analysis of the potential environmental impacts was based on the physical site, facilities, and activities in existence or contemplated by DOE at the time the environmental impact statement was prepared. The primary missions at the NNSS and other sites in the state of Nevada remain unchanged; however, since the *1996 NTS EIS* was prepared, the administration of the sites and their physical boundaries and facilities have changed and there has been an evolution in the programs and activities conducted in support of the DOE/NNSA missions. This section provides an overview of these changes to bridge the gap between the sites, data, and analyses in the *1996 NTS EIS* and this *NNSS SWEIS*.

2.5.1 Administrative Changes

Creation of NNSA. Established by Congress in 2000 through the National Nuclear Security Administration Act (Title XXXII of the National Defense Authorization Act for Fiscal Year 2000, Public Law [P.L.] 106-65), NNSA is a separately organized, semiautonomous agency within DOE. DOE/NNSA is responsible for the management and security of the Nation's nuclear weapons, certain nuclear nonproliferation programs, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, DOE/NNSA Federal agents provide safe, secure transportation of nuclear weapons and components and special nuclear material, as well as support for other missions related to national security. DOE/NNSA administers the NNSS, RSL, and NLVF and is a tenant on the USAF's TTR.

Transfer of Responsibility for Project Shoal and the Central Nevada Test Area. Responsibility for Project Shoal and Central Nevada Test Area environmental restoration sites was transferred to the DOE Office of Legacy Management in 2006. The DOE/NNSA NSO's Environmental Management Program completed surface remediation at these sites before the transfer; the remaining work is associated with long-term surveillance (groundwater monitoring) and maintenance. These sites are no longer under DOE/NNSA control and, by agreement with the DOE Office of Legacy Management, are not further addressed in this *NNSS SWEIS.*

Renaming the Nevada Test Site. In order to better reflect the diversity of nuclear, energy, and homeland security activities conducted at the site, the former Nevada Test Site was renamed the Nevada National Security Site in 2010.

2.5.2 Physical Changes

The NNSS boundary and land withdrawal changes. The *1996 NTS EIS* identified various public land orders and withdrawals, as well as a Memorandum of Understanding between the USAF and the DOE Nevada Operations Office (the predecessor of the DOE/NNSA NSO), as the basis for the lands composing the NNSS. The Military Lands Withdrawal Act of 1999 (P.L. 106-65) revoked Public Land Order 1662 in its entirety and legislatively withdrew the area that makes up the northwestern corner of the NNSS for exclusive DOE use. The Military Lands Withdrawal Act resulted in changes to the border around the northwestern corner of the NNSS, which was historically used for nuclear weapons testing under the Memorandum of Understanding. Figure 2–2 shows both the current NNSS boundary and the boundary as it existed in 1996.

Area 5 Land Transfer. As part of an April 1997 settlement agreement (which resulted in dismissal of *Nevada v. Pena* [CV-5-94-00576-PMP (RLH)] by the U.S. District Court in Nevada) between the State of Nevada and DOE, consultation with the U.S. Department of Interior was initiated concerning the status of existing land withdrawals with regard to LLW waste storage and disposal. This consultation process concluded with DOE/NNSA's formal acceptance of custody and control of the approximately 740 acres constituting the Area 5 RWMC in a land transfer action.

Yucca Mountain Management Agreement. As indicated in the fiscal year 2010, 2011, and 2012 budget requests, the Administration decided to cease funding and activities related to the development of a repository at Yucca Mountain, while developing alternative storage and disposal approaches for spent nuclear fuel and high-level radioactive waste. Proposed actions associated with the former Yucca Mountain Project included construction, operation, monitoring, and eventual closure of a geologic repository at Yucca Mountain for disposal of spent nuclear fuel and high-level radioactive waste already in storage or projected to be generated at 72 commercial and 5 DOE sites across the United States. In 1994, the DOE Nevada Operations Office entered into a management agreement with the DOE Yucca Mountain Site Characterization Office for use of about 58,000 acres of the NNSS land for site characterization activities related to the former Yucca Mountain Project. Under the agreement, the Yucca Mountain Project was responsible for meeting the same environmental requirements that applied to the NNSS independent of, but in coordination with, the NNSS organizations. DOE/NNSA maintains the infrastructure and buildings and provides security and support to DOE to remain compliant with Federal and state regulations pursuant to existing site permits. DOE recognizes that it has an obligation to remediate lands disturbed by past activities associated with the former Yucca Mountain Project. Accordingly, DOE has evaluated the potential cumulative impacts of remediating the lands and closing the infrastructure and buildings at Yucca Mountain (see Chapter 6 of this SWEIS). This analysis is based on the preliminary approach to remediating and closing the Yucca Mountain site and facilities described under the No Action Alternative in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002e). The preliminary approach analyzed in Chapter 6 of this SWEIS represents but one of many potential approaches. Upon receipt of appropriations, DOE plans to prepare a detailed proposal to remediate the lands and close the infrastructure and buildings, as required by law, regulations, and applicable agreements, and then undertake further National Environmental Policy Act reviews, as appropriate. After the completion of site closure, DOE would initiate a long-term surveillance program.

Notwithstanding the decision to terminate the Yucca Mountain Project, DOE remains committed to meeting its obligations to manage and ultimately dispose spent nuclear fuel and high-level radioactive waste. The Blue Ribbon Commission on America's Nuclear Future was established in March 2010 to conduct a comprehensive review of the back end of the fuel cycle and evaluate alternative approaches for meeting these obligations. The Blue Ribbon Commission provided a final report in January 2012 that highlights the Commission's findings and conclusions and presents recommendations for consideration by the Administration and Congress, as well as interested state, tribal, and local governments; other stakeholders; and the public (BRC 2012).

Higher-than-expected growth in Clark and Nye Counties. The *1996 NTS EIS* projected that, in 2005, the populations of Clark and Nye Counties would be 1,380,920 and 38,516 persons, respectively (DOE 1996c). The actual populations in mid-2005 were 1,796,380 and 41,302 persons for Clark and Nye Counties, respectively (NSBDC 2010). These numbers represent an approximate 30 percent increase over projected values for Clark County and a 7 percent increase for Nye County. In Clark County, much of the growth occurred in the northwestern portion of the Las Vegas Valley, projecting toward the NNSS. This growth is potentially relevant to the analysis in this *NNSS SWEIS* because it creates a greater demand for resources and a larger number of people closer to the NNSS. Most recently, however, there has been a small decrease in population for both Clark and Nye Counties. Clark County decreased 0.8 percent from a high of 1,967,716 in mid-2008 to 1,952,040 in mid-2009. Nye County decreased 2.1 percent from a high of 47,370 in mid-2008 to 46,360 in mid-2009. The population used as the baseline for analysis in this *NNSS SWEIS* is provided in Chapter 4, Section 4.1.4. Information on the analysis of socioeconomic impacts is located in Chapter 5, Section 5.1.4.

As the populations in Clark and Nye Counties have increased, concern over water rights and water use has also increased. The Southern Nevada Water Authority has sought to purchase water rights in Lincoln, White Pine, and Nye Counties to meet the growing demand in Clark County. Nye County established the Nye County Water District in 2009 to manage, evaluate, and mitigate groundwater and surface-water resources in Nye County and to develop a long-range sustainability plan (Nye 2010). Water consumption at the NNSS has decreased compared with the 2,975 million gallons per year projected in the *1996 NTS EIS* over the 10-year planning period. While NNSS water use has decreased, solar power generation facilities, described in Chapter 3 of this *NNSS SWEIS*, could increase the demand for water in the southern areas of the NNSS. Further information on NNSS water use and groundwater availability is presented in Chapter 4, Sections 4.1.2.1 and 4.1.6.2. Potential impacts from implementation of alternatives are presented in Chapter 5, Sections 5.1.2.1 and 5.1.6.2, and in Chapter 6, Section 6.3.6.2.

2.5.3 Program and Activity Changes

A number of changes related to NNSS programs and activities have occurred since the *1996 NTS EIS* after the appropriate level of National Environmental Policy Act review was conducted. The most important of these changes are described as follows:

- DOE/NNSA relocated its operational capabilities associated with Security Category I and II special nuclear material and the critical assembly machines from Technical Area 18 at Los Alamos National Laboratory in New Mexico to DAF at the NNSS. DOE/NNSA conducts nuclear criticality operations at DAF to enable personnel to gain knowledge and expertise in advanced nuclear technologies that support nuclear materials management and criticality safety, emergency response, nonproliferation, safeguards, arms control, and stockpile stewardship science.

- DOE/NNSA expanded BEEF (initial operation began in 1994), as planned and analyzed in the *1996 NTS EIS*. It was modified to perform explosives-driven, pulsed-power experiments.

- DOE/NNSA completed construction and modifications of JASPER to conduct experiments that provide data on the Nation's nuclear weapons stockpile.

- DOE/NNSA relocated the Atlas Facility from Los Alamos National Laboratory to the NNSS. The Atlas Facility was used to conduct pulsed-power experiments until it was placed in standby mode in 2007.

- DOE/NNSA identified the U12g Tunnel for the activities of the Improvised Nuclear Device Program. If an improvised nuclear device were to be recovered, the tunnel would be used to stage, assess, and safeguard the weapon.

- A Counterterrorism Support Program was instituted that makes use of site facilities for training and adds activities at NPTEC in Area 5 to address emergency response and counterterrorism training.

- RNCTEC was constructed in Area 6 to provide analysis and evaluation capability for radiological and nuclear detection devices.

- DOE/NNSA completed upgrades to the Aerial Operations Facility in Area 6, including construction of a runway and a broad variety of infrastructure improvements.

- A Solar Enterprise Zone was identified at the NNSS, as described in the *1996 NTS EIS*, but a proposed commercial solar facility was cancelled by the project proponent.

- The Nevada Desert Free Air Carbon Dioxide Enrichment Facility and the Mojave Global Change Facility were built in Area 5. These facilities are used to perform controlled manipulative experiments (e.g., analyses of carbon dioxide enrichment, increased precipitation, and evolving soil conditions on natural systems) under controlled conditions.

- The U.S. Military Development and Training in Tactics and Procedures for Counterterrorism Threats and National Security Defense Program was instituted to develop methods for combating adversaries in a desert environment. This activity could occur at any location on the NNSS.

- The Area 5 RWMC resumed acceptance of mixed low-level radioactive waste from approved offsite generators in 2006 after a restriction on the receipt of these wastes was lifted by the Nevada Division of Environmental Protection during the renewal of the interim status permit in December 2005.

- Environmental Restoration Program activities have been ongoing since the *1996 NTS EIS* (DOE 1996c) was published. These activities have included the following:
  - Underground Test Area Project – Activities included conducting groundwater characterization and monitoring, drilling new monitoring wells, and developing groundwater flow and transport models.
  - Soils Project – Activities included characterization, monitoring, sampling, and corrective actions.
  - Industrial Sites Project – The majority of sites under the Federal Facility Agreement and Consent Order have been closed. Activities under this project included remediating, decontaminating, and decommissioning unneeded facilities.
  - Defense Threat Reduction Agency sites – The Defense Threat Reduction Agency is responsible for these sites. Surface-disturbing activities associated with these sites have been completed. Environmental monitoring, such as water sampling, was initiated and is ongoing.
  - Borehole Management Program – Most unneeded boreholes have been plugged at the NNSS. The program's expected completion date is the end of 2013.

Overview of Changes to the American Indian Writing Contributions Since the *1996 NTS EIS*

In 1995, the U.S. Department of Energy (DOE) invited the Consolidated Group of Tribes and Organizations (CGTO) to participate in the development of the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)*, to represent the American Indian perspective of the actions proposed and analyzed by DOE, and to consider and address the resources impacted. In response, the CGTO developed Appendix G for the *1996 NTS EIS* and provided italicized text for selected sections.

Appendix G and the italicized Final Environmental Impact Statement (EIS) text presented the American Indian perspective and recommended impact mitigation approaches for reducing potential impacts to Indian resources and other heritage values within the analyzed areas. American Indian involvement with the *1996 NTS EIS* and the development of Appendix G followed an American Indian Consultation Model[1] for government-to-government interactions among DOE and culturally affiliated American Indian Tribes. This was considered an innovative approach by Federal agencies at that time.

During the 2009 DOE Annual Tribal Meeting with the CGTO, DOE invited the CGTO to revisit the *1996 NTS EIS* and subsequent National Environmental Policy Act (NEPA) Supplement Analyses, to review the current and proposed activities presented in this site-wide environmental impact statement (SWEIS), and to develop text that reflects the CGTO's perspective and current concerns. DOE also expanded the CGTO's involvement by providing us with the opportunity to write culturally appropriate text summarizing our perspective and concerns for every section and appendix within the SWEIS, as appropriate, in addition to writing Appendix C, "The American Indian Assesment of Resources and Alternatives Presented in the SWEIS".

See Appendix C for more details.

[1] *The American Indian Consultation Model was based on the Consultation Model produced for the DoD Legacy Project, which was modified by the American Indian Writers Subgroup (AIWS) for the CGTO and implemented during the development of the 1996 NTS EIS. This model was again revisited and implemented by the AIWS for the CGTO in the development of the SWEIS, and is presented in Section 10.2.1.*

CHAPTER 3
DESCRIPTION OF ALTERNATIVES

3.0 DESCRIPTION OF ALTERNATIVES

This chapter contains descriptions of the alternatives that are being evaluated by the U.S. Department of Energy and National Nuclear Security Administration (DOE/NNSA) for continued operation of the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site), the Remote Sensing Laboratory (RSL) at Nellis Air Force Base, the North Las Vegas Facility (NLVF), the Tonopah Test Range (TTR), and environmental restoration sites located on the Nevada Test and Training Range (formerly the Nellis Air Force Range). Three alternatives are addressed in this *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* (*NNSS SWEIS*): (1) the No Action Alternative, described in Section 3.1; (2) the Expanded Operations Alternative, described in Section 3.2; and (3) the Reduced Operations Alternative, described in Section 3.3. Other sections of this chapter include Section 3.4, Comparison of Potential Consequences of the Alternatives; Section 3.5, Alternatives Eliminated from Detailed Study; and Section 3.6, Identification of the Preferred Alternative. Appendix A of this *NNSS SWEIS* provides a more detailed description of the alternatives. Some of the descriptions include American Indian perspectives prepared by the American Indian Writers Subgroup; the American Indian Writers Subgroup input is in text boxes identified with a Consolidated Group of Tribes and Organizations feather icon.

Descriptions of the alternatives are organized under three mission areas, each with two or more associated programs. These missions and their associated programs are: (1) the National Security/Defense Mission, which includes the Stockpile Stewardship and Management, Nuclear Emergency Response, Nonproliferation, Counterterrorism, and Work for Others Programs; (2) the Environmental Management Mission, which includes the Waste Management and Environmental Restoration Programs; and (3) the Nondefense Mission, which includes the General Site Support and Infrastructure, Conservation and Renewable Energy, and Other Research and Development Programs.

The three alternatives include similar types of projects and activities, but differ primarily in operational intensity and facilities requirements. Under all of the alternatives in this site-wide environmental impact statement (SWEIS), DOE/NNSA would maintain the capability to conduct an underground nuclear test. Only if directed by the President in the interest of national security would DOE/NNSA conduct such a test; however, conducting such a test is not included or analyzed under any of the alternatives in this SWEIS. A brief description of underground nuclear test phenomenology is included for informational purposes in Appendix H. The No Action Alternative generally reflects the use of existing facilities to maintain operations at levels consistent with those experienced since 1996, as well as those anticipated by project-specific National Environmental Policy Act (NEPA) analyses and agency decisions made since 1996 (see Chapter 2, Section 2.5). The Expanded Operations Alternative differs from the No Action Alternative in that, for many activities, the levels of operation would be higher and a number of new facilities would be constructed to support these higher levels of operation. In addition, under the Expanded Operations Alternative, DOE/NNSA would modify NNSS land use zones to better reflect the kinds of activities that would be undertaken. Under the Reduced Operations Alternative, DOE/NNSA would conduct some activities at levels similar to those under the No Action Alternative, but for other activities, the levels of operations would be lower or would cease. DOE/NNSA would also make NNSS land use zone changes under the Reduced Operations Alternative that would limit most activities in the northwestern portion of the NNSS. Mission-related capabilities, projects, and programmatic activities are identified for each of the proposed alternatives in the following sections and **Table 3–1** summarizes the similarities and differences among the three alternatives evaluated in this SWEIS. Detailed descriptions of the activities included under each alternative are provided in Appendix A.

DOE "National Environmental Policy Act Implementing Procedures" (10 *Code of Federal Regulations* [CFR] Part 1021) define site-wide NEPA documents as broad-scope environmental impact statements (EISs) or environmental assessments (EAs) that are programmatic in nature and identify and assess the individual and cumulative impacts of ongoing and reasonably foreseeable future actions at a DOE/NNSA site. This SWEIS considers ongoing and proposed programs, capabilities and projects (i.e., activities) at DOE/NNSA facilities in Nevada over the next 10 years.

The nature of ongoing activities and their associated environmental impacts are well understood. In contrast, however, the nature of some proposed activities is less well known. In the interest of disclosing potential environmental impacts that could occur at the NNSS and offsite locations over the next 10 years, this SWEIS includes ongoing activities, as well as activities that are more conceptual in nature.

To assess potential environmental impacts from all such activities, it was necessary for DOE/NNSA to estimate at a programmatic level certain aspects of the more conceptual proposed activities, such as the potential area of land disturbance or the amount of groundwater that may be required. DOE/NNSA incorporated these programmatic-level estimates, along with more-detailed information on ongoing and better-understood activities, into the analysis of impacts. For instance, estimated areas of land disturbance for both potential future activities and well-defined activities were used in estimating impacts on resources such as soils (area of disturbance and erosion), cultural resources (number of sites potentially affected), and biology (vegetation/habitat loss, number of desert tortoises affected).

DOE/NNSA understands that the level of NEPA analysis conducted for some proposed future activities may not be sufficient to permit implementation, and such activities could require additional NEPA analysis. These activities are identified in this chapter. DOE/NNSA will conduct NEPA reviews for these activities, as appropriate, in the future. DOE/NNSA's NEPA review procedures are described in Chapter 9, Section 9.1.1.

DOE/NNSA has at various times considered the possibility of supporting commercial solar projects at the NNSS. In this *NNSS SWEIS*, DOE/NNSA evaluates potential commercial solar power generation facilities under each of the three alternatives; however, there is no specific proposal for such a project at this time. For this reason, DOE/NNSA cannot be certain regarding the size of any solar power generation facility that might be constructed or whether DOE/NNSA support for such a facility might extend beyond providing access to land and certain infrastructure, such as providing partial funding. However, to ensure consideration of potential environmental impacts in a decision by DOE/NNSA to actively support development of one or more commercial solar power generation facilities at the NNSS, each alternative in this *NNSS SWEIS* addresses commercial-scale projects (the size of the potential facility varies with each alternative). DOE/NNSA selected the potential size of the generation facility under each alternative in terms of megawatts of generating capacity to provide a reasonable range of generating capacities, not to portray any actual project under consideration. Neither did DOE/NNSA intend to stipulate a certain generating capacity per unit of land area, realizing that as technology improves, smaller parcels of land may be sufficient to generate the same amount of electricity than are currently required. The assumptions used in the analyses of impacts from a potential solar power generation facility at the NNSS were selected to provide conservative analyses that would not underestimate impacts. If a commercial solar power project were proposed at the NNSS in the future, project-specific NEPA review would be required.

Detailed Description of Alternatives—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) is concerned about culturally perceived harmful land disturbing U.S. Department of Energy (DOE) actions described in this chapter and Appendix A of this site-wide environmental impact statement (SWEIS). We are concerned because these actions adversely impact the Nevada National Security Site (NNSS) land and offsite locations, which in turn affect the American Indian cultural landscape.

Since 1987, DOE has provided opportunities for representatives of the CGTO to visit portions of the NNSS and identify important places, spiritual trails, and landscapes of traditional and contemporary cultural significance.[1] These actions by DOE are considered positive steps towards fulfilling its trust responsibility through facilitating co-stewardship and land management strategies between DOE and the CGTO; however, this is an ongoing process.

To avert or minimize further impacts, the CGTO recommends DOE and the CGTO develop co-management strategies to help protect the land by implementing the following actions before continuing with these current or proposed activities:

- Identify those areas that have been disrespected and culturally damaged, so that balance can once again be restored.
- Avoid further harmful ground-disturbing activities
- Make mitigation of restorable areas a top priority
- Avert or minimize damage to geological formations important to the cultural and ecological landscape, songscapes and storyscapes
- Implement collaborative environmental restoration techniques that require minimal ground disturbing activities (see CGTO response to Section 3.1.2.2)
- Continue to pursue systematic consultations with American Indians so potentially impacted resources can be readily identified, alternative solutions discussed, and adverse impacts averted
- Provide American Indian people increased access to culturally significant areas so that we can use our knowledge, prayers, and traditions to effectively restore balance to the natural and spiritual harmony of the NNSS area and offsite locations

In addition, the CGTO recommends DOE and the CGTO continue to hold annual meetings to discuss current and proposed actions in greater depth, deliberate potential impacts, and consider and develop mutually acceptable mitigation measures. This is particularly necessary for those actions requiring additional National Environmental Policy Act (NEPA) analysis, including but not limited to solar and geothermal energy development.

In the view of Indian people, the ideal alternative would be to avoid any action that further disturbs the land and resources associated with the NNSS and the offsite locations.

We believe we have been created and placed on these lands. Because of our birth-right and strong ties to our ancestral land, the CGTO believes we have undeniable rights to interact with its precious resources, and a continuous obligation to protect it. The CGTO takes this responsibility very seriously and has developed our input for the alternatives presented throughout Chapter 3 so we may fulfill this obligation.

See Appendix C for more details.

[1] *Because this is a public document, the exact locations of these areas will not be revealed unless determined necessary during government-to-government consultation.*

Table 3–1 Comparison of Mission-Based Program Activities Under the Proposed Alternatives

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
National Security/Defense Mission		
Stockpile Stewardship and Management Program (see Sections 3.1.1.1, 3.2.1.1, and 3.3.1.1 of this chapter for additional information)		
Maintain readiness to conduct underground nuclear tests.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Conduct up to 10 dynamic experiments per year within NNSS Areas 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, 19, or 20.	Conduct up to 20 dynamic experiments per year within NNSS Areas 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, 19, or 20.	Conduct up to 6 dynamic experiments per year at the NNSS; no dynamic experiments would be conducted in Areas 19 or 20.
Conduct up to 20 conventional explosives experiments per year at BEEF and up to 10 per year within NNSS Areas 1, 2, 3, 4, 12, or 16 using up to 70,000 pounds TNT-equivalent of explosive charges; would also support Work for Others Program.	• Conduct up to 100 conventional explosives experiments per year within NNSS Areas 1, 2, 3, 4, 12, or 16 using up to 120,000 pounds TNT-equivalent of explosive charges (50 of these would be at BEEF with a TNT-equivalent limitation of 70,000 pounds); would also support Work for Others Program. • Add second firing table and high-energy x-ray capability at BEEF. • Establish up to three areas at the NNSS for conducting explosive experiments with depleted uranium and conduct up to 20 experiments per year.	Conduct up to 10 conventional explosives experiments per year at BEEF using up to 70,000 pounds TNT-equivalent of explosive charges per year to directly support the Stockpile Stewardship and Management Program; no other explosives experiments would be conducted.
Conduct up to 12 shock physics experiments per year at the NNSS using actinide targets at JASPER in Area 27 and up to 10 experiments per year using the Large-Bore Powder Gun in Area 1.	Conduct up to 36 shock physics experiments per year at the NNSS using actinide targets at JASPER in Area 27 and up to 24 experiments per year using the Large-Bore Powder Gun in Area 1.	Conduct up to 6 shock physics experiments per year at the NNSS using actinide targets at JASPER in Area 27 and up to 8 experiments per year using the Large-Bore Powder Gun in Area 1.
Conduct up to 500 criticality operations (experiments, training, and other operations) per year at the National Criticality Experiments Research Center at DAF in Area 6.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Maintain the Atlas Facility in standby with the capability to conduct up to 12 pulsed-power experiments per year.	Activate the Atlas Facility and conduct up to 24 pulsed-power experiments per year.	Decommission and disposition the Atlas Facility.
Conduct up to 600 plasma physics and fusion experiments each year at NLVF and 50 per year in NNSS Area 11.	Conduct up to 1,000 plasma physics and fusion experiments each year at NLVF and 650 per year in NNSS Area 11, increasing the size and complexity of such experiments.	Conduct up to 350 plasma physics and fusion experiments each year at NLVF and 25 per year in NNSS Area 11.
Conduct five drillback operations at the NNSS over about a 10-year period.	Same as under the No Action Alternative.	Same as under the No Action Alternative.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Conduct Stockpile Stewardship and Management Program activities in NNSS Areas 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, 19, or 20, including the following:	Same as under the No Action Alternative, plus:	Same as under the No Action Alternative, except: Stockpile Stewardship and Management Program activities would not be conducted in Areas 19 and 20.
– Disposition damaged U.S. nuclear weapons on an as-needed basis.	– Stage nuclear devices pending dismantlement, modification/maintenance, and/or transportation to another location. – Dismantle up to 100 nuclear weapons per year. – Replace limited-life components of up to 360 nuclear devices and conduct associated maintenance activities. – Test weapons components for quality assurance under the Limited Life Component Exchange Program.	
– Stage special nuclear material, including nuclear weapon pits.	– Transfer special nuclear material, including nuclear weapon pits, to and from other parts of the DOE complex for staging and use in experiments at the NNSS.	
Conduct training for the Office of Secure Transportation up to six times per year at various locations on NNSS roads.	Same as under the No Action Alternative, plus: Develop facilities in Area 17 and upgrade or construct new facilities in Area 6, 12, or 23 to support training for the Office of Secure Transportation.	Conduct training for the Office of Secure Transportation up to four times per year at various locations on NNSS roads.
Conduct the following stockpile stewardship operations at the TTR: – Conduct tests and experiments, including flight test operations for gravity weapons (i.e., bombs). – Conduct ground/air-launched rocket and missile operations. – Conduct impact testing. – Conduct passive testing of joint test assemblies and conventional weapons. – Conduct fuel-air explosives testing.	Same as under the No Action Alternative, except: Certain safeguards and security functions and other administrative functions would be returned to the U.S. Air Force	Same as under the No Action Alternative, except: – Discontinue ground/air-launched rocket and missile operations. – Discontinue fuel-air explosives testing at the TTR.
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs (see Sections 3.1.1.2, 3.2.1.2, and 3.3.1.3 of this chapter for more information)		
Provide support for the Nuclear Emergency Support Team, the Federal Radiological Monitoring and Assessment Center, the Accident Response Group, and the Radiological Assistance Program. Most of this support is out of RSL at Nellis Air Force Base.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Conduct Aerial Measuring System activities from RSL at Nellis Air Force Base.	Same as under the No Action Alternative.	Same as under the No Action Alternative.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Conduct WMD emergency responder training at various DOE/NNSA NSO venues.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Support the DOE Emergency Communications Network.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Disposition improvised nuclear devices and deploy the DOE/NNSA Disposition Program and FBI Disposition Forensic Program to the NNSS for training and exercises or for an actual event, as needed.	Same as under the No Action Alternative, plus disposition of radiological dispersion devices, as needed.	Same as under the No Action Alternative.
Integrate existing activities and primarily NNSS facilities to support U.S. efforts to control the spread of WMDs, particularly nuclear WMDs, including arms control, nonproliferation activities, nuclear forensics, and counterterrorism capabilities.	Same as under the No Action Alternative, plus: At the NNSS: • Construct laboratory space and other facilities for design and certification of treaty verification technology, training of inspectors, and development of arms control confidence-building measures as part of the Arms Control Treaty Verification Test Bed.[a] • Develop and construct new facilities to support a Nonproliferation Test Bed to simulate chemical and radiological processes that an adversary would clandestinely conduct.[a] • Construct an Urban Warfare Complex to support counterterrorism training.[a]	Same as under the No Action Alternative.
Work for Others Program (see Sections 3.1.1.3, 3.2.1.3, and 3.3.1.3 of this chapter for more information)		
Continue to conduct Work for Others Program activities in all appropriate zones on the NNSS, and at RSL and NLVF.	Same as under the No Action Alternative, except: The NNSS land use zone designation for Area 15 would be changed from "Reserved Zone" to "Research, Test, and Experiment Zone."	Same as under the No Action Alternative, except: Work for Others Program activities, with the exception of military training and exercises, would not be conducted in Areas 18, 19, 20, 29, and 30 at the NNSS.
Host treaty verification activities.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Conduct nonproliferation projects and counterproliferation research and development at the NNSS, including:	Same as under the No Action Alternative.	Same as under the No Action Alternative, except:
– Conduct conventional weapons effects and other explosives experiments.		Discontinue Work for Others Program conventional weapons effects and other explosives experiments.
– Support development of capabilities to detect and defeat military assets in deeply buried hardened targets.		Discontinue development of capabilities to defeat military assets in deeply buried hardened targets.
– Conduct up to 20 controlled chemical and biological simulant release experiments per year (each experiment would include multiple releases by a variety of means, including explosive).		Discontinue projects requiring explosive releases of chemical or biological simulants.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
– Support training, research and development of equipment, specialized munitions, and tactics related to counterterrorism.		
Support the U.S. Department of Defense and other Federal agencies in developing counterterrorism capabilities.	Develop and construct new facilities to support counterterrorism training and research and development activities.	Same as under the No Action Alternative.
Conduct criticality experiments to support NASA's deep space power source development within the parameters for criticality experiments established under the Stockpile Stewardship and Management Program.	Same as under the No Action Alternative, plus: Support NASA's deep space power source development, including conducting experiments using existing boreholes at the NNSS to sequester emissions such as radionuclides.[a]	Same as under the No Action Alternative.
Host the use of various aerial platforms, such as airplanes, unmanned aerial systems and helicopters, at various locations at the NNSS for research and development, training, and exercises.	• Increase use of various aerial platforms, such as airplanes, unmanned aerial systems, and helicopters, for research and development, training, and exercises, including constructing additional hangars, shops, and buildings at existing airports at the NNSS. • Conduct up to 3 underground and 12 open-air radioactive tracer experiments per year. • Host treaty verification activities, including development of a facility for simulating nuclear fuel cycle-related radionuclide release detection and characterization.[a] • Develop a facility for specialized explosive experiments and simulated manufacture to support high-explosives experiments.[a] • Support increased research and development of active interrogation equipment, methods, and training. • Develop new facilities to support research and development in radio frequency generation and infrasonic observations.[a] • Develop new facilities, including simulated clandestine laboratories, to support chemical and biological simulant experiments.[a]	Same as under the No Action Alternative.
Conduct Work for Others Program activities at the TTR, including robotics testing, smart transportation-related testing, smoke obscuration operations, infrared tests, and rocket development.	Same as under the No Action Alternative, except: Certain safeguards and security functions and other administrative functions would be turned over to the U.S. Air Force.	Same as under the No Action Alternative.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Environmental Management Mission		
Waste Management Program (see Sections 3.1.2.1, 3.2.2.1, and 3.3.2.1 of this chapter for more information)		
Dispose up to 15,000,000 cubic feet of LLW and 900,000 cubic feet of MLLW [b] in the Area 5 RWMC.	Dispose up to 48,000,000 cubic feet of LLW and 4,000,000 cubic feet of MLLW at the Area 5 RWMC and Area 3 RWMS.	Same as under the No Action Alternative.
Maintain the Area 3 RWMS on standby.	Open the Area 3 RWMS for disposal of authorized and/or permitted waste.	Same as under the No Action Alternative.
Repackage onsite-generated MLLW.	Same as under the No Action Alternative, plus: At the Area 5 RWMC, store MLLW received from on- and offsite generators pending treatment via macroencapsulation and microencapsulation (i.e., repackaging), sorting/segregating, and bench-scale mercury amalgamation, as appropriate, and/or dispose this waste.	Same as under the No Action Alternative.
Store onsite-generated TRU waste (up to 9,600 cubic feet over the next 10 years) pending offsite disposal.	Same as under the No Action Alternative, except a larger volume (up to 19,000 cubic feet over the next 10 years) of TRU waste would be generated by increased activities at NNSS facilities, such as JASPER.	Same as under the No Action Alternative, except smaller volumes (up to 7,100 cubic feet over the next 10 years) of TRU waste would be generated by reduced operational levels at NNSS facilities, such as JASPER.
Store onsite-generated hazardous waste as needed at the Area 5 Hazardous Waste Storage Unit pending offsite treatment or disposal. Up to 170,000 cubic feet would be generated over the next 10 years.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Operate the Area 11 Explosives Ordnance Disposal Unit. No more than 41,000 pounds of explosives would be treated over the next 10 years.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Operate the Area 6 Hydrocarbon Landfill.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Operate the Area 23 Solid Waste Disposal Site and the U10c Solid Waste Disposal Site. Up to 3,400,000 cubic feet would be disposed over the next 10 years.	Same as under the No Action Alternative, plus: Larger volumes of solid sanitary waste (up to 8,500,000 cubic feet) would be generated by increased activity levels at the NNSS over the next 10 years. Construct new sanitary solid waste disposal facilities as needed in Area 23 and develop a new solid waste disposal site in Area 25 to support environmental restoration activities.	Same as under the No Action Alternative, except lower volumes of solid sanitary waste (up to 3,300,000 cubic feet) would be generated by reduced activity levels at the NNSS over the next 10 years.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Environmental Restoration Program (see Sections 3.1.2.2, 3.2.2.2, and 3.3.2.2 of this chapter for more information)		
Underground Test Area Project – Comply with the FFACO; monitor groundwater from existing wells; drill new characterization and monitoring wells; develop groundwater flow and transport models; and continue to evaluate closure strategies.	Same as under the No Action Alternative, except: Characterization and monitoring wells would be developed more quickly.	Same as under the No Action Alternative.
Soils Project – Identify and characterize areas with contaminated soils and perform corrective actions in compliance with the FFACO.	Same as under the No Action Alternative, except: If stricter cleanup standards are implemented, larger volumes of radioactive waste would be generated and disposed.	Same as under the No Action Alternative.
Industrial Sites Project – Identify, characterize, and remediate industrial sites under the FFACO and continue decontaminating and decommissioning facilities.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Defense Threat Reduction Agency sites – In accordance with the FFACO, perform remediation activities at sites that are the responsibility of the Defense Threat Reduction Agency.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Execute the Borehole Management Program.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Nondefense Mission		
General Site Support and Infrastructure Program (see Sections 3.1.3.1, 3.2.3.1, and 3.3.3.1 of this chapter for more information)		
Conduct small projects to maintain the present capabilities of DOE/NNSA NSO facilities in all areas of the NNSS and at NLVF, RSL, and the TTR. Maintain existing infrastructure, manage various permits and agreements, and provide security for the former Yucca Mountain site.	Same as under the No Action Alternative, plus: • Construct a new 85,000-square-foot multistory security building in Area 23. • Replace the NNSS 138-kilovolt electrical transmission system. • Expand cellular telecommunication system on the NNSS. • Reconfigure Mercury.[a]	Same as under the No Action Alternative, except: Only critical infrastructure would be maintained within Areas 18, 19, 20, 29, and 30 of the NNSS, including certain communications facilities; electrical transmission lines and substations; and Well 8. Roads within these areas would only be maintained to provide access to the infrastructure and environmental restoration sites.
Conservation and Renewable Energy Program (see Sections 3.1.3.2, 3.2.3.2, and 3.3.3.2 of this chapter for more information)		
Continue to identify and implement energy conservation measures and renewable energy projects in compliance with applicable Executive Orders and DOE Orders.	Same as under the No Action Alternative, plus:	Same as under the No Action Alternative, except:
– Reduce energy intensity by 3 percent annually through the end of fiscal year 2015, for a total 30 percent reduction.		
– Reduce greenhouse gas emissions by 28 percent by fiscal year 2020.		
– Install advanced electric metering systems.		

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
– Obtain at least 7.5 percent of the NNSS annual electricity and thermal consumption from renewable energy sources.		
– Support development of a 240-megawatt commercial solar power generation facility in Area 25.[a c]	• Modify NNSS land use zones to establish a 39,600-acre Renewable Energy Zone in Area 25 and support development of commercial solar power generation facilities in Area 25 with a maximum combined generating capacity of 1,000 megawatts.[a, c] • Construct a 5-megawatt photovoltaic solar power generation facility near the Area 6 Construction Facilities. • Support a Geothermal Demonstration Project and Geothermal Research Center at the NNSS.[a]	Support development of a 100-megawatt commercial solar power generation facility in Area 25.[a c]
– Reduce water use by 16 percent by 2015.		
– Maximize use of alternative fuels (e.g., E85 and biodiesel).		
– Ensure all new construction and renovation projects implement high-performance building goals.		
Other Research and Development Programs (see Sections 3.1.3.3, 3.2.3.3, and 3.3.3.3 of this chapter for more information)		
Support the DOE National Environmental Research Park Program and other non-DOE/NNSA research and development activities in all areas of the NNSS.	Same as under the No Action Alternative.	National Environmental Research Park Program and other non–DOE/NNSA research and development activities would be conducted in all areas of the NNSS except Areas 18, 19, 20, 29, and 30.

BEEF = Big Explosives Experimental Facility; DAF = Device Assembly Facility; FBI = Federal Bureau of Investigation; FFACO = Federal Facilities Agreement and Consent Order; JASPER = Joint Actinide Shock Physics Experimental Research Facility; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NASA = National Aeronautics and Space Administration; NLVF = North Las Vegas Facility; NNSA = National Nuclear Security Administration; NNSS = Nevada National Security Site; NSO = Nevada Site Office; NNSS = Nevada National Security Site; RSL = Remote Sensing Laboratory; RWMC = Radioactive Waste Management Complex; RWMS = Radioactive Waste Management Site; TNT = 2,4,6-trinitrotoluene; TRU = transuranic; TTR = Tonopah Test Range; WMD = weapon of mass destruction.

[a] These potential projects have not reached a point of development to allow full analysis in this *NNSS SWEIS* and would be subject to project-specific NEPA review before DOE/NNSA would make any decision regarding implementation.

[b] The actual permitted capacity of the Mixed Waste Disposal Unit (Cell 18) is 899,996 cubic feet.

[c] DOE/NNSA has not received or solicited proposals for any commercial solar power generation projects.

3.1 No Action Alternative

As defined in this *NNSS SWEIS*, the No Action Alternative reflects the use of existing facilities and ongoing projects to maintain operations consistent with those experienced in recent years at the NNSS and offsite locations in Nevada. For each mission and its supporting programs, levels of operations for associated capabilities and projects were determined by evaluating historic operational values since 1996, such as the number of experiments performed at the Joint Actinide Shock Physics Experimental Research Facility (JASPER) or the U1a Complex; reasonable expectations for newer projects, such as the number of projected shots for the Large-Bore Powder Gun; or the nature and number of proposed activities, such as training undertaken for the Office of Secure Transportation. For example, in 2004 and 2006, DOE/NNSA conducted 8 experiments with plutonium at JASPER; for the No Action Alternative, DOE/NNSA is analyzing up to 12 such experiments at JASPER. The operational level for disposal operations of low-level radioactive waste (LLW) in the No Action Alternative was based on the volumes of LLW actually disposed during fiscal years (FY) 1997 through 2010. The No Action Alternative level of operations represents the baseline against which the other alternatives are compared. In the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (*1996 NTS EIS*) (DOE 1996c), DOE/NNSA identified land use zones in which certain categories of activities, such as nuclear, dynamic, and hydrodynamic experiments and other compatible defense and nondefense research and development and testing, would be conducted. The land use zones are used to manage activities at the NNSS to prevent interference among the various missions, programs, projects, and activities, but are not considered absolute descriptors of the range of activities that may occur in a particular zone. **Figure 3–1** depicts these land use zones and the major facilities at the NNSS that would continue under the No Action Alternative.

3.1.1 National Security/Defense Mission

Under the No Action Alternative, DOE/NNSA would continue to pursue the Stockpile Stewardship and Management, Nuclear Emergency Response, Nonproliferation, Counterterrorism, and Work for Others Programs.

3.1.1.1 Stockpile Stewardship and Management Program

The term "stockpile stewardship" refers to core competencies in activities associated with research, design, development, and testing of nuclear weapons components, as well as assessment and certification of their safety and reliability. DOE/NNSA's science-based Stockpile Stewardship and Management Program maintains and enhances the safety, reliability, and performance of the U.S. nuclear weapons stockpile, including the ability to design, produce, and test weapons, to meet national security requirements. Stockpile stewardship and management activities at DOE/NNSA facilities in Nevada are conducted via a variety of methods, including experiments involving special nuclear materials (SNM) and high explosives (either in combination or separately), shock physics, nuclear criticality, pulsed power, and plasma physics and nuclear fusion. Under the No Action Alternative, diagnostics and other instrumentation would be developed and used in related tests and experiments. In addition, DOE/NNSA would conduct drillback operations; support Office of Secure Transportation training; and, as necessary, disposition damaged nuclear weapons. Major facilities at the NNSS where stockpile stewardship and management activities would be performed include the Device Assembly Facility (DAF), the U1a Complex, the Big Explosives Experimental Facility (BEEF), and JASPER. DOE/NNSA also conducts stockpile stewardship and management activities at the TTR.

> **Special Nuclear Material (SNM)**
>
> SNM is (1) plutonium, uranium-233, uranium enriched in isotopes of uranium-233 or -235, or any other material that the U.S. Nuclear Regulatory Commission determines to be SNM, or (2) any material artificially enriched by any of these radioactive materials.

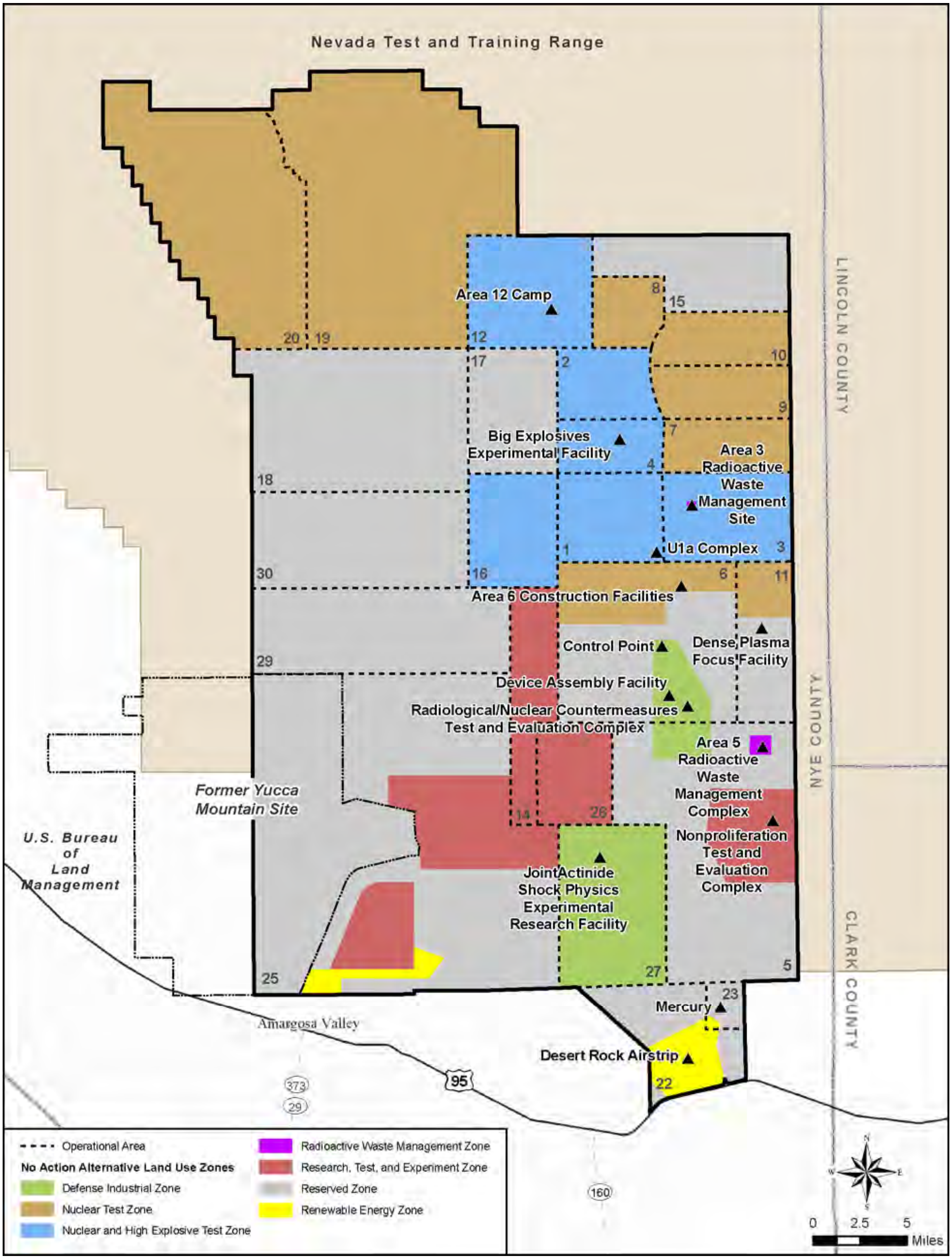

Figure 3–1 Nevada National Security Site Land Use Zones and Major Facilities Under the No Action Alternative

Stockpile stewardship and management activities would continue at DOE/NNSA facilities in Nevada under the conditions of the ongoing nuclear testing moratorium. These activities would emphasize science-based stockpile stewardship tests, experiments, and projects to maintain the safety and reliability of the nuclear weapons stockpile without underground nuclear testing. However, the No Action Alternative includes those activities necessary to maintain the capability to conduct underground nuclear tests. Such a test would be conducted only if so directed by the President in the interest of national security. Therefore, conducting an underground nuclear test is neither included nor analyzed under any of the alternatives in this *NNSS SWEIS*. Readiness-to-test capabilities include maintaining the necessary infrastructure and, more importantly, exercising the research and engineering disciplines of the U.S. nuclear weapons program through an active science-based Stockpile Stewardship and Management Program at the NNSS to ensure the continued competence of its technical staff. As part of its readiness-to-test activities, DOE/NNSA would conduct training and exercises using various kinds of nuclear weapon simulators. A generic description of underground nuclear testing is provided in Appendix H.

In addition to maintaining the capability to conduct nuclear weapon tests and in support of stockpile stewardship and management at the NNSS, DOE/NNSA would perform a variety of national security activities under the No Action Alternative, consistent with the program goals and direction provide in Annex D of DOE/NNSA's *2011 Biennial Plan and Budget Assessment on the Modernization and Refurbishment of the Nuclear Security Complex* (NNSA 2010) and as summarized in the following descriptions. Detailed descriptions of these activities are included in Appendix A of this *NNSS SWEIS.*

Dynamic experiments. Dynamic experiments, including subcritical and hydrodynamic experiments, would be conducted in alcoves at the U1a Complex, in unused nuclear test vertical emplacement holes, or at other sites within the Nuclear Test and Nuclear and High Explosives Test Zones of the NNSS, which include all or parts of Areas 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, 19, and 20. Under the No Action Alternative, DOE/NNSA would conduct up to 10 dynamic tests per year. Over the next 10 years, a total of 5 dynamic experiments would be conducted in emplacement holes and cause new land disturbances.

Dynamic Experiments

Dynamic Plutonium Experiments

Dynamic plutonium experiments are designed to improve knowledge of plutonium material properties, including equation of state (an equation that expresses the relationship between temperature, pressure, and volume of a substance) and strength, over broad ranges of relevant pressures, temperatures, and time scales. They range from essentially static experiments to increasingly dynamic experiments. None of these experiments reaches nuclear criticality nor involves a self-sustaining nuclear reaction.

Hydrodynamic Experiments

Hydrodynamic experiments are high-explosives-driven experiments to assess the performance and safety of nuclear weapons. During a nuclear weapon function test, the behavior of solid materials is similar to liquids, hence the term "hydrodynamic." These experiments do not use special nuclear material (plutonium or enriched uranium), but are conducted using test assemblies that are representative of nuclear weapons.

Hydrodynamic experimentation is a central component in maintaining nuclear weapons design and assessment capability. It is coupled with high-performance computer modeling and simulation to certify, without underground nuclear testing, the safety, reliability, and performance of the nuclear components of weapons.

Subcritical Experiment

Subcritical experiments are performed with special nuclear material (for example, plutonium) in a manner that prevents it from achieving a nuclear explosion. Subcritical experiments are designed to improve current knowledge of the dynamic properties of new or aged nuclear weapons parts and materials and to assess the effects of new manufacturing techniques on weapon performance. Subcritical experiments can vary any or all factors that influence criticality (mass, density, shape, volume, concentration, moderation, reflection, neutron absorption, enrichment, and interactions). Because there is no nuclear explosion, subcritical experiments are consistent with the U.S. nuclear testing moratorium.

Conventional explosives experiments. Experiments using explosives, including high explosives, would be conducted at BEEF and other locations at the NNSS. Experiments would use up to 70,000 pounds

TNT [2,4,6-trinitrotoluene]-equivalent of explosive charges. Experiments within the BEEF operational area could include potentially hazardous materials such as beryllium, depleted uranium, deuterium, and tritium. Up to 20 conventional explosives experiments would be conducted each year at BEEF and up to 10 per year would be conducted at other locations at the NNSS under the No Action Alternative. The experiments would consist of both open-air and contained (no release to the atmosphere) research and diagnostic experiments using a variety of explosive compounds. These totals do not include the dynamic experiments addressed in the preceding paragraph. Conventional explosives operations supporting other programs at the NNSS are described under those programs. All explosive operations would be conducted in compliance with DOE Manual 440.1-1A, *DOE Explosives Safety Manual*.

Shock physics experiments. Shock physics experiments are a subset of dynamic experiments, but are not included in the dynamic experiments described above. There are two shock physics facilities at the NNSS: JASPER in Area 27, and the Large-Bore Powder Gun at the U1a Complex in Area 1. Up to 12 SNM experiments per year would be conducted at JASPER under the No Action Alternative. The Large-Bore Powder Gun would be operated in an alcove in the U1a Complex and would be used to conduct up to 10 experiments per year using SNM. Additional operations would be conducted without SNM at each of these facilities.

Criticality experiments, training, and other activities. Under the No Action Alternative, DOE/NNSA would conduct up to 500 criticality operations at the National Criticality Experiments Research Center within DAF each year for experiments, training, and other purposes in support of Stockpile Stewardship and Management and other programs.

Categories of Special Nuclear Material (SNM)
(Security Categories I, II, III, and IV)

The U.S. Department of Energy (DOE) uses a graded approach to provide SNM safeguards and security. Quantities of SNM stored at each DOE site are categorized into Security Categories I, II, III, and IV, with the greatest quantities included under Security Category I, and lesser quantities included in descending order under Security Categories II through IV.

Pulsed-power experiments. Under the No Action Alternative, the Atlas Facility would be maintained in a standby status with the capability to conduct up to 12 pulsed-power experiments per year. A description of the Atlas Facility may be found in Appendix A, Section A.1.1.1.

Plasma physics and fusion experiments. Using the Dense Plasma Focus Machines located in Area 11 of the NNSS and at NLVF, DOE/NNSA would conduct plasma physics and fusion experiments to support the Stockpile Stewardship and Management and Work for Others Programs. In the future, fusion experiments at the NNSS and NLVF could support energy production research. Up to 650 plasma physics and fusion experiments would be conducted yearly under the No Action Alternative: 50 in Area 11 of the NNSS and 600 at NLVF.

Drillback operations. DOE/NNSA assumes that five drillback operations to obtain samples from former underground nuclear test cavities would take place under the No Action Alternative over the next 10 years. Each drillback operation would be conducted near a former underground nuclear test location and would disturb approximately 5 acres of land.

Stockpile management activities. Stockpile management activities are the hands-on, day-to-day functions and operations involved in maintaining an enduring nuclear weapons stockpile. The following stockpile management activities would be conducted by DOE/NNSA at the NNSS under the No Action Alternative:

- Disposition of damaged U.S. nuclear weapons, as needed
- Staging, assembly, and disassembly of nuclear devices –

Nuclear Weapon Pit

The pit is the central core of a nuclear weapon containing plutonium-239 and/or highly enriched uranium that undergoes fission when compressed by high explosives. The pit and the high explosive are known as the "primary" of a nuclear weapon.

"Staging" means to maintain programmatic material, such as nuclear devices, SNM, or other materials, in a safe and secure manner until needed for a test, experiment, or other activity. Staging does not include maintaining material with no reasonable expectation of use in the foreseeable future.

- SNM staging, including nuclear weapon pits

Training for the Office of Secure Transportation. The DOE/NNSA Office of Secure Transportation would use existing NNSS infrastructure to conduct training and exercises up to six times per year to maintain and improve the skills of its agents to safely and securely transport nuclear weapons, weapons components, and SNM. Training includes practicing convoy activities on existing NNSS roads and adjacent off-road areas.

TTR operations. The primary mission of DOE/NNSA at the TTR is to ensure that U.S. nuclear weapons systems meet the highest standards of safety and reliability. In addition, Work for Others Program activities are conducted at the TTR. DOE/NNSA activities at the TTR are conducted under the conditions set forth in a land use permit from the U.S. Air Force (USAF) and are the responsibility of the Sandia Site Office, located in Albuquerque, New Mexico. Under the No Action Alternative, in support of stockpile stewardship and management, DOE/NNSA would use the TTR for the following activities:

- Tests and experiments, including flight tests for gravity weapons (bombs), would be conducted to ensure the compatibility of the hardware necessary for the interface between weapons and delivery systems and to assess weapon system functions in realistic delivery conditions. DOE/NNSA does not expect to use Category I/II SNM in flight tests.
- Testing would be conducted to test various parameters of a weapon while in flight or when dropped, including penetration of the ground surface. Weapons tested would include joint test assemblies and conventional and inert projectiles. Joint test assemblies are nuclear weapons with a portion of the nuclear package omitted, making them incapable of achieving the criticality required to produce a nuclear detonation. Impact tests would include the following:
  - Air-drop operations
  - Ground/air-launched rocket operations
  - Ground/air-launched missile operations
  - Compressed-air gun operations
  - Davis Gun operations
  - Fuel-air explosives operations
  - Open-air and underground detonation of explosives
  - Post-test procedures and recovery operations
- Tests would be conducted to check the systems in joint test assemblies and conventional weapons. Tests would also be conducted on behalf of nonproliferation research to develop equipment and techniques for determining whether other countries are using or developing nuclear capabilities. Passive tests would include the following:
  - Telemetry, microwave, and photometrics operations
  - Radar operations
  - Laser tracker operations
  - Radiographic operations
  - Electromagnetic radiation testing

Although not listed under the Work for Others description in Section 3.1.1.3, all of these Stockpile Stewardship and Management Program activities listed for the TTR are similar to activities that may be conducted as Work for Others at the TTR.

3.1.1.2 Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs

DOE/NNSA facilities in Nevada provide a broad support base for Nuclear Emergency Response Program activities, including a variety of areas and facilities that may be used for training and exercise activities. Under the No Action Alternative, DOE/NNSA would support the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs by conducting the activities summarized in the following discussion. Detailed descriptions of these activities are included in Appendix A of this *NNSS SWEIS.*

- Personnel and logistical support for the Nuclear Emergency Support Team would be provided at RSL. Nuclear Emergency Support Team activities would also occur at the NNSS and other locations.
- Support consequence management, including personnel and early-phase activities management, would be provided for the Federal Radiological Monitoring and Assessment Center (FRMAC).
- Fixed-wing and rotary-wing aircraft would be provided for emergency response and aerial mapping activities as part of the Aerial Measuring System. These assets are based at RSL and activities are conducted at various locations around the country.
- Personnel and logistical support would be provided to the Accident Response Group.
- Logistical support would be provided to the Radiological Assistance Program.
- Weapons of mass destruction emergency responder training would be provided.
- Equipment and technical support would be provided for the DOE-dedicated Emergency Communications Network.

Radiological Emergency Response Assets

Nuclear Emergency Support Team (NEST) – NEST provides specialized technical expertise in resolving nuclear or radiological terrorist incidents. The National Nuclear Security Administration (NNSA) assists the Federal Bureau of Investigation and the U.S. Department of State with conducting, directing, and coordinating search and recovery operations for nuclear materials, weapons, or devices, and assists in identifying and deactivating improvised nuclear devices or radiological dispersal devices.

Aerial Measuring System (AMS) – AMS provides rapid response to radiological emergencies with helicopters and fixed-wing aircraft equipped to detect and measure radioactive material. In addition, AMS surveys U.S. Department of Energy (DOE) sites, participates in interagency exercises, and performs work for other Federal agencies. AMS can also provide detailed aerial photographs and multi-spectral imagery and analyses.

Radiological Assistance Program (RAP) – RAP is a first-response resource in assessing a radiological emergency, conducting the initial radiological assessment of the area of the emergency and providing assistance to minimize immediate radiation risks. RAP also provides emergency response training to first responders, and is involved in the Weapons of Mass Destruction First Responder Training Program. RAP is implemented on a regional basis, with eight Regional Coordinating Offices in the United States. The NNSA Nevada Site Office (NSO) is part of Region 7, headquartered in Oakland, California.

Federal Radiological Monitoring and Assessment Center (FRMAC) – FRMAC coordinates the efforts of 17 agencies to integrate the Federal response to a radiological emergency within the United States. DOE's responsibility is to set up and initially manage a FRMAC and NNSA provides the Consequence Management Response Team, which draws from NNSA Emergency Response Assets, including the RAP and AMS. The Phase 1 Consequence Management Response Team is deployed from among NNSA/NSO assets.

Accident Response Group (ARG) – ARG develops and maintains readiness to efficiently manage the resolution of accidents or significant incidents involving nuclear weapons that are in DOE's custody and support the U.S. Department of Defense for similar incidents with weapons in its custody. ARG's role in an emergency situation involving a nuclear weapon includes initial onsite assessment; performing evaluations for the safety and health of emergency response personnel, the public, and the environment; weapon recovery; and support for onsite radiological monitoring, analysis, and assessment.

- Improvised nuclear devices would be dispositioned as needed, including conducting forensics activities on such a device and its components under the DOE/NNSA Disposition Program and the Federal Bureau of Investigation (FBI) Disposition Forensics Program. Training drills and exercises would be conducted at existing NNSS facilities to maintain a readiness capability for the NNSA Disposition Program and FBI Disposition Forensics Program.

  The NNSA Disposition Program and FBI Disposition Forensics Program would deploy to the NNSS for periodic exercises and training or for an actual incident. All activities would take place in existing facilities at the NNSS.

Nuclear Forensics

Nuclear forensics is the analysis of nuclear materials recovered from either the capture of unused materials or the radioactive debris following a nuclear explosion. Nuclear forensics can contribute significantly to the identification of the sources of the materials and the industrial processes used to obtain them. In the case of an explosion, nuclear forensics can also reconstruct key features of the nuclear device (AAAS 2008).

- Nonproliferation- and counterterrorism-related activities would continue in the areas of arms control (see below), nonproliferation, and counterterrorism. Nonproliferation- and counterterrorism-related activities would provide scientific research and development, technology realization, process and procedure development, equipment testing and certification, and training. The kinds of activities that would be involved in supporting nonproliferation and counterterrorism include use of underground detonations of conventional explosives for seismic studies, releases of biological and chemical simulants, geological studies, and experiments to simulate radio frequencies resulting from various nuclear fuel cycle technologies. These activities are addressed in more detail in Section 3.1.1.3. Some activities supporting U.S. nonproliferation and counterterrorism efforts would occur at RSL and NLVF, but activities would primarily be conducted at the NNSS.

  Under the No Action Alternative, nonproliferation- and counterterrorism-related activities would integrate existing capabilities (i.e., research and development, training, nonproliferation tests and experiments, counterterrorism training, etc.) under an overall program. There would be no new facilities constructed, although existing buildings and other facilities would be modified to accommodate these activities.

Arms control. A key component of nonproliferation activities would be the use of existing facilities as part of an Arms Control Treaty Verification Test Bed dedicated to supporting U.S. arms control initiatives and commitments. This component would support design and certification of treaty verification technology, training of inspectors, and development of arms control confidence-building measures.

Test Bed

A test bed is an area that includes physical structures or designated terrain where tests and experiments are conducted. Test beds may be permanent facilities or temporary sites.

Nonproliferation. Facilities would be provided for Federal agencies to develop remote sensing equipment, methodologies, and training to support national and international nonproliferation programs. Under the No Action Alternative, DOE/NNSA would use existing facilities in Nevada to support research and development in the following areas:

- Safeguarding fissile materials in nations with nuclear weapons or nuclear industries
- Tightening export controls on technology with potential application to weapons of mass destruction
- Improving border protection by installing detectors for radioactive materials

- Inspecting commercial shipments for smuggled nuclear materials

Counterterrorism. DOE/NNSA would support research, development, and training associated with detecting and countering various types of improvised explosive devices, including those that are vehicle-borne. These activities would occur at BEEF, the Nonproliferation Test and Evaluation Complex, and other locations at the NNSS. Detonations of high explosives associated with counterterrorism-related activities would be conducted at various existing facilities and other locations on the NNSS. All explosive operations would be conducted in compliance with DOE Manual 440.1-1A, *DOE Explosives Safety Manual*.

3.1.1.3 Work for Others Program

The Work for Others Program, hosted by DOE/NNSA, facilitates the use by other agencies and organizations of DOE/NNSA facilities and capabilities, such as BEEF, the Nonproliferation Test and Evaluation Complex, T-1 Training Area, and other areas of the NNSS as well as resources at RSL, NLVF, and the TTR. Under the No Action Alternative, DOE/NNSA would continue to host the projects of agencies such as the U.S. Department of Defense (DoD) and the U.S. Department of Homeland Security (DHS), as well as other Federal, state, and local government agencies and nongovernmental organizations, by conducting the activities summarized in the following discussion. Detailed descriptions of these activities are included in Appendix A of this *NNSS SWEIS.*

Treaty verification. DOE/NNSA would continue to host projects related to verification of compliance under a number of nuclear weapon-related treaties. The projects would range from hosting inspections by other nations to conducting research and development in the area of detecting violations of treaties by others.

Nonproliferation projects and counterproliferation research and development. DOE/NNSA would continue to provide support for the following types of activities by other agencies:

- Conventional weapons effects testing, including live-drop and static detonations

- Development and demonstration of capabilities and technologies using conventional high explosives and other methods to effectively threaten and defeat military missions protected in tunnels and other deeply buried and hardened facilities

- Explosives experiments and other explosives operations using up to 2,000 pounds of explosives at various locations on the NNSS. All explosive operations would be conducted in compliance with DOE Manual 440.1-1A, *DOE Explosives Safety Manual*.

- Controlled experiments involving releases (including explosive releases) of biological and chemical simulants. Up to 20 controlled chemical and biological simulant release experiments (each experiment would consist of multiple releases) would be conducted yearly. More-detailed information regarding releases of chemicals and biological simulants is included in Appendix A, Section A.1.1.3.

Counterterrorism. DOE/NNSA would continue to support DoD and other Federal agencies in developing methods for engaging or neutralizing an adversary in a variety of topographical environments. In addition to ground-based operations, military operations would be conducted in the restricted airspace above the NNSS and the TTR.

DHS and DoD would continue to use facilities at the NNSS to develop technology for homeland security applications. The NNSS would continue to provide land and infrastructure to support testing and evaluation of radiological and nuclear detection devices for use in transportation-related applications. DHS would continue to use the Radiological/Nuclear Countermeasures Test and Evaluation Complex (RNCTEC), a facility constructed at the NNSS on behalf of DHS, as well as other NNSS land and infrastructure, to conduct its activities.

DOE/NNSA's Counterterrorism Operations Support Program would continue to support the Federal Emergency Management Agency's efforts to develop and implement national programs to enhance the capability of state and local agencies to respond to incidents involving weapons of mass destruction through coordinated training, equipment acquisition, technical assistance, and support for state and local exercise planning.

Military Training and Exercises. DOE/NNSA would continue to support DoD by providing land, airspace, and infrastructure for use by various branches of the military to conduct training and exercises. These activities range from small-scale exercises, i.e., focused at a specific building or site, to large-scale exercises involving multiple air and/or ground assets with live-fire operations. These activities would include live fire of military munitions, including small arms, hand grenades, rocket-propelled grenades, etc. Military training and exercises may be conducted throughout the NNSS, but would be primarily conducted in the western portions, including Areas 18, 19, 20, 25 (northern portion), 29, and 30 to preclude interference with and from other NNSS activities. Military training and exercises are subject to all applicable regulatory requirements and to DOE/NNSA NSO work authorization processes (NSO O 412.X1E, *Real Estate/Operations Permit*), which are designed to minimize hazards to workers, the environment, and NNSS physical assets.

Support for the U.S. National Aeronautics and Space Administration (NASA). DOE/NNSA would conduct criticality experiments at DAF in support of NASA's efforts to develop power sources for use in future missions to Mars and similar deep space exploration.

Miscellaneous Work for Others Program activities. DOE/NNSA would continue to provide facilities and airspace for use of aerial platforms for various purposes, including research and development to assess and mitigate operational safety and efficiency of unmanned aerial systems, training and exercises, and deployment of sensors for detection of various items. These types of operations would use a variety of manned and unmanned aerial systems, including fixed-wing aircraft (airplanes) and helicopters.

Work for Others Program activities at the TTR. These activities would be similar to those addressed under the Stockpile Stewardship and Management Program, with the following additions:

- Robotics testing and development (handling, application, and recovery of hazardous [chemical] material)
- Smart transportation-related testing – preprogrammed/remote-controlled air and ground vehicles
- Smoke obscuration operations
- Infrared tests
- Rocket development, testing, and deployment

National Security/Defense Mission—American Indian Perspective

The Consolidated Group of Tribes and Organizations' (CGTO) concerns and perspective regarding the National Security/Defense Mission are presented in the following text, which summarizes our views and applies to all aspects of this mission, including those pertaining to the Stockpile Stewardship and Management Program; the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Program; and the Work for Others Program.

According to tribal elders, *"There is always going to be testing. Areas such as U1a that support underground testing are where the effects are evaluated. There are programs and facilities where stockpile stewardship and management activities are currently performed. The CGTO knows that the U.S. Department of Energy (DOE) maintains and conducts experiments and testing at various locations throughout the NNSS. We continue to be concerned about these activities and their impacts to the cultural landscape. Our involvement is essential to restoring and maintaining the balance to the land and its resources."*

The CGTO understands the National Security Defense Mission includes complying with the nuclear weapons test moratorium of 1992, which precludes new underground nuclear testing. We also understand DOE is required to maintain a state of readiness to resume nuclear tests if so directed by the President. The CGTO continues to be intensely opposed to all nuclear testing. In consideration of our ancestral ties and proximity to the land, the DOE, as a representative of the Federal government, must fulfill its trust responsibility by fully informing the CGTO and culturally affiliated tribal governments prior to any proposed testing activities. This step is vital to protecting the spiritual and physical health of our people by preparing for the desecration of our Holy Land and its resources.

The CGTO understands the fundamental intent of the Nonproliferation and Counterterrorism projects is to promote world peace and reduce the need to use the Nevada National Security Site (NNSS) and its offsite locations for nuclear weapons production, storage, assembly, and testing. However, the CGTO believes these activities may increase the number of weapons stored, disassembled, and disposed. These dangerous conditions may result in the land becoming angry and further contaminated, thereby impeding our ability to access important resources on our ancestral land.

The CGTO knows from past experience, but not formal study, that military training exercises and weaponry tests can adversely impact cultural resources. Military people move across the land on foot and in vehicles without either the time or the purpose to pay attention to delicate plants being disturbed, animals that are being dislocated, or the archaeological material and other important resources underfoot.

Often geographically distinctive power places or culturally sensitive areas are targeted without regard or knowledge of the significance to Indian people. Military exercises involving aircraft disrupt the harmony within the cultural landscape. Cultural resources may be damaged when conventional weapons are fired nearby. The environmental setting is disrupted from the noise and vibrations associated with these military operations and overflights. Noise and vibrations upset the spirituality and solitude of the area, negatively impacting songscapes and storyscapes. When the thoughts and focus are interrupted, the balance and well-being of the community as a whole become affected. Cultural resources are damaged when conventional weapons are fired nearby. Without a formal study, the exact impacts of military training exercises will not be fully understood. Thus, the CGTO again recommends adequate funds and time be provided for the CGTO to develop a guidance document. At a minimum, applicable CGTO representatives must obtain appropriate military clearances and access to pray for (talk to) and prepare the land and its resources prior to these military exercises.

See Appendix C for more details.

3.1.2 Environmental Management Mission

DOE/NNSA's Environmental Management Mission includes the Waste Management and Environmental Restoration Programs. Related activities under the No Action Alternative are described in the following sections. A more detailed description of these activities is provided in Appendix A, Section A.1.2.

Environmental Management Mission—American Indian Perspective

The Consolidated Group of Tribes and Organizations' (CGTO) concerns and perspective regarding the Environmental Management Mission are presented under the Waste Management Program (Section 3.1.2.1) and the Environmental Restoration Program (Section 3.1.2.2), as appropriate.

See Appendix C for more details.

3.1.2.1 Waste Management Program

The Waste Management Program would continue to store, treat, and/or dispose various wastes at the NNSS. These wastes include LLW, mixed low-level radioactive waste (MLLW), transuranic (TRU) waste, mixed TRU waste, hazardous waste, asbestos and polychlorinated biphenyl (PCB) wastes, hydrocarbon-contaminated soil and debris, and solid wastes such as construction debris or sanitary solid waste. Liquid nonhazardous wastes (such as sewage and other wastewater) are not included under the Waste Management Program, but are addressed in Section 3.1.3.1, General Site Support and Infrastructure Program. All DOE/NNSA waste management activities operate in compliance with applicable regulatory requirements and DOE Orders. Waste management activities at DOE/NNSA sites in Nevada under the No Action Alternative would include the following:

Waste Definitions

Radioactive Waste – Solid, liquid, or gaseous materials that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value, considering costs of recovery.

Transuranic (TRU) Waste – Radioactive waste containing alpha particle-emitting radionuclides having an atomic number greater than 92 (the atomic number of uranium) and half-lives greater than 20 years, in concentrations greater than 100 nanocuries per gram.

Low-Level Radioactive Waste (LLW) – Radioactive waste not classified as high-level radioactive waste, TRU waste, spent fuel, or byproduct material as defined by Section 11e(2) of the Atomic Energy Act of 1954, as amended. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as LLW, provided the concentration of TRU elements is less than 100 nanocuries per gram.

Hazardous Waste – A category of waste regulated under the Resource Conservation and Recovery Act (RCRA). To be considered hazardous, waste must be a solid waste under RCRA and must exhibit at least one of four characteristics described in 40 *Code of Federal Regulations* (CFR) 261.20-24 (ignitability, corrosivity, reactivity, and toxicity) or be specifically listed by the U.S. Environmental Protection Agency in 40 CFR 261.31-33.

Mixed Waste – Waste containing both radioactive and hazardous components, as defined by the Atomic Energy Act and RCRA, respectively. Mixed waste intended for disposal must meet the Land Disposal Restrictions as listed in 40 CFR Part 268. Mixed waste is a generic term for specific types of mixed waste, such as mixed low-level radioactive waste (MLLW) and mixed TRU waste.

Waste Generator – An individual, facility, corporation, government agency, or other institution that produces waste material for certification, treatment, storage, or disposal.

Waste Acceptance Criteria – A document that establishes the National Nuclear Security Administration Nevada Site Office waste acceptance criteria. The document provides the requirements, terms, and conditions under which the Nevada National Security Site (NNSS) accepts LLW and MLLW for disposal. It includes requirements for the generator's waste certification program, characterization, traceability, waste form, packaging, and transfer. The criteria apply to radioactive waste received at the NNSS Area 3 Radioactive Waste Management Site and Area 5 Radioactive Waste Management Complex for storage or disposal.

LLW and MLLW management. LLW and MLLW from approved generators that meet the NNSS waste acceptance criteria would be accepted for disposal. The volume of LLW projected for disposal at the NNSS over the next 10 years and analyzed under the No Action Alternative is based on the actual volume of LLW disposed at the NNSS during FY 1997 through FY 2010, and is estimated to total about 15,000,000 cubic feet. Up to 1 percent of the total projected LLW volume could consist of nonradioactive, classified waste forms that require disposal in a manner similar to LLW. These classified waste forms would be disposed in the Area 5 Radioactive Waste Management Complex (RWMC) at the NNSS. In order to provide a conservative analysis of potential human health impacts, DOE/NNSA assumed that the entire volume of waste was composed of only radioactive wastes. The volume of MLLW projected for disposal at the NNSS over the next 10 years is based on the disposal capacity of the new Mixed Waste Disposal Unit, Cell 18,[1] and is estimated to total about 900,000 cubic feet.

DOE/NNSA would continue to manage onsite-generated MLLW by a combination of several options: (1) treatment at the TRU Pad in the Area 5 RWMC, when appropriate; (2) storage at the TRU Pad or at a new MLLW storage facility, pending

[1] *The actual permitted volume of MLLW that may be disposed in Cell 18 is 899,996 cubic feet.*

certification for disposal; and/or (3) shipment to a permitted facility, such as Energy Solutions in Clive, Utah, or the Materials and Energy Corporation in Oak Ridge, Tennessee, for appropriate treatment. Onsite-generated MLLW treated at another location would be returned to the NNSS for disposal or would be disposed at a permitted commercial facility. Under the No Action Alternative, offsite-generated MLLW would not be treated at the NNSS.

Under the No Action Alternative, the Area 5 RWMC would continue to operate within the approximately 740-acre area set aside for waste management purposes. LLW disposal units would be developed, filled, and closed as needed, in compliance with applicable regulatory requirements and DOE Orders. NNSS- and offsite-generated LLW would be disposed within these units. The Nevada Division of Environmental Protection (NDEP) issued a Resource Conservation and Recovery Act (RCRA) Part B permit effective December 1, 2010, for a new MLLW disposal unit, Cell 18, at the Area 5 RWMC. Construction of the new MLLW disposal unit is complete and it began accepting MLLW for disposal in January 2011. Temporary storage operations for MLLW would continue at RCRA-permitted facilities. Support facilities within the Area 5 RWMC would continue to operate.

The Area 3 Radioactive Waste Management Site (RWMS) would not be utilized under the No Action Alternative.

Small quantities (a few cubic feet over the next 10 years) of LLW may be generated at RSL and NLVF. Normal operations at the TTR are not expected to generate radioactive waste, but environmental restoration activities at the TTR would generate LLW and possibly unknown quantities of TRU waste. These environmental restoration wastes would be disposed at appropriate disposal sites, such as the Area 5 RWMC and/or the Waste Isolation Pilot Plant, as appropriate.

TRU and mixed TRU waste management. TRU waste generated by DOE/NNSA operations or by the Environmental Restoration Program (an estimated 9,600 cubic feet over the next 10 years) would be safely stored at the TRU Pad, pending characterization and shipment either to the Waste Isolation Pilot Plant for disposal or to another facility, such as Idaho National Laboratory, for processing before being sent to the Waste Isolation Pilot Plant.

TRU and mixed TRU wastes would not be generated at RSL, NLVF, or by DOE/NNSA Sandia Site Office activities at the TTR. However, an unknown quantity of TRU waste may be generated by environmental restoration projects at the TTR.

Hazardous waste management. DOE/NNSA activities would generate about 170,000 cubic feet of hazardous waste at the NNSS over the next 10 years under the No Action Alternative. The Hazardous Waste Storage Unit in Area 5 of the NNSS would continue to operate under a RCRA Part B permit issued by NDEP. Onsite-generated hazardous waste would be stored for up to 1 year prior to shipment to offsite treatment and/or disposal facilities.

RSL is a small-quantity generator of hazardous waste. As it is generated, hazardous waste would be accumulated at RSL for no more than 90 days and then transported off site to a permitted facility for treatment and/or disposal. Waste management field activities at RSL are provided by the USAF as landlord services under a Memorandum of Agreement. USAF personnel pick up and dispose miscellaneous laboratory and process equipment wastes under the terms of Nellis Air Force Base Plan 12 (Hazardous Waste Management Plan, October 2007).

NLVF is a conditionally exempt, small-quantity generator of hazardous waste. Hazardous waste would continue to be accumulated at NLVF and transferred off site to a commercially permitted facility for treatment and/or disposal.

Excess materials that may otherwise be considered hazardous waste would continue to be shipped off site for recycling. Excess materials are those that are no longer needed or are unusable but can be recycled.

The TTR is a small-quantity generator of hazardous waste. Hazardous wastes would continue to be accumulated at the TTR for no more than 180 days before being transferred off site to a permitted treatment, storage, and disposal facility.

Used oil from all DOE/NNSA NSO facilities and the TTR would continue to be collected and sent off site for recycling.

Asbestos and PCB waste management. Friable, nonradioactive asbestos waste would continue to be disposed at the Area 23 Solid Waste Disposal Site and possibly at the U10c Solid Waste Disposal Site, pending permit modification and review. Radioactive asbestos waste would continue to be disposed at the Area 5 RWMC. Nonfriable asbestos waste would continue to be disposed at the U10c Solid Waste Disposal Site. Nonradioactive PCB wastes would be accumulated at the Hazardous Waste Storage Unit in Area 5, pending transfer to a permitted treatment and/or disposal facility. Radioactive PCB-contaminated waste meeting 40 CFR Part 761 requirements would continue to be disposed in the MLLW Disposal Unit at the Area 5 RWMC.

DOE/NNSA would continue to dispose asbestos and PCB wastes generated at the TTR at a permitted treatment, storage, and disposal facility.

Explosives waste treatment. DOE/NNSA would continue to treat old and/or unusable explosives by open-air detonation at the permitted Explosive Ordnance Disposal Unit in Area 11.

Hydrocarbon-contaminated soil and debris management. The Area 6 Hydrocarbon Solid Waste Disposal Site would continue to operate under a permit issued by NDEP and would accept onsite-generated soil and debris contaminated with hydrocarbons. The U10c Solid Waste Disposal Site would also continue to operate under a permit issued by NDEP and would accept limited amounts of onsite-generated soil and debris contaminated with hydrocarbons. Onsite-generated hydrocarbon-contaminated LLW would continue to be disposed in the Area 5 RWMC. During routine activities at RSL and NLVF, no hydrocarbon-contaminated waste would be generated. If an accidental release of hydrocarbon-contaminated waste were generated, it would be disposed at a facility permitted to receive such waste. The TTR would continue to dispose hydrocarbon-contaminated soil and debris at an offsite permitted/approved landfill.

Solid waste management. DOE/NNSA activities would generate about 3,700,000 cubic feet of sanitary solid waste and construction and demolition waste over the next 10 years. Sanitary solid waste would be disposed at existing permitted facilities at the NNSS. DOE/NNSA would continue to operate the Area 23 Solid Waste Disposal Site. This permitted facility accepts less than 20 tons of sanitary waste per day. Industrial solid waste and construction and demolition debris would continue to be disposed at the U10c Solid Waste Disposal Site. An estimated 370,000 cubic feet of sanitary solid waste would be sent off site for recycling, rather than landfill disposal during the next 10 years.

At RSL and NLVF, sanitary solid waste would continue to be disposed off site by a municipal waste service.

At the TTR, sanitary solid waste would continue to be disposed at the USAF sanitary waste landfill. Industrial solid waste such as construction or demolition debris would be disposed at a USAF landfill or shipped off site for disposal at the NNSS or a permitted commercial landfill.

Excess materials that are suitable for recycling or reuse, such as scrap metal, would be shipped off site for recycling.

Waste Management Program—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) understands current and proposed waste management activities identified under the Environmental Management Mission include high-hazard experiments involving nuclear material and high explosives, and storing nuclear materials. The CGTO is aware the Nevada National Security Site (NNSS) is used to store hazardous waste, to store and dispose of non-hazardous waste and debris, and to secure and dispose of low-level radioactive waste, low-level mixed radioactive waste (i.e., containing certain hazardous wastes). After many years, the CGTO continues to be greatly concerned with the ongoing storage and disposal of these various waste streams at the NNSS, and the transportation of radioactive waste to the NNSS from locations in Nevada and from other states.

We understand the radioactive and hazardous materials and waste described in this site-wide environmental impact statement (SWEIS) are defined in scientific terms and governed by state and federal regulations. For example, to scientists, radioactive rocks are well understood with specific quantifiable physical properties. Scientists believe if they manage radioactivity in a purely scientifically appropriate manner, they are largely safe for use and disposal at the NNSS, an area often perceived by non-Indian people as a barren wasteland.

Contrary to scientific belief, American Indian people hold complex traditional views of radioactivity, based upon the fundamental knowledge that all resources—including the rocks—are alive. Indian people believe radioactive rocks are very powerful.

We know that radioactive rocks can become "angry rocks" if they are removed without proper ceremony, used in a culturally inappropriate way, disposed of without ceremony, or placed where they do not want to be. The angry rock constitutes a threat that can neither be contained nor controlled by conventional means. It has the power to pollute food, medicine, and places, none of which can be used afterward by Indian people. Spiritual impacts are even more threatening, considering the angry rock would be transported along highways before ultimately being disposed of at the NNSS, affecting animal creation places, access to spiritual beings, and unsung human souls.

Indian knowledge and use of radioactive rocks, or minerals, in the western United States goes back for thousands of years. Areas with high concentrations of these minerals are called dead zones. Such areas contain places of power or energy and could only be visited or certain minerals used under the supervision of specially-trained Indian people, who are sometimes referred to in the English language as a shaman or medicine man Therefore, the U.S. Department of Energy would benefit from this knowledge if applied correctly.

Continuing to transport the waste is detrimental to the public and the tribes. We are specifically concerned about the downtown transportation route. According to a tribal elder, "The springs are located there and, if contaminated, can seep into many other water sources and contaminate the people and the environment."

According to tribal elders, *"We are not sure how long Nellis and the NNSS have been designated as these types of facilities, and how much waste has been created, stored, and transported. This information is necessary for the CGTO to fully understand how significant the people and our resources may have been affected, and to prepare ceremonies, prayers, and culturally appropriate mitigation measures to attempt to restore balance. For example, Sunrise Mountain is a very significant mountain. Behind this mountain is an important cave, Gypsum Cave, which some Indian people fear but is highly respected. There are traditional stories surrounding this area. The mountain and the cave are both culturally significant. Caves are supposed to hold much power. They are supposed to interact with your mind. When you leave a cave, you are much more powerful."* Gypsum Cave, which is protected and monitored by culturally affiliated tribes and the Bureau of Land Management (BLM), is awaiting designation as a Traditional Cultural Property that may be impacted by the transportation of the waste.

See Appendix C for more details.

3.1.2.2 Environmental Restoration Program

Under the No Action Alternative, the DOE/NNSA Environmental Restoration Program would continue, in compliance with the most recent version of the Federal Facility Agreement and Consent Order (FFACO), to characterize, monitor, and remediate identified contaminated areas, facilities, soils, and groundwater. The Environmental Restoration Program is organized into three projects and supports the Defense Threat Reduction Agency in addressing its environmental restoration sites at the NNSS. The three projects are the Underground Test Area (UGTA) Project, Soils Project (includes contaminated soil sites from the TTR and the Nevada Test and Training Range), and the Industrial Sites Project (includes the Decontamination and Decommissioning Project and facilities to be remediated at the TTR and the NNSS described in the *1996 NTS EIS*). In addition, DOE/NNSA's Borehole Management Program work is executed by the Environmental Restoration Program. Activities that would be undertaken over the next 10 years by the Environmental Restoration Program are described in the following discussion. More-detailed descriptions of these activities are provided in Appendix A of this *NNSS SWEIS*.

Underground Test Area Project. In compliance with the FFACO, the UGTA Project would continue to characterize and monitor groundwater from existing wells; drill new characterization wells; expand groundwater monitoring to include new wells; develop groundwater flow and transport models; and evaluate closure strategies including adaptive monitoring and management. Up to 50 new groundwater characterization and monitoring wells would be developed over the next 10 years. UGTA Project activities would occur on the NNSS, Nevada Test and Training Range, U.S. Bureau of Land Management land, and privately owned land as necessary and as permission is obtained.

Federal Facility Agreement and Consent Order

The Nevada National Security Site Environmental Restoration Program includes activities to comply with the Federal Facility Agreement and Consent Order (FFACO), which was entered into in 1996 by the U.S. Department of Energy, the U.S. Department of Defense, and the State of Nevada. The FFACO provides a process for identifying sites having potential historic contamination, implementing state-approved corrective actions, and instituting closure actions for remediated sites.

Soils Project. The Soils Project would continue to investigate and characterize soil sites (using in situ monitoring, air monitoring, surface-water contaminant transport studies, and soil sampling) and perform corrective actions, as necessary. The Soils Project would ensure that proper use restrictions are in place to implement site closure so that worker doses are below the applicable regulatory limits and are kept as low as reasonably achievable. Under the FFACO, one of two strategies is implemented in remediating contaminated soils sites: clean closure or closure-in-place. Clean closure would include removing contaminated media from a site, rendering the site "clean" (i.e., the remaining levels would be below levels considered safe for the designated use of the site). In cases where the benefit (including reducing hazards to workers, the public, and environment) derived from removal of contaminated material justifies the cost of removal, clean closure would be the preferred closure strategy. However, because the NNSS, TTR, and Nevada Test and Training Range are remote, secure sites with no unescorted public access allowed, most soils sites may be closed using the closure-in-place strategy. Under a closure-in-place scenario, potential source material (e.g., lead bricks, batteries, hazardous waste) would generally be removed, with the radioactively contaminated soil left in place. Under either closure strategy, the Soils Project would implement the controls necessary to prevent the spread of unsafe concentrations of remaining contamination, and, if necessary, would ensure that proper use restrictions are in place to implement the site closure. The current closure strategy for soil project sites at the NNSS is based on current industrial land use scenarios with a 25-millirem-per-year exposure action level. Soils sites on the Nevada Test and Training Range, including the TTR, would be remediated to action levels that are mutually agreed upon by DOE/NNSA, the USAF, and NDEP. The potential for stricter cleanup levels is addressed under the Expanded Operations Alternative. NNSA anticipates that all identified Soils Project sites will be closed under the FFACO by the end of 2022.

Industrial Sites Project. The Industrial Sites Project would continue its field program to identify, characterize, and remediate industrial sites under the FFACO and to decontaminate and decommission unneeded facilities. The majority of FFACO industrial sites have been closed. Remediation, decontamination, and decommissioning activities are projected to be complete by the end of 2018. Industrial Sites Project activities would continue at present levels, although alternate uses of remediated facilities may require revised cleanup levels.

Defense Threat Reduction Agency sites. The Defense Threat Reduction Agency sites are identified as part of the DOE/NNSA Environmental Restoration Program because their site activities are considered environmental remediation on the NNSS. However, the Defense Threat Reduction Agency is responsible for implementing and funding these activities in compliance with applicable agreements with NDEP. Surface-disturbing activities associated with these sites have been completed and environmental monitoring, such as water sampling, would continue.

Borehole Management Program. Under the No Action Alternative, DOE/NNSA would continue to plug unneeded boreholes on the NNSS. Based on the current schedule and known inventory of unneeded boreholes on the NNSS that need to be plugged, the Borehole Management Program would be complete by the end of 2012.

Environmental Restoration Program—American Indian Perspective

According to tribal elders, *"The Creator placed everything—the land, rocks, plants and animals-where they are for a purpose. However, now that the NNSS land is disturbed and has become upset, we must come up with the appropriate prayers and ceremonies to rebalance the land and its resources."*

The Consolidated Group of Tribes and Organizations (CGTO) views environmental restoration activities attributed to the Environmental Management Mission as a positive effort to rebalance the world as everything is connected. Individual restoration projects are insufficient alone but are starting points and should be considered as stages or steps in a comprehensive and complex spiritual and ecological restoration program. The CGTO's view coincides with the principles of holistic ecosystem management subscribed to by the public and many Federal agencies.

A key component to environmental restoration is revegetating the disturbed areas to resemble its original condition. According to tribal elders, *"Prior to re-vegetation efforts, we talk to the land to apologize for what has been done and to let it know what we plan to do. Then we ask the Creator for its help. We choose our seeds from the sweetest and/or best plants, and store them for the winter to dry. When the winter is over, we place the seeds in a moist towel or sock and allow the new plant to sprout. We then plant the sprouts in small containers with soil until they are strong enough to be transplanted into the ground. This is a long and delicate process, requiring patience and traditional ecological knowledge passed down from our ancestors. If the plants are struggling to grow, we tag them and move them to face the same direction as the Sun."*

The U.S. Department of Energy (DOE) would benefit from this unique knowledge to further enhance their re-vegetation efforts of disturbed sites. The CGTO knows DOE struggles with the success rates of the density and diversity of native plants during their re-vegetation efforts. A co-stewardship approach between the CGTO and DOE to collectively manage this land would enable DOE to enhance their re-vegetation efforts, thereby saving time, money, and resources.

In the 1996 *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)* and in the 2002 *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2002 NTS SA)*, the CGTO continued to express concerns about the removal of contaminated soils and the need for religious leaders to conduct balancing ceremonies and healing prayers at these disturbed locations. The CGTO recommended that tribal representatives provide information about the re-vegetation of a portion of the Double Tracks Site located on the Tonopah Test Range (TTR). The CGTO maintains our involvement is still necessary for the Double Tracks site as well as for the Clean Slates site located at TTR; however, we are awaiting DOE's approval to proceed. Because of the long lapse of time since the last visits, the CGTO believes it is necessary to revisit and reevaluate site conditions.

As stated earlier, the CGTO is supportive of restoring the environment. However, we are concerned about the future plans to decontaminate and decommission (D&D) some buildings that may have asbestos and other contamination, which will be released during the process. Specifically, the CGTO is concerned about potential impacts to the air, water, plants and animals. In addition, nearby tribes may be performing ceremonies and prayers and need to be notified so the D&D process does not negatively impact these important religious and traditional events through elevated noise, vibration levels and the spreading of dead air.[1]

Over the past 14 years, various initiatives have been undertaken to restore animal habitats and reintroducing certain animals, such as the desert big horn sheep near the southern portion of the Nevada National Security Site (NNSS), without participation from the CGTO. Modification of habitat or the restocking of animals is considered a highly sensitive religious act and requires participation from the CGTO. For these activities to be successful and to properly restore environmental balance, it is essential to have tribal representatives involved throughout this process.

In the 2008 *Draft Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2008 Draft NTS SA)*, the AIWS presented information regarding the successful reintroduction of a gray wolf in Idaho during the late 1970's, which was a collaborative effort between American Indians and a Federal agency. On the day of release, a Federal liaison unlatched the door of the cage and the animal scrambled out. Waiting for the wolf was an American Indian holy man in traditional regalia, sitting on a horse and watching. The wolf and man gazed at each other and the man spoke words welcoming the wolf back to its natural habitat. The wolf stood for a few more seconds and accepted the holy man's encouragement and blessing. Then the wolf turned and ran into the forest. Everyone present was very moved by the welcoming back ceremony. They knew that was the right thing to do. The CGTO believes collaborative projects such as this underscores the need for American Indian involvement whenever plant or animal species transplanted from other locations are reintroduced to the NNSS area.

We recommend conducting ethnographic studies involving the CGTO to better understand sites such as, but not limited to, Water Bottle Canyon, Timber Mountain, Shoshone Mountain, and other sites identified by the CGTO. Spiritual and ecological restoration assessments and projects require traditional management practices, and the involvement of tribal cultural experts to be successful. These specialists are needed to conduct initial assessments and site inventories, and to make recommendations for the next steps of the restoration effort. This strategy will result in the identification of resources, features, and other site aspects both tangible and intangible, that are in need of healing and restoration using culturally appropriate steps necessary to achieve restoration and balance.

[1] *Refer to Appendix C.2.8, Air Quality and Climate, for additional information regarding dead air.*

Environmental Restoration Program—American Indian Perspective (cont'd)

Clearly, members of the CGTO have unique and extensive experience in collaborative spiritual and ecological restoration. We have many examples of successful collaboration among our tribal members and Federal agencies. For example, the Big Warm Spring near the Duckwater Shoshone Tribe has been used throughout history for spiritual cleansing and healing. Young men are taken there during the "coming of age" to wash and cleanse themselves. In 2005, in collaboration with the U.S. Fish and Wildlife Service, the Duckwater Shoshone Tribe restored the Big Warm Spring to its original size and removed the non-native fish species. In 2007, during the final phase of the project, tribal members reintroduced the Railroad Valley Spring Fish to the Big Warm Spring in a culturally appropriate manner, successfully completing the spiritual and ecological restoration for this collaborative effort.

There are many potential spiritual and ecological restoration projects on the NNSS in need of attention, all with the goal of balancing the spiritual, cultural, and ecological inner-workings of those places. Based on CGTO experience with environmental restoration projects, we encourage DOE to implement a more aggressive collaborative environmental restoration program. Potential projects focusing on the protection of wildlife, plant resources, and geological features, include the following:

Restoration of Water Bottle Canyon

Water Bottle Canyon is a natural water tank area and an exceptional cultural site. Cultural resources include *pohs*, tanks, rock rings, tonal rocks, and traditional-use plants. Any activities impacting the side canyon or Water Bottle Canyon affect the rest of the gully system, which is connected through physical and spiritual flows. Presently, the spiritual aspects of Water Bottle Canyon are out of balance and require cultural interactions to bring the canyon back into balance. The cleaning of the *pohs* and tanks in this canyon system is one of several cultural practices needed to begin spiritual and ecological restoration. This project can reduce drought conditions, and provide spiritual, cultural, and ecological benefits to the area while concurrently fulfilling the primary goal of spiritual and ecological rebalancing. Implementation of this project will require the appropriate cultural experts to identify project sites, inventory and evaluate the conditions, resources, and features of the sites, and develop a compatible restoration plan. The Project would require overnight camping, annual activities, and monitoring of site conditions.

Evaluation of Traditional Cultural Property

During the DOE Annual Tribal Meeting with the CGTO, held September 12, 2009, the CGTO recommended the DOE support the nomination of a Traditional Cultural Property, previously identified as *Wunjikuda*. The CGTO recommended expanding the studies to enhance previously collected ethnographic information, and determining an appropriate title using knowledgeable tribal elders identified by the CGTO. The CGTO also recommended the DOE sponsor overnight camping activities at this site to elicit additional information from knowledgeable tribal representatives for the development and submittal of the nomination to the National Register of Historic Places.

Cleaning Pohs and Tanks

The *pohs* and tanks found throughout the NNSS require traditional attention and cultural management to function effectively. The *pohs* and tanks at Water Bottle Canyon and Ammonia Tanks, for example, are interrelated and tie each location to one another. Both sites are used to store water from the rain needed and used for ceremonial purposes to restore balance. American Indian people have Rain Shaman who have the ability to talk to all of the elements responsible for bringing water or rain to the land, people and animals. According to tribal elders, *"When the water arrives, it is approached with great respect and awakened very carefully when prayed upon. In appreciation and in honor of the water's return, the animals come back, the plants flourish and people will continue to pray and give thanks all ultimately leading to balance and restoration of the area."* Customarily, Indian people cleaned the *pohs* and tanks through the use of songs, stories and prayers. Cleaning of the *pohs* and tanks were followed by the Rain Shaman who called the rain.

By supporting the CGTO's proposed project to clean the *pohs* and tanks, DOE will reduce drought conditions and restore balance to the area. It will provide spiritual, cultural, and ecological benefits to the land and environment, thereby facilitating our obligation of spiritual and ecological rebalancing. Implementation of this project will require the appropriate cultural experts to identify project sites, to inventory and evaluate the conditions, resources, and features of the site, and to develop a culturally compatible restoration plan.

See Appendix C for more details.

3.1.3 Nondefense Mission

The Nondefense Mission generally includes those activities that are necessary to support mission-related programs, such as constructing and maintaining facilities, providing supplies and services, warehousing, and similar activities. Activities related to supply and conservation of energy, including renewable energy and other research and development projects, are included under the Nondefense Mission. Sections 3.1.3.1 and 3.1.3.2 describe Nondefense Mission activities that DOE/NNSA would undertake at its facilities in Nevada under the No Action Alternative. A more detailed description of these activities is included in Appendix A of this *NNSS SWEIS*.

Nondefense Mission—American Indian Perspective

There are a variety of current and proposed actions considered under the Nondefense Mission. Many of these are related to the Nevada National Security Site (NNSS) Environmental Research Park, which allows universities and other Federal agencies to conduct research. Other projects involve solar and geothermal energy development, and constructing the Nevada Desert Free-Air Carbon Dioxide Enrichment and the Mojave Global Change facilities proposed in Area 5. The Consolidated Group of Tribes and Organizations' (CGTO) concerns and perspective regarding the Nondefense Mission, including activities associated with the Infrastructure, Conservation and Renewable Energy, and Other Research and Development Programs, are summarized here.

Indian people view each proposed project under the Nondefense Mission as potentially impacting cultural resources. Non-Indian people unfamiliar with the importance of leaving cultural resources untouched may find and collect artifacts or remove plants that are significant to American Indian people. Construction of the proposed solar generating facility in Area 25 involves draining the Sun of its power unnaturally and making it weak. Construction also involves scraping the land, generating dust emissions, facilitating erosion, and impeding visual resources.

All landforms within the NNSS are highly sensitive to American Indians. The ability to see the land without the distraction of buildings, towers, cables, roads, and other objects is central to the spiritual interaction between Indian people and their traditional lands. Visual resources may be negatively impacted if proposed solar and geothermal projects are pursued. The CGTO must be part of any future discussions of these projects due to potential impacts on visual resources that may impede traditional and cultural ceremonies.

Only Indian people know which places are appropriate for visits by non-Indian people and how to manage plants, animals, and soil samples so that these activities do not disrupt the land and its associated spirituality. Because of the potential effects on the environment and its resources from Nondefense Mission projects, the CGTO must become an integral part of site-specific studies and develop culturally appropriate text for future National Environmental Policy Act (NEPA) analyses, including environmental assessments and mitigation plans.

See Appendix C for more details.

3.1.3.1 General Site Support and Infrastructure Program

Like any large facility, the NNSS has a substantial infrastructure that provides all site-support services. Under the No Action Alternative, infrastructure-associated activities would continue, including projects such as repairs and replacements to maintain present facility capabilities. For instance, maintenance and repair projects include: repair Area 23 sewer main, remediate underground storage tanks, replace five roll-up doors, renovate and reactivate several water tanks, replace electric hot water heaters, install water tank security ladders, replace roofs on several buildings, and repair/maintain NNSS roadways.

In addition to maintaining and repairing its infrastructure at the NNSS, RSL, NLVF, and the TTR, DOE/NNSA would maintain the existing infrastructure, provide site security, and manage all applicable existing permits and agreements for the former Yucca Mountain site. DOE/NNSA would perform these functions pending decisions on the disposition of the former Yucca Mountain site.

Although they are part of DOE/NNSA's infrastructure, characterization and monitoring wells developed under the UGTA Project are addressed under the Environmental Management Program, and proposed and potential renewable energy projects are addressed under the Conservation and Renewable Energy Program, rather than the General Site Support and Infrastructure Program.

3.1.3.2 Conservation and Renewable Energy Program

Under the No Action Alternative, DOE/NNSA would continue to identify and implement conservation measures and renewable energy projects in the following areas:

- Energy efficiency
- Renewable energy

- Water conservation
- Transportation/fleet management
- High-performance and sustainable buildings

Table 3–2 summarizes the NNSS Conservation and Renewable Energy Program.

Commercial solar power facility. Under the No Action Alternative, DOE/NNSA is evaluating a hypothetical 240-megawatt parabolic trough commercial solar power generation facility at the NNSS. DOE/NNSA has determined that the southwestern portion of Area 25 would be the only reasonable location on the NNSS for a commercial solar power generation facility. Area 25 includes an extensive area of suitable terrain for solar power generation facilities, has existing vehicular access from Highway 95 via Lathrop Wells Road and an existing 138-kilovolt transmission line, and is removed from national security-related activities on the NNSS that require limited access to uncleared individuals. Although it possesses many of the same attributes as Area 25, Area 22 is not being considered as a potential location for solar power development in this *NNSS SWEIS* because all current solar power technologies require the use of substantial amounts of water for cooling and other purposes and there would be potential impacts on Devil's Hole (see Chapter 5, Section 5.1.6) resulting from construction of any facility built in Area 22 that would draw water from the underlying hydrographic basin. Low-water-use renewable energy projects may be considered for Area 22 in the future.

The solar technologies that are most likely to be deployed at utility scale over the next 20 years are photovoltaic and concentrating solar power, such as parabolic trough, power tower, and dish engine (DOE/BLM 2012). It is unknown what technology would be used in a solar power generation facility at the NNSS, but the analysis in this *NNSS SWEIS* assumes a concentrating solar power parabolic trough facility using a dry-cooling system, based on the prevalence of that technology in other operating, proposed, and potential solar energy projects in southern Nevada (see Chapter 6, Table 6–2), and because impacts on sensitive resources, such as groundwater, would be greater than those from a photovoltaic facility, resulting in a more conservative analysis (i.e., impacts would not likely be underestimated). It is estimated that a concentrating solar power facility using parabolic trough technology would require between 9 and 10 acres of land for each megawatt of generating capacity, based on the proposed Amargosa Farm Road Solar Project (BLM 2010c). This acres-per-megawatt rate of generating capacity is about double that used in the *Final Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States* (DOE/BLM 2012), but is consistent with proposed parabolic trough solar power facilities currently being considered in southern Nevada. The assumptions used in the *Final Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States* are shown in Appendix A, Section A.1.3.2. Using the ratio scaled from the Amargosa Farm Road Solar Energy Project, the projected amount of power generated from a 2,400-acre Renewable Energy Zone on the NNSS is about 240 megawatts (West 2010). As stated in Chapter 5, Section 5.1.6.2.1, operation of a 240-megawatt commercial solar power generation facility using concentrating solar power technology would require up to approximately 250 acre-feet of water per year. In addition, electrical transmission capacity would be required to integrate the electricity generated by a 240-megawatt facility into the regional grid system. Approximately 10 miles of new 230-kilovolt transmission line, disturbing about 250 acres of land (all of it off of the NNSS) is assumed to be required for purposes of this analysis. Valley Electric Association is in the process of upgrading parts of its 138-kilovolt transmission line system in Amargosa Valley to 230 kilovolts, and other entities are planning/proposing construction of 500-kilovolt transmission lines into Amargosa Valley (see Chapter 6, Section 6.2.4.4). Currently, there are no specific proposals for commercial-scale solar power generation projects at the NNSS. Therefore, additional project-specific NEPA review would be required to identify, analyze, and document project-specific impacts if such a commercial-scale solar power generation facility were proposed.

Table 3–2 The National Nuclear Security Administration Conservation and Renewable Energy Program Under the No Action Alternative [a]

Energy Efficiency – DOE/NNSA would improve energy efficiency and reduce greenhouse gas emissions at the NNSS by reducing energy intensity by 3 percent annually, or a total of 30 percent through the end of FY 2015, relative to the 2003 baseline. Energy efficiency can be defined for a component or service as the amount of energy required in the production of that component or service; for example, the amount of steel that can be produced with one billion British thermal units of energy. Energy efficiency is improved when a given level of service is provided with reduced amounts of energy inputs, or services or products are increased for a given amount of energy input. Energy intensity is defined as the amount of energy used in producing a given level of output or activity. It is measured by the quantity of energy required to perform a particular activity (service), expressed as energy per unit of output or activity measure of service. Energy intensity measures energy consumption per gross square foot of building space, including industrial and laboratory facilities. Additional activities to improve energy efficiency would include the following: • Installing advanced electric metering systems to the maximum extent practicable at all NNSS buildings and implementing a centralized data collection, reporting, and management system • Using standardized operations and maintenance and measurement and verification protocols coupled with real-time information collection and centralized reporting capabilities to the extent practicable • Expediting improvement in the quality, consistency, and centralization of data collected and reported through the use of commercially available software • Reducing greenhouse gas emissions by 28 percent by FY 2020
Renewable Energy – DOE/NNSA would maximize installation of onsite renewable energy projects at the NNSS where technically and economically feasible. The initial goal would be to acquire at least 7.5 percent of the NNSS' annual electricity and thermal consumption from onsite renewable sources. In the event commercial-scale renewable energy projects are implemented at the NNSS (following additional National Environmental Policy Act analysis), DOE/NNSA would enter into an agreement with a commercial entity to construct a solar power generation project at the NNSS with the provision that a portion of the electric power generated would be provided to meet NNSS electrical needs.
Water – In FY 2007, DOE/NNSA established a water production baseline (210.6 million gallons) in accordance with Executive Order 13423 (72 FR 3919). Specific water consumption figures are not available by facility because the NNSS does not meter individual buildings. Instead, water production data were used to provide metrics in this area. DOE/NNSA sites began saving water through several conservation measures, including installation of WaterSense™ products, xeric landscaping, use of nonpotable water for dust suppression, and 4-day workweeks. DOE/NNSA established a goal of reducing potable water production at the NNSS by 2 percent a year, to 177 million gallons per year, by FY 2015. Water production was reduced by 18 percent in FY 2008 compared with the FY 2007 baseline, thereby exceeding the FY 2015 goal of 16 percent water reduction. Water production was reduced by an additional 8 percent in FY 2009. Efforts to identify water-saving projects and obtain funding to complete them are ongoing to ensure that the water production goals that have been met are maintained.
Transportation/Fleet Management – The current DOE/NNSA fleet has 540 alternative-fuel vehicles, equal to 96 percent of the covered fleet. DOE/NNSA requires that its fleet operate any alternative-fuel vehicles on alternative fuels to the maximum extent practicable. In FY 2007, DOE/NNSA constructed an E85 fuel station in Mercury and implemented a plan to promote the use of E85 fuel (an alcohol–fuel mixture that typically contains a mixture of up to 85 percent denatured fuel ethanol and gasoline or other hydrocarbon by volume). In FY 2007, the total actual usage of E85 was 135,141 gallons; the consumption for FY 2008 was 182,997 gallons, a 35 percent increase in usage. For every gallon of E85 used, 85 percent of the petroleum base fuel is reduced; for every gallon of B-20 biodiesel used, 20 percent is reduced; and for every gallon of unleaded gasoline used, 10 percent is reduced. Biodiesel fuel is used in all equipment, with the exception of emergency generators and boilers, and is currently at the maximum possible usage level.
High-Performance Sustainable Buildings – DOE/NNSA would ensure that (1) all new construction and renovation projects implement design, construction, maintenance, and operation practices in support of the high-performance building goals of Executive Order 13423 (72 FR 3919) and statutory requirements and (2) existing facilities' maintenance and operations practices meet the goals of Executive Order 13423. The DOE/NNSA NSO's High-Performance Building Plan would also align with Executive Order 13327 (69 FR 5897) and DOE Order 430.1B, *Real Property Asset Management*. At a minimum, the High-Performance Building Plan would include employment of integrated design principles, optimization of energy efficiency, use of renewable energy, protection and conservation of water, enhancement of indoor environmental quality, and reduction of environmental impacts of materials in accordance with the annual Site Sustainability Plan for DOE/NNSA facilities in Nevada.

FR = *Federal Register*; FY = fiscal year; NNSA = National Nuclear Security Administration; NSO = Nevada Site Office; NNSS = Nevada National Security Site.

[a] Goals and information as of December 2009.

3.1.3.3 Other Research and Development Programs

In 1992, the NNSS became the seventh unit of the DOE National Environmental Research Park Program. The NNSS program operated under a cooperative agreement between the DOE Nevada Operations Office (now the DOE/NNSA NSO); the University of Nevada, Reno; and the University of Nevada, Las Vegas, whereby the DOE Nevada Operations Office's Environmental Management Office provided financial assistance for scientific research projects unique to the Nevada National Environmental Research Park. In addition, scientific research projects conducted by parties other than those in the above-mentioned agreement could be conducted, but would be funded by sources other than DOE/NNSA.

Nevada National Security Site (NNSS) Environmental Research Facilities

The Nevada Desert Free-Air Carbon Dioxide Enrichment (FACE) Facility and Mojave Global Change Facility (MGCF) are two environmental research facilities located in Area 5 of the NNSS that conduct long-term environmental research. FACE is a state-of-the-art facility designed to study responses of an undisturbed desert ecosystem to increasing levels of atmospheric carbon dioxide. This facility is in a standby condition due to lack of funding.

MGCF was established in Area 5 of the NNSS to examine the impact of global climate change factors other than increased carbon dioxide (i.e., increasing summer monsoon rains, increased nitrogen deposition, and disturbance or destruction of the desert soil crust) on the Mojave Desert ecosystem.

3.2 Expanded Operations Alternative

The scope of the Expanded Operations Alternative in this SWEIS is defined to include the capabilities and projects described under the No Action Alternative, plus additional newly proposed capabilities and projects. These additional activities would include modification and/or expansion of existing facilities and construction of new facilities. In addition, some ongoing activities would be conducted more frequently than under the No Action Alternative. For each activity addressed in this section, the differences from the No Action Alternative are noted. In addition to changes in activities, under the Expanded Operations Alternative, there would be two changes in NNSS land use zones: (1) the designated use for Area 15 would be changed from "Reserved" to "Research, Test, and Experiment"; and (2) approximately 39,600 acres within Area 25 would be designated as a Renewable Energy Zone. These land use zone changes would clarify the availability of Area 15 as a location for conducting various types of research, tests, and experiments, and the Renewable Energy Zone would designate an area where the DOE/NNSA NSO has determined it would be reasonable and feasible to locate commercial renewable energy projects, as explained in Section 3.1.3.2 of this chapter. **Figure 3–2** depicts the land use zones and major facilities at the NNSS under the Expanded Operations Alternative.

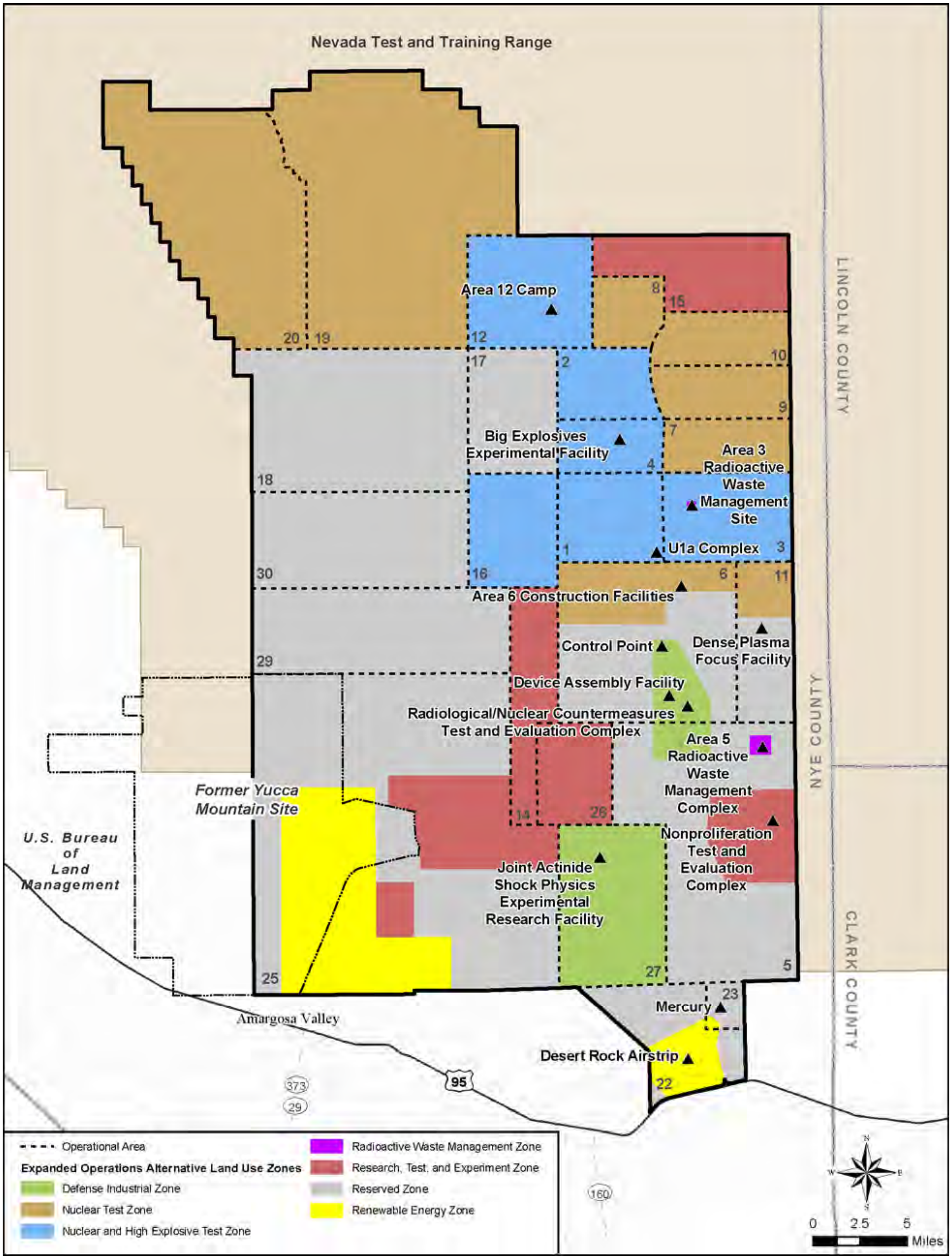

Figure 3–2 Nevada National Security Site Land Use Zones and Major Facilities Under the Expanded Operations Alternative

3.2.1 National Security/Defense Mission

Under the Expanded Operations Alternative, DOE/NNSA would pursue additional activities associated with the Stockpile Stewardship and Management, Nuclear Emergency Response, Nonproliferation, Counterterrorism, and Work for Others Programs.

3.2.1.1 Stockpile Stewardship and Management Program

Stockpile Stewardship and Management Program activities are described in more detail in Appendix A of this *NNSS SWEIS*. As under the No Action Alternative, the Expanded Operations Alternative includes those activities necessary to maintain the capability to conduct underground nuclear tests. Such a test would be conducted only if so directed by the President in the interest of national security. Therefore, conducting an underground nuclear test is neither included nor analyzed under any of the alternatives in this *NNSS SWEIS*. A generic description of underground nuclear testing is provided in Appendix H.

Under the Expanded Operations Alternative, there would be no changes from the No Action Alternative for the following Stockpile Stewardship and Management Program projects and activities:

- Criticality experiments in DAF
- Drillback operations
- Disposition of damaged U.S. nuclear weapons

Stockpile stewardship and management activities that would change relative to the No Action Alternative under the Expanded Operations Alternative include the following:

Dynamic experiments. DOE/NNSA would conduct up to 20 dynamic experiments per year. Over the next 10 years, a total of 5 dynamic experiments would be conducted in emplacement holes and cause new land disturbances.

Conventional explosive experiments at BEEF and other locations in the Nuclear and High Explosives Test Zone. DOE/NNSA would conduct up to 100 explosives experiments per year. DOE/NNSA would add a second firing table and ancillary features within the already developed area at BEEF, and would develop and test for proof-of-concept a high-energy x-ray capability at BEEF. Following successful testing, the new x-ray system would be moved to the U1a Complex for operational use.

In addition to explosives experiments at BEEF (limited to 70,000 pounds TNT-equivalent based on facility design), at the request of the Defense Threat Reduction Agency, DOE/NNSA would support experiments using up to 120,000 pounds of TNT-equivalent of explosives at various locations other than BEEF within the Nuclear and High Explosives Test Zone at the NNSS. These detonations would be conducted both underground and in the open air. Conventional explosives operations supporting other programs at the NNSS are described under those programs. All explosive operations would be conducted in compliance with DOE Manual 440.1-1A, *DOE Explosives Safety Manual*.

DOE/NNSA would establish one or more areas dedicated to conducting explosives experiments with depleted uranium. Up to three depleted uranium experiment areas, each about 40 acres in size, may be established in Areas 2, 4, 12, or 16. An annual maximum of 4,000 pounds of depleted uranium and 12,000 pounds of explosives (TNT-equivalent) would be used to conduct up to 20 of these experiments per year.

Shock physics experiments. DOE/NNSA would make the shock physics experimental facilities available for academic and other research on a no-conflict basis and would increase the number of experiments with actinide materials up to 36 per year at JASPER and 24 at the Large-Bore Powder Gun.

Pulsed-power experiments. The Atlas Facility would be activated, and up to 24 pulsed-power experiments per year would be conducted. A description of the Atlas Facility is included in Appendix A, Section A.1.1.1.

Fusion experiments at the NNSS and NLVF. New experimental uses would be pursued for the Dense Plasma Focus Machines that require deuterium-deuterium, deuterium-tritium, and tritium-tritium fusion and pulsed x-ray production. These experiments would require a much larger capacitive energy storage bank than the one currently in use at the Area 11 facility. To facilitate the new uses for the Dense Plasma Focus Machine currently located in Area 11 of the NNSS, it would be relocated to an existing building in Area 6 of the NNSS. Following the relocation, the Area 11 facility would be placed in standby. DOE/NNSA would conduct up to 1,650 plasma physics and fusion experiments per year: 1,000 would use the Dense Plasma Focus Machine at NLVF, and 650 would use the machine in Area 11 (or Area 6 if it were moved).

Stockpile management activities. As it would under each alternative, DOE/NNSA would conduct nuclear explosives operations at the NNSS in association with conducting an underground nuclear test, if such a test were directed by the President. In addition, under the Expanded Operations Alternative, DOE/NNSA would conduct the following activities:

- Stage (i.e., maintain programmatic material, such as SNM, or other materials, in a safe and secure manner until needed in a test, experiment, or other activity; staging does not include maintaining material with no reasonable expectation of use in the foreseeable future) nuclear devices pending disassembly, modification/maintenance, and/or transportation to or from another location
- Conduct dismantlement of weapons or weapon systems to aid the United States in meeting its commitment to reduce its nuclear weapons stockpile (weapons shipments to the NNSS under this activity would not exceed 100 per year)
- Modify and maintain nuclear devices at DAF, including replacing limited-life components in nuclear weapons systems (weapons shipments to the NNSS under this activity would not exceed 360 per year)
- Test weapons components for quality assurance purposes at DAF

SNM staging, including pits. DOE/NNSA would continue to stage SNM at appropriate facilities on the NNSS. SNM would be relocated from and/or to other DOE/NNSA sites, as necessary to meet program needs. For example, the following materials would be moved to the NNSS: up to 4 metric tons of SNM from the Zero Power Physics Reactor Program at Idaho National Laboratory (for use in criticality experiments); about 200 kilograms of global security SNM staged at Lawrence Livermore National Laboratory (for use in detector development and as radiation test objects); 2 kilograms of uranium-233 staged at Los Alamos National Laboratory (associated with test readiness); and 500 kilograms of highly enriched uranium, depleted uranium, and uranium staged at Lawrence Livermore National Laboratory (associated with criticality safety). In addition, DOE/NNSA would stage weapon pits at DAF, pending their transport to the Pantex Plant in Texas or another appropriate location.

Training for the Office of Secure Transportation. In addition to hosting training and exercises on NNSS roads, DOE/NNSA would construct new facilities in Area 17 to support Office of Secure Transportation training programs. The new facilities would occupy approximately 10,000 acres. A total of about 25 miles of roads and fire breaks would be developed surrounding active training areas and between individual training venues. Potable water would be obtained from an existing well approximately

4.5 miles away, requiring construction of a water pipeline. An electrical distribution line would also be constructed to extend electrical service from the vicinity of the well to the new facilities. Main access to the complex would be from the Tippipah Highway.

Facilities would be expanded in the 12 Camp (Area 12), Area 6 Control Point, or Mercury (Area 23), and maintenance and administrative buildings and a dormitory would be constructed to support training operations. These facilities would also be available to other NNSS customers when not in use by the Office of Secure Transportation.

These new and expanded facilities projects are conceptual at this time and would require an appropriate level of NEPA review before they could be implemented.

Stockpile stewardship and management activities at the TTR. There would be changes in some site support functions, such as site security, which would be transferred to the USAF and could affect the number of employees.

3.2.1.2 Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Program projects and activities are described in detail in Appendix A of this *NNSS SWEIS*. Under the Expanded Operations Alternative, there would be no changes from the No Action Alternative for the following Nuclear Emergency Response, Nonproliferation, and Counterterrorism Program projects and activities:

- Support for the Nuclear Emergency Support Team
- Consequence management support for FRMAC, the Aerial Measuring System, Accident Response Group, and Radiological Assistance Program
- Training for weapons of mass destruction emergency responders
- Equipment provision and technical support for the DOE-dedicated Emergency Communications Network

Nuclear emergency response, nonproliferation, and counterterrorism activities that would change relative to the No Action Alternative under the Expanded Operations Alternative include the following:

Disposition of improvised nuclear devices on an as-needed basis. In addition to improvised nuclear devices, radiological dispersion devices would be dispositioned on an as-needed basis at the NNSS under the Expanded Operations Alternative.

Nonproliferation- and counterterrorism-related activities. DOE/NNSA nonproliferation- and counterterrorism-related activities would include four related areas: arms control, nonproliferation, nuclear forensics, and counterterrorism. Although the purpose of nonproliferation- and counterterrorism-related activities would be the same as that under the No Action Alternative, new nonproliferation and counterterrorism facilities, described below, would be constructed at various locations on the NNSS to undertake enhanced activities. Because the new nonproliferation and counterterrorism facilities (Arms Control Treaty Verification Test Bed, Nonproliferation Test Bed, and Urban Warfare Complex) are still conceptual in nature and their locations are unknown, they are analyzed at a programmatic level in this SWEIS, and an appropriate level of NEPA review would be required before they could be implemented.

Arms control. The Arms Control Treaty Verification Test Bed would require construction of both indoor and outdoor laboratory space and test areas for design and certification of treaty verification technologies, training of inspectors, and development of arms control-related confidence-building measures. These facilities would be sited at various locations at the NNSS, and construction of new facilities would require a total of about 100 acres of land. A new facility for data fusion, analysis, and visualization would be constructed. The new building would have approximately 10,000 square feet of floor space and would be integrated with a building constructed to house other Arms Control Treaty Verification functions.

Nonproliferation. A Nonproliferation Test Bed would require construction of a new facility for simulations of chemical and radiological processes that could be conducted clandestinely by an adversary.

Counterterrorism. In addition to counterterrorism training at existing facilities, an Urban Warfare Complex would be constructed at the NNSS. This complex would include full-scale, modular replicas of the types of urban areas where terrorists and insurgents typically seek refuge. The Urban Warfare Complex would be constructed on about 100 acres in a remote area on the NNSS.

3.2.1.3 Work for Others Program

Work for Others Program activities are described in more detail in Appendix A of this *NNSS SWEIS*. Under the Expanded Operations Alternative, there would be no changes from the No Action Alternative for the following Work for Others Program activities:

- Treaty verification
- Military training and exercises
- Work for Others Program activities at the TTR

Work for Others Program activities that would change relative to the No Action Alternative under the Expanded Operations Alternative include the following:

Nonproliferation projects and counterproliferation research and development. Support would be provided for development of radiation detection capabilities, additional sensor technologies, and active interrogation programs to detect nuclear material.

Counterterrorism. Counterterrorism activities would include research, development, testing, and evaluation of unmanned aerial systems, as well as integration of training and exercises. Other activities would include development and testing of sensors for detection and defeat of improvised explosive devices, which would require construction of test beds (roads, intersections, small towns, etc.) and support facilities. Construction of these facilities would include new buildings with about 10,000 square feet of new floor space and would disturb about 75 acres of land.

DHS counterterrorism operations support would include construction of new training facilities (about 10,000 square feet of floor space). In addition, RNCTEC would be operated up to the level of a Hazard Category 2 nonreactor nuclear facility, which would allow larger amounts of radioactive material in alternative configurations to be used in tests and experiments. A high-speed road, a short section of full-scale railroad line, a simulated seaport facility, and a mock urban area would also be added to RNCTEC (DOE 2004f), requiring about 125 acres of additional land in Area 6. These new facilities are still conceptual in nature and their potential locations have not been identified; however, their potential impacts are analyzed at a programmatic level in this *NNSS SWEIS*. An appropriate level of NEPA review (beyond this SWEIS) would be required before DOE/NNSA makes any decision regarding these facilities.

Support for NASA. DOE/NNSA would support NASA nuclear rocket motor development, including using existing boreholes to examine for proof of concept the use of deep alluvial basins for sequestering radionuclides released as part of emissions from tests of a yet-to-be-developed prototype nuclear rocket motor. Over about a 10-year period, NASA would not likely test a nuclear rocket motor, but may conduct proof-of-concept tests using a surrogate, such as spiked xenon, in a borehole to evaluate the effectiveness of the alluvium for this purpose. DOE/NNSA would identify and comply with all applicable regulatory requirements for both proof-of-concept experiments and any actual test of a nuclear rocket motor. If NASA proposes to test an actual nuclear rocket motor, a NEPA review would be conducted.

Aviation Work for Others. Activities would include increased research, development, and use of aerial platforms at the NNSS. To support these activities, additional facilities would be required at Desert Rock Airport (hangars, shops, and other buildings occupying approximately 200,000 square feet) and the Area 6 Aerial Operations Facility (a hangar occupying approximately 20,000 square feet). Additional facilities occupying approximately 5,000 square feet may be required at other locations to support air operations, including testing of various types of manned and unmanned aerial systems such as small, remote-controlled, fixed-wing airplanes and helicopters. Research and development would be conducted with unmanned aerial systems to assess and mitigate operational safety and efficiency issues. In addition, unmanned aerial systems would be tested for a wide variety of potential uses, such as carrying sensors for collecting environmental data (e.g., multi- and hyperspectral imagery) to be used in digital environmental model development and for terrain analysis in arid and semiarid regions.

Active interrogation. Active interrogation involves the use of a radiation source to detect nuclear material. Under the Expanded Operations Alternative, Work for Others Program activities would include support for development of active interrogation systems to detect nuclear material and other materials of interest. DOE/NNSA would support research and development of active interrogation equipment, including accelerators and other radiation-generating devices and associated radiation detection systems/methods, and training. DHS would conduct active interrogation activities at RNCTEC, but other Federal agencies would require an additional facility, most likely located in Area 12 or 16. In addition to fixed facilities, temporary test beds would be used to provide various terrain, roadway patterns, and other factors to simulate conditions that may be encountered in actual deployment of the active interrogation system. The temporary test beds would be used primarily for testing mobile accelerators and other radiation-generating devices (from man-portable up to units housed in large transportation containers) and detectors. In general, temporary active interrogation test beds would use existing NNSS roads, but could also include some off-road areas. Construction of additional support facilities and temporary test beds would disturb about 100 acres of previously undisturbed land over the next 10 years.

Active interrogation research and development would involve operation of accelerators/radiation-generating devices at energy levels in the range of 10 to 100 million electron volts to irradiate various materials using, for example, electrons, protons, or other types of radiation such as x-rays or neutrons (proton-generating units may attain energy levels of up to 4 billion electron volts). The devices would be used for either radiography or for interrogation of objects to detect and identify such things as fissionable materials, chemicals, or contraband. Other devices may produce gamma rays to be used for the same purposes. Still other systems would include deuterium-deuterium or deuterium-tritium neutron generators (see description of fusion experiments in Sections 3.1.1.1 and 3.2.1.1) that produce from 2.5 to 14 million electron volt neutrons.

Test objects would be irradiated using interrogation beams produced by the accelerators/radiation-generating devices. Test objects would consist in part of fissionable materials such as uranium and plutonium. Fissionable material in a test object would be limited to quantities that can be demonstrated to be subcritical under all normal, abnormal, and accident conditions (quantity and nature of process activities must preclude the potential for a nuclear criticality). Test objects that incorporate fissionable material would be used in either shielded or unshielded configurations or surrounded by, for example, naturally occurring radioactive material. The interrogation beams would also be used to irradiate nonfissionable materials, such as chemicals or simulated contraband, to determine the signatures produced by the real materials. Test objects would be placed up to 1.25 miles from the beam source, and radiation and other detection systems would be placed at various distances away to detect radiation from the test objects.

Radioactive tracer experiments. Radioactive tracer experiments would be conducted to validate sensor technology. These experiments would include both underground releases and open-air releases of radioactive noble gases and nonradioactive gases (i.e., helium and sulfur hexafluoride). The underground experiments would release up to 27 curies of radioactive noble gases with short half-lives (5 to 36 days); nonradioactive releases would include up to 300 gallons of helium and 2,000 gallons of sulfur hexafluoride. The underground experiments would include explosive gas releases, pressurized releases, explosive radioactive particulate releases, and a baseline survey of contamination from previous activities. The open-air experiments would release small quantities of radionuclides with short half-lives. Up to 12 experiments involving open-air releases would be conducted each year. DOE/NNSA would comply with all relevant regulatory and reporting requirements, including applicable requirements of 40 CFR Part 61, Subpart H, for all experiments that could result in a release of radioactive material to the air. DOE/NNSA would ensure that the cumulative annual radiological dose at the boundary of the NNSS resulting from all activities involving radioactive materials would comply with the U.S. Environmental Protection Agency's annual emission standard of 10 millirem (40 CFR 61.92).

New test beds. Additional test beds would be developed to support research and development for sensors, high-power microwaves, and high-power lasers. New test beds (including approximately 50,000 square feet of new building spaces) would be constructed at various locations on the NNSS and would disturb approximately 200 acres of previously undisturbed land. Because there are no specific plans for construction of these new test beds at this time, additional NEPA reviews would be necessary before they could be implemented.

The following new test beds would be developed at the NNSS under the Expanded Operations Alternative:

Nuclear-Fuel-Cycle-Related Radionuclide Release, Diagnostics and Solids Detection, and Characterization Test Bed. In support of the various nuclear nonproliferation treaties in which the United States participates or anticipates participation, DOE/NNSA would create test beds for use in developing sensors to support treaty verification and nonproliferation validation. Facilities to support deployment of fixed uranium oxides and controlled amounts of depleted uranium would include static concrete display pads, static target display pans, thermal targets, and ponds and pools of water.

Specialized Explosive Testing and Manufacture Test Bed. Support for DoD and the U.S intelligence community would expand to include development of sensors and techniques for detection and defeat of improvised explosive devices, homemade explosives, conventional military ordnance, and chemical explosives, as well as explosives-driven, shaped-charge development and evaluation.

Radio Frequency Generation Test Bed. Technologies would be developed to detect, sample, characterize, and identify radio frequency signatures and observables. The test bed would be used to develop the ability to generate specific signals, to characterize the radio frequency environment, and to monitor tests.

Infrasonic Observations Test Bed. Technologies would be developed to monitor earthquakes and underground disturbances. This test bed would be used to develop the ability to detect specific signals, characterize the seismic environment, and monitor tests.

Chemical Test Bed. Activities at this test bed would include simulated manufacture and release of illegal drugs by authorized Federal organizations to develop detection and prevention technologies. An existing facility would be used to train personnel and test sensors and procedures for detection of toxic industrial chemicals.

Biological Simulants Test Bed. These operations would include production of biological simulants in an appropriate laboratory by authorized Federal organizations for use in detection technology development. Biological simulant releases to the soil, the air, or an NNSS sewer/septic system would emulate anticipated real-world scenarios. Construction to support these functions would disturb up to 50 acres of land.

3.2.2 Environmental Management Mission

The DOE/NNSA Environmental Management Mission includes the Waste Management and Environmental Restoration Programs. Under the Expanded Operations Alternative, the Waste Management Program would accept greater volumes of LLW and MLLW from both offsite and onsite sources. As under the No Action Alternative, the Environmental Restoration Program would continue to meet the requirements of the most recent FFACO.

3.2.2.1 Waste Management Program

Under the Expanded Operations Alternative, waste management activities associated with some waste types would increase. In particular, up to approximately 48,000,000 cubic feet of LLW and 4,000,000 cubic feet of MLLW would be disposed at the NNSS over the next 10 years. Up to 1 percent of the total projected LLW volume could consist of nonradioactive, classified waste forms that require disposal in a manner similar to LLW. These classified waste forms would be disposed in the Area 5 RWMC at the NNSS. In order to provide a conservative analysis of potential human health impacts, DOE/NNSA assumed that the entire volume of waste was composed of only radioactive wastes. Within the existing Area 5 RWMC, new disposal units would be constructed, filled, and closed to accommodate these additional waste volumes. New MLLW disposal cells would require a RCRA permit(s) from NDEP. Under the Expanded Operations Alternative, the Area 3 RWMS could be opened to receive LLW generated from environmental restoration and other activities at DOE/NNSA sites within the State of Nevada. Specifically, this action could be triggered by a need for additional disposal space beyond that available in the Area 5 RWMC for disposal of large on-site remediation debris, or soils from clean-up activities on the NTTR. While there is no near-term need to use the Area 3 RWMS, However, should DOE/NNSA need to activate the Area 3 Radioactive Waste Management Site, it would first undergo detailed consultation with the State of Nevada, and would limit disposal to in-state generated LLW.

The basis for the estimated waste volumes under this alternative is described in Appendix A. The increase in waste volumes between this and the No Action Alternative is largely due to an assumed extensive removal of contaminated soil from cleanup activities at Nevada locations outside the NNSS (e.g., the TTR and the Nevada Test and Training Range) with shipment to the NNSS for disposal, and to increased projections of wastes that may be shipped to the NNSS from out-of-state generators. These projections of waste are considered upper-bound estimates; actual volumes that may be generated depend on programmatic and regulatory decisions by the generators that would be addressed in separate NEPA reviews, as well as funding considerations. Although for purposes of analysis it was assumed that the projected wastes would be disposed at the NNSS, there may be other cost-effective options for disposing the wastes, such as the use of commercial disposal capacity.

Use of rail-to-truck transloading would increase, including the use of transloading facilities within Nevada, should commercial vendors establish such a facility. DOE/NNSA is not proposing to construct or cause to be constructed any new rail-to-truck transfer facilities to accommodate shipments of radioactive waste or materials under any of the alternatives considered in this SWEIS.

Under the Expanded Operations Alternative, DOE/NNSA would treat and store various types of MLLW received from on- and offsite generators. MLLW treatment capacity would be developed within the Area 5 RWMC, including repackaging by means of macroencapsulation and/or stabilization/microencapsulation, sorting/segregating, and bench-scale mercury amalgamation of both onsite- and offsite-generated MLLW. Initially, MLLW storage capacity would be developed on the TRU Pad to accommodate MLLW treatment (for either onsite- or offsite-generated wastes), pending development of MLLW storage capacity in existing or new facilities within the Area 5 RWMC. To handle the increased volumes and more-frequent shipment receipt rates of LLW and/or MLLW, a waste offloading and staging area would be established at the Area 5 RWMC. Appropriate permits would be obtained before expanding MLLW storage capacity or implementing any of these treatment technologies.

In addition, waste management activities at the NNSS under the Expanded Operations Alternative would include the following:

- Because of the projected increased annual number of experiments at JASPER and other national security activities, somewhat larger quantities of TRU waste would be generated annually (about 1,900 cubic feet per year from all activities). As with the No Action Alternative, TRU waste generated by DOE/NNSA activities in Nevada would be safely stored at the TRU Pad pending shipment off site for disposition along with other legacy waste (waste or contamination resulting from previous nuclear weapons-related activities) or newly generated environmental restoration waste.
- Continued treatment by evaporation of liquids containing small concentrations of tritium; and continued management of hazardous waste, asbestos and PCB wastes, and hydrocarbon-contaminated soil and debris in compliance with applicable regulations and permits. An estimated 170,000 cubic feet of hazardous waste would be generated by DOE/NNSA activities.
- Continued treatment of explosives at the Explosives Ordnance Disposal Unit in Area 11.
- Continued operation of the Area 23 Class II Solid Waste Disposal Site, the Area 6 Class III Solid Waste Disposal Site (Hydrocarbon Landfill), and the U10c Class III Solid Waste Disposal Site. To accommodate the potential increases in solid wastes (up to about 9,400,000 cubic feet generated over the next 10 years) that may be generated by various operations at the NNSS under the Expanded Operations Alternative, DOE/NNSA would seek permits to construct and operate new solid waste disposal facilities, as needed. A new sanitary waste landfill in Area 23 would require approximately 15 acres of land. To support environmental restoration work in Area 25, DOE/NNSA would obtain appropriate permits to construct and operate a construction/demolition debris landfill that would disturb up to 20 acres in Area 25 of the NNSS. Approximately 970,000 cubic feet of the generated sanitary solid waste would be sent off site for recycling during the next 10 years.
- Under the Expanded Operations Alternative, DOE/NNSA would establish staging and maintenance support capacity at the Area 5 RWMC for radioactive material transport packagings. DOE/NNSA would temporarily stage, inspect, and perform maintenance on DOE/NNSA-certified (and possibly commercial) and U.S. Department of Transportation (DOT)-authorized transport packagings for transport of radioactive material.

> ***Packaging*** means the assembly of components necessary to ensure compliance with Federal packaging requirements. It may consist of use of one or more receptacles; absorbent materials; spacing structures; thermal insulation; radiation shielding; service equipment for filling, emptying, venting, and pressure relief; or devices for cooling or absorbing mechanical shocks.
>
> ***Package*** means, for radioactive materials, the packaging together with its radioactive contents as presented for transport.
>
> Source: 49 CFR 173.403

The transport packagings would be emptied of radioactive material before inspection, maintenance, or staging. This proposed capability would allow consolidation of specialty packagings at a centralized location that is convenient to DOE/NNSA sites in the western United States. The proposed capability would be located in a fenced area within the Area 5 RWMC on approximately 1 acre of previously disturbed land. The area would be graded and covered with a gravel or asphalt pad. No more than 15 transport packagings would be staged within the area at any time. Operation of the area would use a small amount of electrical power and require only two to three workers on an as-needed basis to perform radiation surveys, container maintenance, or pre-use inspections. Minimal waste generation is expected.

3.2.2.2 Environmental Restoration Program

Under the Expanded Operations Alternative, the DOE/NNSA Environmental Restoration Program would continue in compliance with the FFACO in the form of characterization, monitoring, and, if necessary, remediation of identified contaminated areas, facilities, and environmental media. The UGTA and Industrial Sites Projects, remediation of Defense Threat Reduction Agency sites, and Borehole Management Program would all continue as under the No Action Alternative, although the pace of cleanup activities could be accelerated. Cleanup standards for Soils Project sites on lands under the jurisdiction of the USAF are subject to agreement among the USAF, NDEP, and DOE/NNSA. The No Action Alternative addressed cleanup levels consistent with current land uses; however, if more-stringent cleanup standards are adopted than currently planned or additional sites are included under the FFACO, the volumes of waste requiring transport and disposal would increase. Although the FFACO is the primary driver for the Soils Project, for purposes of analysis under the Expanded Operations Alternative, this SWEIS assumes that a clean closure strategy would be implemented for a number of contaminated soil sites on the Nevada Test and Training Range and the TTR (i.e., Clean Slate 2 and 3, Project 57, and Small Boy), whereby a total of about 504 acres would be excavated to a depth of 0.5 feet and the removed soil would be disposed as LLW. The impact of this estimated additional volume of waste that would need to be disposed at the NNSS is analyzed in Chapter 5, Section 5.1.11.

3.2.3 Nondefense Mission

The Nondefense Mission generally includes those activities that are necessary to support mission-related programs, such as construction and maintenance of facilities, provision of supplies and services, warehousing, and similar activities. Activities related to energy supply and conservation, including renewable energy, are considered part of the Nondefense Mission, as are other research and development activities that may occur at DOE/NNSA facilities in Nevada, including activities at the Nevada National Environmental Research Park. As described in the following paragraphs, all Nondefense Mission programs would be modified to some extent under the Expanded Operations Alternative.

3.2.3.1 General Site Support and Infrastructure Program

Under the Expanded Operations Alternative, in addition to small projects to maintain the present capabilities of the NNSS, infrastructure-associated activities would include increasing capacities and capabilities or extending the ranges of facilities and/or services to accommodate new operational programs and projects. A detailed description of new activities associated with the General Site Support and Infrastructure Program and the reasons they are proposed under the Expanded Operations Alternative may be found in Appendix A, Section A.2.3.1.

In addition to accommodating operational requirements and constructing the new facilities described in Sections 3.2.1 and 3.2.2, the following infrastructure enhancements would be implemented:

- A security building in Area 23 would be constructed to replace outdated facilities and consolidate security facilities and functions into a new, approximately 85,000-square-foot, two-story facility. The buildings replaced would be evaluated and either demolished or used for another purpose.
- The existing 138-kilovolt electrical transmission system would be replaced between Mercury Switching Center in Area 23 and Valley Substation in Area 2 to increase the capacity of the system from about 40 megawatts to 100 megawatts. The efficiency of the system would be improved, but the system operating voltage would not increase.
- The telecommunication system on the NNSS would be upgraded to better integrate wired and wireless systems.
- Buildings in Mercury are typically 30 to 50 years old. To maintain an efficient and effective operation in support of national security activities, it is necessary to replace most of these facilities and supporting infrastructure due to their lack of energy efficiencies and deteriorating condition. Under the Expanded Operations Alternative, Mercury would be reconfigured to provide the modern facilities and infrastructure necessary to support advanced experimentation and production at the NNSS. Because the reconfiguration of Mercury is conceptual in nature, an appropriate level of NEPA review would be required before it could be implemented.

These projects would contribute to meeting DOE/NNSA Strategic Goal 2.1: Transform the Nation's nuclear weapons stockpile and supporting infrastructure to be more responsive to the threats of the twenty-first century.

As under the No Action Alternative, in addition to maintaining and repairing its infrastructure at the NNSS, RSL, NLVF, and the TTR, DOE/NNSA would maintain the existing infrastructure, provide site security, and manage all applicable existing permits and agreements for the former Yucca Mountain site. DOE/NNSA would perform these functions pending decisions on the disposition of the former Yucca Mountain site.

As noted under the No Action Alternative, although considered infrastructure, characterization and monitoring wells developed under the UGTA Project are addressed as part of the Environmental Management Program and proposed and potential renewable energy projects are addressed under the Conservation and Renewable Energy Program, rather than the General Site Support and Infrastructure Program.

3.2.3.2 Conservation and Renewable Energy Program

Under the Expanded Operations Alternative, DOE/NNSA would continue to identify and implement energy conservation measures and renewable energy projects as described under the No Action Alternative. In addition, NNSA would pursue renewable energy projects, including geothermal and solar.

NNSS Photovoltaic Power Project. Under the Expanded Operations Alternative, DOE/NNSA proposes to build a 5-megawatt photovoltaic solar power system near the Area 6 Construction Facilities. The 5-megawatt photovoltaic system would require about 50 acres of land, based on a similar project at Nellis Air Force Base (USAF 2006c).

Commercial solar power generation. Under the Expanded Operations Alternative, DOE/NNSA would allow development of one or more full-scale commercial solar power generation facilities in Area 25 of the NNSS with a combined generating capability of up to 1,000 megawatts. As shown in Figure 3–2, the solar power generation facilities would be located within an area of about 39,600 acres in the southwestern part of the NNSS. The reasons for DOE/NNSA's consideration of commercial solar power development only in Area 25 and decision to assess the concentrating solar power parabolic trough technology in this *NNSS SWEIS* are addressed in Section 3.1.3.2. The facility(ies) could use a variety of solar power-generating technologies (i.e., parabolic trough, power tower, dish engine, photovoltaic) with a combined generating capability of up to 1,000 megawatts. Construction of 1,000 megawatts of commercial solar power generation facilities using concentrating solar power technology and a hybrid cooling system would disturb up to about 10,000 acres of land, as noted in Chapter 5, and operation would require up to approximately 700 acre-feet of water per year, as noted in Section 5.1.6.2.2. Approximately 10 miles of new 500-kilovolt electrical transmission line (outside of the NNSS) would be required to integrate the electricity generated into the regional system, which would disturb approximately 350 acres of land. The analysis in this SWEIS is based on assumptions for a representative commercial solar project (West 2010). Because there is no specific proposal for a commercial solar power generation project, a NEPA review would be required to evaluate any such proposals in the future.

Geothermal Demonstration Project. There are no proposals to develop a Geothermal Demonstration Project at the NNSS, at this time; however, there has been recent interest in such a project. Under such a project, the NNSS would be evaluated to determine the feasibility of demonstrating an enhanced geothermal electrical generating system. If the initial evaluation were favorable, the location for a Geothermal Demonstration Project on the NNSS would depend on a combination of factors, including the system's potential, land use zone restrictions, and environmental and economic considerations. Approximately 30 to 50 acres of land would be disturbed by construction of a Geothermal Demonstration Project. Several boreholes would be drilled up to 20,000 feet deep. Up to 20 acre-feet of water would be required to initially prime the system. A continuously operating 50-megawatt power plant would require an estimated 50 acre-feet of water per year. As a separate but related project, a Geothermal Research Center, would be established in Mercury using existing facilities. A Geothermal Demonstration Project would be interconnected to the NNSS electrical transmission system, but would not generate sufficient power to exceed the capacity of the rebuilt NNSS 138-kilovolt transmission system addressed in Section 3.2.3.1. Because there are no specific proposals for geothermal exploration or development on the NNSS at this time, additional NEPA review would be required before such work could be conducted.

3.2.3.3 Other Research and Development Programs

Under the Expanded Operations Alternative, DOE/NNSA would continue to host existing environmental research projects at the NNSS and would actively promote and expand the National Environmental Research Park Program. DOE/NNSA would consider new environmental or other proposed research and/or development projects not related to DOE/NNSA National Security/Defense or Environmental Management missions on a case-by-case basis.

Expanded Operations Alternative—American Indian Perspective

CGTO

The Consolidated Group of Tribes and Organizations' (CGTO) concerns and perspective regarding the Expanded Operations Alternative include those discussed previously under Sections 3.0, 3.1.1, 3.1.2, 3.1.2.1, 3.1.2.2, and 3.1.3, as well as those summarized here. Under the Expanded Operations Alternative, the U.S. Department of Energy (DOE) would pursue geothermal electrical generation in a variety of locations depicted in Figure A.2.3-1, and solar energy systems and facilities in Areas 6 and 25, respectively.

The CGTO understands that DOE is proposing to construct modular geothermal power plants that have a relatively small surface footprint. However, the initial project support activities will reportedly impact 30 to 50 acres. The CGTO also understands that DOE may pursue solar power by constructing a 5 megawatt photovoltaic system, and commercial solar power generating facilities. These proposed solar power electrical generation projects would impact approximately 50 acres and 39,600 acres of land, respectively. The CGTO is particularly concerned with the land and resources potentially impacted by these projects.

Construction of the proposed solar power electrical generation system and facilities, and the geothermal electrical generation facility involves scraping the land, irreparably destroying the land and vegetation. Facility construction will facilitate erosion, impede visual resources, and will emit dust and other potentially hazardous pollutants into the air. This will, in turn, impact the land, water, air, plants, animals, and cultural resources, and will affect the solitude and cultural integrity of the land. Some examples of resources impacted have been highlighted throughout this section.

The CGTO is concerned that DOE's proposed activities unnaturally harnesses the earth's power without understanding the implications of these actions or all that is necessary to begin to prepare the earth and its resources. Numic people have a complex understanding of *power* and believe it is special force that was placed in all things at the time the world was created. It is that spark which keeps the world going and all of its elements thinking, talking, moving, and interacting. This special *power* moves and has the ability to move down hill, often concentrating or pooling in certain places like mineral outcrops, cliffs, and caves. It has characteristics similar to water, and can be understood as having the ability to return to the sky to become like rain and snow, which are called down from the sky by the highest mountains. This special *power* has a rotation of movement similar to the hydrological cycle and has the ability to impact all things.

The CGTO is concerned about unnaturally harnessing the power of the Sun. According to tribal elders, *"The Sun is like a big battery. Once you drain its power, will it die? For those of us spiritually connected to the Sun, what will happen to us if it is killed? We know the Sun has only so much energy. If the Sun is drained, how will it be replenished? If the Sun goes away, everything will die. Because of the complexity and potential implications to the environment, cultural landscape, and our own survival, we strongly encourage the DOE to pursue a study that evaluates the cultural implications of pursuing solar energy. The stories and activities of our ancestors are tied greatly to the Sun. Today, our prayers and ceremonies still travel or rely on its strength."*

According to information presented throughout the site-wide environmental impact statement, the proposed geothermal electrical generation facilities would use the power of rocks that are hot. Rocks, or minerals, are culturally important and have significant roles in many aspects of Indian life. For example, the Chalcedony would have made an attractive offering acquired and then left at the vision quest or medicine site located to the north on top of a volcano like Scrugham Peak. In particular, Indian people have observed the presence of the following minerals used as offerings on the Nevada National Security Site (NNSS): (1) Obsidian, (2) Chalcedony, (3) Yellow Chert (otherwise known as Jasper), (4) Black Chert, (5) Pumice, (6) Quartz Crystal, and (7) Rhyolite Tuff.

Obsidian is a glass-like stone produced by volcanoes when they talk. According to information obtained by Dr. Richard Stoffle with the University of Arizona and presented in the report *Black Mountain: Traditional Uses of Volcanic Landscapes*, Southern Paiutes use a green volcanic glass during curing ceremonies that involved bleeding the patient. Volcanic glass found below Scrugham Peak was used in the first arrow making lessons for young men. Such lessons were held in small rock shelters found along the base of the basalt flow that constitutes Buckboard Mesa. Obsidian flakes were placed before important rock art panels as offering to the spirits who lived on the other side of the passageway provided by the panel. Small obsidian stones, commonly called *Apache Tears*, cover a depth of 4 inches on the face of Shoshone Mountain in southern Nevada. This massive deposit of obsidian stones is interpreted by Indian people as being provided by the mountain as both a spiritual backdrop and a location for vision quests.

Volcanic rocks are used in a wide range of ceremonial activities. According to a tribal elder, *"Indian women enhance the quality of breast milk by squirting it on heated rocks."* Volcanic rocks are used for medicine society sweat lodge meetings. Indian people call some volcanic rocks "grandfather stones," a designation that reflects reverence as well as wisdom. Such rocks are sought in special places of power and carried over long distances to serve as the heated stones in sweat lodges.

Other traditional use minerals are known to exist throughout the NNSS and offsite locations. In order to document the cultural significance of these areas, additional ethnographic mineral studies are needed to fully understand the location and importance of these minerals at the proposed project site locations prior to any surface disturbing activities. The CGTO is particularly apprehensive about the potential impacts or use of these minerals resulting from proposed geothermal activities.

Expanded Operations Alternative—American Indian Perspective (cont'd)

Some of the locations proposed for geothermal electrical power plants are recognized as traditionally or spiritually important. In particular, the CGTO is concerned about activities that have the potential to impact Oasis Valley, Amargosa River, Timber Mountain Caldera Complex, Black Mountain, Gold Meadows, Cane Springs, Calico Hills area, Crater Flats, Scrugham Peak, Shoshone Mountain, Devil's Hole, Ash Meadows, and Death Valley. The CGTO is concerned about locating the proposed geothermal project along hydrological basins, whose power is derived from volcanic activity.

We know the forces of power in the world move along channels and combine into specific nodes or places of power. A common set of these channels follows the path of water. From this beginning, the water moves downhill in rivulets, washes, and streams. The water often goes underground where it forms similar networks of channels moving in various directions, corresponding to hydrological basins. Water is often attracted to volcanic activity, thus producing power places like hot mineral springs.

The CGTO is concerned the DOE may impact hot springs in their pursuit of geothermal power. According to information obtained by Dr. Richard Stoffle with the University of Arizona and presented in the report *Black Mountain: Traditional Uses of Volcanic Landscapes*, hot springs come from the earth where volcanic activity still occurs even if the magma cannot be seen on the surface. Such springs are a combination of water and volcanoes producing a special place where both ceremonial and medicine activities occur. Indian people from Owens Valley have a single origin story for all of the hot springs in the southern Great Basin and northern Mohave Desert. According to traditional stories, a great ball of fire came from the sky and landed at Coso Hot Springs and then splashed to form at once all of the other hot springs.

Hydrological Impacts

According to information presented in the Site-Wide Environmental Impact Statement, the proposed solar and geothermal projects will require a tremendous amount of water. A modular geothermal power plant alone will require up to 20 acre-feet to initially prime the system.

Indian people believe water is a living being that is fully sentient and willful. Water is already stressed throughout the region. The CGTO is concerned about the use of this very limited and important resource.

Because water is a powerful being it is associated with other powerful beings, such as water babies, a supernatural being that lives in and protects the water. These beings are like the people of the water. They are highly respected by American Indian culture. If water is contaminated and misused, the water babies may cause harm and move to other areas that are not contaminated.

Air Quality and Climate Impacts

Construction of these proposed facilities will impact large areas of land, potentially emitting dust and contaminants. The CGTO knows the air is alive. The Creator puts life into the air, which is shared by all living things. Air can be destroyed, causing pockets of dead air. There is only so much living air that surrounds the world. If it is destroyed, it is gone forever and cannot be restored. Dead air lacks the spirituality and life necessary to support other life forms. The CGTO is concerned about emitting things into the air that are unnatural, and raises the potential health and environmental issues associated with these emissions.

Visual Resource Impacts

All landforms within the NNSS have high sensitivity levels for American Indians. The ability to see the land without obstructions like buildings, towers, cables, roads, and other objects is essential for the spiritual interaction between Indian people and their traditional homelands. Visual resources may be negatively impacted if proposed solar and geothermal projects are pursued. The CGTO must be part of any future discussions as these may impact visual resources and may impede traditional and cultural ceremonies.

Final Thoughts

Only Indian people have traditional ecological knowledge that tells us how and where to interact with plants and animals, water sources, and collect soil samples to minimize impacts to the land while maintaining its spiritual integrity. Because of the potential effects to our ancestral land and its delicate resources, the CGTO must be an integral part of the solar power electrical generation and geothermal electrical generating power projects by conducting systematic ethnographic studies before the ground is disturbed.

The CGTO strongly encourages DOE to evaluate the cultural impacts of pursuing solar and geothermal energy in culturally sensitive areas because of the complexity and potential implications to the environment, cultural landscape, and our survival. The CGTO recommends developing culturally appropriate text for future National Environmental Policy Act (NEPA) analyses, including the environmental assessments and mitigation plans required for these proposed undertakings.

See Appendix C for more details.

3.3 Reduced Operations Alternative

The Reduced Operations Alternative addressed in this SWEIS includes the same types of activities as the No Action Alternative; however, for many programs, the levels of operations would be reduced. Perhaps the most important change from No Action under the Reduced Operations Alternative would be cessation of all activities other than environmental restoration, environmental monitoring, site security operations, military training and exercises, and maintenance of Well 8 and critical communications and electrical transmission systems in the northwestern portion of the NNSS (Areas 18, 19, 20, 29, and 30). Maintenance of Pahute Mesa, Stockade Wash, and Buckboard Mesa Roads would be minimized to provide only access for maintaining necessary infrastructure and conducting environmental restoration activities and operations at Pahute Mesa Airstrip would be limited to those necessary to provide access for the activities that would continue in these areas. The electrical transmission/distribution system beyond the Echo Peak Substation in Areas 19 and 20 would be de-energized. Ceasing all activities other than those mentioned in Areas 18, 19, 20, 29, and 30 would reduce DOE/NNSA's maintenance requirements at the NNSS and allow scarce resources to be focused on the more used areas of the NNSS. It may also reduce impacts on some resources, relative to the No Action and Expanded Operations Alternatives. **Figure 3–3** illustrates the configuration of the NNSS under the Reduced Operations Alternative.

Reduced Operations Alternative—American Indian Perspective

CGTO The Consolidated Group of Tribes and Organizations' (CGTO) concerns and perspective regarding the Reduced Operations Alternative include those discussed previously under Sections 3.0, 3.1.1, 3.1.2, 3.1.2.1, 3.1.2.2, and 3.1.3. The CGTO is supportive of a decrease in culturally perceived harmful land-disturbing activities within the Nevada National Security Site (NNSS) area and the offsite locations. To successfully reduce operations and restore environmental balance, it is essential to have tribal representatives involved throughout the process to help guide the U.S. Department of Energy (DOE) in conducting culturally appropriate activities.

See Appendix C for more details.

The following description of the missions, programs, capabilities, projects, and activities that would be conducted under the Reduced Operations Alternative primarily addresses only this alternative's differences from the No Action Alternative; that is, those projects and activities that would be conducted at a lower level of intensity or not at all.

3.3.1 National Security/Defense Mission

Under the Reduced Operations Alternative, DOE/NNSA would continue to pursue activities in support of the Stockpile Stewardship and Management, Nuclear Emergency Response, Nonproliferation, Counterterrorism, and Work for Others Programs.

3.3.1.1 Stockpile Stewardship and Management Program

Stockpile stewardship and management operations would continue under the conditions of the ongoing nuclear testing moratorium. As under the No Action Alternative, the Reduced Operations Alternative includes those activities necessary to maintain the capability to conduct underground nuclear tests. Such a test would be conducted only if so directed by the President in the interest of national security. Conducting an underground nuclear test is neither included nor analyzed under any of the alternatives in this *NNSS SWEIS*. A generic description of underground nuclear testing is provided in Appendix H. Detailed descriptions of Stockpile Stewardship and Management Program activities under the Reduced Operations Alternative are provided in Appendix A, Section A.3.1.1.

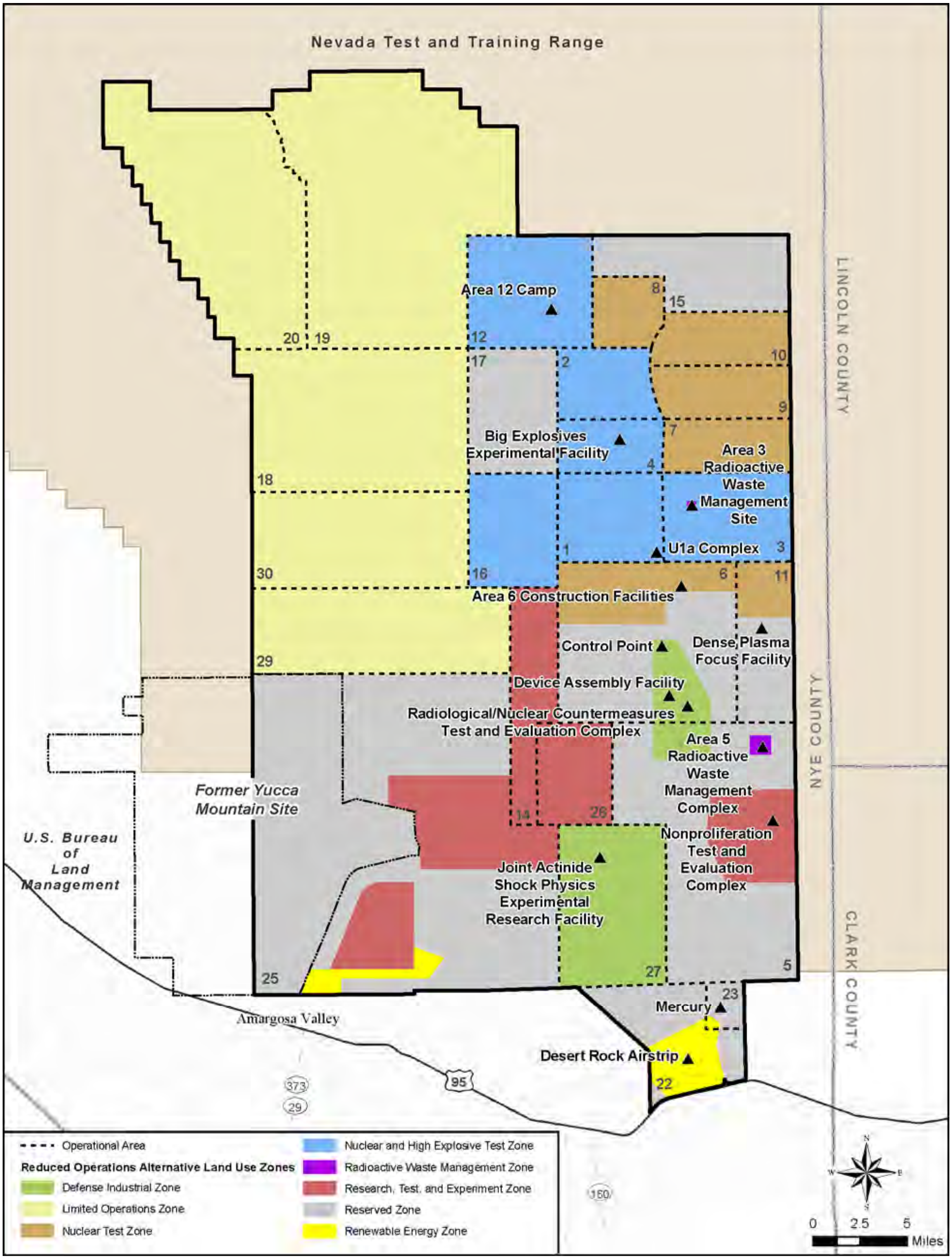

Figure 3–3 Nevada National Security Site Land Use Zones and Major Facilities Under the Reduced Operations Alternative

Under the Reduced Operations Alternative, there would be no change from the No Action Alternative for the following Stockpile Stewardship and Management Program projects and capabilities:

- Shock physics experiments at the Large-Bore Powder Gun
- Criticality experiments at DAF
- Disposition of damaged U.S. nuclear weapons
- Storage and staging of nuclear devices
- Staging of SNM, including pits
- Readiness-related training and exercises using various kinds of nuclear weapon simulators

In addition to maintaining these capabilities, under the Reduced Operations Alternative, the following changes in stockpile stewardship and management capabilities at DOE/NNSA facilities in Nevada would occur:

Dynamic experiments. DOE/NNSA would conduct no more than six of these experiments per year. Over the next 10 years, a total of five dynamic experiments would be conducted in emplacement holes and cause land disturbances. No dynamic experiments would occur in Areas 19 or 20 of the NNSS.

Conventional explosives experiments. DOE/NNSA would annually conduct up to 10 conventional explosives experiments in the Nuclear and High Explosives Test Zone to directly support the Stockpile Stewardship and Management Program. No other explosives experiments would be conducted.

Shock physics experiments. No more than six shock physics experiments with SNM would be annually conducted at JASPER.

Pulsed Power Experiments at the Atlas Facility. The Atlas Facility would be decommissioned and dispositioned.

Fusion experiments at the NNSS and NLVF. DOE/NNSA would conduct up to 375 plasma physics and fusion experiments per year: up to 350 would use the Dense Plasma Focus Machine at NLVF, while no more than 25 would use the machine in Area 11.

Support for Office of Secure Transportation Training. The number of times per year that Office of Secure Transportation training and exercises would be supported would be reduced to four.

Stockpile stewardship and management activities at the TTR. DOE/NNSA would not conduct fixed rocket launcher operations, cruise missile operations, or fuel-air explosives operations at the TTR.

3.3.1.2 Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs

There would be no change from the No Action Alternative for Nuclear Emergency Response, Nonproliferation, or Counterterrorism Program activities. See Appendix A, Section A.1.1.2, for a detailed description of these activities.

3.3.1.3 Work for Others Program

Under the Reduced Operations Alternative, DOE/NNSA would continue to host the projects of other Federal agencies, state and local governments, and nongovernmental organizations; however, certain activities, such as large-scale explosives tests and experiments, would not be conducted. DOE/NNSA also would no longer support the following Work for Others Program activities, which are associated with nonproliferation projects and counterproliferation research and development:

- Conventional weapons effects tests, including live-drop and static high-explosives detonations
- Development and demonstration of capabilities and technologies to attack and defeat military targets protected in tunnels and other deeply buried hardened facilities
- Explosives experiments
- Experiments requiring explosive releases of chemical and biological simulants

No Work for Others Program activities, except military training and exercises, would be conducted in Areas 18, 19, 20, 29, and 30 of the NNSS under the Reduced Operations Alternative. The reason for this exception is that military training and exercises are currently conducted primarily in the western half of the NNSS to ensure adequate separation and avoid interference with other DOE/NNSA activities. This separation would need to be continued for safety and security considerations.

3.3.2 Environmental Management Mission

The DOE/NNSA Environmental Management Mission includes the Waste Management and Environmental Restoration Programs. Under the Reduced Operations Alternative, both of these programs would be the same as under the No Action Alternative, except that less TRU waste would be generated annually (about 710 cubic feet per year from all activities) because of the projected reduced annual number of experiments at JASPER and other national security activities. As with the No Action Alternative, this waste would be safely stored at the TRU Pad pending shipment off site for disposition along with other legacy or newly generated environmental restoration waste. DOE/NNSA activities would generate an estimated 170,000 cubic feet of hazardous waste. Smaller quantities of solid wastes (3,600,000 cubic feet) were also projected (compared to the No Action Alternative) because of reduced employment and construction activities. About 360,000 cubic feet of sanitary solid waste would be sent off site for recycling. Under the Reduced Operations Alternative, environmental restoration activities would continue in accordance with the most recent FFACO.

3.3.3 Nondefense Mission

The Nondefense Mission generally includes those projects and capabilities necessary to support DOE/NNSA-related programs such as construction and maintenance of facilities, provision of supplies and services, warehousing, and similar activities. Activities related to supply and conservation of energy, including renewable energy and other research and development, are considered part of the Nondefense Mission. Activities under the Reduced Operations Alternative would be the same as those under the No Action Alternative, including maintenance of the "cold standby" status of the former Yucca Mountain site, but at a lower level of effort, reflective of operational levels and establishment of the "Limited Use Zone."

3.3.3.1 General Site Support and Infrastructure Program

Under the Reduced Operations Alternative, infrastructure-associated activities would include repairs, replacements, and projects to maintain the reduced capabilities of the NNSS. DOE/NNSA would maintain only critical infrastructure within Areas 18, 19, 20, 29, and 30, including the Echo Peak, Motorola, and Shoshone communications facilities; the Echo Peak, Castle Rock, and Stockade Wash Substations; electrical transmission lines interconnecting these substations; and Well 8. Roads within Areas 18, 19, 20, 29, and 30 would be minimally maintained to provide the basic access necessary to maintain the noted infrastructure and to access environmental restoration sites in those areas. As noted under the No Action Alternative, although considered infrastructure, characterization and monitoring wells developed under the UGTA Project are addressed under the Environmental Management Program and proposed and potential renewable energy projects are addressed under the Conservation and Renewable Energy Program, rather than the General Site Support and Infrastructure Program.

3.3.3.2 Conservation and Renewable Energy Program

Commercial Solar Power Generation. Under the Reduced Operations Alternative, DOE/NNSA assumes development of a 100-megawatt commercial solar power generation plant in Area 25 of the NNSS. The reasons for DOE/NNSA's consideration of commercial solar power development only in Area 25 and decision to assess the concentrating solar power parabolic trough technology in this *NNSS SWEIS* are addressed in Section 3.1.3.2. DOE/NNSA estimated 1,200 acres of land would be required for a 100-megawatt parabolic trough solar power generation facility. Operation of a commercial 100-megawatt concentrating solar power generation facility using hybrid cooling technology would require up to approximately 175 acre-feet of groundwater per year, as noted in Section 5.1.6.2.3. Unlike under the No Action and Expanded Operations Alternatives, the existing electrical transmission system on the NNSS has sufficient capacity to transmit the electrical energy produced by a 100-megawatt facility and new transmission line construction would not be required. Minor infrastructure construction and maintenance may be required to support the development of up to 100 megawatts of solar power generation within Area 25. The analysis in this SWEIS was based on assumptions for a representative commercial solar project. Because there are no current proposals for a commercial solar power generation facility on the NNSS, a separate NEPA review would be required for any specific proposal.

3.3.3.3 Other Research and Development Programs

Under the Reduced Operations Alternative, DOE/NNSA would continue to host existing environmental research projects at the NNSS, but would not actively promote the National Environmental Research Park Program. DOE/NNSA would consider any new environmental or other proposed research and/or development projects not related to DOE/NNSA National Security/Defense or Environmental Management Missions in all areas of the NNSS except Areas 18, 19, 20, 28, 29, and 30 on a case-by-case basis.

3.4 Identification of the Preferred Alternative

Council on Environmental Quality regulations for implementing NEPA (40 CFR 1502.14(e)) require an agency to identify its preferred alternative or alternatives, if one or more exists, in the draft EIS. At the time the *Draft NNSS SWEIS* was published, DOE/NNSA had not selected a preferred alternative. Since publication of the *Draft NNSS SWEIS*, DOE/NNSA has identified its Preferred Alternative (see Table 3–3).

In identifying its Preferred Alternative, DOE/NNSA considered the current and future needs of DOE/NNSA and other users of the NNSS and offsite locations. In doing so, DOE/NNSA balanced mission requirements established by the U.S. Congress with contemporary goals and objectives identified in planning documents such as the *10 Year Site Plan Fiscal Year 2012* for the NNSS (DOE 2011c), and anticipated funding levels for DOE/NNSA, as well as other users of the NNSS and offsite locations, such as DHS. DOE/NNSA also considered the preferences expressed by commentors on the *Draft NNSS SWEIS* and sought to balance those preferences with the needs of the agency and other users of the NNSS and offsite locations in Nevada.

DOE/NNSA's Preferred Alternative is a "hybrid" comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Table 3–3 provides a comparison of mission-based program activities under the three alternatives and visually identifies by light blue shading which elements of the three alternatives were selected for the Preferred Alternative. In some cases, DOE/NNSA identified preferences from each alternative for different activities within a single program area. For example, under the Stockpile Stewardship and Management Program, DOE/NNSA identified its preference for conducting up to 10 dynamic experiments per year (consistent with the No Action Alternative), conducting up to 36 shock physics experiments per year at JASPER (consistent with the Expanded Operations Alternative), while also decommissioning the Atlas Facility (consistent with the Reduced Operations Alternative) as part of the Preferred Alternative.

As the Preferred Alternative is a "hybrid" composed of elements of each of the three alternatives that were examined in the Draft *NNSS SWEIS*, DOE/NNSA determined that the potential environmental consequences of the Preferred Alternative would fall within the range of magnitudes seen between the No Action and Expanded Operations Alternatives, varying by the affected environmental resource area, and there would be no synergistic effects resulting in previously unanalyzed impacts stemming from the hybrid alternative. For some environmental resources, the range of potential impacts is closer to that estimated for the No Action Alternative. For example, land disturbance under the Preferred Alternative is estimated at 8,107 acres, with the No Action and Expanded Operations Alternatives resulting in approximately 4,460 and 25,877 acres, respectively. Impacts on environmental resources closely tied to land disturbance (e.g., habitat loss, takes of threatened or endangered species, loss of cultural resources) would therefore also be closer in magnitude to those estimated for the No Action Alternative. For other environmental resources, the potential impacts would be much closer or identical to those estimated for the Expanded Operations Alternative. For example, radiological human health impacts result largely from LLW transportation and disposal activities. Under the Preferred Alternative, the volume of LLW requiring transportation and disposal would be identical to that identified under the Expanded Operations Alternative; thus, the potential impacts would be the same. **Tables 3–4, 3–5, 3–6** and **3–7** provide summaries of the potential impacts of the Preferred Alternative for each DOE/NNSA site, as well as the impacts of the three alternatives examined in the *Draft NNSS SWEIS*.

3.5 Comparison of Potential Consequences of the Alternatives

A summary of the potential impacts of the alternatives evaluated in this SWEIS is provided in this section. Tables 3–4 through 3–7 present side-by-side comparisons of the impacts under the alternatives at the NNSS, RSL, NLVF, and the TTR, respectively. The information presented in Tables 3–4 through 3–7 is a summary only; for detailed discussion, please refer to the appropriate resource section(s) of Chapter 5.

Table 3–3 Mission-Based Program Activities Under the Preferred Alternative (in blue)

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
National Security/Defense Mission		
Stockpile Stewardship and Management Program (see Sections 3.1.1.1, 3.2.1.1, and 3.3.1.1 of this chapter for additional information)		
Maintain readiness to conduct underground nuclear tests.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Conduct up to 10 dynamic experiments per year within NNSS Areas 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, 19, or 20.	Conduct up to 20 dynamic experiments per year within NNSS Areas 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, 19, or 20.	Conduct up to 6 dynamic experiments per year at the NNSS; no dynamic experiments would be conducted in Areas 19 or 20.
Conduct up to 20 conventional explosives experiments per year at BEEF and up to 10 per year within NNSS Areas 1, 2, 3, 4, 12, or 16 using up to 70,000 pounds TNT-equivalent of explosive charges; would also support Work for Others Program.	• Conduct up to 100 conventional explosives experiments per year within NNSS Areas 1, 2, 3, 4, 12, or 16 using up to 120,000 pounds TNT-equivalent of explosive charges (50 of these would be at BEEF with a TNT-equivalent limitation of 70,000 pounds); would also support Work for Others Program. • Add second firing table and high-energy x-ray capability at BEEF. • Establish up to three areas at the NNSS for conducting explosive experiments with depleted uranium and conduct up to 20 experiments per year.	Conduct up to 10 conventional explosives experiments per year at BEEF using up to 70,000 pounds TNT-equivalent of explosive charges per year to directly support the Stockpile Stewardship and Management Program; no other explosives experiments would be conducted.
Conduct up to 12 shock physics experiments per year at the NNSS using actinide targets at JASPER in Area 27 and up to 10 experiments per year using the Large-Bore Powder Gun in Area 1.	Conduct up to 36 shock physics experiments per year at the NNSS using actinide targets at JASPER in Area 27 and up to 24 experiments per year using the Large-Bore Powder Gun in Area 1.	Conduct up to 6 shock physics experiments per year at the NNSS using actinide targets at JASPER in Area 27 and up to 8 experiments per year using the Large-Bore Powder Gun in Area 1.
Conduct up to 500 criticality operations (experiments, training, and other operations) per year at the National Criticality Experiments Research Center at DAF in Area 6.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Maintain the Atlas Facility in standby with the capability to conduct up to 12 pulsed-power experiments per year.	Activate the Atlas Facility and conduct up to 24 pulsed-power experiments per year.	Decommission and disposition the Atlas Facility.
Conduct up to 600 plasma physics and fusion experiments each year at NLVF and 50 per year in NNSS Area 11.	Conduct up to 1,000 plasma physics and fusion experiments each year at NLVF and 650 per year in NNSS Area 11, increasing the size and complexity of such experiments.	Conduct up to 350 plasma physics and fusion experiments each year at NLVF and 25 per year in NNSS Area 11.
Conduct five drillback operations at the NNSS over about a 10-year period.	Same as under the No Action Alternative.	Same as under the No Action Alternative.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Conduct Stockpile Stewardship and Management Program activities in NNSS Areas 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 16, 19, or 20, including the following:	Same as under the No Action Alternative, plus:	Same as under the No Action Alternative, except: Stockpile Stewardship and Management Program activities would not be conducted in Areas 19 and 20.
– Disposition damaged U.S. nuclear weapons on an as-needed basis.	– Stage nuclear devices pending dismantlement, modification/maintenance, and/or transportation to another location. – Dismantle up to 100 nuclear weapons per year. – Replace limited-life components of up to 360 nuclear devices and conduct associated maintenance activities. – Test weapons components for quality assurance under the Limited Life Component Exchange Program.	
– Stage special nuclear material, including nuclear weapon pits.	– Transfer special nuclear material, including nuclear weapon pits, to and from other parts of the DOE complex for staging and use in experiments at the NNSS.	
Conduct training for the Office of Secure Transportation up to six times per year at various locations on NNSS roads.	Same as under the No Action Alternative, plus: Develop facilities in Area 17 and upgrade or construct new facilities in Area 6, 12, or 23 to support training for the Office of Secure Transportation.	Conduct training for the Office of Secure Transportation up to four times per year at various locations on NNSS roads.
Conduct the following stockpile stewardship operations at the TTR:	Same as under the No Action Alternative, except: Certain safeguards and security functions and other administrative functions would be returned to the U.S. Air Force	Same as under the No Action Alternative, except:
– Conduct tests and experiments, including flight test operations for gravity weapons (i.e., bombs). – Conduct ground/air-launched rocket and missile operations. – Conduct impact testing. – Conduct passive testing of joint test assemblies and conventional weapons. – Conduct fuel-air explosives testing.		– Discontinue ground/air-launched rocket and missile operations. – Discontinue fuel-air explosives testing at the TTR.
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs (see Sections 3.1.1.2, 3.2.1.2, and 3.3.1.3 of this chapter for more information)		
Provide support for the Nuclear Emergency Support Team, the Federal Radiological Monitoring and Assessment Center, the Accident Response Group, and the Radiological Assistance Program. Most of this support is out of RSL at Nellis Air Force Base.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Conduct Aerial Measuring System activities from RSL at Nellis Air Force Base.	Same as under the No Action Alternative.	Same as under the No Action Alternative.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Conduct WMD emergency responder training at various DOE/NNSA NSO venues.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Support the DOE Emergency Communications Network.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Disposition improvised nuclear devices and deploy the DOE/NNSA Disposition Program and FBI Disposition Forensic Program to the NNSS for training and exercises or for an actual event, as needed.	Same as under the No Action Alternative, plus disposition of radiological dispersion devices, as needed.	Same as under the No Action Alternative.
Integrate existing activities and primarily NNSS facilities to support U.S. efforts to control the spread of WMDs, particularly nuclear WMDs, including arms control, nonproliferation activities, nuclear forensics, and counterterrorism capabilities.	Same as under the No Action Alternative, plus: At the NNSS: • Construct laboratory space and other facilities for design and certification of treaty verification technology, training of inspectors, and development of arms control confidence-building measures as part of the Arms Control Treaty Verification Test Bed.[a] • Develop and construct new facilities to support a Nonproliferation Test Bed to simulate chemical and radiological processes that an adversary would clandestinely conduct.[a] • Construct an Urban Warfare Complex to support counterterrorism training.[a]	Same as under the No Action Alternative.
Work for Others Program (see Sections 3.1.1.3, 3.2.1.3, and 3.3.1.3 of this chapter for more information)		
Continue to conduct Work for Others Program activities in all appropriate zones on the NNSS, and at RSL and NLVF.	Same as under the No Action Alternative, except: The NNSS land use zone designation for Area 15 would be changed from "Reserved Zone" to "Research, Test, and Experiment Zone."	Same as under the No Action Alternative, except: Work for Others Program activities, with the exception of military training and exercises, would not be conducted in Areas 18, 19, 20, 29, and 30 at the NNSS.
Host treaty verification activities.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Conduct nonproliferation projects and counterproliferation research and development at the NNSS, including:	Same as under the No Action Alternative.	Same as under the No Action Alternative, except:
– Conduct conventional weapons effects and other explosives experiments.		Discontinue Work for Others Program conventional weapons effects and other explosives experiments.
– Support development of capabilities to detect and defeat military assets in deeply buried hardened targets.		Discontinue development of capabilities to defeat military assets in deeply buried hardened targets.
– Conduct up to 20 controlled chemical and biological simulant release experiments per year (each experiment would include multiple releases by a variety of means, including explosive).		Discontinue projects requiring explosive releases of chemical or biological simulants.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
– Support training, research and development of equipment, specialized munitions, and tactics related to counterterrorism.		
Support the U.S. Department of Defense and other Federal agencies in developing counterterrorism capabilities.	Develop and construct new facilities to support counterterrorism training and research and development activities.	Same as under the No Action Alternative.
Conduct criticality experiments to support NASA's deep space power source development within the parameters for criticality experiments established under the Stockpile Stewardship and Management Program.	Same as under the No Action Alternative, plus: Support NASA's deep space power source development, including conducting experiments using existing boreholes at the NNSS to sequester emissions such as radionuclides.[a]	Same as under the No Action Alternative.
Host the use of various aerial platforms, such as airplanes, unmanned aerial systems and helicopters, at various locations at the NNSS for research and development, training, and exercises.	• Increase use of various aerial platforms, such as airplanes, unmanned aerial systems, and helicopters, for research and development, training, and exercises, including constructing additional hangars, shops, and buildings at existing airports at the NNSS. • Conduct up to 3 underground and 12 open-air radioactive tracer experiments per year. • Host treaty verification activities, including development of a facility for simulating nuclear fuel cycle-related radionuclide release detection and characterization.[a] • Develop a facility for specialized explosive experiments and simulated manufacture to support high-explosives experiments.[a] • Support increased research and development of active interrogation equipment, methods, and training. • Develop new facilities to support research and development in radio frequency generation and infrasonic observations.[a] • Develop new facilities, including simulated clandestine laboratories, to support chemical and biological simulant experiments.[a]	Same as under the No Action Alternative.
Conduct Work for Others Program activities at the TTR, including robotics testing, smart transportation-related testing, smoke obscuration operations, infrared tests, and rocket development.	Same as under the No Action Alternative, except: Certain safeguards and security functions and other administrative functions would be turned over to the U.S. Air Force.	Same as under the No Action Alternative.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Environmental Management Mission		
Waste Management Program (see Sections 3.1.2.1, 3.2.2.1, and 3.3.2.1 of this chapter for more information)		
Dispose up to 15,000,000 cubic feet of LLW and 900,000 cubic feet of MLLW [b] in the Area 5 RWMC.	Dispose up to 48,000,000 cubic feet of LLW and 4,000,000 cubic feet of MLLW at the Area 5 RWMC and Area 3 RWMS. [d]	Same as under the No Action Alternative.
Maintain the Area 3 RWMS on standby.	Open the Area 3 RWMS for disposal of authorized and/or permitted waste.	Same as under the No Action Alternative.
Repackage onsite-generated MLLW.	Same as under the No Action Alternative, plus: At the Area 5 RWMC, store MLLW received from on- and offsite generators pending treatment via macroencapsulation and microencapsulation (i.e., repackaging), sorting/segregating, and bench-scale mercury amalgamation, as appropriate, and/or dispose this waste.	Same as under the No Action Alternative.
Store onsite-generated TRU waste (up to 9,600 cubic feet over the next 10 years) pending offsite disposal.	Same as under the No Action Alternative, except a larger volume (up to 19,000 cubic feet over the next 10 years) of TRU waste would be generated by increased activities at NNSS facilities, such as JASPER.	Same as under the No Action Alternative, except smaller volumes (up to 7,100 cubic feet over the next 10 years) of TRU waste would be generated by reduced operational levels at NNSS facilities, such as JASPER.
Store onsite-generated hazardous waste as needed at the Area 5 Hazardous Waste Storage Unit pending offsite treatment or disposal. Up to 170,000 cubic feet would be generated over the next 10 years.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Operate the Area 11 Explosives Ordnance Disposal Unit. No more than 41,000 pounds of explosives would be treated over the next 10 years.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Operate the Area 6 Hydrocarbon Landfill.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Operate the Area 23 Solid Waste Disposal Site and the U10c Solid Waste Disposal Site. Up to 3,400,000 cubic feet would be disposed over the next 10 years.	Same as under the No Action Alternative, plus: Larger volumes of solid sanitary waste requiring disposal (up to 8,500,000 cubic feet) would be generated by increased activity levels at the NNSS over the next 10 years. Construct new sanitary solid waste disposal facilities as needed in Area 23 and develop a new solid waste disposal site in Area 25 to support environmental restoration activities.	Same as under the No Action Alternative, except lower volumes of solid sanitary waste requiring disposal (up to 3,300,000 cubic feet) would be generated by reduced activity levels at the NNSS over the next 10 years.

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
Environmental Restoration Program (see Sections 3.1.2.2, 3.2.2.2, and 3.3.2.2 of this chapter for more information)		
Underground Test Area Project – Comply with the FFACO; monitor groundwater from existing wells; drill new characterization and monitoring wells; develop groundwater flow and transport models; and continue to evaluate closure strategies.	Same as under the No Action Alternative, except: Characterization and monitoring wells would be developed more quickly.	Same as under the No Action Alternative.
Soils Project – Identify and characterize areas with contaminated soils and perform corrective actions in compliance with the FFACO.	Same as under the No Action Alternative, except: If stricter cleanup standards are implemented, larger volumes of radioactive waste would be generated and disposed.	Same as under the No Action Alternative.
Industrial Sites Project – Identify, characterize, and remediate industrial sites under the FFACO and continue decontaminating and decommissioning facilities.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Defense Threat Reduction Agency sites – In accordance with the FFACO, perform remediation activities at sites that are the responsibility of the Defense Threat Reduction Agency.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Execute the Borehole Management Program.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Nondefense Mission		
General Site Support and Infrastructure Program (see Sections 3.1.3.1, 3.2.3.1, and 3.3.3.1 of this chapter for more information)		
Conduct small projects to maintain the present capabilities of DOE/NNSA NSO facilities in all areas of the NNSS and at NLVF, RSL, and the TTR. Maintain existing infrastructure, manage various permits and agreements, and provide security for the former Yucca Mountain site.	Same as under the No Action Alternative, plus: • Construct a new 85,000-square-foot multistory security building in Area 23. • Replace the NNSS 138-kilovolt electrical transmission system. • Expand cellular telecommunication system on the NNSS. • Reconfigure Mercury.[a]	Same as under the No Action Alternative, except: Only critical infrastructure would be maintained within Areas 18, 19, 20, 29, and 30 of the NNSS, including certain communications facilities; electrical transmission lines and substations; and Well 8. Roads within these areas would only be maintained to provide access to the infrastructure and environmental restoration sites.
Conservation and Renewable Energy Program (see Sections 3.1.3.2, 3.2.3.2, and 3.3.3.2 of this chapter for more information)		
Continue to identify and implement energy conservation measures and renewable energy projects in compliance with applicable Executive Orders and DOE Orders.	Same as under the No Action Alternative, plus:	Same as under the No Action Alternative, except:
– Reduce energy intensity by 3 percent annually through the end of fiscal year 2015, for a total 30 percent reduction.		
– Reduce greenhouse gas emissions by 28 percent by fiscal year 2020.		
– Install advanced electric metering systems.		
– Obtain at least 7.5 percent of the NNSS annual electricity and thermal consumption from renewable energy sources.		

NO ACTION ALTERNATIVE	EXPANDED OPERATIONS ALTERNATIVE	REDUCED OPERATIONS ALTERNATIVE
– Support development of a 240-megawatt commercial solar power generation facility in Area 25.[a c]	• Modify NNSS land use zones to establish a 39,600-acre Renewable Energy Zone in Area 25 and support development of commercial solar power generation facilities in Area 25 with a maximum combined generating capacity of 1,000 megawatts.[a, c] • Construct a 5-megawatt photovoltaic solar power generation facility near the Area 6 Construction Facilities. • Support a Geothermal Demonstration Project and Geothermal Research Center at the NNSS.[a]	Support development of a 100-megawatt commercial solar power generation facility in Area 25.[a c]
– Reduce water use by 16 percent by 2015.		
– Maximize use of alternative fuels (e.g., E85 and biodiesel).		
– Ensure all new construction and renovation projects implement high-performance building goals.		
Other Research and Development Programs (see Sections 3.1.3.3, 3.2.3.3, and 3.3.3.3 of this chapter for more information)		
Support the DOE National Environmental Research Park Program and other non-DOE/NNSA research and development activities in all areas of the NNSS.	Same as under the No Action Alternative.	National Environmental Research Park Program and other non–DOE/NNSA research and development activities would be conducted in all areas of the NNSS except Areas 18, 19, 20, 29, and 30.

= Activities included as part of the Preferred Alternative.

BEEF = Big Explosives Experimental Facility; DAF = Device Assembly Facility; FBI = Federal Bureau of Investigation; FFACO = Federal Facilities Agreement and Consent Order; JASPER = Joint Actinide Shock Physics Experimental Research Facility; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NASA = National Aeronautics and Space Administration; NLVF = North Las Vegas Facility; NNSA = National Nuclear Security Administration; NNSS = Nevada National Security Site; NSO = Nevada Site Office; RSL = Remote Sensing Laboratory; RWMC = Radioactive Waste Management Complex; RWMS = Radioactive Waste Management Site; TNT = 2,4,6-trinitrotoluene; TRU = transuranic; TTR = Tonopah Test Range; WMD = weapon of mass destruction.

[a] These potential projects have not reached a point of development to allow full analysis in this *NNSS SWEIS* and would be subject to project-specific NEPA review before DOE/NNSA would make any decision regarding implementation.

[b] The actual permitted capacity of the Mixed Waste Disposal Unit (Cell 18) is 899,996 cubic feet.

[c] DOE/NNSA has not received or solicited proposals for any commercial solar power generation projects.

[d] Reactivation of the Area 3 RWMS would only occur based upon mission need and as stated in Section 4.1.11.1.1.1, including detailed consultation with the State of Nevada.

Table 3–4 Summary of Potential Impacts at the Nevada National Security Site

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use (for details go to Chapter 5, Sections 5.1.1.1, 5.1.1.2, and 5.1.1.3)				
National Security/ Defense Mission	No impacts were identified from the continuation of activities at the current levels of operations or foreseeable actions because activities under this alternative would continue to be compatible with existing land use designations on the NNSS and primary land uses adjacent to the site.	No impacts were identified from the increased activities and change in land use designations under this alternative because activities would be compatible with the proposed land use designations and primary land uses adjacent to the NNSS. The Reserved Zone would decrease in area by 5.5 percent; the Research, Test, and Experiment Zone would increase by 21 percent.	No impacts were identified from the decreased activities and change in land use designations under this alternative because activities would be compatible with the proposed land use designations and primary land uses adjacent to the NNSS. The Reserved Zone would decrease in area by 71 percent, and Areas 18, 19, 20, and 30 would change from Reserved to Limited Use, which is a new land use zone designation.	No impacts were identified from the increased activities and change in land use designations under this alternative because activities would be compatible with the proposed land use designations and primary land uses adjacent to the NNSS. Area 15 would change from the Reserved to the Research, Test, and Experiment zone designation. Areas 18, 19, 20, and 30 would change from Reserved to Limited Use, which is a new land use zone designation.
	<u>*Airspace*</u> No new impacts were identified from airspace activities because these activities would be maintained at the current level of air traffic, navigational aid services, and airspace structure, and would be coordinated and scheduled by the controlling entity responsible for NNSS airspace, the Nellis Air Traffic Control Facility.	<u>*Airspace*</u> Minimal impacts would result from increased usage of aerial platforms and airspace usage, as these activities would continue to be coordinated with the Nellis Air Traffic Control Facility.	<u>*Airspace*</u> Same as under the No Action Alternative.	<u>*Airspace*</u> Minimal impacts would result from increased usage of aerial platforms and airspace usage, as these activities would continue to be coordinated with the Nellis Air Traffic Control Facility.
Environmental Management Mission	No impacts were identified from the continuation of activities at the current levels of operations because activities under this alternative would not change.	No impacts were identified from the increased activities under this alternative, as these activities would be compatible with land use designations and primary land uses adjacent to the site.	Same as under the No Action Alternative.	No impacts were identified from the increased activities under this alternative, as these activities would be compatible with land use designations and primary land uses adjacent to the site.
Nondefense Mission	No impacts were identified from the continuation of activities at the current levels of operations or foreseeable actions because activities under this alternative would continue to be compatible with existing land use designations on the NNSS and primary land uses adjacent to the site. The Solar Enterprise Zone would be renamed the Renewable Energy Zone.	Same as the No Action Alternative, plus: Area 15 would be changed from a Reserved Zone to a Research, Test, and Experiment Zone, and the Solar Enterprise Zone would be renamed the Renewable Energy Zone and increase in area by 276 percent.	Same as under the No Action Alternative.	Same as the No Action Alternative, plus: Area 15 would be changed from a Reserved Zone to a Research, Test, and Experiment Zone.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Infrastructure and Energy (for details go to Chapter 5, Sections 5.1.2.1 and 5.1.2.2)				
Infrastructure	Buildings, transportation, water supply, and services are adequate to handle temporary increases in demands during construction and long-term demands during operations. Infrastructure would be maintained as needed to accommodate ongoing activities. In addition, new LLW cells would be developed to accommodate disposal of those waste types. Up to 50 new wells would be developed by the UGTA Project.	Same as under the No Action Alternative, plus: New buildings (about 479,000 square feet), ranges and training facilities (13,455 acres), water distribution lines, wastewater treatment systems (septic tanks), power lines, and communication systems would be added and improvements would be made to existing infrastructure. In addition, new LLW/MLLW cells would be developed to accommodate disposal of increased volumes of those waste types and new sanitary and construction/D&D waste landfills in Areas 23 and 25. An upgrade to the NNSS electrical transmission system would increase capacity from 40 to 100 megawatts. A 5-megawatt photovoltaic solar power generation facility would be developed in Area 6.	Same as under the No Action Alternative, except: Buildings, transportation, water supply, and services would experience reduced demands. Because most operations in the northwestern portion of the NNSS (within Areas 18, 19, 20, 29, and 30) would be discontinued, non-essential infrastructure in those areas would be shut down or removed.	Same as under the No Action Alternative, plus: New buildings (about 350,000 square feet), ranges and training facilities (approximately 3,455 acres), water distribution lines, wastewater treatment systems (septic tanks), power lines, and communication systems would be added and improvements would be made to existing infrastructure. In addition, new LLW/MLLW cells would be developed to accommodate disposal of increased volumes of those waste types and new sanitary and construction/D&D waste landfills in Areas 23 and 25. An upgrade to the NNSS electrical transmission system would increase capacity from 40 to 100 megawatts. A 5-megawatt photovoltaic solar power generation facility would be developed in Area 6. Because most operations in the northwestern portion of the NNSS (within Areas 18, 19, 20, 29, and 30) would be discontinued, non-essential infrastructure in those areas would be shut down or removed.
	A commercial 240-megawatt solar power generation plant would be developed in Area 25 of the NNSS. Up to 10 miles of new 230-kilovolt transmission lines would be required to interconnect the new generation facility with the main power grid. The commercial facility would provide a portion of the electrical power at the NNSS. Sanitary needs of construction and operational employees would be provided by the commercial entity and are not	Up to 1,000 megawatts of commercial solar power generating capacity would be developed in Area 25 of the NNSS. Up to 10 miles of new 500-kilovolt transmission lines would be required to interconnect the new generating facilities with the main power grid. The commercial facilities would provide a portion of the electrical power at the NNSS. Sanitary needs of construction and operational employees would be provided by the commercial entity and are not expected to affect the NNSS solid waste or	A commercial 100-megawatt solar power generation plant would be developed in Area 25 of the NNSS. No new transmission lines would be required to interconnect the new generating facility with the main power grid. The commercial facility would provide a portion of the electrical power at the NNSS. Sanitary needs of construction and operational employees would be provided by the commercial entity and are not expected to affect the NNSS solid waste or	A commercial 240-megawatt solar power generation facility would be developed in Area 25 of the NNSS. Up to 10 miles of new 230-kilovolt transmission lines would be required to interconnect the new generation facility with the main power grid. The commercial facility would provide a portion of the electrical power at the NNSS. Sanitary needs of construction and operational employees would be provided by the commercial entity and are not

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
	expected to affect the NNSS solid waste or wastewater infrastructure.	wastewater infrastructure.	wastewater infrastructure.	expected to affect the NNSS solid waste or wastewater infrastructure.
Energy	Average electric power demand would be 22 megawatts, with a peak demand of 30 megawatts.	Average electrical power demand would be 28 megawatts, with a peak demand of 41 megawatts. As noted under Infrastructure, DOE/NNSA would rebuild the 138-kilovolt transmission system on the NNSS to accommodate increased loads.	Average electrical power demand would be 20 megawatts, with a peak demand of 27 megawatts.	Average electrical power demand would be 28 megawatts, with a peak demand of 41 megawatts. As noted under Infrastructure, NNSA would rebuild the 138-kilovolt transmission system on the NNSS to accommodate increased loads.
	Annual usage of various liquid fuels was estimated, as follows: Fuel oil for heating – 66,000 gallons Unleaded gasoline – 427,000 gallons Ethanol/E85 – 217,000 gallons #2 diesel – 65,000 gallons Biodiesel – 343,000 gallons	Annual usage of various liquid fuels was estimated, as follows: Fuel oil for heating – 83,000 gallons Unleaded gasoline – 534,000 gallons Ethanol/E85 – 271,000 gallons #2 diesel – 81,000 gallons Biodiesel – 429,000 gallons	Annual usage of various liquid fuels was estimated, as follows: Fuel oil for heating – 59,000 gallons Unleaded gasoline – 384,000 gallons Ethanol/E85 – 195,000 gallons #2 diesel – 59,000 gallons Biodiesel – 309,000 gallons	Annual usage of various liquid fuels was estimated, as follows: Fuel oil for heating – 83,000 gallons Unleaded gasoline – 534,000 gallons Ethanol/E85 – 271,000 gallons #2 diesel – 81,000 gallons Biodiesel – 429,000 gallons
	DOE/NNSA would maintain and repair energy infrastructure.	DOE/NNSA would maintain and repair energy infrastructure.	DOE/NNSA would maintain and repair energy infrastructure for PA.	DOE/NNSA would maintain and repair energy infrastructure.
Transportation [a] and Traffic (for details go to Chapter 5, Sections 5.1.3.1 and 5.1.3.2, and Appendix E)				
Transportation (for details go to Chapter 5, Sections 5.1.3.1.1, 5.1.3.1.2, and 5.1.3.1.3, and Appendix E)				
Out-of-state LLW/MLLW (All values are projected from shipment of the entire LLW inventory over a 10-year period)				
Truck transport				
Worker risk (LCF)	1 (1.3)	3 (3.1)	1 (1.3)	3 (3.1)
Population risk (LCF)	0 (0.2)	1 (0.6)	0 (0.2)	1 (0.6)
Radiological accident (LCF)	0 (0.0002)	0 (0.01)	0 (0.0002)	0 (0.01)
Traffic fatality	2	6	2	6
Rail transport only				
Worker risk (LCF)	0 (0.3)	1 (1.1)	0 (0.3)	1 (1.1)
Population risk (LCF)	0 (0.1)	0 (0.3)	0 (0.1)	0 (0.3)
Radiological accident (LCF)	0 (0.00006)	0 (0.005)	0 (0.00006)	0 (0.005)
Traffic fatality	6	15	6	15
Combined rail-truck transport				
Worker risk (LCF)	0 (0.5)	2 (1.7)	0 (0.5)	2 (1.7)
Population risk (LCF)	0 (0.1)	1 (0.5)	0 (0.1)	1 (0.5)
Radiological accident (LCF)	0 (0.00008)	0 (0.005)	0 (0.00008)	0 (0.005)
Traffic fatality	6	16	6	16

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Traffic (for details go to Chapter 5, Sections 5.1.3.2.1, 5.1.3.2.2, and 5.1.3.2.3)				
Onsite traffic impacts	There would be about 20 additional vehicle trips per day on Mercury Highway, which would operate at a level of service A during peak traffic hours. Construction of a 240-megawatt commercial solar power generation facility would result in 500 (average over the period of construction) and 1,000 (during the peak of the construction period) additional vehicle trips on a daily basis during the peak commute hours on Lathrop Wells Road; increased roadway maintenance or improvements may be required.	There would be about 800 additional vehicle trips per day on Mercury Highway, which would operate at a level of service B or better during peak traffic hours. Construction of 1,000 megawatts of commercial solar power generation facilities would result in 750 (average over the period of construction) and 1,500 (during the peak of the construction period) additional vehicle trips on a daily basis during the peak commute hours on Lathrop Wells Road; increased roadway maintenance or improvements may be required.	There would be about 150 fewer vehicle trips per day on Mercury Highway, which would operate at a level of service A during peak traffic hours. Construction of a 100-megawatt commercial solar power generation facility would result in 400 (average over the period of construction) and 800 (during the peak of the construction period) additional vehicle trips on a daily basis during the peak commute hours on Lathrop Wells Road; increased roadway maintenance or improvements may be required.	There would be about 800 additional vehicle trips per day on Mercury Highway, which would operate at a level of service B or better during peak traffic hours. Construction of a 240-megawatt commercial solar power generation facility would result in 500 (average over the period of construction) and 1,000 (during the peak of the construction period) additional vehicle trips on a daily basis during the peak commute hours on Lathrop Wells Road; increased roadway maintenance or improvements may be required.
Regional traffic impacts	U.S. Route 95, State Route 160, and State Route 372 would experience the greatest increases in daily traffic volumes in the area around the NNSS; however, these would be relatively minor and would not affect the levels of service on regional roadways. Overall traffic volumes would increase during peak hours because of additional traffic attributable to the construction of a solar power generation facility.	Segments of State Route 372, State Route 160, U.S. Route 95, and State Route 164 would experience moderately high percent increases in daily traffic compared to the No Action Alternative. Most of the increase in daily traffic volumes during the peak hours would be attributable to workers commuting to the NNSS. Any detectable changes in traffic volumes would primarily occur during the main commuting hours and at the entry gates of the NNSS (the main entrance gate for regular NNSS employees and Gate 510 for those associated with the construction and operation of the commercial solar power generation facilities in Area 25). However, the levels of service on public roadways in the region would not change.	Although the number of commuter trips for the reduced NNSS workforce would decrease, overall traffic volumes would increase slightly during peak hours because of additional traffic volumes attributable to construction and operation of the solar power generation facility. Impacts on regional traffic under this alternative would, therefore, be slightly less than or similar to those described under the No Action Alternative; volume-to-capacity ratios and levels of service would not change.	Segments of State Route 372, State Route 160, U.S. Route 95, and State Route 164 would experience moderately high percent increases in daily traffic compared to the No Action Alternative. Most of the increase in daily traffic volumes during the peak hours would be attributable to workers commuting to the NNSS. Any detectable changes in traffic volumes would primarily occur during the main commuting hours and at the entry gates of the NNSS (the main entrance gate for regular NNSS employees and Gate 510 for those associated with the construction and operation of a commercial solar power generation facility in Area 25). However, the levels of service on public roadways in the region would not change.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Socioeconomics (for details go to Chapter 5, Sections 5.1.4.1, 5.1.4.2, and 5.1.4.3)				
	Operation of a 240-megawatt commercial solar power facility would increase employment by 150 FTEs, of which about 15 solar power facility employees would relocate from outside of the region. Sufficient housing exists to support the increased population. A total of 22 new students relocating to Clark County would create a need for 1 additional teacher to maintain the student-to-teacher ratio. An increase of 6 new students in Nye County would not result in a need for additional teachers. Direct jobs would reduce unemployment by 0.07 and 0.99 percent, respectively, in Clark and Nye Counties.	Site employment would increase by 625 FTEs; about 63 employees would relocate from outside of the region. Sufficient housing exists in the area to support the increased population. A total of 92 new students relocating to Clark County would create a need for 4 new teachers to maintain the student-to-teacher ratio. An increase of 27 new students in Nye County would create a need for 1 new teacher to maintain the student-to-teacher ratio. Direct jobs would reduce unemployment by 0.31 and 4.2 percent, respectively, in Clark and Nye Counties.	Site employment would decrease by 45 FTEs, increasing unemployment in Clark County by about 0.03 percent and in Nye County by about 0.39 percent. Additional employees would not relocate to Clark or Nye County and there would be no need for new housing or teachers.	Site employment would increase by approximately 575 FTEs; about 60 employees would relocate from outside of the region. Sufficient housing exists in the area to support the increased population. A total of approximately 90 new students relocating to Clark County would create a need for 4 new teachers to maintain the student-to-teacher ratio. An increase of approximately 25 new students in Nye County would create the need for 1 new teacher to maintain the student-to-teacher ratio. Direct jobs would reduce unemployment by 0.3 and 4.0 percent, respectively, in Clark and Nye Counties.
	Approximately 500 FTEs over 35 months, with a peak of 1,000 FTEs, would need to be hired for construction of the solar power generation facility.	Approximately 750 FTEs over 42 months, with a peak of 1,500 FTEs, would need to be hired for construction of the solar power generation facility. Other construction projects at the NNSS would require approximately 250 FTEs over the 10-year period.	Approximately 400 FTEs over 32 months, with a peak of 800 FTEs, would need to be hired for construction of the solar power generation facility.	Approximately 500 FTEs over 35 months, with a peak of 1,000 FTEs, would need to be hired for construction of the solar power generation facility. Other construction projects at the NNSS would require approximately 250 FTEs over the 10-year period.
	Direct jobs, indirect jobs, and construction materials purchases would reduce unemployment and have a beneficial effect on local government revenues.	Direct jobs, indirect jobs, and construction materials purchases would reduce unemployment and have a beneficial effect on the local economy and government revenues.	Job loss would have a small negative impact on the local economy; construction material purchases for the solar power generation facility would have a small positive economic impact, including generating additional revenues for local governments. Direct construction jobs and indirect jobs would reduce unemployment and would have a beneficial impact on the economy in the region.	Direct jobs, indirect jobs, and construction materials purchases would reduce unemployment and have a beneficial effect on local government revenues.
	Buildings associated with construction and operation of a solar power generation facility and increased site personnel would create an increased demand for onsite security and fire and rescue services.	Buildings associated with construction and operation of a larger solar power generation facility and other facilities on site and the increase in personnel would create a greater demand for onsite security and fire and rescue services.	Buildings associated with construction and operation of a solar power generation facility would create an increased demand for onsite security and fire and rescue services.	Buildings associated with construction and operation of a solar power generation facility and increased site personnel would create an increased demand for onsite security and fire and rescue services.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Geology and Soils (for details go to Chapter 5, Sections 5.1.5.1, 5.2.5.2, and 5.1.5.3)				
National Security/ Defense Mission	About 700 acres of soil would be disturbed by dynamic experiments in boreholes, explosives experiments, drillback operations, OST training and exercises, experiments involving biological simulants, and counterterrorism training.	About 13,455 acres of soil would be disturbed by the same kinds of activities as under the No Action Alternative, including: Up to 10,000 acres of soil would be disturbed for an OST training facility, 120 acres for depleted uranium experiment sites, and 3,335 acres for additional explosives experiments, new test beds and training facilities, drillback operations, and additions to existing aviation facilities at the NNSS.	About 430 acres of soil would be disturbed by many of the same kinds of activities as under the No Action Alternative, except: There would be 50 percent fewer explosive experiments and 33 percent less OST training and exercises.	About 3,455 acres of soil would be disturbed by the activities including: dynamic experiments, explosives experiments, drillback operations, OST training and exercises, experiments involving biological simulants, counterterrorism training, depleted uranium experiments, new test beds and training facilities, and additions to existing aviation facilities at the NNSS.
Environmental Management Mission	About 190 acres of soil would be disturbed for construction of new waste cells at the Area 5 RWMC. Up to 420 acres of soil would be disturbed as part of the Environmental Restoration Program, Soils Project cleanup. Up to 500 acres of soil would be disturbed for development of UGTA Project monitoring wells.	About 600 acres of soil would be disturbed for construction of new waste cells at the Area 5 RWMC. About 35 acres of soil would be disturbed for new sanitary and D&D/construction waste landfills in Areas 23 and 25. Environmental Restoration Program impacts would be the same as under the No Action Alternative.	Same as under the No Action Alternative.	About 600 acres of soil would be disturbed for construction of new waste cells at the Area 5 RWMC. About 35 acres of soil would be disturbed for new sanitary and D&D/construction waste landfills in Areas 23 and 25. Up to 420 acres of soil would be disturbed as part of the Environmental Restoration Program, Soils Project cleanup. Up to 500 acres of soil would be disturbed for development of UGTA Project monitoring wells.
Nondefense Mission	Construction of a 240-megawatt commercial solar power generation facility and associated transmission lines would disturb approximately 2,650 acres.	Construction of 1,000 megawatts of commercial solar power generation facilities and associated transmission lines would disturb up to 10,300 acres. Replacing the existing 138-kilovolt NNSS electrical transmission line would temporarily disturb about 467 acres of soil. Construction of a DOE/NNSA photovoltaic solar power generation facility would disturb about 50 acres of land. Minor soil disturbance is expected from several additional research projects. Development of a Geothermal Demonstration Project would disturb up to 50 acres of soil.	Construction of a 100-megawatt commercial solar power generation facility could disturb up to 1,200 acres.	Construction of a 240-megawatt commercial solar power generation facility and associated transmission lines would disturb approximately 2,650 acres. Replacing the existing 138-kilovolt NNSS electrical transmission line would temporarily disturb about 467 acres of soil. Construction of a DOE/NNSA photovoltaic solar power generation facility would disturb about 50 acres of land. Minor soil disturbance is expected from several additional research projects. Development of a Geothermal Demonstration Project would disturb up to 50 acres of soil.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Hydrology (for details go to Chapter 5, Section 5.1.6)				
Surface Water Resources (for details go to Chapter 5, Sections 5.1.6.1, 5.1.6.1.1, 5.1.6.1.2, and 5.1.6.1.3)				
National Security/ Defense Mission	Disturbance of about 700 acres of land by dynamic experiments in boreholes, explosives experiments, drillback operations, OST training and exercises, experiments involving releases of chemicals and biological simulants, and counterterrorism training would cause alterations of natural drainage pathways, contamination of ephemeral surface waters via chemical agents, and sedimentation to ephemeral surface waters.	About 13,455 acres of soil and near-surface geologic media would be disturbed by activities similar to those under the No Action Alternative, including: Up to 10,000 acres of disturbance for OST training facilities, 120 acres for depleted uranium experiment sites, and 3,335 acres for additional explosives experiments, new test beds and training facilities, drillback operations and additions to existing aviation facilities at the NNSS. This would result in proportionately larger impacts on ephemeral waters compared to the No Action Alternative.	About 430 acres of soil and near-surface geologic media would be disturbed by many of the same kinds of activities as under the No Action Alternative, except: There would be 50 percent fewer explosives experiments, and 33 percent less OST training and exercises. This would result in proportionately smaller impacts on ephemeral waters compared to the No Action Alternative.	Disturbance of about 3,455 acres of land would cause alterations of natural drainage pathways, contamination of ephemeral surface waters via chemical agents, and sedimentation to ephemeral surface waters.
Environmental Management Mission	Disturbance of up to 190 acres of soil to construct, use, cover, and close disposal units within the existing Area 5 RWMC would result in impacts on ephemeral waters due to alteration of natural drainage pathways, increased erosion, and subsequent sedimentation.	Disturbance of up to 600 acres of soil to construct, use, cover, and close disposal units within the existing Area 5 RWMC, plus up to 35 acres of disturbance for new sanitary/D&D/construction waste landfills would result in impacts on ephemeral waters due to alteration of natural drainage pathways, increased erosion, and subsequent sedimentation.	Same as under the No Action Alternative for both Waste Management and Environmental Restoration.	Disturbance of up to 600 acres of soil to construct, use, cover, and close disposal units within the existing Area 5 RWMC, plus up to 35 acres of disturbance for new sanitary/D&D/ construction waste landfills would result in impacts on ephemeral waters due to alteration of natural drainage pathways, increased erosion, and subsequent sedimentation.
	The Soils Project would reduce or stabilize legacy contamination in soil and could result in disturbance of up to 420 acres. Soil disturbance on about 500 acres of land from drilling additional wells for the UGTA Project could cause localized erosion, as could D&D of industrial sites, remediation of Defense Threat Reduction Agency sites, and the Borehole Management Program. These activities would affect ephemeral waters by altering natural drainage pathways and increasing sedimentation. Stabilization and/or removal of contaminated facilities	Environmental Restoration impacts would be the same as under the No Action Alternative.		The Soils Project would reduce or stabilize legacy contamination in soil and could result in disturbance of up to 420 acres. Soil disturbance on about 500 acres of land from drilling additional wells for the UGTA Project could cause localized erosion, as could D&D of industrial sites, remediation of Defense Threat Reduction Agency sites, and the Borehole Management Program. These activities would affect ephemeral waters by altering natural drainage pathways and increasing sedimentation. Stabilization and/or removal of contaminated facilities

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
	and soils would reduce the potential for contamination of ephemeral waters.			and soils would reduce the potential for contamination of ephemeral waters.
Nondefense Mission	No new land disturbances would occur during infrastructure-related activities under the No Action Alternative.	Up to 517 acres of land would be disturbed by rebuilding the existing 138-kilovolt transmission line on the NNSS and constructing a 5-megawatt photovoltaic solar power generation facility. These disturbances would result in alterations of natural drainage pathways and increased sedimentation of ephemeral waterways.	Same as under the No Action Alternative, except: The land area associated with the development of a 100-megawatt solar power generation facility would be 1,200 acres.	Development of a 240-megawatt commercial solar power generation facility and associated transmission lines would alter natural drainage pathways over 2,650 acres in Area 25, though it is expected that larger ephemeral waters (e.g., Fortymile Wash) would be avoided; however, there would be a potential for chemical contamination of and sedimentation to ephemeral waters during construction-related land preparation. Up to 517 acres of land would be disturbed by rebuilding the existing 138-kilovolt transmission line on the NNSS and constructing a 5-megawatt photovoltaic solar generating facility. Development of a Geothermal Demonstration Project would disturb up to 50 acres. These disturbances would result in alterations of natural drainage pathways and increased sedimentation of ephemeral waterways.
	Development of a 240-megawatt commercial solar power generation facility and associated transmission lines would alter natural drainage pathways over 2,650 acres in Area 25, though it is expected that larger ephemeral waters (e.g., Fortymile Wash) would be avoided; however, there would be a potential for chemical contamination of and sedimentation to ephemeral waters during construction-related land preparation.	Development of up to 1,000 megawatts of commercial solar power generation facilities and associated transmission lines would disturb drainage pathways over 10,300 acres and increased erosion and construction/operational activities would potentially increase sedimentation to and chemical contamination of ephemeral waterways. Development of a Geothermal Demonstration Project would disturb up to 50 acres and cause sedimentation to ephemeral waters, as well as long-term alteration of natural drainage pathways.		

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Groundwater Resources (for details go to Chapter 5, Sections 5.1.6.2, 5.2.6.2.1, 5.1.6.2.2, and 5.1.6.2.3)				
Total water use (excluding solar power facility)				
	Total water use for DOE/NNSA activities would not exceed 691 acre-feet per year. This water demand would exceed published estimates of the sustainable yield for Basin 160 (Frenchman Flat), although other yield estimates suggest that adverse impacts on water supply may not occur.	Total water use for DOE/NNSA activities would increase by 25 percent from the No Action Alternative, to 862 acre-feet per year. This water demand would exceed published estimates of the sustainable yield for Basin 160 (Frenchman Flat), although other yield estimates suggest that adverse impacts on water supply may not occur.	Total water use for DOE/NNSA activities would decrease by 10 percent from the No Action Alternative, to 622 acre-feet per year. This water demand would exceed published estimates of the sustainable yield for Basin 160 (Frenchman Flat), although other yield estimates suggest that adverse impacts on water supply may not occur.	Total water use for DOE/NNSA activities would total as much as 862 acre-feet per year. This water demand would exceed published estimates of the sustainable yield for Basin 160 (Frenchman Flat), although other yield estimates suggest that adverse impacts on water supply may not occur.
National Security/ Defense Mission	No new or additional impacts on groundwater resources.	The following would be additional impacts on the groundwater resource, compared to the No Action Alternative: • 5.5 acre-feet per year of potable water for construction workers. • Water use for new construction of facilities included in the overall 25 percent increase in all water uses.	Same as under the No Action Alternative.	The following would be additional impacts on the groundwater resource, compared to the No Action Alternative: • 5.5 acre-feet per year of potable water for construction workers. • Water use for new construction of facilities included in the 862 acre-feet per year.
Environmental Management Mission	Through 2020, 30 acre-feet per year of nonpotable water for the drilling of new wells under the UGTA Project. Less than 7 acre-feet of total water use for dust suppression during D&D of facilities.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Through 2020, 30 acre-feet per year of nonpotable water for the drilling of new wells under the UGTA Project. Less than 7 acre-feet of total water use for dust suppression during D&D of facilities.
Nondefense Mission	Positive impact of reducing potable water production 16 percent by 2015 utilizing water conservation measures.	Same as under the No Action Alternative, plus: • A 5-megawatt photovoltaic solar power system near Area 6 would use 0.5 acre-feet per year of nonpotable water. • A one-time nonpotable water demand of 20 acre-feet to prime a geothermal power plant. Once operational, the geothermal power plant would use 50 acre-feet of water per year.	Same as under the No Action Alternative.	Positive impact of reducing potable water production 16 percent by 2015 utilizing water conservation measures and partially offset by: • A 5-megawatt photovoltaic solar power system near Area 6 would use 0.5 acre-feet per year of nonpotable water. • A one-time nonpotable water demand of 20 acre-feet to prime a geothermal power plant. Once operational, the geothermal power plant would use 50 acre-feet of water per year.

	No Action Alternative	Expanded Operations Alternative	Reduced Operations Alternative	Preferred Alternative
Commercial Solar Power Generation Facilities				
Construction	350 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision	1,000 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision	200 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision	350 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision
Operation	250 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision These water demands are below the sustainable yield of the Fortymile Canyon, Jackass Flats Subdivision Basin (4,000 acre-feet per year).	700 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision These water demands are below the sustainable yield of the Fortymile Canyon, Jackass Flats Subdivision Basin (4,000 acre-feet per year).	175 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision These water demands are below the sustainable yield of the Fortymile Canyon, Jackass Flats Subdivision Basin (4,000 acre-feet per year).	250 acre-feet per year from Fortymile Canyon, Jackass Flats Subdivision These water demands are below the sustainable yield of the Fortymile Canyon, Jackass Flats Subdivision Basin (4,000 acre-feet per year).
Biological Resources (for details go to Chapter 5, Sections 5.1.7, 5.1.7.1.1, 5.1.7.2, and 5.1.7.3)				
National Security/ Defense Mission	Approximately 295 acres of currently undisturbed desert tortoise habitat would be affected by activities in Frenchman Flat, Yucca Flat, Jackass Flats, Mercury Valley, and Fortymile Canyon. Estimated number of desert tortoises affected ranges from 4 to 21, all by harassment.	Approximately 1,930 acres of currently undisturbed desert tortoise habitat would be affected in the same areas as under the No Action Alternative. Estimated number of desert tortoises affected ranges from 30 to 136, all by harassment.	Approximately 160 acres of currently undisturbed desert tortoise habitat would be affected in the same areas as under the No Action Alternative. Estimated number of desert tortoises affected ranges from 2 to 11, all by harassment.	Approximately 1,910 acres of currently undisturbed desert tortoise habitat would be affected in the same areas as under the No Action Alternative. Estimated number of desert tortoises affected ranges from 30 to 136, all by harassment.
	Total new disturbed area (about 700 acres) would be 0.09 percent of undisturbed land on the NNSS.	Total new disturbed area (about 13,455 acres) would be 1.70 percent of undisturbed land on the NNSS.	Total new disturbed area (about 430 acres) would be 0.05 percent of undisturbed land on the NNSS.	Total new disturbed area (about 3,455 acres) would be 0.47 percent of undisturbed land on the NNSS.
Environmental Management Mission	Approximately 760 acres of currently undisturbed desert tortoise habitat would be affected, primarily by environmental restoration activities in Frenchman Flat, Yucca Flat, Jackass Flats, and Mercury Valley. Estimated number of desert tortoises affected ranges from 4 to 26, all by harassment.	Approximately 1,205 acres of currently undisturbed desert tortoise habitat would be affected because of additional waste management activities. Estimated number of desert tortoises affected ranges from 4 to 33, all by harassment.	Same as under the No Action Alternative.	Approximately 1,205 acres of currently undisturbed desert tortoise habitat would be affected because of additional waste management activities. Estimated number of desert tortoises affected ranges from 4 to 33, all by harassment.
	Total new disturbed area (about 1,110 acres) would be 0.14 percent of undisturbed land on the NNSS.	Total new disturbed area (about 1,555 acres) would be 0.2 percent of undisturbed land on the NNSS.		Total new disturbed area (about 1,555 acres) would be 0.2 percent of undisturbed land on the NNSS.
Nondefense Mission	Over the next 10 years, up to 125 desert tortoises would be taken on NNSS roadways, due to non-project vehicle travel. Fewer than 20 of these desert tortoises are expected to be taken by injury or mortality.	Over the next 10 years, up to 125 desert tortoises would be taken on NNSS roadways, due to non-project vehicle travel. Fewer than 20 of these desert tortoises are expected to be taken by injury or mortality.	Over the next 10 years, up to 125 desert tortoises would be taken on NNSS roadways, due to non-project vehicle travel. Fewer than 20 of these desert tortoises are expected to be taken by injury or mortality.	Over the next 10 years, up to 125 desert tortoises would be taken on NNSS roadways, due to non-project vehicle travel. Fewer than 20 of these desert tortoises are expected to be taken by injury or mortality.
	Approximately 2,650 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury	Approximately 10,535 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury Valley, and	Approximately 1,200 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury Valley, and	Approximately 2,885 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury

	No Action Alternative	Expanded Operations Alternative	Reduced Operations Alternative	Preferred Alternative
	Valley, and Frenchman Flat would be affected by DOE/NNSA activities, including a 240-megawatt commercial solar power generation facility and associated transmission lines in Jackass Flats. Estimated number of desert tortoises affected ranges from 0 to 41, all by harassment.	Frenchman Flat would be affected by DOE/NNSA activities, including 1,000 megawatts of commercial solar power generation facilities and associated transmission lines in Jackass Flats. Estimated number of desert tortoises affected ranges from 4 to 178, all by harassment.	Frenchman Flat would be affected by DOE/NNSA activities, including a 100-megawatt commercial solar power generation facility in Jackass Flats. Estimated number of desert tortoises affected ranges from 0 to 19, all by harassment.	Valley, and Frenchman Flat would be affected by DOE/NNSA activities, including a 240-megawatt commercial solar power generation facility and associated transmission lines in Jackass Flats. Estimated number of desert tortoises affected ranges from 4 to 62, all by harassment.
	Total new disturbed area (about 2,650 acres) would be 0.34 percent of undisturbed land on the NNSS.	Total new disturbed area (about 10,867 acres) would be 1.37 percent of undisturbed land on the NNSS.	Total new disturbed area (about 1,200 acres) would be 0.15 percent of undisturbed land on the NNSS.	Total new disturbed area (about 3,167 acres) would be 0.40 percent of undisturbed land on the NNSS.
Air quality (for details go to Chapter 5, Sections 5.1.8, 5.1.8.1, 5.1.8.2, and 5.1.8.3 and Appendix D)				
Annual Average Operational Emissions in 2015 (tons per year)				
PM_{10}	6.8	20.1	4.4	7.9
$PM_{2.5}$	3.4	8.1	2.6	4.4
CO	123.3	160.9	109.8	155.6
NO_x	39.7	56.6	36.3	54.8
SO_2	0.73	1.1	0.43	0.80
VOCs	5.9	11.0	4.8	7.2
Lead	0.030	~0.010	0.0024	0.01
Hazardous air pollutants	0.41	0.53	0.40	0.53
CO_2-equivalent	39,690	49,303	38,045	49,298
Peak Year Construction Emissions (tons per year)				
PM_{10}	20.0	129.1	8.4	65.7
$PM_{2.5}$	6.0	35.6	2.6	16.8
CO	44.8	296.5	24.4	193.6
NO_x	56.0	388.6	24.4	218.9
SO_2	0.14	0.68	0.08	0.29
VOCs	6.2	41.6	2.8	23.1
Lead	0.0000089	0.000013	0.0000071	0.0000089
Hazardous air pollutants	0.038	0.058	0.030	0.038
CO_2-equivalent	5,686	21,158	2,774	5,689
Radiological Air Quality				
	No activities are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions.	Except for depleted uranium and radiotracer experiments, no additional activities are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions.	No activities are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions.	Except for depleted uranium and radiotracer experiments, no additional activities are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions.

	No Action Alternative	Expanded Operations Alternative	Reduced Operations Alternative	Preferred Alternative
Visual Resources (for details go to Chapter 5, Sections 5.1.9, 5.1.9.1, 5.1.9.2, and 5.1.9.3)				
National Security/ Defense Mission	No impacts on visual resources.	No impacts on visual resources.	No impacts on visual resources.	No impacts on visual resources.
Environmental Management Mission	No impacts on visual resources.	No impacts on visual resources.	No impacts on visual resources.	No impacts on visual resources.
Nondefense Mission	Construction and operation of a commercial solar power generation facility and associated transmission lines would disturb about over 2,650 acres of land and would reduce the visual quality from a Class B to a Class C rating in portions of Area 25 visible to viewers on U.S. Route 95.	Construction of approximately 200,000 square feet of additional facilities would be added to Desert Rock Airport that would have an adverse effect on visual resources visible from U.S. Route 95. Construction and operation of commercial solar power generation facilities and associated transmission lines over about 10,300 acres of land would reduce the visual quality from a Class B to a Class C rating in portions of Area 25 visible to viewers on U.S. Route 95. A Geothermal Demonstration Project could alter the visual character and reduce visual quality if facilities are built along U.S. Route 95.	Construction and operation of a commercial solar power generation facility over 1,200 acres of land may occur; if so, it would reduce the visual quality from a Class B to a Class C rating in portions of Area 25 visible to viewers on U.S. Route 95.	Construction and operation of a commercial solar power generation facility and associated transmission lines would disturb about 2,650 acres of land and would reduce the visual quality from a Class B to a Class C rating in portions of Area 25 visible to viewers on U.S. Route 95. Construction of approximately 200,000 square feet of additional facilities would be added to Desert Rock Airport that would have an adverse effect on visual resources visible from U.S. Route 95. A Geothermal Demonstration Project could alter the visual character and reduce visual quality if facilities are built along U.S. Route 95.
Cultural Resources (for details go to Chapter 5, Section 5.1.10, 5.5.1.10.1, 5.1.10.2, and 5.1.10.3)				
National Security/ Defense Mission	Approximately 700 acres of undisturbed land would be affected by activities in Frenchman Flat, Yucca Flat, Jackass Flats, Mercury Valley, and Fortymile Canyon. An estimated 24 cultural resources sites would be involved, of which an estimated 10 may be NRHP-eligible.	Approximately 13,455 acres of undisturbed land would be affected in the same areas as under the No Action Alternative. An estimated 624 cultural resources sites would be involved, of which an estimated 265 may be NRHP-eligible.	Approximately 430 acres of undisturbed land would be affected in the same areas as under the No Action Alternative. An estimated 16 cultural resources sites would be involved, of which an estimated 6 may be NRHP-eligible.	Approximately 3,335 acres of undisturbed land would be affected in the same areas as under the No Action Alternative. An estimated 180 cultural resources sites would be involved, of which an estimated 63 may be NRHP-eligible.
Environmental Management Mission	Approximately 1,110 acres of undisturbed land would be affected, primarily by environmental restoration activities in Frenchman Flat, Yucca Flat, Jackass Flats, Emigrant Valley, Mercury Valley, and Fortymile Canyon. An estimated 29 cultural resources sites would be involved, of which an estimated 7 may be NRHP-eligible.	Approximately 1,555 acres of undisturbed land would be affected because of additional waste management activities. An estimated 43 cultural resources sites would be involved, of which an estimated 12 may be NRHP-eligible.	Same as under the No Action Alternative.	Approximately 1,555 acres of undisturbed land would be affected because of additional waste management activities. An estimated 43 cultural resources sites would be involved, of which an estimated 12 may be NRHP-eligible.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Nondefense Mission	No impacts on cultural resources for DOE/NNSA infrastructure and energy conservation activities.	Approximately 517 acres of undisturbed land would be affected by DOE/NNSA infrastructure and renewable energy projects. An estimated 15 cultural resources sites may be involved, of which an estimated 6 would be NRHP-eligible.	Same as under the No Action Alternative.	Approximately 517 acres of undisturbed land would be affected by DOE/NNSA infrastructure and renewable energy projects. An estimated 15 cultural resources sites may be involved, of which an estimated 6 would be NRHP-eligible.
	Approximately 2,650 acres of undisturbed land in the Jackass Flats area would be affected by development of a 240-megawatt commercial solar power generation facility and associated transmission lines. An estimated 1,802 cultural resources sites would be involved, of which an estimated 557 would be NRHP-eligible.	Approximately 10,300 acres of undisturbed land in the Jackass Flats area would be affected by development of up to 1,000 megawatts of commercial solar generation facilities and associated transmission lines. An estimated 7,004 cultural resources sites would be involved, of which an estimated 2,163 would be NRHP-eligible. Approximately 50 acres of undisturbed land would be affected by development of a Geothermal Demonstration Project in the Yucca Flat area. An estimated 2 cultural resources sites may be involved, of which 1 would be NRHP-eligible.	Approximately 1,200 acres of undisturbed land in the Jackass Flats area would be affected by development of a 100-megawatt commercial solar power generation facility. An estimated 816 cultural resources sites would be involved, of which an estimated 252 may be NRHP-eligible.	Approximately 2,650 acres of undisturbed land in the Jackass Flats area would be affected by development of a commercial solar power generation facility and associated transmission lines. An estimated 1,802 cultural resources sites would be involved, of which an estimated 557 would be NRHP-eligible.
Waste Management (10-year volumes) (for details go to Chapter 5, Sections 5.1.11.1, 5.1.11.2, and 5.1.11.3)				
LLW	15,000,000 cubic feet of LLW is within the disposal capacity of the Area 5 RWMC.	48,000,000 cubic feet of LLW is within the disposal capacity of the Area 3 RWMS and the Area 5 RWMC. [i]	Same as under the No Action Alternative.	48,000,000 cubic feet of LLW is within the disposal capacity of the Area 3 RWMS and the Area 5 RWMC. [i]
MLLW	900,000 cubic feet of MLLW is within the permitted disposal capacity of Cell 18 in the Area 5 RWMC.	Disposal of 4,000,000 cubic feet of MLLW would require additional permitted MLLW disposal capacity at the Area 5 RWMC.	Same as under the No Action Alternative.	Disposal of 4,000,000 cubic feet of MLLW would require additional permitted MLLW disposal capacity at the Area 5 RWMC.
TRU waste	9,600 cubic feet generated by DOE/NNSA activities in Nevada. All TRU waste disposed within available capacity at WIPP.	19,000 cubic feet generated by DOE/NNSA activities in Nevada. All TRU waste disposed within available capacity at WIPP.	7,100 cubic feet generated by DOE/NNSA activities in Nevada. All TRU waste disposed within available capacity at WIPP.	19,000 cubic feet generated by DOE/NNSA activities in Nevada. All TRU waste disposed within available capacity at WIPP.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Hazardous waste	Total of 210,000 cubic feet, including 42,000 cubic feet generated by a commercial solar power generation facility. All would be recycled, treated, and/or disposed within available offsite capacity. Disposal of hazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS hazardous waste management capabilities would not be impacted under current permit conditions.	Total of 340,000 cubic feet, including 170,000 cubic feet generated by commercial solar power generation facilities. All would be recycled, treated, and/or disposed within available offsite capacity. Disposal of hazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS hazardous waste management capabilities would not be impacted under current permit conditions.	Total of 190,000 cubic feet, including 17,000 cubic feet generated by a commercial solar power generation facility. All would be recycled, treated, and/or disposed within available offsite capacity. Disposal of hazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS hazardous waste management capabilities would not be impacted under current permit conditions.	Total of 212,000 cubic feet, including 42,000 cubic feet generated by a commercial solar power generation facility. All would be recycled, treated, and/or disposed within available offsite capacity. Disposal of hazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS hazardous waste management capabilities would not be impacted under current permit conditions.
Solid waste	Total of 3,800,000 cubic feet, including 3,700,000 cubic feet generated by DOE/NNSA activities in Nevada and 160,000 cubic feet generated by operation of a 240-megawatt commercial solar power generation facility. DOE/NNSA solid waste disposed at the NNSS would not exceed the disposal capacity at NNSS landfills. Included in the DOE/NNSA volume are 370,000 cubic feet that would be transported off site to be recycled within available offsite capacity. Disposal of nonhazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS disposal capacity would not be impacted under current permit conditions.	Total of 10,000,000 cubic feet, including 9,400,000 cubic feet generated by DOE/NNSA activities in Nevada and 630,000 cubic feet generated by operation of 1,000 megawatts of commercial solar power generation facilities. DOE/NNSA solid waste disposed at the NNSS would not exceed the disposal capacity at NNSS landfills. Included in the DOE/NNSA volume are 970,000 cubic feet that would be transported off site to be recycled within available offsite capacity. Disposal of nonhazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS disposal capacity would not be impacted under current permit conditions.	Total of 3,700,000 cubic feet, including 3,600,000 cubic feet generated by DOE/NNSA activities in Nevada and 77,000 cubic feet generated by operation of a 100-megawatt commercial solar power generation facility. DOE/NNSA solid waste disposed at the NNSS would not exceed the available capacity at NNSS landfills. Included in the DOE/NNSA volume are 360,000 cubic feet that would be transported off site to be recycled within available offsite capacity. Disposal of nonhazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS disposal capacity would not be impacted under current permit conditions.	Total of 9,560,000 cubic feet, including 9,400,000 cubic feet generated by DOE/NNSA activities in Nevada and 160,000 cubic feet generated by operation of a 240-megawatt commercial solar power generation facility. DOE/NNSA solid waste disposed at the NNSS would not exceed the disposal capacity at NNSS landfills. Included in the DOE/NNSA volume are 970,000 cubic feet that would be transported off site to be recycled within available offsite capacity. Disposal of nonhazardous solid waste generated by a commercial solar power generation facility would be the responsibility of that project. NNSS disposal capacity would not be impacted under current permit conditions.

	No Action Alternative		***Expanded Operations Alternative***		***Reduced Operations Alternative***		***Preferred Alternative***	
Human Health (for details go to Chapter 5, Sections 5.1.12, 5.1.12.1, 5.1.12.2, and 5.1.12.3, and Appendix G)								
Annual Radiological Impacts of Normal Operations (for details go to Chapter 5, Sections 5.1.12.1.1, 5.1.12.1.2, 5.1.12.1.3, and 5.1.12.1.4 and Appendix G)								
Offsite Population								
Collective Dose (person-rem)	0.50		0.89		0.48		0.89	
LCF risk	3×10^{-4}		5×10^{-4}		3×10^{-4}		5×10^{-4}	
MEI								
Dose (millirem)	2.8		4.8		2.7		4.8	
LCF risk	2×10^{-6}		3×10^{-6}		2×10^{-6}		3×10^{-6}	
Workers								
Collective Dose (person-rem)	5.2		6.6		4.8		6.6	
LCF risk	3×10^{-3}		4×10^{-3}		3×10^{-3}		4×10^{-3}	
Subsistence Consumer [b]								
Dose (millirem)	13		15		13		15	
Risk (LCF)	8×10^{-6}		9×10^{-6}		8×10^{-6}		9×10^{-6}	
Annual Industrial Accident Incidence Rate (unless noted otherwise)								
	TRC	***DART***	***TRC***	***DART***	***TRC***	***DART***	***TRC***	***DART***
Nevada National Security Site, including Commercial Solar Power Facility Operations	32	14	44	20	28	13	41.9	19
Commercial Solar Power Generation Facility – Operations	6.2	3.2	8.3	4.2	5.2	2.7	6.2	3.2
Commercial Solar Power Generation Facility – Construction (per project duration) [c]	60	31	110	56	44	23	60	31
Annual Industrial Accident Fatality Rates								
Nevada National Security Site, including Commercial Solar Power Facility – Operations (maximum annual incidence) [d]	0.019		0.031		0.015		0.021	
Commercial Solar Power Generation Facility – Construction (during construction period)	0.019 [e]		0.029 [f]		0.015 [g]		0.019	

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Noise Impacts				
Workers	Mitigated through worker protection practices.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Mitigated through worker protection practices.
Public	Minimal due to remoteness of site and distance to receptors.	Same as under the No Action Alternative, but there would be some increased traffic noise due to larger workforce and increase in daily truck trips.	Similar to the No Action Alternative, but slightly reduced due to smaller workforce.	Same as under the No Action Alternative, but there would be some increased traffic noise due to larger workforce and increase in daily truck trips.
Facility Accident – Dose Consequence and Annual Risk [h] (for details go to Chapter 5, Sections 5.1.12.2.1, 5.1.12.2.2, and 5.1.12.2.3, and Appendix G)				
Highest Risk Facility Accident – DAF explosion involving 55 pounds of high explosive and 1 kilogram of plutonium (assumed frequency 1 in 1,250 years)				
Offsite Population				
Dose (person-rem)	23	Same as under the No Action Alternative.	Same as under the No Action Alternative.	23
LCF risk per year	1×10^{-5}	Same as under the No Action Alternative.	Same as under the No Action Alternative.	1×10^{-5}
MEI				
Dose (rem)	0.18	Same as under the No Action Alternative.	Same as under the No Action Alternative.	0.18
LCF risk per year	9×10^{-8}	Same as under the No Action Alternative.	Same as under the No Action Alternative.	9×10^{-8}
Noninvolved Worker				
Dose (rem)	6.5	Same as under the No Action Alternative.	Same as under the No Action Alternative.	6.5
LCF risk per year	3×10^{-6}	Same as under the No Action Alternative.	Same as under the No Action Alternative.	3×10^{-6}

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Environmental Justice (for details go to Chapter 5, Sections 5.1.13.1, 5.1.13.2, and 5.1.13.3)				
	Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected. An increase in construction jobs for the solar power generation facility could provide jobs for unemployed individuals, which would have a beneficial impact on low-income individuals.	Same as under the No Action Alternative, except there would be a larger number of construction jobs created.	Same as under the No Action Alternative, except there would be fewer construction jobs created.	Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected. An increase in construction jobs for the solar power generation facility could provide jobs for unemployed individuals, which would have a beneficial impact on low-income individuals.

CO = carbon monoxide; CO_2-equivalent = carbon dioxide-equivalent; D&D = decontamination and decommissioning; DAF = Device Assembly Facility; DART = days away, restrictive, or transferred; FTE = full-time equivalent; LCF = latent cancer fatality; LLW = low-level radioactive waste; MEI = maximally exposed individual; MLLW = mixed low-level radioactive waste; NNSA = National Nuclear Security Administration; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; NRHP = National Register of Historic Places; OST = Office of Secure Transportation; PM_{n} = particulate matter with an aerodynamic diameter of *n* micrometers or less; rem = roentgen equivalent man; RWMC = Radioactive Waste Management Complex; RWMS = Radioactive Waste Management Site; SO_2 = sulfur dioxide; TRC = total recordable cases; TRU = transuranic waste; UGTA = Underground Test Area; VOC = volatile organic compound; WIPP = Waste Isolation Pilot Plant.

[a] The reported radiological risks are the projected number of LCFs in the population and are therefore presented as whole numbers. The calculated value is shown in parentheses.

[b] Potential dose to a subsistence consumer includes the MEI dose plus a 10-millirem per year dose from consuming crops raised in soil contaminated by past testing and contaminated game animals. The latter dose component would be independent of current site operations.

[c] Based on 500 full-time equivalent workers for a 35-month construction period for the No Action Alternative; 750 full-time equivalent workers for a 42-month construction period for the Expanded Operations Alternative; and 400 full-time equivalent workers for a 32-month construction period for the Reduced Operations Alternative.

[d] Annual value includes value from DOE/NNSA construction activities and an annualized rate from solar power generation facility construction (see footnotes e, f, and g).

[e] Annualized value based on 500 full-time equivalent workers for a 35-month solar power generation facility construction period.

[f] Annualized value based on 750 full-time equivalent workers for a 42-month solar power generation facility construction period.

[g] Annualized value based on 400 full-time equivalent workers for a 32-month solar power generation facility construction period.

[h] The risk is the annual increased likelihood of an LCF in the MEI or the noninvolved worker or the increased likelihood of a single LCF occurring in the offsite population, accounting for the estimated probability (frequency) of the accident occurring.

[i] Reactivation of the Area 3 RWMS would only occur based upon mission need and as stated in 4.1.11.1.1.1, including detailed consultation with the State of Nevada.

Table 3–5 Summary of Potential Impacts at the Remote Sensing Laboratory

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use (for details go to Chapter 5, Section 5.2.1)				
	No impacts were identified from the continuation of activities at the current levels of operations or foreseeable actions because activities under this alternative would continue to be compatible with existing land use designations on Nellis Air Force Base.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No impacts were identified from the continuation of activities at the current levels of operations or actions because activities under this alternative would continue to be compatible with existing land use designations on Nellis Air Force Base.
Infrastructure and Energy (for details go to Chapter 5, Sections 5.2.2.1, and 5.2.2.2, and 5.2.2.3)				
	Infrastructure would be maintained as needed to accommodate ongoing activities. No new buildings or facilities are planned. Energy demand is expected to continue at about 4,850 megawatt-hours per year and the existing electrical distribution is adequate to support this demand. Natural gas use is expected to continue to be about 33,673 therms per year. There is adequate capacity to serve this demand and the condition of the gas lines is satisfactory. Approximately 11,000 gallons of JP-8 jet fuel are used each year for aircraft operations. An adequate supply of JP-8 fuel is available directly through Nellis Air Force Base.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Infrastructure would be maintained as needed to accommodate ongoing activities. No new buildings or facilities are planned. Energy demand is expected to continue at about 4,850 megawatt-hours per year and the existing electrical distribution is adequate to support this demand. Natural gas use is expected to continue to be about 33,673 therms per year. There is adequate capacity to serve this demand and the condition of the gas lines is satisfactory. Approximately 11,000 gallons of JP-8 jet fuel are used each year for aircraft operations. An adequate supply of JP-8 fuel is available directly through Nellis Air Force Base.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Transportation and Traffic (for details go to Chapter 5, Sections 5.2.3.1, and 5.2.3.2)				
Transportation	No radioactive materials transported. Nonradioactive material transports are included in Nevada National Security Site impacts.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No radioactive materials transported. Nonradioactive material transports are included in Nevada National Security Site impacts.
Traffic	The number of personnel at RSL is expected to remain the same, and there are no construction or other projects proposed that would result in increased traffic. There would be no additional impacts on onsite or regional traffic conditions.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	The number of personnel at RSL is expected to remain the same, and there are no construction or other projects proposed that would result in increased traffic. There would be no additional impacts on onsite or regional traffic conditions.
Socioeconomics (for details go to Chapter 5, Section 5.2.4)				
	There would be no change in employment; therefore, there would be no change in socioeconomic impacts.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no change in employment; therefore, there would be no change in socioeconomic impacts.
Geology and Soils (for details go to Chapter 5, Section 5.2.5)				
	There would be no impacts on geological and soil resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no impacts on geological and soil resources.
Hydrology (for details go to Chapter 5, Sections 5.2.6.1, 5.2.6.2, and 5.2.6.3)				
Surface Water Resources	No proposed activities would affect surface hydrology.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No proposed activities would affect surface hydrology.
Groundwater Resources	No proposed facilities or activities would adversely affect groundwater quality or supply.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No proposed facilities or activities would adversely affect groundwater quality or supply.
Biological Resources (for details go to Chapter 5, Section 5.2.7)				
	All activities would occur in previously disturbed, developed areas and would not affect biological resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	All activities would occur in previously disturbed, developed areas and would not affect biological resources.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Air Quality (for details go to Chapter 5, Sections 5.2.8.1.1, 5.2.8.1.2, and 5.2.8.1.3)				
Annual Average Operational Emissions in 2015 (tons per year)				
PM_{10}	0.084	Same as under the No Action Alternative.	Same as under the No Action Alternative.	0.084
$PM_{2.5}$	0.067			0.067
CO	4.1			4.1
NO_x	1.6			1.6
SO_2	0.034			0.034
Volatile organic compounds	0.3			0.3
Lead	~0.01			~0.01
Hazardous air pollutants	0.19			0.19
CO_2-equivalent	3,147			3,147
Radiological Air Quality	No activities are expected to produce radiation beyond those documented for 2008 baseline conditions.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No activities are expected to produce radiation beyond those documented for 2008 baseline conditions.
Visual Resources (for details go to Chapter 5, Sections 5.2.9.1, 5.2.9.2, and 5.1.9.3)				
	There would be no impacts on visual resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no impacts on visual resources.
Cultural Resources (for details go to Chapter 5, Section 5.2.10)				
	All activities would occur in previously disturbed, developed areas and would not affect cultural resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	All activities would occur in previously disturbed, developed areas and would not affect cultural resources.
Waste Management (for details go to Chapter 5, Section 5.2.11)				
Hazardous waste	Annually, about 680 cubic feet of hazardous waste generated and transported to be recycled, treated, and/or disposed within available offsite capacity.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Annually, about 680 cubic feet of hazardous waste generated and transported to be recycled, treated, and/or disposed within available offsite capacity.
Solid waste	Annually, about 4,550 cubic feet generated and transported to be recycled or disposed within available offsite capacity.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Annually, about 4,550 cubic feet generated and transported to be recycled or disposed within available offsite capacity.

	No Action Alternative		*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*	
Human Health (for details go to Chapter 5, Sections 5.2.12, 5.2.12.1, and 5.2.12.2)						
Normal Operations	There would be no radiological or hazardous chemical risks.		Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no radiological or hazardous chemical risks.	
Annual Industrial Accident Incidence Rate	***TRC***	***DART***	Same as under the No Action Alternative.	Same as under the No Action Alternative.	***TRC***	***DART***
	32	14			32	14
Noise	Noise from RSL activities and traffic would be minimal compared to ambient traffic noise and aircraft noise at Nellis Air Force Base.		Same as under the No Action Alternative.	Same as under the No Action Alternative.	Noise from RSL activities and traffic would be minimal compared to ambient traffic noise and aircraft noise at Nellis Air Force Base.	
Facility Accidents	There would be no radiological or hazardous chemical accident risks.		Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no radiological or hazardous chemical accident risks.	
Environmental Justice (for details go to Chapter 5, Section 5.2.13, 5.2.13.1, 5.2.13.2, and 5.2.13.3)						
	Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected.		Same as under the No Action Alternative.	Same as under the No Action Alternative.	Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected.	

CO = carbon monoxide; CO_2-equivalent = carbon dioxide-equivalent; DART = days away, restrictive, or transferred; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter of *n* micrometers or less; RSL = Remote Sensing Laboratory; SO_2 = sulfur dioxide; TRC = total recordable cases; VOC = volatile organic compound.

Table 3–6 Summary of Potential Impacts at the North Las Vegas Facility

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use (for details go to Chapter 5, Section 5.3.1)				
	No impacts were identified from the continuation of activities at the current levels of operations or foreseeable actions because activities under this alternative would continue to be compatible with existing land use designations.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No impacts were identified from the continuation of activities at the current levels of operations or foreseeable actions because activities under this alternative would continue to be compatible with existing land use designations.
Infrastructure and Energy (for details go to Chapter 5, Sections 5.3.2.1 and 5.3.2.2)				
	Infrastructure would be maintained as needed to accommodate ongoing activities. No new buildings or facilities are planned. Electric energy demand is expected to continue at about 15,000 megawatt-hours per year and the existing electrical distribution is adequate to support this demand. Natural gas use is expected to continue to be about 48,000 therms per year. There is adequate capacity to serve this demand.	Same as under the No Action Alternative for infrastructure. Electric energy demand would increase by no more than 10 percent. The capacity of the electrical distribution system and the capability of commercial providers are adequate to supply the needed electrical energy.	Same as under the No Action Alternative for infrastructure. Electrical energy demand is expected to be the same as under the No Action Alternative or slightly lower.	Infrastructure would be maintained as needed to accommodate ongoing activities. No new buildings or facilities are planned. Electric energy demand would increase by no more than 10 percent, for a total of 16,500 megawatt-hours per year, and the existing electrical distribution is adequate to support this demand. Natural gas use is expected to continue to be about 48,000 therms per year. There is adequate capacity to serve this demand.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Transportation [a] (for details go to Chapter 5, Sections 5.3.3.1 and 5.3.3.2)				
Transportation	No radioactive materials analyzed. Nonradioactive material transports are included in NNSS impacts.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No radioactive materials analyzed. Nonradioactive material transports are included in NNSS impacts.
Traffic	No increase in traffic volume due to NLVF-related traffic compared to the projected baseline; levels of service would remain the same.	Approximately a 2 percent increase in daily traffic volumes during peak hours on local roads, when compared to the projected baseline; levels of service would remain the same.	Less than 1 percent decrease in daily traffic volumes during peak hours on local roads; levels of service would remain the same.	Approximately a 2 percent increase in daily traffic volumes during peak hours on local roads, when compared to the projected baseline; levels of service would remain the same.
Socioeconomics (for details go to Chapter 5, Sections 5.3.4.1, 5.3.4.2, and 5.3.4.3)				
	There would be no change in employment; therefore, there would be no change in socioeconomic impacts.	Employment would increase by 361 FTEs; about 36 employees would relocate from outside the region. Up to 3 new teaching jobs would need to be filled to maintain the current student-to-teacher ratio. Sufficient housing exists in the region to support the increased population. Direct jobs would reduce unemployment by 0.27 and 0.12 percent in Clark and Nye Counties, respectively. Direct jobs and indirect jobs would have a beneficial effect on the local economy and government revenues. The addition of 361 employees would result in an increase in the number of service calls, but would have a negligible impact on area hospitals and hospital personnel.	Employment would decrease by 45 FTEs, increasing unemployment in Clark County by about 0.12 percent and in Nye County by about 0.04 percent. Additional employees would not relocate to Clark or Nye County and there would be no impact on student-to-teacher ratios. Job loss would have a small negative impact on the local economy and government revenues. There would be no impact on public services.	Employment would increase by 361 FTEs; about 36 employees would relocate from outside the region. Up to 3 new teaching jobs would need to be filled to maintain the current student-to-teacher ratio. Sufficient housing exists in the region to support the increased population. Direct jobs would reduce unemployment by 0.27 and 0.12 percent in Clark and Nye Counties, respectively. Direct jobs and indirect jobs would have a beneficial effect on the local economy and government revenues. The addition of 361 employees would result in an increase in the number of service calls, but would have a negligible impact on area hospitals and hospital personnel.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Geology and Soils(for details go to Chapter 5, Sections 5.3.5.1, 5.3.5.2, and 5.3.5.3)				
	Proposed activities would not affect geological and soil resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Proposed activities would not affect geological and soil resources.
Hydrology (for details go to Chapter 5, Sections 5.3.6.1, and 5.3.4.2)				
Surface Water Resources	Proposed activities would not affect surface hydrology.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Proposed activities would not affect surface hydrology.
Groundwater Resources	Proposed activities would not adversely affect groundwater quality or supply.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Proposed activities would not adversely affect groundwater quality or supply.
Biological Resources (for details go to Chapter 5, Sections 5.3.7)				
	All activities would occur in previously disturbed, developed areas and would not affect native biological resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	All activities would occur in previously disturbed, developed areas and would not affect native biological resources.
Air Quality (for details go to Chapter 5, Sections 5.3.8.1, 5.3.8.2, and 5.3.8.3)				
Annual Average Operational Emission in 2015 (tons per year)				
PM_{10}	0.36	0.44	0.33	0.44
$PM_{2.5}$	0.24	0.28	0.21	0.28
CO	24.4	30.5	22.0	30.5
NO_x	5.9	7.2	5.4	7.2
SO_2	0.079	0.095	0.072	0.095
VOCs	0.77	0.96	0.70	0.96
Lead	<0.01	<0.01	<0.01	<0.01
Hazardous air pollutants	0.062	0.078	0.056	0.078
CO_2-equivalent	8,378	9,031	8,118	9,031
Radiological Air Quality	No activities are expected to produce radiation beyond those documented for 2008 baseline conditions.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No activities are expected to produce radiation beyond those documented for 2008 baseline conditions.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Visual Resources (for details go to Chapter 5, Sections 5.3.9.1, 5.3.9.2, and 5.3.9.3)				
	There would be no impacts on visual resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no impacts on visual resources.
Cultural Resources (for details go to Chapter 5, Section 5.3.10)				
	All activities would occur in previously disturbed, developed areas and would not affect cultural resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	All activities would occur in previously disturbed, developed areas and would not affect cultural resources.
Waste Management (for details go to Chapter 5, Section 5.3.11)				
LLW	150 cubic feet generated over the next 10 years and disposed within available capacity at the NNSS in the Area 5 RWMC.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	150 cubic feet generated over the next 10 years and disposed within available capacity at the NNSS in the Area 5 RWMC.
Hazardous waste	1,100 cubic feet generated over the next 10 years and shipped off site to be recycled, treated, and/or disposed within available capacity.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	1,100 cubic feet generated over the next 10 years and shipped off site to be recycled, treated, and/or disposed within available capacity.
Solid waste	500,000 cubic feet generated over the next 10 years and shipped off site to be recycled or disposed within available capacity.	590,000 cubic feet generated over the next 10 years and shipped off site to be recycled or disposed within available capacity.	460,000 cubic feet generated over the next 10 years and shipped off site to be recycled or disposed within available capacity.	590,000 cubic feet generated over the next 10 years and shipped off site to be recycled or disposed within available capacity.

	No Action Alternative		*Expanded Operations Alternative*		*Reduced Operations Alternative*		*Preferred Alternative*	
Human Health (for details go to Chapter 5, Sections 5.3.12.1 and 5.3.12.2)								
Offsite Population Collective Dose (person-rem) LCF risk MEI or noninvolved worker Dose (millirem) LCF risk	4.1×10^{-5} 2×10^{-8} 3.5×10^{-4} 2×10^{-10}		Same as under the No Action Alternative.		Same as under the No Action Alternative.		4.1×10^{-5} 2×10^{-8} 3.5×10^{-4} 2×10^{-10}	
Annual Industrial Accident Incidence Rate								
North Las Vegas Facility – Site Operations	***TRC***	***DART***	***TRC***	***DART***	***TRC***	***DART***	***TRC***	***DART***
	22	9.5	27	12	20	8.6	27	12
Noise	Noise from NLVF-related activities and traffic would not exceed ambient traffic noise.		Same as under the No Action Alternative.		Same as under the No Action Alternative.		Noise from NLVF-related activities and traffic would not exceed ambient traffic noise.	
Facility Accidents	There would be negligible radiological or hazardous chemical accident risks.		Same as under the No Action Alternative.		Same as under the No Action Alternative.		There would be negligible radiological or hazardous chemical accident risks.	
Environmental Justice (for details go to Chapter 5, Sections 5.3.13.1, 5.3.13.2, and 5.3.13.3)								
	Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected.		Same as under the No Action Alternative.		Same as under the No Action Alternative.		Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected.	

CO = carbon monoxide; CO_2-equivalent = carbon dioxide-equivalent; DART=days away, restrictive, or transferred; FTE = full-time equivalent; LCF = latent cancer fatality; LLW = low-level radioactive waste; MEI = maximally exposed individual; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter of *n* micrometers or less; rem = roentgen equivalent man; RWMC = Radioactive Waste Management Complex; SO_2 = sulfur dioxide; TRC = total recordable cases; VOC = volatile organic compound.

[a] Does not include tritiated liquids shipped from NLVF to the NNSS for treatment.

[b] The volumes of LLW generated at NLVF under the three alternatives shown in this table are included in the volumes of LLW to be disposed at the NNSS under the appropriate alternatives in Table 3–4.

Table 3–7 Summary of Potential Impacts at the Tonopah Test Range

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use (for details go to Chapter 5, Section 5.4.1)				
	There would be no impact on land use from the continuation of activities at the current levels of operations because activities would continue to be compatible with existing land use designations on the TTR and primary land uses on the Nevada Test and Training Range.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no impact on land use from the continuation of activities at the current levels of operations because activities would continue to be compatible with existing land use designations on the TTR and primary land uses on the Nevada Test and Training Range.
	<u>*Airspace*</u> No new impacts were identified for airspace activities because these activities would be maintained at the current level of air traffic, navigational aid services, airspace structure, and coordinated and scheduled by the Nellis Air Traffic Control Facility.	<u>*Airspace*</u> Same as under the No Action Alternative.	<u>*Airspace*</u> Impacts would be slightly reduced compared to the No Action Alternative because of the discontinuation of fixed rocket and missile launches, cruise missile operations, and detonation of fuel-air explosives at the TTR, which would increase the restricted airspace availability for other military uses as coordinated and scheduled by the Nellis Air Traffic Control Facility.	<u>*Airspace*</u> No new impacts were identified for airspace activities because these activities would be maintained at the current level of air traffic, navigational aid services, airspace structure, and coordinated and scheduled by the Nellis Air Traffic Control Facility.
Infrastructure and Energy (for details go to Chapter 5, Sections 5.4.2.1 and 5.3.4.2)				
	Infrastructure would be maintained as needed to accommodate ongoing activities. No new buildings or facilities are planned.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Infrastructure would be maintained as needed to accommodate ongoing activities. No new buildings or facilities are planned.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Transportation [a] and Traffic (for details go to Chapter 5, Sections 5.4.3.1 and 5.4.3.2)				
TTR LLW/MLLW				
Incident-free truck transport				
worker risk (LCF)	0 (9×10^{-6})	0 (0.0005)	0 (9×10^{-6})	0 (0.0005)
population risk (LCF)	0 (1×10^{-6})	0 (0.0002)	0 (1×10^{-6})	0 (0.0002)
Transport accidents				
radiological risk (LCF)	0 (1×10^{-12})	0 (6×10^{-11})	0 (1×10^{-12})	0 (6×10^{-11})
nonradiological fatalities	0 (0.002)	0 (0.1)	0 (0.002)	0 (0.1)
Nonradiological waste transport fatalities	Nonradioactive material transports included in NNSS impacts.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Nonradioactive material transports included in NNSS impacts.
Traffic	Up to 2 additional truck trips per day from Environmental Restoration Program radioactive waste transport; minimal impacts on onsite and regional traffic conditions.	Up to 10 additional truck trips per day from Environmental Restoration radioactive waste transport; minimal impacts on onsite and regional traffic conditions.	Same as under the No Action Alternative.	Up to 10 additional truck trips per day from Environmental Restoration Program radioactive waste transport; minimal impacts on onsite and regional traffic conditions.
Socioeconomics (for details go to Chapter 5, Sections 5.4.4.1, 5.4.4.2, and 5.4.4.3)				
	No change in employment; therefore, no change in socioeconomic impacts.	Employment would decrease by 63 FTEs, which would increase the unemployment rate by about 0.01 percent in Clark County and about 1.64 percent in Nye County. Local spending would decrease and revenues for Clark and Nye Counties could decrease. This small decrease would have a negligible adverse impact on local economies. There would be no impact on public services.	Employment would decrease by 67 FTEs, which would increase the unemployment rate by about 0.01 percent in Clark County and about 1.76 percent in Nye County. Local spending would decrease and revenues for Clark and Nye Counties could decrease. This small decrease would have a negligible adverse impact on local economies. There would be no impact on public services.	Employment would decrease by 63 FTEs, which would increase the unemployment rate by about 0.01 percent in Clark County and about 1.64 percent in Nye County. Local spending would decrease and revenues for Clark and Nye Counties could decrease. This small decrease would have a negligible adverse impact on local economies. There would be no impact on public services.

	No Action Alternative	Expanded Operations Alternative	Reduced Operations Alternative	Preferred Alternative
Geology and Soils (for details go to Chapter 5, Sections 5.4.5.1, 5.4.5.2, and 5.4.5.3)				
National Security/Defense Mission	There would be localized impacts on soil and geology from tests using gravity weapons, joint test assemblies, and inert projectiles. Some soil contamination could occur. Work for Others – Some localized soil disturbance from a variety of site activities.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be localized impacts on soil and geology from tests using gravity weapons, joint test assemblies, and inert projectiles. Some soil contamination could occur. Work for Others – Some localized soil disturbance from a variety of site activities.
Environmental Management Mission	Environmental restoration – Possible disturbance of soil from environmental restoration of contaminated sites, including Clean Slate 1, 2, and 3 at TTR. Overall, however, environmental restoration would reduce or stabilize the inventory of legacy contamination.	Same as under the No Action Alternative, plus: Up to 11,000,000 cubic feet of soil could be removed during environmental restoration activities at the Clean Slate 1, 2, and 3 sites. Overall, however, environmental restoration would reduce or stabilize the inventory of legacy contamination.	Same as under the No Action Alternative.	Up to 11,000,000 cubic feet of soil could be removed during environmental restoration activities at the Clean Slate 1, 2, and 3 sites. Overall, however, environmental restoration would reduce or stabilize the inventory of legacy contamination.
Nondefense Mission	There would be no impacts on geological and soil resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	There would be no impacts on geological and soil resources.
Hydrology (for details go to Chapter 5, Sections 5.4.6.1 and 5.4.5.2)				
Surface Water Resources				
National Security/Defense Mission	Gravity weapons drops and rocket and missile testing could cause alterations of natural drainage pathways and chemical contamination of ephemeral waters. Operation of ground-based remote control vehicles could cause sedimentation to ephemeral waters.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Gravity weapons drops and rocket and missile testing could cause alterations of natural drainage pathways and chemical contamination of ephemeral waters. Operation of ground-based remote control vehicles could cause sedimentation to ephemeral waters.
Environmental Management Mission	Environmental restoration projects could cause beneficial restoration of natural drainage pathways and adverse impacts of chemical contamination of and sedimentation to ephemeral waters.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Environmental restoration projects could cause beneficial restoration of natural drainage pathways and adverse impacts of chemical contamination of and sedimentation to ephemeral waters.
Nondefense Mission	No proposed activities would affect surface hydrology.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No proposed activities would affect surface hydrology.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Groundwater Resources				
	Proposed activities would not adversely affect groundwater quality or supply.	Same as under the No Action Alternative.	Potable water use would decrease by 50 percent compared to current use because several testing activities would cease.	Proposed activities would not adversely affect groundwater quality or supply.
Biological Resources (for details go to Chapter 5, Section 5.4.7.1)				
	All work would occur in previously disturbed areas and there would be no additional impacts on biological resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	All work would occur in previously disturbed areas and there would be no additional impacts on biological resources.
Air Quality and Climate (for details go to Chapter 5, Sections 5.4.8.1, 5.4.8.2, and 5.4.8.3)				
Annual Average Operational Emission in 2015 (tons per year) [b]				
PM_{10}	<4.0	<3.8	<3.8	<3.8
$PM_{2.5}$	<4.0	<3.8	<3.8	<3.8
CO	<10.8	<6.1	<5.8	<6.1
NO_x	<17.1	<14.8	<14.7	<14.8
SO_2	<0.93	<0.92	<0.92	<0.92
VOC	<1.4	<1.1	<1.1	<1.1
Lead	<0.010	<0.010	<0.010	<0.010
Hazardous air pollutants	<1.1	<1.1	<1.1	<1.1
CO_2-equivalent	3,652	1,790	1,671	1,790
Radiological Air Quality	No activities are expected to produce radiation beyond those documented for 2008 baseline conditions.	Remediation activities would likely result in increased suspended particulates and higher radiological air emissions relative to those observed in the 2008 baseline conditions. Monitoring would be performed to assess the potential for offsite impacts and the need for mitigating action.	Same as under the No Action Alternative.	Remediation activities would likely result in increased suspended particulates and higher radiological air emissions relative to those observed in the 2008 baseline conditions. Monitoring would be performed to assess the potential for offsite impacts and the need for mitigating action.
Visual Resources (for details go to Chapter 5, Sections 5.4.9.1, 5.4.9.2, and 5.4.9.3)				
	No impacts on visual resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No impacts on visual resources.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Cultural Resources (for details go to Chapter 5, Section 5.4.10)				
	All work would occur in previously disturbed areas. DOE/NNSA would consult with the State Historic Preservation Officer prior to environmental restoration of the Clean Slate 1, 2, and 3 sites because they are considered historically significant.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	All work would occur in previously disturbed areas. DOE/NNSA would consult with the State Historic Preservation Officer prior to environmental restoration of the Clean Slate 1, 2, and 3 sites because they are considered historically significant.
Waste Management [e] (for details go to Chapter 5, Section 5.4.11)				
LLW	200,000 cubic feet generated by Environmental Restoration Program activities would be disposed within available capacity at the NNSS Area 5 RWMC.	11,000,000 cubic feet generated by Environmental Restoration Program activities would be disposed within available capacity at the NNSS Area 5 RWMC and Area 3 RWMS.	Same as under the No Action Alternative.	11,000,000 cubic feet generated by Environmental Restoration Program activities would be disposed within available capacity at the NNSS Area 5 RWMC and Area 3 RWMS.
Hazardous waste	About 4,500 cubic feet of hazardous waste would be generated over the next 10 years that would be transported to permitted offsite facilities to be recycled, treated, and/or disposed within available capacity.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	About 4,500 cubic feet of hazardous waste would be generated over the next 10 years that would be transported to permitted offsite facilities to be recycled, treated, and/or disposed within available capacity.
Solid waste	33,000 cubic feet disposed at onsite landfills within available capacity. An additional 61,000 cubic feet recycled or disposed at the NNSS or other offsite facilities within available capacity.	16,000 cubic feet disposed at onsite landfills within available capacity. An additional 61,000 cubic feet recycled or disposed at the NNSS or other offsite facilities within available capacity.	15,000 cubic feet disposed at onsite landfills within available capacity. An additional 61,000 cubic feet recycled or disposed at the NNSS or other offsite facilities within available capacity.	16,000 cubic feet disposed at onsite landfills within available capacity. An additional 61,000 cubic feet recycled or disposed at the NNSS or other offsite facilities within available capacity.

		No Action Alternative		***Expanded Operations Alternative***		***Reduced Operations Alternative***		***Preferred Alternative***	
Human Health (for details go to Chapter 5, Sections 5.4.12.1 and 5.4.12.2)									
Annual Radiological Impacts of Normal Operations due to Legacy Soil Contamination									
Offsite Population	Dose (person-rem) Risk (LCFs)	<1 $<6 \times 10^{-4}$		Same as under the No Action Alternative.		Same as under the No Action Alternative.		<1 $<6 \times 10^{-4}$	
MEI	Dose (millirem) Risk (LCFs)	0.024 1.4×10^{-8}						0.024 1.4×10^{-8}	
Annual Industrial Accident Incidence Rate									
Tonopah Test Range Industrial – Site Operations		***TRC***	***DART***	***TRC***	***DART***	***TRC***	***DART***	***TRC***	***DART***
		1.6	0.7	0.7	0.3	0.6	0.3	0.7	0.3
Noise Impacts									
	Workers	Mitigated through worker protection practices.		Same as under the No Action Alternative.		Same as under the No Action Alternative.		Mitigated through worker protection practices.	
	Public	Large noises and traffic noise mitigated due to remoteness of site and distance to receptors.		Same as under the No Action Alternative, plus: Minimal increase from higher level of traffic		Same as under the No Action Alternative, except: No large noises – fuel-air explosive experiments would not occur.		Large noises and traffic noise mitigated due to remoteness of site and distance to receptors.	
Facility Accidents – Dose Consequence and Annual Risk [c] *Highest Risk Accident (Aircraft crash and fire into multiple containers of contaminated soil - estimated frequency 1 in 590,000 per year)*									
Offsite Population	Dose (person-rem) Risk (LCFs per year)	0.012 1×10^{-11}		Same as under the No Action Alternative.		Same as under the No Action Alternative.		0.012 1×10^{-11}	
MEI	Dose (rem) Risk (LCFs per year)	0.00034 3×10^{-13}						0.00034 3×10^{-13}	
Noninvolved Worker	Dose (rem) Risk (LCFs per year)	1.5 2×10^{-9}						1.5 2×10^{-9}	

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Environmental Justice				
	Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected.			Impacts on low-income and minority populations would be identical to those of the general population. Therefore, no disproportionately high and adverse impacts on minority or low-income populations are expected.

CO = carbon monoxide; CO_2-equivalent = carbon dioxide-equivalent; DART = days away, restrictive, or transferred; FTE = full-time equivalent; LCF = latent cancer fatality; LLW = low-level radioactive waste; MEI = maximally exposed individual; MLLW = mixed low-level radioactive waste; NNSA = National Nuclear Security Administration; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter of *n* micrometers or less; rem = roentgen equivalent man; RWMC = Radioactive Waste Management Complex; RWMS = Radioactive Waste Management Site; SO_2 = sulfur dioxide; TRC = total recordable cases; TTR = Tonopah Test Range; VOC = volatile organic compound.

[a] The reported radiological risks are the projected number of LCFs in the population and are therefore presented as whole numbers. The calculated value is shown in parentheses.

[b] The emissions under the Expanded Operations would be less than the levels projected under the No Action Alternative because certain site support functions would be transferred from DOE/NNSA to the U.S. Air Force, resulting in fewer DOE/NNSA and DOE/NNSA contractor employees at the TTR.

[c] The risk is the annual increased likelihood of an LCF in the MEI or noninvolved worker or the increased likelihood of a single LCF occurring in the offsite population, accounting for the estimated probability (frequency) of the accident occurring.

3.6 Alternatives Eliminated from Detailed Study

This section identifies the alternatives that were considered but eliminated from detailed study and provides a brief explanation of the reason for elimination.

3.6.1 Discontinue Operations at the Nevada National Security Site

In its *1996 NTS EIS*, DOE considered cessation of all operations at the NNSS and placing all facilities into a cold standby status (Discontinue Operations Alternative) and considered discontinuing all Defense mission-related and most Work for Others Program activities at the NNSS (Alternate Use of Withdrawn Lands Alternative). In its December 9, 1996, Record of Decision (ROD) (61 *Federal Register* [FR] 65551), DOE decided that it would implement the Expanded Use Alternative for all activities other than LLW and MLLW management, which was to continue under the Continue Current Operations Alternative. DOE later decided to implement the Expanded Use Alternative for LLW and MLLW management at the NNSS (65 FR 10061).

Because discontinuing operations at the NNSS was previously considered but rejected by DOE in 1996 and because there is a continuing need for the NNSS for National Security/Defense Mission programs, closing the NNSS or discontinuing National Security/Defense Mission programs, projects, and activities are considered unreasonable alternatives.

Ceasing operations at the NNSS would result in a loss of support for a number of missions and other activities that are critical to national security, including Stockpile Stewardship and Management, Nonproliferation and Counterterrorism, and Homeland Security. In addition, as the only U.S. nuclear weapons testing facility, the NNSS must be available to conduct an underground nuclear test if so directed by the President. Because these activities are vital to national security and are among the major components of the missions assigned to the NNSS by DOE/NNSA, discontinuing operations at the NNSS would not achieve the purpose and need stated in Chapter 1.

3.6.2 Transfer the Nevada National Security Site to Another Agency

One organization provided a scoping comment that suggested that the NNSS should be transferred "out of NNSA control and, indeed, out of the 'active' nuclear weapons complex altogether" (a curatorship alternative). The comment cited statements by the President, United Nations resolutions, the Comprehensive Test Ban Treaty, and U.S. initiatives to strengthen the Nonproliferation Treaty as support for considering such an alternative. Although the United States has not ratified the Comprehensive Test Ban Treaty, since 1992, it has observed a moratorium on underground nuclear testing. However, there have been no new policies or legislative direction to abandon the capability to conduct an underground nuclear test if extraordinary events jeopardize the supreme national interests, which, if the United States were a signatory, would be allowed by Article IX of the Comprehensive Test Ban Treaty. The *Final Complex Transformation Supplemental Programmatic Environmental Impact Statement* (DOE/EIS-0236S4) (DOE 2008l) addressed alternatives for consolidating Nuclear Weapons Complex facilities and activities. Thus, closure of the NNSS and/or transfer of responsibility to another organization as part of a larger plan to consolidate the Nuclear Weapons Complex are not being considered in this SWEIS.

3.6.3 Prepare a Programmatic Environmental Impact Statement

In scoping comments for this *NNSS SWEIS*, the Nevada Attorney General opined that a programmatic EIS should be prepared for the NNSS. DOE defines a site-wide NEPA document as "a broad scope EIS or EA that is programmatic in nature and identifies and assesses the individual and cumulative impacts of ongoing and reasonably foreseeable future actions at a DOE site." Although this *NNSS SWEIS* is "programmatic in nature" with regard to DOE/NNSA facilities and activities in the State of Nevada, it would not provide the basis for a DOE programmatic decision, but would provide the basis for site-specific implementation of programmatic decisions that have already been made in existing programmatic EISs and other NEPA documents. Those EISs and other NEPA documents include the *Final Programmatic Environmental Impact Statement for Stockpile Stewardship and Management* (DOE 1996d); *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DOE 1997); *Complex Transformation SPEIS* (DOE 2008l); and the *Final Environmental Impact Statement for the Proposed Relocation of Technical Area 18 Capabilities and Materials at the Los Alamos National Laboratory* (DOE 2002h), as well as a number of project-specific environmental assessments. With regard to this *NNSS SWEIS*, DOE NEPA regulations (10 CFR 1021.330(c)) require large, multiple-facility DOE sites, such as the NNSS, to prepare SWEISs. This *NNSS SWEIS* addresses the full range of missions, programs, capabilities, projects, and activities under the purview of DOE/NNSA in Nevada. Where project information is sufficiently specific, the analyses are similarly specific and will support implementing decisions by DOE/NNSA. Where project information is insufficient to support an implementing decision, or if there are statutory or regulatory uncertainties, a more programmatic description is provided and implementation would require an appropriate level of additional NEPA review.

3.6.4 Renewable Energy Alternative

DOE/NNSA announced in its Notice of Intent for this SWEIS (74 FR 36691) that it would address a Renewable Energy Alternative. During the scoping meetings, several suggestions were made to include renewable energy in each of the alternatives addressed in this SWEIS. DOE/NNSA recognizes the need to incorporate, as appropriate, conservation and renewable energy planning as part of the activities it undertakes at the NNSS. Therefore, the Renewable Energy Alternative was not addressed as a separate alternative, but was made part of each of the alternatives addressed in detail in this SWEIS.

3.6.5 1996 Record of Decision-Based No Action Alternative

As indicated in its Notice of Intent to prepare this SWEIS, dated July 24, 2009 (74 FR 36691), DOE/NNSA initially defined the No Action Alternative as "the continued implementation of the *1996 NTS EIS* ROD, and the amendment to the ROD for the *1996 NTS EIS* (65 FR 10061 at 10065) at DOE/NNSA sites in Nevada over the next 10 years." The Notice of Intent also stated that No Action would "include the implementation of other decisions supported by separate NEPA analyses completed since the issuance of the *1996 NTS EIS*" as well as "actions analyzed in eight environmental assessments and their associated Findings of No Significant Impacts, as well as actions categorically excluded from the preparation of either an EA or EIS." The original No Action Alternative considered for analysis in this SWEIS would have addressed significantly higher numbers of many DOE/NNSA activities, based on levels of activities analyzed in the *1996 NTS EIS*. As development of this SWEIS progressed, it became apparent that those potential levels of activities were unrealistically high in some cases. For this reason, DOE/NNSA decided to base the analysis for the No Action Alternative in this SWEIS on actual levels of operations known to have occurred since 1996. For instance, the *1996 NTS EIS* analyzed 1,100 potential dynamic plutonium experiments over a 10-year period. Under the No Action Alternative, this SWEIS considers up to 10 such experiments per year, or 100 over the next 10 years. Chapter 1, Table 1–1 provides a comparison of the Expanded Use Alternative from the *1996 NTS EIS* and the No Action Alternative in this *NNSS SWEIS*.

CHAPTER 4
AFFECTED ENVIRONMENT

4.0 AFFECTED ENVIRONMENT

This chapter describes the existing environmental conditions of the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site), the Remote Sensing Laboratory (RSL) at Nellis Air Force Base, the North Las Vegas Facility (NLVF), and the Tonopah Test Range (TTR). During the preparation of this *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 (NNSS SWEIS)*, the most up-to-date and accurate information available was used to describe existing environments, facilities, activities, and projects. This information serves as a baseline from which to identify and evaluate environmental changes resulting from the proposed alternatives. The baseline conditions, for the purpose of analysis, are the conditions that currently exist.

The environmental resources discussed in this chapter include land use, infrastructure and energy, transportation and traffic, socioeconomics, geology and soils, hydrology, biological resources, air quality and climate, visual resources, cultural resources, waste management, human health and safety, and environmental justice. For some environmental resource areas, the regions of influence (ROIs) are limited to the areas contained within each U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) jurisdictional boundary. For other environmental resource areas, such as transportation and air quality, the ROIs are larger and include all of southern Nevada, as well as portions of Utah, Arizona, and California.

4.1 Nevada National Security Site

This section describes the existing environmental conditions found at the NNSS, a unique national resource managed by the DOE/NNSA Nevada Site Office (NSO) that is located approximately 57 miles from the intersection of Interstate 15 and U.S. Route 95 in Las Vegas, Nevada. The NNSS covers approximately 1,360 square miles (larger than the state of Rhode Island) and is one of the largest restricted access areas in the United States. The NNSS is surrounded by thousands of additional acres of land withdrawn from the public domain for use as a protected wildlife range and a military gunnery range, creating an unpopulated land area of nearly 6,500 square miles.

DOE/NNSA consulted with American Indian tribes and groups that have cultural affiliation with the NNSS to obtain input for this site-wide environmental impact statement (SWEIS). American Indian input regarding natural and cultural resources at the NNSS was provided by the American Indian Writers Subgroup of the Consolidated Group of Tribes and Organizations (CGTO) and may be found in shaded text boxes throughout this chapter identified with a CGTO feather icon.

4.1.1 Land Use

The NNSS is located about 57 miles northwest of downtown Las Vegas in the remote desert and mountainous terrain of southern Nye County, Nevada, at the southern end of the Great Basin. The Federal Government (primarily the U.S. Bureau of Land Management [BLM], the U.S. Department of Defense [DoD], DOE/NNSA, and the U.S. Forest Service [USFS]) manages more than 85 percent of the land in Nevada, and 93 percent in Nye County (DOE 2008g). Approximately 22 percent of the total land area in Nye County, including the NNSS, is designated for federally restricted access for U.S. Government activities.

The NNSS consists of sparsely vegetated basins or flats—Jackass Flats in the southwestern quadrant, Frenchman Flat in the southeastern quadrant, and Yucca Flat in the northwestern quadrant—separated by low mountains that dominate the western and southern sides of the site. Frenchman Flat and Yucca Flat each contain a large playa (the flat-floored bottom of a desert basin that may contain water after a seasonally high runoff). The northeastern quadrant of the site comprises mountains with a pinyon-juniper and sagebrush forest separated by canyons. The dominant mountains in this quadrant are Rainier Mesa near the center of the northern border and Pahute Mesa in the northwestern region of the site (DOE 2002f; Wills and Ostler 2001).

The NNSS is controlled by DOE/NNSA and is the largest and most extensive of DOE/NNSA's sites in terms of the complexity of its facilities, buildings, and infrastructure, and its land area. Although the NNSS is under DOE/NNSA management, DoD and other customers use the site for National Security/Defense and Nondefense Mission-related experiments, training, and research. Chapters 2 and 3 of this SWEIS describe in more detail the missions, levels of operation, and clients that use the NNSS. Numerous offices, laboratories, and support buildings are located throughout the NNSS to assist in these missions.

In 1998, the DOE Nevada Operations Office (now the DOE/NNSA NSO) prepared a Resource Management Plan for the NNSS, as specified in the Record of Decision (ROD) (65 *Federal Register* [FR] 10061) for the 1996 *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (*1996 NTS EIS*). The goals for managing the NNSS resources (both natural and manmade) were developed in consideration of the balance between the primary mission of the NNSS, economic development, and the limits of ecological sustainability. While the principles of the Resource Management Plan have been retained, the primary planning document for new facilities and programs throughout the DOE complex is the Ten-Year Site Plan. Ten-year site plans are required by DOE Order 430.1B, *Real Property Asset Management* (DOE 2008e), and the NNSS Ten-Year Site Plan is used as an integrated planning tool to help develop an efficient and responsive infrastructure that effectively supports the DOE/NNSA NSO's missions.

4.1.1.1 Adjacent Land Use

The lands adjacent to the NNSS include the Nevada Test and Training Range (formerly Nellis Air Force Range), Desert National Wildlife Refuge, and Nye County. The NNSS is located within Nye County, which comprises communities widely separated by distance and which, in 2008, had a population of 43,600 people (USCB 2008b). The nearest community to the NNSS is Amargosa Valley, located about 2 miles south of the NNSS, with a population of 1,400. Additional nearby communities include Indian Springs (about 16 miles southeast of the NNSS, population 1,400); Beatty (about 17 miles west of the NNSS, population 800); Pahrump (about 26 miles south of the NNSS, population 38,200); and Alamo (about 42 miles northeast of the NNSS, population 460). There are other urban and residential land uses outside of and adjacent to the NNSS in the Pahrump Valley (about 22 miles southwest of the NNSS), which is the largest populated area near the NNSS (NV State Demographer's Office 2008). Las Vegas is the closest major metropolitan area (about 57 overland miles southeast of the NNSS, population 564,484) (USCB 2008b).

Nevada Test and Training Range. The Nevada Test and Training Range surrounds the NNSS to the north, east, and west, and is managed by the U.S. Air Force (USAF). It provides a safe and secure remote desert location to test equipment and train military personnel. Testing and training activities occurring on the Nevada Test and Training Range include armament and high-hazard testing (aerial gunnery, rocketry, electronic warfare), tactical maneuvering training, and equipment and tactics development and training. The Nevada Test and Training Range also provides a 3-million-acre security and safety buffer area for activities occurring on the NNSS because it is withdrawn from public use and has limited public access.

Desert Wildlife National Refuge. The Desert National Wildlife Refuge, administered by the U.S. Fish and Wildlife Service (USFWS), is located mostly within the southeastern section of the Nevada Test and Training Range, along the eastern border of the NNSS. The refuge was established in 1936 with the primary objective being the sustainability of the desert bighorn sheep and its habitat. The portion of the refuge that is within the Nevada Test and Training Range is closed to public access. This results in approximately 5,470 acres of additional remote, unpopulated land area surrounding the NNSS, withdrawn from public domain and use (USFWS 2009b).

Bureau of Land Management Land. BLM manages lands adjacent to the NNSS to the south and southwest. BLM is responsible for carrying out numerous programs for the management and conservation of public lands and resources throughout Nevada. Land uses occurring on BLM-managed lands include agriculture, energy and mineral extraction, livestock grazing, and recreation. These lands also provide resources for fish and wildlife habitat (including wild horses and burros); wilderness areas; and archaeological, paleontological, and historic sites. A small portion of the Nevada Wild Horse Range, one of the many herd management areas within Nevada, overlaps the northwestern corner of the NNSS. BLM is responsible for managing the wild horse population under the Wild Free-Roaming Horses and Burros Act of 1971; however, access to the range is coordinated through DOE/NNSA.

Nye County. Primary land uses in Nye County occurring in close proximity to the NNSS include mining, grazing, agriculture, and recreation. Section 4.1.5.3 describes soils, including the status of prime farmland soils at the NNSS. **Figure 4–1** depicts land ownership and uses surrounding the NNSS.

BLM has identified seven solar energy study areas in Nevada. The closest study area to the NNSS is in Amargosa Valley, located south and west of the NNSS's southwestern corner, along the U.S. Route 95 corridor between Beatty and Pahrump. Lands identified as solar energy study areas have excellent solar resources and suitable slope, as well as proximity to roads and transmission lines or designated corridors, and include at least 2,000 acres of BLM-administered public lands. Sensitive lands, wilderness, and other high-conservation-value lands, as well as lands with conflicting uses, were excluded from consideration as solar study areas. BLM published a Notice of Intent in the *Federal Register* on July 13, 2009, announcing the development of an environmental impact statement for the Amargosa Farm Road Solar Energy Project. An application for a 4,350-acre right-of-way on public lands was submitted to BLM for two 224-megawatt, dry-cooled solar power generation facilities, as well as thermal storage tanks. This document is expected to be finalized after publication of this SWEIS.

DOE and BLM have issued the final programmatic environmental impact statement that evaluates utility-scale solar energy development, to develop and implement agency-specific programs that would establish policies and mitigation strategies for solar energy projects, and to amend relevant BLM land use plans with the intent of establishing a new BLM solar energy development program.

4.1.1.2 Historical Nevada National Security Site Development and Current Land Use

Historical Nevada National Security Site Development. Until the mid-1900s, the land on which the NNSS would be established provided traditional, ceremonial, and recreational areas for American Indians. The first European Americans known to traverse what is now the NNSS were emigrants on their way to California in 1849. Short-lived periods of mining and ranching occurred in this region. Military use of the area began in 1940 and, since that time, the NNSS has remained associated with national security and defense activities (DOE 2002f). Section 4.1.10 includes a more detailed description of the history of the NNSS.

There are 19 historic mining districts on the NNSS, as described in the *1996 NTS EIS*. These mining districts would be of interest for economic mining if the NNSS were opened for public access; however, the NNSS has been closed for commercial mineral development since the 1940s (DOE 1996c).

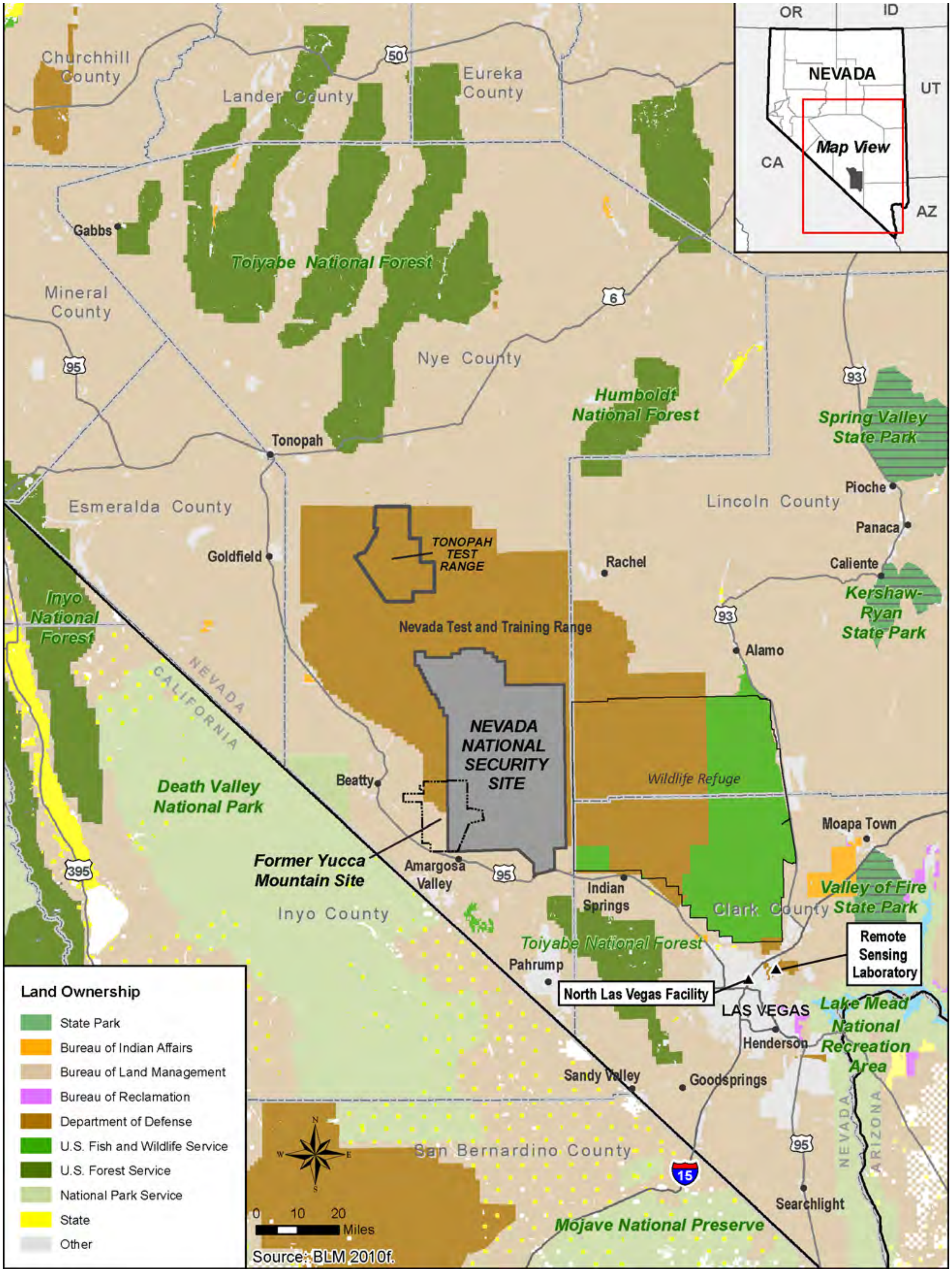

Figure 4–1 Location of Nevada National Security Site and Offsite Locations in the State of Nevada

> **Plowshare Program**
>
> Beginning in 1961, the Plowshare Program was a research development activity, consisting of 35 individual nuclear detonations, established to explore a wide variety of peaceful uses for the inexpensive energy available from nuclear explosions. The majority of detonations that took place at the Nevada National Security Site occurred in the Yucca Flat region.
>
> Peaceful applications utilizing the explosive energy from aboveground detonations that were explored include rock-moving exercises to facilitate the construction of canals, harbors, and dams and aid in the construction of highway and railroad corridors through mountainous areas. Underground engineering applications that were explored include stimulation of natural gas production and formation of underground natural gas and petroleum storage reserves.
>
> Despite great expectations, many projects within the Plowshare Program did not progress past the planning phase. A lack of confidence that projects could be completed at less cost than by conventional means and insufficient public and congressional support led to the program's termination.

The first atmospheric nuclear test detonation at the NNSS took place in 1951 on Area 5 of Frenchman Flat. Atmospheric detonations associated with nuclear testing continued through the 1950s until international test ban negotiations culminated in the Limited Test Ban Treaty of 1963, which banned atmospheric testing, but continued to allow underground testing. Nuclear testing occurred at the NNSS for over 40 years until the President declared a moratorium on nuclear weapons testing in October 1992. During the same time that the NNSS was being used for testing nuclear weapons, tests and experiments under the Plowshare Program were conducted there to support and promote peaceful uses of nuclear detonations. Testing and activities associated with these other projects continued until the mid-1970s. These weapons effects experiments have left behind damaged or demolished military hardware, as well as everyday structures and artifacts of domestic life, such as a bank vault, a train trestle, an underground parking garage, and houses built of various materials. Hundreds of saucer-like craters, formed by the subsidence of the ground above an underground test, are located throughout the areas where these detonations occurred.

Inaccessible to the public, Mercury (formerly called Base Camp Mercury), the "town" located at the entrance to the NNSS, is about 5 miles north of U.S. Route 95. Development of this built-up area increased after 1951, when it served as a base camp area providing basic facilities for personnel involved with NNSS operations, reaching its peak usage by the end of the 1960s. Mercury served, and continues to serve, as the center of administrative services and activities for the NNSS. It provides a variety of structures and services, including office space, laboratory facilities, fire and medical facilities, and overnight living quarters for personnel (DOE 2007a). Mercury is described in more detail in Chapter 2 of this SWEIS.

The NNSS is divided into numbered operational areas to facilitate management; communications; and distribution, use, and control of resources. Chapter 2, Table 2–1, of this SWEIS describes these operational areas and identifies where atmospheric and underground nuclear testing previously occurred.

Current DOE/NNSA Use. The NNSS currently supports work under three missions: (1) National Security/Defense, (2) Environmental Management, and (3) Nondefense. Further details are included in Chapter 2 of this SWEIS. Since the cessation of nuclear testing in 1992 and the subsequent creation of the Stockpile Stewardship and Management Program, DOE/NNSA has consolidated working environments and disposed many excess facilities. As of 2008, the NNSS has 486 buildings, 113 trailers, a 340-mile onsite network of paved roads, and over 300 miles of unpaved roads within its 880,000 acres (DOE 2008i). Most of the experimental facilities and infrastructure are concentrated along the main roadway thoroughfare (Mercury Highway); the majority of maintenance, support, and development activities also are located along this corridor.

Current Military Use. Military organizations use portions of the NNSS for land area exercises and training involving navigation, maneuvering through obstacles, mission rehearsal, and related tactics. The remote areas of the NNSS also provide these organizations with the ability to perform classified exercises.

Existing facilities at the NNSS that resemble real-world chemical, water, and nuclear plant facilities are used by DoD for training scenarios and test beds for sensors for both counterproliferation exercises and defensive security force training. The geology, geography, and tunnel complexes of the NNSS provide unique training venues for DoD and other Federal agencies because these features replicate real-world interests.

Public Use. Access to the NNSS is restricted and limited to public bus tours. Tours must be scheduled in advance. Timber Mountain Caldera, a unique volcanic feature listed as a National Natural Landmark by the National Park System, is located on both the NNSS and USAF-managed Nevada Test and Training Range lands. The U.S. National Park Service manages the Timber Mountain Caldera site, except for portions within the NNSS that are managed by DOE/NNSA. Access to this site through portions located within the NNSS is coordinated by DOE/NNSA.

Under Executive Order 13007, *Indian Sacred Sites*, Federal land agencies are directed, to the extent practical, to allow access to and ceremonial use of American Indian sacred sites by American Indian religious practitioners (DOE 2008f).

Land Use—American Indian Perspective

CGTO

The Nevada National Security Site (NNSS) area is part of the traditional Holy Lands of the Western Shoshone, Southern Paiute, and Owens Valley Paiute and Shoshone peoples. We rely on these lands for medicinal purposes, religious activities and ceremonies, food, recreational use, and integral places described in traditional narratives and religious ceremonies.

Indian people know these lands contain not only archaeological remains left by our ancestors but also natural resources and geologic formations in the region, such as plants, animals, water sources and minerals; natural landforms that mark important locations for keeping our history alive and for teaching our children about our culture. We use traditional sites in the NNSS region to make tools, stone artifacts, and ceremonial objects; many sites are also associated with traditional healing ceremonies and power places.

For many centuries, the NNSS area has been a central place in the lives of American Indian tribes, continuously used by these tribes from antiquity to contemporary times. Until the mid-1900s, traditional festivals involving religious and secular activities attracted American Indian people to the area from as far as San Bernardino, California. Similarly, groups came to the area from a broad region during the hunting season and used animal and plant resources that were crucial for their survival and cultural practices.

Several areas in the NNSS region are recognized as traditionally or spiritually important. For example, Fortymile Canyon is an important crossroad where trails from such distant places as Owens Valley, Death Valley, and the Avawatz Mountain come together. Black Cone, in Crater Flats is an important religious site that is considered to be an entry to the underworld. Prow Pass continues to be an important ceremonial site and, because of this religious significance, tribal representatives recommend that the U.S. Department of Energy (DOE) avoid affecting this area. Oasis Valley was historically an important area for trade, and continues to be a place recognized for ceremonial use. Other areas are considered important based on the abundance of artifacts, traditional-use plants and animals, rock art, and possible burial sites. Despite the current physical separation of tribes from the NNSS and neighboring lands, we continue to recognize the meaningful role of these lands in our culture and continued survival.

The Consolidated Group of Tribes and Organizations (CGTO) maintains we have Creation-based rights to protect, use, and have access to lands of the NNSS and the immediate area. These rights were established at Creation and persist forever. Despite the loss of many traditional lands on the NNSS to pollution and reduced access, Indian people have neither lost our ancestral ties nor have we forgotten our responsibilities in caring for it. As one elder noted, *"Land is to be respected. It sustains us economically, spiritually, and socially."*

During the past decade, representatives of the CGTO have visited portions of the NNSS and have identified places, spiritual trails, and cultural landscapes of traditional and contemporary cultural significance. Because this is a public document, the exact locations of these areas will not be revealed; however, they do include a burial cave, a Native American Graves Protection and Repatriation Act (NAGPRA) reburial area, and a local trail and ceremonial landscape near a large water tank. These actions by DOE are considered positive steps towards facilitating co-stewardship arrangements between DOE and the CGTO to help co-manage important Indian resources of the NNSS and to regain balance.

See Appendix C for more details.

4.1.1.3 Public Land Orders and Withdrawals

The NNSS comprises several separate land transfers from other Federal agencies to DOE/NNSA, as well as land from a legislative withdrawal. The NNSS is federally owned, access-controlled, and withdrawn from public settlement, location, or entry. Withdrawal of land from public use also excludes public mining and mineral leasing.

Public lands may be withdrawn and reserved for military training and testing in support of the Nation's national defense requirements. Lands designated as withdrawn are typically withdrawn from all forms of appropriation under public land laws. The term "withdrawal," as defined by the Federal Land Policy and Management Act of 1976, as amended in 2001 (Public Law [P.L.] 92-579), means withholding an area of Federal land from settlement, sale, location, or entry, under some or all of the general land laws, for the purpose of (1) limiting activities under those laws to maintain other public values in the area; (2) reserving the area for a particular public purpose or program; or (3) transferring jurisdiction of an area of Federal land, other than "property" governed by the Federal Property and Administrative Services Act, as amended (40 *United States Code* [U.S.C.] 472), from one department, bureau, or agency to another department, bureau, or agency.

The following three administrative land withdrawals (public land orders) by the Secretary of the Interior and one legislative withdrawal by Congress, provide the jurisdictional basis for DOE/NNSA's stewardship and management of the lands constituting the NNSS:

Public Land Order 805. Public Land Order 805, issued on February 12, 1952, reserved approximately 435,000 acres of land for use by the Atomic Energy Commission as a weapons testing site.

Public Land Order 2568. Public Land Order 2568, issued on December 19, 1961, transferred 318,000 acres of land previously reserved for the USAF to the jurisdiction of the Atomic Energy Commission for use in connection with the NNSS for test facilities, roads, and safety distances.

Public Land Order 3759. Public Land Order 3759, issued on August 3, 1965, reserved 21,108 acres of land for placement under the jurisdiction of the Atomic Energy Commission for use in connection with the NNSS.

Military Lands Withdrawal Act of 1999, Public Law 106-65. Enacted on October 5, 1999, this act renewed the withdrawal of lands known as "Pahute Mesa" that are an integral part of the NNSS and provided the site of nuclear weapons testing activities. Pursuant to the act, these lands were transferred from DoD to DOE/NNSA, thus aligning jurisdictional responsibilities consistent with DOE/NNSA's retention of environmental, safety, and health responsibilities at the NNSS. Use of this area by DOE/NNSA was previously covered under a Memorandum of Understanding with the USAF.

Figure 4–2 depicts the current NNSS boundary and the boundary prior to 1999.

Area 5 Land Transfer. As part of an April 1997 settlement agreement between the State of Nevada and DOE/NNSA, consultation with the U.S. Department of Interior, which oversees BLM, was initiated concerning the status of existing land withdrawals with regard to low-level radioactive waste (LLW) storage and disposal. This consultation process concluded in November 2009, when DOE/NNSA formally accepted permanent custody of and accountability for the 740-acre Area 5 Radioactive Waste Management Complex (RWMC).

Yucca Mountain Project. In 1994, the DOE Nevada Operations Office (now the DOE/NNSA NSO) entered into a management agreement with the Yucca Mountain Site Characterization Office for use of about 58,000 acres of NNSS land for site characterization activities related to the Yucca Mountain Project. Under this agreement, the Yucca Mountain Project was responsible for meeting the same environmental requirements that apply to the NNSS independent of, but in coordination with, DOE/NNSA.

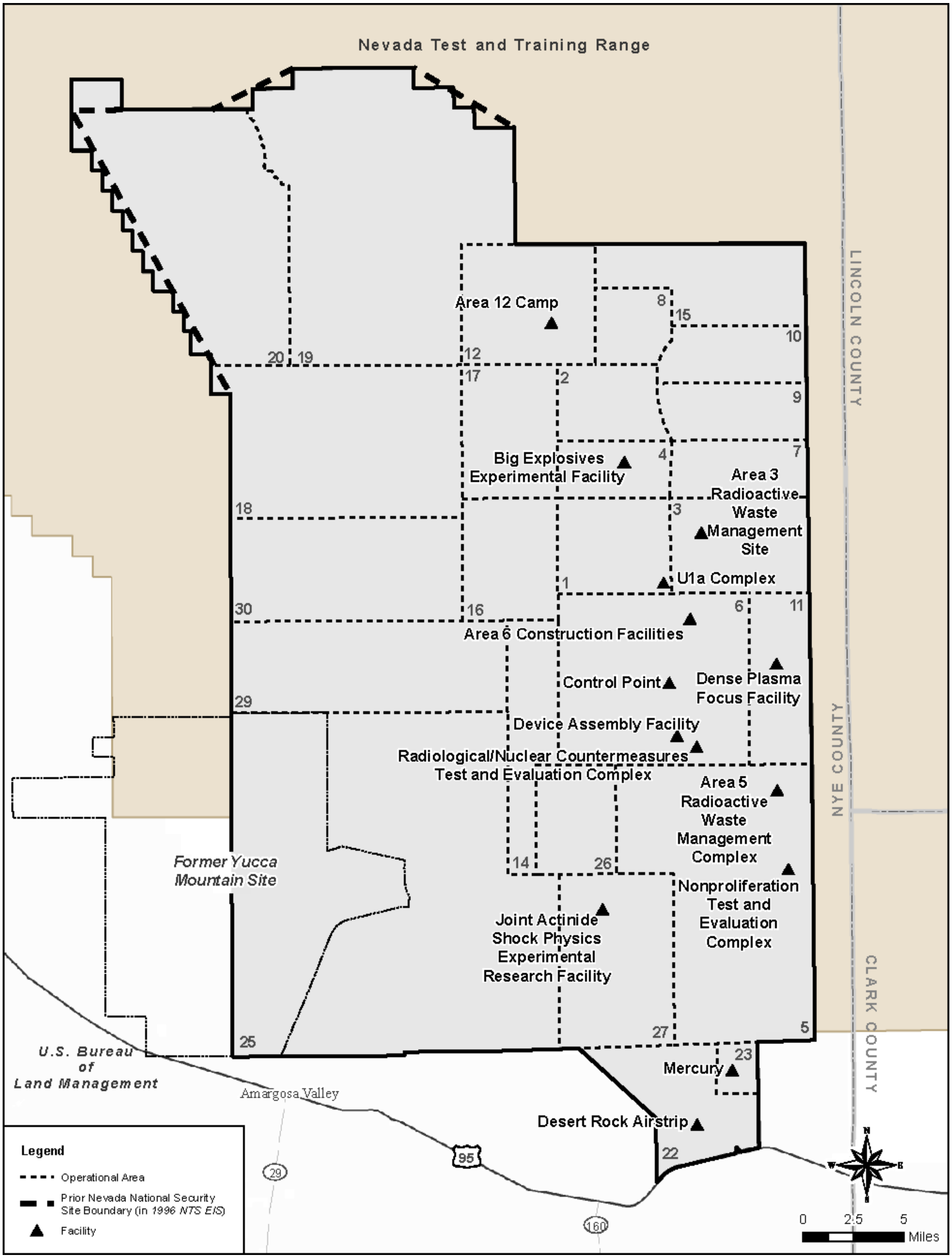

Figure 4–2 Nevada National Security Site Boundary Resulting from the Military Lands Withdrawal Act of 1999 (Public Law 106-65)

DOE's portion of *The Budget of the United States Government Fiscal Year 2011* states, "The Administration has determined that Yucca Mountain, Nevada, is not a workable option for a nuclear waste repository and will discontinue its program to construct a repository at the mountain in 2010. The Department will carry out its responsibilities under the Nuclear Waste Policy Act within the Office of Nuclear Energy as it develops a new nuclear waste management strategy."

4.1.1.4 Land Use Designations

Existing land use on the NNSS is divided into seven zone designations that support the three NNSS missions: National Security/Defense, Environmental Management, and Nondefense.

These land use zone designations, which are described in **Table 4–1**, include previously disturbed areas, areas with desirable slope and soil conditions for construction, and areas that have mission requirements such as remoteness and space for safety and security reasons. The areas within the land use zones may be sensitive to development for mission, environmental, or cultural reasons, and certain areas are protected from certain uses; however, these zones may host activities not normally associated with the particular zone designation, pending compatibility with existing activities or other factors that would affect collocation of activities, including the health and safety of personnel or avoidance of environmentally sensitive areas. Additionally, DOE/NNSA considers all zone designations compatible with environmental restoration activities.

Most of the experimental facilities are consolidated along a central corridor leading to Mercury Highway (the main thoroughfare on the NNSS). To help simplify the distribution, use, and control of resources, the NNSS is also divided into 26 numbered operational areas. The zone designations generally encompass portions of one or more NNSS areas and are depicted in **Figure 4–3**. Chapter 2, Table 2–1, describes the historical use of the NNSS operational areas, and Section 2.1.1 describes the major facilities. Section 4.1.2 describes the facilities located within each of the numbered areas, and Section 4.1.11 describes waste management activities and support facilities in detail.

4.1.1.5 Airspace

Approximately 40 percent of the airspace within Nevada is military "special use" airspace. Airspace in Nevada is managed in a manner that best serves the competing needs of commercial, general, military, and DOE/NNSA's aviation interests. The Federal Aviation Administration (FAA) is responsible for the overall management of airspace and has established different airspace designations that are designed to protect aircraft flying to or from an airport, transiting between airports, or operating within special use areas identified for defense-related purposes. Flight rules and air traffic control procedures have been established to govern how aircraft must operate within each type of designated airspace.

FAA regulates military operations in the National Airspace System through the implementation of FAA Order JO 7400.2G, *Procedures for Handling Airspace Matters*, and FAA Handbook 7610.4J, *Special Military Operations*. The latter was jointly developed by DoD and FAA to establish policy, criteria, and specific procedures for air traffic control planning, coordination, and services during defense activities and special military operations.

> **Special Use Airspace**
>
> Airspace where activities must be confined because of their nature or where limitations are imposed upon aircraft operations that are not part of those activities, or both. This airspace includes restricted airspace, military operations areas, and controlled firing areas.
>
> **Restricted Airspace**
>
> An area of airspace in which the controlling authority has determined that air traffic must be restricted, if not continually prohibited. It denotes the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles.

Table 4–1 Description of the Nevada National Security Site Land Use Zone Designations

Zone Designation	*Description of Zone Designation*	*Acres of Zone Designation on the NNSS*	*Operational Area within Zone Designation*
Defense Industrial Zone	Land area designated for stockpile stewardship experiments and operations to maintain confidence in the safety and reliability of the stockpile without underground nuclear testing. Activities include exercises, operations, and experiments (including subcritical experiments involving special nuclear materials). The land area is located around critical assembly areas and is dedicated to defense-related activities.	41,700 acres	Area 27; portions of Areas 6 and 5
Nuclear Test Zone	Land area reserved for underground hydrodynamic tests, dynamic experiments, and underground nuclear weapons and weapons effects tests. This zone includes compatible defense and nondefense research, development, and testing activities. The emplacement hole inventory, underground alcove areas where radioactive materials are tested (designed such that radioactive materials will not reach aboveground environments), is located within this zone.	224,000 acres	Areas 7, 8, 9, 10, 19, and 20; portions of Areas 6 and 11
Nuclear and High Explosives Test Zone	Land area designated for additional underground and aboveground high-explosive tests or experiments. This zone includes compatible defense and nondefense research, development, and testing activities.	103,800 acres	Areas 1, 2, 3, 4, 12, and 16
Radioactive Waste Management Zone	Land area designated for the shallow land burial of low-level and mixed low-level radioactive wastes.	820 acres	Portions of Areas 3 and 5
Research, Test, and Experiment Zone	Land area designated for small-scale research, development projects, pilot projects, and outdoor tests and experiments related to development, quality assurance, or reliability of materials and equipment under controlled conditions. This zone contains compatible defense and nondefense research, development, and testing projects and activities.	76,200 acres	Areas 14 and 26; portions of Areas 5 and 25
Reserved Zone	Controlled-access land area that provides a buffer between nondefense research, development, and testing activities. The Reserved Zone includes areas and facilities that provide widespread flexible support for diverse short-term nondefense research, testing, and experimentation. This land area is also used for short-duration exercises and training, such as Nuclear Emergency Search Team and Federal Radiological Monitoring and Assessment Center training and land navigation exercises and training.	410,100 acres (includes acreage from the former Yucca Mountain Project Zone)	Areas 15, 17, 18, 29, and 30; portions of Areas 5, 6, 11, 22, 23, and 25
Renewable Energy Zone	Land area and infrastructure reserved for future solar power development, light industrial equipment, and commercial manufacturing capability.	11,900 acres	Portions of Areas 22, 23, and 25

NNSS = Nevada National Security Site.

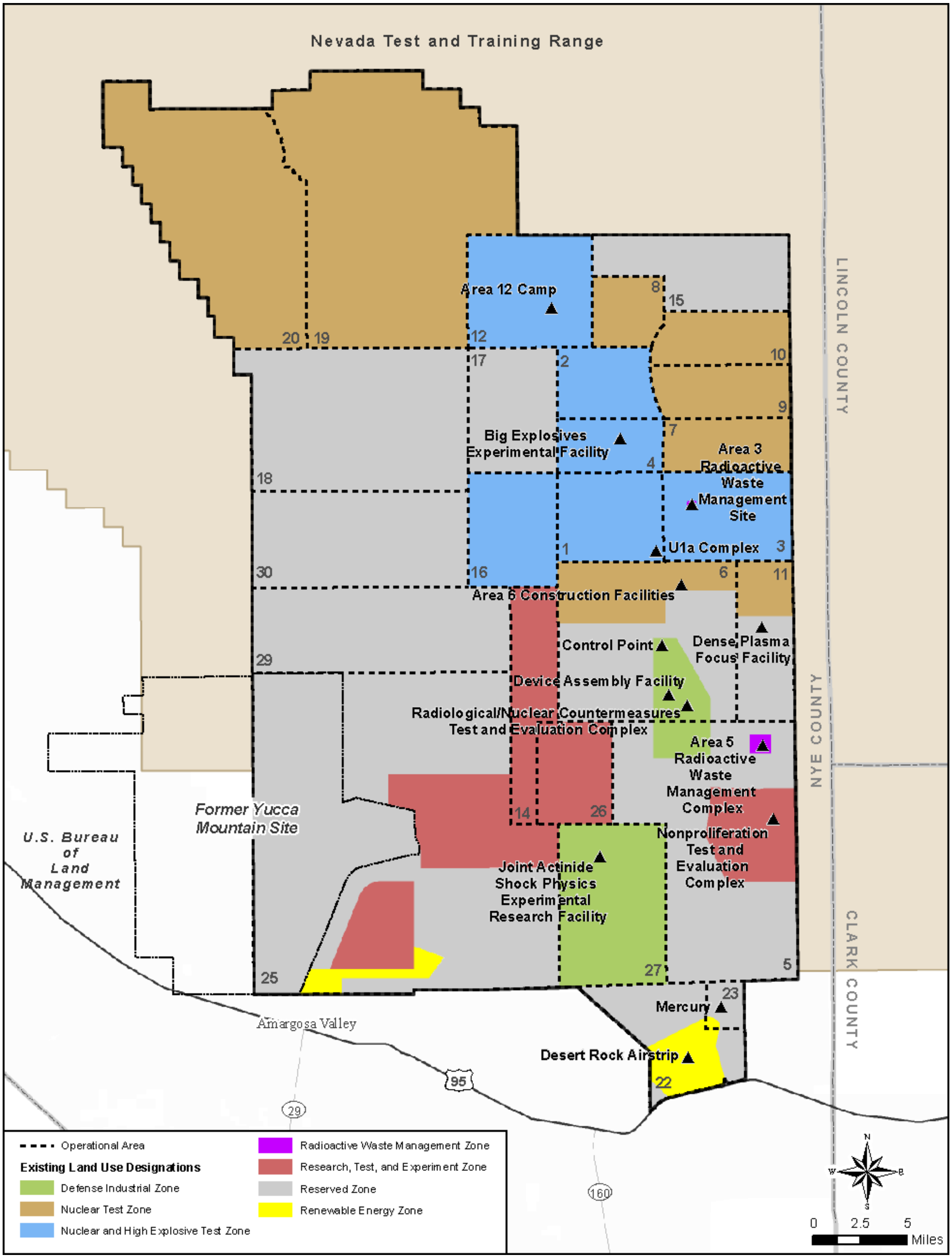

Figure 4–3 Existing Land Use Zones and Major Facilities on the Nevada National Security Site

The airspace above the NNSS was withdrawn and designated as Restricted Area 4808 (R-4808), special use airspace, by FAA and DOE/NNSA. The restricted area within this airspace is used by DOE/NNSA, which has established that this parcel of airspace is used by DOE/NNSA 24 hours a day, 365 days per year, and is not accessible by the public, except under certain conditions. R-4808 (the airspace above the NNSS and the northeastern portions of the Nevada Test and Training Range) and R-4809 (the airspace above the TTR) are managed by DOE/NNSA and are never authorized for use by civilian aircraft, except under conditions such as flights in direct support of a project at or proposed for the NNSS, meeting minimum security requirements, being scheduled in the airspace by DOE/NNSA, and other project-dependent conditions. The restricted airspace surrounding the NNSS to the north, east, and west is controlled by the Nevada Test and Training Range (DOE/NV 1998b).

Airspace associated with the NNSS and its vicinity is shown in **Figure 4–4**. The NNSS airspace is part of the Nevada Test and Training Range, which includes four restricted areas, the desert military operating areas/air traffic control assigned airspace, two low-altitude tactical navigation areas, 29 military training routes (established to provide low-altitude and high-speed training, allowing the military to conduct training for combat tactics), and three refueling routes (DOE 1996c). The NNSS contains four airstrips and seven helipads, located in Areas 6, 12, 22, 23, and 25.

4.1.2 Infrastructure and Energy

4.1.2.1 Infrastructure and Utilities

This section discusses the buildings and transportation infrastructure and potable water, wastewater, and communications utilities. Further transportation-related information is discussed in Section 4.1.3. Solid waste collection and landfills are discussed in Section 4.1.11. Energy systems distribution, use, and demand (electricity, natural gas, and liquid fuels) are discussed in Section 4.1.2.2. Discussions of NNSS and outside community support services, including law enforcement and security, fire protection, and health care, are presented in Section 4.1.4.

4.1.2.1.1 Infrastructure

Facilities. As of November 2009, there were 486 buildings and 113 trailers that support activities at the NNSS. **Table 4–2** presents the building floor space maintained at the NNSS, as well as the building floor space for leased properties off site, delineated by their respective functions, including administration, storage, industrial and production processes; research and development; services; and other uses (e.g., hangars, guard stations, and dormitories). As of November 2009, NNSS floor space totaled 2,231,602 square feet and offsite floor space totaled 214,071 square feet (NNSA/NSO 2009b). Most of these facilities and the supporting infrastructure at the NNSS are 30 to 50 years old and are rapidly deteriorating (DOE 2008f; NSTec 2009e).

DOE/NNSA ensures that existing facilities' maintenance and operation practices, as well as all new construction and renovation projects, conform to the requirements of Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (72 FR 3919), and Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (74 FR 52117), signed by President Obama on October 5, 2009, which expands on Executive Order 13423. In accordance with DOE Order 436.1, *Departmental Sustainability*, DOE/NNSA prepares an annual Site Sustainability Plan, which identifies performance goals and accomplishments in meeting High Performance and Sustainable Building Guidance of the Interagency Sustainability Working Group (ISWG 2008).

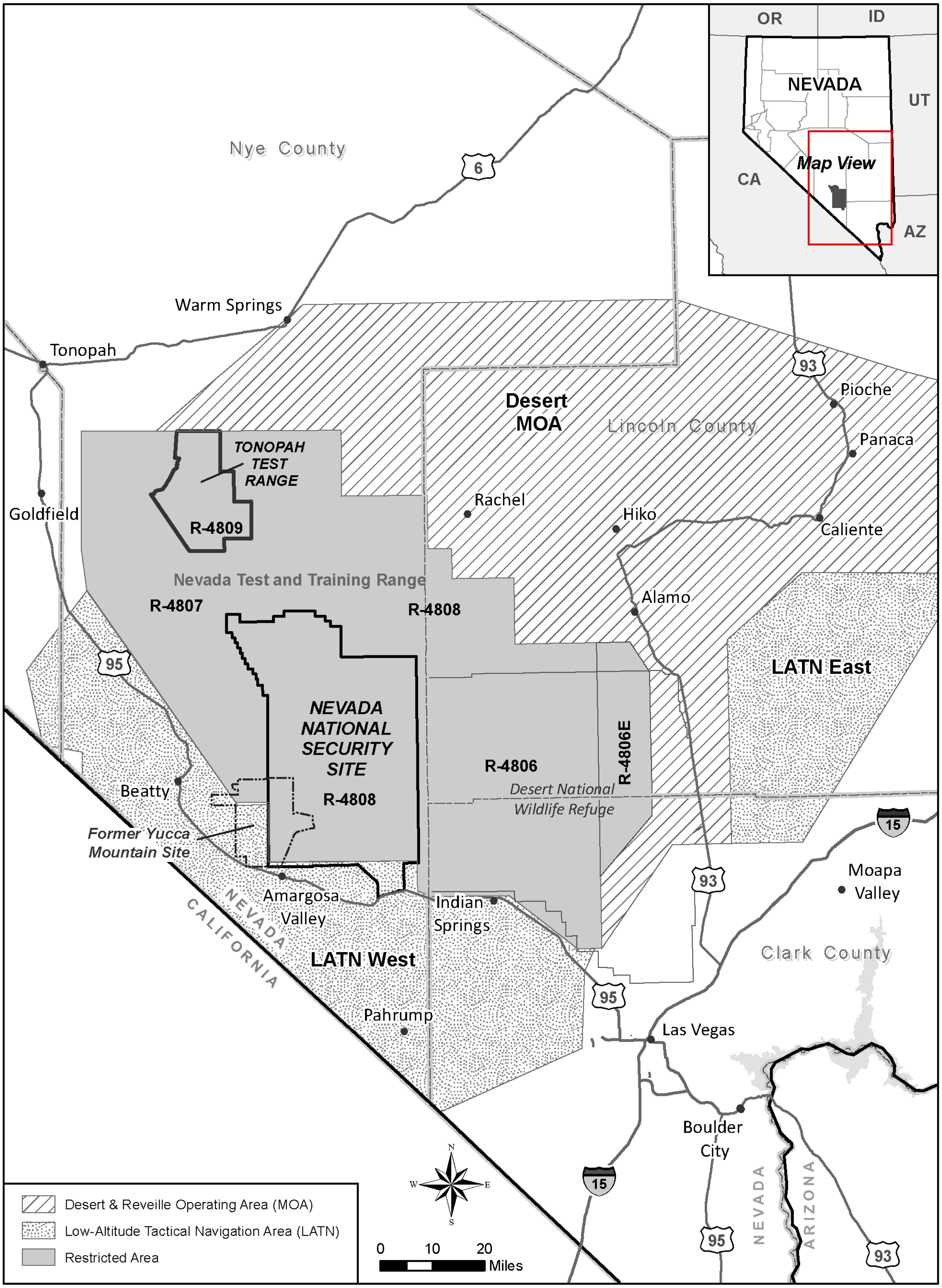

Figure 4–4 Airspace Within the Vicinity of the Nevada National Security Site

Table 4–2 Nevada National Security Site Building Floor Space by Function

Function	*Floor Space (square feet)*	*Offsite Leased Floor Space (square feet)*
Administrative	383,336	117,263
Storage	332,877	1,104
Industrial and Production Processes	359,980	8,253
Research and Development	486,405	87,451
Service Buildings	413,948	0
Other	255,056	0
TOTAL	2,231,602	214,071

Source: NNSA/NSO 2009b.

Transportation Systems. The NNSS is accessible and navigable by vehicles via a network of paved and unpaved roads, accompanied by parking areas. The onsite road network consists of approximately 340 miles of paved roads, including 195 miles considered mission essential, and over 300 miles of unpaved roads.

The primary paved roads in the southern part of the NNSS include Mercury Highway, Jackass Flats Road, Cane Spring Road, and Lathrop Wells Road. Mercury Highway is the primary access route to the NNSS from U.S. Route 95. Mercury Bypass is well constructed and runs from just north of gate 100 to north of Mercury. This 26-foot-wide road was built to enable the rerouting of all traffic with a forward area destination.

The primary paved roads on the northern part of the NNSS are Pahute Mesa Road, Buckboard Mesa Road, and Tippipah Highway. The areas served by these roads are Pahute Mesa, Buckboard Mesa, and Rainier Mesa, respectively. Pahute Mesa Road from Yucca Flat to the Area 20 camp is typical of hot-mix paved roads on the NNSS. At the higher elevations, the road is winding and crosses rugged terrain that may be hazardous under winter conditions.

Three basic types of roads have evolved over the years at the NNSS to support direct mission and mission support requirements: major transport routes, e.g., Mercury Highway, constructed of asphalt concrete suitable for sustained highway loads and speeds; spur roads of shorter length to specific activity locations, e.g., Road 5-01 Radioactive Waste Management Site, generally consisting of multiple applications of oil and chip suitable for use at reduced speeds and loads; and unpaved routes, e.g., Fortymile Canyon Road, graded and passable at low speed suitable for construction or maintenance vehicles.

Determining the level of road serviceability required to meet operational demands on the NNSS is a solid basis for establishing design, construction, maintenance, and safety criteria. The following hierarchy has been established to evaluate existing and proposed roadways:

- Level I – Roads that provide safe access to heavily used areas at highway speeds (currently 55 miles per hour); basic emergency response; and critical personnel and material movement routes. Level I roads handle the entire spectrum of vehicular traffic encountered at the NNSS.
- Level II – Roads that provide access to more-remote areas and/or complete loop access to most used areas. Highway speed and load capabilities are important. Roads facilitate periodic operations, construction, and maintenance, and provide a bypass during selected operations. Level II roads are primarily program-specific and receive all types of vehicular traffic except for tour buses and heavy construction machinery.
- Level III – Roads that maintain established access to specific active programmatic, campaign, or Directed Stockpile Work sites. Level III roads are limited in capacity and serviceability.
- Level IV – Unpaved roads that provide more direct and efficient access to selected locations or direct access to established isolated activities. Level IV roads are not routinely used.

Using this hierarchy of roads, **Table 4–3** presents roads assigned to each level.

Table 4–3 Roads Assigned to Each Level of Hierarchy Established on the Nevada National Security Site

Level 1	**Road Segment/Classification [a]**
Mercury Highway	U.S. 95 to BJY Intersection (RA)1
Mercury Bypass	South Turnout to North Turnout (RF)
Rainier Mesa Road	BJY Intersection to Area 12 Camp (RA)
Tippipah Highway	Mercury Highway to Area 12 Camp (RA)
Cane Spring Road	Mercury Highway to 27-01 Road (RC)
5-01 Road	Mercury Highway to Area 5 RWMC site (RC)
3-03 Road	Mercury Highway to Area 3 RWMS site (RC)
Level II	**Road Segment/Classification [a]**
Stockade Wash Road	A-12 Camp to Pahute Mesa Road (RC)
Buckboard Mesa Road	18-03 Road to Pahute Mesa Road North (RF)
Cane Spring Road 27-01	Road to Jackass Flats Road (RC)
Jackass Flats Road (South)	Mercury Bypass to 27-01 Road (RC)
27-01 Road	Cane Spring Road to Jackass Flats Road (RC)
Pahute Mesa Road	Mercury Highway to Stockade Wash Road (RA)
Tweezer Road	Mercury Highway to Construction Area (RF)
18-03 Road/Airport Road	Pahute Mesa Road to Buckboard Mesa Road (RC)
Level III	**Road Segment/Classification [a]**
Jackass Flats Road (North)	27-01 Road to Cane Spring Road (RC)
Pahute Mesa Road	Stockade Wash Road to Buckboard Mesa Road N (RF)
4-04 Road	Rainier Mesa Road to BEEF site (RF)
Level IV	**Road Segment/Classification [a]**
Mercury Highway	Old BJY Intersection to Gate 700 (RA)
Lathrop Wells Road	Cane Spring Road to NNSS boundary (RA) (Gate 510)
Desert Rock Road	Mercury Highway to Desert Rock Airport (RF)
Airport Road (Area 18)	18-03 Road to Pahute Mesa Airport (RF)
5-07 Road	Mercury Highway to 5-01 Road (RF)
5-06 Road	5-01 Road to Spill Test Facility (RF)
Tunnel Access Roads	Multiple spurs (RF)
Other existing paved, gravel, or graded roads	

BEEF = Big Explosives Experimental Facility; RWMC = Area 5 Radioactive Waste Management Complex; RWMS = Area 3 Radioactive Waste Management Site.
[a] Comparison with Nevada state road classifications is shown: Rural Arterial (RA); Rural Connector (RC); Rural Feeder (RF).
Source: FY 2007 Utility Management Plan, Table 2-1.

With the exception of Mercury Highway, the 340 miles of paved and 300 miles of unpaved roads were not designed or intended for use at the loads and speeds of today’s traffic, e.g., 55 miles per hour. While numerous repairs and safety improvements to various segments have allowed continuous operations along most NNSS roadways, portions of the paved road system are currently substandard (DOE 2008i). Approximately 15 miles of roadway (amount usually determined by funding) are oiled and chipped each year to prevent deterioration and provide safe road surfaces. Based on this level of effort, each of the 340 miles of paved road can only be treated every 22 years. However, in 2010, a major Mercury Highway road improvement project was completed on the entire length of the road.

Traffic conditions on NNSS roads are discussed in Section 4.1.3.

Parking for government and private vehicles is available at most buildings on the NNSS; and paved parking areas are available for commuter buses at support facilities in Areas 6, 12, 23, and 25. Collectively, the NNSS has approximately 1 square mile of paved land comprising parking areas. A bus fleet operation is used to transport personnel to and from the NNSS and Las Vegas/Pahrump, Nevada. These buses are operated by a private firm under subcontract to DOE/NNSA (NNSA/NSO 2009c). There are no operational railroads that access the NNSS.

The NNSS transportation-related infrastructure also includes the following air facilities:

Pahute Airstrip. This airstrip is located in Area 18 and has a paved runway and a secondary support facility. It is currently limited to helicopter use due to runway deterioration.

Desert Rock Airport. Located in Area 22, this airport has a paved runway with radio-activated lights, an administrative/control building, aircraft parking areas, and other ancillary features. It is unmanned, but operational, and its use is controlled by DOE/NNSA.

Yucca Lake Airstrip. This airstrip is located in Area 6 and has a secondary support facility and an unpaved runway that is subject to flooding following local storms.

Area 6 Aerial Operations Facility. Located in Area 6, this is an unmanned aerial system research and development facility. It has a paved runway, taxiways, and aircraft parking areas, as well as hangars, shops, and administrative buildings.

Helipads. Helipads with windsocks, fire extinguishers, and painted markings are located in seven locations across the NNSS.

All roads, parking areas, and air facilities at the NNSS are maintained for mission-related uses.

4.1.2.1.2 Utilities

The utility systems discussed in this section include the potable water supply, wastewater collection and treatment, and communication systems.

Water Supply. The NNSS water systems provide potable, fire-protection, construction, and wildlife preservation water throughout the expanse of the installation. Water production and distribution systems have been in place at the NNSS for over 50 years, serving work populations of up to 10,000 workers.

Drinking water needs are met by deep-well groundwater draws from two major aquifers (the volcanic and the alluvial aquifers) that are not influenced by surface waters. In addition, groundwater is withdrawn from the carbonate, volcanic, and alluvial aquifers for nonpotable, construction, and fire protection purposes.

The NNSS comprehensive water production and distribution system consists of three permitted public water systems (PWSs), two wildlife preservation reservoirs, and two isolated environmental sampling wells (DOE 2008l).

The three discrete PWSs permitted by the Nevada Division of Environmental Protection (NDEP) to provide potable water to the NNSS are served by six wells (Well 4/4a, Well 5b/5c, Well 8, Well 16D, Well C-1, and Well J-12). The transmission and distribution systems include mains, valves, hydrants, booster pump stations, pump suction tanks, and reservoir storage tanks. Each PWS extends to the point of the service connection. Two tanker trucks used to haul potable water from the permitted wells to remote work sites are also permitted, but are not considered PWSs (NSTec 2010d).

The NNSS water system is spread over four distinct water service areas and consists of eight water systems; two wildlife preservation reservoirs; numerous water storage tanks, fillstands, and construction water open pit reservoirs, as well as approximately 140 miles of pipeline located throughout the site

(DOE 2008l). These water service areas are discussed in detail below in relation to their location and the areas they support.

Water Service Area A. Encompasses Areas 19 and 20. System capabilities within this service area have been abandoned for more than a decade. There are two wells in this area (Wells 19c and 20), both of which are out of service and have monitoring casing to prevent vandalism or contamination (DOE/NV 2008c).

Water Service Area B. Encompasses Areas 2, 4, 7, 8, 9, 10, 12, 15, 17, and 18. PWS NV0004099 serves Area 12. Well 2, which is within this service area, is out of service and is locked to prevent vandalism or contamination. Well 8 provides water to Area 12 and supplies water to the construction water open pit reservoir system. Water Service Area B also includes one pumping station and two water storage tanks (DOE 2009f; DOE/NV 2008c).

Water Service Area C. Encompasses Areas 1, 3, 5, 6, 11, 22, 23, 26, and 27. PWS NV0000360 serves Areas 5, 6, 22, and 23. Five active wells provide water in this service area (Wells C-1, 4, 4a, 5b, and 5c). Fillstand A-6 is used to supply potable water via water trucks to the Joint Actinide Shock Physics Experimental Research Facility (JASPER), Area 12, and the Big Explosives Experimental Facility (BEEF). Water Service Area C also includes five pumping stations and nine water storage tanks (DOE 2009f; DOE/NV 2008c).

Water Service Area D. Encompasses Areas 14, 16, 25, 29, and 30. PWS NV0004098 serves Area 25. It consists of two active wells (Wells J12 and 16d). Water Service Area D also includes three pumping stations and 12 water storage tanks (DOE 2009f; DOE/NV 2008c).

Water is currently hauled into Areas 26 and 27 by truck. There are four elevated tanks in Area 26 that store construction water and one tank in Area 27 that stores fire protection and potable water (DOE/NV 2008c).

The annual maximum production capacity of the site's potable supply wells (based on equipment capacity) is approximately 2.1 billion gallons per year, although the combined sustainable yield of the groundwater basins is substantially lower, and the sustainable yield of each basin is considered in groundwater withdrawals. Section 4.1.6.2 and Chapter 5, Section 5.1.6.2, provide additional information on groundwater wells, basins, and sustainable yields.

Water Conservation. DOE/NNSA is currently implementing programs to maximize compliance with Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, as detailed in the Annual Site Sustainability Plan required by DOE Order 436.1, *Departmental Sustainability,* and in the annual Executable Energy Plans. One of the goals of these plans is to reduce the use of energy and water in DOE/NNSA facilities by advancing water conservation (NSTec 2011c).

According to DOE/NNSA's Energy Executable Plan of December 2008, the goal is to reduce potable water consumption by no less than 16 percent from the 2007 level by 2015. This reflects an average reduction in water consumption of approximately 2 percent per year. To accomplish this goal, the NNSS began saving water through several water conservation measures and best management practices for water efficiency. Examples include the installation of WaterSense™ products (including toilets and urinals, faucets and showerheads, boiler systems, and other water uses), xeric landscaping, water-efficient irrigation, system audits and leak repairs, use of nonpotable water for dust suppression when possible, and institution of 4-day workweeks (NSTec 2011c). Potable water consumption for the NNSS is presented in **Table 4–4** (see Section 4.1.6.2 for further information on water usage at the NNSS).

Gray water recycling was deemed cost-prohibitive at the NNSS due to the quantity of flow and lack of redistribution means. Gray water is sometimes used for dust control; however, depending on the extent of treatment, there are restrictions on how the water may be used (NSTec 2008b).

Table 4–4 Potable Water Consumption for the Nevada National Security Site by Year

Year	*Potable Water Consumption (gallons, approximate)*
2005	182,650,000
2006	221,250,000
2007	225,150,000
2008	172,550,000
2009	190,000,000
2010	185,765,000
2011	184,073,000

Source: NSTec 2010c; Rudolph 2012.

Wastewater Collection and Treatment Systems. The NNSS sanitary sewer system consists of approximately 100 linear miles of cast iron or polyvinylchloride mains and service laterals. Domestic and industrial wastewater is treated using either sewage treatment lagoon systems or septic tanks with leach field systems.

In fiscal year (FY) 2003, due to insufficient flow in the lagoons, to remain compliant with Nevada regulations, DOE/NNSA placed 8 of the 10 sewage lagoon systems in inactive status and installed new septic systems that allowed the lagoons to be bypassed. Only the Area 23 (Mercury) and Area 6 (Yucca Lake Complex) lagoon systems remain operative (NSTec 2010g). These two active lagoons operate under NDEP Water Pollution Control General Permit GNEV93001, with design flow capacities of 73,407 gallons per day (Area 23, Mercury) and 10,850 gallons per day (Area 6, Yucca Lake Complex) (NDEP 2005). The current rate of wastewater production for the two operating lagoons is presented in **Table 4–5**.

Table 4–5 Wastewater Production for the Mercury and Yucca Lake Lagoons at the Nevada National Security Site by Year

Year	*Wastewater Production (average gallons per day)*		*Total Treated in Lagoon Systems (average gallons per day)*
	Mercury Sewage Lagoon System	*Yucca Lake Sewage Lagoon System*	
2005	44,510	8,229	52,739
2006	42,124	9,219	51,343
2007	42,367	7,427	49,794
2008	32,588	1,084	33,672
2009	26,550	1,049	27,599
Permit capacity	73,407	10,850	84,257
Percentage of lagoon capacity used in 2009	36%	10%	33%

Source: NSTec 2010g.

Sludge removed from the wastewater treatment systems is disposed in the Area 23 sanitary landfill or the Hydrocarbon Disposal Site in Area 6, depending on the hydrocarbon content (DOE 2008f).

Installation of new septic tank systems to supplement the NNSS's wastewater treatment capacity enabled the NNSS to meet current site needs and comply with state regulations (DOE 2008f). There are currently 23 permitted septic tank systems at the NNSS (NSTec 2010h). Each septic tank has a capacity for handling 5,000 gallons of wastewater per day. Seven of the septic tanks are maintained by the National Security Technologies, LLC, Department of Water and Waste, and the remaining units are maintained by the individual facilities with which they are connected. Collectively, the 23 septic systems provide a capacity for treating 115,000 gallons of wastewater per day. The currently permitted septic systems at the NNSS and the approximate number of people they serve per workday are presented in **Table 4–6**.

Table 4–6 Nevada National Security Site Septic Tank Locations and Capacities for 2010

Permit Number	*Location*	*Capacity* [a] *(gallons)*	*Number of People Served per Workday*
NY-1054	Area 3, Waste Management Office	5,000	10
NY-1069	Area 18	5,000	1
NY-1076	Area 6, Art Hangar	5,000	20
NY-1077	Area 27, Baker	5,000	10
NY-1106	Area 5, NPTEC	5,000	20
NY-1079	Area 12 (U12G)	5,000	1
NY-1080	Area 23, 1103	5,000	20
NY-1081	Area 6, CP-70	5,000	0
NY-1082	Area 22, 22-1	5,000	5
NY-1083	Area 5, RWMC	5,000	20
NY-1084	Area 6, DAF	5,000	40
NY-1085	Area 25, Central Support Area	5,000	0
NY-1086	Area 25, RCP	5,000	0
NY-1087	Area 27, Able	5,000	15
NY-1089	Area 12, Camp	5,000	2
NY-1090	Area 6, LANL Construction	5,000	10
NY-1091	Area 23, Gate 100	5,000	150
NY-1103	Area 22, DRA	5,000	1
NY-1110-HAA-A	Area 12, 12-910	5,000	1
NY-1112	Area 1, U1a	5,000	40
NY-1113	Area 1, 1-121	5,000	1
NY-1124	Commercial individual sewage disposal system NNSS Area 6 permit to operate	5,000	–
NY-1128	Commercial individual sewage disposal system NNSS Area 6 Yucca Lake Project permit to construct	5,000	–
Total capacity		**115,000**	**367**
Demand	**Assuming 20 gpd per person,[b] total treatment demand**	**7,340**	**6% of collective capacity**

DAF = Device Assembly Facility; gpd = gallons per day; LANL = Los Alamos National Laboratory; NNSS = Nevada National Security Site; NPTEC = Nonproliferation Test and Evaluation Complex; RWMC = Area 5 Radioactive Waste Management Complex.

[a] Source: NSTec 2010h.

[b] Liu and Liptak 1997; CMU 2004.

DOE/NNSA assumes that a typical wastewater generation rate for the NNSS would be approximately 20 gallons per day, based on the upper limits of an average flow rate for an office setting (7 to 16 gallons per day) and a school with cafeteria setting (10 to 20 gallons per day) (Liu and Liptak 1997). This estimate is further confirmed by a study done at Carnegie Mellon University that calculated per capita water use in 2004 for the NNSS at 20.81 gallons per day (CMU 2004).

As shown in Table 4–6, the septic tank systems at the NNSS are currently being used at approximately 6 percent of their collective capacity. As shown in **Table 4–7**, the population at the NNSS is currently using approximately 17 percent of the collective total capacity of wastewater treatment at the NNSS (the capacity of the two lagoons and 23 septic tanks).

Areas not serviced by a permanent wastewater system are provided with portable sanitary units. The portable sanitary units are serviced regularly, and the wastewater is discharged to a permitted onsite treatment system (DOE 2008f).

Table 4–7 Estimated Total Wastewater Treatment Capacity at the Nevada National Security Site

Wastewater Treatment System	*Capacity (gallons per day)*
Lagoons: Mercury and Yucca Lake Systems [a]	84,257
Septic Systems [b]	115,000
Total NNSS Capacity	199,257
Total Wastewater Generation [c]	34,000
Percentage of Capacity Used	17%

NNSS = Nevada National Security Site.
[a] Based on NDEP permit design flow capacity.
[b] Based on 23 septic systems at 5,000 gallons per day each.
[c] Based on 20 gallons per day of wastewater per person for the current population of 1,700 persons.

Communication Systems. Communication systems cover not only the entire area of the NNSS, but also reach far beyond its boundaries. The NNSS telecommunications/information technology infrastructure is composed of fiber optic and copper cabling and microwave systems. The distribution architecture is composed of approximately 205 miles of fiber optic cabling, thousands of circuit miles of legacy copper telecommunications cabling, and seven major microwave links. The systems include telephone network, data transmission, and storage systems, as well as video, radio, and mail systems. Parts of the NNSS telecommunications/information infrastructure are technologically dated and have been degraded in many locations (DOE 2008f).

4.1.2.2 Energy

Electrical power and liquid fuels are necessary for the continued operations of the NNSS, RSL, NLVF, and the TTR. These sources provide energy to support the buildings, vehicles, and operations at the facilities.

4.1.2.2.1 Electrical Energy

Electrical service at the NNSS is supplied by two power sources: (1) NV Energy (previously Nevada Power) and (2) the Valley Electric Association (DOE 2008f). It is distributed to the site by an onsite 138-kilovolt transmission loop that supplies eight substations, one switching center, and one 138-kilovolt radial. The power distribution involves an extensive 34.5-kilovolt system, and short 69-kilovolt and 12-kilovolt systems. These voltages are transformed to a 4.16-kilovolt distribution voltage, and then subsequently to 480–208/120-volt working levels. The NNSS is served by approximately 600 miles of transmission and distribution lines (NSTec 2008b).

The electrical capacity at the NNSS is approximately 45 megawatts, and the current load is approximately 20 megawatts. From 2003 through 2006, electrical usage at the NNSS ranged from 57,000 to 95,000 megawatt-hours, averaging 81,000 megawatt-hours with a peak load usage of 27 megawatts (DOE 2008f). Electrical usage at the NNSS during FY 2009 was 84,577 megawatt-hours. Utility use in areas surrounding the NNSS is holding steady; the NNSS capacity should remain at 45 megawatts in the foreseeable future (NNSA/NSO 2010a).

4.1.2.2.2 Natural Gas

There is no infrastructure for natural gas supply at the NNSS.

4.1.2.2.3 Liquid Fuels

The NNSS uses various types of liquid fuel for its energy needs. Red dye fuel oil is used to heat many buildings and facilities (though numerous oil-fired boilers have been replaced with electric boilers). Unleaded gasoline, diesel fuel, and biofuels (such as ethanol/E85 and biodiesel) are used to power its vehicle fleet and equipment. **Table 4–8** presents liquid fuel usage at the NNSS in 2009 by type.

Table 4–8 Fuel Usage in Fiscal Year 2009 at the Nevada National Security Site

Fuel Type	*Quantity (gallons)*
#2 Red Dye Fuel Oil for Heating	66,433
Unleaded Gasoline	426,964
Ethanol/E85	216,616
#2 Diesel	64,844
Biodiesel	343,191

Source: NNSA/NSO 2010b.

The NNSS has two service stations, each with the capacity to store 10,000 gallons of unleaded gasoline and 9,500 gallons of biodiesel. E85 fueling stations are located near these NNSS gasoline/biodiesel service stations. The NNSS currently has a secure source for daily delivery of E85 fuel and currently has no need for a large onsite stored reserve.

The bulk storage tanks in Area 6 are capable of storing approximately 100,000 gallons of biodiesel and 40,000 gallons of unleaded gasoline (DOE 2008l). Both tanks are filled and maintained to support four weeks of biodiesel consumption and two weeks of unleaded fuel consumption in case of a fuel shortage (NSTec 2009e).

The trend over the last several years has been a decline in petroleum-based fuel usage. The majority of the NNSS fleet currently operates on alternative fuels. The NNSS uses E85 fuel for alternative-fuel vehicles and B-20 biodiesel for all diesel vehicles and off-road equipment. As of December 2008, the NNSS had 548 alternative-fuel vehicles that are E85-capable, equal to 94 percent of the NNSS vehicle fleet. The NNSS requires its fleet to operate all alternative-fuel vehicles on alternative fuels to the maximum extent practicable.

4.1.2.2.4 Conservation and Renewable Energy

The Federal Energy Policy Act of 2005 (EPACT 2005, Section 203(a) [42 U.S.C. 15,853 (a)]) requires DOE to reduce the use and cost of energy at its facilities by advancing energy efficiency, water conservation, and renewable energy sources. As a result, DOE/NNSA has implemented various energy and water conservation practices and is working toward maximizing installation of onsite renewable energy projects at the NNSS where technically and economically feasible.

NNSA has met the requirements for installing electrical meters (as set forth in Section 103 of the Energy Policy Act of 2005) for 90 percent of the electricity used by NNSS and NLVF (NSTec 2011c). The metering allows DOE/NNSA to better track its use of electricity to help improve its ability to identify conservation opportunities.

As part of energy conservation efforts under Energy Saving Performance Contract funding, some NNSS buildings have been retrofitted with low-energy light fixtures and programmable thermostats. Several onsite renewable energy projects have been implemented at the NNSS, including: (1) solar lighting installed for pedestrian footpaths, (2) solar light post in front of the cafeteria, (3) solar-powered monitoring stations, (4) solar-powered low-volume continuous air sampling systems, and (5) solar-powered pedestrian crosswalk lighting (NSTec 2008b).

4.1.3 Transportation and Traffic

This section addresses baseline transportation conditions with respect to onsite and regional traffic, including transportation of materials and wastes. “Onsite traffic” relates to the roadway network within site boundaries; “regional traffic” relates to the roadway network surrounding the site.

4.1.3.1 Onsite Transportation

Access to the NNSS is restricted; guard stations are located at entrances, as well as at other locations throughout the site. The main entrance to the NNSS, Gate 100, is located on Mercury Highway, which originates at U.S. Route 95. Although there are access points at other locations, their use is restricted and they are usually barricaded. Vehicles accessing the NNSS are generally limited to the main entrance. Other existing roadways, some of which are unpaved, provide access or exit routes in cases of emergency or for special purposes.

The NNSS has 640 miles of roadways: 340 miles of paved roads and 300 miles of unpaved roads (DOE 2007c). The paved roads are considered primary roads; most are two-way, two-lane roads with speed limits of 55 miles per hour, unless posted otherwise. The speed limit in developed areas is 20 miles per hour. The maximum speed limit on dirt roads is 35 miles per hour. The majority of the paved roadway network was constructed prior to 1965 and is considered to be in substandard condition, requiring extensive and effective remedial reconstruction, rehabilitation, and resurfacing actions (DOE 2009f). The unpaved portion of the roadway system is composed of graded gravel roads and jeep trails. The NNSS also has numerous unpaved test- or experiment-related roads that are no longer used after a test or experiment is completed.

Figure 4–5 depicts the NNSS's onsite roadway network, which can be considered in terms of a southern network and a northern network. The primary paved roads in the southern part of the NNSS include Mercury Highway, Jackass Flats Road, Cane Spring Road, and Lathrop Wells Road. Mercury Highway is the primary access route to the NNSS from U.S. Route 95. South of Gate 100, Mercury Highway is a two-lane highway. At the gate, it widens to multiple lanes to facilitate entry through the guard station. North of the gate, the highway narrows to a two-lane highway and remains a two-lane highway northward to the transition to Rainier Mesa Road. Most of Mercury Highway is 26 feet wide (13 feet wide per travel lane), but the shoulders vary from 4 to 6 feet wide. Mercury Bypass runs from just north of Gate 100 to north of Mercury. This 26-foot-wide road was built to divert traffic around Mercury to outlying areas of the NNSS.

The primary roads in the northern part of the NNSS include Mercury Highway, Pahute Mesa Road, Buckboard Mesa Road, Stockade Wash Road, Rainier Mesa Road, and Tippipah Highway. The areas served by these roads are Buckboard Mesa, Pahute Mesa, and Rainier Mesa.

Mercury Highway is the main thoroughfare within the NNSS and handles most of the traffic volume at the site. The highway runs approximately 37 miles from the southern border of the NNSS to its intersection with Rainier Mesa Road. A 1999 traffic study estimated that approximately 1,500 vehicle trips were made through the main access gate at the NNSS per day. Peak hours were from 6:00 to 7:00 a.m. and from 5:00 to 6:00 p.m., Monday through Thursday (because most personnel work 4 days per week) (PBS&J 1999). The study also revealed that the mix of vehicles accessing the main gate was approximately 90 percent automobiles, 7 percent trucks, and 3 percent buses. In the northern roadway network, approximately 700 vehicle trips on Mercury Highway occurred per day, of which about 81 percent were automobiles, 15 percent were trucks, and 4 percent were buses. The study determined that the highway was operating at adequate capacity, but that overall surface conditions were suboptimal and could pose traffic safety concerns (PBS&J 1999). In 2010, a major Mercury Highway road improvement project was completed along the entire length of the road. Recent vehicle counts just north of the Mercury interchange at U.S. Route 95 indicate that the total volume of vehicles accessing the NNSS increased 29 percent between 1999 and 2008 (NDOT 2008a, Nye County). NNSS employment data indicate that the number of onsite employees was approximately 1,300 in 1999 and 1,700 in 2008, representing a 31 percent increase over this timeframe (NNSA 2000, 2008; DOE 2002g). Therefore, because of the similar increases in traffic levels and NNSS personnel, DOE/NNSA assumed that the number of onsite employees is a reasonable indicator of traffic levels at the NNSS and that current number of onsite vehicle trips per day has also increased by approximately 30 percent since the 1999 traffic study. Major roadway improvements and maintenance work on Mercury Highway and Rainier Mesa Road have occurred over the last decade and are ongoing.

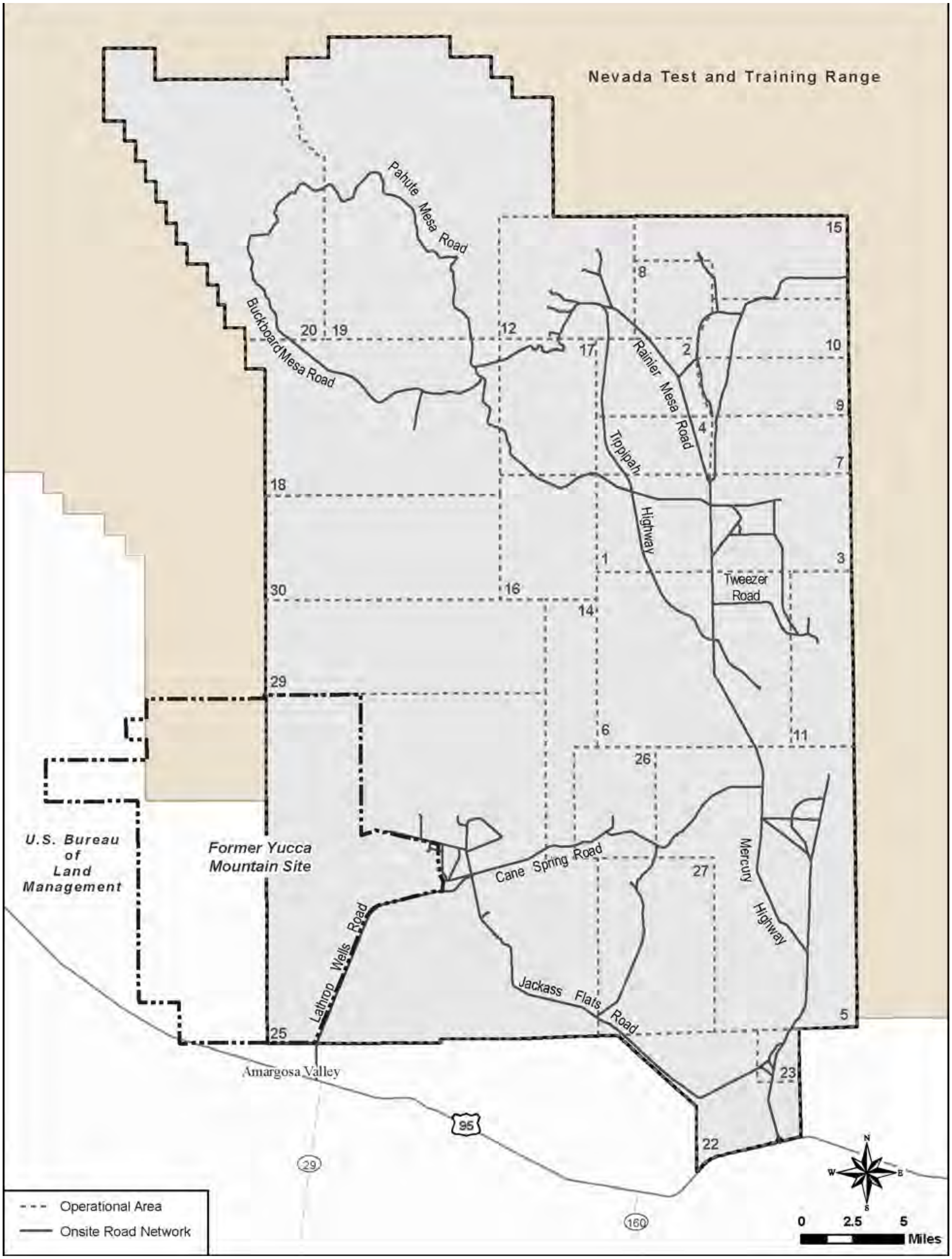

Figure 4–5 Nevada National Security Site Transportation System

Transportation facilities related to the onsite roadway network include bus parking and commuter-vehicle parking areas. At least 50 percent of NNSS employees commute to the site by bus, but the privately owned vehicles of commuting personnel still contribute to the majority of traffic accessing the NNSS (NSTec 2010a). Commuter buses provide daily passenger service to the NNSS from Las Vegas via U.S. Route 95 and from Pahrump via Nevada State Route 160 and U.S. Route 95. The number of buses entering and exiting the NNSS on a daily basis varies, depending on the onsite activities in progress. Currently, there are 15 buses serving the Las Vegas area and 2 buses serving the town of Pahrump. These buses have dedicated routes to the following locations: Mercury, the Area 6 Device Assembly Facility (DAF), the Control Point in Area 6, the Area 6 Construction Facilities, and Area 5 (when projects are being conducted in the area). Parking for government and private commuter vehicles is available at most buildings on the NNSS.

4.1.3.2 Regional Transportation

4.1.3.2.1 Regional Transportation System

The NNSS is located in a region served by a network of U.S., interstate, and state highways. A significant portion of the commuter and truck traffic associated with the NNSS (approximately 95 percent) arrives via U.S. Route 95 from the Las Vegas area (DOE 2008l). Although the transport of materials and waste includes a nationwide system, the ROI for the regional, nonradiological traffic analysis presented in this SWEIS primarily covers the major roadways within Nye and Clark Counties that are most frequently used by personnel and visitors of the NNSS and by vehicles transporting nonradioactive and radioactive materials and waste to or from the NNSS. **Figure 4–6** presents the major roadways in the southern Nevada region, including those serving RSL, NLVF, and the TTR (discussed in subsequent sections of this chapter), and highlights the major transportation routes for shipments of radioactive materials and waste to and from the NNSS. **Figure 4–7** shows the road network in the vicinity of Las Vegas and highlights the major transportation route used for shipments of radioactive materials and waste.

Interstate 15 is the major transportation artery in the Las Vegas area. It is a north–south highway that passes to the south of the NNSS, connecting San Diego, California, to Salt Lake City, Utah, and continuing northward. In southern Nevada, this interstate highway is generally a four-lane divided highway, except in the Las Vegas metropolitan area, where it expands to six lanes. The 53-mile Las Vegas Beltway (also known as Interstate 215 and Clark County Route 215) encircles all but the east side of Las Vegas. Interstate 40 is a major east–west highway approximately 100 miles south of Las Vegas. Interstate 80 and U.S. Route 50 are major east–west highways to the north of the NNSS. Interstate 80 passes about 250 miles north of the NNSS, and U.S. Route 50 passes about 150 miles north.

U.S. Route 95 is a major north–south roadway extending from the Mexican border north to the Canadian border. U.S. Route 95 is a four-lane road between Las Vegas and the interchange with Mercury Highway (the highway leading onto the NNSS) and a two-lane road as it continues north. The interchange of U.S. Route 95 and Interstate 15, also referred to as the "Spaghetti Bowl," has undergone some recent construction to improve traffic flow. U.S. Route 93 is a major north–south, two-lane roadway that enters Nevada south of Lake Mead, and then extends through Las Vegas to the Canadian border, intersecting U.S. Route 50 east of Ely, Nevada, and Interstate 80 near the town of Wells, Nevada. U.S. Route 6 is an east–west, two-lane roadway to the north of the NNSS that links U.S. Routes 93 and 95.

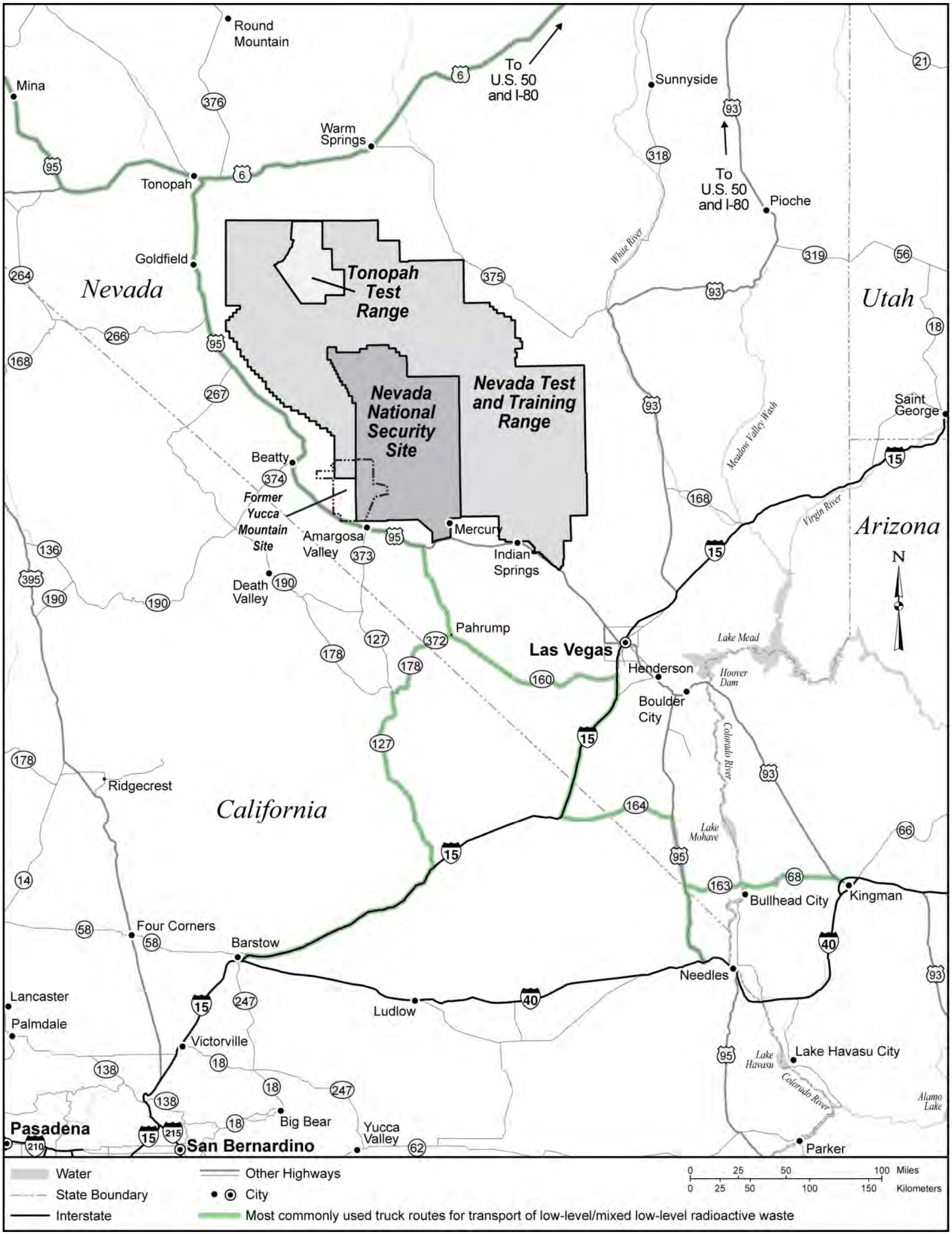

Figure 4–6 Regional Transportation Routes Surrounding the Nevada National Security Site

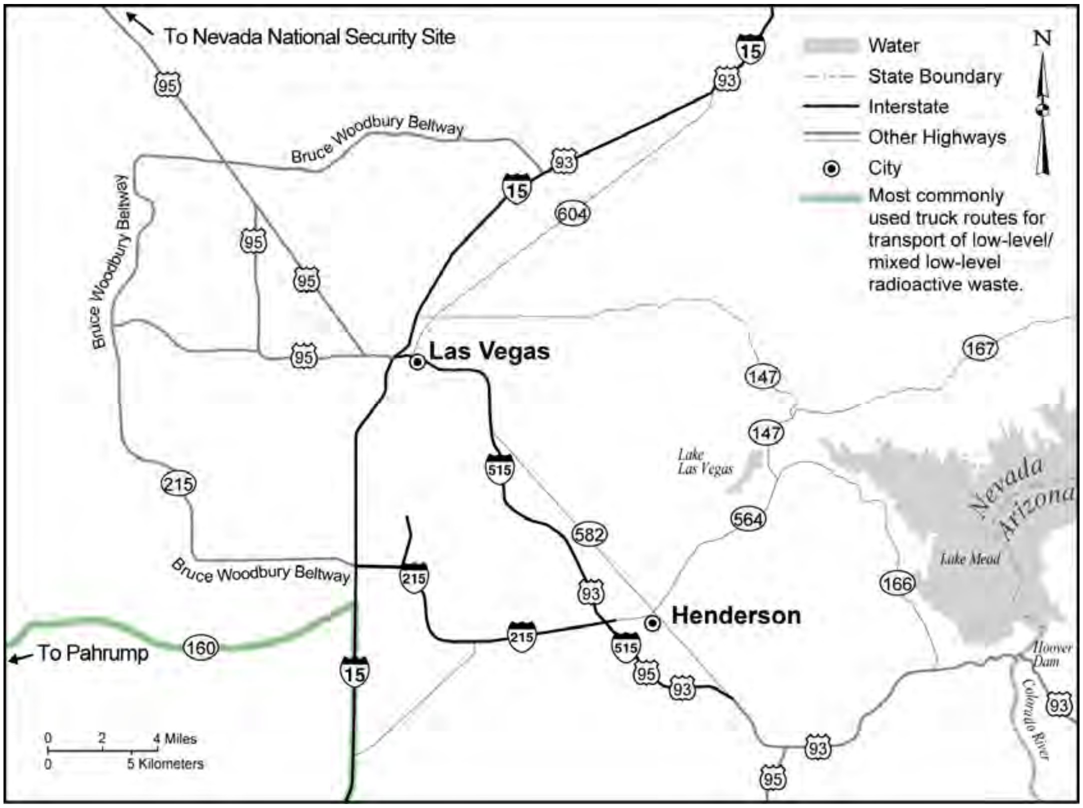

Figure 4–7 Transportation Routes Within the Las Vegas Metropolitan Area

The DOE/NNSA NSO has historically avoided shipping LLW and mixed low-level radioactive waste (MLLW) using the Interstate 15/U.S. Route 95 interchange, based on a verbal commitment from DOE/NNSA. This informal commitment was made at a time when the major highway infrastructure, specifically Interstate 15 and U.S. Route 95, was unable to safely handle the rapidly growing volume of traffic. Since the mid-2000s, U.S. Route 95 has been widened and expanded overpasses have been built to accommodate traffic much more safely. In addition, the Las Vegas Beltway, which extends around approximately three-quarters of the valley, was built at the far edges of Las Vegas to further reduce traffic loads on Interstate 15 and U.S. Route 95. In addition, a bypass bridge has been constructed adjacent to Hoover Dam. This bridge opened to all traffic in October 2010. Trucks transporting waste on Interstate 15 from the south avoid traveling through Las Vegas by taking Nevada State Route 160 to its intersection with U.S. Route 95. Radioactive waste being transported from points north of Las Vegas avoids Interstate 15 in Nevada by using U.S. Route 50, traveling west to U.S. Route 6 and then south on U.S. Route 95. As a result of DOE/NNSA's informal commitment, more-circuitous routes are used for the transport of radioactive materials and wastes. The following combinations of routes are most commonly used to ship radioactive materials and wastes to and from the NNSS (NNSA/NSO 2009a):

- From southern California: Interstate 15 to California State Route 127, to California State Route 127, to California State Route 178, to Nevada State Route 372, to Nevada State Route 160, to U.S. Route 95

- From the east via Interstate 40: Interstate 40 to U.S. Route 95, to Nevada State Route 164, to Interstate 15, to Nevada State Route 160, to U.S. Route 95 or Interstate 40, to U.S. Route 93, to Arizona State Route 68, to Nevada State Route 163, to U.S. Route 95, to Nevada State Route 164, to Interstate 15, to Nevada State Route 160, to U.S. Route 95

- From the east via Interstate 80: Interstate 80 to U.S. Route 93 (Alternate), to U.S. Route 93, to U.S. Route 6, to U.S. Route 95
- From the west via Interstate 80: Interstate 80 to U.S. Route 50 (Alternate), to U.S. Route 50, to U.S. Route 95
- From the east via U.S. Route 50: U.S. Route 50 to U.S. Route 6/50, to U.S. Route 6, to U.S. Route 95

There is no direct railroad access at the NNSS. An east–west rail line passes through northern Nevada, roughly paralleling Interstate 80. Another rail line extends northward through Barstow, California, and through Las Vegas and Caliente, Nevada, into Utah. Further south is a rail line through Arizona and California. Any materials or wastes that are destined for the NNSS and are initially transported by rail are offloaded at an intermodal site in Parker, Arizona, and placed onto trucks to complete the trip (NNSA/NSO 2009a).

Nonradioactive materials transported to and from the NNSS include construction materials and equipment that support site operations. Radioactive materials include source, special nuclear material, or other equipment that support research and development activities. Radioactive wastes transported to or from the NNSS include LLW, MLLW, and transuranic (TRU) waste (NNSA/NSO 2009a). DOE/NNSA received approximately 20,000 truck shipments of LLW and MLLW from 1997 through 2010. TRU waste is no longer transported to the NNSS; however, it is transported from the NNSS to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, for disposal or to Idaho National Laboratory for processing prior to disposal at WIPP (NNSA/NSO 2007).

4.1.3.2.2 Traffic Volumes and Level of Service Analysis

Population and economic growth in Nevada over the past couple of decades have significantly increased demands on the state's major roads and highways, especially in the Las Vegas metropolitan area. In 2007, Nevada was ranked fourth in the Nation in terms of its share of congested urban interstates and other highways or freeways, with 59 percent of the state's urban highways carrying a level of traffic that is likely to result in significant delays during peak travel hours (TRIP 2009). Between 1991 and 2001, daily vehicle miles traveled increased by 53 percent in Clark County, which experienced the greatest amount of population growth of any metropolitan area in the country over this timeframe (NDOT 2003).

Traffic volumes on Mercury Highway at a location 0.2 miles north of the Mercury interchange are available from the Nevada Department of Transportation and are considered representative of the average daily traffic volumes generated by the NNSS because this highway serves as the main roadway onto the site. **Table 4–9** presents the annual average daily traffic volumes for this location from 1999 through 2008. According to these data, traffic volumes moderately increased (by approximately 30 percent) over this 10-year period.

Table 4–9 Annual Average Daily Traffic Volumes, 1999–2008

Location	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Main Access Road to the Nevada National Security Site	855	1,000	960	960	960	1,250	1,350	1,250	1,100	1,100

Source: NDOT 2008a, Nye County.

The level of service is a measurement typically used by traffic professionals to gauge the adequacy of transportation facilities. All references to levels of service in this section are defined by the *2000 Highway Capacity Manual* published by the Transportation Research Board (TRB 2000). For analysis purposes, the manual defines six categories of level of service that reflect the level of traffic congestion and qualify the operating conditions of an intersection (CMPO 2006). The six levels are given letter designations ranging from "A" to "F," with "A" representing the best operating conditions (free flow, little delay) and "F" the worst (congestion, long delays). For this analysis, the quantitative value that is computed and used to categorize the roadway (based on average daily traffic volumes and roadway characteristics) is the volume-to-capacity ratio. The level-of-service designations for associated ratio values are presented in **Table 4–10**.

Table 4–10 Level-of-Service and Volume-to-Capacity Criteria

Level of Service	*Operating Conditions*	*Criteria (Volume-to-Capacity)*		
		Freeway [a]	*Multilane Highway* [b]	*Two-Lane Highway* [c]
A	Very short delays; progression is extremely favorable.	0 – 0.35	0 – 0.33	0 – 0.12
B	Progression, short delay times.	0.36 – 0.54	0.34 – 0.50	0.13 – 0.24
C	Number of vehicles stopping is significant, although many still pass through the intersection without being required to stop.	0.55 – 0.77	0.51 – 0.65	0.25 – 0.39
D	Many vehicles must stop, and the proportion of vehicles not stopping declines.	0.78 – 0.93	0.66 – 0.80	0.40 – 0.62
E	Poor progression, and/or high volume-to-capacity ratios; considered by many agencies to be the limit of acceptable delay.	0.94 – 1.00	0.81 – 1.00	0.63 – 1.00
F	Intersection oversaturation; high volume-to-capacity ratios; poor progression and long delays; considered to be unacceptable to most drivers.	> 1.00	> 1.00	> 1.00

[a] A divided highway with full control of access and two or more lanes for the exclusive use of traffic in each direction.
[b] An undivided highway with four or more lanes (includes both directions); may be divided with medians with two-way left-turn lanes.
[c] A two-lane, undivided highway.

Major roadways in the Las Vegas metropolitan area, including segments of Interstate 15, Nevada State Route 160, and U.S. Route 95, typically experience high levels of traffic congestion (TRIP 2007). Many portions of these roadways within the city are operating at a level of service of E or F because of the heavy traffic volumes, especially during peak commuting hours.

Outside the Las Vegas metropolitan area, traffic within the ROI is generally considered light and free flowing. **Table 4–11** shows the daily traffic volumes and volume-to-capacity ratios during peak hour conditions, with corresponding levels of service, on the key regional and local roadways in the ROI. The NNSS contribution to the existing traffic congestion in the Las Vegas metropolitan area is considered minor compared to the city's existing traffic volumes, as presented in Table 4–11. Daily traffic volumes were projected to the year 2020 to provide a baseline comparison for future traffic conditions in terms of the potential impacts discussed in Chapter 5. These projected volumes take into account population growth (assuming approximately an annual traffic volume of 5 percent) (NV State Demographer's Office 2008) and are provided in Table 4–11.

Daily traffic volumes were projected to the year 2020 to provide a baseline comparison for future traffic conditions in terms of the potential impacts discussed in Chapter 5. These projected volumes take into account population growth (assuming an approximate annual traffic volume of 5 percent) (NV State Demographer's Office 2008) and are provided in Table 4–11.

Table 4–11 Traffic Volumes and Levels of Service on Key Roads During Peak Hour Conditions

Route	Location	Number of Lanes	2008 (current baseline) Annual Average Daily Traffic	2008 (current baseline) Volume-to-Capacity Ratio During Peak Hour	2008 (current baseline) Level of Service During Peak Hour	2020 [a] (future baseline) Annual Average Daily Traffic	2020 [a] (future baseline) Volume-to-Capacity Ratio During Peak Hour	2020 [a] (future baseline) Level of Service During Peak Hour
Nye County								
U.S. Route 6	0.3 miles east of Warm Springs Road	2	220	0.01	A	358	0.02	A
	200 feet west of Warm Springs Road	2	300	0.02	A	489	0.03	A
	0.2 miles east of Nevada State Route 376 (Tonopah-Austin Road)	2	590	0.03	A	961	0.06	A
	0.2 miles west of Nevada State Route 376	2	1,100	0.06	A	1,792	0.11	A
Nevada State Route 373	0.5 miles south of U.S. Route 95	2	910	0.05	A	1,482	0.09	A
Nevada State Route 372	0.8 miles west of Nevada State Route 160	4	12,000	0.35	B	19,547	0.57	C
	0.1 miles east of Nevada–California state line	2	820	0.05	A	1,336	0.09	A
U.S. Route 95	In Tonopah, 100 feet south of Bryan Ave	4	6,900	0.27	A	11,239	0.43	B
	500 feet north of Cemetery Road, north of Tonopah	2	4,200	0.32	C	6,841	0.53	D
	0.2 miles south of U.S. Route 6 in Tonopah	4	5,400	0.21	A	8,796	0.34	B
	9 miles south of Scotty's Junction (State Route 267)	2	2,300	0.14	B	3,746	0.22	B
	1 mile north of Beatty (State Route 374)	2	2,500	0.15	B	4,072	0.24	B
	0.2 miles west of Amargosa Valley (State Route 373)	2	2,600	0.15	B	4,235	0.25	C
	1.5 miles east of Amargosa (State Route 373)	2	2,900	0.17	B	4,724	0.28	C
	4 miles west of Mercury Interchange	2	2,900	0.17	B	4,724	0.28	C
Mercury Highway	0.2 miles north of Mercury Interchange on U.S. Route 95	2	1,100	0.07	A	1,100	0.07	A

			2008 (current baseline)			*2020 [a] (future baseline)*		
Route	***Location***	***Number of Lanes***	***Annual Average Daily Traffic***	***Volume-to-Capacity Ratio During Peak Hour***	***Level of Service During Peak Hour***	***Annual Average Daily Traffic***	***Volume-to-Capacity Ratio During Peak Hour***	***Level of Service During Peak Hour***
Nevada State Route 160	0.1 miles south of U.S. Route 95	2	1,000	0.06	A	1,629	0.10	A
	7.7 miles north of Nevada State Route 372	2	1,600	0.09	A	2,606	0.15	B
	0.1 miles north of Nevada State Route 372 (near Pahrump)	4	23,000	0.68	D	37,465	1.10	F
	200 feet south of Nevada State Route 372 (near Pahrump)	4	21,000	0.62	C	34,207	1.01	F
	0.3 miles north of the Clark–Nye county line	4	8,900	0.26	A	14,497	0.43	B
Clark County								
Nevada State Route 160	12 miles west of Interstate 15	2	8,100	0.32	C	10,886	0.43	D
	4 miles west of Interstate 15	4	22,000	0.49	B	29,566	0.66	D
	200 feet west of Interstate 15	8	36,000	0.35	B	48,381	0.47	B
U.S. Route 95	9.25 miles north of Indian Springs	4	3,600	0.07	A	4,838	0.09	A
	4 miles east of Indian Springs	4	6,400	0.13	A	8,601	0.17	A
	0.5 miles south of Snow Mountain Interchange (in northwest Las Vegas)	4	9,200	0.18	A	12,364	0.24	A
	0.4 miles north of Ann Road Interchange (in northwest Las Vegas)	6	84,000	1.1	F	112,889	1.48	F
	0.5 miles west of Interstate 15 (between Rancho Drive and Martin Luther King Boulevard)	10	212,000	1.66	F	284,910	2.23	F
	0.5 miles east of Interstate 15 (between Las Vegas Boulevard and Main Street)	8	176,000	1.73	F	236,529	2.32	F
	Between Russell Road and Sunset Road (in southwest Las Vegas)	6	111,000	1.45	F	149,175	1.95	F
	0.8 miles north of Nevada State Route 163 (west of Bullhead City)	2	8,100	0.32	A	10,886	0.43	B
	1 mile south of Nevada State Route 163 (Nevada–California state line)	2	3,200	0.13	B	4,301	0.17	B

Route	Location	Number of Lanes	2008 (current baseline)			2020 [a] (future baseline)		
			Annual Average Daily Traffic	Volume-to-Capacity Ratio During Peak Hour	Level of Service During Peak Hour	Annual Average Daily Traffic	Volume-to-Capacity Ratio During Peak Hour	Level of Service During Peak Hour
Interstate 215	Between Green Valley Parkway and Valle Verde Drive (in southwest Las Vegas)	8	142,000	1.39	F	190,836	1.87	F
	Between Decatur Boulevard and Interstate 15 (in central-south Las Vegas)	8	151,000	1.48	F	202,931	1.99	F
	0.2 miles north of State Route 159 (in central-west Las Vegas)	4	46,000	0.90	E	61,820	1.21	F
Losee Road	0.3 miles south of Cheyenne Avenue (north of NLVF)	4	15,000	0.38	B	20,159	0.52	C
	0.2 miles south of Carey Avenue (south of NLVF)	4	17,000	0.44	B	22,847	0.59	C
Las Vegas Boulevard	0.3 miles south of Nellis Boulevard (west of RSL)	4	13,000	0.33	A	17,471	0.45	B
Nellis Boulevard	300 feet north of Cheyenne Avenue (west of RSL)	6	27,000	0.46	B	36,286	0.62	C
Nevada State Route 164	1.1 miles west of U.S. Route 95 (west of Searchlight)	4	690	0.03	A	927	0.04	A
Interstate 15	At the Nevada–California state line	4	38,000	0.75	C	51,069	1.00	E
	5 miles north of Interstate 215 (in south-central Las Vegas)	8	263,000	2.58	F	353,450	3.47	F
	1 mile north of Interstate 515 (in central Las Vegas)	10	147,000	1.15	F	197,556	1.55	F
	5 miles north of Interstate 515 (near central Las Vegas)	8	72,000	0.71	C	96,762	0.95	E
	5.5 miles north of Interstate 515 (in north-central Las Vegas)	4	34,000	0.67	C	45,693	0.90	D
	North of West Mesquite Interchange (Nevada–Utah state line)	4	19,000	0.37	B	25,534	0.50	B

NLVF = North Las Vegas Facility; RSL = Remote Sensing Laboratory.

[a] 2008 traffic volumes were projected to the year 2020 (represents future baseline conditions), assuming an annual increase in traffic volumes of 5 percent for Nye County and Clark County (NV State Demographer's Office 2008).

Source: NDOT 2008a, Nye County; NDOT 2008b, Clark County; NDOT 2010.

4.1.4 Socioeconomics

4.1.4.1 Region of Influence

The ROI is defined as both the area in which the principal direct and secondary socioeconomic effects of site action are likely to occur and the area expected to be of the most consequence for local jurisdictions. The socioeconomic information presented in this SWEIS discusses current conditions in an ROI comprising Nye and Clark Counties, Nevada. This ROI includes most of the residential distribution of the employees of DOE/NNSA, its contractor personnel, and supporting government agencies.

Within this ROI, there are also several American Indian reservations, tribal enterprises, tribally controlled schools, tribal police departments, and tribal emergency response units (DOE 1996c). The following reservations are located within the designated ROI: Duckwater Shoshone Tribe, Las Vegas Paiute Tribe, Moapa Paiute Tribe, and Yomba Shoshone Tribe. In addition, there are tribes that are located geographically outside the ROI, but are potentially affected by NNSS activities. One of these tribes, the Timbisha Shoshone Tribe, based in Death Valley, California, is located closer to the NNSS than many towns in northern Nye County. As a consequence of this proximity, the people of the Timbisha Shoshone Tribe are a part of the social and economic ROI of the NNSS. For example, students from the Timbisha Shoshone Tribe attend public school in Beatty, Nevada, whereas many Shoshone students from Tacopa, California, attend school in Pahrump, Nevada. Timbisha tribal members both work and shop in Clark and Nye Counties. The Pahrump Paiute Tribe, located in Pahrump Valley, is composed of American Indian people who have been historically recognized by Federal and state agencies to be both qualified to receive services as American Indian people and a group that is seeking Federal acknowledgment.

4.1.4.2 Economic Activity

Economic activity impacts in the ROI of Clark and Nye Counties were analyzed separately for each county. The differences in size, economies, and contributions would produce a misleading analysis if both were analyzed as one aggregate area. For example, in 2008, Nye County accounted for 1.4 percent of total Nevada employment, contrasted with Clark County, which accounted for 71.6 percent of total Nevada employment (USCB 2008b).

Clark County. Between 2000 and 2008, total employment in Clark County increased an average of 13.3 percent annually (USCB 2008b).

Clark County, which covers an area of 7,927 square miles, is located in southern Nevada and is composed of large expanses of unincorporated land and five incorporated cities (DOE 1996c). These are Las Vegas, North Las Vegas, Henderson, Boulder City, and Mesquite. By 2008, total employment in Clark County had increased to 890,221, representing an average annual increase of 5.0 percent from the 2000 figure of 637,339 (USCB 2000, 2008b). Between 2000 and 2008, average annual employment growth in Nevada was 4.1 percent, higher than the United States' average of 1.3 percent.

In 2008, per capita income was $28,138 (USCB 2008b). The unemployment rate in Clark County in 2008 was 6.0 percent, the same as that of the state (6.0 percent) and slightly lower than the national unemployment rate of 6.4 percent. However, as of August 2010, the unemployment rate was 14.7 percent, up 8.7 percent from November 2008.

The largest employment sector in Clark County in 2010 comprised arts, entertainment, recreation, accommodation, and food services (28 percent) (USCB 2010a). Educational services, health care, and social assistance accounted for 12.5 percent of employment. Retail trade; professional, scientific, and management; construction; and finance, insurance, and real estate accounted for 11.2 percent, 10.8 percent, 9.4 percent, and 6.8 percent of employment, respectively. The remaining 20.5 percent was divided among the following sectors: transportation, warehousing, and utilities (4.8 percent); other services (4.2 percent); public administration (3.9 percent); manufacturing (3.4 percent); wholesale trade (2.2 percent); information (1.7 percent); and agricultural, forestry, fishing and hunting, and mining (0.3 percent). Employers of the largest workforces in the region are listed in **Table 4–12**.

Table 4–12 Clark County's Largest Employers

Employer	*Number of Employees*
Clark County School District	30,000 – 39,999
Wynn Las Vegas, LLC	10,000 – 19,999
Wal-Mart Stores, Inc.	9,500 – 9,999
The Venetian Casino Resort	8,000 – 8,499
Clark County	7,500 – 7,999
MGM Grand Hotel/Casino	7,500 – 7,999
Bellagio, LLC	7,500 – 7,999
Aria Resort & Casino, LLC	7,000 – 7,499
Mandalay Bay Resort & Casino	6,500 – 6,999
Desert Palace, Inc.	5,500 – 5,999
Rio Properties, LLC	4,500 – 4,999
Nevada Property 1, LLC – Cosmopolitan	4,000 – 4,499
GNS Corporation – Mirage	4,000 – 4,499
University Medical Center of Southern Nevada	3,500 – 3,999
Flamingo Las Vegas	3,500 – 3,999
Smith's Food & Drug Centers, Inc.	3,000 – 3,499
Ramparts, Inc. – Luxor	2,500 – 2,999
City of Las Vegas	2,500 – 2,999
Southwest Airlines	2,500 – 2,999
Harrah's Las Vegas	2,500 – 2,999

LLC = Limited Liability Corporation.
Source: DETR 2011a.

Nye County. Nye County, located northwest of Clark County, covers an area of approximately 18,064 square miles (46,786 square kilometers) (DOE 1996c, 4-54). The Federal Government controls 93 percent of the land area. Mining, Federal installations, tourist and recreation attractions, and grazing allotments all occur largely on public land in Nye County.

Nye County comprises communities that are widely separated by distance, each with a distinct and independent economic base (DOE 1996c, 4-54). The NNSS and the TTR have been operating in Nye County for many decades. Federal facilities have provided employment for Nye County residents and a minor amount of procurement for local business. The economy in each community depends on different private companies and, in some cases, different industries. Because the communities are widely separated by distance, economic links between communities are limited. Metropolitan economies generally absorb a significant portion of business and residential purchases. Rural economies, such as Nye County, however, often leak large portions of both business and residential purchases to larger communities, resulting in economic loss and a different set of economic development needs from those of more-urban areas.

Nye County's strategy to increase economic development opportunities from Federal facilities is to engage the appropriate divisions of DOE/NNSA in a formal set of interactions (DOE 1996c, 4-54). Nye County has identified the need for a qualified workforce and business base to fulfill Federal requirements. To this end, Nye County has developed programs to inform local businesses of Federal procurement opportunities and continuing formal and informal interaction with appropriate Federal agencies. One example of this proactive approach is Nye County's status as a cooperating agency in the development of this *NNSS SWEIS*.

Between 2000 and 2008, total employment in Nye County increased an average of 4.3 percent annually (USCB 2000, 2008b). In 2008, per capita income in Nye County was $21,071 (USCB 2008b). The unemployment rate for Nye County in 2008 was 5 percent, lower than the state's (6 percent) and the Nation's (6.4 percent). However, as of August 2010, the unemployment rate was 17.2 percent, up 12.2 percent from 2008.

The largest employment sector in Nye County in 2010 comprised arts, entertainment, recreation, accommodation, and food services (19.0 percent) (USCB 2010b). Educational services, health care, and social assistance accounted for 15.1 percent. Construction accounted for 13.9 percent. Retail trade; agriculture, forestry, fishing and hunting, and mining; and professional, scientific, and management accounted for 10.4 percent, 8 percent, and 7.4 percent, respectively. The remaining 22.1 percent was divided among the following sectors: transportation, warehousing, and utilities (6.3 percent); public administration (6.3 percent); finance, insurance, and real estate (4.3 percent); other services (4.2 percent); manufacturing (2.2 percent); information (1.8 percent); and wholesale trade (1.3 percent). Employers of the largest workforces in the region are listed in **Table 4–13**.

Table 4–13 Nye County's Largest Employers

Employer	*Number of Employees*
Bechtel Nevada Corporation	1,000 – 1,499
Nye County School District	800 – 899
Smoky Valley Mining Division	800 – 899
Nye County	600 – 699
Wackenhut Services, Inc.	300 – 399
Wal-Mart Supercenter	300 – 399
Golden Pahrump Nugget, LLC	300 – 399
CCA of Tennessee, LLC	200 – 299
Flamingo Paradise Gaming, LLC	200 – 299
Desert View Regional Medical	100 – 199
Aces High Management, LLC	100 – 199
Home Depot USA, Inc.	100 – 199
State of Nevada	100 – 199
Smith's Food & Drug Centers, Inc.	100 – 199
Front Sight Management, Inc.	90 – 99
Premier Magnesia, LLC	90 – 99
Healthcare Partners of Nevada	80 – 89
Lockheed Martin Corporation	80 – 89
Valley Electric Association	70 – 79
U.S. Postal Service	70 – 79

LLC = Limited Liability Corporation.
Source: DETR 2011b.

Table 4–14 shows employment numbers for the NNSS, NLVF, RSL, and the TTR.

Table 4–14 Onsite Employment

	NNSS					
	NNSS Only	*Including Contract Employees for Solar Plant*	*NLVF*	*RSL*	*TTR*	*Total*
No Action	1,699	1,849	1,442	132	106	3,379

NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; RSL = Remote Sensing Laboratory; TTR = Tonopah Test Range.

4.1.4.3 Population

Clark County. In 2008, Clark County's total population was 1,821,359, an increase of 445,594 individuals, or approximately 32.4 percent, from 1,375,765 in 2000 (USCB 2000, 2008b). This increase was equivalent to an annual average growth of approximately 4.0 percent for the county over the 2000 to 2008 period. By comparison, the average annual growth was approximately 3.4 percent for Nevada and nearly 1 percent for the United States between 2000 and 2008. Most recently, however, there has been a small decrease in population. Clark County decreased 0.8 percent from a high of 1,967,716 in mid-2008 to 1,952,040 in mid-2009 (NSBDC 2010).

The population of the city of Las Vegas totaled 564,484 in 2008, an increase of 18 percent from the 2000 level of 478,434 (USCB 2000, 2008b). The average annual growth of 2.2 percent for the 2000 to 2008 period was below the county level. In 2000, the city of Las Vegas accounted for 34.8 percent of Clark County's population; in 2008, the city accounted for 31.0 percent of the total population in Clark County.

The population of the city of North Las Vegas was 115,488 in 2008, an increase of 78.9 percent from the 2000 level (USCB 2000, 2008b). The average annual growth of 9.9 percent for the 2000 to 2008 period was well above the county level. In 2008, the city of North Las Vegas accounted for 11.3 percent of Clark County's population, an increase from 2000, when the city accounted for 8.4 percent of the total population in Clark County. These data indicate a trend toward outward expansion of the Las Vegas metropolitan area.

Nye County. In 2008, the population for Nye County was 43,555, an increase of 11,070, or 34.1 percent, from the 2000 level (USCB 2000, 2008b). This overall increase is equivalent to an annual average growth for Nye County of about 4.3 percent over the 2000 to 2008 period; the average annual population growth in Nevada was about 3.4 percent, and in the United States, 1 percent. Most recently, however, there has been a small decrease in population. Nye County decreased 2.1 percent from a high of 47,370 in mid-2008 to 46,360 in mid-2009 (NSBDC 2010).

Pahrump is the largest and most rapidly growing community in Nye County. The 2008 population for the town of Pahrump was 36,390, up 47.7 percent from 24,631 in 2000 (USCB 2000, 2008b). The average annual growth was 6.0 percent for the 2000 to 2008 period. In 2008, Pahrump accounted for 83.5 percent of the population in Nye County.

The 2000 (2008 population data were not available) population in the town of Tonopah was 2,627, down from 3,810 in 1990 (USCB 2000, 2008b). In 2000, Tonopah accounted for 23.7 percent of the population in Nye County.

The 2000 (2008 population data were not available) population in Beatty was 1,154, down from 1,652 in 1990 (USCB 2000, 2008b). In 2008, Beatty accounted for only 2.6 percent of the population in Nye County.

4.1.4.4 Housing

Clark County. In 2008, the housing stock in Clark County consisted of 784,892 units, an increase of 234,113 units, or 42.5 percent, over the 2000 total of 550,799 (USCB 2000, 2008b). Between 2000 and 2008, Clark County housing unit vacancies increased from 47,546 units, or 8.5 percent of the housing stock, in 2000 to 208,275 vacant units, or 13.8 percent of the housing stock, in 2008. According to the Case-Shiller Home Price Index, single-family home prices in Las Vegas were down 28 percent in 2009, and off 46 percent from the peak in August 2006. Prices continue to fall because of an excess supply of housing. According to an April 2009 analysis, the number of excess single-family homes is over 7,000. Multifamily housing, condominiums, and townhouses are also overbuilt, with excess supply topping 7,800 units. Others estimate an excess supply of nearly 35,000 units (UNLV 2009).

An excess supply of residential real estate has caused permitting activity to come to a standstill (UNLV 2009). The number of building permits issued annually in Clark County rose sharply in the mid-2000s, with a peak of 39,015 permits issued in 2005. In 2008, the number of permits dropped, with only 24,596 issued. Monthly permitting from January to October 2009 averaged 508 units per month. Building permits issued in a given year may not represent the actual number of units built; however, they indicate the level of new residential development in the county.

In 2008, the housing stock in the city of Las Vegas consisted of 236,730 units, an increase of 46,006, or 24.1 percent, over the 2000 total of 190,724 (USCB 2000, 2008b). Between 2000 and 2008, housing unit vacancies in the city of Las Vegas increased from 13,974 units, or 7.3 percent of the housing stock, to 29,005 units, or 12.3 percent of the housing stock.

Nye County. In 2008, the housing stock in Nye County consisted of 16,592 units, an increase of 658 units, or 4.1 percent, over the 2000 total of 15,934 (USCB 2000, 2008b). Between 2000 and 2008, Nye County housing unit vacancies increased from 2,625 units, or 16.5 percent of the housing stock, to 3,202 units, or 19.3 percent of the housing stock. The vacancy rate does not reflect substandard units or houses held for occasional and recreational use.

4.1.4.5 Public Finance

The financial characteristics of Clark and Nye Counties are presented in this section. For many jurisdictions discussed, ad valorem taxes are a major source of revenue. These are taxes levied on the assessed valuation of real property. "Assessed valuation" is a valuation set upon real estate as a basis for levying taxes. Thirty-five percent of the taxable value placed on real property is used as the basis for levying property taxes in most Nevada jurisdictions.

Nevada has one of the most liberal tax structures in the Nation from a tax planning perspective. Nevada has no personal state income tax, unitary tax, corporate income tax, inventory tax, estate and/or gift tax, franchise tax, or inheritance tax.

Clark County. Clark County, incorporated in 1909, is governed by a Board of County Commissioners and a county manager (DOE 1996c). The seven members of the board are elected by each district to serve staggered four-year terms. Within the county are 5 incorporated cities, including Las Vegas, which is the county seat, and 13 unincorporated towns. County services include the county recorder, assessor, treasurer, social services, airport, hospital, and criminal justice. In addition, the county provides a full range of local services, such as fire, police, road maintenance and construction, animal control, building inspection, and water and sewage systems to county residents living in unincorporated areas.

In Clark County, the sales tax rate is 8.100 percent (NV Energy 2010a). The 2009 to 2010 average countywide property tax rate was 3.1849 percent. The formula for calculating real property tax is as follows:

$$\text{Taxable Value} \times 0.35 = \text{Assessed Value}$$
$$\text{Assessed Value} \times \text{Tax Rate} = \text{Total Real Property Tax}$$

In 2008, the county's primary revenue sources for government activities were ad valorem taxes ($799,257,814), consolidated taxes ($489,752,501), and sales and use taxes ($265,477,538) (Clark County 2008). These three revenue sources accounted for 25 percent, 15 percent, and 8 percent, respectively, or a total of 48 percent, of government activities revenues. The remaining 52 percent of revenue in Clark County came from interest income, franchise fees, fuel taxes, motor vehicle privilege taxes, room taxes, and other taxes. The county's total expenses were $4,205,515,941. Government activities constituted $2,506,782,626 of total expenses; the largest functional expenses were public safety ($1,082,216,327) and public works ($467,845,743). Business-type activities contributed $1,698,733,315 to total expenses; the largest components were hospital ($589,797,799), water ($431,929,066), and airport ($495,754,402).

Nye County. Nye County is governed by a Board of County Commissioners and a county manager. In Nye County, the sales tax rate is 7.100 percent (NV Energy 2010b). The 2009 to 2010 average countywide property tax rate was 3.1621 percent. The formula for calculating real property tax is the same as that for Clark County.

In 2008, the county's primary revenue sources for government activities were intergovernmental resources ($37,626,930), property taxes ($20,186,445), and miscellaneous ($8,268,727) (Nye County School District 2009). The county's total expenses were $70,843,657. Government activities constituted $20,347,092 of total expenses; the largest functional expenses were public safety ($18,861,475), capital projects ($9,123,301), and public works ($8,287,225).

4.1.4.6 Public Services

The key public services examined in this analysis are public education, police protection, fire protection, and health care. Providers of these services in the ROI are public school districts, police and fire departments, and hospitals and clinics. Existing conditions for each major public service are determined by student-to-teacher ratios at primary and secondary public schools and by the ratio of employees (sworn officers, professional firefighters, and health care personnel) to the serviced population.

4.1.4.6.1 Public Education

Higher Education. The University of Nevada, Las Vegas, was officially established in 1957 (UNLV 2010). More than 220 undergraduate, masters, and doctoral degree programs are offered to a student body of 28,605. The university has on-campus research facilities, including the Desert Biology Research Center, Center for Business and Economic Research, Nuclear Waste Transportation Research Center, and Parent/Family Wellness Center. The Desert Research Institute, a separate division of the University and Community College System of Nevada, was founded in 1959 as an international center for environmental research. The University of Nevada Medical School trains medical students and resident physicians at the University Medical Center, where the school is located. The Harry Reid Center is an environmental studies organization located on campus and operated by the university.

Clark County School District. The Clark County School District includes all of Clark County, which covers 7,910 square miles and includes the metropolitan Las Vegas area, all outlying communities, and rural areas (Clark County School District 2009). During the 2009–2010 school year, the district operated 350 schools: 212 elementary schools, 58 middle schools, 46 high schools, 25 alternative schools, and 9 special needs schools. The district operates one of the Nation's largest school construction and modernization programs. In fall 2009, the district opened 3 new elementary schools and 3 high schools. The student-to-teacher ratio is 21:1.

Nye County School District. During the 2009–2010 school year, the district operated 18 schools: 7 elementary schools, 3 elementary/middle schools, 1 middle school, 1 middle school/high school, 3 high schools; 1 combined K–12 (kindergarten through 12th grade) school; 1 combined 6th–12th grade school; and one tribally controlled school that is kindergarten through 8th grade (Nye County School District 2009). Some 426 certified personnel were employed by the district in the 2009–2010 school year, and the district had a 2008 enrollment of 6,348 students. The approximate average student-to-teacher ratio for the Nye County School District was 18.6:1.

American Indian Education. Under Federal and tribal law, American Indian children can be educated in tribally controlled, federally certified schools located on American Indian reservations (DOE 1996c). Federal funds are available for the education of American Indian children through the Indian Education Act. Compensation from the Federal Government is provided to any school district that enters into a cooperative agreement with federally recognized tribes regarding a public, private, or tribally controlled school.

In Nye County, there is one tribally controlled elementary school, which is operated by the Duckwater Shoshone Tribe. In 2009, the school had 16 students enrolled from preschool to 8th grade (Nye County School District 2009).

A tribally operated Head Start Program is located on the Moapa Paiute Indian Reservation (DOE 1996c). The program is open to all eligible preschool students, including both American Indian and non–American Indian students from nearby communities. This program is funded through the Inter-Tribal Council of Nevada, which operates Head Start Programs elsewhere in Nevada. American Indian students also attend public schools that are not tribally controlled.

4.1.4.6.2 Police Protection

Police protection in the ROI is provided by the Las Vegas Metropolitan Police Department, the North Las Vegas Police Department, and the Nye County Sheriff's Office, with stations at Tonopah, Pahrump, Beatty, Mercury, and Amargosa Valley. Each station provides law enforcement services in conjunction with other law enforcement agencies, including the Nevada Highway Patrol.

Las Vegas Metropolitan Police Department. The department is headed by the elected sheriff of Clark County. In addition to patrolling the city of Las Vegas, the department provides service for rural areas of the county. The department maintains 3,542 sworn personnel for a level of service of 6.27 personnel per 1,000 people (Castle 2010). There are 15 training personnel and 8 civilian crime prevention specialists, which include community relations, crime prevention, and Drug Abuse Resistance Education (DARE) officers. Some 2,200 vehicles (650 patrol cars), including four-wheel vehicles, motorcycles, and search and rescue vehicles, are used by the department. The holding facility capacity for the Clark County Detention Center is 2,984; the capacity of the Las Vegas Detention Center, operated by the City of Las Vegas, is 1,200.

North Las Vegas Police Department. The North Las Vegas Police Department was founded in 1946 with an original jurisdiction covering almost 4 square miles and approximately 3,000 people (NLVPD 2010). It now services 100.44 square miles and a population of approximately 221,003. The North Las Vegas Police Department, which consists of the police department and the detention center, currently employs a total of 739 employees, including 458 commissioned personnel and 281 civilian personnel. The commissioned staff consists of 310 police personnel and 148 detention personnel. The civilian staff consists of 265 full-time employees and 16 part-time employees, as well as 123 crossing guards employed on a part-time basis (whose numbers are not included in total of civilian personnel). Statistics show that there are 1.33 officers per 1,000 residents.

Nye County Sheriff's Office. The Nye County Sheriff's Office, whose main office is located in Tonopah, serves the entire county and supports substations located in Pahrump, Mercury, Amargosa Valley, Beatty, Smoky Valley, and Gabbs (Becht 2010).

There are 87 total patrol personnel, including administrative staff, 4 DARE/school resource officers, 3 assistant sheriffs, and 1 person specifically assigned to training (Becht 2010). In addition, there are approximately 106 vehicles, including detention transport vehicles and other specialty vehicles (SWAT [special weapons and tactics], Mobile Command Post, etc.)

Based on population estimates, current staffing levels are roughly 1.15 officers per 1,000 members of the population (Becht 2010).

There are 7 sworn detention personnel and 151 bed spaces for prisoners (Becht 2010).

Onsite Law Enforcement. Civilian law enforcement at the NNSS is provided under a contract with the Nye County Sheriff's Department. Officers work out of a substation located in Mercury. Nellis Air Force Base Security Forces respond to RSL when called. The Police Services portion of the current Inter-Service Support Agreement between DOE/NNSA and Nellis Air Force Base, dated January 2006, reads, "In the event of an emergency, Nellis Security Forces response will be limited to securing the exterior of the facility only." Law enforcement for the TTR is also provided by the Nye County Sheriff's Department, and law enforcement at NLVF is provided by the North Las Vegas Police Department.

Onsite Security. Security enforcement is the responsibility of WSI, a private contractor. The NNSS is a controlled-access area and WSI provides site-wide protective services according to the guidelines established by the DOE/NNSA NSO.

4.1.4.6.3 Fire Protection

Fire protection for the ROI is provided by the Clark County Fire Department, Las Vegas Fire Department, and several volunteer fire departments in Nye County (including Tonopah, Pahrump, Beatty, and Amargosa Valley).

Clark County Fire Department. The Clark County Fire Department is divided into two sections: urban and rural (DOE 1996c). The urban fire stations are located in areas that are not cities and do not have their own fire departments. The rural fire stations are manned by volunteer firefighters and are discussed in the subsection on volunteer fire departments below.

In 2008, the Clark County Fire Department provided service to a population of 861,546 in an area covering 7,420 square miles (CCFD 2008). The Clark County Fire Department operates out of 27 paid fire stations and 13 volunteer fire stations. With 650 paid firefighters, 350 volunteer firefighters, 58 inspectors/investigators, and 50 support employees, the department provides a level of service equal to 1.28 firefighters per 1,000 people.

Las Vegas Fire and Rescue. Las Vegas Fire and Rescue has 18 fire stations that protect an area of 133.2 square miles and a population of 607,876 residents (Szymanski 2010). The department uses 19 engines, 6 ladder trucks, 20 emergency medical service rescue units, 3 battalion chief units, 1 heavy rescue unit, 1 hazardous material unit, 1 Chemical-Biological-Radiological-Explosives-Nuclear unit, 1 air/light resource unit, 1 3,000-gallon water tender, and 1 mobile command post. The department has 681 employees, including 12 battalion chiefs, 87 captains, 91 engineers, 126 firefighter/paramedics, and 179 firefighters. Last year, the department responded to nearly 85,000 incidents. Las Vegas Fire and Rescue is both an accredited and an ISO [International Organization for Standardization] Class One department.

City of North Las Vegas Fire Department. The North Las Vegas Fire Department is staffed by 234 uniformed and civilian employees who serve in divisions such as Administration, Fire Operations, Homeland Security and Special Operations, Business and Support Services, Community Life Safety, and Code Enforcement (NLVFD 2010). Personnel provide emergency services response, advanced life support, emergency management, department training and record-keeping, fire prevention, inspection, fire protection enforcement, fire investigations, code compliance, public information, and public education, as well as administrative services. The North Las Vegas Fire Department provides all-hazard 24-hour emergency response service from eight fire stations using seven engines, two trucks, six advanced life-support rescue units, and two battalion chief units. The department provides fire engineering and inspection services, along with a complete public education program. All "first-out" emergency vehicles provide medical services at the advanced-care (paramedic) level.

In 2007, the North Las Vegas Fire Department responded to 23,679 emergency incidents, resulting in 29,009 unit responses, and conducted 3,816 plan reviews, 10,930 fire and business inspections, and 122 fire investigations (NLVFD 2010). Public education activities reached over 62,000 citizens at 226 public events. The Tactical Medic Program started operations on April 18, 2007, and made 68 deployments in 2007 and 54 deployments in the first 4 months of 2008, all in support of the North Las Vegas Police Department. Additionally, 30 members of the North Las Vegas Fire Department are active participants in the Federal Emergency Management Agency's Nevada Urban Search and Rescue Task Force 1. Technical rescue and hazardous material response programs are currently under development.

Volunteer Fire Departments. Nye County's main hub for coordinating volunteer fire protection is Station 51, located in Pahrump, Nevada. Station 51 is the home of a quick response fire/HAZMAT [hazardous materials]/EMS [emergency medical services] station, and it also functions as the Southern Emergency Operations Center for the southern part of the county. Station 51 consists of 3 paid staff and approximately 20 volunteers. Equipment for Station 51 consists of Engine 51, Engine 52, Brush 51, Rescue 51, HAZMAT 51, Tender 51, Medic 51, Command 51, Command 52, two quads, a trailer containing decontamination supplies, a mass casualty trailer, a mobile command post, and a disaster supplies bus.

Station 11 is located in Tonopah, Nevada, and is the base for the Tonopah Volunteer Fire Department, Tonopah Volunteer Ambulance Service, and Emergency Services Northern Office and serves as the Emergency Operations Center for the northern part of the county. Station 11's volunteer fire department consists of approximately 20 volunteers and no paid staff. Equipment for Station 11 consists of Engine 11, Engine 12, Rescue 11, Ladder 11, Command 11, and a four-by-four utility terrain vehicle with a patient rescue trailer. The Tonopah Volunteer Ambulance Service, an intermediate-level service, has approximately 15 volunteers, and its equipment consists of Medic 11, Medic 12, a mass casualty trailer, and a disaster response trailer. The Emergency Services Department has 2 paid staff members at this location.

Station 21 is located in Round Mountain/Smoky Valley, Nevada, and is the base for the Round Mountain Volunteer Fire Department. A staff of approximately 14 volunteers and 1 paid member respond to fire and rescue calls from this station. Station 21 is also the home of the Northern HAZMAT Team. Equipment includes Engine 21, Engine 22, HAZMAT 21, Rescue 21, Command 21, and a trailer containing decontamination supplies. The Smoky Valley Volunteer Ambulance Service is an intermediate-level service with approximately 16 volunteers. Equipment includes Medic 21 and Medic 22.

Station 31 is located in Beatty, Nevada, and is the base for the Beatty Volunteer Fire Department and Beatty Volunteer Ambulance Service. Approximately 12 volunteers serve on the fire department and there is 1 paid station superintendent/responder. Equipment includes Engine 31, Engine 32, Rescue 31, Tender 31, Ladder 31, a quad, and Command 31. The Beatty Volunteer Ambulance Service consists of approximately 10 volunteers, who respond at an intermediate level. Equipment includes Medic 31, Medic 32, a mass casualty trailer, and a Point of Distribution trailer.

Station 61 is located in Manhattan, Nevada, and is the base for the Manhattan Volunteer Fire Department. Approximately eight volunteers serve on the department. Equipment includes Engine 61 and Rescue 61.

Station 71 is located in Gabbs, Nevada, and is the base for the Gabbs Volunteer Fire Department and the Gabbs Volunteer Ambulance Service. Approximately six volunteers serve on the fire department. Equipment includes Engine 71 and Rescue 71. The Ambulance Service has approximately eight volunteers and the equipment includes Medic 71 and Medic 72.

Station 81 is located in Belmont, Nevada, and is the base for the Belmont Community Emergency Response Team (CERT). Approximately 10 volunteers serve on the CERT team. Equipment includes CERT 81, CERT 82, and a mobile fire attack trailer.

Station 91 is located in Duckwater/Currant Creek, Nevada, and is the base for the volunteer fire department. Approximately eight volunteers serve on the fire department. Equipment includes Engine 91, Command 91, and a mobile fire attack trailer.

Each station has dedicated mutual aid areas and Station 51 provides mutual aid to Southern Inyo County in California, Clark County, BLM, USFWS, the NNSS, throughout Nye County, and anywhere dispatched, as determined by the director of emergency services. The NNSS Fire/HAZMAT/EMS Team provides mutual aid to Nye County in Crystal, Nevada, and along the transportation corridor leading to Amargosa.

The Pahrump Valley Fire Department is a combination career and volunteer department with 22 career positions (RCI 2005). According to a 2004 study, 22 volunteers were reported at the time of the assessment (RCI 2005). Seven career firefighters are on duty each day. Four fire stations are associated with the Pahrump Valley Volunteer Fire Department. Two fire stations are staffed on a 24-hour basis with career personnel; one is manned by a combination of career and volunteer personnel; and one is manned by volunteers and houses reserve equipment.

Equipment consists of one command car, four engines (plus one reserve engine), six medics, three tenders, two brushes, one tower ladder, one rescue unit, two attack units, and one hazardous material response unit.

Onsite Fire Protection. The fire protection capacity of the NNSS is structured to accommodate current mission requirements, and a self-contained firefighting department is responsible for suppression and prevention. Other services include rescue, hazardous material response, training of fire personnel, fire prevention inspection, installation of all fire extinguishers at the NNSS, and fire-prevention awareness programs. NNSS Fire and Rescue operates out of two fire stations; one is in Mercury, and a newly constructed station in Area 6 provides rapid response to emergencies in the forward areas of the NNSS (DOE 2009f).

4.1.4.6.4 Health Care

Health care services within the ROI include 15 full-service hospitals located in Clark and Nye Counties. These facilities provide a wide array of medical services, including physical examinations; treatment of illness; emergency, intensive, and coronary care; internal medicine; x-ray and laboratory; infertility, obstetrics, and gynecology; neonatal intensive care; inpatient and outpatient surgery; pharmaceuticals; optometry; dental; respiratory therapy; and skilled nursing and long-term care. Services provided by three special service hospitals include psychiatric, chemical dependency, and mental health treatment. In addition, the Clark County Health District provides public health services and coordinates the EMS system. The following information pertains to hospitals and medical facilities within the ROI.

Boulder City Hospital is a nonprofit, 20-bed acute-care critical access hospital and a 47-bed skilled nursing facility located in Boulder City, Nevada (Boulder City Hospital 2010). It has a medical staff of nearly 200 physicians, representing nearly 26 specialties.

Centennial Hills Hospital and Medical Center opened in January 2008 and is located in northwest Las Vegas. It provides 171 beds, including a 41-bed Emergency Department, 25-bed Women's Center, 6-bed Level II Nursery, 32-bed Intensive Care Unit, and 108 medical/surgical beds. It also provides a wide range of medical services and procedures (Centennial Hills Hospital 2011).

Mountainview Hospital is a short-term hospital located in Las Vegas, Nevada (NV Energy 2010c). It has 235 beds and two specialty units: adult and pediatric (191 beds) and intensive care (36 beds).

Desert Springs Hospital is a 351-bed, acute-care facility located in southeast Las Vegas that has been providing for the health care needs of Las Vegas residents since 1971 (NV Energy 2010c). The hospital provides 24-hour emergency services, including a fast-track area in the emergency room to treat less-acute patients and comprehensive cardiology services. New facilities include a maternity center featuring labor, delivery, recovery, and postpartum suites; a third catheterization laboratory; and a 107,000-square-foot medical office building and outpatient surgery facility.

Lake Mead Hospital Medical Center has served the North Las Vegas Community since 1960 (NV Energy 2010c). The facility now has 198 licensed beds. The medical staff consists of over 800 specialists and primary care physicians.

Mike O'Callaghan Federal Hospital is a joint venture between the U.S. Department of Veterans Affairs and DoD (99th Medical Group Hospital, Nellis Air Force Base) (NV Energy 2010c). It is situated on a 49-acre site adjacent to Nellis Air Force Base, approximately 11 miles northeast of downtown Las Vegas.

The facility has 114 beds, 52 of which are designated for Department of Veterans Affairs use: 36 for medical/surgical, 14 for psychiatric, and 2 for intensive care/coronary care.

St. Rose Dominican Hospital is a system of three acute-care facilities in southern Nevada: the Rose de Lima Campus in Henderson (opened in 1947), the Siena Campus in Henderson (opened in 2000), and the San Martín Campus in southwest Las Vegas (opened in 2006). Combined, the three campuses offer more than 500 patient beds and have a collective staff of nearly 3,000 employees.

Southern Hills Hospital, located in southwest Las Vegas and opened in 2004, is a full-service hospital. There are a total of 139 beds. Services include an accredited Chest Pain Center, certified Primary Stroke Center, the Nevada Neurosciences Institute, children's services, Emergency Department, and maternity services (Southern Hills Hospital 2011).

Spring Valley Hospital Medical Center opened in October 2003 and is a full-service acute care facility. It has 231 beds, including 105 medical/surgical beds, 22 rehabilitation beds, 18 intensive care beds, 21 intermediate care beds, 12 chest pain observations beds, 28 women's center beds, 9 Level II nursery beds, and 18 Level III Neonatal Intensive Care Unit beds (Spring Valley Hospital 2011).

Summerlin Hospital Medical Center features 169 licensed beds, all of which are private patient rooms (NV Energy 2010c). The acute-care facility has adjoining facilities for outpatient services such as surgery, a laboratory, and radiology, as well as two medical office buildings.

Sunrise Hospital and Medical Center is located in Las Vegas (Healthgrades 2010). This short-term hospital has 610 beds and three specialty units, including adult and pediatric (436 beds), intensive care (92 beds), and surgical intensive care (10 beds).

University Medical Center, which is affiliated with the University of Nevada School of Medicine, is the premier teaching hospital in the state. The medical center serves the medical needs of southern Nevada and parts of California, Utah, and Arizona, as well as those of millions of visitors to Las Vegas.

Valley Hospital Medical Center, founded in 1972, is a licensed, 409-bed, full-service acute-care hospital located in the heart of Las Vegas that serves the greater Las Vegas area and the surrounding rural communities of southern Nevada (NV Energy 2010c).

The Desert View Regional Medical Center, located in Pahrump, Nevada, opened April 27, 2006. It is a short-term acute-care hospital with 24 private rooms, expandable to 50 beds, a 24-hour emergency room, two surgical suites; diagnostic imaging; physical therapy; delivery suites and a nursery; a diagnostic sleep center; and a decontamination room.

Nye Region Medical Center is located in Tonopah (NV Energy 2010c). It has 44 beds, one physician, and three nurses.

Onsite Health Care. An eight-bed dispensary in Mercury serves as a clinic for the NNSS. Facilities include rooms for emergency care; examination and treatment; and x-ray and associated darkroom equipment, offices, and storage. First-aid stations are located near field activities for quick treatment of personnel.

4.1.5 Geology and Soils

This section presents an analysis of the regional geology and soil environment, including descriptions of the physiography, stratigraphy, structural geology, seismicity, volcanism, and mineralogy of the NNSS and the surrounding region. Although construction, facility operations, and surface and subsurface tests have reworked localized areas of soils and bedrock, the condition of the regional geology and soils remains largely unchanged. This section provides an updated review of the geology and soils in the affected environment as presented in Chapter 4, Section 4.1.4, of the *1996 NTS EIS*.

Beginning in 1951, shortly after the establishment of the NNSS, geologic studies were commissioned for the site. Initially used to support nuclear testing in the 1950s and 1960s, the surface and subsurface geologic surveys were gradually expanded and then compiled into a series of databases now used to create a comprehensive knowledge of the region. Geologic mapping, site-wide geophysical surveys, exploratory drilling and testing, fault mapping, and detailed geotechnical studies have all contributed to the wide-ranging knowledge of the area's geology. The results of the military and academic investigations have been described in a Geological Society of America Memoir in 1968 (Eckel 1968), and updated with new groundwater studies (Laczniak et al. 1996; Sweetkind et al. 2010), and geology reports on the Yucca Mountain area (Stuckless and Levich 2007). The Annual NNSS Environmental Report summarizes the general geologic knowledge at the site, which has remained consistent from 2008 through 2011 (DOE/NV 2009d, 2011). Because of continuous investigations, the NNSS is considered geologically one of the most well-researched regions in the United States (DOE 1996a).

4.1.5.1 Physiography

The NNSS is located in the southern part of the Great Basin, the northernmost subprovince of the Basin and Range Physiographic Province. This region is characterized by north–south-trending, linear mountain ranges that are separated by broad sediment-filled basins. The mountain ranges, formed by tilted, fault-bounded blocks of bedrock, can extend as much as 50 miles in length and 15 miles in width. Extensive fault zones, including the Walker Lane shear zone, its subsidiary, the Las Vegas shear zone, and the southwestern Nevada volcanic field, also affect the area topography. The Walker Lane shear zone transverses the TTR from the north to the southeast and gradually merges with the Las Vegas shear zone, which borders the southern edge of the NNSS (Faulds and Henry 2008). The flat uplands of the northwest NNSS, including the Pahute and Rainier Mesas, are composed of volcanic units of the southwestern Nevada volcanic field. Vertical relief at the NNSS varies from 3,280 feet above sea level at Frenchman Flat and Jackass Flats to 7,216 and 7,675 feet above sea level on Pahute and Rainier Mesas, respectively.

The Great Basin Subprovince is an internally draining basin with no outlet to the Pacific Ocean. Two deserts, the Mojave Desert and the Great Basin Desert, are located within the Great Basin Subprovince and are characterized by their arid conditions and landforms formed by wind and water. The northern section of the NNSS is located in the Great Basin Desert; the southern third is located in the Mojave Desert, with transitional valleys in between. The topography of the region includes rugged mountain and mesas with steep sides. Eroded material from the ranges collects on alluvial fans that extend into the valley floors. The sediments in the alluvial fans and valleys are typically composed of coarse to fine alluvial debris (boulders, cobbles, sand, silt, and clay).

Yucca Flat and Frenchman Flat are topographically closed valleys. In the lowest portions of these valleys, water from snowmelt and other runoff from higher elevations collects during wet seasons. The collected water contains fine sediments and dissolved solids, including salts. As the water evaporates, these fine sediments and evaporite salts are left behind to form a playa. Jackass Flats is topographically open and drains via Fortymile Wash to the south off the NNSS.

Past actions by DOE, particularly underground nuclear testing, have significantly altered the topography at the NNSS. Yucca Flat and, to a much lesser extent, Pahute and Rainier Mesas are pockmarked with craters from surface explosions and collapsed test cavities. Buckboard Mesa, Shoshone Mountain, Dome Mountain, and Frenchman Flat also exhibit evidence of past tests. Other excavations on the NNSS include blasting for road construction, excavation of aggregate material (e.g., sand and gravel), flood and drainage control, and historical mining tunnels and shafts.

4.1.5.2 Regional Geology

The NNSS is located in a region of complex stratigraphic and structural elements that combines volcanic uplands and calderas, Basin-and-Range faulted bedrock, Mesozoic thrust faults, and modern alluvial basins. All of these features overlay a basement complex of highly deformed Proterozoic- and Paleozoic-age sedimentary and metasedimentary rocks. Approximately 40 percent of the NNSS surface is alluvium-filled basins; 40 percent is Tertiary-age volcanic rocks; and 20 percent is Paleozoic- and

Precambrian-age sedimentary rocks (DOE/NV 2011). **Figure 4–8** presents a simplified map of the geologic units expressed at the surface. **Table 4–15** presents a description and age of the geologic units found at the NNSS. A detailed compilation of the rock units at the NNSS can be found in Slate et al. (1999).

The regional tectonic history is complex, and the geologic record reflects a history of deposition of marine sediments, compressional deformation, erosion, and volcanic activity that spans an interval of hundreds of millions of years. During the late Paleozoic era, the region was a stable continental shelf, periodically covered by shallow seas that gradually deepened westward. Thick layers of limestone, dolomite, shale, and sandstone deposited in the Cambrian through the early Devonian periods are present on the NNSS. In the late Devonian era, uplift west and north of the NNSS resulted in the seas retreating, erosion, and deposition of Mississippian sandstones and shales in a foreland basin (Poole and Sandberg 1991).

Major east–west compression and deformation occurred during an event called the Sevier orogeny, which produced regional thrusts, folds, and strike-slip faults. As a result of the thrust faulting, sheets of older Paleozoic sedimentary rocks were thrust over younger rocks. Erosion continued through the early Tertiary period. This erosion was interrupted in the Miocene by episodes of silicic volcanism, emplacement of granitic rocks, and extensional deformation as widespread normal faults and local strike-slip faulting. Crustal extension in this region has continued for the last 20 million years but at diminished rates in the Pliocene and Quaternary (DOE 1996c). Extensional deformation accompanied by local strike-slip faulting formed large basins in the east (Yucca Flat, Frenchman Flat) and the south (Jackass Flats) of the NNSS; this deformation exposed Paleozoic and Mesozoic rocks in the ranges flanking the basins of Yucca and Frenchman Flat. The valleys subsequently filled with coarse gravels and sands eroded from the mountain ranges, which are layered with finer grains that were reworked by wind and water. Crustal extension is continuing today, and is recorded by instrumentally located earthquakes and the presence of local fault scarps in Quaternary alluvial deposits.

Most of the uplands along the western edge of the NNSS and the TTR are covered by middle Tertiary-age volcanic rocks that are part of the southwestern Nevada volcanic field (Sawyer et al. 1994). This volcanic field includes a broad volcanic plateau underlain by tuffs and lavas that erupted from multiple caldera complexes in the area. At least 17 ash-flow tuff sequences have been associated with eruptions from seven major, overlapping caldera complexes (Byers et al. 1989; DOE 1996c; DOE/NV 2011). Most of the calderas were formed from large-volume eruptions approximately 16 to 7.5 million years ago, while the youngest caldera-forming events most likely occurred about 7.5 million years ago, forming the Stonewall Caldera (DOE 1996c). These eruptions deposited high silica deposits of ash, tuff, and lava. The multiple layers of ash-flow tuff and lava are seen exposed today in the complex Tertiary volcanic sequences and mountain ranges. Approximately 8 million years ago, volcanic activity in the area transitioned to low-volume, nonexplosive eruptions of basalt scoria and lava. The volcanic activity is marked by basaltic scoria cones and associated lava flows at Crater Flat and Frenchman Flat. Since the last major eruptions about 7.5 million years ago, only scattered, short-duration volcanic activity has occurred in Nevada (DOE 1996c). The waning tectonism and transition to small-volume basaltic volcanism indicate that future large-scale volcanic activity is not expected at the NNSS (DOE 1996c).

There are over 300 described Tertiary volcanic units at the NNSS (DOE/NV 2011; Warren et al. 2000, 2003), although limited units are often grouped into larger, more-extensive units. Due to the large number of volcanic units and multiple caldera sources, the volcanic stratigraphy has been subsequently revised and updated with additional research. Byers et al. (1989) presents a detailed review of the past studies and the evolution of concepts on calderas of the southwestern Nevada volcanic field from 1960 to 1988; this work was updated by Sawyer et al. (1994). The revised stratigraphy was used to generate complex hydrogeologic models for use in analyzing the movement of groundwater near testing locations in support of the Underground Test Area (UGTA) Project.

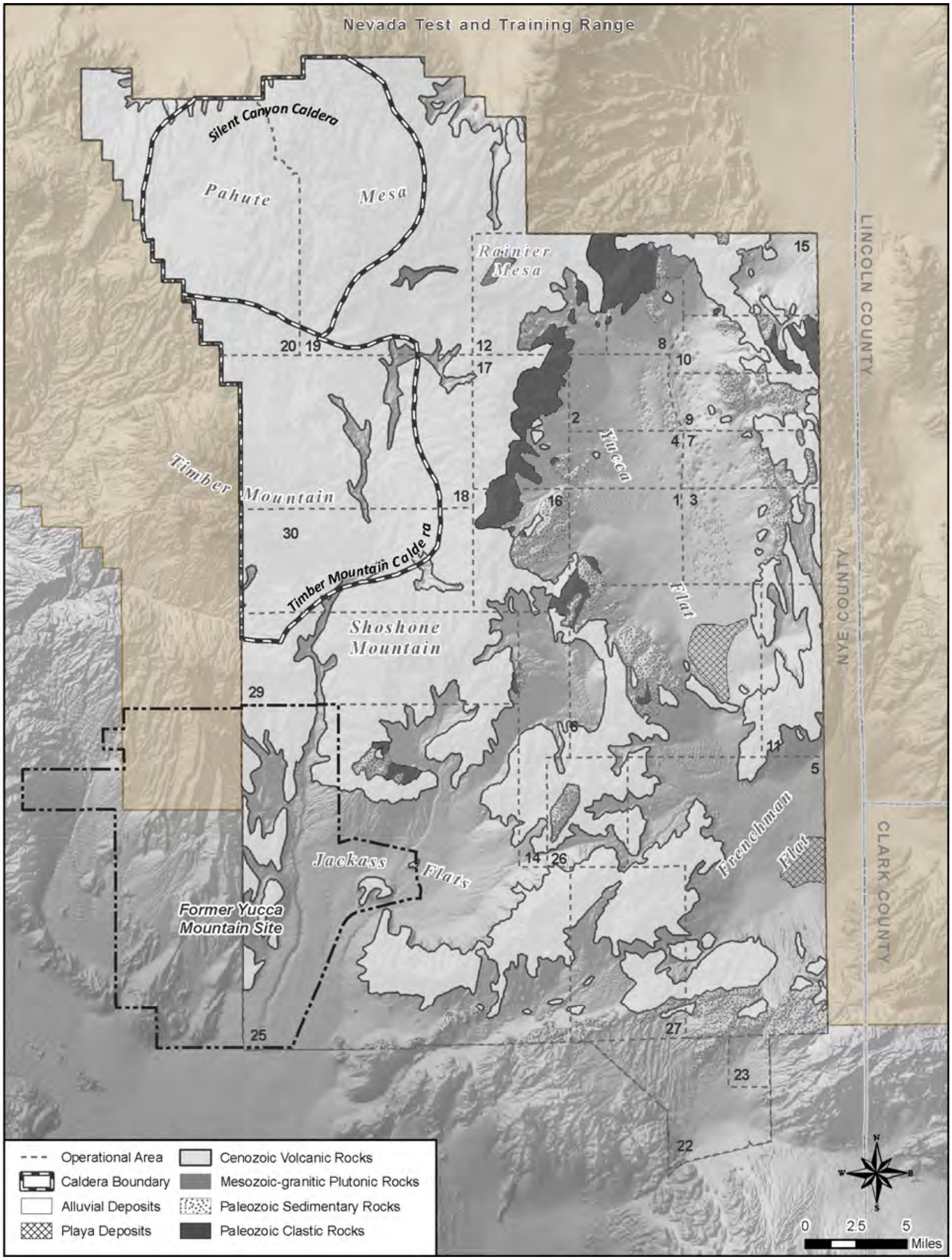

Figure 4–8 Simplified Map of the Geologic Units

Table 4–15 Summary Stratigraphy of the Nevada National Security Site

Era	*Period*	*Series*	*Group*	*Map Units*	*Description*	*Thickness*	*Example Location*
Cenozoic	Quaternary	Holocene – Present Day	Surficial & Volcanic Deposits	Young Alluvial Deposits	Intermixed gravel, sand, and silt, unconsolidated to poorly consolidated, poorly to moderately well-sorted, locally cross-bedded.	32.8 feet	Fortymile Wash
				Playa	Silt, fine sand and clay, poorly to moderately well-consolidated, calcareous, moderately well-sorted. Ocasionally saline.	65.6 feet	Yucca Flat, Frenchman Flat
		Early Holocene/ Pleistocene		Intermediate Alluvial Deposits	Intermixed and interbedded gravel, sand, and silt. Clasts are light and pinkish gray, with variable sorting and cross-beds. Moderately to densely packed pavement.	Up to 98.4 feet	Yucca Flat, Frenchman Flat
		Pleistocene		Youngest Basalt	Isolated black and reddish-brown cinder cones, lava flows, feeder.	Variable	Crater Flat
		Middle to early Pleistocene/ Pliocene		Old Alluvial Deposits	Intermixed and interbedded gravel, sand and silt, light brownish gray to light gray. Generally poorly sorted and moderately cemented with carbonate.	Greater than 131 feet	Yucca Flat, Frenchman Flat, Jackass Flat
	Tertiary (Miocene)	Miocene	Thirsty Canyon Group	Gold Flat Tuff, Pahute Mesa and Rocket Wash Tuffs, Basalt of Thirsty Mountain, Stonewall Flat Tuff	Ash-flow tuff, basalt lava flows and nonwelded tuff from the Black Mountain caldera. Multiple sequences of tuff formations from sequential volcanic eruptions. High-alkali feldspar and low-plagioclase minerals present in tuff.	Greater than 1,640 feet	Pahute Mesa, Buckboard Mesa
			Timber Mountain Group	Ammonia Tanks Tuff, Rainier Mesa Tuff	Rhyolite ash-flow tuff, subordinate rhyolite lava flows and volcanic domes, with related intracaldera breccias. Volcanic rocks erupted from the Timber Mountain caldera complex. Contains an abundance of quartz phenocrysts in rhyolite and iron-magnetic minerals in upper layers. Also contains some thin basaltic lava flows.	Greater than 1,640 feet	Timber Mountain Caldera Complex, Pahute Mesa
			Paintbrush Group	Paintbrush Tuff, Wahmonie Formation	Alkali rhyolite nonwelded tuff and lava flows erupted form Claim Canyon caldera. Biotite, hornblende, and some clinopyroxene present in sequence through the group. Rhyolite lava flows and related nonwelded tuff.	3,608 feet	West of Frenchman Flat, Shoshone Mountain, Yucca Mountain
			Crater Flat Group	Prow Pass Tuff, Bullfrog Tuff	Assemblage of ash-flow tuff and related lava flows and airfall tuffs.	Variable	South of Timber Mountain

Era	***Period***	***Series***	***Group***	***Map Units***	***Description***	***Thickness***	***Example Location***
			Belted Range Group	Grouse Canyon Tuff, Tunnel Formation, Comedites of Quartet Dome and Split Range	Voluminous assemblage of peralkine ash-flow tuff and related lava flows and air fall tuff. The source calderas were buried under later eruptions.	Greater than 1,640 feet	Pahute Mesa, Belted Range
		Oligocene/ Cretaceous		Gabbro dikes	Dark-green hornblende gabbro and diorite dikes that cut pre-Tertiary rocks. Medium-grained texture, with plagioclase, hornblende, clinopyroxene, and biotite as the component minerals.	Variable	Northern margin of Yucca Flats
		Upper		Granitic intrusion	Medium-grained intrusive rocks, hornblende-biotite granodiorite, quartz monzonite. Includes Climax stock.	Variable	Northern edge of Yucca Flat
Mesozoic	Cretaceous	Lower		Tippipah Limestone	Light to medium gray and light brown well-bedded marine limestone, calcareous mudstone, and minor chert pebble conglomerate. Forms ledges easily.	4,101 feet	West of Yucca Flat
Paleozoic	Permian	–		Eleana Formation	Chert-rich sandstone and pebble conglomerate, siliceous siltstone.		
	Penn.	–					
	Miss.	Upper and Middle		Guilmette Formation	Thick-bedded finely to coarsely crystalline marine limestone. Contains sandy limestone and thick beds of quartz sandstone; quartzite beds are brecciated.	1,148 feet	Shoshone Mountain
	Devonian	Upper, Middle, Lower		Slope-facies carbonate	Dark gray limestone, dolomite, silty carbonate rocks, well-bedded, locally laminated, debris-flow deposits. Locally fossiliferous.	Variable	Eastern Rainier Mesa
		Middle		Simonson Dolomite	Bedded dolomite and local sandy dolomite. Includes silty and cherty dolomite at base. Fossils present.	984 feet	
		Lower		Sevy Dolomite and Laketown Dolomite	Thick-bedded dolomite, beds of quartz, commonly brecciated. Base is well-bedded, locally cherty, with fossils present.	3,166 feet	West of Yucca Flat
		Lower Devonian/ Upper Silurian		Lone Mountain Dolomite	Varying color dolomite with increased bedding at base. Sparse fossils.	1,607 feet	Yucca Mountain
	Silurian	Upper		Lone Mountain Dolomite Ely Springs Dolomite	Varying color dolomite with increased bedding at base. Sparse fossils. Two major units: Upper is gray dolostone with silty and clay-rich dolostone, and a thin sandy zone. Lower is fine-grained, cherty dolomite.	Upper: 1,607 feet Lower: 164 to 492 feet	Yucca Mountain
	Ordovician	Middle		Eureka Quartzite	Two major parts. Upper is white, very fine medium-grained sandstone and quartzite. Lower is varicolored, medium-grained quartzite interval with thin limestone and dolomite.	246 to 475 feet	

Era	*Period*	*Series*	*Group*	*Map Units*	*Description*	*Thickness*	*Example Location*
		Middle to Lower	Pogonip Group	Antelope Valley Limestone, Ninemile Formation	Medium, well-bedded silty limestone, dolomite, with chert and siltstone.Various invertebrate fossils present.	3,444 feet	
	Cambrian	Upper		Nopah Formation	Poorly to well-bedded carbonates with shale and siltstones. Includes Dunderberg Shale Member. Invertebrate fossils present.	2,362 feet	
		Upper to Middle		Bonanza King Formation	Well-bedded dolomite and limestone with a banded appearance.	4,199 feet	East of Yucca Flat
		Middle to Lower		Carrara Formation	Heterogeneous sequence of shales, siltstone, sandstone, limestone and silty limestone. Clastic rocks at base, silty limestone beds at top. Stromatolith, trilobite fossils present.	1,148 to 1,541 feet	
		Lower		Zabriskie Quartzite	Resistant, massive, white quartz, pink quartz, and red quartz sandstone.	98.4 to 1,148 feet	
		Late		Wood Canyon Formation	Quartz sandstone, mica and quartz sandstone, clay-rich sandstones, and magnesium carbonates; may be slightly metamorphosed. Includes Stirling Quartzite.	2,296 to 3,772 feet	North of Rainier Mesa
				Stirling Quartzite	Medium to thick-bedded, commonly laminated, fine-grained quartz sandstone, mica quartz sandstone, interbedded with pebbly sandstone. Also limestone and dolostone. Locally metamorphosed.	4,921 feet	
Proterozoic	Precambrian	–		Johnnie Formation	Thick-bedded, few cross-beds, locally pebbly quartz sandstone, with laminated mica siltstone, limestone, and calcareous siltstone.	2,952 to 6,561 feet	
				Metamorphic and intrusive rocks	Light-gray and brown biotite schist, biotite-hornblende schist, and biotite-epidote schist intruded by gneissic monzogranite. Some aplite and pegmatite dikes, quartzofeldspathic gneiss and buiotite schist, minor metaconglomerate, and marble also present.	Bedrock	Gold Flat, Funeral Mountains

Source: Slate et al. 1999.

Soils form in the youngest geologic material at the NNSS, the late Tertiary and Quaternary alluvial, colluvial, spring, lake, playa, and eolian (windblown) deposits. The unconsolidated sediments are formed by erosion of Paleozoic and Tertiary volcanic materials from the surrounding ranges that are deposited in the alluvial fans formed at the basin margins. The alluvial fans consist of interbedded gravel, sand, and silt that vary in their cementation. Valleys that only have internal drainage often collect shallow water after seasonal storms and snowmelt in the spring. As the water evaporates, it leaves stratified lake bed sediments and precipitated salts. The resulting playa sediments are typically bedded sand, silt, or clay. The playa typically looks like a dry lake bed that may contain water after a seasonally high runoff. Sand and silt from the playas can be eroded, transported by wind, and subsequently reworked by moving water. However, most sediments remain stable as long as they are not disturbed.

4.1.5.2.1 Site-Specific Geology

The oldest bedrock at the NNSS is the Paleozoic and Proterozoic sedimentary rock, which includes dolomite, limestone, quartzite, and mudstones (see Table 4–15). The carbonate section of the sedimentary rocks often forms the primary regional aquifer and a "basement" for the Great Basin's hydrology (DOE/NV 2011). The Paleozoic and Precambrian rocks have been subjected to thrust and extensional faulting, as described in Section 4.1.5.2.2. The rocks were formed from marine sediments and have a thickness of up to 32,800 feet (DOE/NV 2011).

The oldest formations of the Proterozoic basement consist of approximately 9,800 feet of lower Cambrian and Proterozoic quartzite and siltstones (DOE 1996c). Above these formations is approximately 15,100 feet of Cambrian through Devonian dolomite, interbedded limestone, and thin but persistent shale and quartzite layers. The youngest of the basement rocks is the Mississippian Eleana formation, which outcrops along the western edge of the Yucca Flat basins, and the Pennsylvanian limestone, which overlies the Eleana formation. In western Yucca Flat, east of the Eleana Range, the Paleozoic-age carbonate rocks have been thrust over the Eleana formation. More information on the basement formations at the NNSS is presented in several publications (Cole 1997; Cole and Cashman 1999; Trexler et al. 2003; Slate et al. 1999).

There are two outcroppings of Mesozoic intrusive rocks at the NNSS; both are granitic masses. The Gold Meadows Stock crops out north of Rainier Mesa, and the Climax Stock is located at the extreme north end of Yucca Flat (DOE/NV 2011). Three underground tests were performed within the Climax Stock. The stock is a granitic rock (quartz monzonite and granodiorite) of Late Cretaceous age that intruded into the Paleozoic sediments.

Pahute and Rainier Mesas are high volcanic plateaus dissected by modern drainages. The mesas are located in the northern portion of the southwestern Nevada volcanic field. Their Tertiary ash-flow tuffs were derived from the Timber Mountain–Oasis Valley caldera complex and the Silent Canyon and Black Mountain calderas. Pahute Mesa was formed from an overlapping complex of fault-controlled calderas, while the laterally extensive tabular outflow sheets of welded tuff covered the surrounding area. During faulting and uplift, the softer pre-Tertiary material was exposed, while the welded tuffs and lava flows resisted erosion. The result was flat-topped mesas with steep sides adjacent to down-dropped valleys. The Timber Mountain caldera, located to the southwest of Pahute and Rainier Mesas, is listed as a national natural landmark by the National Park Service (DOE 1996c).

There are two buried calderas at Pahute Mesa; drill hole and geophysical data indicate that their morphology may be largely controlled by the Basin and Range faults (Warren et al. 2000). All of the tests at Pahute and Rainier Mesas were underground tests that occurred within the Tertiary volcanic rocks and did not penetrate the pre-Tertiary bedrock.

Other historical testing locations are located at Buckboard Mesa, Dome Mountain, and Shoshone Mountain. Buckboard Mesa is located along the northeastern edge of Timber Mountain, while Dome Mountain is a foothill to the southeast. These two sites within the Timber Mountain caldera complex have similar geologic characteristics, including a thick sequence of volcanic rocks that also includes rhyolitic lavas and ash-flow tuffs; volcanic-derived sediments, including sandstone and conglomerate; and basalts. Radial fracturing and faulting typical of a caldera are present at both of these sites. Shoshone Mountain is located southeast of Timber Mountain. The mountain is capped by a unit called rhyolite of Shoshone Mountain, and lithic ridge tuff. North of Shoshone Mountain, the Paleozoic sandstone and conglomerate of Eleana formation and carbonates of the Tippipah limestone are exposed. Quartzite of the Guilmette formation is also present in the area.

Yucca Flat and Frenchman Flat are alluvium- and tuff-filled valleys bounded by mountain ranges with Paleozoic sedimentary and Tertiary volcanic rocks. Thick layers of sand and gravel have collected at the base of these valleys. At Yucca Flat, subsurface gravity surveys using isostatic gravity data from surface stations have estimated the thickness of the alluvial deposits to be up to 8,200 feet (Phelps et al. 1999). From the edge of the mountain ranges, coarse-grained deposits in alluvial fans grade laterally to clay deposits at playas in the lowest part of the valleys. Some windblown sand and silt may also collect at the basin troughs.

4.1.5.2.2 Structural History

As a result of the depositional periods interrupted by tectonic upheaval, the structural record in the region is complex. Geologic structures, such as faults and folds, strongly affect the regional hydrology. Groundwater predominantly travels through cooling joints and fractures, often enhanced proximal to faults. Other structures such as caldera faults or normal faults modify surface drainage and erosion patterns.

Five types of structural features occur in the region around the NNSS: (1) thrust faults (e.g., Belted Range thrusts); (2) normal faults (e.g., the Yucca and West Greeley faults); (3) transverse faults and structural zones (e.g., the Rock Valley fault, Walker Lane shear zone); (4) calderas (e.g., the Timber Mountain and Silent Canyon caldera complexes); and (5) detachment faults (e.g., the Fluorspar Canyon–Bullfrog Hills detachment fault).

The Belted Range thrust fault is the principal pre-Tertiary structure in the NNSS region and, therefore, only affects the pre-Tertiary rocks in the area. The fault can be traced or inferred from Bare Mountain, just south of the southwest corner of the NNSS, to the northern Belted Range north of the NNSS, a distance of more than 81 miles (DOE/NV 2011). The Belted Range thrust fault is an eastward thrust, which generally places late Proterozoic–early Cambrian rocks over rocks as young as the Mississippian Period. Several overlapping thrust faults occur east of the main thrust fault. Deformation related to the Belted Range thrust fault occurred sometime between 100 and 250 million years ago.

Normal faults associated with the formation of the Basin and Range mountain sequence are the most recent structural elements. The high-angle faults cut across Paleozoic volcanic, Precambrian sedimentary rocks, and early Cenozoic volcanic formations. Most of the faults in the region are northwest–northeast-striking and high angle (DOE/NV 2011). Good examples of normal faults at the NNSS are found at Yucca and Frenchman Flats. In Yucca Flat, the faults generally trend north–south; in Frenchman Flat, the faults generally strike west–southwest in the south, curving northward in the northern portion of the valley. Evidence of normal faulting is also visible in the Tertiary tuffs of Pahute and Rainier Mesas (e.g., the West Greeley fault) (DOE/NV 2011). Shoshone Mountain has normal faults that also have a strike-slip component.

The Walker Lane shear zone trends northwest to southeast of the TTR along the western edge of the NNSS (DOE 1996c). The Walker Lane shear zone is a major strike-slip fault zone that extends several hundred miles to merge with the Las Vegas shear zone. To the west of the Walker Lane shear zone and northwest of the NNSS is a series of volcanic centers, including Goldfield, Cactus Range, Stonewall Mountain, and Mount Helen (DOE 1996c).

4.1.5.2.3 Faulting and Seismic Activity

As seismic activity still occurs in the Basin and Range Physiographic Province, there have been earthquakes in the recent past around the NNSS. In addition, historical nuclear testing has generated ground motion and triggered seismic activity that could be felt miles away from the testing sites. Seismic activity in the Great Basin tends to be concentrated towards the west and, to a lesser extent, the east margins of the basin (USGS 2010a). Seismic activity in the NNSS region was described by Vortman (1991). The analysis determined that, from 1868 to 1991, 11,988 seismic events were recorded within 120 miles of the NNSS. Of these events, 8,161 were naturally occurring and 3,827 were induced by humans (DOE 1996c). This is a minimum count of events because placement of seismic instruments capable of detecting low-magnitude events in the region began after testing in 1951. Other studies of Great Basin earthquakes have compared the regional stress field to earthquake occurrence and surface fault expression (Rodgers et al. 1987; Gomberg 1991; Smith et al. 2001). These studies correlated some earthquakes with faults with surface expression, although they also identified many other moderate-size earthquakes that could not be associated with mapped faults (e.g., Smith et al. 1991).

The southern Great Basin contains many Quaternary fault traces, but few indications of movement in the last 10,000 years. Quaternary faults are identified by the presence of discontinuous scarps in volcanic material or in the alluvial sediment in valleys. The Spotted Range–Mine Mountain structural zone appears to be the only currently active fault system within the site. The Spotted Range–Mine Mountain structural zone is the revised name for the Cane Spring and Rock Valley fault zones that were described in the *1996 NTS EIS*. These faults are located in southwestern Frenchman Flat and have a generally northeast strike and a left-lateral slip (Anderson 1998a). The Mine Mountain fault is also associated with the Spotted Range–Mine Mountain structural zone and trends northeast–southwest, but is located along the southwestern edge of Yucca Flat, east of Shoshone Mountain (Anderson 1998b).

Small earthquakes have occurred at or near the Spotted Range–Mine Mountain structural zone; although no surface displacements were associated with them (Carr 1974; DOE 1996c). The last earthquake with a magnitude over 5.0 was near Little Skull Mountain in 1992. The shallow 5.6-magnitude earthquake was associated with the Spotted Range–Mine Mountain structural zone and was potentially caused by a 7.5-magnitude earthquake near Landers, California (DOE 1996c). This earthquake was notable because it damaged several of the NNSS facilities that were built prior to revised building codes. Since 1992, several smaller earthquakes ranging between magnitudes of 3.0 to 4.0 have occurred near Little Skull Mountain, Frenchman Flat, and Calico Hills, all in the southern portions of the NNSS. The largest of these earthquakes had a magnitude of 4.0 in 1997, south of Calico Hills; earthquakes with magnitudes of 4.5 and 4.8 occurred in January 1999 in Frenchman Flat; and a 4.6-magnitude earthquake occurred southwest of Skull Mountain in 2002 (USGS 2010b).

Yucca Flat is bisected by a fault scarp called Yucca Fault, which stretches approximately north–south. Several investigations of the scarp height and sediment ages indicate that most of the recent movement occurred between 10,000 and 130,000 years ago. There is also evidence that southern sections of the fault were displaced by testing activities (Anderson 1998c). Testing in Yucca Flat during the 1970s and 1980s generated manmade earthquakes with magnitudes between 4.0 and 6.0 (Rodgers et al. 2005).

The Bare Mountain fault forms the border on the eastern side of Bare Mountain and the western edge of Crater Flat, and is the southernmost portion of the Walker Lane shear zone. The fault strikes generally north, and dips to the east-southeast. Trenches along the fault found that surface movement along the fault has likely not occurred within 130,000 years, although when movement did occur in the southern portion, it occurred in multiple locations at once (Anderson 1998d).

There are two fault systems in the Yucca Mountain property: the eastern area, which contains the Soltario Canyon, Iron Ridge, Stagecoach Road, Paintbrush Canyon, and Bow Ridge faults; and the western area, which contains the Black Cone, northern and southern Crater Flat, Windy Wash and Fatigue Wash faults (Anderson 1998e, 1998f). The faults within the fault sequences have a braided appearance, with clockwise movement along northerly striking fault lines, and extensional displacement. The Yucca Mountain eastern group shows movement within the late Quaternary (less than 130,000 years), while the western group cuts across Holocene and latest Pleistocene deposits, which would indicate movement within the last 15,000 years (Anderson 1998e, 1998f).

Sandia National Laboratories developed a program for recording surface and subsurface motions resulting from underground nuclear explosions (DOE 1996c). Test-induced ground motion is affected by several factors: (1) the yield of the device; (2) ground-coupling at the source of the explosion, which is a function of the test design, depth of the device, local geology, and stratigraphy; (3) geological complexity along the ground wave path; and (4) the topography and geology at the location receiving ground motion (DOE 1996c). There is always some variation or unknown associated with estimating these factors; however, because of the long history of conducting nuclear weapon tests, ground motion predictions for tests at the NNSS have become increasingly accurate.

DOE policy is to design, construct, and operate its facilities so that workers, the general public, and the environment are protected from the impacts of natural phenomena hazards (including seismic events) on DOE facilities. Executive Order 12699, *Safety of Federal and Federally Assisted or Regulated New Building Construction* requires new buildings owned by the Federal government to be designed and constructed in accordance with appropriate seismic design and construction standards. DOE Order 420.1B, *Facility Safety*, and DOE G-420.1-2, *Guide for the Mitigation of Natural Phenomena Hazards for DOE Nuclear Facilities and Nonnuclear Facilities*, require that structures, systems, and components at DOE facilities be designed to withstand the effects of natural phenomena hazards using a graded approach. The graded approach is implemented by five performance categories requiring natural phenomena hazard protection, with Performance Category 0 for those structures, systems, and components requiring no natural phenomena hazard protection and Performance Category 4 for those structures, systems, and components requiring protection from the release of hazardous material similar to that provided by commercial nuclear power plants. For each performance category, DOE Standard 1020-2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, provides natural phenomena hazard design, evaluation, and construction requirements. DOE Standard 1023-95, *Natural Phenomena Hazards Assessment Criteria*, provides general and detailed criteria for establishing adequate design-basis load levels for DOE structures, systems, and components. DOE seismic design criteria also meet the requirements of the International Building Code (ICC 2009).

Seismic waves from nuclear explosions are believed to relieve tectonic stress, as seen by the aftershocks and movement along some Quaternary faults around the testing zones (DOE 1996c; Rodgers et al. 1991). The Yucca Fault and Carpetbag Fault, in Yucca Flat, showed indications of reactivation (Frizzell and Shulters 1990) by vertical and lateral displacement as a result of past nuclear detonations in Yucca Flat, though most of this movement is believed to be due to differential compaction of the porous alluvium over the existing buried fault scarp.

As a result of the ongoing moratorium on nuclear testing, the last underground nuclear tests at the NNSS occurred in 1992. The only architectural damage in surrounding communities resulting from underground nuclear testing occurred with test yields over 100 kilotons (DOE 1996c). For the period of time between the enactment of the Threshold Test Ban Treaty and the last underground nuclear test, only a few reports of very minor test-related damage were received (DOE 1996c). For communities farther than 30 miles from the test location, only multiple-story buildings would be affected by the larger tests, should testing resume (DOE 1996c).

4.1.5.2.4 Geotechnical Hazards

There are several geotechnical hazards at the NNSS and the TTR that may present a small risk to structures and roads. The main hazards include slope, soil, and ground instability. Areas near rugged topography and cliffs, combined with ground motion from earthquakes or nuclear tests (should testing resume), present an increased risk for slope stability hazards. However, most existing structures at the NNSS were built in locations with a lower potential for geotechnical hazards.

Many soils in Nevada contain clay minerals (e.g., montmorillonite) that swell when wet (DOE 1996c). Soils with a volume change of 3 percent or less when wet have low limitations when used for construction. Soils that swell from 3 to 6 percent of their volume have moderate limitations, while soils that swell greater than 6 percent of their dry volume have high limitations. Soils with moderate-to-high limitations due to shrink-swell properties could affect the stability of structures.

In general, ground stability is adversely affected by the presence of weathered or fractured bedrock, a high percentage of void space in the soil, lack of vegetation, freeze-thaw sequences, soil erosion from wind or flowing water, or ground motion. Knowledge of the subsurface activities is also important, as underground nuclear tests may have rubble chimneys that did not reach the surface, but would pose a hazard for any construction or other activity; these areas on the NNSS are known and are fenced and controlled.

Some soil processes enhance ground stability. Development of a pebble pavement as soil is stripped away by erosion, as well as accumulation of calcium carbonate minerals in subsurface horizons, can provide additional stability to certain structures. These areas are also less likely to be reworked by surface flow, so the soil column would be more comprehensive (Friesen 1992).

4.1.5.2.5 Geologic Resources

Potential geologic resources around the NNSS include mineral mining, aggregate, oil and natural gas, and geothermal resources. The availability of the resources has not changed significantly since the publication of the *1996 NTS EIS*.

For more than 100 years, sections of the southern Great Basin have produced amounts of base and precious metals, particularly gold, silver, copper, lead, zinc, tungsten, and uranium (Kral 1951). At the NNSS, there are four historic mining districts (SAIC/DRI 1991). These mining districts would be of interest for economic mining if the NNSS were open for public access. However, the NNSS has been closed to commercial mineral development since the 1940s (SAIC/DRI 1991).

Gold, silver, copper, lead, zinc, and mercury are present in the region around the NNSS. Gold and silver deposits are mined in the Goldfield mining district to the northwest of the Nevada Test and Training Range. Silver may still be present in the Oak Spring District, located at the north end of Yucca Flat; a significant amount of silver has been taken from the Groom mine (BLM 1979) located on the Nevada Test and Training Range, northeast of the NNSS. Economic quantities of copper, lead, and zinc have also been extracted from the Groom mine (SAIC/DRI 1991). On NNSS property, gold or silver deposits may be present in the Wahmonie District, located on the south-central NNSS, although prospecting in the 1930s found few ore deposits (SAIC/DRI 1991; NPS 2000).

In the 1950s and 1960s, commercial tungsten mining occurred at the Oak Spring District, which indicates that the NNSS has a moderate potential for economic tungsten deposits (SAIC/DRI 1991). Iron, in the form of magnetite, is also present in the region; however, there is a low potential for its commercial ores at the NNSS (Sherlock et al. 1996). Aggregate materials are typically mined from alluvial fans that border the region's mountain ranges. There are sufficient aggregate resources in the region to support foreseeable future demand from construction (DOE 1996c).

Uranium resources may be present in the northwestern part of the Nevada Test and Training Range (BLM 1979). Zeolitized rocks are common in the NNSS region. The widespread occurrence of zeolite deposits in the region suggests a low-to-moderate potential for development (SAIC/DRI 1991). Barite is known to occur in the Mine Mountain District, specifically in veins associated with quartz and mercury, antimony, and lead mineralization. However, barite veins at the NNSS are small and impure and do not represent a potential barite resource (SAIC/DRI 1991). Fluorite was reported to be present in the Calico Hills area, although little is known about the occurrence of fluorite, and its resource potential is assumed to be low to moderate (SAIC/DRI 1991).

The northeastern and southwestern portions of the NNSS and the Nevada Test and Training Range have a theoretical potential for hydrocarbon resources, as the rock type, age, and thermal maturity all contribute to a potential for pockets of oil or gas reserves (Grow et al. 1994). The northeastern and southern sections of the NNSS and Nevada Test and Training Range have potential for oil and gas, while the southern portion of the NNSS and southeastern portion of the Nevada Test and Training Range have a potential for gas. The presence of oil deposits at Railroad Valley, about 50 miles north of the NNSS, has led some researchers to hypothesize that large petroleum deposits could also be present under similar conditions at the site (Chamberlain 1991). However, Trexler et al. (1996) states that the likeliest formation (Chainman shale) is less extensive than previously thought, and may have lost as much as 80 percent of the original hydrocarbon content from migration. Other investigations (SAIC/DRI 1991; Garside et al. 1988) have also determined that large-scale hydrocarbon resources would be very unlikely because there are few laterally extensive carbon-bearing formations, the thermal maturity of the region is just within acceptability, and the large fault complexes throughout the NNSS are likely to have fractured the confining bedrock. No surface occurrences of oil, gas, coal, tar, sand, or oil shale at the NNSS have been reported, and numerous boreholes drilled at the site have not revealed any hydrocarbon shows within the likeliest formations (DOE 1996c). There are also no oil or gas wells at the NNSS (Hess and Johnson 1996).

4.1.5.2.6 Geothermal Resources

The extensional forces that create seismicity in the Basin and Range Province have also thinned the crust so that the upward flow of heat from the mantle warms the shallow bedrock. Increased heat flow through aquifer-bearing bedrock creates hot springs that could be amenable for use with a geothermal plant facility. Hot springs are not present at the NNSS; however, several are located west of the NNSS (Coolbaugh et al. 2005). If downhole temperatures near Yucca Mountain are representative (120 degrees Fahrenheit [°F] to 140 °F), groundwater temperatures in the region may be insufficient for some types of commercial power development (DOE 1988). However, a 1994 preliminary assessment of the geothermal potential of the NNSS found good potential for development of a moderate-temperature geothermal resource. This resource potential was judged suitable for development of a binary geothermal power plant (HRCES 1994).

An Enhanced Geothermal System, a type of binary geothermal power-generating technology, would use steam created in bedrock to turn electricity-generating turbines. The bedrock would need to be at least 356 ºF to heat the steam. An open system could use steam from hot-water-bearing bedrock (wet), while a closed system could use heat from bedrock that does not contain an aquifer (dry). In a review of geothermal resources, DOE/NNSA determined that several locations at the NNSS appear to have the heat potential to support an Enhanced Geothermal System (Brown 2009). Hot-water-bearing bedrock is located outside the NNSS at East Yucca Flat, Wahmonie Volcanic Center, Crater Flat, and Oasis Valley. The hot dry rock areas include Halfpint Range, Climax Mine, Gold Meadows, the Timber Mountain Caldera Complex, and Calico Hills.

4.1.5.3 Soils

There are few soil surveys for the NNSS and surrounding areas because the site was established as a nuclear weapons testing site prior to the nationwide soil survey program. Radioactivity and nuclear testing have also resulted in restricted ready access to some parts of the NNSS. Soil surveys internal to the NNSS have been conducted at locations of interest, particularly those associated with the Yucca Mountain site, new facility construction sites, and onsite waste disposal sites. However, most of the soil characterization is limited to a series of geotechnical descriptions for a particular construction project, rather than a regional soil analysis. These documents are used for internal uses and permit applications. A great deal of research at the NNSS has been focused on defining areas of contamination at testing locations and the movement of contaminants through the soil column.

Soils at the NNSS are similar to those throughout southern Nevada. Most of the soils form on the alluvial fans and valley floors, with thin soils forming on mesa and mountain surfaces. The most common soils at the NNSS are aridisols and entisols. The amount of development these soils have undergone depends on their age, their parent materials, and particularly their geomorphic position. Entisols generally form on steep mountain slopes where erosion is active. Aridisols tend to be older and form on more-stable fans and terraces (DOE 1996c). Evaporate deposits found in playas tend to develop in aridisols. The parent materials for most of these soils are mixed alluvial sediments that were eroded from the surrounding ranges. The soil texture generally grades from coarse-grained soil close to the mountain fronts to fine-grained sediments in playas at the bottom of valleys. This gradation can be seen in cross sections at Yucca Flat and Frenchman Flat. Overall, most of the soils are reasonably young, with low leaching, and retain their structures from when the parent materials were deposited.

Underlying the surface of more well-developed soils is a layer of caliche (calcium carbonate minerals precipitated from evaporating carbonate-saturated groundwater). The saltiness of the soils increases toward the center of internal drainage basins because snowmelt, rainfall, and groundwater tend to collect, concentrate, and then evaporate. The highest level of soluble salts at the NNSS can be found in the soil horizons at Frenchman Flat (DOE 1996c).

The soils at the NNSS are highly susceptible to erosion by wind and water. Although finer-grained soils on steep slopes are more easily erodible, mineral composition and topography can also affect the movement of topsoil. Because the NNSS has not undergone a comprehensive soil survey review, locations of soils that are easily erodible have not been identified.

Approximately 7,800 acres of surface and near-surface soils at the NNSS, the TTR, and the Nevada Test and Training Range contaminated from nuclear testing activities at a level requiring use restrictions are addressed by the DOE/NNSA NSO Environmental Restoration Program. These include about 6,006 acres on the NNSS, 571 acres on the TTR, and 1,222 acres on the Nevada Test and Training Range. The soils were contaminated by radioactive isotopes expelled from open air testing at Yucca Flat, Frenchman Flat, Plutonium Valley (Area 11), and other areas around the NNSS, the TTR, and the Nevada Test and Training Range. Section 4.1.5.4.1 provides a more detailed description of the soil contamination and isotopes at the NNSS and the surrounding areas.

Prime Farmland soils have not been identified at the NNSS and surrounding areas. However, agriculture production in Nevada often requires irrigation, so soil suitability for irrigation could be used as a proxy for soils with a potential to be classified as Prime Farmland. Previous maps by the Division of Water Resources show that the lowest elevations of Yucca Flat, Frenchman Flat, and Jackass Flats would be the most suitable at the NNSS for water retention (Rush 1974). Other soils at the NNSS tend to be too thin or too permeable to be effectively irrigated. In Yucca Flat, the cobbly, stony soils have moderately low water-holding capability, while Frenchman Flat and Jackass Flats have severe limitations with low water-holding capabilities. These areas tend to flood and drain, rather than retain groundwater directly below the surface (DOE 1996c).

4.1.5.4 Radiological Sources as a Result of Testing

4.1.5.4.1 Soils

There are approximately 143 releases of radioactivity onto surface and near-surface soils as a direct result of past nuclear weapons testing on the NNSS, the TTR, and the Nevada Test and Training Range (DOE/NV 2011). The impacts from radioactive contamination have been considerable and, in some cases, significant. The areas of greatest soil contamination were the locations of atmospheric testing of nuclear weapons, safety tests, and shallow borehole tests. Additional surface contamination occurred from crater tests and deep underground testing. This section describes the results of past tests and the remaining contamination in the soils.

DOE/NNSA is managing contaminated sites in accordance with the Federal Facility Agreement and Consent Order (FFACO), in conjunction with the State of Nevada. A variety of corrective actions are used to remediate soil contamination, including soil removal and “closure in place,” in which the site is fenced, warnings are posted, and access is restricted (DOE/NV 2011). As of December 31, 2010, 18 sites have been approved for closure in accordance with the FFACO by the State of Nevada (DOE/NV 2011).

Under the FFACO, the goal of the Environmental Restoration Program is to characterize, monitor, and remediate identified contaminated areas, facilities, soils, and groundwater at the NNSS and its associated facilities. Within the Environmental Restoration Program, the Soils Project is responsible for the corrective action units (CAUs) that consist of surface and shallow subsurface contamination from nuclear experiments or testing on the NNSS, the TTR, and the Nevada Test and Training Range. **Figures 4–9** and **4–10** depict all Environmental Restoration Program corrective action sites (CASs) (i.e., sub-units of CAUs) for the Soils, Industrial Sites, and UGTA Projects on the NNSS, TTR, and Nevada Test and Training Range. Figure 4–9 depicts CASs that have been closed under the FFACO and Figure 4–10, CASs that that are not yet closed.

The Soils Project implements air monitoring and radiological surveying of affected soils and implements comprehensive remediation and/or monitoring plans. The Soils Project includes surface and near-surface releases from atmospheric testing, safety experiments, hydronuclear experiments, nuclear rocket engine tests, Plowshare excavation tests, and subsurface nuclear tests with corresponding surface releases (Bechtel Nevada 1998a). The tests that generated radiological soil contamination are described below.

A total of 105 atmospheric tests were conducted on the NNSS and Nevada Test and Training Range from 1951 to 1963, when the Limited Test Ban Treaty was signed (DOE 1996c). The majority of atmospheric tests were conducted at Yucca Flat and Frenchman Flat on the NNSS. Atmospheric weapons testing included weapons dropped by planes, detonated from towers, suspended from balloons, or detonated on the ground surface (DOE 1996c). Depending on the proximity of the explosion to the ground surface and the size of the yield, surface disturbances from atmospheric testing varied widely.

Radioactivity from atmospheric tests was dispersed by three primary mechanisms: (1) throwout, (2) base surge, and (3) fallout (DOE 1996c). Throwout occurs immediately after the initial detonation, when large volumes of rock and soils are thrown outward. Base surge follows as the throwout laterally expands and begins to settle. Fallout consists of the finest particles that remain suspended and mixed with the radioactive weapon residues before gradually being deposited on the ground surface. Fallout can be transported away from the test location because it can remain suspended for several hours after a test. Soil contaminated with radioactive fallout can also be transported limited distances through resuspension by wind. The extent and distribution of contamination from an atmospheric test are quite variable depending on the height of detonation, the yield and type of device, the nature of the ground surface, the mass of the inert material surrounding the device, and the weather conditions during and after the test (DOE 1988).

Various isotopes, including strontium, cesium, barium, hydrogen-3 (tritium), and iodine, form during a nuclear detonation. Most of these isotopes have short half-lives; however, strontium-90 and cesium-137 have half-lives of 28 and 30 years, respectively, so they are retained longer in the soil (Glasstone and Dolan 1977). Because most of the isotopes released during the atmospheric tests rapidly decayed, most of the radioactivity was reduced within the first 12 hours after detonation (OTA 1989). Americium, plutonium, cobalt, cesium, strontium, and europium are the primary radioactive isotopes still present in the soils from historical atmospheric testing. The surface radiation concentration in soils is concentrated near ground zero in the areas where atmospheric testing occurred (Frenchman Flats, Yucca Flat, and Buckboard Mesa) (DOE 1996c). McArthur estimated that, in Frenchman Flat, 20 curies of radioactivity remain at or near the soil surface (McArthur 1991). In Areas 2 and 4, approximately 11.0 and 10.4 curies of cesium-137 were measured at the Kepler and Shasta ground zero locations, respectively (McArthur and Kordas 1985). In Yucca Flat and Buckboard Mesa, some of the radioactivity in soils may also be attributed to underground testing in the area; however, it is likely that the majority is connected to atmospheric testing (DOE 1996c).

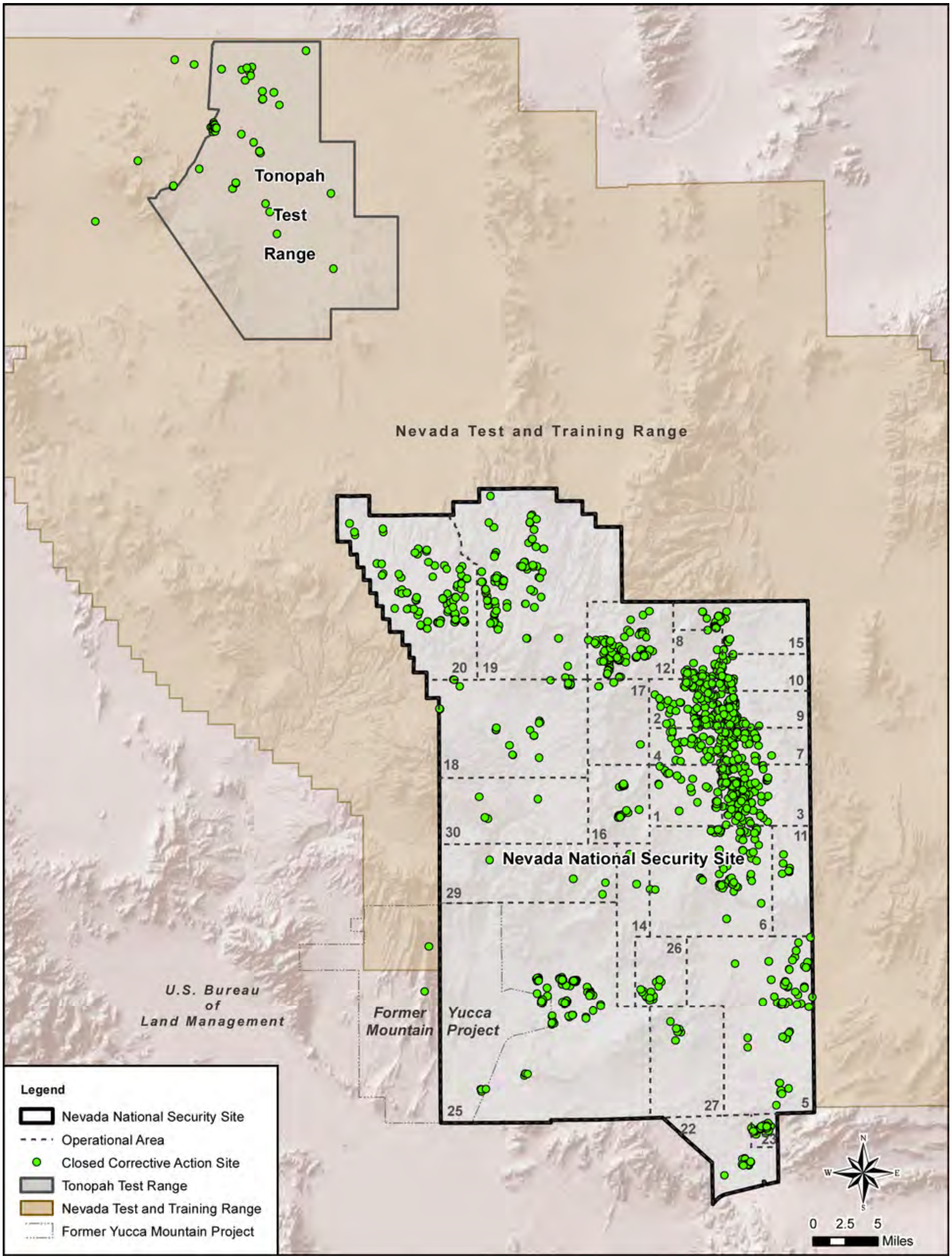

Figure 4–9 Location of Corrective Action Sites on the Nevada National Security Site, Tonopah Test Range, and Nevada Test and Training Range that are Closed under the Federal Facility Agreement and Consent Order

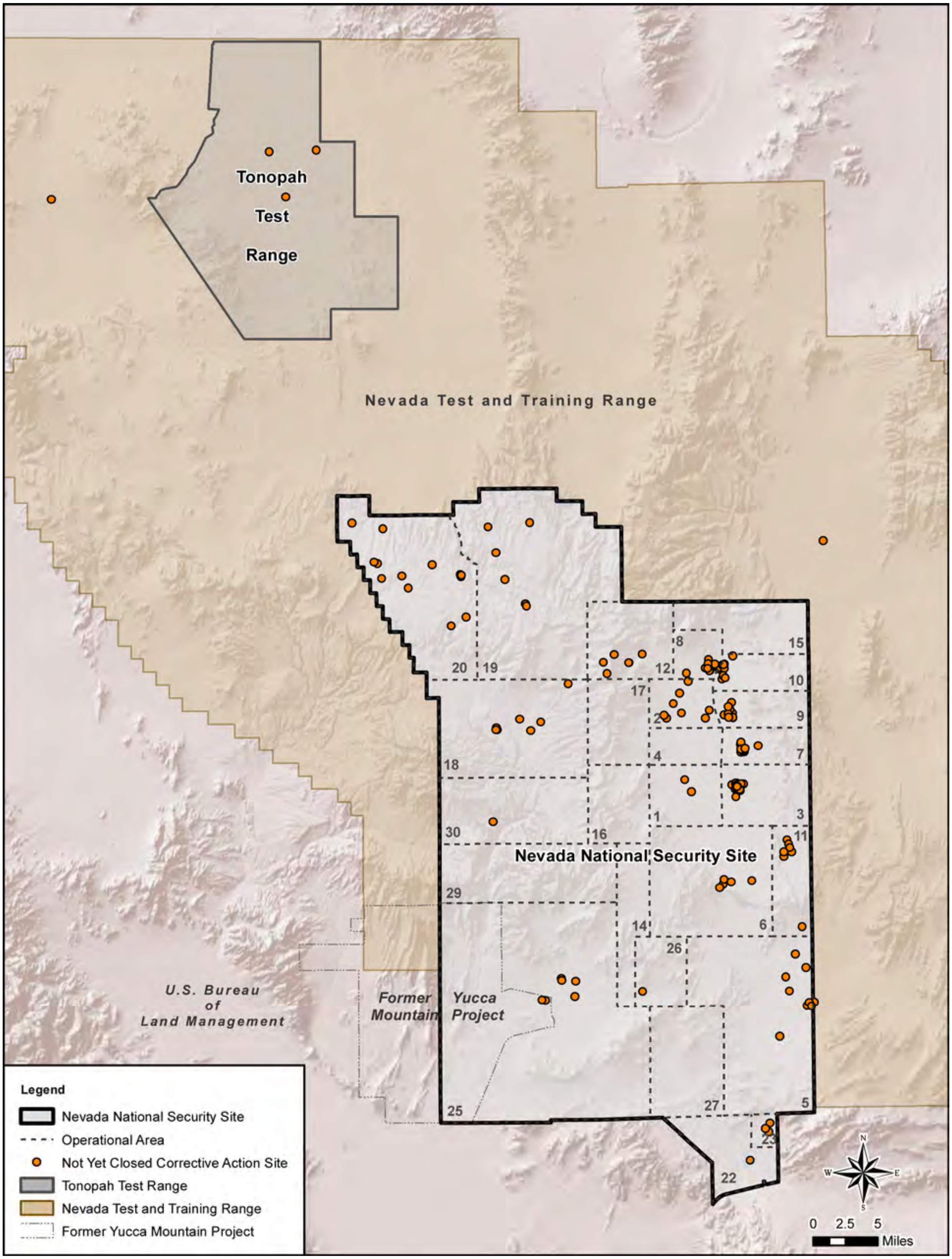

Figure 4–10 Location of Corrective Action Sites on the Nevada National Security Site, Tonopah Test Range, and Nevada Test and Training Range that are not yet Closed under the Federal Facility Agreement and Consent Order

As shown in **Figure 4–11**, areas of surface soil contamination on the NNSS have been identified, fenced, and/or posted as Radiation Areas and Contamination Areas, in accordance with the *Nevada Test Site Radiation Control Manual* (DOE/NV 2012c). The aggregated area of these contaminated areas is about 6,006 acres, or less than 1 percent of the overall area of the NNSS. A decay-corrected estimate of the total surface source term at the NNSS is about 1,614 curies as of January 2012 (Kidman 2012); however, there is a substantial level of uncertainty in this source term with a range as low as 820 and as high as 3,300 curies. Access to these contaminated areas is controlled.

Fifteen subsurface nuclear tests with corresponding surface releases were conducted on the NNSS between 1958 and 1972. In each of these tests, radioactivity from the subsurface detonation was released to surface soils around their ground zeros. While these releases consisted mostly of short-lived noble gases, cesium is the major long-lived source of radioactive dose at these sites.

Between 1955 and 1963, 27 safety experiments with surface or near-surface releases were conducted on the NNSS and the Nevada Test and Training Range, including the TTR. These safety experiments used mixtures of plutonium and uranium that were subjected to detonations of conventional explosives. Safety experiments at the NNSS were performed in Yucca Flat (Areas 3, 7, 8, and 9); Plutonium Valley (Area 11); Rainier Mesa (Area 12); and in the Nevada Test and Training Range (including the TTR) to the northeast and northwest of the NNSS. Although most tests had no nuclear yield, the explosions spread mostly plutonium, uranium, and americium.

Figures 4–12, **4–13**, and **4–14**, respectively, show the Double Tracks site; the Clean Slate 1, 2, and 3 sites; and the Project 57 site. DOE/NNSA has conducted interim remediation on the Double Tracks and Clean Slate 1 sites to remove all radioactive contamination that exceeds 400 picocuries per gram. The Clean Slate 2 and 3 and Project 57 sites have not yet been remediated. In addition to these sites, the Small Boy test resulted in an area of radioactive contamination extending from the northeastern portions of Area 5 east onto the Nevada Test and Training Range, as shown in Figure 4–11. Soils sites on the Nevada Test and Training Range, including the TTR, are expected to be remediated to an action level that is mutually agreed upon by DOE/NNSA, the USAF, and NDEP.

In addition to explosive tests, a series of activities was conducted at the Nuclear Rocket Development Station in Areas 25 and 26. From 1959 through 1973, the area was used for a series of experiments involving an open-air nuclear reactor, nuclear engine, and nuclear furnace tests, as well as for the High Energy Neutron Reactions Experiment (DOE 1996c). Equipment and facilities remain from some of these locations. Some limited areas of contaminated soils are also present. The total inventory of isotopes remaining in the soils in this area of the NNSS has been estimated to be about 1 curie (McArthur 1991). The primary soil contaminants in this area are isotopes of strontium, cesium, cobalt, and europium (DOE 1996c). Cleanup of contaminated soils resulting from nuclear rocket and related testing is addressed as part of the Environmental Management Mission under the Environmental Restoration Program (FFACO 2008).

At the end of 2010, two Soil Site corrective action sites were closed, leaving 110 CAS that remain to be closed (DOE/NV 2011).

4.1.5.4.2 Subsurface

Underground nuclear tests at Yucca Flat and Frenchman Flat were detonated primarily in alluvium or in the volcanic rocks. A few tests were detonated in the underlying carbonate rocks beneath the northern Yucca Flat during the early years of the testing program (DOE 1996c; OTA 1989). Testing near or below the water table was common in both the Yucca Flat weapons test basin and Frenchman Flat test area.

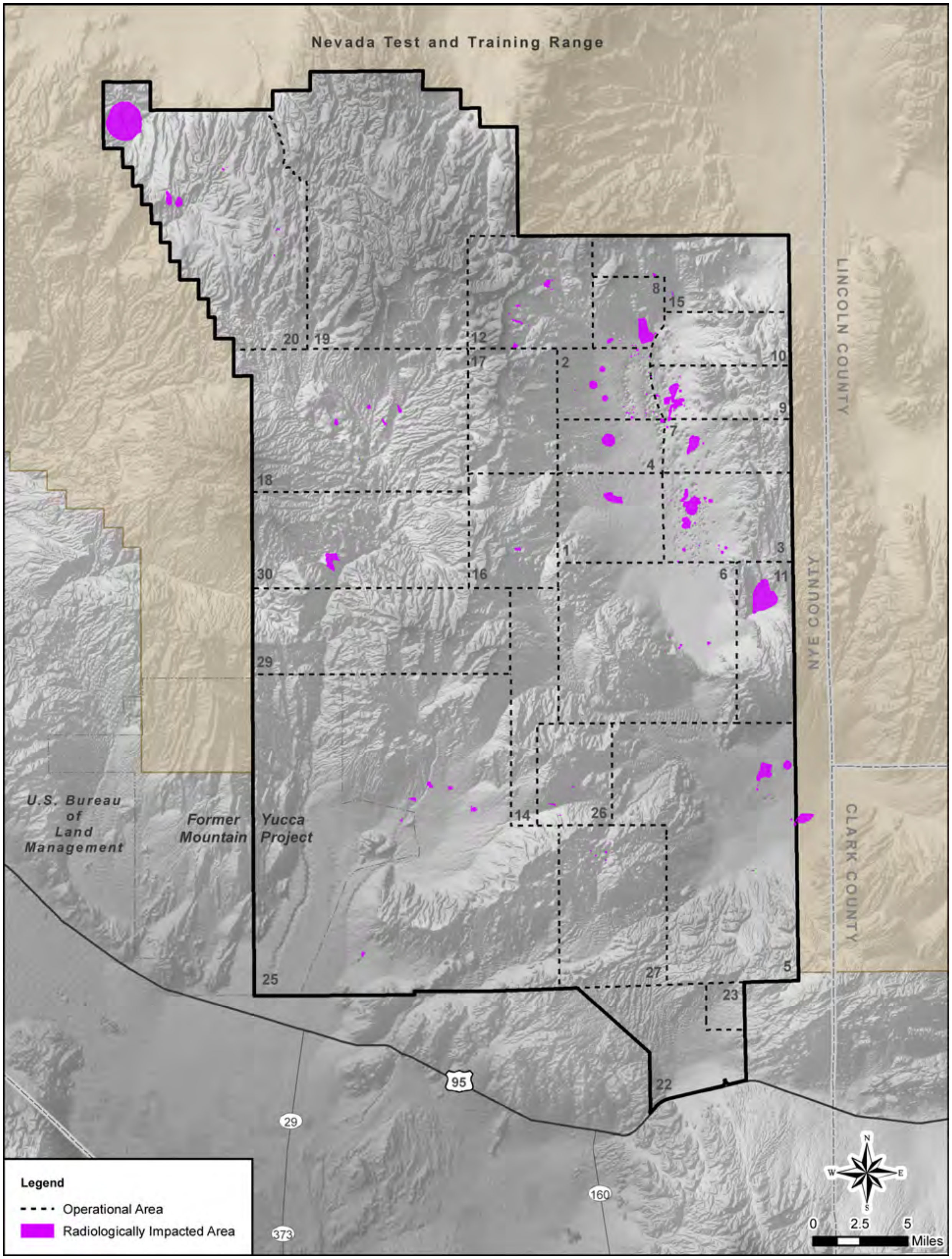

Figure 4–11 Areas on the Nevada National Security Site that are Fenced and/or Posted as Radiation Areas and/or Contamination Areas in Accordance with *Nevada Test Site Radiation Control Manual* (DOE/NV/25946-801, Revision 1, February 2010)

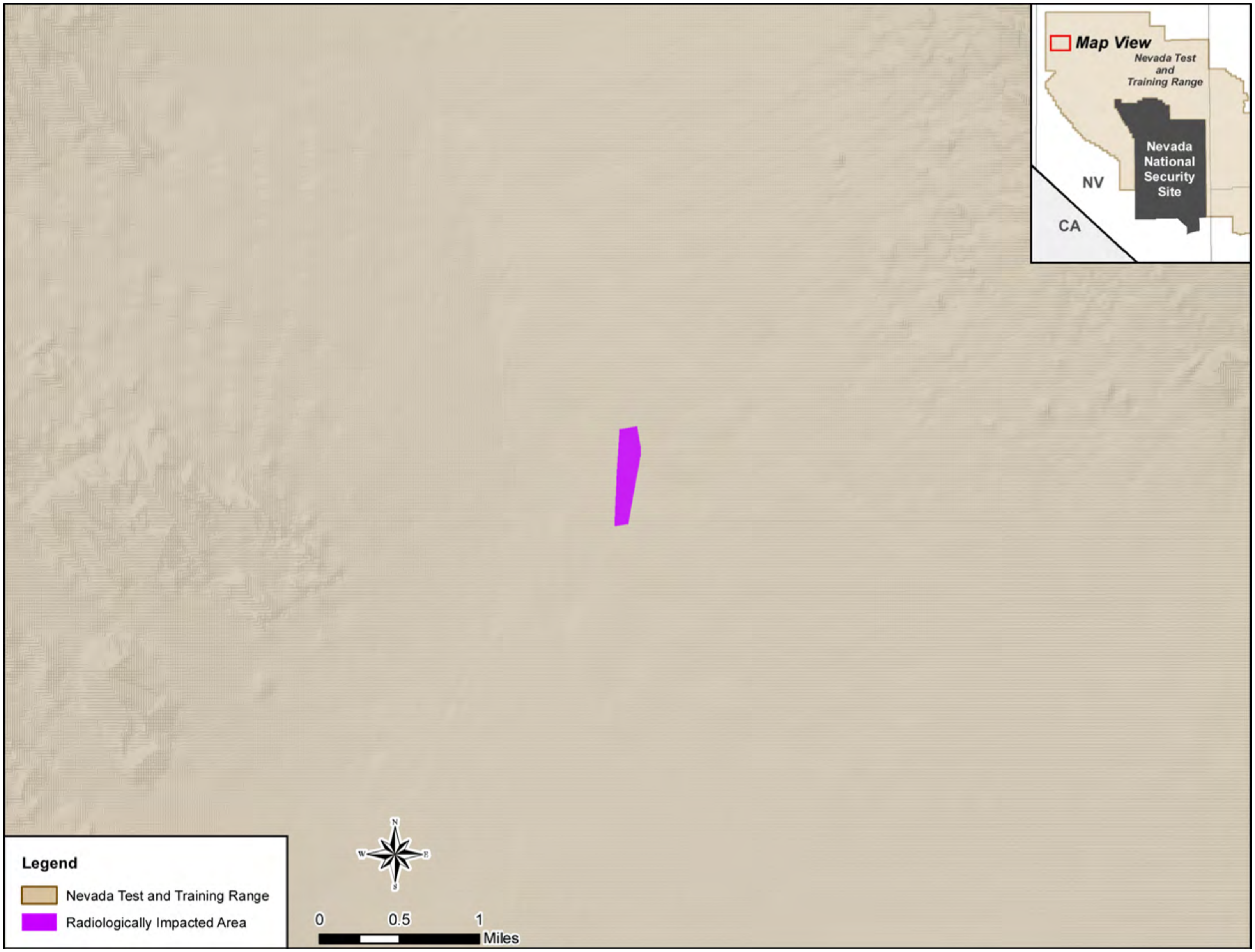

Figure 4–12 Areas on the Nevada Test and Training Range that are Fenced and/or Posted as Radiation Areas and/or Contamination Areas in Accordance with *Nevada Test Site Radiation Control Manual* (DOE/NV/25946-801, Revision 1, February 2010): the Double Tracks Site

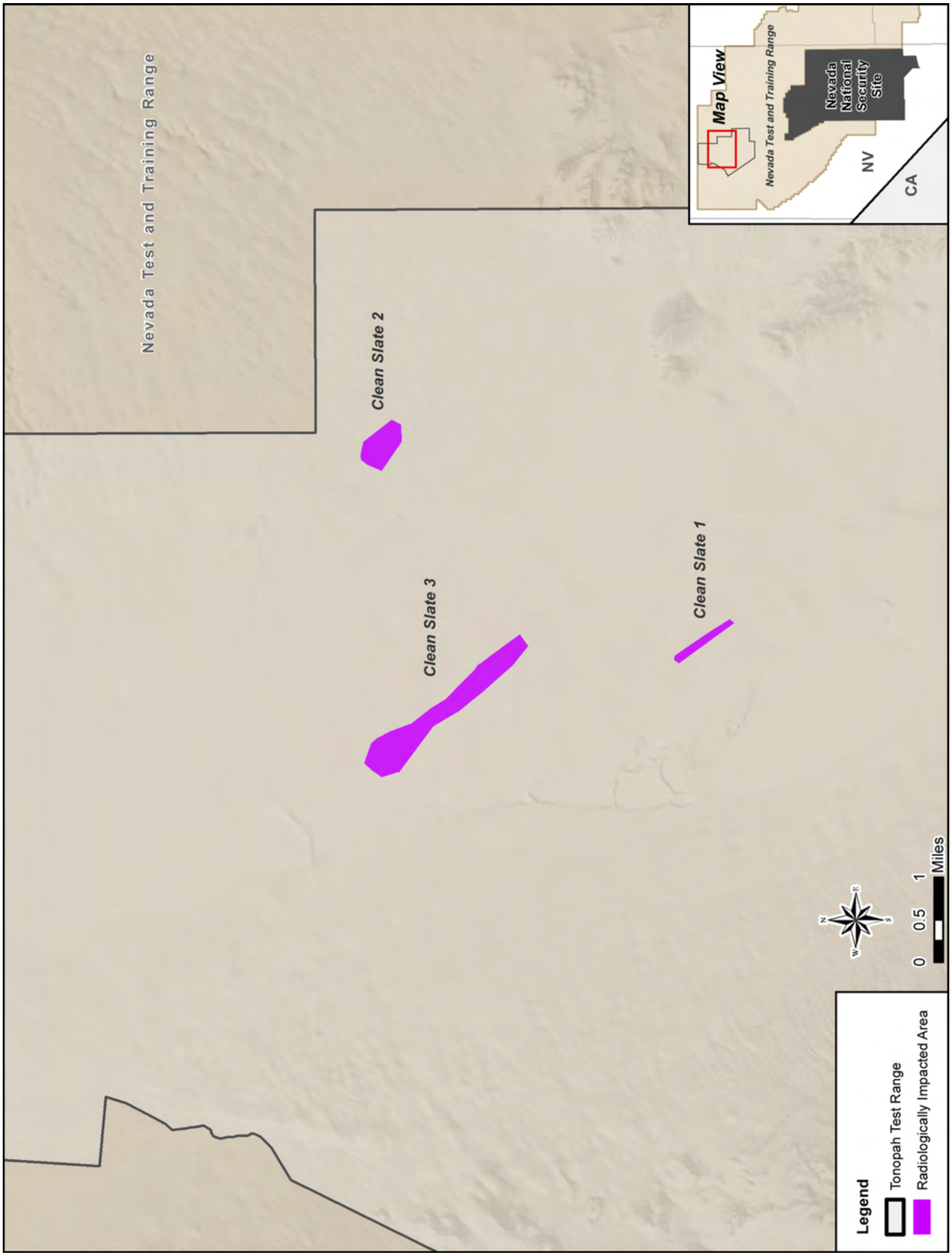

Figure 4–13 Areas on the Nevada Test and Training Range that are Fenced and/or Posted as Radiation Areas and/or Contamination Areas in Accordance with *Nevada Test Site Radiation Control Manual* (DOE/NV/25946-801, Revision 1, February 2010): Clean Slate 1, 2, and 3 Sites on the Tonopah Test Range

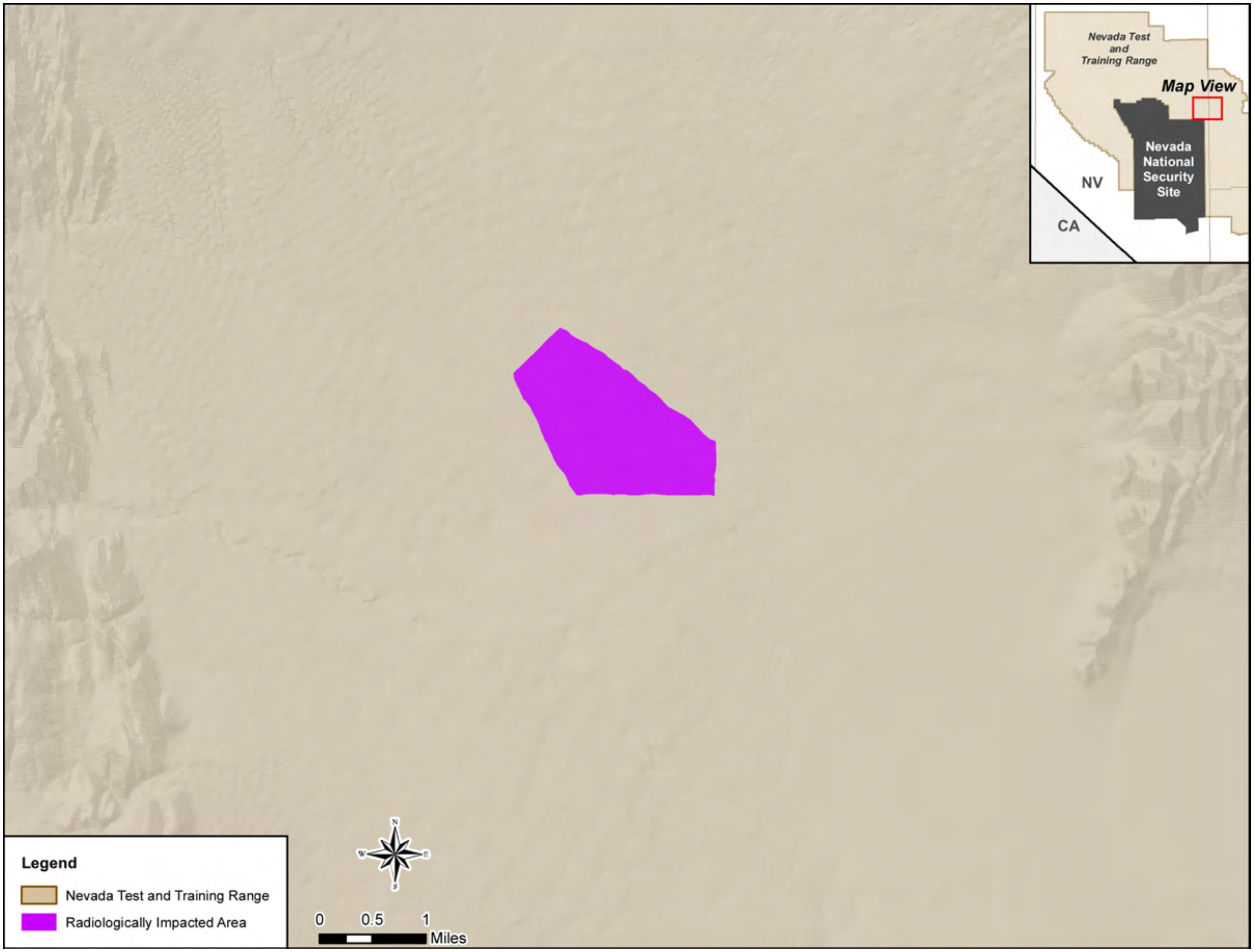

Figure 4–14 Areas on the Nevada Test and Training Range that are Fenced and/or Posted as Radiation Areas and/or Contamination Areas in Accordance with *Nevada Test Site Radiation Control Manual* (DOE/NV/25946-801, Revision 1, February 2010): Project 57 Site

A total of 828 underground nuclear tests were conducted at the NNSS. This resulted in pockets of radiological contamination in the bedrock in underground nuclear testing areas at the subsurface and in the near vicinity of the testing locations. Underground testing is broken down into three main categories: (1) shallow borehole tests, (2) deep vertical tests, and (3) tunnel tests. This section presents the condition of the bedrock as a result of the tests.

From 1960 through 1968, shallow borehole tests were used to test a variety of explosives. "Shallow borehole tests" refer to the tests performed within 200 feet of the surface. Some of these were related to the safety experiments; others were conducted as part of Project Plowshare. Project Plowshare used nuclear detonations to determine whether the explosions could be used for large-scale excavations, such as creating harbors and canals. As a result, some large ejection craters were created at the NNSS, such as the Sedan Crater in Area 10 at the northern end of Yucca Flat and Buggy in Area 18. The Sedan Crater, a 1,280-foot-diameter crater, was generated from a 104-kiloton nuclear device detonated 635 feet underground. McArthur estimated that the remaining inventory of surficial radioactivity at the Sedan Crater is 344 curies (McArthur 1991). The craters contain radioactivity injected from the initial detonation that is being slowly covered as surrounding material is eroded into the craters. The total estimate for all releases from shallow borehole tests to the surficial soil horizon at the NNSS is 2,000 curies (DOE 1996c).

Deep vertical tests occurred at Frenchman Flat, Yucca Flat, Pahute Mesa, and Rainier Mesa. The tunnel complexes at Rainier Mesa and Shoshone Mountain were also used for horizontal tests. Radiological contamination, disruption of the geologic media, and seismic waves (i.e., ground motion) are other major impacts of underground nuclear testing. Some of the tests generated shock waves equivalent to 5.0-magnitude and 7.0-magnitude earthquakes, which were felt for miles outside of the NNSS with no permanent effects.

Following a deep underground nuclear detonation, a pocket of vaporized bedrock is almost instantaneously formed, which quickly fractures and propels a shock wave out from the test site. As the gases cool, molten rock begins to collect and solidify on the cavity sidewalls and settles in a puddle at the bottom of the cavity. When gas pressure decreases to the point that it can no longer support the overlying rock and soil, the cavity may collapse, forming a chimney upward above the cavity. The collapse of the overburden in the chimney occurs until the vertical stress is equalized or the chimney reaches the surface (DOE 1996c). The result is a saucer-like collapse crater. The collapse crater differs from the shallow borehole tests because the crater collapses inward, with no ejecta striations. The complete process usually occurs within a few hours after detonation. A more complete description of underground nuclear test phenomena is contained in Appendix H.

Yucca Flat is pockmarked with subsidence craters formed by deep vertical underground tests. The crater sizes range in diameter from 200 to 1,500 feet, and in depth from a few feet to 200 feet. The size of the crater depends on the depth of the test, the properties of the geologic units, and the explosive energy yield. The creation of craters is the principal visible consequence from underground nuclear testing. The seismic waves created by underground nuclear detonations also created pressure ridges, small displacement faults that occurred as the detonation created upward pressure initially and then released it. Young faults, such as the Yucca Fault in Yucca Flat, showed some signs of reactivation as a result of the bedrock equalizing to the new stress field around the testing area.

Some cratering occurred on Pahute Mesa due to underground tests; however, the greater competency of the volcanic tuffs and lavas prevented large-scale cratering. Some surface fracturing occurred on Pahute and Rainier Mesas. The amount of fracturing in a given test location is predictable, based on test parameters and the host bedrock. Site selection factors that were essential to both containment and the integrity of the test data ensured that failures within the test areas did not occur.

The fracturing of the rock in the near-test environment may have resulted in some alteration of the natural permeability of the rocks underlying portions of the NNSS. The shock wave and compressive forces from the tests can increase the permeability of the rock by creating more fractures near the test, but can also decrease the permeability by opening and closing fractures at greater distances from the test (DOE 1996c). The bedrock is generally unchanged beyond three cavity radii of the detonation site. At further distances, some fractures may open and then close because of the stress differential as the shock wave passes through. The process of opening and subsequent closing of existing rock fractures could reduce the permeability of the rock by reducing the fracture aperture.

Just as surface and atmospheric tests increased the radioactivity of the soils at the surface, underground nuclear tests created pockets of radioactive contamination around the detonation site. The amount of radiation in these pockets has to be estimated because, unlike surface tests, the detonation site is surrounded by fractured and unfractured bedrock. Immediately after the detonation, the amount of radiation spikes, then reduces as the isotopes with short half-lives decay. Most investigators have concluded that much of the radioactivity released during an underground detonation, exclusive of tritium, remains in the melt glass in the original cavity, especially the refractory isotope species; the more-volatile nuclides tend to condense on the chimney rubble (Borg et al. 1976). Refractory species include plutonium, rare earth elements, zirconium, and alkaline earth elements; volatile species include alkali metals, ruthenium, uranium, antimony, tellurium, and iodine. The most mobile isotopes are the gaseous species, including argon, krypton, tritium, and xenon, which tend to rise through the chimney and may ultimately seep out to the surface (DOE 1996c). The total amount of radioactivity released into the underground environment during a test is called the radiological source term. The source term includes both short- and long-half-life isotopes. The estimated radiological source term from all deep underground tests reported in the *1996 NTS EIS* was 300 million curies (DOE 1996c). In 2001, scientists at Los Alamos and Lawrence Livermore National Laboratories estimated the underground source term beneath the NNSS, decay-corrected to September 23, 1992, to be about 132 million curies (Bowen et al. 2001). Of the 132 million curies, approximately 95 percent (125 million curies) was estimated to be tritium, which has a half-life of about 12.3 years. As of September 2012, radioactive decay will have reduced the tritium component of the underground source term to about 23 million curies.

Geology and Soil—American Indian Perspective

CGTO

When visiting Area 5 of the Nevada National Security Site (NNSS) in 2009, Indian people observed several traditional use minerals. In particular, Indian people have observed the presence of: (1) Chalcedony, (2) Obsidian, (3) Yellow Chert (otherwise known as Jasper), (4) Black Chert, (5) Pumice, (6) Quartz Crystal, and (7) Rhyolite Tuff. Other traditional use minerals are known to exist in other areas throughout the NNSS.

Minerals are culturally important and have significant roles in many aspects of Indian life. For example, the Chalcedony would have made an attractive offering, which could be acquired here and then left at the vision quest or medicine site located to the north on top of a volcano like Scrugham Peak. Upon return, traditional Indian people would bring offerings back to where we acquired offerings.

Obsidian is a glass-like stone produced by volcanoes. Indian people used a green volcanic glass during curing ceremonies that involved bleeding the patient. Volcanic glass found below Scrugham Peak was used in the first arrow making lessons for young men. Such lessons were held in small rock shelters found along the base of the basalt flow that constitutes Buckboard Mesa. Obsidian flakes were placed before important rock art panels as offering to the spirits that lived on the other side of the passageway provided by the panel. Small obsidian stones, commonly called Apache Tears, have been found on the face of Shoshone Mountain in southern Nevada. This massive deposit of obsidian stones is interpreted by Indian people as being provided by the mountain as both a spiritual backdrop and a location rationale for vision quests.

Volcanic rocks are used in a wide range of ceremonial activities. Indian women enhance the quality of breast milk by squirting it on heated rocks. They are used for medicine society sweat lodge meetings. Indian people call some volcanic rocks “grandfather stones,” a designation that reflects reverence as well as wisdom. Such rocks are sought in special places of power and carried over long distances to serve as the heated stones in sweat lodges.

See Appendix C for more details.

4.1.6 Hydrology

4.1.6.1 Surface Water

The NNSS lies within the Basin and Range Physiographic Province and the Great Basin, which is a closed hydrographic basin from which no surface water leaves, except by evaporation. Much of Nevada is contained within the Great Basin, including the NNSS, the TTR, and all but the southern corner of the Nevada Test and Training Range. Consistent with the Great Basin, the internal drainage of regional hydrographic basins is controlled by topography (USAF 1999). The Great Basin comprises numerous smaller hydrographic basins; parts of nine different smaller basins occur within the boundaries of the NNSS. The basins that cover the greatest amount of land area on the NNSS include (1) Fortymile Canyon (the Buckboard Mesa and Jackass Flats Subdivisions), (2) Yucca Flat, (3) Rock Valley, and (4) Frenchman Flat. Hydrographic basins on the NNSS that are less extensive in land area include portions of Gold Flat, Kawich Valley, Emigrant Valley, Mercury Valley, and Oasis Valley (see **Figure 4–15**).

The similarity of physical environmental attributes throughout the region allows for a general discussion of surface-water features and characteristics of the NNSS, the TTR, and the Nevada Test and Training Range, as well as offsite features of importance in close proximity. Thus, the surface-water section begins with a brief discussion of regional conditions before focusing on the NNSS.

Surface-Water Features. None of the streams in the region perennially contains water. Thus, streams are ephemeral and are fed by runoff from snowmelt and precipitation during storm events. Storms are most common in winter and occur occasionally in fall and spring; localized thunderstorms often occur in the summer. Much of the runoff quickly infiltrates into rock fractures or into the dry soils. Some runoff is carried down alluvial fans in arroyos, and some drains onto playas where it may stand for weeks as a lake (DOE 1988). These usually dry playas illustrate a perennial water deficit that has been characteristic of southern Nevada since about 1850 (Forester et al. 1999).

The Amargosa River, in the Amargosa Desert, is the main ephemeral stream feature in the region, though it is normally dry, and lies approximately 20 miles southwest of the NNSS at its closest point. The Amargosa River continues to Death Valley, California (DOE 1988).

Springs are the only perennial surface-water sources throughout the region. Most perennial surface discharges from springs occur as pools at some large springs. In most instances, discharged spring water travels only a short distance from the source before evaporating or infiltrating the ground. Springs, seeps, and marsh areas of the region discharge from less than one to several thousand gallons of water per minute. In larger springs, discharges are typically several tens to several hundreds of gallons per minute. The largest discharge is at Crystal Pool in Ash Meadows, approximately 15 miles south of the NNSS southern boundary (DOE 1988). A small lake, locally known as Crystal Reservoir, with a storage capacity of 1,489 acre-feet, is present in Ash Meadows. Water for the reservoir is supplied by a flume from Crystal Pool (Giampaoli 1986).

NNSS-Specific Conditions. There are no important perennial or intermittent streams on the NNSS. During infrequent runoff events, ephemeral channel systems in the western half and southernmost parts of the NNSS carry runoff beyond the NNSS boundaries. Fortymile Canyon is the largest drainage system, draining to the Amargosa River approximately 20 miles southwest of the NNSS boundary. The main tributary in the Fortymile Canyon system is Fortymile Wash. On the NNSS, Fortymile Canyon and its ephemeral tributaries consist of well-defined canyons; however, the canyon splits into several tributaries beyond the NNSS boundary (DOE 1996a).

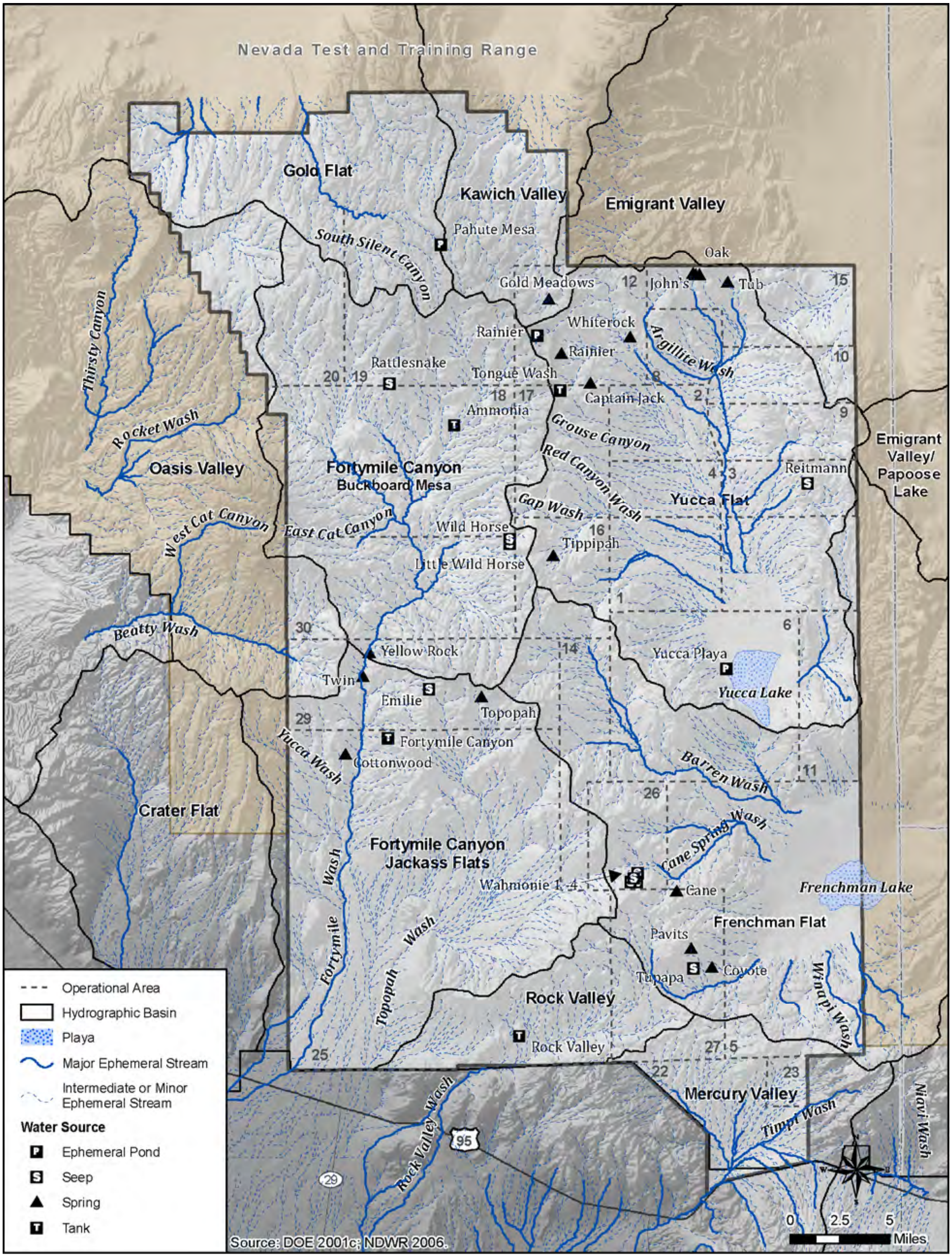

Figure 4–15 Hydrographic Basins and Surface-Water Features on the Nevada National Security Site

There are two other major NNSS drainages that discharge to the Amargosa River: (1) Topopah Wash and (2) Rock Valley. Topopah Wash originates in the Jackass Flats Subdivision of Fortymile Canyon in the south-central portion of the NNSS and trends southwesterly. Rock Valley drains from the southernmost portion of the NNSS westward (see Figure 4–15). Both of these drainage systems are dry throughout most years (DOE 1996a).

In general, ephemeral surface flows on the NNSS are infrequent, with no flow in some years, while in other years, flows may occur for only a few days (DOE 1996a). For example, stream flows measured in Fortymile Wash near the NNSS boundary (approximately 3 miles northwest of the intersection of Lathrop Wells Road and U.S. Route 95) for the water years of 2002 through 2004 (a water year runs from October 1 through September 30) showed no flow at all in 2002 and 2004 (USGS 2002, 2004). In 2003, a discharge of less than 0.1 cubic feet per second was recorded as the yearly maximum and the flow was not sufficient to measure a water height (USGS 2003). Recordable flow events do occur in Fortymile Wash periodically. The most notable of these occurred during March 11–13, 1995, when U.S. Route 95 was closed due to water flowing over the road. The peak discharge at the aforementioned stream flow gauging station during this event was 1,200 cubic feet per second. Historically, stream flow has occurred throughout the Fortymile Wash channel system in January and February 1969, March 1983, July and August 1984, and March 1995, with several other periods where flow occurred in portions of the overall system (Savard 1998). Although these washes contain water infrequently, when they do contain water, they provide many of the beneficial functions that surface-water resources typically provide, such as providing habitat for desert species and serving as flood control features.

There are several "tanks" on the NNSS, which are natural rock depressions that capture surface runoff. There are little data available on the hydrologic characteristics of the tanks. During a study conducted in 1997, the maximum surface areas of individual tanks on site measured approximately 160 square feet with maximum water depths of approximately 3 feet. In addition, there are three ephemeral ponds on the NNSS: (1) Yucca Playa Pond, (2) Pahute Mesa Pond, and (3) Rainier Pond. Yucca Playa Pond occurs in a low spot on the west side of Yucca Lake Playa, where water collects naturally from playa drainage (Hansen et al. 1997). Pahute Mesa Pond occurs in the northern portion of the NNSS near the boundary between Gold Flat and Kawich Valley. Pahute Mesa Pond typically contains water for short periods following summer rain events (DOE/NV 2011). Rainier Pond was discovered in 2009 (see Figure 4–15).

In areas where underground nuclear tests have occurred, ground surface disturbances and craters have altered natural drainage paths. Some craters have captured nearby drainage and headward erosion of drainage channels has occurred. In some areas of the NNSS, the natural drainage system has been completely altered by the craters (DOE 1996a). The majority of past underground nuclear tests and associated craters are concentrated in the following NNSS locations: Areas 2, 3, 4, 6, 7, 8, 9, 10, and 15. Areas 5, 11, 12, 16, 19, and 20 have been affected as well.

There are 26 known springs and seeps on the NNSS (DOE/NV 1999; Hansen et al. 1997), although some are dry for most of the year (see Figure 4–15). Additionally, 143 manmade impoundments (plastic-lined and earthen sumps) currently exist at the NNSS, but similar to natural water sources, not all of the manmade impoundments contain water year-round.

Records of Wells, Test Holes, and Springs in the Nevada Test Site and Surrounding Area (Moore 1961) provides data on discharges from eight springs on the NNSS and one spring approximately 10 miles north of the NNSS on the Nevada Test and Training Range (i.e., Indian Springs) sampled from 1957 to 1960. The largest two of the nine springs in the study located on the NNSS discharged more than 1 gallon per minute (Cane Spring, 2 to 3 gallons per minute; Whiterock Spring, 1 to 2 gallons per minute); all others discharged less than 1 gallon per minute. *Nevada Test Site Wetlands Assessment* (Hansen et al. 1997, Table 5-1) provides more-recent data (1996 to 1997) on 20 NNSS springs and seeps that indicate a general lowering of discharge rates since the early 1960s. Discharge rates ranged from 0.0 to 0.8 gallons per minute, with the greatest values measured at Cane Spring (0.8 gallons per minute), Tippipah Spring

(0.7 gallons per minute), and Whiterock Spring (0.5 gallons per minute). All others discharged less than 0.5 gallons per minute, with several exhibiting no discharge (i.e., Coyote, Gold Meadows, Pavits, and Rainier Springs, as well as Tupapa Seep and Wahmonie Seeps 2 and 3).

The Clean Water Act 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 the U.S. Environmental Protection Agency (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 the Clean Water Act (EPA and Army 2007). Based on the new guidance, no wetlands at the NNSS are expected to qualify as waters of the United States (DOE/NV 2009d) due to a lack of surface hydrologic connections to navigable waterways or their tributaries, though certain tributaries on the NNSS may qualify (e.g., Fortymile Wash). If an activity is proposed that may affect a tributary or wetland that is potentially a water of the United States, a site-specific evaluation by the U.S. Army Corps of Engineers would be determinative in terms of jurisdictional status. **Table 4–16** provides a summary of the general characteristics of potential wetland areas known to exist on the NNSS. Some of the wetland areas have not yet been studied thoroughly due to their remote nature and, in some instances, their relatively recent discovery.

Table 4–16 General Characteristics of Potential Wetland Areas on the Nevada National Security Site

Potential Wetland Area	***Area of Surface Water (square feet)*** [a]	***Dominant Vegetation*** [b]	***Wildlife Types Observed***
Ammonia Tanks	323	Louisiana sagewort (*Artemisia ludoviciana*)	Mammals and upland game birds
Cane Spring	43	Goodding's willow (*Salix gooddingii*) Baltic rush (*Juncus balticus*) Basin wildrye (*Leymus cinereus*) Willow dock (*Rumex salicifolia*)	Mammals, upland game birds, migratory waterfowl, raptors, and passerine birds
Captain Jack Spring	75	Seep monkeyflower (*Mimulus guttatas*) Willow dock (*Rumex salicifolia*) Water speedwell (*Veronica anagallis-aquatica*)	Mammals, upland game birds, raptors, and passerine birds
Carrie Spring	22	N/A	N/A
Cottonwood Spring	969	Fremont's cottonwood (*Populus fremontii*)	Mammals
Coyote Spring	0	Inland saltgrass (*Distichlis spicata*)	Mammals
Emilie Seep	N/A	N/A	N/A
Fortymile Canyon Tanks	86	None identified	Mammals and raptors
Gold Meadows Spring	0	Baltic rush (*Juncus balticus*)	Mammals, upland game birds, raptors, and passerine birds
John's Spring	54	Clustered field sedge (*Carex praegracilis*) Seep monkeyflower (*Mimulus guttatas*)	Mammals and passerine birds
Little Wild Horse Seep	22	N/A	Mammals and passerine birds
Oak Spring	11	Sandbar willow (*Salix exigua*) Basin wildrye (*Leymus cinereus*)	Mammals, upland game birds, and passerine birds
Pahute Mesa Pond	24,488	N/A	Mammals
Pavits Spring	0	None identified	Mammals and upland game birds
Rainier Pond	N/A	N/A	N/A
Rainier Spring	0	Basin wildrye (*Leymus cinereus*)	None
Rattlesnake Seep	32	N/A	N/A
Reitmann Seep	16	Parish's spikerush (*Eleocharis parishii*) Annual rabbitsfoot grass (*Polypogon monspeliensis*)	Mammals, upland game birds, raptors, and passerine birds
Rock Valley Tank	1	Foxtail brome (*Bromus rubens*)	Mammals

Potential Wetland Area	*Area of Surface Water (square feet)* [a]	*Dominant Vegetation* [b]	*Wildlife Types Observed*
Tippipah Spring	2,045	Baltic rush (*Juncus balticus*) Annual rabbitsfoot grass (*Polypogon monspeliensis*) Biennial cinquefoil (*Potentilla biennis*) Water speedwell (*Veronica anagallis-aquatica*)	Mammals, upland game birds, raptors, and passerine birds
Tongue Wash Tank	48	None identified	Mammals, upland game birds, and passerine birds
Topopah Spring	86	Baltic rush (*Juncus balticus*) Rocky Mountain rush (*Juncus saximontanus*) Sandberg bluegrass (*Poa secunda*) Louisiana sagewort (*Artemisia ludoviciana*) Willow dock (*Rumex salicifolius*) Water speedwell (*Veronica anagallis-aquatica*)	Mammals, upland game birds, raptors, and passerine birds
Tub Spring	1	Skunkbush sumac (*Rhus trilobata*)	Mammals, upland game birds, and passerine birds
Tupapa Seep	0	Cheatgrass (*Bromus tectorum*) Foxtail barley (*Hordeum jubatum*)	Mammals and passerine birds
Twin Spring	22	Southern cattail (*Typha domingensis*)	Mammals and upland game birds
Wahmonie Seep 1	54	Emory's baccharis (*Baccharis emoryii*) Rubber rabbitbrush (*Ericamaerica nauseosa*) Baltic rush (*Juncus balticus*) Basin wildrye (*Leymus cinereus*) Water speedwell (*Veronica anagallis-aquatica*)	Mammals, upland game birds, and passerine birds
Wahmonie Seep 2	3	Emory's baccharis (*Baccharis emoryii*)	Mammals
Wahmonie Seep 3	0	Emory's baccharis (*Baccharis emoryii*) Foxtail brome (*Bromus rubens*) Louisiana sagewort (*Artemisia ludoviciana*)	Mammals
Wahmonie Seep 4	377	N/A	Mammals
Whiterock Spring	1	Sandbar willow (*Salix exigua*) Baltic rush (*Juncus balticus*)	Mammals, upland game birds, raptors, and passerine birds
Wild Horse Seep	22	N/A	Mammals
Yellow Rock Spring	323	Skunkbush sumac (*Rhus trilobata*) Cheatgrass (*Bromus tectorum*)	Mammals
Yucca Playa Pond	246,816	Saltceder (*Tamarix ramosissima*)	Mammals, upland game birds, migratory waterfowl, and raptors

N/A = information not available.
[a] Maximum inundated area recorded at time of survey (1996, 1999, 2000, or 2009).
[b] Dominant vegetation defined as 10 percent or greater absolute cover.
Source: Bechtel Nevada 1999, 2000b; Hanson et al. 1997; NSTec 2010j.

Surface-Water Characteristics. There is no known human consumption of surface water on the NNSS. In fact, no public water supplies are drawn from springs in the Amargosa Valley, which is located downgradient from the NNSS along the primary pathway for surface-water flow. The closest surface-water supply used for public consumption is Lake Mead (NDEP 2010c), which is located approximately 100 miles southeast of the NNSS and supplies a large portion of the water demand of metropolitan Las Vegas.

Little data on the characteristics of water in the region are available because all streams in the region are ephemeral. *Records of Wells, Test Holes, and Springs in the Nevada Test Site and Surrounding Area* (Moore 1961) presented results on chemical analyses for eight springs on the NNSS (see **Table 4–17**). More-recent (1996 to 1997), but less extensive data are provided in **Table 4–18**.

Table 4–17 Chemical Analyses of Water from Springs on the Nevada National Security Site (1957 – 1959)

Spring Name	***Cane***	***Cane***	***Topopah***	***Topopah***	***Tippipah***	***Tippipah***	***Rainier***	***Captain Jack***	***White-rock***	***White-rock***	***White-rock***	***White-rock***	***Oak***	***Butte***	***Indian***
Date of Collection	***9/19/57***	***3/24/58***	***9/17/57***	***3/25/58***	***9/17/57***	***3/24/58***	***9/18/57***	***5/1/59***	***4/5/57***	***9/18/57***	***3/21/58***	***5/19/59***	***4/28/58***	***4/30/59***	***5/1/58***
°F	66	64	70	53	53	54	61	56	56	59	48	67	55	52	50
pH	7.9	8.0	6.9	6.9	7.7	7.4	8.3	6.9	6.9	7.1	7.2	8.8	7.5	7.1	7.2
Specific Conductance in Microohms at 25 °C	425	403	291	114	207	192	346	188	215	222	197	219	241	260	358
Silica (ppm)	64	63	71	50	53	50	65	43	80	52	119	48	57	64	61
Aluminum (ppm)	0	0	0.2	0.3	0.6	0	0.2	0.6	1.1	0.1	0.8	0.7	0.1	0.1	0.1
Iron (ppm)	0.1	0	0.08	0.44	0.31	0.23	0.04	0.95	0.62	0.03	0.44	0.3	0	0.13	0.08
Manganese (ppm)	0[a]	0	0	0	0	0	0[a]	0[a]	0	0	0.4 [a]	0	0[a]	0	0
Calcium (ppm)	32	30	20	7.2	4.8	4.8	7.2	3.2	4.8	4.0	6.4	4.8	18	16	42
Magnesium (ppm)	9.2	9.2	3.9	1.0	0.1	0	1.0	0	0	0.2	0	0	4.9	3.9	7.8
Strontium (ppm)	0	<0.1	0	<0.1	0	<0.1	0.2	<0.2	0	0	<0.1	<0.2	<0.1	<0.2	<0.2
Sodium (ppm)	37	36	19	14	40	37	66	47	39	42	35	39	22	31	17
Potassium (ppm)	7.8	7.6	18	6.4	3.0	3.2	4.0	2.2	5.4	5.4	7.4	4.0	6.4	4.0	4.8
Bicarbonate (ppm)	163	152	147	48	88	81	158	95	72	78	66	50	116	118	148
Carbonate (ppm)	0	0	0	0	0	0	2.0	0	0	0	0	13	0	0	0
Sulfate (ppm)	28	30	11	15	16	19	18	25	23	29	32	23	14	14	36
Chloride (ppm)	20	19	6.0	3.0	7.2	6.0	14	4.0	11	8.0	6.0	9.0	9.0	11	12
Fluoride (ppm)	0.5	0.7	0.7	0.3	0.2	0.3	0.6	0.4	0.4	0.4	0.6	0.6	0.3	0.4	0.4
Nitrate (ppm)	19	18	0.1	2.0	4.6	4.2	0.6	0	4.9	4.8	4.8	1.9	0	0	0
Phosphate (ppm)	0.25	0	10	0.9	0.45	0.4	2.2	1.2	0.5	0.65	0.45	0.55	0.1	0.21	0
Total Dissolved Solids (sum) [a]	298	288	222	123	172	164	256	172	204	184	243	167	189	202	254
Hardness (as calcium carbonate) – Total (ppm)	118	113	66	22	12	12	22	8.0	12	11	16	12	65	56	137
Hardness (as calcium carbonate) – Non-carbonate (ppm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
Percent Sodium	399	399	322	50	84	83	84	90	82	84	75	83	40	52	211

°C = degrees Celsius; °F = degrees Fahrenheit; ppm = parts per million; pH = a measure of acidity or basicity.

[a] In solution at time of analysis.

Source: Moore 1961, Table 5.

Table 4–18 Water Quality Measurements of Natural Water Sources on the Nevada National Security Site (June 1996 – February 1997)

Surface-Water Feature	*Date Sampled*	*Location (microhabitat)*	*Water Temperature (°C)*	*Dissolved Oxygen (parts per million)*	*pH*	*Total Dissolved Solids (parts per million)*	*Electrical Conductivity (µS)*
Cane Spring	6/19/96	cave pool	19.4 [a]	6.2 [a]	7.7 [a]	190 [a]	–
	9/09/96	cave pool	17.4	6.0	7.1	207	406
	11/13/96	cave pool	15.7	8.4	7.2	209	424
	6/19/96	flow box	28.0 [a]	0.7 [a]	7.3 [a]	248 [a]	–
	9/09/96	flow box	22.2	2.6	7.0	227	453
	11/13/96	flow box	9.2	6.7	7.3	256	525
Captain Jack Spring	6/19/96	spring pool	19.0 [a]	5.5[a]	7.1 [a]	90 [a]	–
	9/10/96	spring pool	16.8	4.9	7.3	959	193
Cottonwood Spring	1/08/97	spring pool	7.4	3.5	7.1	54	107
Reitmann Seep	6/19/96	spring pool	30.0 [a]	–	9.2 [a]	379 [a]	–
	7/24/96	spring pool	28.4	2.1	7.7	346	–
	9/10/96	spring pool	31.5	8.1	8.8	336	669
	11/22/96	spring pool	12.4	2.7	7.4	287	557
Tippipah Spring	6/18/96	open channel pool	18.6 [a]	1.2	6.8	114	–
	9/03/96	open channel pool	18.5	1.0	6.7	135	267
	11/15/96	open channel pool	13.7	4.6	7.2	119	243
	9/03/96	cave pool	15.3	6.7	7.0	114	227
	11/22/96	cave pool	14.3	7.8	7.1	106	212
Topopah Spring	6/20/96	spring pool	14.9 [a]	3.8	7.5	66	–
	9/09/96	spring pool	20.0	2.7	6.7	69	139
Tub Spring	6/24/96	guzzler can	26.0 [a]	–	7.6	147	–
	9/10/96	guzzler can	26.5	6.0	7.5	146	294
Twin Spring	1/08/97	spring pool	16.8	1.0	7.0	137	271
Wahmonie Seep 1	6/20/96	wash pool	17.8 [a]	1.8	7.5 [a]	259	–
Whiterock Spring	6/18/96	flow box	16.8	8.1 [a]	7.0	124	–
	9/03/96	flow box	18.7	6.6	7.2	139	277
	9/03/96	west cave pool	15.6	5.8	7.4	142	276
Yucca Playa Pond	1/07/97	pond	1.7	13.6	8.1	162	328

°C = degrees Celsius; µS = microsiemen; pH = a measure of acidity or basicity.
[a] Values represent single readings. All other values are an average of three readings.
Note: "–" indicates no data collected.
Source: Hansen et al. 1997, Table 5-2.

Prior to 1998, natural springs on the NNSS were tested annually for radiological constituents. In 1998, in accordance with the Routine Radiological Environmental Monitoring (RREM) Plan, this sampling was discontinued because the onsite springs are fed by locally derived or "perched" groundwater (i.e., groundwater in a saturated zone of material separated from other groundwater bodies by a relatively impervious zone) (Hansen et al. 1997; Moore 1961) that is not hydrologically connected to any of the aquifers that may be affected by underground nuclear tests (Bechtel Nevada 1998a; DOE/NV 1999). In 1996 and 1997, seven natural springs on site were sampled because only seven had enough water to provide a sample. The sampled springs were (1) Rainier Mesa Spring, (2) Oak Spring, (3) Whiterock Spring, (4) Captain Jack Spring, (5) Tippipah Spring, (6) Topopah Spring, and (7) Cane Spring. In 1996, the average gross beta concentration of the sampled springs was 9.2×10^{-9} microcuries per milliliter, and in 1997 it was 9.8×10^{-9} microcuries per milliliter. These average values represent approximately 23 to 25 percent of the EPA Derived Concentration Guide for exposure to the public (based on a strontium-90 value for drinking water of 4 millirem effective dose equivalent). Although these values are much lower than the Derived Concentration Guide, it is important to note that spring water is not used for human consumption on the NNSS (DOE/NV 1997b, Table 5.11; 1998c, Table 5.6). It is also important to note that this radiation is due to elements that naturally exist in the volcanic geologic medium (e.g., uranium and potassium-40).

Flood Hazards. Flash flooding occurs on the NNSS in response to heavy precipitation events, especially during summer thunderstorms. The runoff from these storms is typically of short duration; however, the storms do result in large peak discharge rates. Flood hazards for DOE/NNSA facilities and activities are most likely associated with flooding in alluvial fans and playas. Throughout the NNSS, there is the potential for sheetflow or channelized flow through arroyos to cause localized flooding. In addition, a rise in any standing water on a playa creates a potential flood hazard. However, because of the size of the NNSS, no comprehensive floodplain analysis has been conducted to delineate the 100- and 500-year floodplains (Cohn 2010).

Playas in the Yucca Flat weapons test basin and Frenchman Flat in the eastern and southeastern parts of the NNSS, respectively, collect and dissipate runoff from their respective hydrographic basins. Control Point and News Knob arroyos (informal names), and Gap Wash, Red Canyon Wash, Tongue Wash, and the Aqueduct arroyos in the Yucca Flat weapons test basin pose a potential flood hazard to existing facilities (DOE 1996a). The Control Point and News Knob arroyos have been assessed for flood hazards (Miller et al. 1994).

Arroyos in Frenchman Flat that pose a potential flood hazard to existing facilities include Barren Wash, Scarp Canyon, Nye Canyon, and Cane Spring (DOE 1996a). There is a 100-year flood hazard area along the southwest corner of the Area 5 RWMC associated with Barren Wash (Schmeltzer et al. 1993). Areas prone to flooding surround Fortymile Wash, a major tributary of Fortymile Canyon. Topopah Wash runs southwesterly across the Jackass Flats Subdivision of Fortymile Canyon from Jackass Divide in the south-central part of the NNSS (DOE 1996a). The 100-year flood-prone areas of Topopah Wash and its tributaries would closely parallel most stream channels with few occurrences of out-of-bank flooding, though 500-year flood events would overtop the banks of all tributaries (not including Topopah Wash itself) and maximum flood events would inundate the entire area (Christensen and Spahr 1980). The Fortymile Canyon Hydrographic Basin poses a flood hazard to offsite areas (SAIC/DRI 1991). Arroyos trending southward from Red Mountain pose a potential flood hazard to sewage lagoons that service Mercury (DOE 1996a).

Water Discharges and Regulatory Compliance. Industrial discharges on the NNSS are limited to two operating sewage lagoon systems: (1) Area 6 Yucca Lake and (2) Area 23 Mercury (these lagoon systems also receive domestic wastewater). The Area 6 Yucca Lake system consists of two primary lagoons and two secondary lagoons. All lagoons in the Area 6 Yucca Lake system are lined with compacted native soils that meet State of Nevada requirements for hydraulic conductivity (3.937×10^{-8} inches per second). The Area 23 Mercury system consists of one primary lagoon, a secondary lagoon, and an infiltration basin. The primary and secondary lagoons in the Area 23 Mercury system have a geosynthetic clay liner and a high-density polyethylene liner. The lining of the ponds allows the Area 23 lagoons to operate as a fully contained, evaporative, nondischarging system (DOE/NV 2011).

These Area 6 Yucca Lake and Area 23 Mercury lagoon systems are operated under a State of Nevada Water Pollution Control General Permit (Permit number: GNEV93001). Through 2008, this permit required annual monitoring of gross alpha, gross beta, and tritium radioactivity. The permit was revised on November 20, 2008, and annual monitoring requirements changed; the lagoons are now sampled for gross alpha, gross beta, and tritium radioactivity, as well as 29 organic and inorganic contaminants only in the event of specific or accidental discharges of potential contaminants (DOE/NV 2009d). There were no such discharges in 2010 (DOE/NV 2011). For the influent water, quarterly monitoring of 5-day biochemical oxygen demand, total suspended solids, and pH (a measure of acidity or basicity) continue to be permit requirements (DOE/NV 2009d). **Table 4–19** provides results of 2008 gross alpha, gross beta, and tritium sampling of the active lagoon systems. No concentrations exceeded permit limitations; tritium concentrations did not reach the sample-specific minimum detectable concentration levels.

Table 4–19 Annual Radiological Results for Sewage Lagoon Effluent (2008)

Monitoring Location	*Gross Alpha ± Uncertainty* [a]	*Gross Beta ± Uncertainty* [a]	*Tritium ± Uncertainty* [a]
	(minimum detectable concentration) (picocuries per liter)		
Area 6 Yucca Lake	4.7 ± 1.3 (1.3) [b]	23.8 ± 4.1 (2.0) [b]	136 ± 225 (370)
Area 23 Mercury	3.8 ± 1.3 (1.5) [b]	27.7 ± 5.0 (3.3) [b]	35 ± 222 (370)
Permit Limit	15	50	20,000

[a] ± 2 standard deviations.
[b] Results are considered detected (i.e., results greater than the sample-specific minimum detectable concentration).
Note: Samples taken July 8, 2008.
Source: DOE/NV 2009d, Table 4-5.

Table 4–20 provides results of 2008 nonradiological water toxicity sampling of the active lagoon systems. The vast majority of potential contaminants were below the laboratory's detection limits; no exceedances of permit limitations occurred.

Table 4–20 Annual Nonradiological Toxicity Analysis Results of Sewage Lagoon Pond Water (2008)

Contaminant	*Permit Limit (ppm)*	*Area 6 Yucca Lake (ppm)*	*Area 23 Mercury (ppm)*
Benzene	0.5	ND	ND
Carbon Tetrachloride	0.5	ND	ND
Chlorobenzene	100	ND	ND
Chloroform	6.0	ND	ND
Cresol (total)	200	ND	ND
2,4-D	10	ND	ND
1,4-Dichlorobenzene	7.5	ND	ND
1,2-Dichloroethane	0.5	ND	ND
1,1-Dichloroethylene	0.7	ND	ND
2,4-Dinitrotoluene	0.13	ND	ND
Hexachlorobenzene	0.13	ND	ND
Hexachlorobutadiene	0.5	ND	ND
Hexachloroethane	3.0	ND	ND
Methylethyl Ketone	200	ND	ND
Nitrobenzene	2.0	ND	ND
Pentachlorophenol	100	ND	ND
Pyridine	5.0	ND	ND
Trichloroethylene	0.5	ND	ND

Contaminant	Permit Limit (ppm)	Area 6 Yucca Lake (ppm)	Area 23 Mercury (ppm)
2,4,5-Trichlorophenol	400	ND	ND
2,4,6-Trichlorophenol	2.0	ND	ND
Vinyl Chloride	0.2	ND	ND
Arsenic	5.0	ND	ND
Barium	100	0.0411	0.0631
Cadmium	1.0	ND	ND
Chromium	5.0	ND	ND
Lead	5.0	ND	ND
Mercury	0.2	ND	ND
Selenium	1.0	ND	ND
Silver	5.0	0.0060	0.0085

ND = Not detected (results were below the laboratory's minimum detection limits); ppm = parts per million.
Note: Samples taken in July 2008.
Source: DOE/NV 2009d, Table 4-10.

Table 4–21 provides 2010 water quality analysis results for sewage lagoon influent waters. No exceedances of permit limitations occurred (DOE/NV 2011).

Table 4–21 Annual Water Quality Results for Sewage Lagoon Influent Waters (2010)

Parameter	Unit	Permit Limit	Minimum and Maximum Values from Quarterly Samples: Area 6 Yucca Lake	Minimum and Maximum Values from Quarterly Samples: Area 23 Mercury
BOD_5	ppm	No Limit	136 – 233	183 – 361
BOD_5 Mean Daily Load	lbs/d	19.09 (Area 6 Yucca Lake) 254.41 (Area 23 Mercury)	0.53 – 3.59	32.67 – 65.74
Total Suspended Solids	ppm	No Limit	145 – 290	160 – 350
pH	S.U.	6.0 – 9.0	8.20 – 8.70	8.00 – 8.50

BOD_5 = 5-day biochemical oxygen demand; lbs/d = pounds per day; pH = a measure of acidity or basicity; ppm = parts per million; S.U. = standard units of pH.
Source: DOE/NV 2011, Table 5-10.

E-Tunnel is a complex of tunnels and drifts in Area 12 that were constructed for underground testing of nuclear devices. Perched groundwater percolating through the pores and fractures of the volcanic tuffs constituting Rainier Mesa encounters radiological artifacts of nuclear experiments, as well as naturally occurring radiological constituents; some of that water exits through the E-Tunnel portal. Attempts were made to eliminate the discharge by plugging the tunnel, which were unsuccessful; therefore, disposal of this water has been performed via infiltration/evaporation in five unlined primary holding ponds, directing most of the effluent toward the groundwater regime. The NNSS manages and operates the E-Tunnel Waste Water Disposal System (ETDS) in Area 12 under a water pollution control permit issued by the NDEP Bureau of Federal Facilities (Permit number: NEV 96021). The permit governs the management of radionuclide-contaminated wastewater that drains from the E-Tunnel portal into the five holding ponds. The permit requires ETDS discharge waters to be monitored every 12 months for certain radiological and nonradiological parameters. In addition, monthly monitoring is required for flow rate, pH, temperature, specific conductance, total volume, and the structural integrity of the holding ponds. **Table 4–22** provides results of 2010 gross alpha, gross beta, and tritium sampling of the ETDS discharge water. Tritium concentrations were about 50 percent of the limit allowed under the permit. The discharge water was also within gross alpha/beta permit limits (DOE/NV 2011). Gross beta values represent radiation from both human-influenced (e.g., tritium) and naturally occurring sources (e.g., radium-228).

Table 4–22 Radiological Results for E-Tunnel Waste Water Disposal System Discharge Water Samples (2010)

Radiological Parameter	*Permit Limit (picocuries per liter)*	*Measured Value (picocuries per liter)*
Tritium	1,000,000	505,000 ± 77,100
Gross Alpha	35.1	8.0 ± 1.6
Gross Beta	101	37.7 ± 6.1

Note: Samples taken in October 2010.
Source: DOE/NV 2011, Table 5-6.

Table 4–23 shows the results of the 2010 water quality sampling of the ETDS holding ponds for nonradiological parameters that are required to be monitored under the water pollution control permit. All measurements were within permit limits and specifications for the annual sample. Most monthly measurements were also within permit limits except for specific conductance at the ETDS discharge point. Specific conductance is a measure of how well water can conduct an electrical current. Monthly specific conductance measurements were 379.0, 369.7, 385.7, 395.7, 371.5, 391.7, 380.2, 389.0, 388.2, and 393.3 microsiemens per centimeter in February, March, April, May, June, August, September, October, November, and December, respectively. These are all below the lower permit limit of 400 microsiemens per centimeter. NDEP determined that specific conductance measurements should continue to be collected after evaluating NNSS's study of this parameter. NDEP suspended the permit requirement for follow-on monitoring and will re-evaluate the permit limits for specific conductance when the permit is renewed in 2013 (DOE/NV 2011).

Table 4–23 Nonradiological Results for E-Tunnel Waste Water Disposal System Discharge Water Samples (2010)

Nonradiological Parameter	*Permit Limit*	*Measured Value*
Cadmium (ppm)	0.045	<0.001
Chloride (ppm)	360	9.43
Chromium (ppm)	0.09	<0.003
Copper (ppm)	1.2	0.00152 [a]
Fluoride (ppm)	3.6	0.25
Iron (ppm)	5.0	2.42
Lead (ppm)	0.014	0.00164 [a]
Magnesium (ppm)	135	1.28
Manganese (ppm)	0.25	0.027
Mercury (ppm)	0.0018	<0.0002
Nitrogen (as nitrate) (ppm)	9	1.27
Selenium (ppm)	0.045	<0.01
Sulfate (ppm)	450	16.9
Zinc (ppm)	4.5	0.0308
pH (S.U.)	6.0 – 9.0	7.21
Specific conductance (μS/cm)	400 – 500	389

pH = a measure of acidity or basicity; ppm = parts per million; S.U. = standard units of pH; μS/cm = microsiemens per centimeter.
[a] Estimated quantity based on the laboratory's minimum detection limit.
Source: DOE/NV 2011, Table 5-11.

4.1.6.2 Groundwater

This section is an overview of the general hydrogeologic setting and characteristics of groundwater underlying the NNSS. Water-resource features, including supply wells and monitoring wells used for access to groundwater, are described in relation to the hydrographic areas in which they lie.

Important characteristics of groundwater systems include recharge zones (areas where water infiltrates from the surface and reaches the saturated zone), discharge points (locations where groundwater reaches the surface), unsaturated zones (the portion of the groundwater system above the water table), saturated zones (the portion of the groundwater system below the water table), aquitards (confining units), and aquifers (water-bearing layers of rock that provide water in usable quantities). In combination, these characteristics define the quantity and quality of the available groundwater.

Hydrogeologic Setting. The NNSS is located within the southern portion of the Great Basin, occupying approximately 0.7 percent of the Great Basin. The Great Basin is a closed hydrographic province (a basin with no external drainage, from which water is lost only by evapotranspiration) with no outlet to the Pacific Ocean. It comprises many hydrographic basins (areas in which surface runoff collects and from which it is carried by a drainage system, such as a river and its tributaries). Hydrographic basins are mapped on the basis of topographic divides and are used by the State of Nevada for the purposes of water appropriation and management. The NNSS lies within a portion of 10 hydrographic basins (Mercury Valley, Rock Valley, Yucca Flat, Frenchman Flat, Buckboard Mesa, Jackass Flats, Oasis Valley, Gold Flat, Kawich Valley, and Emigrant Valley; see **Figure 4–16**).

> **Acre-foot**: The volume of water that will cover an area of 1 acre to a depth of 1 foot; 1 acre-foot is equivalent to 325,851 gallons.

The perennial yield for the 10 hydrographic basins partly or wholly located within the NNSS, as shown in **Table 4–24**, is estimated at 33,050 acre-feet per year. The perennial yield is an estimate of the quantity of groundwater that can be withdrawn from a basin on an annual basis without depleting the reservoir (Scott et al. 1971). The perennial yield values used by the Nevada State Engineer were applied for purposes of analysis to all basins. The values used by the Nevada State Engineer for most basins are conservative estimates (considering only recharge through precipitation in a basin), and are based upon a series of reports dating to 1970 and earlier. The term sustainable yield, as used in this *NNSS SWEIS*, means the quantity of groundwater that can be withdrawn in the future from a basin without depleting the reservoir, considering any resources (water rights) already committed to other users. Sustainable yield is effectively the value of a basin's perennial yield minus any existing annual withdrawals.

For Frenchman Flat, the Nevada State Engineer has previously estimated a perennial yield of only 100 acre-feet per year (NDWR 2010a). However, this yield is based upon previous assumptions that little or no groundwater recharge from precipitation occurred in Basin 160. More-recent studies suggest that in-basin recharge does occur in Basin 160, and that perennial yield values are much higher than 100 acre-feet per year. DOE/NNSA has extensively studied the groundwater recharge in Frenchman Flat, using a model from the UGTA program, two U.S. Geological Survey (USGS) models (Hevesi et al. 2003), and two Desert Research Institute models (Russell and Minor 2002). All of these models provide revised estimates of precipitation-driven recharge (and thus perennial yield) of Frenchman Flat using more-rigorous analytical methods and more-recent data. As an example, the UGTA model (yields an estimate of 1,070 acre-feet per year) for Frenchman Flat and the USGS and Desert Research Institute models provide perennial yield estimates of 1,830 and 1,320 acre-feet per year, respectively.

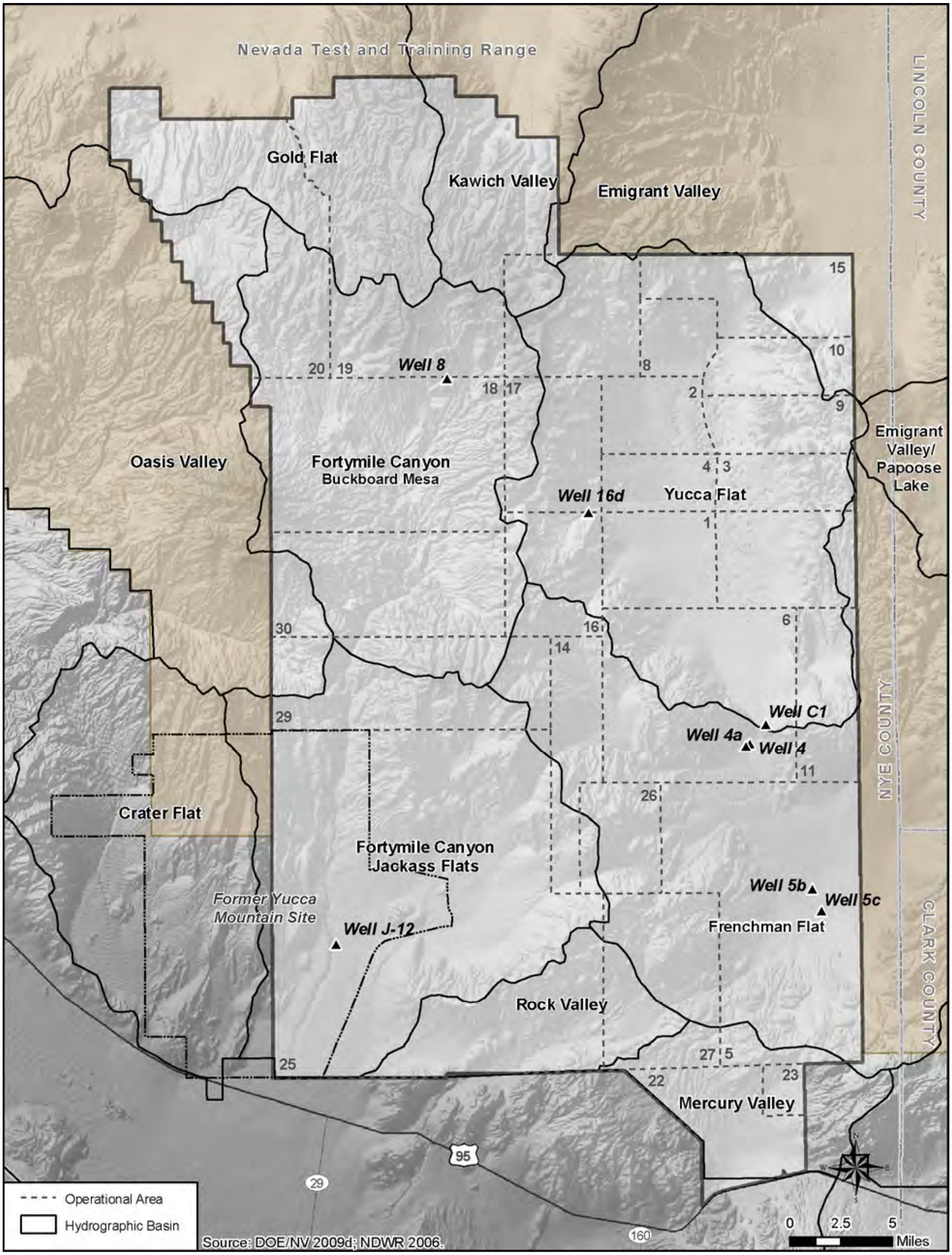

Figure 4–16 Hydrographic Basins at the Nevada National Security Site

Table 4–24 Perennial Yield of Hydrographic Basins at the Nevada National Security Site

Hydrographic Basin	*Hydrographic Basin Number*	*Perennial Yield (acre-feet per year)* [a]	*Total Committed Groundwater Resources (acre-feet per year)* [a, b]	*Sustainable Yield (acre-feet per year)*
Mercury Valley	225	8,000	0	8,000
Rock Valley	226	8,000	0	8,000
Yucca Flat	159	350	0	350
Frenchman Flat	160	100	0	100
Fortymile Canyon, Buckboard Mesa Subdivision	227 [b]	3,600	0	3,600
Fortymile Canyon, Jackass Flats Subdivision	227 [a]	4,000	56	3,944
Oasis Valley	228	2,000	1,727	273
Gold Flat	147	1,900	95	1,805
Kawich Valley	157	2,200	8	2,192
Emigrant Valley	158	2,900	12	2,888
Total	N/A	33,050	1,898	31,152

[a] Source: NDWR 2010a.
[b] Represents water rights appropriated to non-DOE/NNSA users off the NNSS.

The eight water supply wells currently used at the NNSS are located within the Fortymile Canyon Buckboard Mesa and Jackass Flats Subdivisions, Yucca Flat, and Frenchman Flat. These four hydrographic basins have a combined perennial yield of 8,050 acre-feet per year. Total water withdrawals at the NNSS between 2005 and 2009 ranged from 530 to 691 acre-feet per year, as shown later in this section in Table 4–27.

Groundwater beneath the NNSS exists within three groundwater subbasins (a subbasin is defined as the area that contributes water to a major surface discharge area), as shown in **Figure 4–17**. The eastern half of the NNSS is located within the Ash Meadows subbasin, where groundwater flows toward the Ash Meadows discharge area downgradient of the NNSS. The Ash Meadows discharge area contains the sensitive Ash Meadows National Wildlife Refuge. Within the northeast corner of this refuge lies Devils Hole, which is home to the Devils Hole pupfish, an endangered species (see Section 4.1.7 for more information regarding Devils Hole). In 1976, the Supreme Court ruled that the Devils Hole pupfish had prior water rights and that a minimum level of water must be preserved to ensure its protection (United States v Cappaert, 426 U.S. 128 [1976]). This decision resulted in the prohibition of any development that could lower the water level in Devils Hole. The western half of the site lies largely within the Alkali Flat Furnace Creek Ranch subbasin, which flows toward the Alkali Flat Furnace Creek Ranch discharge area, and a small section of the northwest corner of the site is located within the Pahute Mesa Oasis Valley subbasin, which flows toward the Pahute Mesa Oasis Valley discharge area. As displayed above, these three subbasins are named for their downgradient discharge areas. As all three discharge areas are located off site, any activity that may affect groundwater on the NNSS has the potential to affect groundwater off the NNSS.

The NNSS is located within the Death Valley regional groundwater flow system extending from central Nevada north of the NNSS to Death Valley. The Death Valley system encompasses approximately 16,000 square miles of the Great Basin (Belcher et al. 2010). It is very complex, involving many aquifers and aquitards, which vary in their characteristics and presence over distance.

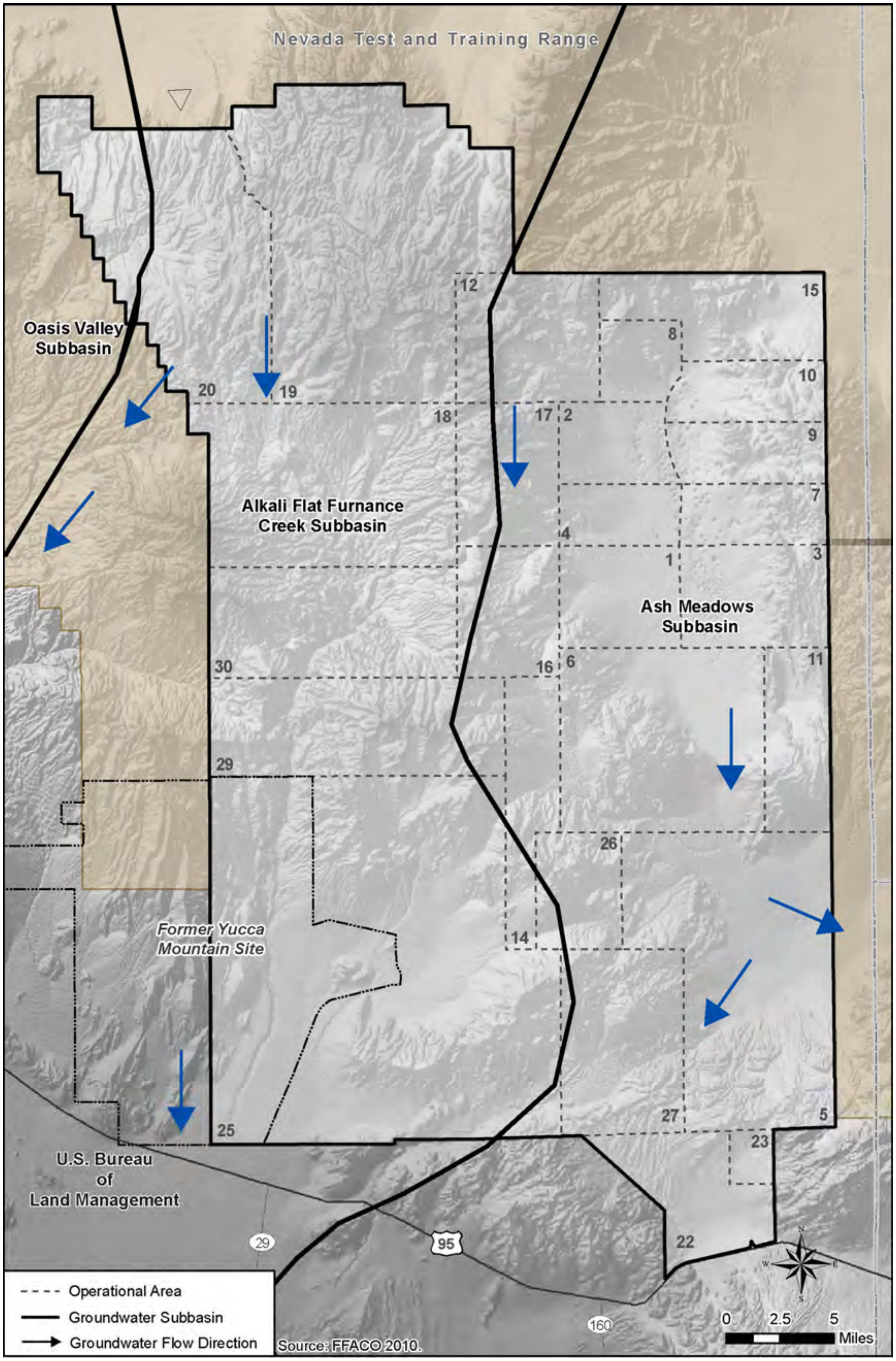

Figure 4–17 Groundwater Subbasins and Flow at the Nevada National Security Site

The principal hydrogeologic water-bearing units of the Death Valley regional groundwater flow system are grouped into three types of aquifers: (1) basin-fill alluvium (or alluvial aquifers), (2) volcanic aquifers, and (3) carbonate aquifers. An alluvial aquifer is in a permeable body of sand, silt, gravel, or other detrital material deposited primarily by running water. Volcanic and carbonate aquifers are permeable units of volcanic rocks and marine carbonate (limestone or dolomite) rock, respectively. The mountainous area that makes up the north-central portion of the NNSS is upheld by volcanic rocks associated with the Timber Mountain caldera complex and includes multiple volcanic aquifers associated with areas of fractured rock. The valley or basin areas in the region contain alluvial aquifers. Together, these volcanic and alluvial aquifers are referred to as "Cenozoic aquifers" because the rocks and sediments in which they occur are of Cenozoic geologic age. The rocks containing the carbonate aquifers are older (Paleozoic age) and regionally extensive, generally occurring at large depths below the Cenozoic aquifers. The major aquifers beneath the NNSS are the Lower Carbonate aquifer system and the Cenozoic aquifer system.

Hydrogeologic Terms

Aquifer: A permeable water-bearing unit of rock or sediment that yields water in a usable quantity to a well or spring.

Artesian: Where water in a lower aquifer is under pressure in relation to an overlying confining unit; when intersected by a well, the water will rise in the borehole to a level above the top of the aquifer.

Saturated zone: The area below the water table where all spaces (fractures and rock pores) are completely filled with water.

Aquitard (or confining unit): A rock or sediment unit of relatively low permeability that retards the movement of water in or out of adjacent aquifers.

Caldera: A near-circular volcanic feature formed by the collapse of rocks overlying a magma chamber from rapid emptying of the chamber during large-volume eruptions.

The Lower Carbonate aquifer system is found primarily in the eastern and southern part of the NNSS and is not present in all areas. The Cenozoic aquifer system is found beneath the main valleys, such as Yucca and Frenchman Flats, and caldera areas, including Pahute Mesa and Timber Mountain.

There is limited hydraulic connection between groundwater in the Lower Carbonate aquifer system and the Cenozoic aquifers (alluvial and volcanic) in many areas, controlled by the location and properties of low-permeability aquitards (see Section 4.1.5 for a discussion of geology and soils). Aquifer types are subdivided into regional and local aquifers dependent on their hydrologic connection to the regional groundwater flow system (Fenelon et al. 2010); in many locations, the alluvial and volcanic form local aquifers where they are separated from the Lower Carbonate aquifer system by volcanic confining units.

Table 4–25 shows the hydraulic parameters of the major aquifers found beneath the NNSS. Hydraulic conductivity is a measure of the ability of the hydrogeologic unit to transmit water, and effective porosity is that portion of the void space within a geologic unit through which groundwater moves (DOE/NV 1997a). The product of hydraulic conductivity and aquifer thickness is transmissivity. Transmissivity is the rate at which groundwater flows through a unit width of an aquifer under a unit hydraulic gradient. As displayed below, the Lower Carbonate aquifer is the most transmissive aquifer below the NNSS; therefore, it controls regional groundwater flow and the possible transport of contaminants. The mean hydraulic conductivity of the alluvial aquifer is lower than the Lower Carbonate aquifer and overlaps with the hydraulic conductivity of the volcanic aquifers. Local conductivity estimates for fractured volcanic rock can be high and approach the conductivity of the Lower Carbonate aquifer, but there is significant lateral variability in rock properties of the volcanic rocks. Mean conductivity of volcanic rocks averaged on a basin-wide scale can be lower than the conductivity of the alluvial aquifer. Their ability to transmit water is lower than that of the Lower Carbonate aquifer. Alluvial and volcanic aquifers are highly variable throughout the region and are assumed to be discontinuous. In most instances, the alluvial aquifer is confined to the basin in which it resides by surrounding mountain ranges. In general, these two aquifers only influence regional flow in localized areas.

Table 4–25 Hydraulic Parameters of the Major Aquifers Below the Nevada National Security Site

Aquifer	*Hydraulic Conductivity*		*Effective Porosity Range (percent)*
	Mean (meters per day)	*Range (meters per day)*	
Alluvial Aquifer	8.44	0.00005–83	31–35
Volcanic Aquifer	1.18	0.0003–12	0.00001–0.006
Carbonate Aquifer	31.71	0.0008–1,570	0.0006–10

Source: DOE/NV 1997a.

Groundwater flow at the NNSS is complex due to the discontinuous nature of the volcanic aquifers (discussed above) and due to major high-angle Basin and Range faults and other features such as caldera structural margins that can juxtapose rocks of contrasting hydraulic conductivity. Groundwater flow through these units is largely controlled by faults and fractures. Groundwater flows generally south and southwest on the NNSS. The flow system extends from the water table to a depth below ground surface that may exceed 4,900 feet where the transmissivity of the rocks becomes much smaller (DOE 1996a). The rates of groundwater flow through the hydrogeologic units are highly variable. The current understanding of groundwater flow at the NNSS is derived from work by Winogard and Thordarson (1975), which was summarized and updated by Laczniak et al. (1996) and Fenelon et al. (2010), and continues to be further developed by the UGTA Project hydrogeologic modeling team. In general, average flow rates over broad areas were estimated by Winogard and Thordarson (1975) to range from 7 to 660 feet per year, but rates can be much higher or lower over short distances in certain geologic settings.

Depth to Groundwater. The depth to groundwater at the NNSS varies from approximately 30 feet at Fortymile Wash to more than 700 feet in Frenchman Flat, to greater than 1,500 feet in portions of Yucca Flat, to finally more than 2,000 feet under the upland portions of Pahute Mesa. Perched groundwater (isolated lenses of water lying above the regional groundwater level) is known to occur in some parts of the NNSS, mainly in the volcanic rocks of Rainier Mesa. The greatest depth to water at the NNSS was measured near Tippipah Point in the central part of the NNSS at 4,093 feet (DOE 2008l; DOE/NV 1997a).

Groundwater Recharge and Discharge. The Death Valley groundwater flow system is recharged by underflow from upgradient areas, as well as precipitation in the higher elevations of the northern and eastern mountain ranges, while discharge areas such as Death Valley and the Amargosa Valley occur primarily in the south and southwest low-lying valleys.

Groundwater recharge includes the water contribution from precipitation and from interbasin underflow from upgradient areas. There are various processes that inhibit recharge of the groundwater from precipitation in arid areas. Therefore, depending on the type of soil, amount of vegetation, evaporation, and subsurface geology, only a fraction of precipitation contributes to recharge. The majority of precipitation recharge on the NNSS is limited to higher elevations, where precipitation is greatest and originates over upland areas of Pahute Mesa, Timber Mountain, and the Belted Range (see Section 4.1.8 for more information regarding precipitation and evaporation at the NNSS). However, total recharge (i.e., all of the water that moves into an aquifer) at the NNSS is dominated by subsurface, lateral regional flow, or interbasin flow. The estimated underflow onto the NNSS from adjacent areas ranges from 38,000 to 44,000 acre-feet per year. Total recharge for the NNSS regional groundwater flow system from both precipitation and lateral interbasin flow has been estimated at 69,097 acre-feet per year (DOE/NNSA/NSO 2008).

Groundwater discharge within the NNSS is minor, consisting of natural discharge at small springs found in mountainous regions that drain perched water within near-surface volcanic rocks and withdrawals at water supply wells. No direct discharge from the regional groundwater flow system occurs on the NNSS. Springs at the NNSS are located well above the regional water table level and have very low discharge rates, ranging from 0.22 to 35 gallons per minute (see Section 4.1.6.1 for more information regarding the location of springs) (DOE/NNSA/NSO 2008). Discharge to these onsite springs is small when compared to the discharge of groundwater from the NNSS to Rock Valley and the Amargosa Desert, which totals an estimated 42,000 acre-feet per year (DOE 1996a).

Water System Terms

Public Water System: A system that provides water for human consumption that has at least 15 service connections or serves at least 25 individuals daily at least 60 days out of the year. Public water systems are further categorized into three different types: community, non-transient non-community, and transient non-community.

Community Water System: A public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Non-Transient Non-Community Water System: A public water system that regularly serves at least 25 of the same nonresident persons per day for more than 6 months per year. Examples of such systems are those serving the same individuals (industrial workers, school children) on a daily basis even though those individuals do not reside at that location.

Transient Non-Community Water System: A non-community public water system that does not serve 25 of the same nonresident persons per day for more than 6 months per year. Examples of such systems include a restaurant or convenience store with fewer than 25 permanent nonresident staff, but the number of people served exceeds 25.

Groundwater Supply. Groundwater is the only local source of potable water on the NNSS. Drinking water needs, as well as water required for nonpotable, construction, and fire protection purposes, are met by groundwater drawn from deep wells installed in the carbonate, volcanic, and alluvial aquifers.

Water production and distribution systems have been in place at the NNSS for over 50 years. Currently, the NNSS has three permitted PWSs served by six wells (Wells 4/4a, 5b/5c, 8, 16D, C-1, and J-12) (NSTec 2010d). Two of the PWSs are non-transient, non-community PWSs (NV0004099 and NV0000360) that operate under permit numbers NY-0360-12NTNC and NY-4099-12NTNC, respectively. The third PWS is a transient system (NV0004098) and operates under permit number NY-4098-12NTNC. See **Table 4–26** for a list of these wells and their associated characteristics (e.g., depth and pumping rate). All three systems are regulated under the Safe Drinking Water Act (DOE/NV 2008c). The transmission and distribution systems include mains, valves, hydrants, booster pump stations, pump suction tanks, and reservoir storage tanks. Potable water is hauled to support facilities not connected to the potable water system in two permitted water-hauling trucks; however, these are not considered part of the PWS (NSTec 2010d). The NNSS drinking water systems currently meet all applicable regulatory standards.

Table 4–26 Nevada National Security Site Supply Well Characteristics

Well Name	*Aquifer*	*Years Active*	*Depth to Water (feet)*	*Well Depth (feet)*	*Hydrographic Basin*	*Pumping Rate (millions of gallons per year)*	
						Maximum	*Average*
Well 4	Volcanic	1983–Present	837	1,479	Frenchman Flat (160)	192	36
Well 4a	Volcanic	1993–Present	838	–	Frenchman Flat (160)	72	54
Well 5b	Alluvial	1951–Present	687	900	Frenchman Flat (160)	88	31
Well 5c	Alluvial	1954–Present	702	1,187	Frenchman Flat (160)	73	37
Well 8	Volcanic	1963–Present	1,087	5,490	Fortymile Canyon, Buckboard Mesa Subdivision (227b)	121	34
Well J-12	Volcanic	1957–Present	740	1,139	Fortymile Canyon, Jackass Flats Subdivision (227a)	61	21
Well 16d	Carbonate	1981–Present	752	3,000	Yucca Flat (159)	52	30
Well C-1	Carbonate	1962–Present	1,544	1,707	Yucca Flat (159)	76	25

Source: DOE/NNSA/NSO 2008.

The NNSS water system is spread over four distinct water service areas and consists of eight water systems, two wildlife preservation reservoirs, numerous water storage tanks, fillstands, and construction water open pit reservoirs, as well as approximately 140 miles of pipeline located throughout the site (DOE 2008l). These water service areas are discussed in detail below in relation to their location and the areas they support. The water service areas are also displayed in **Figure 4–18**.

Water Service Area A. Encompasses Areas 19 and 20. System capabilities within this service area have been abandoned for more than a decade. There are two wells in this area (Wells 19c and 20), both of which are out of service and have monitoring casings to prevent vandalism or contamination (DOE/NV 2008c).

Water Service Area B. Encompasses Areas 2, 4, 7, 8, 9, 10, 12, 15, 17, and 18. PWS NV0004099 serves Area 12. Well 2, which is within this service area, is out of service and has a monitoring casing to prevent vandalism or contamination. Well 8 provides water to Area 12 and supplies water to the construction water open pit reservoir system. Water Service Area B also includes one pumping station and two water storage tanks (DOE 2009f; DOE/NV 2008c).

Water Service Area C. Encompasses Areas 1, 3, 5, 6, 11, 22, 23, 26, and 27. PWS NV0000360 serves Areas 5, 6, 22, and 23. Five active wells provide water in this service area (Wells C-1, 4, 4a, 5b, and 5c). Fillstand A-6 is used to supply potable water via water trucks to JASPER, Area 12, and BEEF. Water Service Area C also includes five pumping stations and nine water storage tanks (DOE 2009f; DOE/NV 2008c).

Water Service Area D. Encompasses Areas 14, 16, 25, 29, and 30. PWS NV0004098 serves Area 25. It consists of two active wells (Wells J12 and 16d). Well 16d is a nonpotable well that serves the batch plant. Water Service Area D also includes three pumping stations and 12 water storage tanks (DOE 2009f; DOE/NV 2008c).

In 2010, a new water well (Well J-14) was designed and drilled in Area 25. Well J-14 and its associated water pipeline were permitted in 2011 as a part of the Area 25 PWS, which is located in Water Service Area D (Radack 2012). Well J-14 was designed to relieve water pressure on the PWS's existing long water transmission line (DOE/NV 2011).

Water is currently hauled into Areas 26 and 27 (Water Service Area C) by truck from Area 25 (Water Service Area D). There are four elevated tanks in Area 26 that store construction water and one tank in Area 27 that stores fire protection and potable water (DOE/NV 2008c).

Since the 1992 moratorium on underground nuclear testing, there has been a significant reduction in personnel and operational activities at the NNSS, and the amount of water consumed at the NNSS has dropped significantly. In 2005, the NNSS installed water volume meters on the active water wells that contribute to the water distribution system; in 2009, the NNSS installed meters on the fillstand locations.

Between 2005 and 2009, total annual water usage from active wells ranged from approximately 173 million to 225 million gallons (from 531 to 690 acre-feet, see **Table 4–27**) (NSTec 2010c), which is significantly less than the peak usage of 3,375 acre-feet per year in 1989 (DOE 1996a). When comparing historic pumping levels in Frenchman Flat to the State Engineer's perennial yield estimate of Frenchman Flat (100 acre-feet per year), the NNSS appears to be overdrawing water by a large percentage (see **Table 4–28**). However, based upon more-recent data derived from USGS studies, the water levels in Frenchman Flat have remained static and have not shown a downward trend of water drawdown, even during peak water usage at the NNSS in 1989. This suggests that the perennial yield of Frenchman Flat is significantly higher than 100 acre-feet per year, and more likely in the range of yields calculated by other DOE/NNSA and USGS models.

In general, water usage at the NNSS has declined since 1989 and the volume of water produced from characterization wells is minor, totaling typically less than 2 acre-feet per well (DOE/NNSA/NSO 2008).

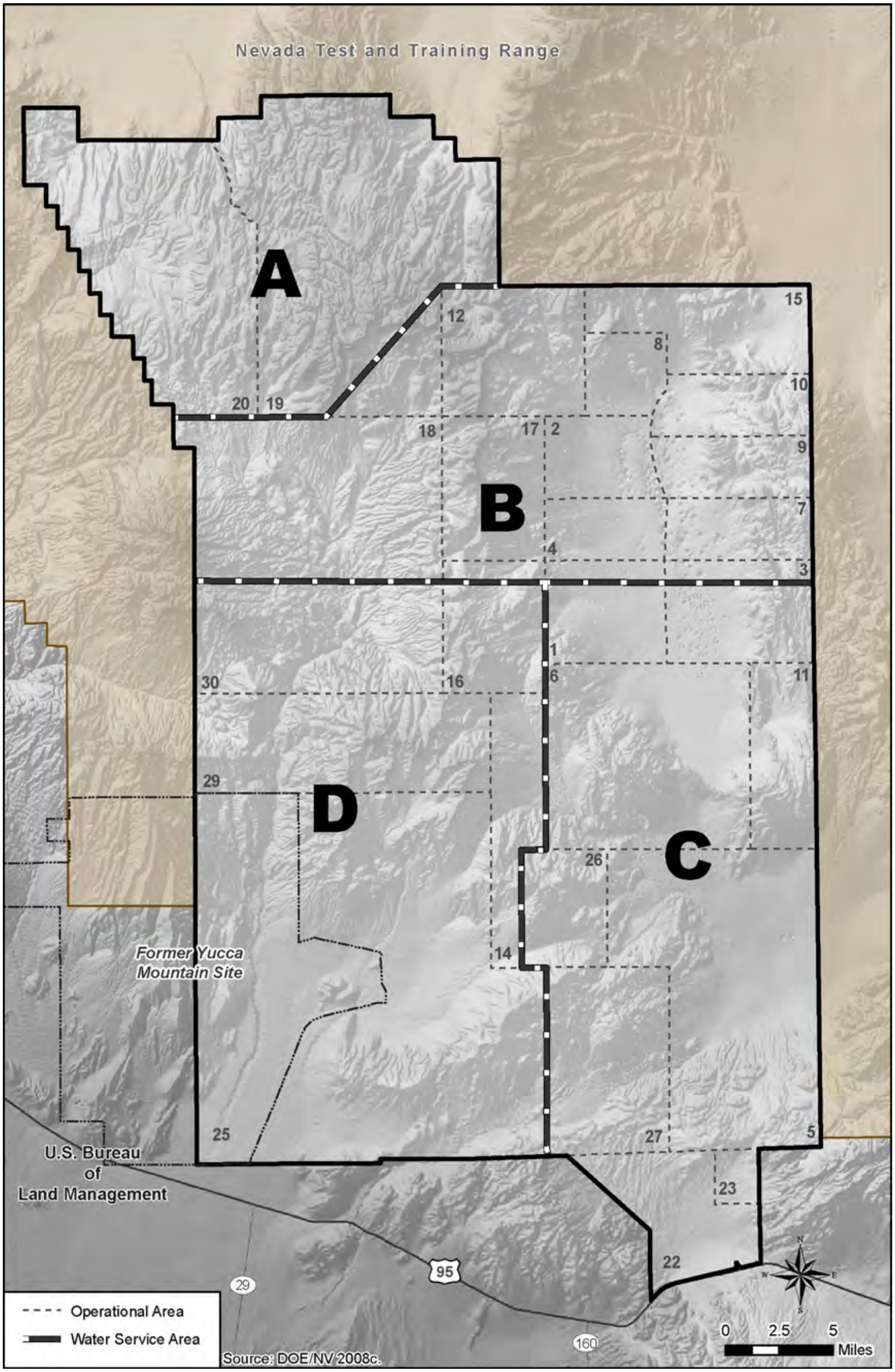

Figure 4–18 Water Service Areas at the Nevada National Security Site

Table 4–27 Nevada National Security Site Well Withdrawal Totals (2005 through 2009)

Well Name	*2005 Use (gallons)*	*2006 Use (gallons)*	*2007 Use (gallons)*	*2008 Use (gallons)*	*2009 Use (gallons)*	*Total Use (gallons)*	*Percent of 2005–2009 Total Use*
Well 4	38,512,000	52,398,000	40,391,000	26,288,000	22,727,000	180,316,000	18.2
Well 4a	52,325,000	66,257,000	60,990,000	34,434,000	49,633,000	264,639,000	26.7
Well 5b	25,600,000	35,608,000	37,968,000	47,348,000	39,315,000	185,839,000	18.7
Well 5c	10,339,000	8,951,000	4,597,000	14,104,000	11,918,000	49,909,000	5.0
Well 8	11,432,000	8,575,000	15,132,000	12,056,000	13,285,000	60,480,000	6.1
Well J-12	13,919,000	14,440,000	23,403,000	10,004,000	5,651,000	67,417,000	6.8
Well 16d	22,818,000	26,505,000	21,393,000	5,800,000	26,104,000	102,620,000	10.3
Well C-1	7,707,000	8,515,000	21,268,000	22,508,000	21,375,000	81,373,000	8.2
Total use in gallons	182,652,000	221,249,000	225,142,000	172,542,000	190,008,000	992,593,000	
Total use in acre-feet	561	679	691	530	583	3,046	

Source: NSTec 2010c.

Table 4–28 Nevada National Security Site Nonpotable Fillstand Flow Totals for 2009

Fillstand Name	*Use*	*Months Used in 2009*	*Total Use (gallons)*	*Total Use (acre-feet)*
FS 5B	Nonpotable	January–December	6,261,100	19.2
FS A-12	Nonpotable	March–December	1,424,200	4.4
FS A-17	Nonpotable	April–December	3,393,100	10.4
FS A-25	Nonpotable	July–December	491,410	1.5
FS A-6 #1 and #2	Nonpotable	May–June	890,400	2.7
FS Birdwell	Nonpotable	March–December	4,917,800	15.1
FS C-1	Nonpotable	February–December	3,666,600	11.3
FS ETS	Nonpotable	February–March	1,277	0.004
FS J-13	Nonpotable	February–March	188,800	0.6
FS Mercury	Nonpotable	February–December	8,037,000	24.7
FS Wet and Wild	Nonpotable	February–December	864,700	2.7
Total Water Withdrawn From Fillstands in 2009			30,136,387	92.5

Source: NSTec 2010c.

The measured annual water usage from the active wells includes fillstand water withdrawals, which are used for nonpotable purposes such as dust suppression (NSTec 2010d). As meters were not installed on the fillstand locations until 2009, detailed information on the division of potable and nonpotable water use is only available for one calendar year. See Table 4–28 for a list of fillstands and corresponding water withdrawals for 2009 and **Table 4–29** for a breakdown of potable and nonpotable water use at the NNSS for 2009.

Table 4–29 Potable and Nonpotable Water Use at the Nevada National Security Site for 2009

	Gallons	*Acre-Feet*
Total Nonpotable Water Use in 2009	30,136,387	93
Total Potable Water Use in 2009	159,871,613	491
Total Water Use in 2009	190,008,000	583

Source: NSTec 2010c.

Table 4–30 provides a summary of historic water withdrawals from affected hydrographic basins at the NNSS from 2005 through 2009. Over 68 percent of the NNSS water withdrawals in this timeframe occurred in Frenchman Flat (Basin 160), with lesser contributions coming from Yucca Flat (Basin 159) and the Jackass Flats and Buckboard Mesa Subdivisions of Fortymile Canyon (Basins 227b and 227a). In terms of use of sustainable yield (perennial yield minus any rights already committed by the State Engineer to other users), Frenchman Flat was the most heavily used during this timeframe (375 to 501 percent of perennial yield used in any year), followed by Yucca Flat (25 to 42 percent in any year). The Jackass Flats and Buckboard Mesa Subdivisions of Fortymile Canyon showed very light use during this timeframe, never exceeding 2 percent of sustainable yield in any year.

Table 4–30 Summary of Water Withdrawals from Hydrographic Basins

Hydrographic Basin	*Sustainable Yield of the Basin (acre-feet per year)*	*NNSS Operational Water Wells by Basin*	*Percentage of Basin's Average Contribution to NNSS Water Supply 2005–2009*	*Range of Total Withdrawals, 2005–2009 (acre-feet per year)*	*Percentage of Perennial Yield Used, 2005–2009*
Frenchman Flat (160)	100	4, 4a, 5b, 5c	68.6%	375–501	375–501%
Fortymile Canyon, Buckboard Mesa Subdivision (227b)	3,600	8	6.1%	26–46	0.7–1.3%
Fortymile Canyon, Jackass Flats Subdivision (227a)	3,944	J-12	6.8%	17–72	0.4–1.8%
Yucca Flat (159)	350	C-1, 16d	18.5%	87–146	25–42%

NNSS = Nevada National Security Site.
Source: Derived from Tables 4–26, 4–28, 4–29.

Groundwater Monitoring and Quality. Water resources in and around the NNSS are monitored through the measurement of groundwater levels in wells and the quantity of water produced. USGS conducts the monitoring, maintains the databases, and reports the results annually in a statewide water resource summary. Over the long term, existing and new regional groundwater modeling will improve the understanding of water availability and planning. The groundwater at the NNSS is classified as Class II groundwater according to the EPA groundwater classification system, which means that it is currently or potentially could be a source of drinking water.

Water chemistry (see **Table 4–31**) varies from a sodium-potassium-bicarbonate type associated with volcanic aquifers, to a calcium-magnesium-bicarbonate type associated with carbonate aquifers, to a calcium-magnesium-sodium-bicarbonate type, which is a mixed type and may represent alluvial aquifers or the mixing of groundwater entering the Lower Carbonate aquifer from overlying volcanic units (DOE/NNSA/NSO 2008). Drinking water quality on the NNSS is monitored to assess compliance with primary and secondary drinking water standards according to the schedule set in applicable Federal and state laws, monitoring waivers, and permits issued by NDEP. The three PWSs and permitted water hauling trucks at the NNSS meet all of the primary and secondary drinking water standards (DOE/NV 2011). The trucks that are permitted to haul water to the PWSs are permitted by NDEP's Bureau of Safe Drinking Water, and the water they carry is subject to water quality standards for coliform bacteria (DOE/NV 2011).

The Safe Drinking Water Act Arsenic Rule amendment, approved in 2001, lowered the allowable maximum level of arsenic in drinking water to 10 parts per billion for PWSs (Congressional Research Service 2007) (note that the water chemistry data displayed in Table 4–31 were collected in 1993, before the Arsenic Rule amendment). Groundwater drawn from two wells serving the PWSs in Area 25 currently exceeds this limit. To maintain compliance with the Safe Drinking Water Act, the pumped groundwater is treated in a reverse osmosis system or a point-of-use treatment to remove the excess arsenic before being distributed for consumption (DOE 2007c).

Table 4–31 Potable Groundwater Chemistry Data on the Nevada National Security Site

Well Name	Calcium	Magnesium	Potassium	Sodium	Bicarbonate	Carbonate	Chloride	Fluoride	Nitrate	Sulfate	TDS
	(milligrams per liter)										
Well 4	23	8	5	51	168	<0.3	12	0.6	4.5	41	309
Well 4a	23	7	6	50	162	<0.3	12	0.7	4.4	42	306
Well 5b	7	2	12	96	180	<0.3	21	0.7	3.1	56	346
Well 5c	2	1	6	131	328	<1.2	10	0.9	1.7	29	422
Well 8	8	1	4	31	81	<0.3	8	0.7	1.3	15	164
Well J-12	14	2	5	42	119	<0.3	7	1.8	2.2	22	232
Well 16d	77	23	7	30	360	<0.3	11	0.5	0.1	58	404
Well C-1	73	28	14	123	601	<0.3	32	1.0	0.1	67	671

TDS = total dissolved solids.
Source: Navarro-Intera 2012.

There have been 828 underground nuclear tests conducted at the NNSS. Approximately one-third of these tests were detonated near or below the water table. Most of the NNSS underground nuclear detonations were conducted at Frenchman Flat, Yucca Flat, Pahute Mesa, and Rainier Mesa. This legacy of nuclear testing has resulted in groundwater contamination in areas now identified as CAUs in environmental studies. Between 30 and 38 percent of underground nuclear tests conducted at or below the water table have contaminated groundwater near underground nuclear test cavities. This groundwater is contaminated with 43 identified radionuclides, the most prevalent of which is tritium (Bowen et al. 2001). In a 2001 report, scientists from Los Alamos National Laboratory and Lawrence Livermore National Laboratory calculated the underground inventory of radionuclides resulting from underground nuclear testing at the NNSS between 1951 and 1992 (Bowen et al. 2001). That report estimated the remaining underground source term of radionuclides as of September 23, 1992, to be about 132 million curies; however, only a portion of this source term would be available as part of the hydrologic source term. The hydrologic source term is that portion of the overall underground source term that is available for transport in the groundwater. As mentioned above, nuclear tests were conducted close enough to the groundwater to potentially contribute to the hydrologic source term. Of the radionuclides produced by an underground nuclear detonation, only those that are readily soluble in water and/or are available to be transported (i.e., not encapsulated within the melt glass within the detonation cavity or otherwise immobile), may become part of the hydrologic source term.

Figure 4–19 shows the locations of underground nuclear tests and established CAU areas of potential groundwater contamination. This figure also illustrates the directions of predicted groundwater flow from the CAUs.

Several groups regularly test water at and surrounding the NNSS. There are approximately 120 active groundwater monitoring wells (see **Table 4–32** for a complete list of these wells used under the NNSS Environmental Restoration Program by the RREM Program and UGTA). The DOE/NNSA NSO's RREM Program samples more than 80 locations, which include wells, springs, and surface-water sites, to make sure radionuclide levels do not exceed Safe Drinking Water Act standards. The UGTA Project samples a network of deep wells to help determine where contaminants are present in groundwater, what direction these contaminants are moving, and how quickly. UGTA wells that are not designated as source term characterization wells are made available for monitoring under the RREM Program (DOE/NV 2011).

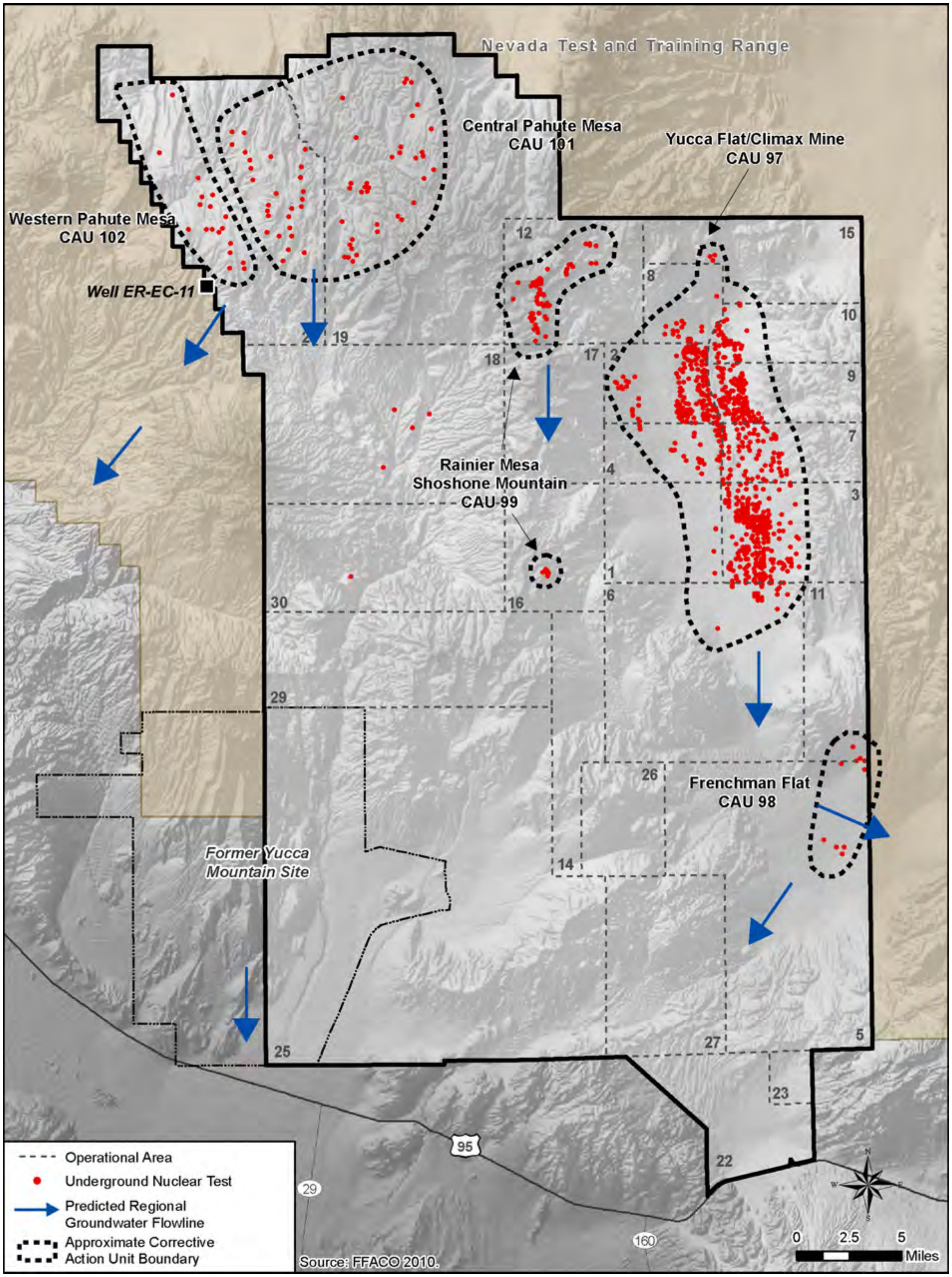

Figure 4–19 Underground Test Area Project Corrective Action Units and Underground Nuclear Test Locations at the Nevada National Security Site

Table 4–32 Groundwater Characterization and/or Monitoring Wells Used by the Underground Test Area Project and the Routine Radiological Environmental Monitoring Program on and near the Nevada National Security Site

Location	*Well Name*	*Depth (feet)*	*Primary Aquifer*	*Location*	*Well Name*	*Depth (feet)*	*Primary Aquifer*	*Location*	*Well Name*	*Depth (feet)*	*Primary Aquifer*
UGTA Project Wells											
Area 2	ER-2-1	2,600	Timber Mountain lower vitric-tuff aquifer	Area 7	ER-7-1	2,500	Lower carbonate aquifer	Area 20	ER-20-5-1	2,823	Topopah Spring aquifer
	UE-2ce-WW	1,650	Lower carbonate aquifer-thrust plate		U-7ba PS 1AS	2,333	Oak Spring Butte confining unit		ER-20-6-1	3,200	Calico Hills zeolitic composite unit
	U-2gg PSE 3A	2,383	Timber Mountain welded-tuff aquifer Timber Mountain lower-vitric tuff aquifer		UE-7nS	2,205	Lower carbonate aquifer		ER-20-6-2	3,200	Calico Hills zeolitic composite unit
Area 3	ER-3-1	2,807	Lower carbonate aquifer		U-4t PS 3A	2,513	Lower tuff confining unit		ER-20-6-3	3,200	Calico Hills zeolitic composite unit
	ER-3-2	3,000	Alluvial aquifer Timber Mountain upper vitric-tuff aquifer Timber Mountain welded-tuff aquifer		U-4u PS 2A	2,280	Lower tuff confining unit		ER-20-5-3	4,294	Calico Hills zeolitic composite unit
	UE-3e 4	2,300	Timber Mountain lower-vitric tuff aquifer Lower tuff confining unit	Area 8	HTH-2	3,422	Lower carbonate aquifer		ER-20-1	2,065	Tiva Canyon aquifer
	U-3cn 5	3,030	Lower carbonate aquifer		UE-10j	2,613	Lower carbonate aquifer		ER-20-2-1	2,524	Calico Hills zeolitic composite unit
	U-3cn PS 2	2,603	Lower tuff confining unit		ER-8-1	2,863	Mesozoic granite confining unit		U-20n PS 1DD	4,520	Calico Hills zeolitic composite unit
Area 5	ER-5-3	2,606	Alluvial aquifer Timber Mountain welded-tuff aquifer	Area 12	ER-12-3	4,908	Lower carbonate aquifer-thrust plate		UE-20n 1	3,300	Calico Hills zeolitic composite unit
	ER-5-3-2	5,683	Lower carbonate aquifer		ER-12-4	3,715	Lower carbonate aquifer-thrust plate		ER-20-8	3,442	Tiva Canyon aquifer Topopah Spring aquifer
	ER-5-3-3	1,800	Alluvial aquifer								
	ER-5-4	3,732	Alluvial aquifer		ER-12-2	6,883	Oak Spring Butte confining Unit Redrock Valley aquifer Upper clastic confining unit		ER-20-7	2,936	Lower Paintbrush confining unit Topopah Spring aquifer Calico Hills zeolitic composite unit
	ER-5-4-2	7,000	Lower tuff confining unit		ER-12-1	3,588	Upper clastic confining unit Lower carbonate aquifer		ER-20-8-2	2,338	Scrugham Peak aquifer
	UE-5n	1,687	Alluvial aquifer								
	RNM-1	1,302	Alluvial aquifer		U-12s	1,596	Mesozoic granite confining unit		ER-20-4	2,499	Calico Hills zeolitic composite unit

Location	***Well Name***	***Depth (feet)***	***Primary Aquifer***
	RNM-2S	1,156	Alluvial aquifer
Area 6	ER-6-1	3,206	Lower carbonate aquifer
	ER-6-1 Sat 1	2,085	Lower carbonate aquifer
	ER-6-1-2	3,200	Lower carbonate aquifer
	ER-6-2	3,430	Lower carbonate aquifer-thrust plate
	UE-14b	3,680	Upper tuff confining unit
			Tiva Canyon aquifer
			Topapah Spring aquifer
			Topopah Spring aquifer
	ER-EC-11	4,148	Tiva Canyon aquifer
			Topopah Spring aquifer
	ER-EC-12	4,069	Tiva Canyon aquifer (two completion strings)
			Topopah Spring aquifer (two completion strings)
	ER-EC-2A	4,974	Fortymile Canyon composite unit
			Timber Mountain composite unit (two completion strings)
	PM-3	3,019	Upper Paintbrush confining unit
			Tiva Canyon Aquifer
			Lower Paintbrush confining unit
	ER-EC-5	2,500	Timber Mountain composite unit (three completion strings
			Fortymile Canyon

Location	***Well Name***	***Depth (feet)***	***Primary Aquifer***
Area 16	ER-16-1	4,566	Lower carbonate aquifer
Area 18	ER-18-2	2,500	Timber Mountain composite unit
Area 19	U-19ad PS 1A	2,609	Paintbrush lava-flow aquifer
	ER-19-1	3,595	Oak Spring Butte confining unit
			Redrock Valley aquifer
			Lower clastic confining unit-upper thrust plate
	U-19q PS 1D	4,991	Bullfrog confining unit
	U-19v PS 1D	4,113	Bullfrog confining unit
	ER-OV-01	180	Fortymile Canyon composite unit
	ER-OV-02	200	Alluvial aquifer
	ER-OV-03A	251	Detached volcanics aquifer
	ER-OV-03B	400	Alluvial aquifer
	ER-OV-04A	151	Alluvial aquifer
	ER-OV-03C	542	Timber Mountain composite unit
	ER-EC-7	1,386	Fortymile Canyon composite unit (two completion strings)

Location	***Well Name***	***Depth (feet)***	***Primary Aquifer***
	U-20 WW	3,268	Calico Hills zeolitic composite unit
Area 30	ER-30-1	1,426	Fortymile Canon composite unit
Offsite	ER-OV-03A2	821	Detached volcanic aquifer
	ER-OV-03A3	821	Detached volcanic aquifer
	ER-OV-03C2	321	Timber Mountain composite unit
	ER-OV-6A	536	Fortymile Canyon composite unit
	ER-OV-6A2	71	Fortymile Canyon composite unit
	ER-EC-4	3,487	Thirsty Canyon volcanic aquifer
			Timber Mountain upper welded tuff aquifer
	ER-EC-6	5,000	Benham aquifer
			Tiva Canyon aquifer
			Topopah Spring aquifer
			Crater Flat composite unit
	Ash-B	1,220	Alluvial aquifer
			Detached volcanic aquifer
	ER-OV-05	200	Alluvial aquifer
	ER-EC-1	5,000	Benham aquifer and Tiva Canyon aquifer

Location	*Well Name*	*Depth (feet)*	*Primary Aquifer*	*Location*	*Well Name*	*Depth (feet)*	*Primary Aquifer*	*Location*	*Well Name*	*Depth (feet)*	*Primary Aquifer*
			composite unit								
	ER-EC-8		Timber Mountain composite unite (two completion strings)								
	ER-EC-13	3,000	Fortymile Canyon composite unit (four completion strings)								Topopah Spring aquifer
	ER-EC-15	3,254	Upper Paintbrush lava-flow aquifer								Crater Flat composite unit
			Tiva Canyon aquifer								
			Topopah Spring aquifer								
RREM Program Wells											
Area 1	UE-1q	2,600	Lower carbonate aquifer	Area 5 (cont.)	RNM-2S	1,156	Alluvial aquifer	Area 12 (cont.)	U-12e [a]	154	Lower tuff confining unit
											Oak Spring Butte confining unit
Area 3	ER-3-2	3,000	Alluvial aquifer		UE5PW-1	839	Alluvial aquifer	Area 16	UE-16d WW	3,000	Upper carbonate aquifer
			Timber Mountain upper vitric-tuff aquifer								
			Timber Mountain welded-tuff aquifer								
	UE-3e 4	2,300	Timber Mountain lower-vitric tuff aquifer		UE5PW-2	919	Alluvial aquifer	Area 17	HTH 1	4,206	Lower carbonate aquifer
			Lower tuff confining unit								
	U-3cn5	3,030	Lower carbonate aquifer		UE5PW-3	955	Timber Mountain welded-tuff aquifer	Area 18	UE-18r	5,004	Timber Mountain composite unit
	U-3cn PS 2	2,603	Lower tuff confining unit	Area 6	WW C-1	1,707	Lower carbonate aquifer		WW 8	5,490	Belted Range aquifer
	WW A	1,870	Alluvial aquifer		WW 4	1,479	Timber Mountain welded-tuff aquifer	Area 19	ER-19-1	3,595	Oak Spring Butte confining unit
											Redrock Valley aquifer
											Lower clastic confining unit-upper thrust plate
Area 4	TW D	1,950	Lower carbonate aquifer		WW 4A	1,517	Timber Mountain welded-tuff aquifer		UE-19c WW	8,489	Belted Range aquifer
											Pie-Belted Range composite unit
Area 5	WW 5B	900	Alluvial aquifer	Area 7	UE-7nS	2,205	Lower carbonate aquifer		U-19v PS 1D	4,113	Bullfrog confining unit
	WW 5C	1,200	Alluvial aquifer		UE-4t	2,413	Lower tuff confining unit		U-19bh	2,148	Paintbrush lava-flow aquifer
	UE-5c WW	2,682	Alluvial aquifer		U-4t PS 3A	2,513	Lower tuff confining unit	Area 20	ER-20-5-1	2,823	Topopah Spring aquifer

Location	Well Name	Depth (feet)	Primary Aquifer	Location	Well Name	Depth (feet)	Primary Aquifer	Location	Well Name	Depth (feet)	Primary Aquifer
	UE-5n	1,687	Alluvial aquifer	Area 8	HTH-2	3,422	Lower carbonate aquifer		ER-20-6-1	3,200	Calico Hills zeolitic composite unit
	RNM-1	1,302	Alluvial aquifer	Area 12	ER-12-1	3,588	Upper clastic confining unit Lower carbonate aquifer		ER-20-6-2	3,200	Calico Hills zeolitic composite unit
Area 20 (cont.)	ER-20-1	2,065	Tiva Canyon aquifer	Offsite	Last Trail Ranch	237	Alluvial aquifer	Offsite (cont.)	ER-OV-03A	251	Detached volcanics aquifer
	ER-20-6-3	3,200	Calico Hills zeolitic composite unit		ER-OV-03C2	321	Alluvial aquifer Timber Mountain composite unit		ER-OV-04A	151	Alluvial aquifer
	ER-20-5-3	4,294	Calico Hills zeolitic composite unit		ER-OV-6A	536	Fortymile Canyon composite unit		ER-OV-03C	542	Alluvial aquifer Timber Mountain composite unit
	ER-20-1-2	2,524	Calico Hills zeolitic composite unit		Fire Hall 2 Well	230	Alluvial aquifer		Roger Bright Ranch		
	U-20n PS 1DDH	4,520	Calico Hills zeolitic composite unit		Peacock Ranch				School Well	320	
	PM-1	7,858	Belted Range aquifer		Spicer Ranch				Cind-R-Lite Mine	460	
	U-20 WW	3,268	Calico Hills zeolitic composite unit		Fairbanks Spring		Alluvial aquifer		Ash-B	1,220	Alluvial aquifer Detached volcanic aquifer
Area 22	Army 1 WW	1,946	Lower carbonate aquifer		Fuller Property				U.S. Ecology	575	
	SM-23-1	1,338	Lower carbonate aquifer		Longstreet Spring		Lower carbonate aquifer		Beatty Wtr Swr-Well3		
Area 25	UE-25p 1	5,923	Lower carbonate aquifer		PM-3	3,019	Upper Paintbrush confining unit Tiva Canyon aquifer Lower Paintbrush confining unit		ER-OV-05		Alluvial aquifer
	UE-25 WT 6	1,257	Yucca Mtn. Crater Flat Composite Unit		HTH 5	926	Lower clastic confining unit		Big Springs		Lower carbonate aquifer
	J-11 Prime	220	Topopah Spring aquifer		Tolicha Peak	2,005	Timber Mountain welded tuff aquifer		Crystal Pool		Lower carbonate aquifer
	J-12 WW	1,139	Topopah Spring aquifer		USW H-1/Inst	6,000	Yucca Mtn. Crater Flat Composite Unit		Revert Springs		
	J-13 WW	3,488	Topopah Spring aquifer		ER-OV-01	180	Fortymile Canyon composite unit				
	J-14 WW	1,775	Topopah Spring aquifer		ER-OV-02	200	Alluvial aquifer				

RREM = Routine Radiological Environmental Monitoring; UGTA = Underground Test Area.
[a] Tunnel Water Conduit Hole.
Source: BLM 2010l.

In addition to the RREM Program and the UGTA Project sampling efforts, the Community Environmental Monitoring Program (CEMP) performs independent, annual monitoring of 29 springs and water supplies in communities surrounding the NNSS (DOE/NNSA/NSO 2010). In 2008, CEMP offsite water sampling locations included 21 wells, 3 surface-water supply systems, and 4 springs. All water samples had levels of tritium either below laboratory detection limits or less than background levels of tritium in surface waters (25 to 35 picocuries per liter) (DOE/NV 2009d). Laboratory detection limits for tritium vary from less than 10 picocuries per liter to about 1,000 picocuries per liter dependent on methods of sample preparation and analytical techniques.

In a study published in 2006, Healing Ourselves and Mother Earth (HOME) conducted groundwater sampling and analysis in an attempt to develop an environmental/health baseline for helping to ascertain if contamination from the NNSS and the then-proposed Yucca Mountain site was approaching surrounding communities. HOME sampled eight wells and two springs located downgradient of the NNSS, the former proposed Yucca Mountain site, and U.S. Ecology's facility near Beatty, Nevada. The results of HOME's study showed analyte levels well within expected concentrations, and below EPA maximum contaminant levels, i.e., action levels. Some uranium and a low but positive reading for some trace metals were also expected, due to all the mineral deposits in the region. HOME also compared its data with that collected from the Nye County Early Warning Drilling Program and found that its data corroborated the results of Nye County, illustrating a wide variation in groundwater chemistry and radiation activity. HOME expressed concern that a possible consequence of the wide variation in gross alpha and beta readings in the data is that the profile of radioactive elements in the groundwater could vary, without triggering action for a more detailed analysis and the possibility of contamination from either the NNSS or Yucca Mountain site moving off site and into the water supply, without activating a warning system. HOME speculates that the variation in groundwater chemistry and radiation could be due to an as-yet-unidentified natural non-uniform binding mechanism in play with the naturally occurring radioisotopes that could affect the appearance and movement of contaminants coming from the NNSS or Yucca Mountain site.

Analytes Monitored by the RREM Program and UGTA Project. Tritium was the radioactive species created in the greatest quantities and is widely believed to be the most mobile in groundwater. Therefore, tritium is the primary target analyte for both the RREM Program and UGTA Project; every groundwater sample is analyzed for this radionuclide (DOE/NV 2011). For this reason, tritium is the primary radionuclide discussed in this SWEIS.

Both the RREM Program and UGTA Project analyze water samples for more than just tritium. The UGTA Project typically performs the following radioisotope analyses on groundwater samples:

- Tritium
- Carbon-14
- Chlorine-36
- Iodine-129
- Strontium-90
- Technetium-99
- Plutonium (-238 and -239/240)
- Gamma emitters* (typically report: actinium-228, aluminum-26, americium-241, antimony-125, beryllium-7, bismuth-212, bismuth-214, cesium-134, cesium-137, cobalt-58, cobalt-60, curium-243/244, europium-152, europium-154, europium-155, lead-212, lead-214, niobium-94, potassium-40, thallium-208, thorium-227, thorium-234, uranium-235)

The RREM Program typically performs the following radioisotope analyses on groundwater samples (quarterly to every 3 years, depending on the radioisotope):

- Tritium
- Carbon-14
- Strontium-90
- Technetium-99
- Plutonium (-238 and -239/240)
- Gamma emitters* (typically report: actinium-228, americium-241, antimony-125, cerium-144, cesium-134, cesium-137, cobalt-60, europium-152, europium-154, europium-155, lead-212, potassium-40, promethium-144, promethium-146, ruthenium-106, thorium-234, uranium-235, yttrium-88)

**Only the following gamma emitters reported by the RREM Program and UGTA Project are included in the radionuclide summary in Bowen et al. 2001 as products of underground nuclear weapons testing: aluminum-26, potassium-40, niobium-94, cesium-137, europium-152, europium-154, uranium-235, and americium-241; all others may be considered as naturally occurring.*

In 1992, Ernest A. Bryant from Los Alamos National Laboratory published *The Cambridge Migration Experiment: A Summary Report* (LA-12335-MS). The Cambric Experiment was a long-term (October 1974 through August 1991) experiment that consisted of first measuring the distribution of radioactive materials in water and rock in the vicinity of the 1965 Cambric underground nuclear test explosion and then inducing an artificial hydraulic gradient by pumping water from a nearby well (91 meters from the well used to characterize the initial source term). The water samples pumped from the test well were regularly analyzed for the presence of radioactive species that might have migrated from the explosion cavity. Among other things, the Cambric Experiment demonstrated that tritium migrates at about the same rate as groundwater relative to most other contaminants. Other radionuclides that exhibited migration with the groundwater during the Cambric Experiment included krypton-85 (a noble gas), chlorine-36, iodine-129, technetium-99, and ruthenium-106. As noted above, each of these, with the exception of krypton-85, is included in the list of radioisotopes analyzed by either the UGTA Project or RREM Program.

As reported by Kersting et al. (1998), groundwater samples taken at Well ER-20-5 in 1997 contained plutonium, apparently associated with colloids. Well ER-20-5 is located on the southwestern part of Pahute Mesa, about 4,265 feet south of the Benham underground nuclear test and 984 feet west of the Tybo underground nuclear test. Analysis of the plutonium in the groundwater samples demonstrated that it was from the Benham test, rather than the Tybo test. Kersting et al. noted, “this is the first time Pu has been shown to be transported by groundwater and for a significant distance.” A low concentration of plutonium (0.42 picocuries per liter, which is well below the Safe Drinking Water Act EPA limit of 15 picocuries per liter) was found in samples taken from Well ER-20-5 #1 in 2004 (Eaton et al. 2007). In a study subsequent to the discovery of plutonium at Well EC-20-5, Smith et al. (2003) noted that general experience from the U.S. nuclear testing program based on radiochemical diagnostic data collected from a variety of test matrices suggests that only a small fraction (5 to 10 percent) of the total plutonium from an underground nuclear detonation would be available for transport in groundwater.

As evidenced by the above list of radiological analytes, DOE/NNSA has and will continue to track and report results of groundwater characterization and monitoring that demonstrates transport of any of the noted elements. Further, the data obtained from the ongoing groundwater characterization and monitoring are used in developing and refining the models used by DOE/NNSA and NDEP to site new characterization and monitoring wells and improve groundwater models.

Underground Test Area Project. The CAUs are investigated and monitored under the UGTA Project, which is the largest component of the NNSS Environmental Restoration Program, with the oversight of NDEP as part of the FFACO (DOE/NV 2010). The UGTA Project started in 1989 and is scheduled to be completed in 2027. This project evaluates the extent of radionuclide groundwater contamination due to past underground nuclear testing through hydrogeologic investigation and characterization, groundwater flow and transport modeling, and groundwater sampling and monitoring. The FFACO was amended in May 2011. Groundwater flow and transport models will be developed for each of the CAUs being evaluated under the UGTA Project to identify ensembles of contaminant boundaries where waters inside the boundaries exceed the radiological protection requirements of the Safe Drinking Water Act. The validity of the contaminant boundary forecasts will be tested through model evaluations that will lead to design and implementation of a long-term closure monitoring well network. The contaminant boundary evaluations provide the basis for establishing use-restriction areas and identifying a regulatory boundary by NDEP for protection of the health and safety of the public. Protection of the public is ensured through an in-depth approach that combines, for each CAU, model forecasts of contaminant transport over 1,000 years and long-term monitoring and institutional controls to restrict public access to contaminated groundwater (DOE/NV 2011).

Groundwater modeling for the UGTA Project is conducted in two steps. First, a regional three-dimensional groundwater flow model was developed for the Death Valley regional flow system to identify risks to the public, workers, and the environment (DOE/NV 1997a). Second, groundwater flow (boundary conditions) from this regional model is used in the development of CAU-scale groundwater flow and transport models. Individualized models are needed due to the complexity of geologic/hydrologic conditions within each CAU. These smaller-scale, site-specific groundwater models will be used to identify contaminant boundaries based on the maximum extent of contaminant migration over a 1,000-year time period. Results of the CAU-specific groundwater models will be used to develop a monitoring network, which augments current monitoring both on and off the NNSS. To ensure public health and safety, groundwater monitoring would continue until there is assurance that there is no remaining risk to public health and safety from groundwater contamination resulting from underground nuclear weapons testing.

CAU-specific groundwater flow and transport models have been completed for the Frenchman Flat CAU (Navarro Nevada Environmental Services 2010). The transport model included evaluations of ensembles of contaminant boundaries. The results of these models were reviewed and accepted by an external peer review panel (Navarro-Intera 2010a). The model results and peer review recommendations were accepted by NDEP, and the Frenchman Flat studies have moved into the model evaluation stage, the final stage before development of a long-term closure monitoring network. **Figure 4–20** shows the model-based estimation of the extent of groundwater contamination in the Frenchman Flat area over the next 1,000 years. As described above, depiction of groundwater contamination is based on the results of models that are being developed and refined. To date, the only UGTA CAU that has completed the Phase II investigation and the Phase II Transport Model is Frenchman Flat. Figure 4–20 depicts the area where there is a 95 percent certainty that groundwater contamination will exceed the Safe Drinking Water Act standards for radionuclides in the Frenchman Flat area over the next 1,000 years, as predicted by the Phase II Transport Model. The Central and Western Pahute Mesa CAUs have not completed Phase II milestones; therefore, a figure predicting groundwater contamination transport in Central and Western Pahute Mesa has not been included.

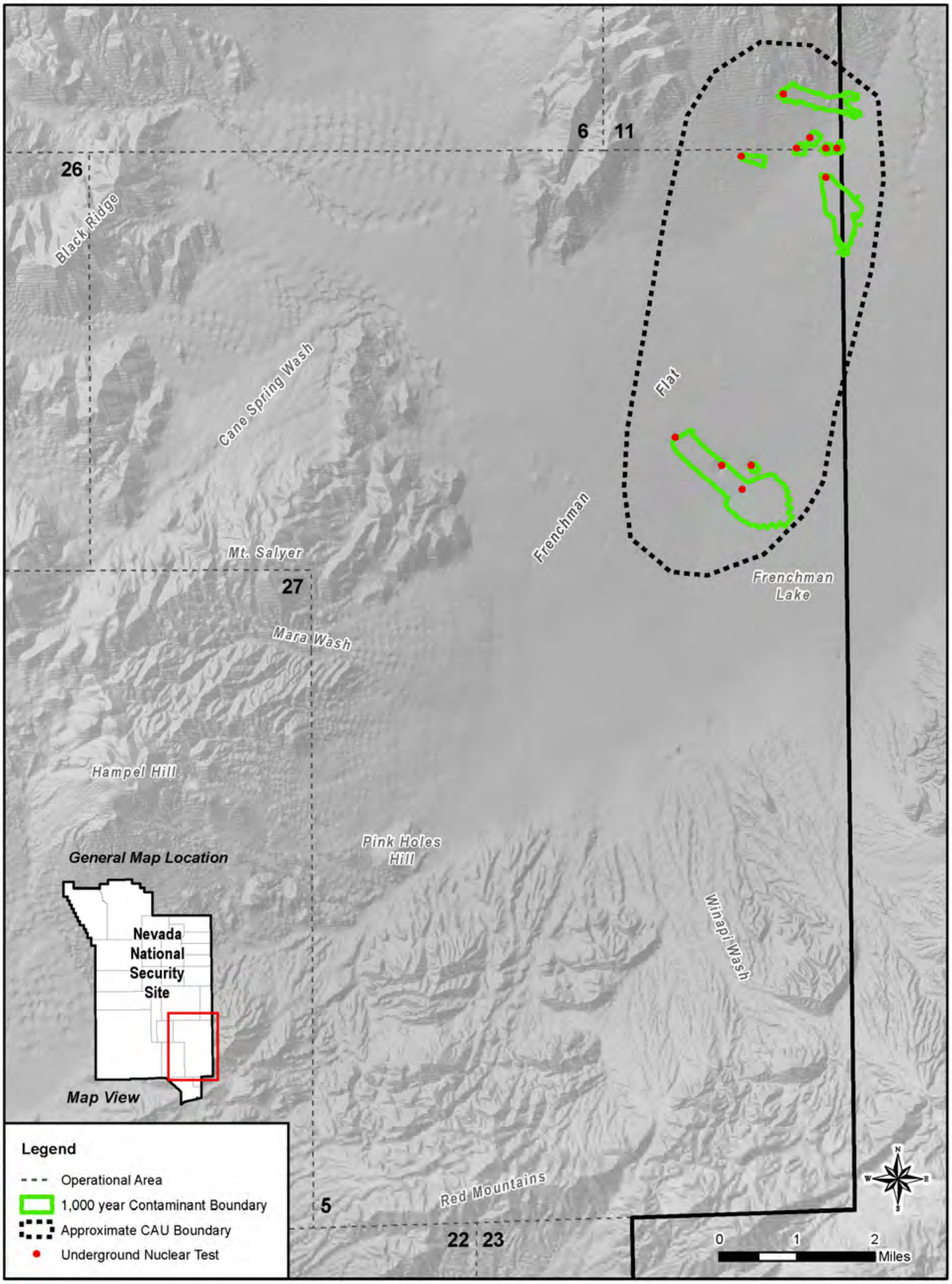

Figure 4–20 Modeled Extent of the Contaminant Boundary in the Frenchman Flat Corrective Action Unit in 1,000 Years

The UGTA Project has been routinely collecting groundwater samples from an average of six wells a year since 2000. The wells include new construction wells, existing on- and offsite monitoring wells (which may also be used under the RREM Program, along with post-shot/cavity wells). The post-shot/cavity wells are sampled as a part of the "hot well" sampling effort under the UGTA Project. Groundwater samples collected during the construction of new wells, as well as samples collected from existing on- and offsite monitoring wells generally did not display concentrations of tritium above the Safe Drinking Water Act standard of 20,000 picocuries per liter between 2000 and 2008. However, the samples taken under the hot well program consistently display tritium concentrations above the Safe Drinking Water Act standard. The hot well sampling effort supports DOE/NNSA's continuing effort to develop flow and transport models and design a long-term monitoring program for wells in or near underground nuclear test cavities. The program's objectives are to characterize the hydrologic source term and evaluate the effects of decay and potential migration of radionuclides through monitoring at or near the source (DOE/NV 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d, 2010). **Table 4–33** shows a summary of the hot well sampling effort and the associated tritium findings from 2003 to 2008. No post-shot/cavity well samples were taken between 2000 and 2003, nor were well samples taken between 2006 and 2008.

Table 4–33 "Hot Well" Tritium Analysis Summary Table (2003 to 2008)

Year Samples Taken	*Total Number of Samples Analyzed*	*Associated Underground Nuclear Test Cavity*	*Range of Results (picocuries per liter)*
2003	4	Gascon, Camembert, Almendro, and Cheshire	200,000 to 160,000,000
2004	4	Bilby, Chancellor, and Tybo	113,000 to 38,000,000
2005	1	Cheshire	37,000,000
2006–2008	0	–	–

Source: DOE/NV 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d.

A new well-drilling campaign, initiated in the summer of 2009 (as a part of Phase II characterization), identified the construction of nine additional wells over the next 3 years to gather additional data for developing groundwater models and contaminant boundary forecasts that would eventually aid in the implementation of a long-term monitoring network for the Pahute Mesa CAU (DOE/NV 2010). Three of the nine wells were drilled in 2009 (ER-EC-11, ER-20-8, and ER-20-7) in Pahute Mesa along the northwestern boundary of the NNSS, and the remaining six will also be located on or near Pahute Mesa. Well ER-EC-11 is located off site on USAF land, and Wells ER-20-8 and ER-20-7 are within the NNSS boundary. For the first time in October 2009, tritium was detected off site in Well ER-EC-11, located less than half a mile off the northwestern boundary of the NNSS and approximately 14 miles from the nearest public water source. The tritium level was found to be 13,180 picocuries per liter, which is below the EPA Safe Drinking Water Act standard of 20,000 picocuries per liter. The sample results were verified by a certified independent laboratory and reported to NDEP (DOE/NV 2011). Current groundwater models in the February 2009 Phase 1 Central and Western Pahute Mesa Transport Model and Western Pahute Mesa Corrective Action Plan display transport in this direction near Pahute Mesa. In 2010, a deeper portion of Well ER-EC-11 was sampled and no tritium was detected. This was not unexpected, as the aquifer sampled is isolated from the overlying contaminated aquifer by a confining unit, which does not readily conduct water (DOE/NV 2011).

In May 2010, Well PM-3, which is approximately 11,000 feet west of the NNSS border on the Nevada Test and Training Range, was found to have detectable levels of tritium at 48.3 picocuries per liter during monitoring under the RREM Program. Well PM-3 is 24,500 feet northwest of Well ER-EC-11 and 188 feet upgradient from Well ER-EC-11. The UGTA Project will collect and test additional water samples from Well PM-3 to confirm the presence of tritium in the well. The UGTA Project sampling results, as well as the RREM Program, will be considered in future data collection decisions and groundwater model evaluations (DOE/NV 2011).

Additionally, many wells have been drilled downgradient of the test cavities showing a migration trend of tritium transport at distance, and other radionuclides transporting very short distances over the same period of time. **Figure 4–21**, located at the end of this section, displays the locations of various wells used for monitoring groundwater at the NNSS and nearby offsite areas, as well as the concentration of tritium that has been detected. The sampling wells are located both at and near historic underground detonation sites and farther downgradient, where they have been strategically placed to intercept any contamination plumes originating from the historic underground tests.

In the past, a non-government group evaluated DOE/NNSA's groundwater monitoring network (Citizen's Alert 2004), pointing to a lack of monitoring wells in the area southwest of Pahute Mesa on the Nevada Test and Training Range. Citizen's Alert contended, among other things, that the monitoring well network was not properly designed and that the likelihood of detecting a plume of contamination off site was diminished because there had been no wells developed in the area southwest of Pahute Mesa on the Nevada Test and Training Range. Since that report was published, and based on DOE/NNSA's and NDEP's ongoing work to characterize groundwater flows and contaminant transport, as shown in Figure 4–21, nine groundwater characterization and monitoring wells have been developed so far within the area of concern by Citizen's Alert and, as previously noted, tritium has been detected at one of the offsite wells, ER-EC-11.

Routine Radiological Environmental Monitoring Plan. The RREM Plan was developed in 1998. The Long-Term Hydrological Monitoring Program was the RREM Plan's predecessor and had been in existence since 1972. Before 1972, groundwater was monitored by the U.S. Public Health Service, USGS, and the U.S. Atomic Energy Commission's contractor organizations. In 1999, there was a final transition from the Long-Term Hydrological Monitoring Program to the RREM Plan to have a single, integrated, and comprehensive monitoring program (DOE/NV 2000c). In 2002, the RREM Plan environmental surveillance system was revised in an effort to make the program more efficient. The purpose of the RREM Plan is to determine whether concentrations of radionuclides in groundwater and surface water at the NNSS pose a threat to public health or the environment. The RREM Plan includes a groundwater monitoring well network of 78 wells located on and off the NNSS, which are sampled at frequencies ranging from once every 3 months to once every 3 years. Ten additional wells have been added to the network and are sampled opportunistically. Of these 88 wells, 72 have been sampled since 1999. These 72 wells include 33 offsite monitoring wells, 29 onsite monitoring wells, and 10 onsite water supply wells. The remaining 16 wells identified by the RREM Plan, but not sampled since 1999, comprise 15 onsite monitoring wells and 1 offsite well. These 16 wells have not been sampled for one or more of the following reasons: they are not accessible, are used for other purposes, are blocked, provide water samples that are of poor quality or are contaminated (disqualifying them from monitoring), or contain waters with known high levels of radiological contamination that are not expected to change (DOE/NV 2009d).

Sampling of the NNSS potable supply wells continues to indicate that nuclear testing has not affected the NNSS water supply network. Gross alpha and gross beta radioactivity have been detected in supply wells at concentrations commensurate with background levels of naturally occurring radionuclides and not above the EPA maximum contaminant level (MCL) of 15 picocuries per liter. Tritium has not been detected above the Safe Drinking Water Act standard of 20,000 picocuries per liter in any of the potable supply wells (DOE/NV 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d). **Table 4–34** is a summary of the samples taken on site and off site, including potable and monitoring wells and the results from 2000 through 2008. The summary table dates back to 2000, as the Long-Term Hydrological Monitoring Program was transitioned over to the RREM Plan the previous year. The tritium analysis was conducted after the samples were enriched. The enrichment process concentrates tritium in a sample to provide very low minimum detectable concentrations (DOE/NV 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d). None of the samples taken within this timeframe under the RREM Plan has displayed concentrations of tritium greater than 11 percent of the Safe Drinking Water Act standard of 20,000 picocuries per liter.

Table 4–34 Routine Radiological Environmental Monitoring Plan Tritium Analysis Summary Table (2000 to 2008)

Year Samples Taken	*Total Number of Samples Analyzed* [a]	*Range of Results Minimum Detectable Concentration (picocuries per liter)*	*Percent of Safe Drinking Water Act Maximum Contaminant Level (20,000 picocuries per liter)*
2000	61	8 to 2,130	0.04 to 10.7
2001	60	10 to 32	0.05 to 0.16
2002	54	12 to 260	0.06 to 1.3
2003	45	18 to 28	0.09 to 0.14
2004	36	17 to 26	0.09 to 0.13
2005	55	13 to 35	0.07 to 0.18
2006	41	11 to 37	0.06 to 0.19
2007	39	17 to 28	0.09 to 0.14
2008	33	18 to 34	0.09 to 0.17

[a] Includes on- and offsite monitoring wells.
Source: DOE/NV 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d.

Only four onsite monitoring wells (PM-1, U-19BH, UE-7NS, and WW A) located within 0.6 miles of a historical underground nuclear test are known to have detectable concentrations of tritium above their respective minimum detectable concentrations; however, the concentrations are well below the Safe Drinking Water Act drinking water limit of 20,000 picocuries per liter (see **Table 4–35** for the 2008 sampling results). All have consistently had detectable levels of tritium in past years, and no trend of rising tritium concentrations has been observed in these wells since 2000.

Table 4–35 Tritium Analysis Results for the Nevada National Security Site Monitoring Wells (2008)

Underground Test Area Well	*Date Sampled*	*^{3}H±Uncertainty* [a] *(minimum detectable concentration) (picocuries per liter)*
PM-1	4-23-08	127 ± 25 (23)
U-19BH	3-17-08	31 ± 13 (19)
UE-7NS	2-27-08	90 ± 24 (30)
WW A	2-12-08	356 ± 59 (28)

^{3}H = tritium (hydrogen-3).
[a] ±2 standard deviations.
Source: DOE/NV 2009d.

Wells PM-1 and U-19BH are located in the Central Pahute Mesa CAU 101 (see Figure 4–19 for CAU and sampling well locations within the NNSS). PM-1 is located in Area 20 of the NNSS and has a history of tritium concentrations near 200 picocuries per liter over the last 10 years. Well U-19BH has a history of tritium concentrations and in 2002 measured with concentrations at approximately 48 picocuries per liter. The tritium concentrations measured at Well U-19BH since 1999 show a downward trend. Wells UE-7NS and WW A are located within the Yucca Flat CAU 97 (see Figure 4–19 for CAU locations within the NNSS). Well UE-7NS was routinely sampled from 1978 to 1987, with the resumption of sampling in 1991. In 2003, tritium concentrations ranged from 133 to 156 picocuries per liter, consistent with the trend of decreasing concentrations observed in recent years. Well WW A has had measureable tritium since the late 1980s. There was an increase in tritium concentrations between 1985 and 1999, which has been followed by a slight downward trend in concentrations since 2000 (DOE/NV 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d).

No adverse impacts on potable groundwater quality have resulted from operations since 1996 (DOE/NV 2002b). Due to the distance between existing water supply wells at the NNSS and the underground tests, DOE/NNSA believes that groundwater use at the NNSS has little or no effect on the migration or spread of contamination from underground nuclear testing. Groundwater at the NNSS is deep and slow moving, which affords protection to adjacent areas (DOE/NV 2010). Groundwater modeling is used to evaluate the effect of water use on potential radionuclide migration and assist in the selection of optimum water-production wells and monitoring wells. As studies are completed, monitoring plans are negotiated and approved for each of the underground test areas. Maintenance of the quality of waters that are currently clean is managed through the implementation of the Groundwater Protection Management Plan.

Offsite water use is far removed from the NNSS testing areas. The closest significant offsite withdrawals are in Oasis Valley, approximately 18.6 miles (30 kilometers) from the nearest underground test, and these withdrawals are not thought to affect contaminant migration.

The NNSS has implemented a Borehole Management Plan to protect groundwater from contamination via infiltration of contaminants at the wellhead. Over 4,000 boreholes were drilled on and off the NNSS in support of nuclear testing. Many of the boreholes are no longer used and are not candidates for future use. These boreholes could serve as a pathway for surface contamination to reach subsurface strata (DOE/NV 2002b). The NNSS has implemented the Borehole Management Plan, which identifies boreholes that should be plugged to avoid any potential contamination of groundwater. As of January 2009, the Borehole Management Program has plugged 617 of the 871 boreholes identified as needing closure. Of the boreholes requiring closure, 151 are believed to penetrate groundwater and underground nuclear test cavities and 93 of these boreholes have been plugged as of January 2009 (DOE/NV 2009d).

Water Resources—American Indian Perspective

CGTO

Indian people believe water is a living organism that is fully sentient and willful. The forces of power in the world move along channels and combine into specific nodes or places of power. A common set of these channels follows the path of water. These paths begin at the tops of mountains, especially the highest peaks. Snow and rain falls on these highlands and peaks after being called down by the mountain itself. From this beginning, the water moves downhill in rivulets, washes, and streams. The water often goes underground where it forms similar networks of channels moving in various directions, only somewhat corresponding to what non-native people call hydrologic basins. Water is often attracted to volcanic activity, thus producing significant power places like hot mineral springs.

According to tribal elders, *"Water is life. Water is needed by the plants and animals. Indian people bless themselves with it. It purifies the body. Water is medicine and must be respected. American Indians need it to conduct religious ceremonies. It cleans the earth. It has a vast connection to the underground. Water shouldn't be contaminated or it will die and lose its spirit."*

Each of the discreet underground water basins, or hydrological basins, has its own origin story. One tribal story tells of a discreet underground water network created by Ocean Woman and where she placed her feet. According to this traditional story, there are points where the water emerges at the surface in springs and seeps. It was here that Ocean Woman placed her medicine staff into the ground and water emerged.

At other points, the surface water in low playa lakes meets the underground water channels. These points are like doorways between the surface world and the underworld.

Rain calling is a basic aspect of American Indian life and culture. Rain ceremonies from the spiritual world help facilitate rain production, and were led by rain callers, often called rain shamans or rain doctors in the English language. The rain caller calls upon the rain by singing songs, and is aided by his spirit helper, which is usually in the form of a mountain sheep. The mountains also had important roles in this activity, and were called up to interact with the clouds and the sky to call down the rain.

Even today, individual traditional Indian people can bring rain. One way this is done is by turning a stinkbug on his back. The rain will come, provided the stinkbug allows a person to tickle his belly with a small stick. As this person prays for rain, he tells the stinkbug why he is asking for rain.

Water Resources—American Indian Perspective (cont'd)

CGTO

If too much rain fell, certain precautions are taken. For example, the children are not allowed to shake willows that will be used for weaving or to kill frogs as this brings more rain. Hummingbirds were not killed for many reasons, but if they are killed, there will be flooding and lightning storms, with lightning killing the person who killed the hummingbird.

The Snow Ceremony was performed to ensure a good winter with heavy snow fall. The spiritual leader, often called a weather doctor in the English language, would call the people together and meet at a special place in the mountains, sometimes near a pine nut gathering area. The spiritual leader would sing songs and offer prayers. According to Indian tradition, the Snow Ceremony is performed during the late fall when the weather becomes cold. A part of this ceremony involves calling on the Snow Fleas. They represent a special category of American Indian environmental knowledge because they are almost invisible and live at the highest elevations on the mountains. The Snow Fleas are the ones that make the snow wet and absorb into the mountain. Without them, the snow is dry and evaporates quickly, and there is less water for the mountains and the valleys below. The Snow Ceremony is conducted in relationship with ceremony of the seeds where young girls dance with seeds in winnowing trays and a spiritual person sings songs to bring whirlwinds, which surround the dancers and scatter the seeds as a gesture of fertilizing the earth. Water is called upon to nourish the soil and the seeds to make them fertile.

Because water is a powerful being it is associated with other powerful beings, such as water babies. Water babies are like the people of the water. They are highly respected by American Indian culture. If water is contaminated, the water babies will move to other areas that are not contaminated. Proof of their existence has been depicted in historic rock drawings throughout Nevada, including one pecked at the volcanic butte at Black Canyon, Pahranagat Valley.

According to a tribal elder, *"Water babies are important to our culture. They are supernatural. They connect everything and you don't want to disrespect them. The springs are all connected and they follow the water flow. Water babies are supernatural beings and are the guardians of the water. They can make sounds like a baby, and you don't want to startle them because they can disturb life. We are taking their native environment away when we drill and contaminate the water. It angers them. When they get mad, there are adverse impacts to wildlife as they can drain you spiritually and physically."*

Playas

The CGTO knows playas occupy a special place in American Indian culture. Playas are often viewed as empty and meaningless places by western scientists, but to Indian people, playas have a role and often contain special resources that do not occur anywhere else.

The CGTO knows that playas were used in traveling or moving to places where work, hunting, pine cutting, or gathering of other important foods and medicine could be done. One elder remembers crossing over dry lake beds and traveling around but near the edges, and how provisions were left there and at nearby springs by previous travelers at camping spots.

According to tribal elders, who were interviewed during previous NNSS evaluations, *"Indian people left caches in playa areas for people who crossed valleys when water and food was scarce. Frenchman playa is such a place. Indian people took advantage of traveling through this playa as mountains completely surround this area. The CGTO knows that most dry lakes are not known to be completely dry. An example is Soda Lake near Barstow, California. The Mohave River flows into this dry lake and most of the year it looks dry but it actually flows underground. Although some people continue to view Frenchman playa [and other playas] as a wasteland, the CGTO knows it is not."*

See Appendix C for more details.

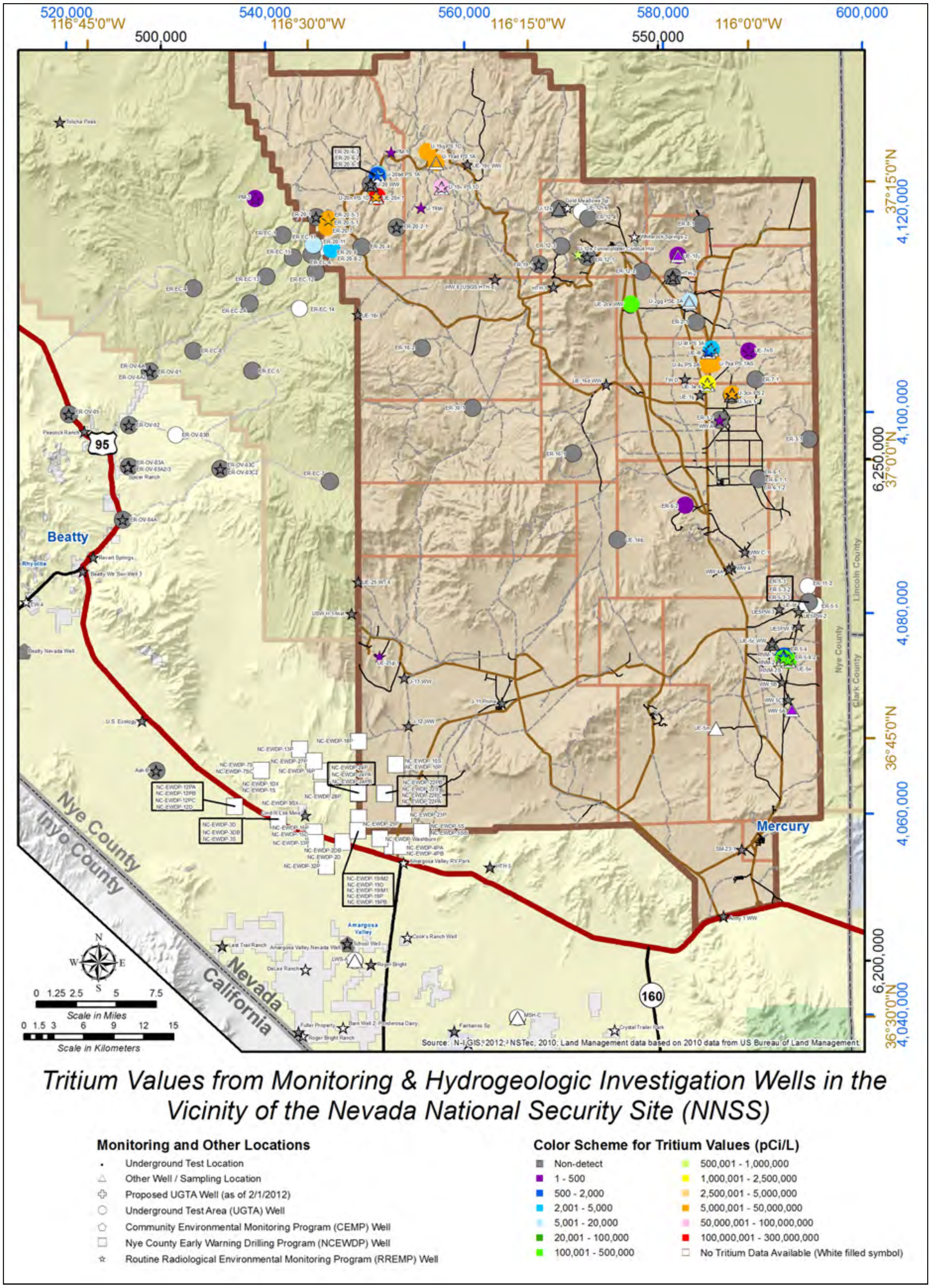

Figure 4–21 Concentration of Tritium Detected in Monitoring and Hydrogeologic Investigation Wells and Springs of the Nevada National Security Site

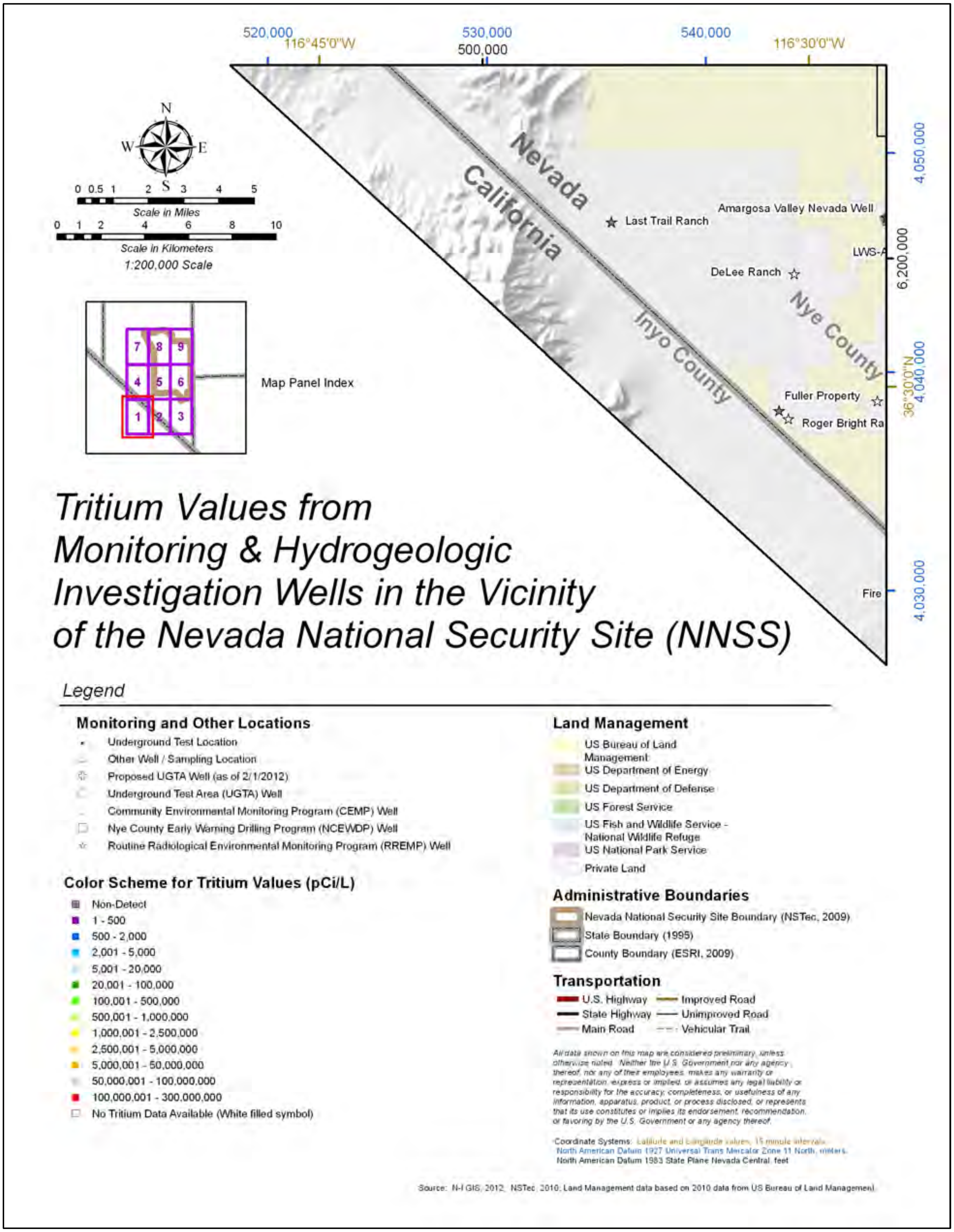

Figure 4–21 Concentration of Tritium (continued) – Panel 1

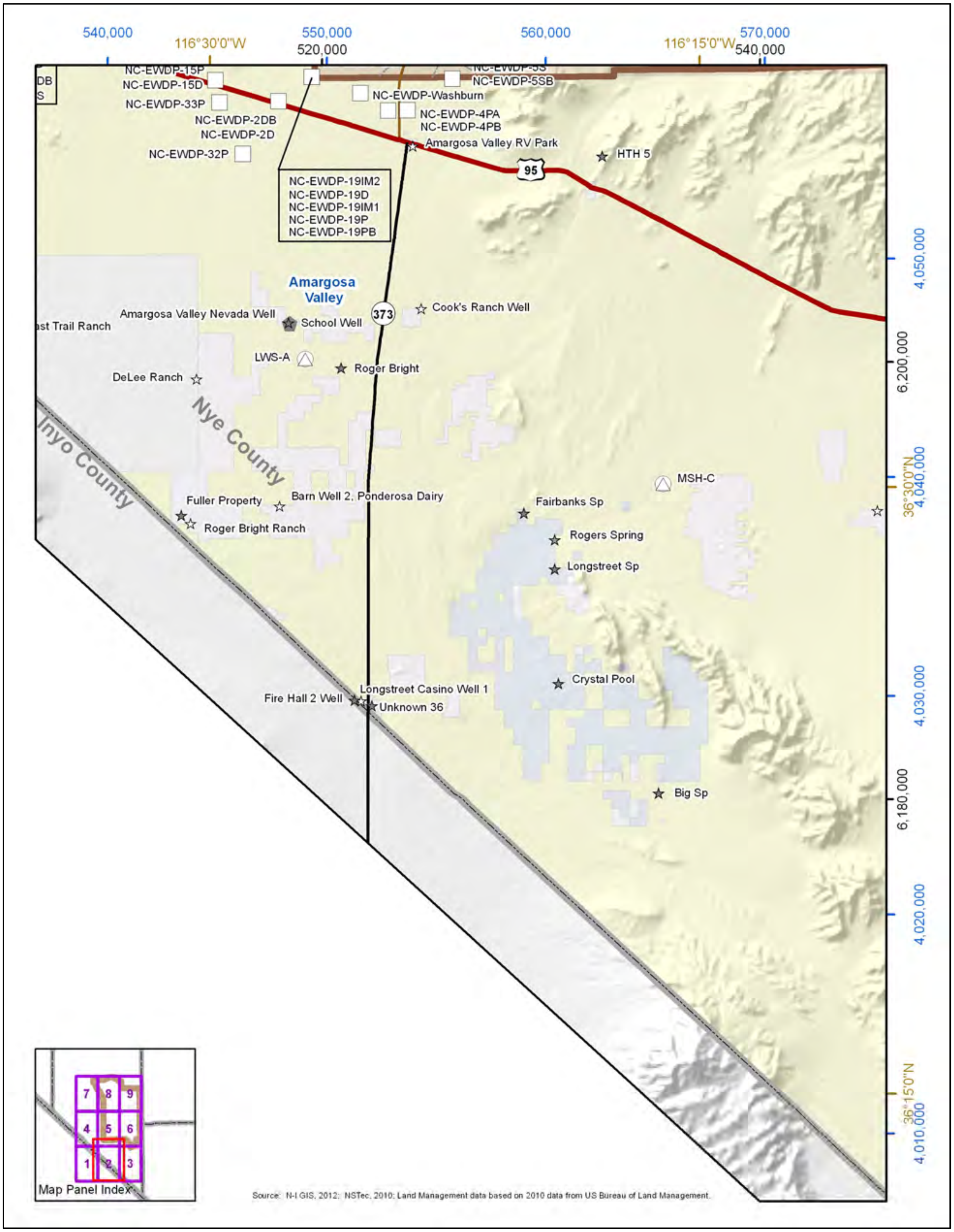

Figure 4–21 Concentration of Tritium (continued) – Panel 2

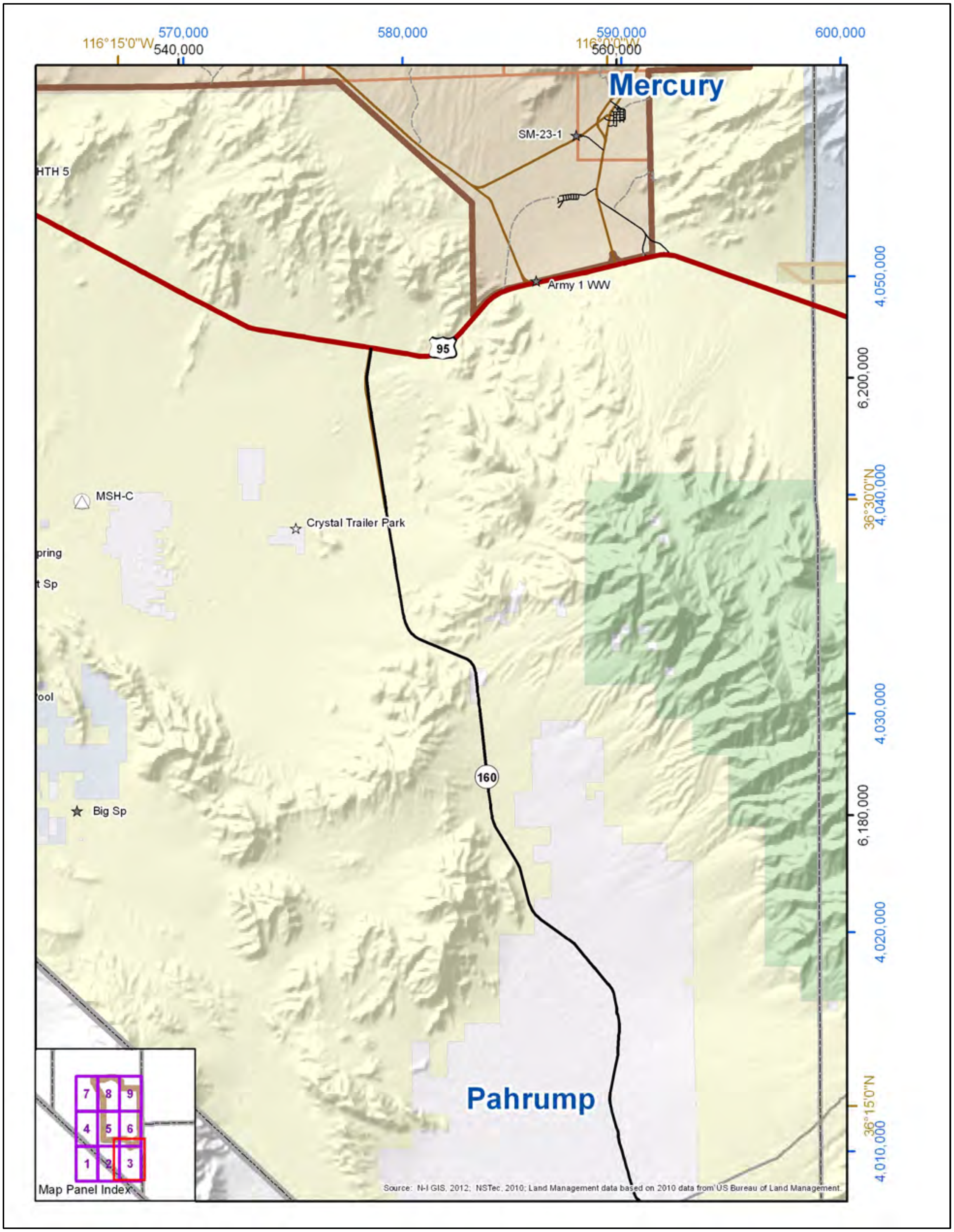

Figure 4–21 Concentration of Tritium (continued) – Panel 3

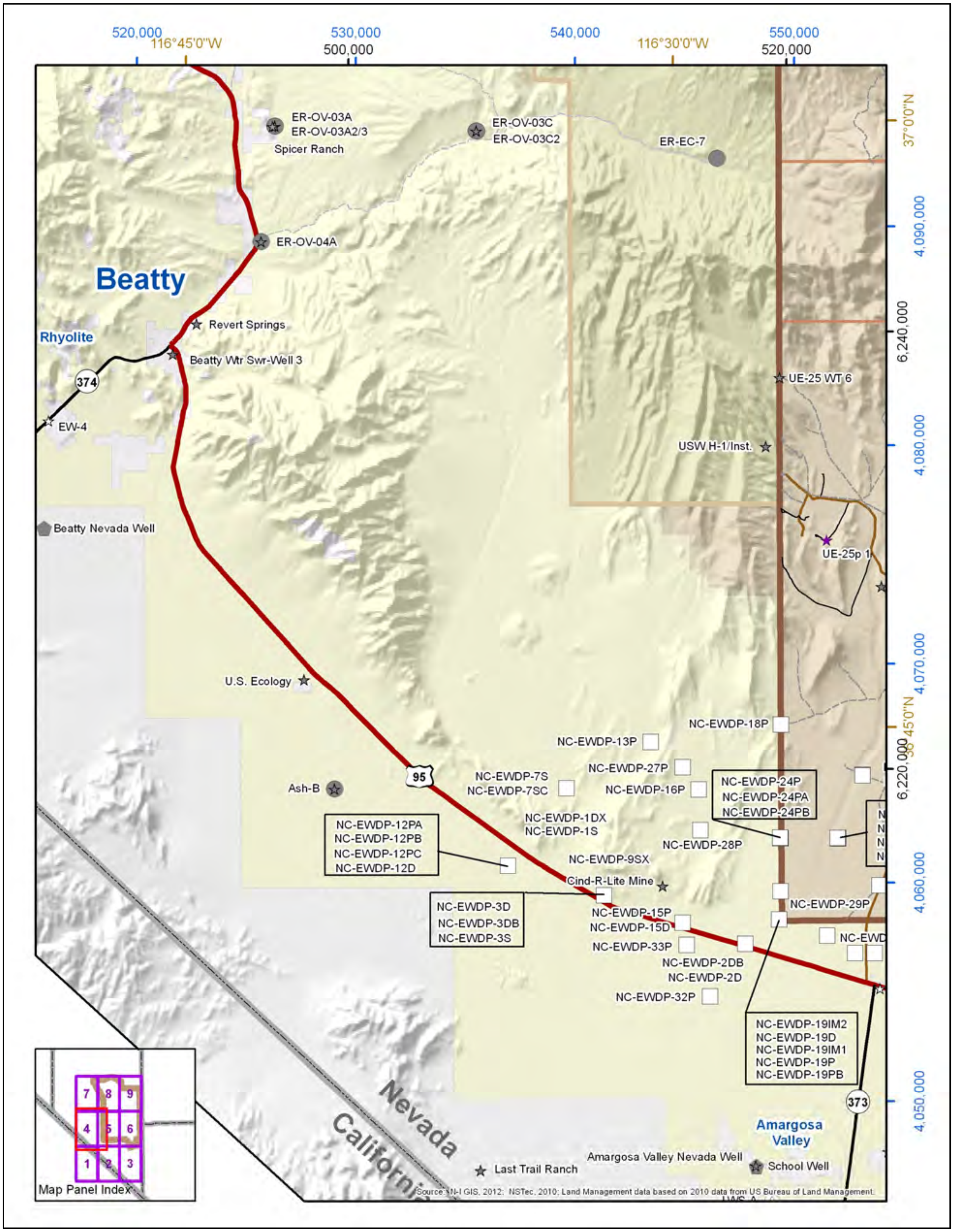

Figure 4–21 Concentration of Tritium (continued) – Panel 4

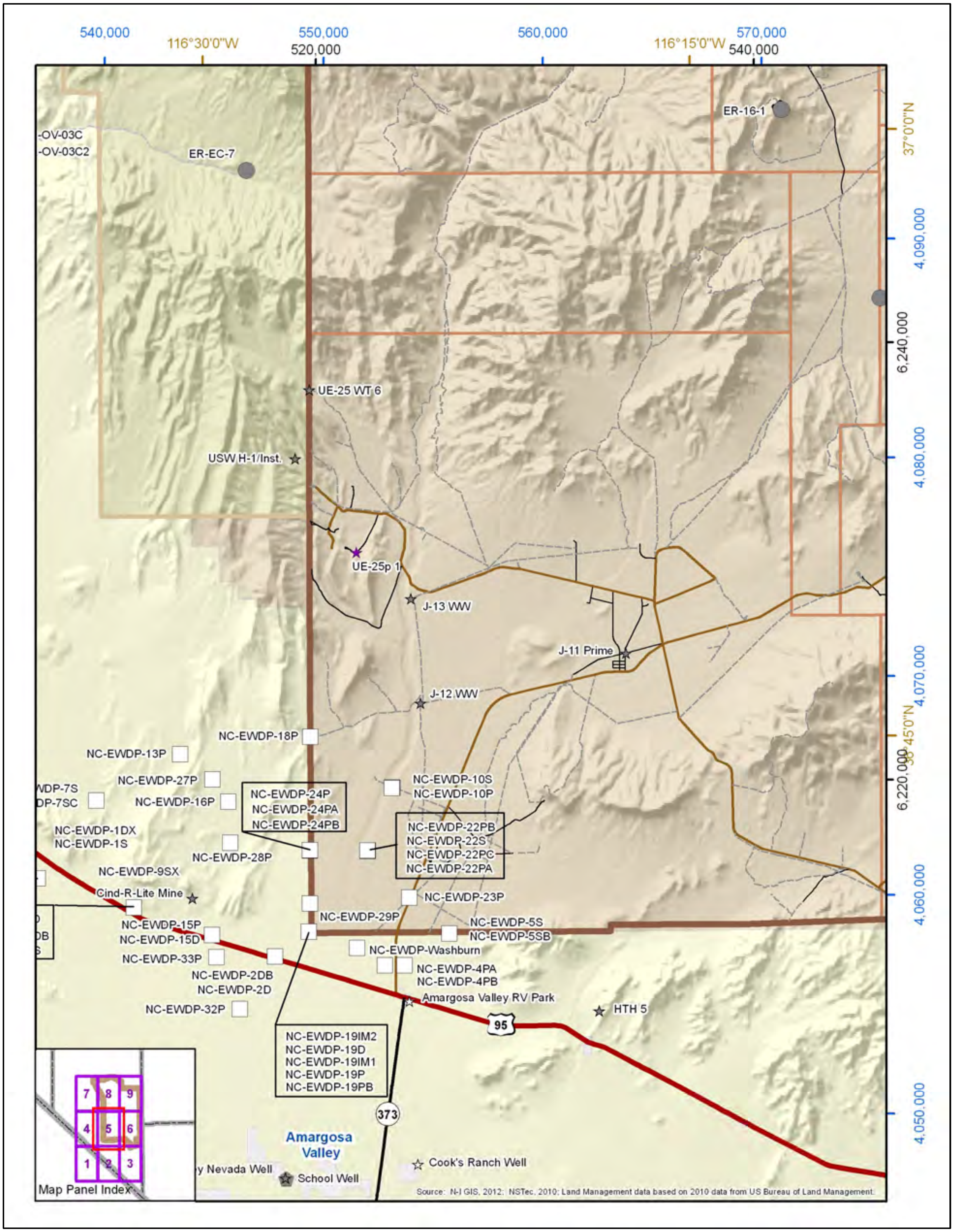

Figure 4–21 Concentration of Tritium (continued) – Panel 5

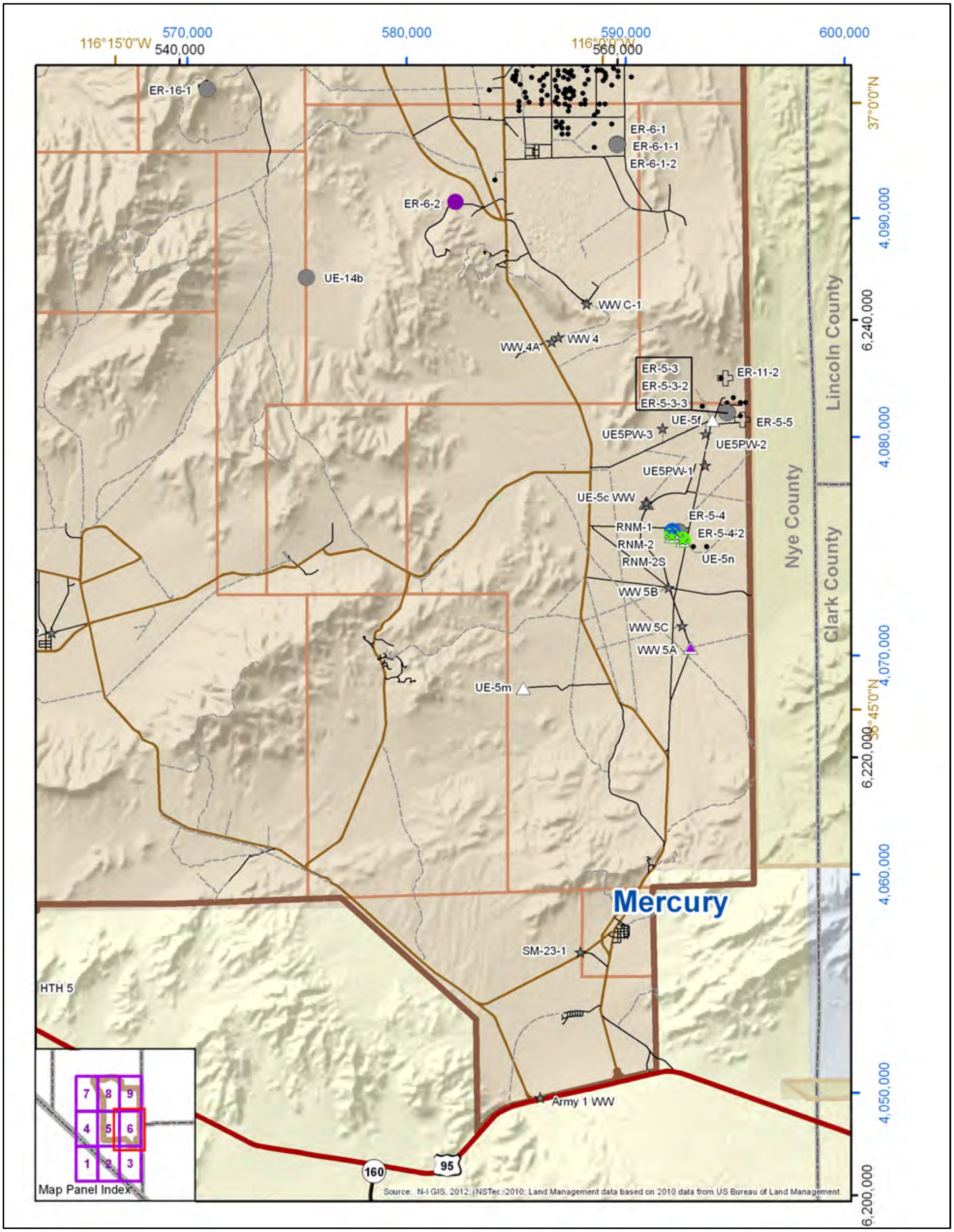

Figure 4–21 Concentration of Tritium (continued) – Panel 6

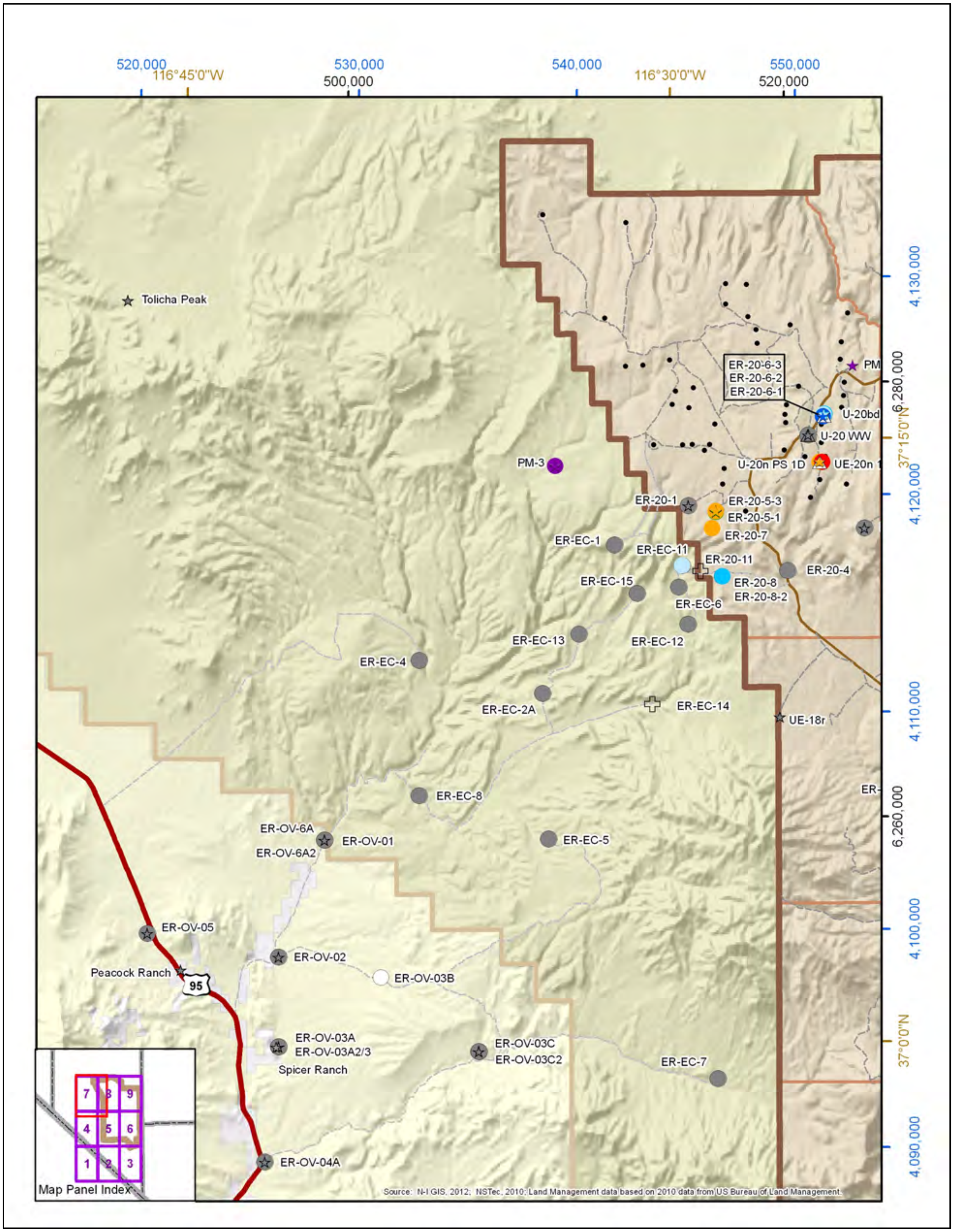

Figure 4–21 Concentration of Tritium (continued) – Panel 7

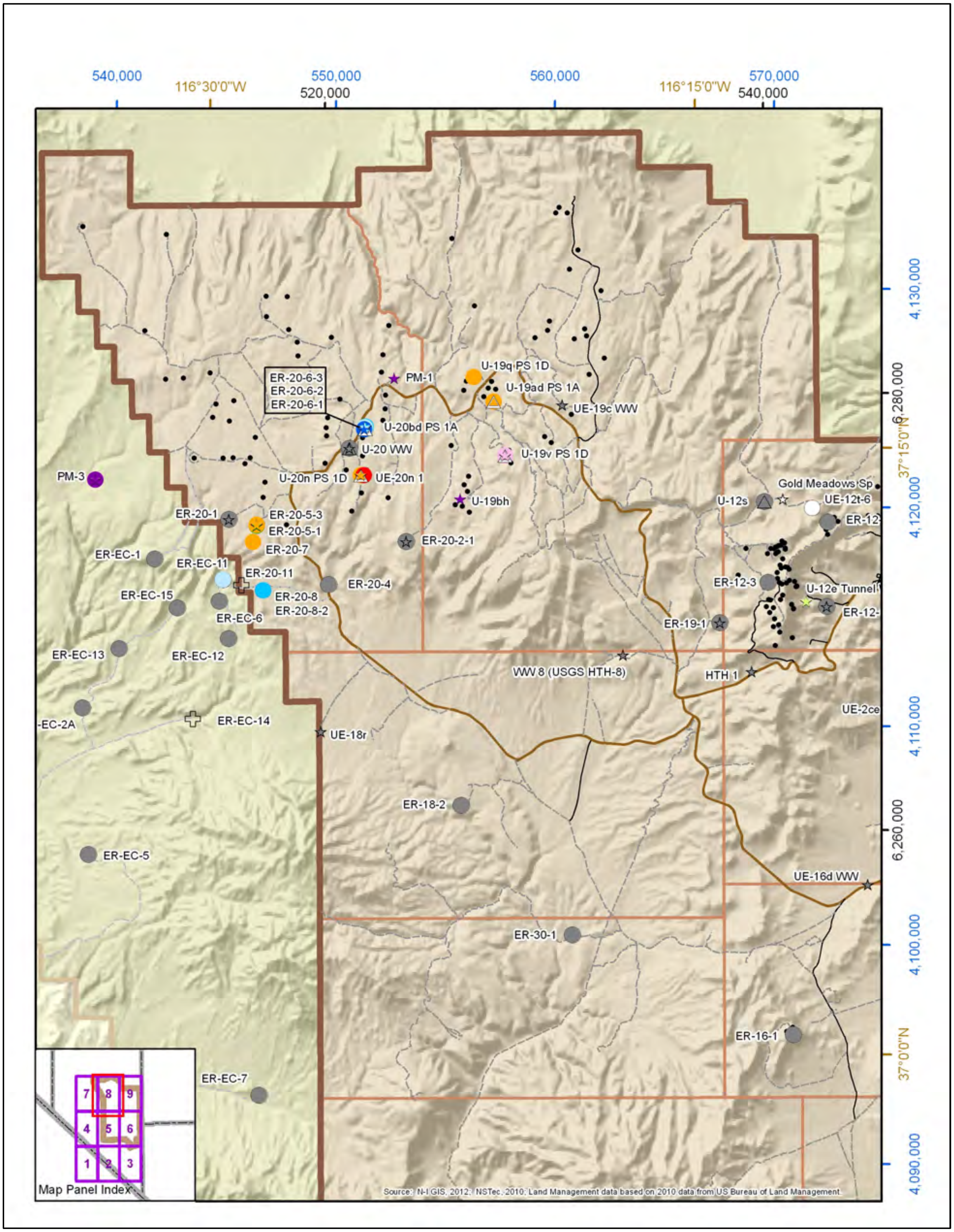

Figure 4–21 Concentration of Tritium (continued) – Panel 8

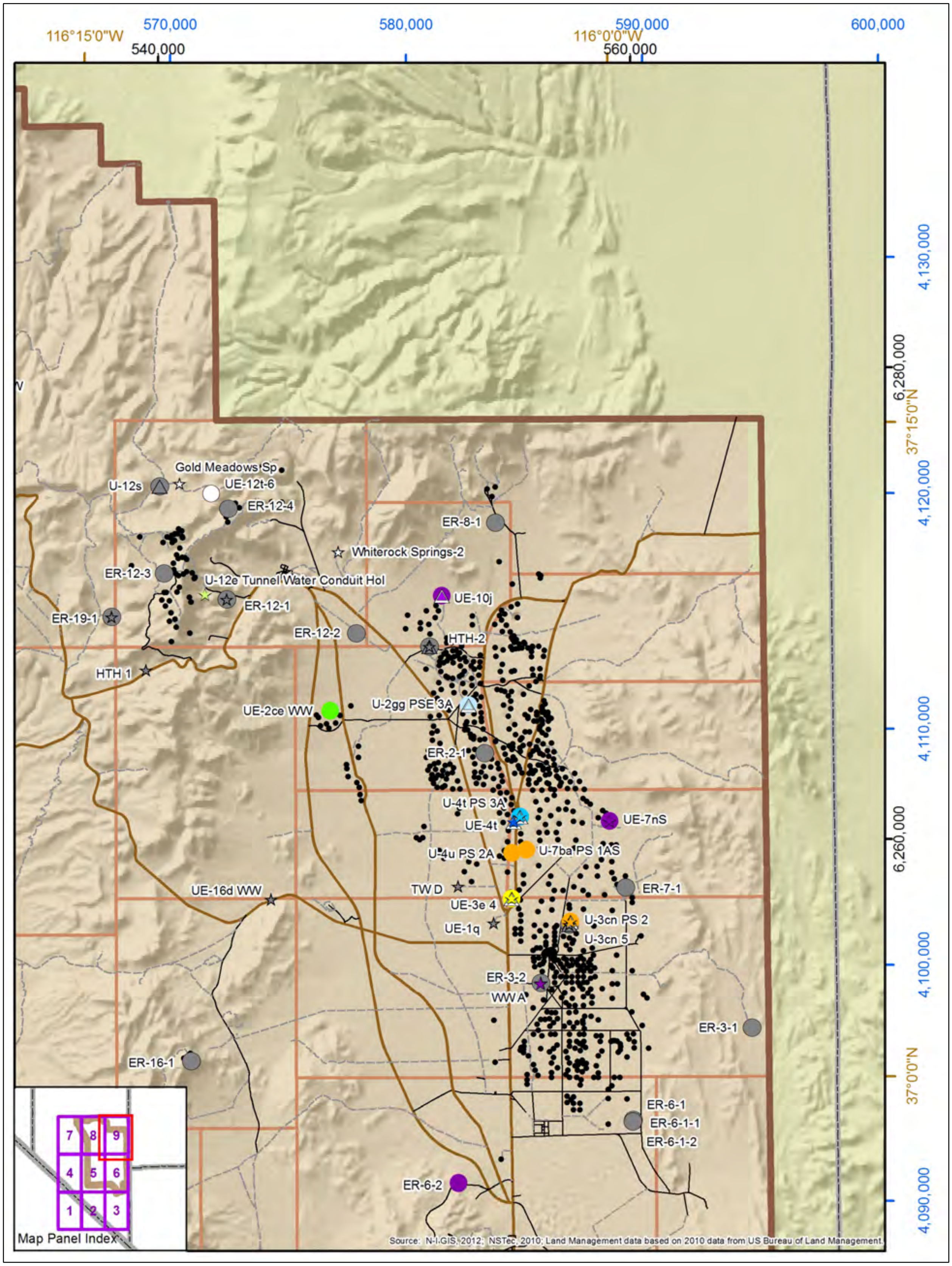

Figure 4–21 Concentration of Tritium (continued) – Panel 9

4.1.7 Biological Resources

The NNSS is located within the Basin and Range physiographic province and along the transition zone between the Mojave Desert and Great Basin ecoregions in south-central Nevada (Beatley 1975, 1976; DOE/NV 2000d) (see Figure 4–15). As a result, this site has a diverse and complex mosaic of plant and animal communities that are representative of both ecosystems, as well as some communities common only in the transition zone. This transition zone extends to the east and west far beyond the NNSS. Thus, the range of almost all species found on the NNSS also extends beyond the site, and there are few rare or endemic species found within the NNSS (DOE 1996c).

Elevation is an important factor affecting the distribution of plant and animal communities on the NNSS. Elevations generally increase from south to north, from a low of 2,688 feet in Jackass Flats to a high of 7,679 feet on Rainier Mesa. Climate and elevation result in a progression from Mojave Desert communities in the south to Great Basin communities in the north.

The biological diversity within the NNSS is also a result of topography. The valleys in the southern and western parts of the NNSS (e.g., Jackass Flats, Rock Valley, and Mercury Valley) have hydrologic connections to drainages outside the NNSS. In contrast, the two large valleys on the eastern side of the NNSS (Frenchman Flat and Yucca Flat) are closed basins. The lack of surface-water drainage out of these closed basins contributes to soil conditions, temperatures, and biotic communities that differ from those found at similar elevations in the open basins (Beatley 1975, 1976; DOE/NV 2000d).

To ensure compliance with laws, regulations, orders, and policies designed to protect plants and animals, the DOE/NNSA NSO has developed an Ecological Monitoring and Compliance (EMAC) Program. Over time, as requirements have progressed, the EMAC Program has become an integral part of the DOE/NNSA NSO Environmental Management System specified in DOE Order 436.1, *Departmental Sustainability*. The EMAC Program consists of several sub-programs and procedures tailored to monitor and protect the flora and fauna of the NNSS and incorporate protection of biological resources into project planning and the day-to-day activities of the NNSS, including the Desert Tortoise Compliance Program, the Sensitive Plant Monitoring Program, the Sensitive and Protected/Regulated Animal Monitoring Program, the Habitat Restoration Program, pre-activity biological surveys, surveys to assess the potential for wildland fires, and surveillance and monitoring of other relevant aspects of the NNSS flora and fauna, including invasive species. The following is a brief description of the various aspects of the EMAC Program.

Desert Tortoise Compliance Program. In August 1989, the desert tortoise was emergency listed under the Endangered Species Act, and the Mojave population of the desert tortoise was listed as threatened in April 1990. In October 1989, the manager of the DOE Nevada Operations Office (now the DOE/NNSA NSO) issued direction to all employees and contractors to protect tortoises on the NNSS, in part by suspending all off-road driving in tortoise habitat; forbade injuring or handling of tortoises; and strengthened existing environmental review requirements. The DOE/NNSA NSO Desert Tortoise Compliance Program was developed in 1992, when, in compliance with Section 7 of the Endangered Species Act (16 U.S.C. 1531 et seq.), the USFWS issued the first Biological Opinion for the NNSS. Since that time, new NNSS Biological Opinions were issued by USFWS in 1996 and 2009. The Desert Tortoise Compliance Program serves to implement the terms and conditions of the Biological Opinion for the NNSS, to document compliance actions taken, and to assist the DOE/NNSA NSO with USFWS consultations. Some of the activities of the Desert Tortoise Compliance Program include (1) reviewing proposed activities at the NNSS to determine if they may be located in tortoise habitat and if clearance surveys and/or monitoring are required, (2) conducting clearance surveys at project sites within 1 day of the start of project construction, (3) ensuring that environmental monitors are on site during heavy equipment operations, (4) developing training modules and ensuring that all personnel working on the NNSS are trained in the requirements of the *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada* (*2009 Biological Opinion*), and (5) preparing annual compliance reports for submittal to USFWS. By implementing the Desert Tortoise

Compliance Program, the DOE/NNSA NSO would ensure that most, if not all, impacts on desert tortoises addressed in this analysis would involve harassment, rather than injury or mortality.

Sensitive Plant Monitoring Program. Under the NNSS Sensitive Plant Monitoring Program, the status or ranking of sensitive plant species known to occur on the NNSS is evaluated annually to ensure such plants are afforded the appropriate protection under Federal and state laws. Sensitive plant species populations on the NNSS are routinely monitored to assess plant density and plant vigor to identify any threats or impacts on the species.

Sensitive and Protected/Regulated Animal Monitoring Program. As part of the Sensitive and Protected/Regulated Animal Monitoring Program, to ensure such animal species are afforded the appropriate protection under Federal and state laws, the DOE/NNSA NSO currently monitors 18 animal species on the NNSS. The DOE/NNSA NSO also monitors raptorial bird species, including the western burrowing owl (*Athene cunicularia hypugaea*). In addition, the DOE/NNSA NSO conducts monitoring and other studies to evaluate species that may be added to the list of sensitive species to determine their abundance and distribution on the NNSS and shares the findings with USFWS and state wildlife agencies to help inform their decisions regarding those species.

Habitat Restoration Program. The Habitat Restoration Program involves the revegetation of disturbed land and evaluation of previous revegetation efforts. These activities are conducted at both the NNSS and the TTR.

Biological Surveys. Biological surveys are performed at project sites where land-disturbing activities are proposed. The goal is to minimize adverse effects of land disturbance on sensitive and protected/regulated plant and animal species, their associated habitat, and other important biological resources. Survey reports document species and resources found and provide mitigation recommendations.

Wildland Fire Surveys. In 2004, the DOE/NNSA NSO began annual surveys each spring to assess wildland fire hazards on the NNSS. NNSS ecologists conduct these wildland fire surveys in coordination with NNSS Fire and Rescue.

Additional Monitoring. Additional monitoring is conducted for such things as natural wetlands to characterize seasonal baselines and trends in physical and biological parameters; West Nile virus to help the Southern Nevada Health District ascertain the presence and/or prevalence of the virus in the NNSS mosquito population; and constructed water sources to assess their use by wildlife and to develop and implement mitigation measures to prevent them from causing significant harm to wildlife.

4.1.7.1 Flora

Based on an analysis of field data collected from ecological landform units, 10 vegetation alliances and 20 associations have been recognized on the NNSS (DOE/NV 2000d) (see **Table 4–36**). **Figure 4–22** shows the 10 vegetation alliances. Each vegetation alliance and association was named for the dominant tree or shrub species, based on relative abundance and the conventions of the Federal Data Committee and Ecological Society of America (DOE/NV 2000d). In terms of total area, the Great Basin Desert occupies approximately 40 percent of the NNSS, followed by the transition zone, which occupies 37 percent. The Mojave Desert occupies the southern 22 percent of the NNSS (DOE/NV 2000d). Within each of these three zones on the NNSS, there are populations of noxious/invasive plant species that have become established over the years. Measures employed by DOE/NNSA to control these unwanted plant species are described in Chapter 5, Section 5.1.7, and Chapter 7, Section 7.7.

Table 4–36 Vegetation Alliances and Associations on the Nevada National Security Site

Ecoregion	*Alliance*	*Association*
Mojave Desert	*Lycium* sp. (Shrubland Alliance)	*Lycium shockleyi–Lycium pallidum* (Shrubland)
	Larrea tridentata/Ambrosia dumosa (Shrubland Alliance)	*Larrea tridentata/Ambrosia dumosa* (Shrubland)
	Atriplex confertifolia–Ambrosia dumosa (Shrubland Alliance)	*Atriplex confertifolia–Ambrosia dumosa* (Shrubland)
Transition Zone	*Hymenoclea-Lycium* (Shrubland Alliance)	*Lycium andersonii–Hymenoclea salsola* (Shrubland)
		Hymenoclea salsola–Ephedra nevadensis (Shrubland)
	Ephedra nevadensis (Shrubland Alliance)	*Menodora spinescens–Ephedra nevadensis* (Shrubland)
		Eriogonum fasciculatum–Ephedra nevadensis (Shrubland)
		Krascheninnikovia lanata–Ephedra nevadensis (Shrubland)
		Ephedra nevadensis–Grayia spinosa (Shrubland)
	Coleogyne ramosissima (Shrubland Alliance)	*Coleogyne ramosissima–Ephedra nevadensis* (Shrubland)
Great Basin Desert	*Atriplex* sp. (Shrubland Alliance)	*Atriplex confertifolia–Kochia americana* (Shrubland)
		Atriplex canescens–Krascheninnikovia lanata (Shrubland)
	Chrysothamnus–Ericameria (Shrubland Alliance)	*Chrysothamnus viscidiflorus–Ephedra nevadensis* (Shrubland)
		Ericameria nauseosa–Ephedra nevadensis (Shrubland)
	Artemisia sp. (Shrubland Alliance)	*Ephedra viridis–Artemisia tridentata* (Shrubland)
		Artemisia tridentata–Chrysothamnus viscidiflorus (Shrubland)
		Artemisia nova–Chrysothamnus viscidiflorus (Shrubland)
		Artemisia nova–Artemisia tridentata (Shrubland)
	Pinus monophylla/Artemisia sp. (Woodland Alliance)	*Pinus monophylla/Artemisia nova* (Woodland)
		Pinus monophylla–Artemisia tridentata (Woodland)

Source: DOE/NV 2000d.

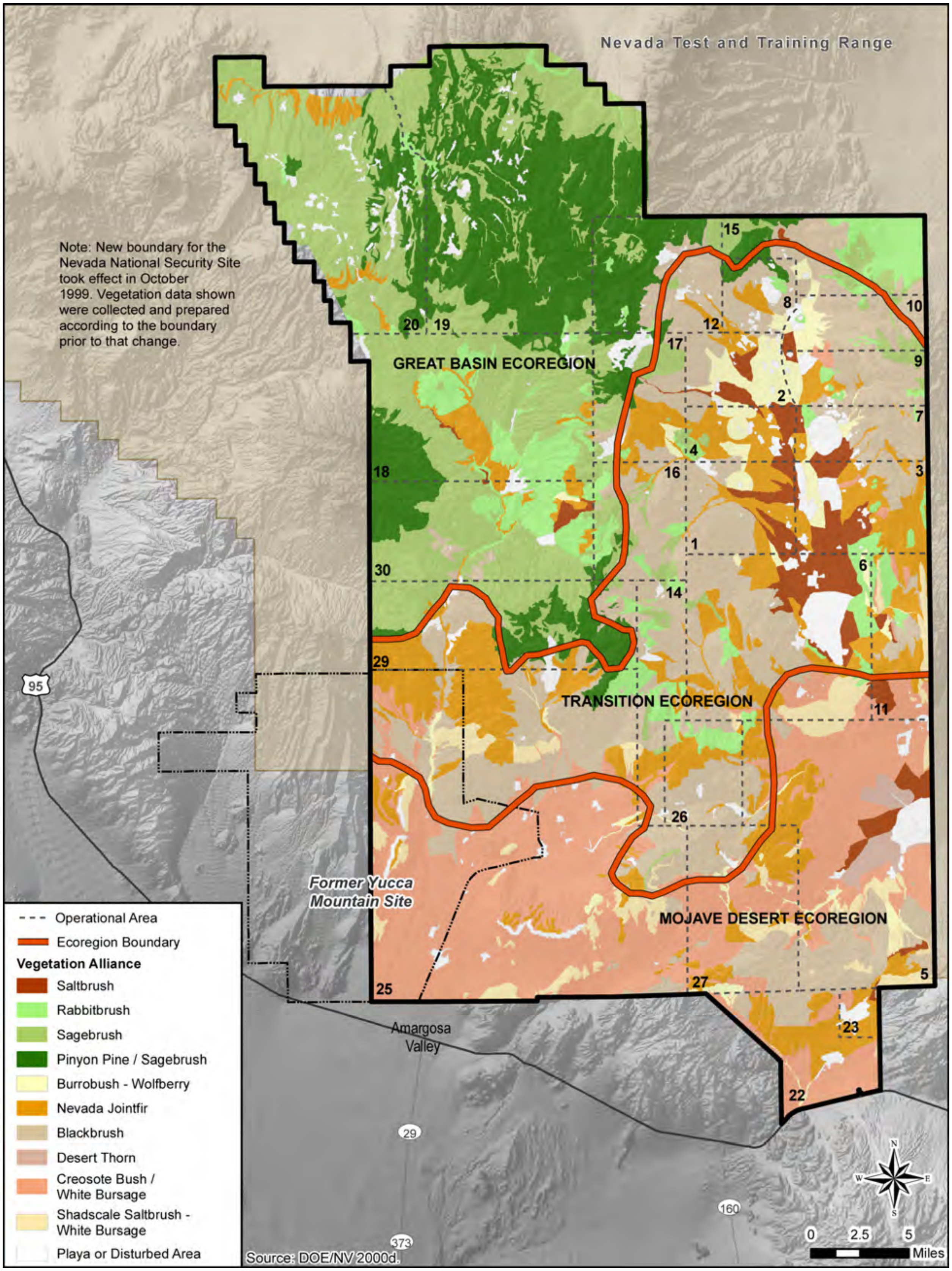

Figure 4–22 Nevada National Security Site Soil Alliances

The flora of the NNSS has been studied extensively and over 750 plant taxa have been collected (DOE/NV 2010). A list of plants found on the NNSS is presented in Appendix F, Tables F–2 and F–3. Table F–1 contains a list of sensitive plant species known to occur on or adjacent to the NNSS.

Early research on vegetation on the NNSS was conducted by Janice C. Beatley. Dr. Beatley established permanent plots on the NNSS in 1963, characterized the common plant associations of the northern Mojave and transition Great Basin Desert, and began documenting long-term changes in these ecosystems (Webb et al. 2003). Dr. Beatley collected data from these permanent plots between 1963 and 1975. In a 2003 USGS report, Webb et al. (2003) presented data on perennial vegetation on the Beatley plots from 1963 through 2003. Webb et al. relocated the Beatley plots and remeasured the vegetation, noting changes in vegetation since the original measurements made by Dr. Beatley. Webb et al. found a striking increase in plant biomass between 1963 and 2000. However, there were some changes in species composition since 1963. Plant associations dominated by creosote bush had large increases in the heights of individual plants, as well as increases in total cover, whereas those dominated by saltbush species had large decreases in cover. Some plots dominated by blackbrush had small decreases in perennial plant cover. The causes of the changes in vegetation are not certain, although Webb et al. indicated the most likely causes could be precipitation increases or increases in atmospheric carbon dioxide.

4.1.7.1.1 Mojave Desert

Mojave Desert plant communities are found at elevations below approximately 4,000 feet. These communities occur on the alluvial fans and valley bottoms of Jackass Flats, Rock Valley, and Mercury Valley and on the alluvial fans of Frenchman Flat. Creosote bush (*Larrea tridentata*) is the dominant shrub within these areas. The soil type and elevation are also contributing factors to the community composition. Shadscale saltbush (*Atriplex confertifolia*) is co-dominant with creosote bush on most alluvial fans where desert pavement is common. On deep, loose soil, such as exists on southern Jackass Flats and northeastern Frenchman Flat, creosote bush is co-dominant with white bursage (*Ambrosia dumosa*) and includes species such as winterfat (*Krascheninnikovia lanata*) and Indian ricegrass (*Achnatherum hymenoides*). Range ratany (*Krameria parvifolia*), Nevada jointfir (*Ephedra nevadensis*), and Fremont indigo bush (*Psorothamnus fremontii*) are common in both communities. At roughly an elevation of 3,500 to 4,000 feet along the northern and eastern slopes of Jackass Flats and the western half of Frenchman Flat, creosote bush, hopsage (*Grayia spinosa*), and wolfberry (*Lycium andersonii*, *L. pallidum*, and *L. shockleyi*) are the dominant shrub species.

4.1.7.1.2 Transition Zone

Two plant communities are unique to the transition zone between the Mojave Desert and Great Basin Desert ecoregions. The first is best developed at elevations from 4,000 to 5,000 feet on alluvial fans and valley floors. The dominant shrub in this community is blackbrush (*Coleogyne ramosissima*), which occurs in mixed stands with creosote bush on the northern alluvial fans of Jackass and Frenchman Flats below about 4,500 feet. At higher elevations (e.g., on the valley floor of Tonopah and Mid Valleys and on the western slopes of Yucca Flat), blackbrush occurs in large, nearly monotypic stands. The second unique transition community occurs in the bottom of the enclosed Frenchman Flat and Yucca Flat basins, where the trapped winter air lowers temperatures below those typical of the Mojave Desert (Beatley 1976). The most abundant shrubs in these areas are hopsage and three species of wolfberry. Winterfat is also common in silty soils. Shadscale saltbush, four-winged saltbush (*Atriplex canescens*), and horsebrush (*Tetradymia glabrata*) can also be found in enclosed basins. Little or no vegetation grows on the playas in these basins.

4.1.7.1.3 Great Basin Desert

Plant communities typical of the desert occur in the Great Basin at elevations generally above 5,000 feet in the northern third of the NNSS. Most of the basin floor is covered with shadscale, and winterfat is also common. On deep, loose soils at middle elevations (4,500 to 5,500 feet), the plant community is dominated by four-winged saltbush. Sagebrush (*Artemisia* sp.) begins to appear at 5,000 feet and is the dominant plant on large parts of Pahute Mesa and Rainier Mesa, as well as elsewhere in the northwestern part of the NNSS. Big sagebrush (*Artemisia tridentata*) is the most abundant shrub on sites with deep soils in this area, and black sagebrush (*Artemisia nova*) is most abundant on the shallow soils of slopes and uplands. Pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) are co-dominant with sagebrush above 6,000 feet and form open shrub woodland. Sites on the NNSS with vegetation or soil modified by nuclear test activities, construction, or other disturbances usually have plant communities that are different from adjacent undisturbed areas. Some of the species that colonize disturbed areas (e.g., cheesebush *[Hymenoclea salsola]* and punctate rabbitbrush *[Chrysothamnus paniculatus]*) are native plants that usually occur in washes. However, most species found on disturbed sites are introduced plants such as red brome (*Bromus rubens*), cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola tragus*), and red-stemmed filaree (*Erodium cicutarium*).

Natural succession of disturbed areas on the NNSS is generally a slow process. Studies of natural succession in the Mojave Desert have shown that several decades, or even centuries, may be required to establish similar plant cover and productivity (Angerer et al. 1994). Because of the increased and more-consistent precipitation, succession rates in the Great Basin Desert are generally quicker than those in the Mojave Desert. Active revegetation of sites can greatly enhance secondary succession. Variables that have been determined to be important in revegetation success are (1) adequate moisture during seed germination and establishment; (2) favorable soil conditions, including depth, texture, fertility, and reduced compaction; and (3) use of species adapted or native to the site.

The only biological communities on and around the NNSS that are not widespread are those associated with springs or other permanent sources of water. There are 16 springs, 10 seeps, 4 tank sites (natural rock depressions that catch and hold surface runoff), and 2 ephemeral ponds on the NNSS (Bechtel Nevada 1998b, 1999; Hansen et al. 1997). Most natural springs are on the mesas and mountains in the northern part of the NNSS (see Figure 4–22); most reservoirs are scattered through the valley bottom to the east and south. There are no springs in the valley bottom areas. Groundwater under the NNSS flows primarily to the south and west and discharges from springs in Ash Meadows, Oasis Valley, and Death Valley (see Section 4.1.5). Most of the springs at the NNSS support wetland (hydrophytic) vegetation, such as cattail, sedges, and rushes, which likely constitute wetlands, as defined by the U.S. Army Corps of Engineers and EPA (33 *Code of Federal Regulations* [CFR] 328.3(b) and 40 CFR 230.3(t), respectively).

4.1.7.1.4 Important Habitats

In 1998, DOE/NNSA evaluated selected biotic and abiotic data collected from ecological landform units to identify areas of the NNSS that may warrant active protection from land-disturbing activities (Bechtel Nevada 1999). Four habitat types on the NNSS were identified as "important habitats": (1) pristine habitat includes areas that have few manmade disturbances; (2) unique habitat contains uncommon biological resources, such as a natural wetland; (3) sensitive habitat includes areas in which vegetation recovers very slowly from direct disturbance (e.g., areas with high susceptibility to wind erosion); and (4) diverse habitat has high plant species diversity (DOE/NV 1998d). Important habitats are shown in **Figure 4–23**. DOE/NNSA believes that the long-term protection of these important habitats is one method by which overall cumulative impacts on biological resources may be minimized. During siting for new projects, these important habitats are avoided whenever possible. Important habitats on the NNSS are not based on regulatory requirements, but were developed as management tools.

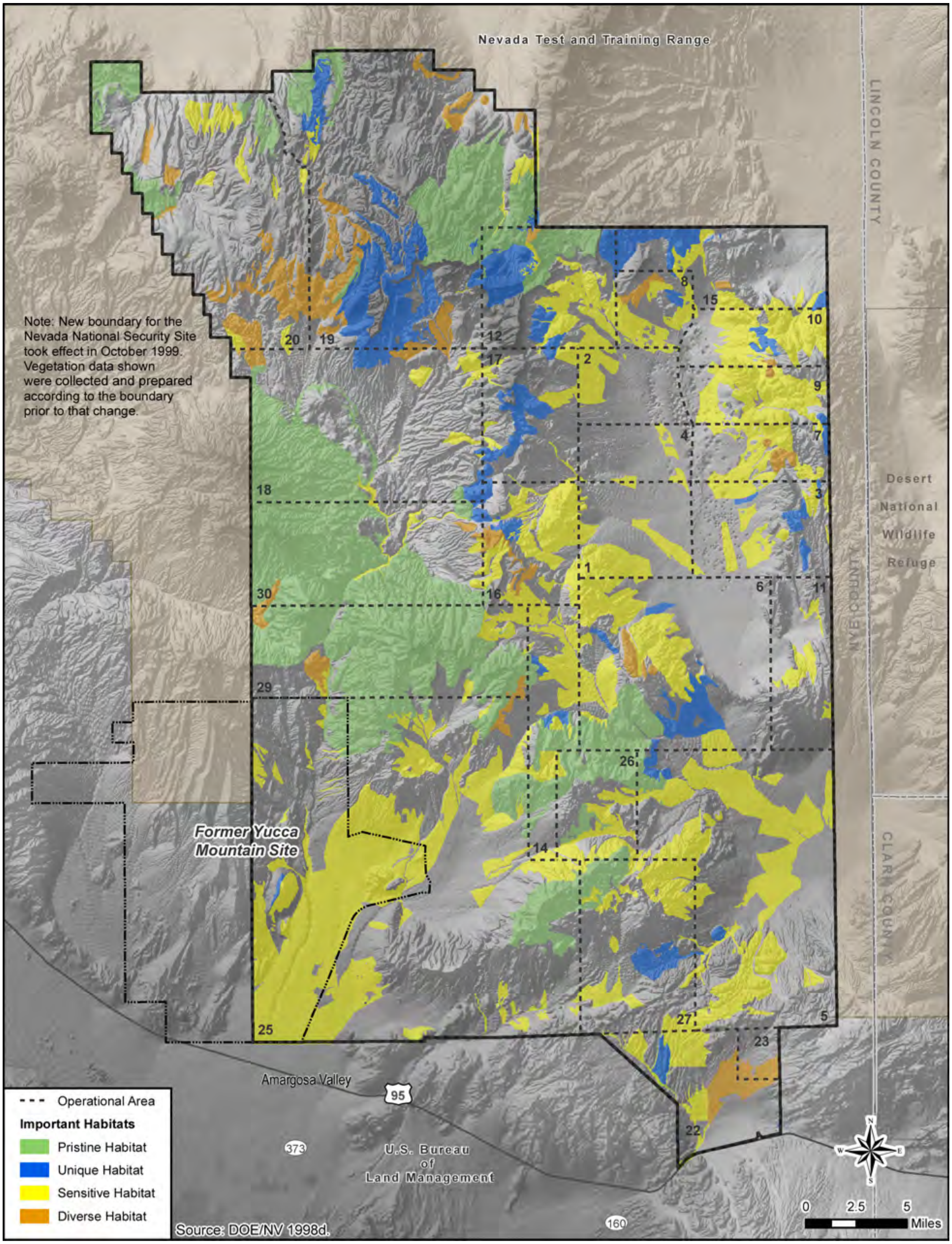

Figure 4–23 Important Habitats on the Nevada National Security Site

4.1.7.2 Fauna

At least 1,163 taxa of invertebrates within the phylum Arthropoda (animals that have an exoskeleton, a segmented body, and jointed appendages) have been identified on the NNSS. Of the known arthropods, 78 percent are insects (DOE/NV 2010). Ants, termites, and ground-dwelling beetles are probably the most important groups of insects on the NNSS in regard to distribution, abundance, and functional roles.

Approximately 300 vertebrate species have been observed on the NNSS, including 60 species of mammals, 239 species of birds, 34 species of reptiles, and 3 species of introduced fish (Wills and Ostler 2001). Approximately 80 percent of the bird species on the NNSS are migrants or seasonal residents (Wills and Ostler 2001). As of 2010, 26 bird species, including 9 raptor species (birds of prey), are known to breed on the NNSS. Raptors that breed on the NNSS include the golden eagle (*Aquila chrysaetos*), long-eared owl (*Asio otus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), prairie falcon (*Falco mexicanus*), American kestrel (*Falco sparverius*), western burrowing owl (*Athene cunicularia hypugaea*), barn owl (*Tyto alba*), and great-horned owl (*Bubo virginianus*) (DOE 2002c). There have been about 300 sightings of golden eagles on the NNSS dating back to 1968. Golden eagle nesting at the NNSS is uncommon. There have been only two documented nests of golden eagles (both in 1999) and only one of those had confirmed young. One of these nests was located on Rainier Mesa near P Tunnel in Area 2 and the other was on the cliffs south of Tippipah Spring in Area 16 (Ostler 2012).

A list of animals that have been sighted on the NNSS is presented in Appendix F, Tables F–4 and F–5. See Table F–1 for a list of sensitive animal species known to occur on or adjacent to the NNSS. Many of the predators and scavengers in this region are widespread and utilize a variety of habitat types. These include coyote (*Canis latrans*), bobcat (*Lynx rufus*), common raven *(Corvus corax)*, red-tailed hawk, loggerhead shrike *(Lanius ludovicianus)*, speckled rattlesnake (*Crotalus mitchellii*), and gopher snake *(Pituophis catenifer)*. Other common species are the long-tailed pocket mouse (*Chaetodipus formosus*), desert woodrat (*Neotoma lepida*), white-tailed antelope squirrel (*Ammospermophilus leucurus*), black-tailed jackrabbit (*Lepus californicus*), black-throated sparrow (*Amphispiza bilineata*), horned lark (*Eremophila alpestris*), Say's phoebe (*Sayornis saya*), and western kingbird (*Tyrannus verticalis*). The side-blotched lizard (*Uta stansburiana*), western whiptail (*Cnemidophorus tigris*), and desert horned lizard (*Phrynosoma platyrhinos*) are the most abundant lizards on the NNSS (Wills and Ostler 2001). The nonnative bullfrog (*Rana catesbeiana*) is the only amphibian that is known to occur on the NNSS (DOE/NV 2010).

Many animal species on the NNSS are common only in the Mojave Desert habitats to the south or the Great Basin Desert habitats to the north. Typical Mojave Desert species found on the NNSS include kit fox (*Vulpes macrotis*), Merriam's kangaroo rat (*Dipodomys merriami*), desert tortoise (*Gopherus agassizii*), chuckwalla (*Sauromalus obesus*), western shovelnose snake (*Chionactis occipitalis)*, and sidewinder snake (*Crotalus cerastes*). Typical Great Basin species in this region include cliff chipmunk (*Eutamias dorsalis*), Great Basin pocket mouse (*Perognathus parvus)*, mule deer (*Odocoileus hemionus*), northern flicker (*Colaptes auratus*), western scrub-jay (*Aphelocoma californica*), Brewer's sparrow (*Spizella breweri*), western fence lizard (*Sceloporus occidentalis*), and striped whipsnake (*Masticophis taeniatus*). About 36 adult wild horses (*Equus caballus*) (not including foals) live on the northern part of the NNSS, usually on or near Rainier Mesa (NSTec 2010).

Some animal species on the NNSS have more-specific habitat requirements and are less widespread. Desert kangaroo rats (*Dipodomys deserti*) are associated with loose, sandy soils at lower elevations. Dark kangaroo mice (*Microdipodops megacephalus*) are restricted to fine, gravelly soils at higher elevations. Chuckwallas occur primarily in rocky outcrops. Desert night lizards (*Xantusia vigilis*) are usually found in stands of yuccas. Many of the birds on the NNSS, including almost all of the waterfowl and shorebirds, use the playas in Frenchman Flat and Yucca Flat, artificial ponds at springs, and sewage lagoons during their migration and/or during winter (Hayward et al. 1963). Bats often seek food over these water sources.

A total of 138 species of animals have been documented at NNSS wetland sites (Wills and Ostler 2001). The largest group of vertebrates using NNSS wetlands is birds (100 species). Passerine birds constitute the majority of birds recorded (80 species). Cane Spring and Yucca Playa Pond are the only natural NNSS locations that are known to attract migratory waterfowl. Many freshwater invertebrates occur in NNSS wetland sites, including an undescribed fairy shrimp. Scat of the desert tortoise has been found at the Rock Valley Tank site.

Wild horses occur in the northern half of the NNSS; their distribution may be related to the location of manmade ponds. Camp 17 Pond in the northwestern corner of Area 18 and Gold Meadows Spring in Area 12 (a natural water source) are heavily used by horses. Camp 17 Pond was used less frequently in 2008 compared with 2007 because 2008 had a wetter spring than 2007, which reduced the water needs of the wild horses (NSTec 2009a). Mule deer use these ponds as well.

An annual horse census is conducted by driving selected NNSS roads and using cameras to record individual markings of animals. Total numbers have dropped from 42 in 2007 to 35 in 2008 (see **Table 4–37**). A similar number of horses was observed in 2009 as in 2008 (i.e., 36 adults, 1 yearling, and 6 foals) (NSTec 2010j). Their estimated range of 222 square kilometers in 2009 is very similar in size to the horse range in 2007 and 2008 (NSTec 2010j). Camp 17 Pond and Gold Meadows Spring continue to be important summer water sources for horses.

Table 4–37 Number of Individual Horses Observed on the Nevada National Security Site by Age Class, Sex, and Year

Age Class	*Year*							
	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Foals Yearlings	11 2	5 0	6 9	5 9 [a]	5 6	8 8	8 1	9 0
Sex [b]	**M / F**	**M / F**	**M / F**	**M / F**	**M / F**	**M / F**	**M / F**	**M / F**
2-Year-Olds	2/2	0/2	0/0	4/4	5/4	3/3	2/3	0/0
3-Year-Olds	0/0	2/2	0/2	0/0	4/4	4/4	1/3	1/1
Older than 3 Years Old	11/20	8/19	8/20	6/21	5/21	7/24	5/27	6/27
Total	37	33	38	44	49	53	42	35

M = male; F = female.
[a] One of the nine was found dead.
[b] Excludes foals and dead horses.
Source: NSTec 2009a.

As described in Section 4.1.5.2, surface runoff periodically ponds on the playas in Yucca and Frenchman Flats. The length of time that water remains on playas and the extent to which playas are used by migratory shorebirds are not routinely monitored. However, water has been observed on the playas for periods of days to months following rainstorms. Occasionally, migratory shorebirds have been observed when the playas are inundated during the spring or fall migratory season.

Several species of state-designated game animals occur in the NNSS, including 412 mule deer (NSTec 2009a) and an unknown number of mountain lions (*Puma concolor*), desert and Nuttall's cottontails (*Sylvilagus nuttallii*), chukar (*Alectoris chukar*), Gambel's quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), and several species of waterfowl. Pronghorn (*Antilocapra americana*) can be seen year-round on the NNSS, particularly in Yucca Flat and in Frenchman Flat in small numbers. Another game animal, the desert bighorn sheep (*Ovis canadensis* ssp. *nelsoni*), is a rare visitor on the NNSS, with only eight recorded observations of its presence on or near the NNSS since 1963. In the past, the species was observed in Mercury and on Rainier Mesa (Wills and Ostler 2001). During 2009, desert bighorn sheep were photographed by motion-activated cameras at Topopah Spring in Area 29 and on Skull Mountain in Area 25, and a ram was documented in Area 18. There is an established population of desert bighorns in the Specter Range south of the NNSS and other populations north and west of the NNSS. Until recently, it was thought the NNSS might only provide a suitable corridor for movement between these populations; however, as part of a recent study of mountain lions on the NNSS, a total of five kills of young (1- to 4-month-old) lambs have been documented in the Fortymile Canyon/Calico Hills area. Although lambing areas have not been documented on the NNSS, this evidence suggests they do exist (Ostler 2012). Further field studies will be needed to determine if the observed desert bighorn sheep are transients or if they are, or will become, residents on the NNSS (NSTec 2010j). Bobcats (*Lynx rufus*), gray foxes (*Urocyn cinereoargenteus*), and kit foxes (*Vulpes macrotis*) are the only state-designated fur-bearing animals on the NNSS. No hunting or trapping is allowed on the NNSS.

4.1.7.3 Threatened and Endangered Species

The only species that has been listed by USFWS as threatened or endangered that occurs on the NNSS is the Mojave Desert population of the desert tortoise. The desert tortoise was listed as threatened by USFWS in 1990. The State of Nevada classifies the desert tortoise as a threatened species, and it is protected under *Nevada Revised Statutes*, Chapter 501.

In 1996, USFWS issued the *Final Programmatic Biological Opinion for Nevada Test Site Activities* (*1996 Biological Opinion*) (USFWS 1996) to the DOE/NNSA NSO, covering activities occurring within desert tortoise habitat on the NNSS. The *1996 Biological Opinion* authorized the incidental “take” (accidental killing, injury, harassment, etc.) of desert tortoises that may occur during NNSS activities. In July 2008, the DOE/NNSA NSO provided USFWS with a biological assessment of activities anticipated to occur on the NNSS over the following 10 years and entered into formal consultation with USFWS to obtain a new Biological Opinion. In February 2009, USFWS issued the *2009 Biological Opinion* (USFWS 2009a) to the DOE/NNSA NSO. Both the *1996 Biological Opinion* and the *2009 Biological Opinion* concluded that activities anticipated to occur on the NNSS would not jeopardize the continued existence of the Mojave population of desert tortoises and no critical habitat would be destroyed or adversely modified. Under the *2009 Biological Opinion*, before implementing any new activity in desert tortoise habitat, DOE/NNSA provides specified information and consults with USFWS to determine if the anticipated incidental take for each action, at the project level, complies with the programmatic *2009 Biological Opinion*. If a proposed activity or group of activities would result in an exceedance of the *2009 Biological Opinion*, DOE/NNSA would consult with USFWS, in accordance with Section 7 of the Endangered Species Act.

Desert tortoises generally occur throughout the southern third of the NNSS (Rautenstrauch et al. 1994). They are found more commonly in bajadas and lower slopes of southern mountains and are rare or absent from the lower basins, particularly in Frenchman Flat. The northern boundary of the desert tortoise range on the NNSS is shown in **Figure 4–24**. Because the Former Yucca Mountain site was not under the jurisdiction of the NNSA/NSO at the time tortoise surveys were conducted for developing the data in Figure 4–24 and compatible data is not available, that area does not have any population densities displayed in the figure; however, for purposes of analysis in this SWEIS, it was assumed that tortoise population densities would be similar to adjacent areas of the NNSS (i.e., ranging from “None to Very Low” to “Low”). The total area of the NNSS (including the portion that is shown as the “Former Yucca Mountain Site in Figure 4–24) that is within the range of the desert tortoise is about 328,400 acres. Overall, approximately 7,350 acres, or 2 percent, of NNSS land within desert tortoise range has been disturbed in the past by construction of facilities and infrastructure and other activities. The net area of desert tortoise habitat at the NNSS is about 321,050 acres. The population density of desert tortoises on the NNSS is considered to be “very low” (USFWS 2009a). Within the NNSS, the northern extent of the desert tortoise occurs between elevations of approximately 3,900 and 4,880 feet. The vegetation in the boundary region is dominated by blackbrush, creosote bush, white bursage, spiny hopsage, and Anderson wolfberry (Beatley 1976; DOE/NV 2000d).

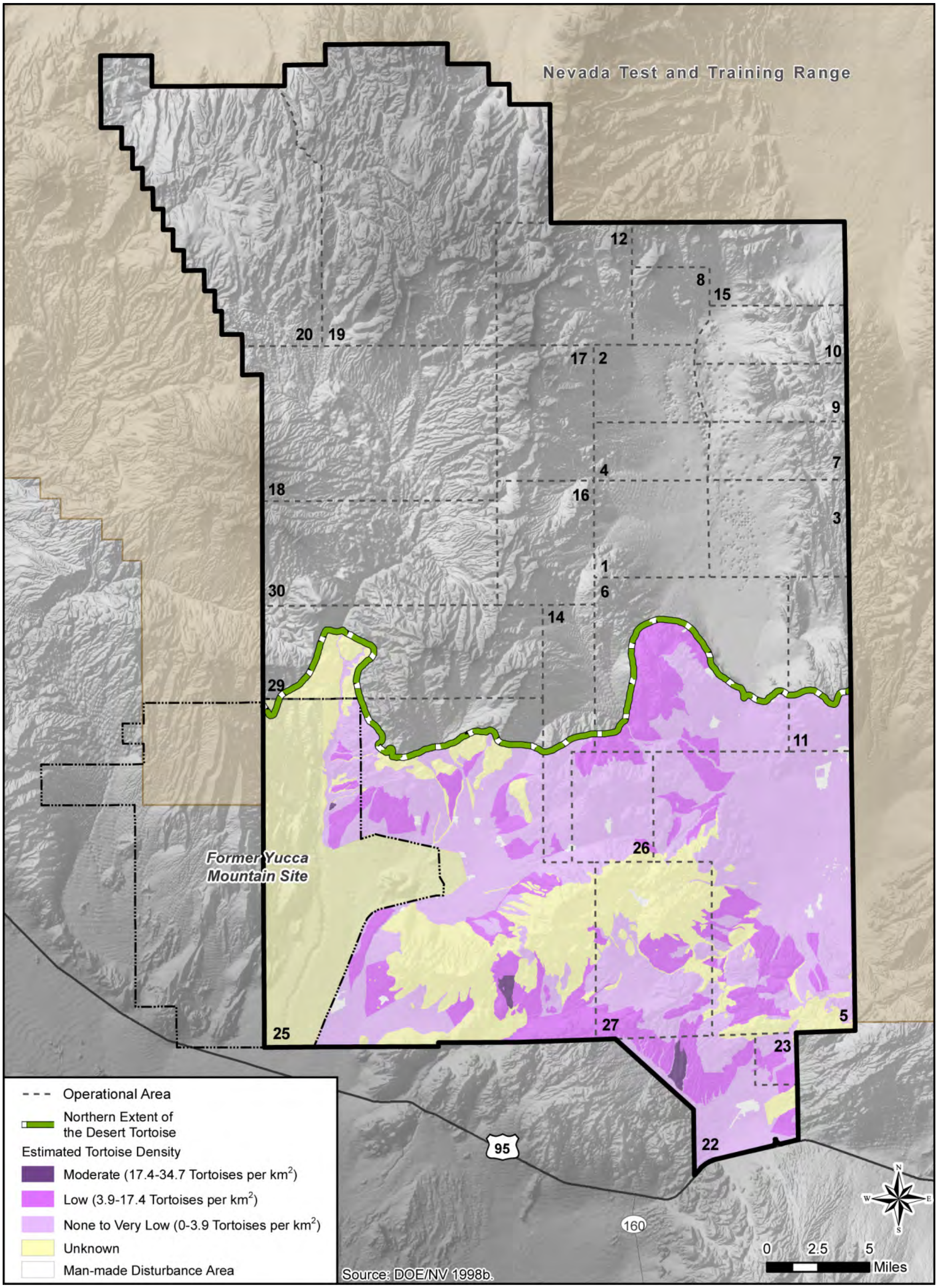

Figure 4–24 Northern Boundary of the Desert Tortoise Range on the Nevada National Security Site

Based on 1996 studies, the relative abundance of the desert tortoise on the NNSS ranges from very low or none (0–3.9 tortoises per square kilometer) to moderate (17.4–34.7 tortoises per square kilometer) (DOE/NV 1998b). Overall, the relative abundance of the desert tortoise on the NNSS is low to very low relative to other areas within the tortoise's range (EG&G 1991). The NNSS contains less than 1 percent of the total habitat of the overall desert tortoise population. A cumulative total of approximately 311 acres of desert tortoise habitat on the NNSS has been disturbed since the desert tortoise was listed in 1992 (NSTec 2009a). Critical habitat for the desert tortoise has not been designated on the NNSS, nor is the NNSS within any Desert Wildlife Management Area delineated in the *Desert Tortoise (Mojave Population) Recovery Plan* (USFWS 1994).

No federally listed threatened or endangered plants are known to occur on the NNSS (NSTec 2010j). However, 18 species of vascular plants and 1 non-vascular plant on the NNSS are considered to be sensitive by the Nevada Natural Heritage Program. Appendix F, Table F–1, includes a list of sensitive plant species known to occur on or near the NNSS. Also in Appendix F is a map showing the known locations of sensitive plant species on the NNSS.

The delisted peregrine falcon (*Falco peregrinus*) and delisted bald eagle (*Haliaeetus leucocephalus*) have also been reported on the NNSS. These species are rare migrants in this region and each has only been sighted once on the NNSS (Greger and Romney 1994). The peregrine falcon was removed from the threatened and endangered species list in 1999 (64 FR 46542), while the bald eagle was removed in 2007 (72 FR 37346). USFWS will monitor the bald eagle population status for a minimum of 5 years after delisting, as required by the Endangered Species Act. The bald eagle will continue to be protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The State of Nevada lists this species as endangered.

4.1.7.4 Other Species of Concern

There are 88 sensitive and protected/regulated species known to occur on or adjacent to the NNSS (NSTec 2010j): 1 moss, 22 flowering plants (including 3 species of yucca, 1 of agave, and 18 cacti), 1 mollusk, 2 reptiles (including the desert tortoise), 15 birds, and 27 mammals. Two of the bird species, chukar (*Alectois chukar*) and Gambel's quail (*Callipepla gambelii*), are regulated as game species and 7 mammals are regulated as game species, as follows: pronghorn antelope (*Antilocarpra americana*), Rocky Mountain elk (*Cervus elaphus*), desert bighorn sheep (*Ovis canadensis nelsoni*), mule deer (*Odocoileus hemionus*), mountain lion (*Puma concolor*), Audubon's cottontail (*Sylvilagus audubonii*), and Nuttall's cottontail (*Sylvilagus nuttallii*). Three species are regulated as furbearers: bobcat, gray fox, and kit fox. Protected and sensitive species of plants and animals are listed in Appendix F, Table F–1. DOE/NNSA reviews the list of sensitive and protected/regulated species each year and conducts ongoing biological surveys to ascertain the presence of sensitive plant and animal species at the NNSS as part of its Ecological Monitoring and Compliance Program.

As discussed above, the Ecological Monitoring and Compliance Program monitors the ecosystem of the NNSS and ensures compliance with laws and regulations pertaining to NNSS biota. An annual report is prepared that summarizes program activities.

As noted above, there are a large number of sensitive wildlife species on the NNSS. One species of potentially sensitive reptiles is present, the western red-tailed skink (*Eumeces gilberti rubricaudatus*). NNSS-wide population numbers are unknown; however, eight red-tailed skinks were captured at 4 of 31 survey sites in 2008 (NSTec 2009a). Western red-tailed skinks have been found primarily in the western and northern portions of the NNSS (NSTec 2010j).

The western burrowing owl (*Athene cunicularia hypugaea*) is the main bird species that may be affected by activities on the NNSS. This species is ground-dwelling and uses burrows found in dry, open areas with flat to gradually sloping terrain. It can be found in most of the major valleys in the eastern and southern portions of the NNSS. Western burrowing owl monitoring, including trapping, has been ongoing on the NNSS for a number of years. A total of 26 breeding pairs and 122 young were detected over a 3-year period from 1999 to 2001 (Hall et al. 2003). There were 7, 8, and 11 breeding pairs and 24, 43, and 55 young detected during 1999, 2000, and 2001, respectively (Hall et al. 2003).

Eight bat species of concern that are known to occur on the NNSS include the spotted bat (*Euderma maculatum*), Townsend's big-eared bat (*Corynorhinus townsendii*), big free-tailed bat (*Nyctinomops macrotis*), long-eared myotis (*Myotis evotis*), small-footed myotis (*M. ciliolabrum*), fringed myotis (*M. thysanodes*), long-legged myotis (*M. volans*), and Yuma myotis (*M. yumaensis*) (Wills and Ostler 2001). Bat monitoring in 2008 included passive acoustic monitoring, preclosure monitoring at tunnels, and removing bats from buildings (NSTec 2009a).

Although not listed as sensitive, all bird species that occur on the NNSS, except chukar (*Alectois chukar*), Gambel's quail (*Callipepla gambelii*), English house sparrow (*Passer domesticus*), rock dove (*Columba livia*), and European starling (*Sturnus vulgaris*), are protected under the Migratory Bird Treaty Act (the noted bird species are not migratory and, therefore, are not covered by the Migratory Bird Treaty Act). As part of pre-activity planning on the NNSS, biological surveys are conducted to ensure protection of sensitive and otherwise protected species. Active nests of migratory birds are protected until the young fledge by avoiding activities that would cause direct harm, such as damaging or destroying a nest, or indirect harm, such as causing disturbance that would cause parent birds to abandon their eggs or young. For example, in 2009, three nests with chicks were protected from harm, including one Say's phoebe nest with four chicks and two nests of unknown species, each with chicks. NNSS activities that may have caused harm to these nests were postponed until the chicks fledged and the nests were empty (DOE/NV 2010).

4.1.7.5 Effects of Past Radiological Tests and Project Activities

A number of studies were conducted to document the types and extent of disturbances of the biological resources that may have resulted from past projects. Much of the focus was on determining the fate and effects of radionuclides, especially TRU radionuclides (Dunaway and White 1974; Gilbert et al. 1988; Howard and Fuller 1987; Howard et al. 1985; White and Dunaway 1975, 1976, 1978; White et al. 1977a, 1977b). Long-term impacts resulting from nuclear tests and nonradiological causes were also investigated (Hunter 1992, 1994a, 1994b, 1994c, 1995).

In areas where atmospheric tests, safety tests, or cratering experiments were conducted, there were measurable changes in the species composition and abundance of plants and animals. Immediately following some tests that deposited fallout containing beta-emitters, shrubs that were more radiosensitive, such as sagebrush, were killed, and a grass disclimax was established. The projects also involved nonradiological physical and mechanical disturbances that altered the characteristics of the soils and usually resulted in the removal of the shrubs, which are a key component of the structure and functioning of these desert ecosystems. The ecological changes observed were similar to effects associated with other human activities that disturb desert habitats, and few could be attributed solely to radiological impacts.

A herd of cattle was allowed to graze the northwestern part of the NNSS for 25 years (Smith and Black 1984). Periodically, tissues of cattle, deer, and bighorn sheep were analyzed for concentrations of radionuclides. Results of this program suggested that, since 1956, no significant amounts of biologically available radionuclides were contributed by activities on the NNSS. Except for periods immediately following the deposition of close-in fallout, tissue concentrations of cesium-137 and strontium-90 reflected the deposition of worldwide fallout. Concentrations of tritium were within the ranges present in the general environment, except in tissues of animals that had access to point sources of tritium, such as the Sedan Crater or the containment ponds in Area 12.

Hypothetical dose commitments for daily ingestion of NNSS beef over varying lengths of time were less than 2 percent of the Federal Radiation Council or the International Commission on Radiological Protection guidelines. Both the calving rate of the herd, which exceeded 85 percent annually, and the 180-day weaning weight, usually greater than 400 pounds, were above average. Routine necropsy and histopathological examinations revealed no harmful health effects that could be attributed to ionizing radiation in herbivores maintained for a lifetime on the NNSS.

Concentrations of radionuclides in soils, plants, and animals in the vicinity of some past tests were above general background levels. Concentrations usually decreased by a factor of 10 between soils and plants and between plants and animals. This is likely due to the fact that plants do not take up all of the contaminants available in the soil and animals, being mobile, may obtain their food from both contaminated and uncontaminated areas. In addition, some contaminants may not be absorbed by the animals, moving through the digestive tract of the animal and being excreted. Chromosomal aberrations were observed in cells of spiny sagebrush collected from Area 11, but the yields may not have been greater than what would be observed in the population naturally, and whether they were valuable or detrimental to the population was undetermined. Depressed levels of circulating lymphocytes and total leukocyte counts were found in kangaroo rats collected in areas contaminated with plutonium, but they were considered to be physiologically inconsequential. Gross pathological changes in native mammals appeared to be minimal and nonspecific. Reproduction in and recruitment to mammalian populations inhabiting contaminated areas were determined to occur largely in response to changes in the food supply of winter annual plants rather than in response to levels of radiation.

In a 2001 paper, Theodorakis et al. reported on a study that examined the effects of radionuclide exposure on Merriam's kangaroo rats at two radiologically contaminated atomic detonation locations on the NNSS. This research found that while genotoxic effects were not observed when all individuals were analyzed, individuals with gene sequences unique to the contaminated sites had greater chromosomal damage than contaminated-site individuals with gene sequences shared with reference (i.e., noncontaminated) sites. The researchers hypothesized that shared-gene-sequence individuals are potential migrants and that unique-gene-sequence individuals are potential long-term residents. They concluded that the radiologically contaminated detonation sites are ecological sinks and that immigration masks the potential mutagenic/carcinogenic effects of radiation on the resident population (Theodorakis et al. 2001). This suggests that individuals of a species that spend a majority of their lives living in a radiologically contaminated area would be more likely to exhibit genetic damage from the radioactivity than members of the same species that may only spend a small portion of their lives in the contaminated area. This would tend to reduce the likelihood of animals from the NNSS passing on damaged genes to animal populations in offsite areas.

The long-term consequences of past DOE activities were studied at past ground zero locations above which atmospheric tests were conducted, within subsidence craters formed following underground tests, in burned areas, on compacted drill pads and scrapes, and along roadsides. One of the major findings was that ecological impacts resulting from DOE/NNSA programs on the NNSS did not differ in type or magnitude from those resulting from other human activities that disturb desert ecosystems. Changes in the vegetation resulted from changes in patterns and amounts of precipitation. Changes in the species composition of vertebrates appeared to be linked to the structure of the vegetation associations, and changes in abundance were in response to altered food supplies, which were linked to vegetation.

Changes to the structure and function of ecosystems were restricted to the immediate vicinity of project sites, and few long-term effects could be attributed to radiological impacts. Concentrations of radionuclides did not produce genetic or cytological abnormalities that appeared to be detrimental to species or populations either in the short or long term. Restoration of disturbed sites will likely follow the routes and rates of succession observed in comparable, manipulated desert ecosystems.

Public access to the NNSS is restricted and precludes the harvest of plants for direct consumption by humans. However, animals may consume contaminated vegetation or water on the NNSS and become contaminated. Because animals may travel off the NNSS, the ingestion of game animals is the primary potential biotic pathway of radiological exposure to the public. The annual radiological monitoring program for the NNSS includes sampling plants and animals at sites with the highest known concentrations of radionuclides. Sampling includes both plants and small game animals and, when available, larger animals that have been found dead on the NNSS (DOE/NV 2003a).

4.1.7.6 Plant and Animal Monitoring for Radioactivity

Historical atmospheric nuclear weapons testing, outfalls from underground nuclear tests, and radioactive waste disposal sites provide sources of potential radiation contamination and exposure to NNSS plants and animals. DOE Order 458.1, *Radiation Protection of the Public and the Environment*, Change 2 (dated June 6, 2011), requires, in part, that radiological activities that have the potential to impact the environment must be conducted in a manner that protects populations of aquatic animals, terrestrial plants, and terrestrial animals in local ecosystems from adverse effects due to radiation and radioactive material released from DOE operations and that when actions taken to protect humans from radiation and radioactive materials are not adequate to protect biota then evaluations must be done to demonstrate compliance. To demonstrate compliance with this requirement, DOE/NNSA monitors plants, animals, and their habitat at the NNSS to determine if the radiological dose exceeds DOE-established limits expressed in "rad" (radiation absorbed dose). Radiological dose limits for plants and animals are found in DOE Standard 1153-2002. Under that standard, dose rates equal to or less than the following are expected to have no direct, observable effect on plant or animal reproduction:

- 1 rad per day (0.01 grays per day [Gy/d]) for aquatic animals
- 1 rad per day (0.01 Gy/d) for terrestrial plants
- 0.1 rad per day (1 milligray per day) for terrestrial animals

DOE/NNSA annually samples plants and game animals to measure the potential for radionuclide transfer through the food chain and determine if NNSS biota are exposed to radiation levels harmful to their own populations. This monitoring includes sampling plants, burrowing animals, and soils at the Area 3 Radioactive Waste Management Site (RWMS) and the Area 5 RWMC as a measure of the integrity of waste disposal cells.

The goal for vegetation monitoring is to sample the most contaminated plants within the NNSS environment. These plants are generally found inside demarcated radiological areas near the "ground zero" locations of historical aboveground nuclear tests. The species selected for sampling represent the most dominant plants, such as trees, shrubs, herbs, or grasses at these sites.

The goal of sampling animals for the purpose of determining potential dose to biota is to select species that are most exposed and most sensitive to effects from radiation. In general, mammals and birds are more sensitive to radiation than fish, amphibians, or invertebrates (DOE 2002a). In addition, animals are sampled to determine potential dose to the public from ingesting their meat. For these reasons, and because no native fish or amphibians are found on the NNSS, the game animals listed in **Table 4–38** are monitored. The sampling strategy used to assess the integrity of radioactive waste containment includes sampling plants, animals, and soil excavated by ants or small mammals on top of waste covers. The animals monitored for assessing the integrity of radioactive waste containment are listed in Table 4–38.

Table 4–38 Nevada National Security Site Animals Monitored for Radionuclides

Game Animals Monitored for Dose Assessments		
Small Mammals	***Large Mammals***	***Birds***
Cottontail rabbit (*Sylvilagus audubonii*) Jackrabbit (*Lepus californicus*)	Mule deer (*Odocoileus hemionus*) Pronghorn antelope (*Antelocarpa americana*)	Mourning dove (*Zenaida macroura*) Chukar (*Alectoris chukar*) Gambel's quail (*Callipepla gambelii*)
Animals Monitored for Integrity of Radioactive Waste Containment or as Game Animal Analogs		
Kangaroo rat (*Dipodomys* sp.) Mice (*Peromyscus* sp.) Antelope ground squirrel (*Ammospermophilius leucurus*) Desert woodrat (*Neotoma lepida*)		

Source: DOE/NV 2010.

As shown in **Table 4–39**, the results of this ongoing monitoring program have consistently demonstrated that, while plants and animals that inhabit radiological sites or radioactive waste containment covers may have elevated concentrations of radionuclides in their bodies, the concentrations are well below levels considered harmful to the health of the plants or animals.

Table 4–39 Site-Specific Dose Assessment Results for Terrestrial Plants and Animals Sampled on the Nevada National Security Site

		Estimated Radiological Dose (rad per day)					
		To Plants			***To Animals***		
Location	***Year***	***Internal***	***External***	***Total***	***Internal***	***External***	***Total***
Area 10 (Sedan Crater)	2010	0.00279	0.00072	0.00351	0.00021	0.00072	0.0093
Area 12 (E-Tunnel Ponds)	2010	0.00003	0.00032	0.00035		NM	
Area 15 (Baneberry)	2010	0.0000004	0.00029	0.00029		NM	
Area 11 (Plutonium Valley)	2009	0.00062	0.0012	0.0018	0.0028	0.0012	0.0040
Area 3 (RWMS)	2009	0.00045	0.00012	0.00057	0.00042	0.00012	0.00054
Area 5 (RWMC)	2009	0.26	0.000003	0.26	0.00011	0.000003	0.00012
Area 20 (Schooner Crater)	2008	0.008	0.003	0.01	0.001	0.002	0.002
Area 12 (E-Tunnel Ponds)	2007	0.000099	0.000091	0.00019	0.000073	0.000091	0.00016
Area 3 (RWMS)	2007	0.0000053	0.0000086	0.000014	0.0000015	0.0000086	0.000010
Area 5 (RWMC)	2007	0.000021	0.0000057	0.000027	0.000021	0.0000057	0.000027
Area 14 (T2 Site)	2006	0.0009	0.0025	0.0034	0.0005	0.0025	0.0030
Area 10 (Sedan Crater) (dove)	2005	0.0010	0.0014	0.0024	0.00015	0.0014	0.0016
(jackrabbits)					0.00016	0.004	0.0016
Area 19 (U-19ad sump) (doves)	2005	NM	NM	NM	0.00034	0.0057	0.0060
Area 11 (Plutonium Valley) (dove)	2004	TO	TO	0.0004	TO	TO	0.001
(jackrabbit)					TO	TO	0.0007
Area 12 (E-Tunnel Ponds) (bat)	2004	NM	NM	NM	TO	TO	0.0005
Area 20 (Cabriolet) (dove)	2003			0.002	TO	TO	0.008
Area 12 (E-Tunnel Ponds) (dove)	2003	NM	NM	NM	TO	TO	0.002
Area 10 (Sedan Crater)	2003	TO	TO	0.002	NM	NM	NM
		Dose limit = 1 rad per day			**Dose limit = 0.1 rad per day**		

NM = Not measured; RWMC = Area 5 Radioactive Waste Management Complex; RWMS = Area 3 Radioactive Waste Management Site; TO = only total dose reported.
Source: DOE/NV 2004a, 2005f, 2006a, 2007d, 2008a, 2009d, 2010, 2011.

Biological Resources—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) knows the Nevada National Security Site (NNSS) contains an ancient playa, surrounded by mountain ranges. The runoff from these ranges serves to maintain a healthy desert floor and environment. Animals frequent the area, and there are numerous animal trails. Animals and the places where they live play a significant part in Indian history and lifestyle. The CGTO knows Indian people have lived on these lands since Creation value all plants and animals, yet some of these occupy more cultural significance in our lives. It is widely known that many Indian people still collect and use plants and animals that are found within the NNSS region. We describe these plants, animals, and insects in this section in an effort to demonstrate their importance to our well-being and survival, and their role in maintaining ecological balance to our Holy Land.

The CGTO knows, based on previous U.S. Department of Energy (DOE)-sponsored ethnobotany studies, that there are at least 364 American Indian traditional use plants on the NNSS (see Table C-1). Plants are still used for medicine, food, basketry, tools, homes, clothing, fire, and ceremony – both social and healing. Sage is used for spiritual ceremonies, smudging[1] and medicine. Indian rice grass and wheat grass are used for breads and puddings. Joshua tree is important for hair dye, basketry, foot ware, and rope. Globe mallow had traditional medicine uses, but in recent times is also used for curing European contagious diseases.

In order to convey the American Indian meaning of these plants, a series of ethnobotany studies were conducted and the findings used to establish a set of criteria for assessing the cultural importance of each plant and of places where plant communities exist. The CGTO provided these cultural guidelines so that National Environmental Poicy Act analyses and other agency decisions could be assessed from an American Indian perspective.

The CGTO knows, based on previous DOE-sponsored ethnofauna studies, there are at least 170 Indian use animals on the NNSS (see Table C-2). All are culturally important to Indian people.

The CGTO knows if they care for the earth and its resources, the Creator will always provide for them. The NNSS area was among the tribes' places to hunt and trap a variety of animals. It is known that special leaders within each tribe would organize large hunts where many Indian people participated. The Indian people would use these animals for many purposes, including food, bones for tool making, fur for warm blankets, ceremonial purposes, and described in traditional winter stories.

Indian people refrain from eating coyote, wolves, and some birds because these animals are fundamental to stories and songs that teach us life lessons to heal, to build character, and to become better people.

The relationships between the animals, the Earth, and Indian people are represented by the respectful roles they play in the stories of our lives then and now. For example, the NNSS contains a valley where an important spiritual journey occurred. It involved Wolf (*Tavats* in Southern Paiute, *Bia esha* in Western Shoshone, *Wi gi no ki* in Owens Valley Paiute) and is considered a Creation story. Out of respect to our traditional teachings, only parts of this story are presented here. When Wolf and Coyote had a battle over who was more powerful, Coyote killed Wolf and felt glorious. Everyone asked Coyote what happened to his brother Wolf. Coyote felt extremely guilty and tried to run and hide but to no avail. Meanwhile, the Creator took Wolf and made him into a beautiful Rainbow (*Paro wa tsu wu nutuvi* in Southern Paiute, *Oh ah podo* in Western Shoshone, *Paduguna* in Owens Valley Paiute). When Coyote saw this special privilege he cried to the Creator in remorse and he too wanted to be a Rainbow. Because Coyote was bad, the Creator put Coyote as a fine, white mist at the bottom of the Rainbow's arch. This story and the spiritual trails discussed in the full version are connected to the Spring Mountains and the large sacred cave in the Pintwater Range as well as to lands now called the NNSS. These areas comprise the home of Wolf, whose spirit is still present and watches over Indian people and our Holy Land.

Stink bugs, willows, frogs, hummingbirds, and snow fleas are all important to Indian people and our respect to rain and snow. (For additional information on these plants and animals, please see text box for Hydrological Resources, Section 4.5.)

The desert bighorn sheep and the desert tortoise are both culturally sensitive animals to Indian people. Among their many special qualities, when used ceremonially, they have the ability to bring rain and reduce drought impacts.

The desert tortoise has further significance to Indian people because of its healing powers, longevity, and wisdom. It is integral to our traditional stories, well-being and perpetuation of our native culture.

See Appendix C for more details.

[1] *Smudging is a spiritual cleansing involving the use of smoke from certain plants during prayers and ceremonies.*

4.1.8 Air Quality and Climate

4.1.8.1 Meteorology

Overview of NNSS Climate. The NNSS is located mostly in the southwestern corner of the Great Basin Desert, with the southern third of the NNSS located in the Mojave Desert (Warner 2004). The NNSS is located in the rain shadow (lee) of the southern Sierra Nevada mountain range and has the general climatic characteristics of a mid-latitude desert area, with relatively little precipitation throughout the year and low humidity, large diurnal and seasonal temperature ranges, and intense solar radiation in the summer. The normally dry desert climate specific to the NNSS can occasionally be interrupted by the southwestern monsoon and convective thunderstorms during the summer months, as well as Eastern Pacific tropical storm remnants in the late summer and fall. The climate conditions can be further modified from time to time during strong *El Niño* cycles, which generally bring more rainfall to the area.

Significant climate differences within the NNSS stem largely from differences in elevation. The NNSS generally slopes downward from north to south (from about 7,700 to 2,700 feet). There is considerable variability in terrain due to the number of mountain ranges (which are generally oriented north–south), mesas, basins, and flats. Local topographical features play an important role in defining local wind flow effects on both diurnal and seasonal time scales. Higher elevations within the NNSS generally experience cooler temperatures and more precipitation, while generally warmer temperatures and less precipitation occur in the basins.

Figure 4–25 shows the Meteorological Data Acquisition stations that monitor meteorological conditions across the NNSS. The NNSS areas are also labeled, and some geographic areas (e.g., Pahute Mesa, Frenchman Flat) are labeled and individually shaded. The following three major NNSS complexes that have historically released radiological and nonradiological hazardous air pollutants are labeled: BEEF, the Nonproliferation Test and Evaluation Complex (NPTEC), and Test Cell C. The Amargosa Valley CEMP station is shown, as is the Desert Rock hourly upper-air and Automated Surface Observing System. Terrain gradients are also shown.

Temperature. Average maximum temperatures range from 90 to 100 °F in the summer and from 50 to 60 °F in the winter. Average minimum temperatures range from 55 to 70 °F in the summer and 20 to 35 °F in the winter. At higher elevations, which are mostly in the northern NNSS, temperatures tend to be 10 to 15 °F cooler (NOAA 2006). For more information regarding temperature trends at the NNSS, please see Appendix D, Section D.1.1.1, of this SWEIS.

Precipitation. Higher elevations, mostly in the northern NNSS, receive an average of about 13 inches of precipitation per year, while locations in the southeastern NNSS near Frenchman Flat receive an average of about 5 inches per year, the lowest average amount (SORD 2008). Precipitation falls most often during winter and early spring (during Pacific storm passage) and during mid- to late-summer (during convective thunderstorms, monsoons, and occasional tropical storm remnants) (NOAA 2006). Nevada has had statewide drought conditions for most of the last decade, with precipitation amounts far below normal. For more information regarding precipitation patterns at the NNSS, including tornado statistics and snowfall and thunderstorm trends, please see Appendix D, Section D.1.1.1.

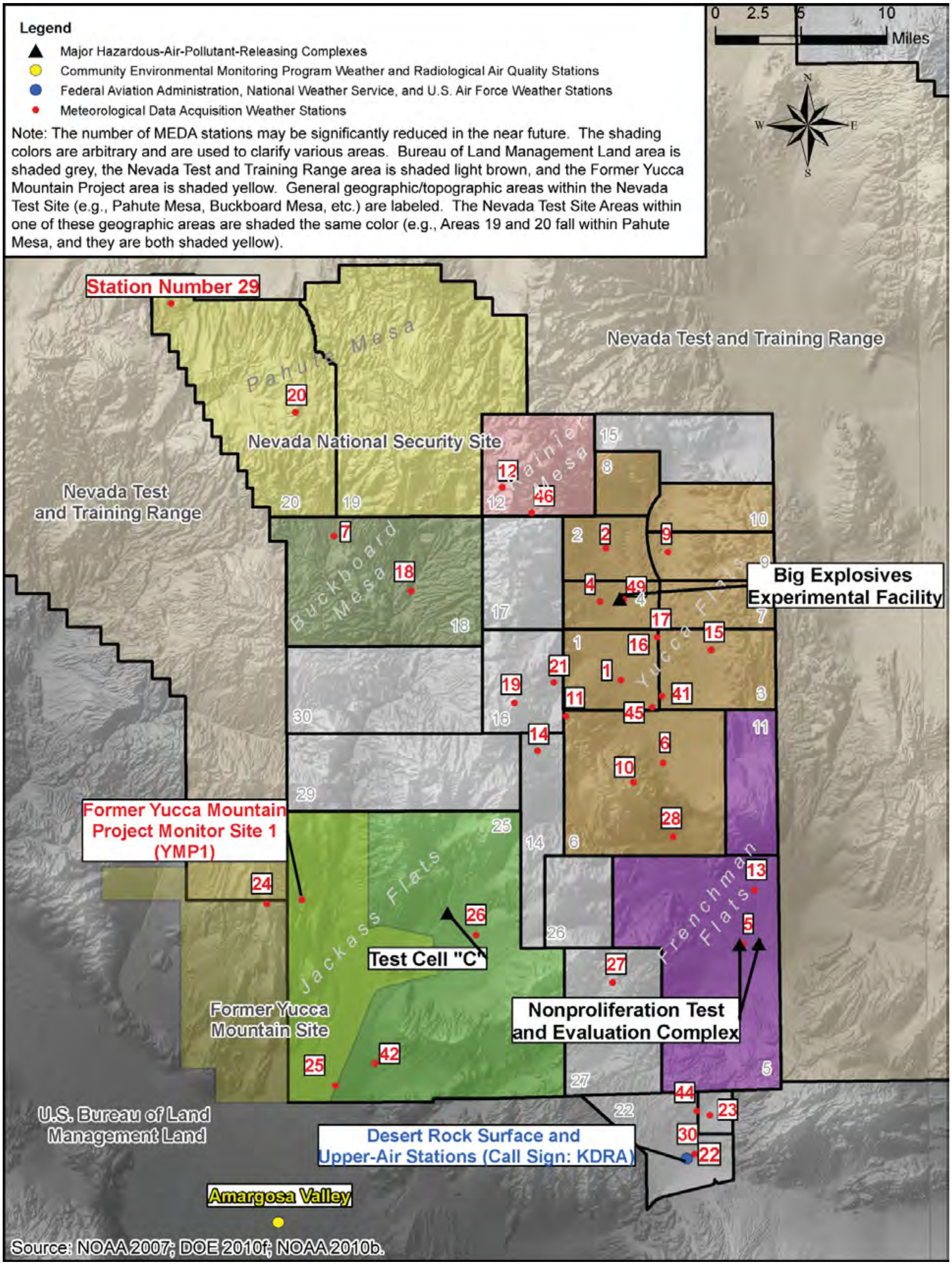

Figure 4–25 Meteorological Data Acquisition System Stations Across the Nevada National Security Site, as of 2010

Wind Flow

Wind conditions affecting the NNSS are perhaps the most complex of the site's meteorological conditions.

The surface winds show strong diurnal variations with distinct nighttime drainage winds in the basins and mountain slopes. Because the terrain tends to slope down in elevation from north to south, these nighttime drainage winds tend to be from the north. Localized terrain gradients that are not north-to-south modify this nighttime wind flow, as do rare low overcast conditions or conditions with extensive nighttime vertical mixing. **Figure 4–26** illustrates the localized wind patterns for the Meteorological Data Acquisition stations nearest the three NNSS sites that have historically, as well as recently, been permitted to release radiological and nonradiological hazardous air pollutants (i.e., BEEF, NPTEC, and Test Cell C). For more information regarding wind flow patterns at the NNSS, please see Appendix D, Section D.1.1.1.

Stability Overview

Cloud cover measurements used to estimate atmospheric stability are available from the Desert Rock site located in the southeastern corner of the NNSS. Based on data recorded from 1978 through 2004 at Desert Rock, stable conditions dominate at night, though stronger windspeeds will tend to mix in the atmosphere, leading to neutral conditions. Nighttimes tend to be more stable during the summer and fall months because of lighter winds at night, relative to the winter and spring periods. Because greater solar radiation leads to greater instability, unstable conditions dominate the daytime hours and the months with highest solar radiation (summer). These stability patterns would be slightly modified within the NNSS based primarily on windspeed differences and potentially on differences in local cloud cover and topology relative to what occurs at Desert Rock (NOAA 2006).

4.1.8.2 Ambient Air Quality

4.1.8.2.1 Region of Influence

The ROI for air quality and climate for the NNSS operations comprises southern Nye County, western Lincoln County, and northern Clark County, with prevailing downwind impacts extending into western Lincoln County. Historic data on pollutant emissions inventories and the compliance status for the State of Nevada are calculated at the county level, and these data provide a basis for determining both existing air quality in the ROI and a metric for emission comparison assessments.

4.1.8.2.2 Existing Air Quality

Current Ambient Air Quality Standards

Air quality is determined by measuring concentrations of certain pollutants in the atmosphere. EPA designates an area as "in attainment" for a particular pollutant if ambient air concentrations of that pollutant are below the National Ambient Air Quality Standards (NAAQS). Pollutants regulated under both the State of Nevada Ambient Air Quality Standards and NAAQS include the following:

- Ozone
- Carbon monoxide
- Nitrogen dioxide
- Sulfur dioxide
- Lead
- Particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10})
- Particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$)

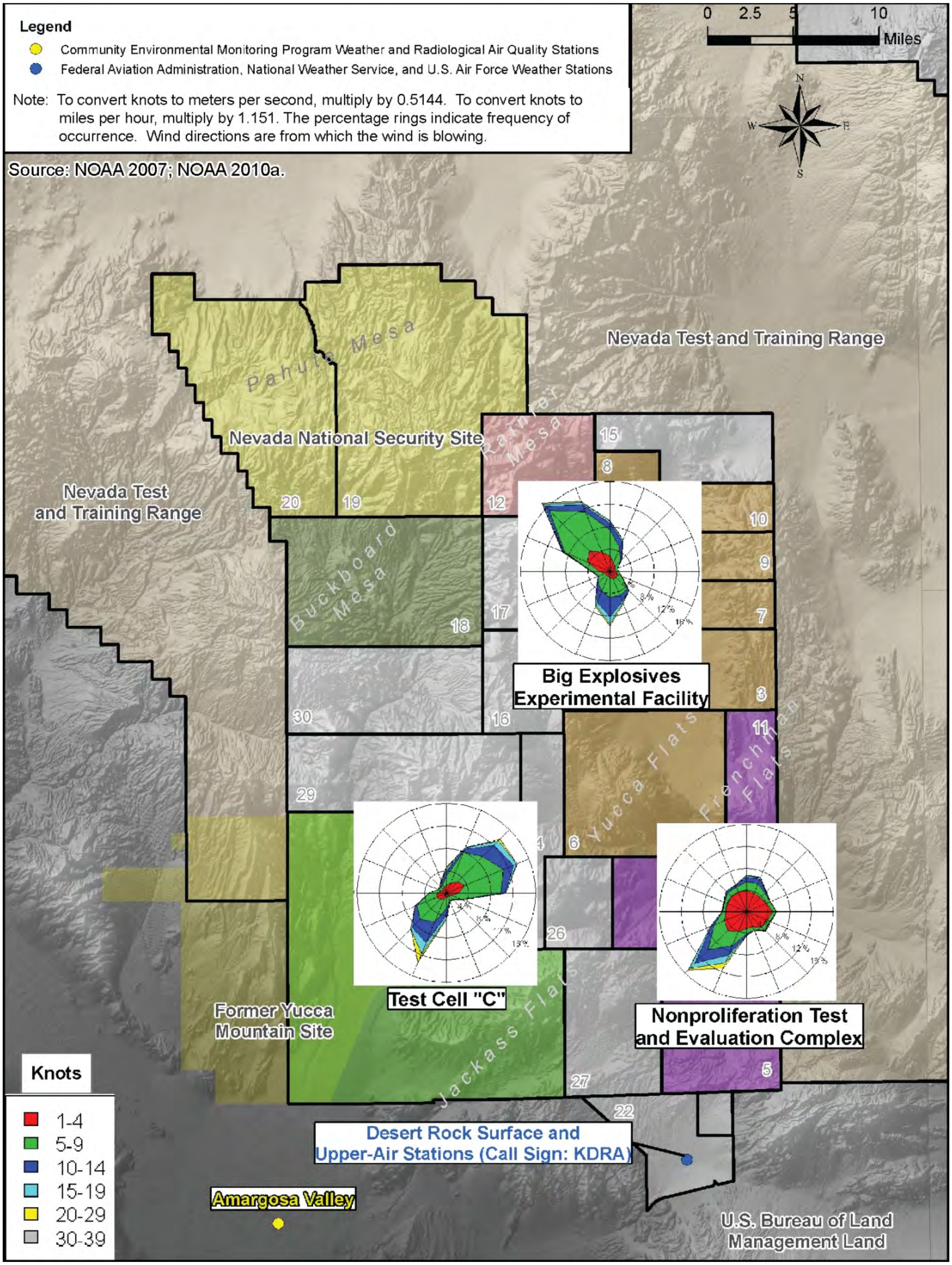

Figure 4–26 Annual Average Wind Roses for Meteorological Data Acquisition Stations near NPTEC, Test Cell C, and BEEF, 2004–2008

Collectively, these NAAQS pollutants are referred to as "criteria pollutants." **Table 4–40** lists NAAQS for both the primary public health standard and the secondary public welfare standard, which includes protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Table 4–40 also lists the State of Nevada Ambient Air Quality Standards.

Table 4–40 State of Nevada and National Ambient Air Quality Standards

Pollutant	*Averaging Time Over Which Pollutant is Measured*	*Nevada Standard*	*National Primary Standard*	*National Secondary Standard*	*Notes Regarding the Air Quality Standard*
Ozone [a]	1 hour	0.12 ppm	None	None	The 1-hour ozone standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one.
	8 hours	None	0.075 ppm	Same as primary	The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed this standard.
Carbon monoxide	8 hours	9 ppm (10,500 μg/m^3) elevations < 5,000 feet	9 ppm (10 mg/m^3) at any elevation	None	Not to be exceeded more than once per year.
		6 ppm (7,000 μg/m^3) elevations > 5,000 feet			
Carbon monoxide (at any elevation)	1 hour	35 ppm (40,500 μg/m^3)	35 ppm (40 mg/m^3)		
Nitrogen dioxide	Annual arithmetic mean	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as primary	Not to be exceeded.
	1 hour	None	0.100 ppm (189 μg/m^3)	None	The 3-year average of the 98th percentile of the annual distribution of the daily maximum 1-hour average at each monitor within an area must not exceed this standard.
Sulfur dioxide [b]	Annual arithmetic mean	0.03 ppm (80 μg/m^3)	0.03 ppm (80 μg/m^3)	None	Not to be exceeded.
	24 hours	0.14 ppm (365 μg/m^3)	0.14 ppm (365 μg/m^3)		Not to be exceeded more than once per year.
	3 hours	0.5 ppm (1,300 μg/m^3)	None	0.5 ppm (1,300 μg/m^3)	
	1 hour	None	0.075 ppm	None	The 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentration at each monitor within an area must not exceed this standard.
Lead	Quarterly arithmetic mean	1.5 μg/m^3	1.5 μg/m^3	Same as primary	Not to be exceeded.
	3-month rolling average	None	0.15 μg/m^3	Same as primary	
Hydrogen sulfide	1 hour	0.08 ppm (112 μg/m^3)	None	None	Not to be exceeded.

Pollutant	*Averaging Time Over Which Pollutant is Measured*	*Nevada Standard*	*National Primary Standard*	*National Secondary Standard*	*Notes Regarding the Air Quality Standard*
PM_{10}	Annual arithmetic mean	50 μg/m^3	None	None	The 3-year average of the weighted annual mean concentration from a single or multiple community-oriented monitors must not exceed this standard.
	24 hours	150 μg/m^3	150 μg/m^3	Same as primary	Not to be exceeded more than once per year on average over 3 years.
$PM_{2.5}$	Annual arithmetic mean	None	15 μg/m^3	Same as primary	The 3-year average of the weighted annual mean concentration from a single or multiple community-oriented monitors must not exceed this standard.
	24 hours		35 μg/m^3	Same as primary	The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed this standard.

μg/m^3 = micrograms per cubic meter; mg/m^3 = milligrams per cubic meter; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; ppm = parts per million.
[a] The U.S. Environmental Protection Agency (EPA) proposed a new standard of between 0.06 and 0.07 ppm in January 2010.
[b] On June 2, 2010, EPA revised the primary sulfur dioxide standard to 75 parts per billion over 1 hour and revoked both the 24-hour and annual standard.
Source: 40 CFR Part 50; NAC 445B.22097.

Air Quality Status. The NNSS is within Nevada Intrastate Air Quality Region 147. Nye County contains all of the NNSS, but has insufficient available data to determine the attainment status. Thus, it is designated as unclassified/attainment because EPA treats an unclassified area as if it is in attainment for regulatory purposes.

As of early 2010, the closest nonattainment areas to the NNSS are Inyo County, California (about 65 miles from the western border of the NNSS), and the Las Vegas Valley Area nonattainment area, located in Clark County (the closest distance is about 25 miles from the southeastern corner of the NNSS). Inyo County is in serious[1] nonattainment for PM_{10}, and the Las Vegas Valley Area of Clark County is in nonattainment for 8-hour ozone,[2] and serious nonattainment for both 8-hour carbon monoxide standards[3] and 24-hour PM_{10}[4] (EPA 2010c).

Prevention of Significant Deterioration (PSD) is a regulation incorporated into the Clean Air Act (CAA) that limits increases of certain pollutants in clean air areas (attainment areas) to certain increments even though ambient air quality standards are being met. CAA has three classes of areas with different increments. The smallest increments allowed are Class I areas, which are areas of special value (natural, scenic, recreational, or historic). Any degradation of existing air quality in these areas should be

[1] *EPA designates areas that do not obtain the NAAQS with respect to a particular air pollutant as nonattainment. Within that designation, classification categories have been established in the Clean Air Act based on the severity of the air pollution problem. Ozone has the broadest number of classification categories, including extreme, severe, serious, moderate, and marginal.*
[2] *Classification for 8-hour ozone under Subpart 2 as marginal with a nonattainment area that includes those portions of Clark County that lie in Hydrographic Areas 164A, 164B, 165, 166, 167, 212, 213, 214, 216, 217, and 218, but excludes the Moapa River Indian Reservation and the Fort Mojave Indian Reservation.*
[3] *Still designated as serious nonattainment for carbon monoxide, but has not had any violations of the carbon monoxide NAAQS since 1999. Clark County Department of Air Quality and Environmental Management submitted a request to EPA in September 2008 for a redesignation to attainment for carbon monoxide. The nonattainment area covers Hydrographic Area 212.*
[4] *Still designated as serious nonattainment for PM_{10}, but has not had any violations of the 24-hour or annual PM_{10} NAAQS since 2004. The nonattainment area covers Hydrographic Area 212.*

minimized. The closest PSD Class I areas to the NNSS are Grand Canyon National Park (about 130 miles to the southeast) and Sequoia National Park (about 105 miles to the west). The NNSS has no sources of pollution large enough to be subject to PSD requirements.

Calculations of Emissions on and near the NNSS

Table 4–41 shows the 2008 estimated air emissions for the criteria pollutants and hazardous air pollutants associated with various NNSS activities. PM_{10} and $PM_{2.5}$ emissions from diesel-fueled vehicles are included in the total PM_{10} and $PM_{2.5}$ emissions. Actions on efforts to mitigate diesel emissions are discussed in Chapter 7, Section 7.8. See Appendix D, Section D.1.1.2.1, for more information on how these emissions were determined and further partitioning by source type and vehicle type for the mobile sources.

Measurements of Ambient Air Concentrations on and near the NNSS

There are no regularly operating ambient air quality monitors for criteria pollutants and hazardous air pollutants within the NNSS. The most comprehensive source of representative data on ambient concentrations of criteria pollutants and hazardous air pollutants for the area surrounding the NNSS is a special study conducted in the southwest portion of the NNSS from October 1991 through September 1995 (see **Figure 4–27** for the locations of the monitors used in the study). During this period, the YMP1 station monitored carbon monoxide, nitrogen dioxide, PM_{10}, ozone, and sulfur dioxide. The YMP1 station was about 1 mile inside the western NNSS border in northwestern Area 25, and it is the only location on the NNSS where criteria pollutants other than PM_{10} have been measured for an extended period of time. Three additional sites monitored PM_{10} (DOE 1999a): YMP5 (about 6 miles southeast of YMP1 in Area 25, from April 1989 until 2002), YMP6 (about 4 miles northeast of YMP1 in extreme northwestern Area 25, from October 1992 until September 1999), and YMP9 (about 12 miles south-southeast of YMP1 in southwestern Area 25, from October 1992 until 2008). An earlier limited 1-month (August 15 – September 15, 1990) air quality monitoring study was done on the NNSS in Areas 6, 12, and 23 for carbon monoxide, sulfur dioxide, and PM_{10}; however, these results are not considered representative of today's ambient air quality concentrations, as overall activity levels at the NNSS have been substantially reduced since the 1992 nuclear testing moratorium. However, the monitored values were all well below the NAAQS and state ambient air quality standards.

The 1991 through 1995 ambient concentrations measured at the YMP1 station are conservative estimates of current concentrations at the NNSS for two reasons. First, the measured PM_{10} ambient concentrations among the four YMP monitors from 1989 through 2005 show a slight downward trend (see **Table 4–42**), and the NNSS onsite stationary emissions of criteria pollutants (see Appendix D, Section D.1.1.2) also trended downward from 1998 through 2008 (see Table 4–41). Second, the principal source of air pollutants is from population activity (vehicle trips and construction) and can be used as a surrogate for increases in PM emissions in the absence of new industrial activity. While Nye County's population increased by about 80 percent between 1990 and 2000, most of that growth occurred at the extreme southern tip of the county in the city of Pahrump, which is about 25 miles south-southeast of the extreme southern tip of the NNSS. Furthermore, the population directly bordering the Yucca Mountain site to its southwest (Amargosa Valley) grew by only about 16 percent, and the two counties in the prevailing upwind direction of the NNSS (Esmeralda County, Nevada, and Inyo County, California) had population decreases of up to almost 30 percent (USCB 2008b). Industrial activity has not changed over this period; thus, it is estimated that the criteria pollutant emissions near the NNSS have in general only decreased since the early 1990s.

Table 4–41 Estimated 2008 Air Emissions of Criteria Pollutants and Hazardous Air Pollutants Due to Nevada National Security Site-Related Activities

	Annual Air Emissions (tons per year)														
	Stationary Sources	***Government-Owned Vehicles***	***NNSS Commuters***			***Commercial Vendors***			***Radiological Waste Trucks***			***Total***			
	Nye County	***Nye County***		***Nye County***			***Nye County***			***Nye County***			***Nye County***		
Pollutant	***On-NNSS***	***On-NNSS***	***Clark County***	***On-NNSS***	***Off-NNSS***	***Clark County***	***On-NNSS***	***Off-NNSS***	***Clark County***	***On-NNSS***	***Off-NNSS***	***Clark County***	***On-NNSS***	***Off-NNSS***	***Total***
PM_{10}	0.22	0.82	0.83	0.14	0.19	0.24	0.11	0.032	0.17	0.0046	0.51	*1.2*	*1.3*	*0.73*	*3.3*
$PM_{2.5}$	0.22	0.66	0.56	0.11	0.11	0.22	0.1	0.029	0.16	0.0042	0.48	*0.94*	*1.1*	*0.62*	*2.7*
CO	0.94	39.6	97.0	18.5	21.0	0.98	0.46	0.13	0.67	0.018	2.0	*98.7*	*59.5*	*23.1*	*181.3*
NO_x	3.4	13.9	24.0	4.6	5.3	2.2	0.97	0.277494	2.3	0.064	7.2	*28.5*	*22.9*	*12.8*	*64.2*
SO_2	0.060	0.076	0.19	0.019	0.047	0.0041	0.0018	0.00051	0.0033	0.000088	0.010	*0.20*	*0.16*	*0.058*	*0.41*
VOCs	0.60	0.80	1.2	0.12	0.35	0.32	0.15	0.042	0.11	0.0029	0.33	*1.6*	*1.7*	*0.72*	*4.0*
Lead	0.0023	0.000022	0.000048	0.0000031	0.000013	0.0000038	0.0000018	0.00000052	0.0000022	0.000000017	0.0000019	*0.000054*	*0.0023*	*0.000015*	*0.0024*
Criteria Pollutant Total	*5.2*	*55.2*	*123.2*	*23.4*	*26.9*	*3.7*	*0.48*	*1.7*	*0.014*	*0.09*	*10.1*	*126.9*	*84.4*	*38.7*	*250.0*
HAPs	0.090	0.058	0.095	0.010	0.030	0.042	0.02	0.0056	0.17	0.00038	0.044	*0.31*	*0.18*	*0.080*	*0.56*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

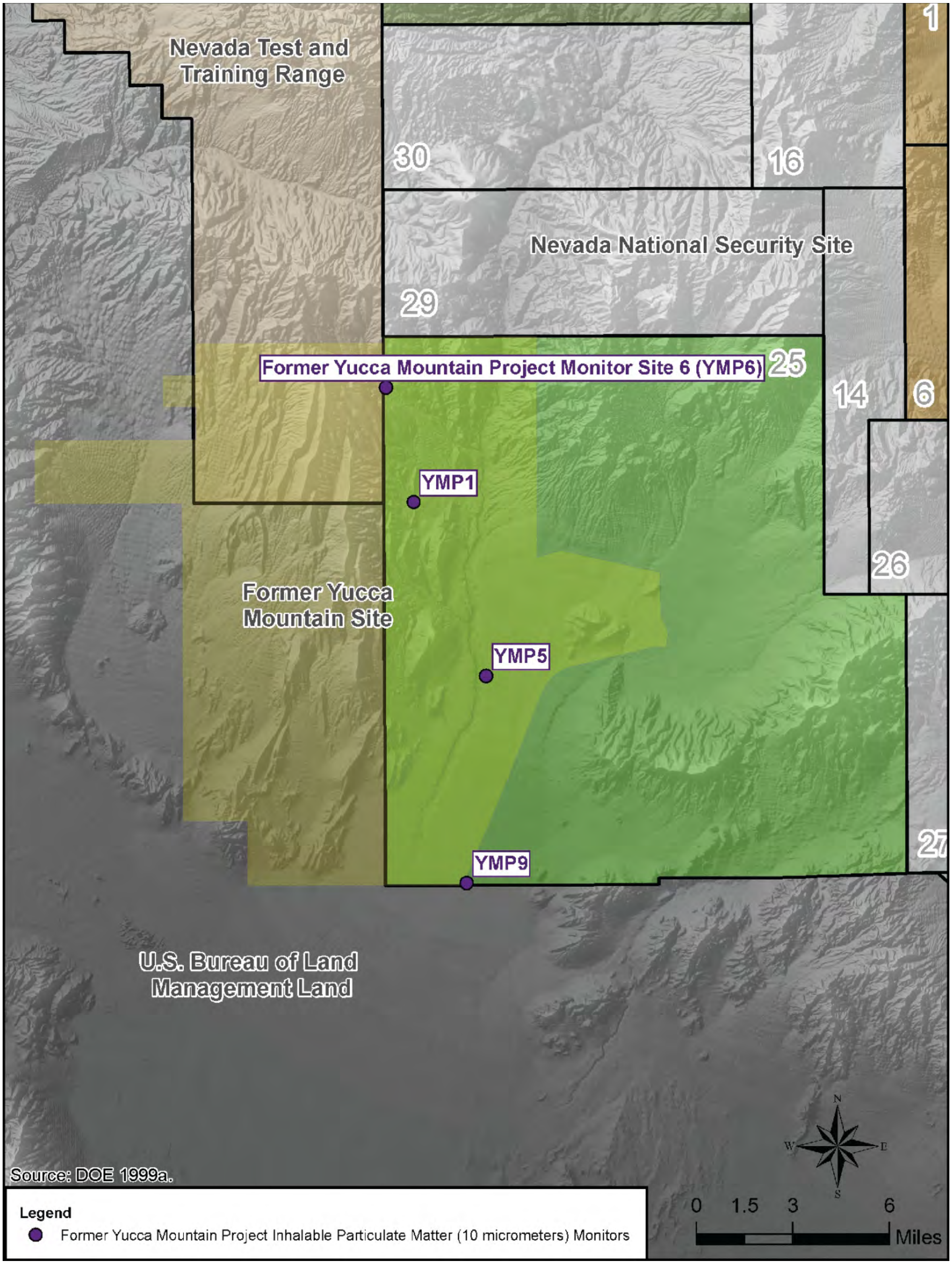

Figure 4–27 Locations of the Four Historical PM_{10} Monitors at the Former Yucca Mountain Site

Table 4–42 YMP1 Station Maximum Observed Ambient Air Quality Concentrations, October 1991 through September 1995, Compared with State of Nevada or National Ambient Air Quality Standards in Place at the Time of Monitoring

Pollutant	Measuring Time Increment	Ambient Air Concentration (parts per million)				
		2009 Nevada or NAAQS, Whichever is Lower	Year 1 (October 1991 to September 1992)	Year 2 (October 1992 to September 1993)	Year 3 (October 1993 to September 1994)	Year 4 (October 1994 to September 1995)
Carbon monoxide	1 hour [a]	35	**0.2**	**0.2**	**0.2**	**0.2**
	8 hours [a]	9 (elevations in Nevada under 5,000 feet above mean sea level)	**0.2**	**0.2**	**0.2**	**0.2**
Nitrogen dioxide	Annual [b]	0.053	0.00201	0.00208	**0.00214**	0.00209
Ozone [c]	1 hour [a]	0.12	**0.096**	0.093	0.081	0.083
	8 hours [d]	0.075	–	–	–	–
Sulfur dioxide	3 hours [a]	0.5	**0.002**	**0.002**	**0.002**	**0.002**
	24 hours [a]	0.14	**0.002**	**0.002**	**0.002**	**0.002**
	Annual [b]	0.03	**0.002**	**0.002**	**0.002**	**0.002**

NAAQS = National Ambient Air Quality Standards.
[a] Not to be exceeded more than once per year.
[b] Annual NAAQS are defined as a calendar year.
[c] The 1-hour Federal ozone standard of 0.12 parts per million, in place during the listed years, was phased out in 2005 and replaced with an 8-hour Federal ozone standard of 0.075 parts per million. The State of Nevada still retains the 1-hour ozone standard of 0.12 parts per million.
[d] The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitoring station within an area over each year must not exceed this standard.
Note: The highest measured concentration in each row is shown in bold font.

As shown in Tables 4–42 and **4–43**, and further discussed in Appendix D, Section D.1.1.2, the Yucca Mountain site has been well within the attainment status of the applicable ambient air quality standards since at least the early 1990s. Given that the 1991 through 1995 ambient concentration measurements from the YMP1 station are still likely representative of the current concentrations on the NNSS as described above, it remains very likely that the ambient air quality on the NNSS is well within all applicable ambient air quality standards.

4.1.8.3 Radiological Air Quality

National Emission Standards for Hazardous Air Pollutants (NESHAPs) are established under Title I of CAA to limit ambient levels of some hazardous air pollutants. The radionuclide inhalation NESHAP for Federal facilities is set at the emissions total (cumulative across all radionuclides) that would cause a member of the public to receive an effective dose equivalent of 10 millirem in a year (DOE/NV 2009d). To put the dose of 10 millirem per year in perspective: a person would receive a dose of about 3 millirem from a single 5-hour jet flight, a dose of about 8 millirem from a single chest x-ray, and a dose of about 200 millirem per year from natural radon (DOE/NV 2009d). The average natural background radiation exposure, excluding that from radon, for persons residing in select U.S. cities is provided in **Table 4–44**.

Table 4–43 Summary of PM_{10} Concentrations, 1989 through 2005, for Four Monitoring Stations in Area 25

Monitoring Station	*Measuring Time Increment*	*Ambient Air Concentration (micrograms per cubic meter)*																	
		Current (2009) NAAQS	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
YMP1	24-hour highest	150 [a]	41	**62**	33	30	30	39	21	60	31	30	18	38	23	52	33	24	32
	Annual average	50 [b]	**12**	**12**	10	**12**	10	10	10	10	9	8	8	11	8	10	8	8	9
YMP5	24-hour highest	150 [a]	40	51	45	49	21	42	**67**	57	26	26	24	45	27	N/A	N/A	N/A	N/A
	Annual average	50 [b]	**13**	10	10	12	9	9	10	10	9	7	8	12	10	N/A	N/A	N/A	N/A
YMP6	24-hour highest	150 [a]	N/A	N/A	N/A	N/A	21	25	14	32	**59**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Annual average	50 [b]	N/A	N/A	N/A	N/A	**9**	7	7	**9**	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
YMP9	24-hour highest	150 [a]	N/A	N/A	N/A	31	21	39	15	**57**	29	22	18	36	22	43	39	27	26
	Annual average	50 [b]	N/A	N/A	N/A	N/A	9	8	7	10	8	6	8	**11**	9	10	**11**	9	9

N/A = not available; NAAQS = National Ambient Air Quality Standards; PM_n = particulate matter with an aerodynamic diameter less than or equal to n micrometers.
[a] Not to be exceeded more than once per year on average over 3 years.
[b] The 3-year average of the weighted annual mean concentration from a single or multiple community-oriented monitors must not exceed this standard.
Note: The highest measured concentration in each row is shown in **bold** font. N/A indicates that the monitor was either not operating or the data are not available.
Source: CRWMS M&O 1997, 1999; DOE 2002d, 2003b, 2004b, 2005a, 2006b; SAIC 1992a, 1992b.

Table 4–44 Average Natural Background Radiation Exposure, Excluding That from Radon, for Select U.S. Cities

City	*Radiation Exposure (millirem per year)*
Denver, Colorado	164.6
Wheeling, West Virginia	111.9
Rochester, New York	88.1
St. Louis, Missouri	87.9
Portland, Oregon	86.7
Los Angeles, California	73.6
Las Vegas, Nevada	69.5
Fort Worth, Texas	68.7
Richmond, Virginia	64.1
Tampa, Florida	63.7
New Orleans, Louisiana	63.7

Source: DOE 1990.

Table 4–45 indicates the NESHAPs concentration levels for environmental compliance for isotopes of americium, cesium, hydrogen, and plutonium. Because analytical methods cannot readily distinguish between plutonium-239 and plutonium-240, the NESHAPs concentration level for plutonium-239 is used for both isotopes. Uranium is not shown because any uranium detected on the NNSS in recent years has been determined to be naturally occurring rather than enriched or depleted (DOE/NV 2009d). Note, however, that 0.06 curies of depleted uranium were estimated to have been released in 2008 from activities at BEEF, in Area 4 (DOE/NV 2009d). A curie is a common measurement of radioactivity and is defined as 3.7×10^{10} disintegrations per second, which is the approximate decay rate of 1 gram of radium (radium-226).

Table 4–45 The Concentration Levels for Five Radionuclides Corresponding to the NESHAPs Effective Dose Equivalent of 10 Millirem per Year in One Year

Radionuclide	*NESHAPs Annual Average Concentration Levels for Environmental Compliance ($\times 10^{-15}$ micrograms per milliliter)*
Americium-241	1.9
Cesium-137	19
Hydrogen-3 (Tritium)	1,500,000
Plutonium-238	2.1
Plutonium-239	2

NESHAPs = National Emission Standards for Hazardous Air Pollutants.
Source: DOE/NV 2009d.

To demonstrate that total radioactivity is in compliance with NESHAPs, the following steps are performed: (1) divide the concentration level of each detected manmade radionuclide by its NESHAP concentration level (concentration ÷ NESHAP concentration level); (2) sum those fractions for all radionuclides; and (3) confirm that the sum is less than 1.0 at each monitoring station used for monitoring NESHAPs compliance. The NNSS has been in compliance with NESHAPs since the *1996 NTS EIS* (DOE 1996c).

The locations of the ambient radiological monitors on and surrounding the NNSS are discussed in Section 4.1.8.3.1. The locations of potential radiation emissions on the NNSS and the types of activities that might produce them are discussed in Section 4.1.8.3.2. The recent radiation concentrations and exposure levels are discussed in Section 4.1.8.3.3.

4.1.8.3.1 Ambient Radiological Monitoring on and near the Nevada National Security Site

On the NNSS, 6 of the 16 sites established by DOE/NNSA that monitor ambient tritium levels are considered "critical receptors." These "critical receptors" are approved to monitor levels of various radionuclides for NESHAPs compliance. Most of these 16 ambient monitors are placed at or near locations of historical nuclear testing or current radiological operations (DOE/NV 2011). The locations of the 16 tritium monitors, with notations for the 6 that are critical receptors, are shown in **Figure 4–28**. The monitoring data from the 6 "critical receptors" demonstrate that the NNSS has been in compliance with the NESHAPs since the *1996 NTS EIS*. Further details on the NNSS ambient radiological monitoring can be found in Appendix D, Sections D.1.1.3.1 and D.1.1.3.

The Desert Research Institute of the Nevada System of Higher Education runs CEMP, which constitutes an offsite non-regulatory network of environmental monitors across southern Nevada, southeastern California, and southwestern Utah. CEMP is a public information and outreach program that monitors for radionuclides that might be released from the NNSS. As of 2008, there were 29 CEMP monitors; the 22 monitors near the Nevada Test and Training Range and Las Vegas area are shown in **Figure 4–29**. Since CEMP was upgraded in 1999 (DOE/DRI 2009), the CEMP monitors have not detected radiation that can be definitively attributed to NNSS activities, and the monitored radiation levels have been well within the background levels observed in other parts of the country (DOE/NV 2011). More details about the radiation detected at CEMP locations are provided in Appendix D, Sections D.1.1.3.1 and D.1.1.3.3.

4.1.8.3.2 Sources of Radiation on the Nevada National Security Site

Between 1951 and 1992, 100 atmospheric and 828 underground nuclear tests were conducted on the NNSS (DOE/NV 2011). Nuclear testing ended in 1992, and since then the NNSS radiation monitoring has focused on detecting airborne radionuclides from historically contaminated soils. Due to occasional high winds, some contaminated soil becomes airborne. Results from the air samplers in these areas indicate that americium-241 and plutonium-230+240 are routinely detected, but only in concentrations slightly above the minimum detectable concentrations. The total emissions (in curies) produced each year from all known legacy sites on the NNSS are estimated with a mathematical resuspension model. For 2008, total annual emissions from legacy sites were estimated as follows: americium-241 – 0.047 curies, plutonium-238 – 0.050 curies, and plutonium-239+240 – 0.29 curies (DOE 2009d). The methods used to estimate all NNSS radiological emissions (both point sources and fugitive dust from the legacy sites) include the use of annual field and water monitoring data, historical soil inventory data, and accepted soil resuspension and air transport models (DOE 2009d). Additional detail on radiological emissions and how they are determined is in Appendix D, Section D.1.1.2.2, Radiological Air Quality. In 1990, most areas within the NNSS had measureable amounts of americium-241 and plutonium-238, -239, and -240 in the first 2 inches of soil (McArthur 1991). Over time, the measurable airborne quantities of radionuclides have decreased as a result of radioactive decay, radionuclide immobilization in soil, and decreases in NNSS activities that would resuspend radionuclides from the soil to the air. According to a 1994 aerial survey, the largest areas of soil contamination correspond to the places where the bulk of nuclear testing occurred—especially the northeastern quarter of the NNSS (on Yucca Flat; locations north and east of Areas 1 and 17), but with notable locations in eastern Frenchman Flat (in Area 5), in northwestern Pahute Mesa (in Area 20), in central Buckboard Mesa (in Area 18), and near Dome Mountain (in Area 30). Evaporation and evapotranspiration can also resuspend tritium from contaminated soil, plants, and ponds such as the ones in Area 12 that receive tritium-contaminated water from East Tunnel. For more information regarding the sources of radiation at the NNSS, please see Section D.1.1.3.2.

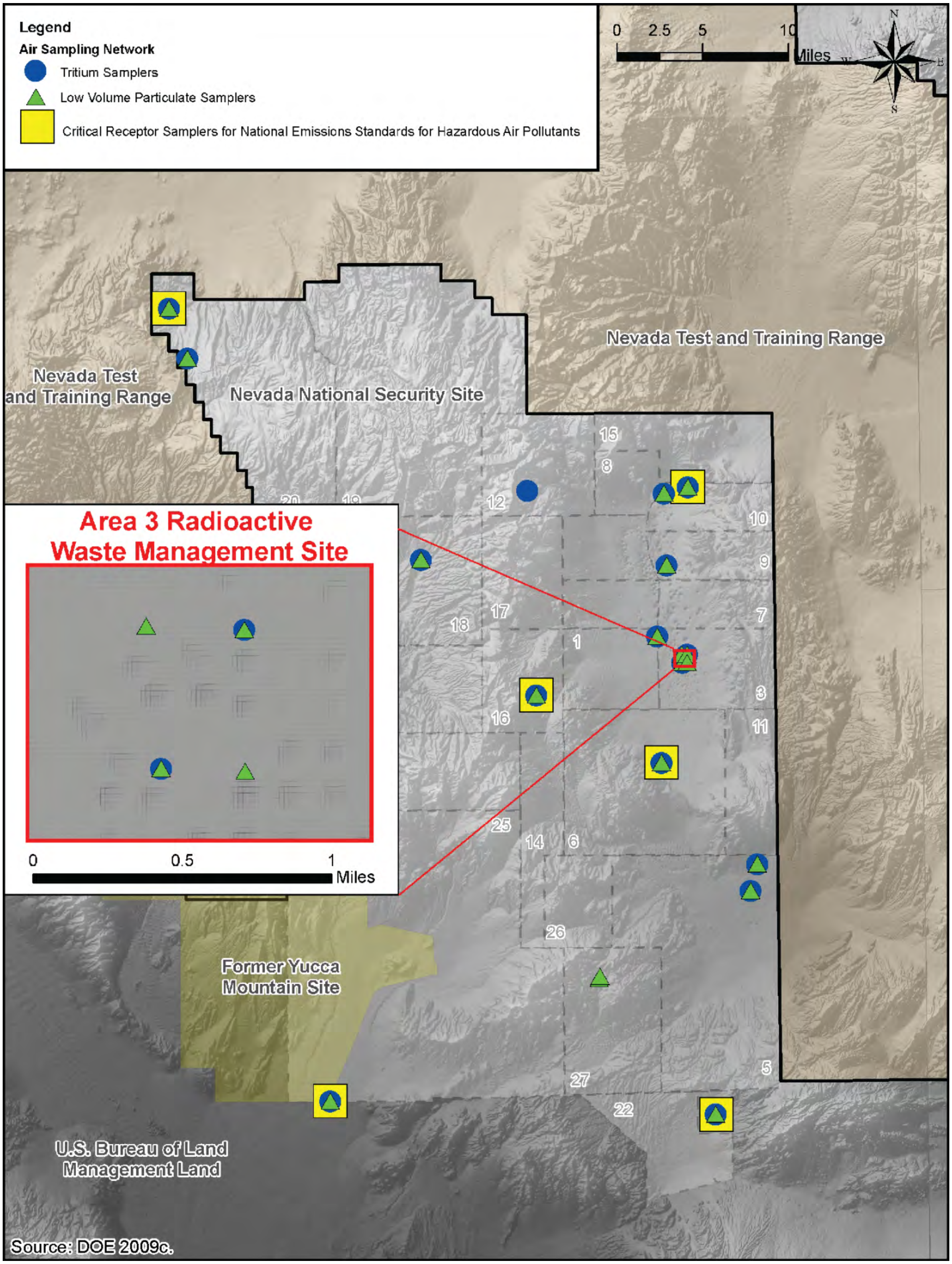

Figure 4–28 Ambient Radiological Monitoring and Critical Receptor Sampling Locations for Air Particulates and Tritium

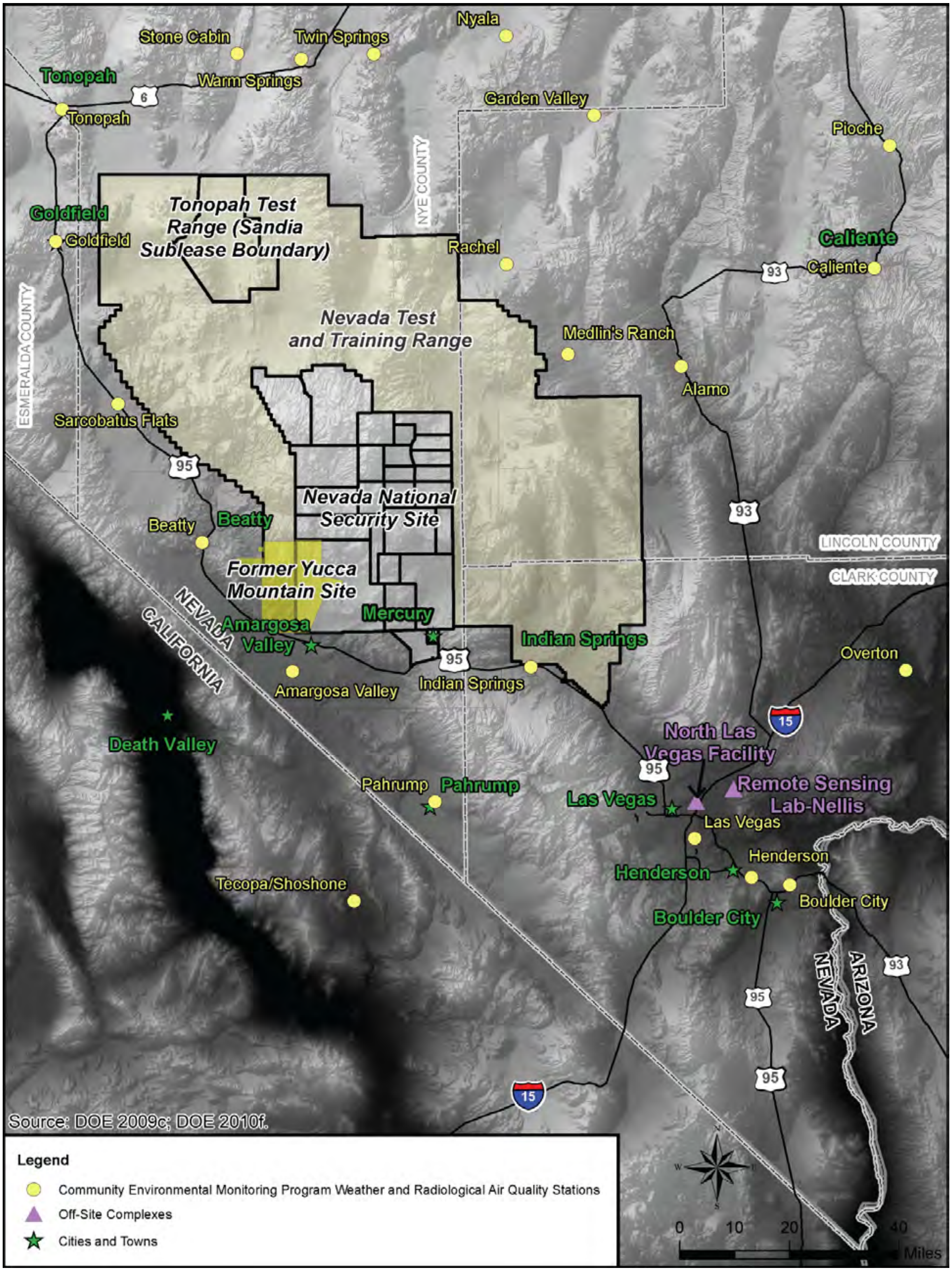

Figure 4–29 Community Environmental Monitoring Program Air Surveillance Network Locations near the Nevada Test and Training Range and Las Vegas, 2008

4.1.8.3.3 Radiation Levels on and near the Nevada National Security Site

The NNSS has been in compliance with the NESHAPs since the *1996 NTS EIS* (DOE 1996c). The maximum annual average radiation at critical receptor locations was from tritium over the most recent years, 2002 through 2008, with a measured concentration of 434×10^{-12} microcuries per milliliter, which is 29 percent of the NESHAPs concentration level. The radiological monitoring network overall indicates that levels of americium-241; plutonium-238, -239, and -240; cesium-137; and tritium on the NNSS have been well below the NESHAPs concentration levels since the *1996 NTS EIS*. In addition, offsite CEMP stations continue to show radiation levels that are well within natural background radiation levels (DOE/NV 2011). For more information regarding the radiation levels on and near the NNSS, please see Appendix D, Section D.1.1.2.2.3.

4.1.8.4 Climate Change

This section describes the affected environment in terms of current and anticipated trends in greenhouse gas emissions and climate. The effects of emissions on the climate involve very complex processes and interact with natural cycles, complicating the measurement and detection of changes. Recent advances in the state of the science, however, are contributing to an increasing body of evidence that it is very likely (greater than 90 percent probability) that anthropogenic greenhouse gas emissions affect climate in detectable and quantifiable ways (IPCC 2007b).

This section begins with a discussion of emissions and then turns to climate. Both discussions start with a description of conditions in the United States, followed by a description of conditions on the NNSS.

4.1.8.4.1 Greenhouse Gas Emissions

Greenhouse gas emissions in the United States in 2007[5] were estimated at 7,150.1 million carbon-dioxide-equivalent[6] metric tons (EPA 2009a), which is about 18 percent of total global emissions[7] (WRI 2009). Annual national emissions, which have increased 17 percent since 1990 and typically increase each year, are heavily influenced by "general economic conditions, energy prices, weather, and the availability of non-fossil alternatives" (EPA 2009a). Carbon dioxide is by far the primary greenhouse gas emitted in the United States, representing almost 85.4 percent of all U.S. greenhouse gas emissions in 2007 (EPA 2009a). The other gases include methane, nitrous oxide, and a variety of fluorinated gases, including hydrofluorocarbons, perfluorinated carbons, and sulfur hexafluoride. The fluorinated gases are collectively referred to as "high global warming potential" (GWP) gases. Methane accounts for 8.2 percent of the remaining greenhouse gases on a GWP-weighted basis, followed by nitrous oxide (4.4 percent) and high-GWP gases (2.1 percent) (EPA 2009a).

Greenhouse gases are emitted from a wide variety of sectors, including energy, industrial processes, waste, agriculture, and forestry. Most U.S. greenhouse gas emissions are from the energy sector, largely due to carbon dioxide emissions from the combustion of fossil fuels, which alone account for 80 percent of total U.S. greenhouse gas emissions (EPA 2009a). Fossil fuel combustion contributes 97 percent of national total carbon dioxide emissions. As stated, carbon dioxide emissions from fossil fuel combustion are dominated by electricity generation, which contributes 42 percent of the total carbon dioxide emissions; the transportation sector contributes 33 percent; the industrial sector, 15 percent; the residential sector, 6 percent; and the commercial sector, 4 percent (EPA 2009a).

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[5] *Most recent year for which an official EPA estimate is available.*
[6] *Each greenhouse gas has a different level of radiative forcing—that is, the ability to trap heat. To compare their relative contributions, gases are converted to a carbon-dioxide equivalent using their unique global warming potential.*
[7] *Based on 2005 data and excludes carbon sinks from forestry and agriculture.*

4.1.8.4.2 Greenhouse Gas Emissions Due to Nevada National Security Site-Related Activities

Table 4–46 provides greenhouse gas emissions due to NNSS-related activities for 2008. The greenhouse gas emissions are presented in carbon-dioxide-equivalent form and are partitioned by various mobile and stationary source types. These emissions were derived from fuel use, vehicle activity, and power consumption data. The greenhouse gas emissions were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010b). These emissions were compared with a reference amount of 25,000 metric tons (27,558 tons), which is an indicator for when a quantitative assessment may be warranted (CEQ 2010).

Power generation (electrical energy generation) is by far the largest single source of greenhouse gas emissions related to NNSS activities. Overall, NNSS-related activities created about 50,478 carbon-dioxide-equivalent tons of greenhouse gas emissions in 2008, about 83 percent over the reference level.

Table 4–46 Carbon-Dioxide-Equivalent Emissions of Greenhouse Gases by Activities Related to the Nevada National Security Site in 2008

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year* [a]
STATIONARY SOURCES		
Power generation	28,517	1.03
Natural gas heating	0	0
Other stationary sources, except air conditioning/refrigeration and natural gas heating	747	0.03
Sulfur hexafluoride from refrigeration/air conditioning	690	0.03
Hydrofluorocarbons from refrigeration/air conditioning	326	0.01
All Stationary Sources	*30,280*	*1.10*
MOBILE SOURCES		
Onsite government vehicles	4,920	0.18
Commuting	13,201	0.48
Hazardous waste transport (nongovernment)	837	0.03
Commercial vendors	1,240	0.05
All Mobile Sources	*20,198*	*0.73*
Total	***50,478***	***1.83***

Note: Fractional amount may not match the shown emission rate due to rounding.

4.1.8.4.3 Current Changes in Climate

This section describes observed historical and current climate change impacts on the United States and, in particular, on the desert southwest. Much of the material that follows is drawn from the following sources, including the citations therein: *Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act* (EPA 2009b) and the *Scientific Assessment of the Effects of Global Change on the United States* (NSTC 2008).

The past decade has been the warmest in more than a century of direct observations; average temperatures for the contiguous United States have risen at a rate near 0.58 °F per decade in the past few decades. In the southwest, the average annual temperature has increased by 1.4 °F over the 1960 to 1978 baseline (Karl et al. 2009). The annual average temperature across the region is projected to rise approximately 4 to 10 °F over the 1960 to 1978 baseline by the end of the century, depending upon how much greenhouse gas emissions increase (Karl et al. 2009).

Higher temperatures cause higher rates of evaporation and plant transpiration, meaning that more water vapor is available in the atmosphere for precipitation events. Depending on atmospheric conditions, increased evaporation means that some areas experience increases in precipitation events, while other areas are left more susceptible to droughts. For the southwest, a severe drought prevailed from 1999 to 2008 (NSTC 2008). Most climate models project a decrease in precipitation for many areas in the southwestern United States throughout the twenty-first century (EPA 2009b; NSTC 2008).

Melting snow and ice, increased evaporation, and changes in precipitation patterns all affect surface water. Stream flow decreased about 2 percent per decade over the past century in the central Rocky Mountain region (NSTC 2008). Annual peak stream flow (dominated by snowmelt) in western mountains occurs at least a week earlier than in the middle of the twentieth century. Changes in temperature and precipitation also affect frozen surface water. Spring and summer snow cover has decreased in the west. In mountainous regions of the western United States, the April snow water equivalent has declined 15 to 30 percent since 1950, particularly at lower elevations and primarily due to warming (NSTC 2008). This decrease in stream flow will likely reduce the groundwater recharge throughout the southwestern United States (NSTC 2008).

Air Quality and Climate—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) knows that the air is alive. The Creator puts life into the air, which is shared by all living things. When a child is born, he pulls in the air to begin its life. The mother watches carefully to make sure that the first breath is natural and that there is no obstruction in the throat. It is believed if the day of birth is a windy day, it is a good day and the child will have a good life.

According to tribal elders' perspectives from Area 5 Nevada National Security Site activities, *"…You can listen to the wind. The wind talks to you. Things happen in nature. Our people had weather watchers, who are kinds of people who will know when crops and things should be done. They watch the different elements in nature and pray to ask the winds to come and talk about these things. Sometimes you ask the north wind to come down and cool the weather. The north wind is asked to blow away the footsteps of the people who have passed on to the afterlife. That kind of wind helps people, it is positive. The wind also brings you songs and messages. Sometimes the messages are about healing people, a sign that the sickness is gone now from the person, or that it is coming to get that sickness to take it away, or it is coming to bring you the strength that you will need to deal with the illness."*

See Appendix C for more details.

4.1.9 Visual Resources

Identifying an area's visual resources and conditions involves three steps: (1) objective identification of the visual features (visual resources) of the landscape; (2) assessment of the character and quality of those resources relative to overall regional visual character; and (3) determination of the importance to people, or *sensitivity*, of views of visual resources in the landscape.

The aesthetic value of an area is a measure of its visual character and quality, combined with the viewer response to the area (FHA 1988). Scenic quality can best be described as the overall impression that an individual viewer retains after driving through, walking through, or flying over an area (BLM 1980). Viewer response is a combination of viewer exposure and viewer sensitivity. Viewer exposure is a function of the number of viewers, number of views seen, distance of the viewers from key observation points to what is being viewed, and viewing duration. Viewer sensitivity relates to the extent of the public's concern for a particular viewshed. These terms and criteria are described in greater detail in the following sections.

Visual Character. Natural and artificial landscape features contribute to the visual character of an area or view. Visual character is influenced by geologic, hydrologic, botanical, wildlife, recreational, and urban features. Urban features include those associated with landscape settlements and development, including roads, utilities, structures, earthworks, and the results of other human activities. The perception of visual character can vary significantly seasonally, even hourly, as weather, light, shadow, and elements that compose the viewshed change. The basic components used to describe visual character for most visual assessments are the elements of form, line, color, and texture of the landscape features (BLM 1980; USFS 1995; FHA 1988). The appearance of the landscape is described in terms of the dominance of each of these components.

Scenic Quality. Scenic quality was evaluated using the scenic quality classes established in the *1996 NTS EIS* and includes the following:

- Class A – The visual environment is made up of outstanding natural and manmade physical features.
- Class B – The visual environment is made up of a combination of outstanding natural and manmade physical features and those that are common to the region.
- Class C – The visual environment is made up of natural and manmade physical features that are common to the region.

Visual Exposure and Sensitivity. The measure of the quality of a view must be tempered by the overall sensitivity of the viewer. Viewer sensitivity or concern is based on the visibility of resources in the landscape, proximity of viewers to the visual resource, elevation of viewers relative to the visual resource, frequency and duration of views, number of viewers, and type and expectations of individuals and viewer groups.

Public roadways, mostly highways, provide the only public vantage points of the NNSS. Commuters and nonrecreational travelers have generally fleeting views and tend to focus on commute traffic, not on surrounding scenery; therefore, they are generally considered to have low visual sensitivity. Highways pass by the NNSS in areas that are largely undeveloped, and views of the sites are fleeting at standard highway speeds. Because roadways provide the majority of views and the viewer sensitivity of roadway users is generally low, the number of viewers that pass by and have views of the NNSS and other DOE/NNSA-managed offsite locations was used to determine the level of sensitivity and to analyze effects on visual resources (see Chapter 5, Section 5.1.9). The 2008 *Annual Traffic Report* (NDOT 2008c) was used to determine traffic volumes on public roadways with views of the NNSS and other DOE/NNSA-managed offsite locations. **Figure 4–30** shows the sensitivity levels assigned to roadways near the NNSS and other DOE/NNSA-managed offsite locations based on traffic volumes; these are as follows:

- High Visual Sensitivity – 3,000 or more average annual daily viewers
- Moderate Visual Sensitivity – 1,000 to 2,999 average annual daily viewers
- Low Visual Sensitivity – 0 to 999 average annual daily viewers

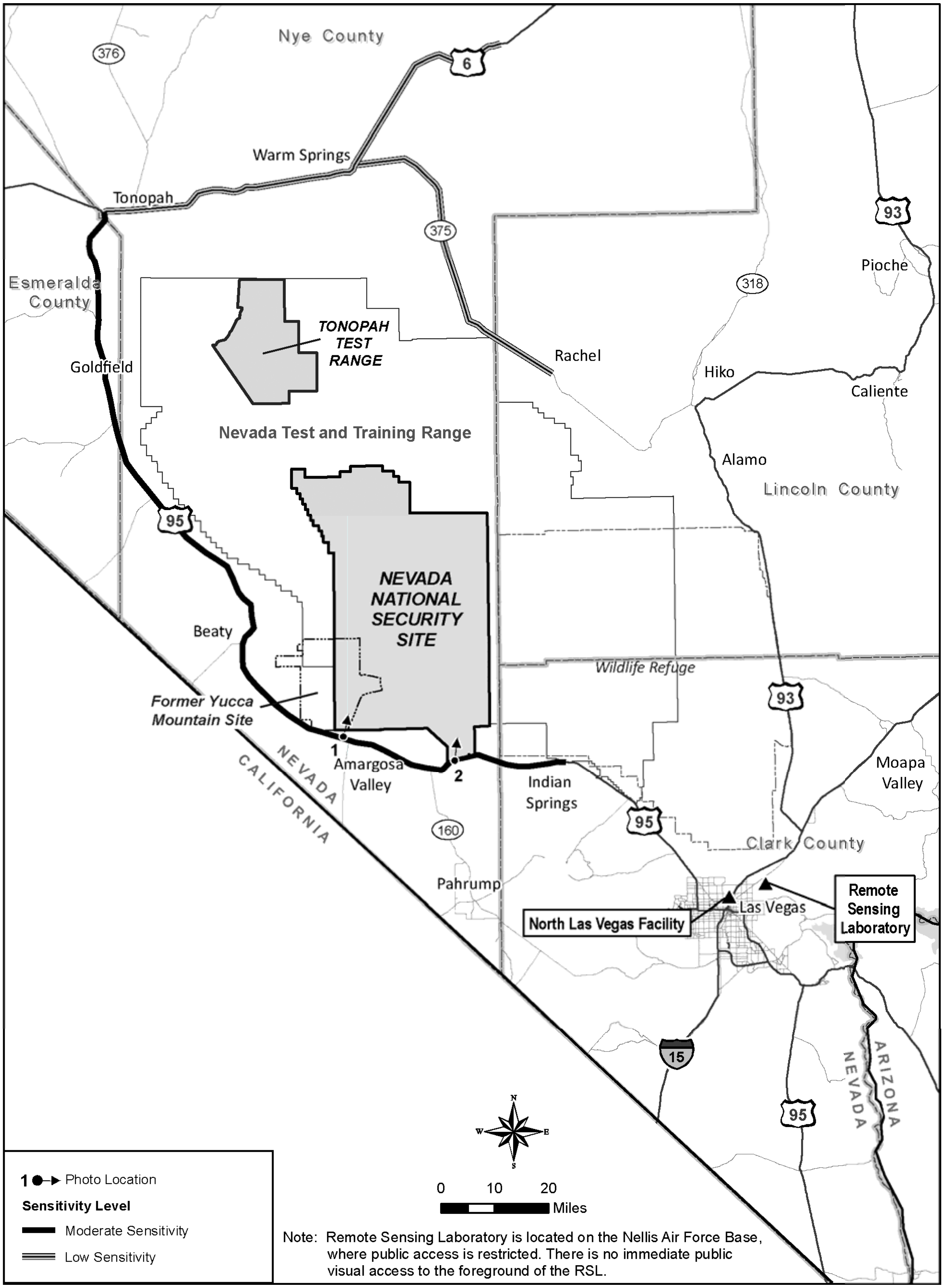

Figure 4–30 Photograph Locations and Sensitivity Levels at the Nevada National Security Site and Other Nevada Locations Managed by the U.S. Department of Energy/National Nuclear Security Administration

The importance of a view is related in part to the position of the viewer to the resource; therefore, visibility and visual dominance of landscape elements depend on their location within the viewshed. A viewshed is defined as all of the surface area visible from a particular location (e.g., an overlook) or sequence of locations (e.g., a roadway or trail) (FHA 1988). To identify the importance of views of a resource, a viewshed must be broken into distance zones of foreground, middleground, and background. Generally, the closer a resource is to the viewer, the more dominant it is and the greater its importance to the viewer. Although distance zones in a viewshed may vary between different geographic regions or types of terrain, the standard foreground zone is up to 0.5 miles from the viewer, the middleground zone is 0.5 miles to 4 miles from the viewer, and the background zone is 4 miles and beyond (USFS 1995).

Visual sensitivity depends on the number and type of viewers and the frequency and duration of views. Visual sensitivity also varies with differences in viewer activity, awareness, and visual expectations in relation to the number of viewers and viewing duration. For example, visual sensitivity is generally higher for views seen by people who are driving for pleasure; people engaging in recreational activities such as hiking, biking, or camping; and homeowners. Sensitivity tends to be lower for views seen by people driving to and from work or as part of their work (USFS 1995; FHA 1988; U.S. Soil Conservation Service 1978). As described above, commuters and nonrecreational travelers have low visual sensitivity. Residential viewers typically have extended viewing periods and are concerned about changes in the views from their homes; therefore, they are generally considered to have high visual sensitivity. Recreational viewers (e.g., those using recreation trails and areas, scenic highways, and scenic overlooks) are usually assessed under the assumption that they have high visual sensitivity.

Visual Resources—American Indian Perspective

CGTO All landforms within the Nevada National Security Site (NNSS) have high sensitivity levels for American Indians. The ability to see the land without the distraction of buildings, towers, cables, roads, and other objects is essential for the spiritual interaction between Indian people and our traditional lands.

Views from places are an important cultural resource that contributes to the location and performance of American Indian ceremonialism. Views combine with other cultural resources to produce special places where power is sought for medicine and other types of ceremony. Views can be of any landscape, but more central viewscapes are experienced from high places, which are often the tops of mountains and the edges of mesas. Indian viewscapes tend to be panoramic and are made special when they contain highly diverse topography. The viewscape panorama is further enhanced by the presence of volcanic cones and lava flows.

Viewscapes are tied with songscapes and storyscapes especially when the vantage point has a panorama composed of multiple locations described by traditional songs or stories. Our traditional songscapes and storyscapes can be compromised if projects like geothermal energy development are pursued. If geothermal resources are altered, our songs and stories will be impacted and will no longer accurately reflect key traditional aspects of the viewscape.

The Consolidated Group of Tribes and Organizations (CGTO) recognizes the cultural significance of viewscapes and have identified a number of these on the NNSS. The Timber Mountain Caldera contains a number of significant vantage points with different panoramas including but not limited to Scrugham Peak, Shoshone Mountain, and Buckboard and Pahute Mesa. The CGTO feels revisiting sites within the viewscapes are essential to Indian people to interact with the land, communicate with the spirits who watch over the land, conduct religious ceremonies with prayers and songs, and monitor each site's condition. Special considerations should be given to tribal elders and youth to provide an educational experience and reinforce positive connections with our culture.

See Appendix C for more details.

Nevada National Security Site Vicinity. The NNSS landscape is typical of the Basin and Range Physiographic Province. Key visual features include the Mercury Valley, on either side of U.S. Route 95, gently sloping upward toward the mountains, mesas, and hills enclosing the valley. Representative locations where photographs were taken and sensitivity levels of the roadways in the area are shown in Figure 4–30. Lower elevations in the valley are vegetated with creosote bush and white bursage shrubland, transitioning to spiny menodora, Nevada jointfir, and white bursage shrubland at higher elevations (DOE/NV 2000d). While this vegetation looks rougher in the foreground, it appears smoother as it recedes into the distance. The coarse, angular terrain of the mountain, mesa, and hill slopes provides visual interest during different times of the day, providing simple-to-complex light and shade patterns (see **Figure 4–31**). These patterns provide visual contrast to the smooth valley floor that does not cast visually dynamic shadows. Light and shade also affect the perceived color of the terrain by saturating or dulling the color hues present in the landscape. Development is limited to the Mercury and Amargosa Valleys. While both of these developed areas are small in scale, the use of light-colored building materials makes these areas more visually apparent against the darker natural landscape (see **Figure 4–32**).

Most of Areas 22 and 23 and portions of Area 25 are the only areas of the NNSS that are visible to the public from U.S. Route 95 and the Amargosa Valley. All other public visual access to the interior of the NNSS is limited by terrain. Portions of the study area visible from U.S. Route 95 are considered to have a Class B scenic quality rating due to the lack of visual intrusions and picturesque views of the natural landscape that vary throughout the day and seasonally, combined with commonality of these views to the region.

Figure 4–31 Landscape Photographs – Visual Interest of Terrain near the Nevada National Security Site

Figure 4–32 Landscape Photographs – Developed Areas near the Nevada National Security Site

4.1.10 Cultural Resources

This section discusses the known prehistoric, ethnographic, and historic cultural resources within the boundaries of the NNSS. Unless otherwise noted, the information in this section is derived from the *1996 NTS EIS* (DOE 1996c). Additional information regarding cultural resources on the NNSS was obtained from the Desert Research Institute, which provides cultural resources program support to the DOE/NNSA NSO (DOE 2010a). Information sources provided by the Desert Research Institute include the *Cultural Resources Management Plan for the Nevada Test Site* update (DOE 2010a); short report summaries; lists of recorded sites on the NNSS and their National Register of Historic Places (NRHP) eligibility status; and excerpts from major archaeological, ethnographic, and historical studies conducted on the NNSS for the DOE/NNSA NSO.

Cultural resources include prehistoric and historic archaeological districts, sites, buildings, structures, or objects created or modified by human activity. Cultural resources also include traditional cultural properties, locations of American Indian significance that are important to a community's practices and beliefs and maintain a community's cultural identity. Under Federal regulation, a significant cultural resource, designated as a "historic property," warrants consideration with regard to potential adverse impacts resulting from proposed Federal actions (DOE 2002e). A cultural resource is a historic property if its attributes make it eligible for listing in the NRHP. Federal agencies also are required to consider the effects of their actions on sites, locations, and other resources, such as plants, that are of cultural or religious significance to American Indians, as established under the American Indian Religious Freedom Act (42 U.S.C. 1996). American Indian graves, associated funerary objects, and objects of cultural patrimony are protected by the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et seq.).

The area of influence for cultural resources is 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. The area of influence for the NNSS is defined as all ground areas that would be disturbed by construction, maintenance, or operations of program facilities and activities occurring on site. Based on current knowledge of cultural resources on the NNSS, all areas have the potential to contain cultural resources. Therefore, the area of influence for this SWEIS comprises the entire NNSS.

The NNSS lies within the Southern Great Basin physiographic region and possesses a long history of American Indian occupation and more-recent European-American settlement and American military use. The following is a brief outline of prehistoric, ethnographic, and historic cultural chronologies.

Archaeological research has documented 12,000 years of human occupation on the NNSS. Numerous prehistoric chronological sequences have been developed for the Southern Great Basin (Lyneis 1982; Pippin 1995, 1998a; Warren and Crabtree 1986). The chronological periods are defined primarily by major changes in patterns of artifact assemblage composition, subsistence, settlement, and land use characterizing each period. The chronology developed by Pippin is most applicable to the NNSS (Pippin 1998a). These chronologies of cultural adaptations generally fall into periods occurring during the late Pleistocene (12,000–10,000 BP [years before present]); early Holocene (10,000–7,500 BP); middle Holocene (7,500–4,500 BP); and late Holocene (4,500–150 BP) (DOE 2010a).

At the time of historic contact during the mid-nineteenth century, the region in which the NNSS is situated was occupied by Numic-speaking hunter-gatherer groups now known as the Western Shoshone and the Southern Paiute, whose territories were defined by ethnicity, political affiliation, and subsistence and settlement patterns (Drollinger et al. 2009; Pippin 1998b).

The first European Americans known to traverse what is now the NNSS were emigrants on their way to California in 1849 (DOE 2010a). The area remained sparsely populated and served primarily as a transportation corridor. However, short-lived periods of mining and ranching occurred in the region as well. Military use of the area began in 1940; since that time, the NNSS has remained associated with national security missions, military research and training, and nuclear weapons testing.

4.1.10.1 Recorded Cultural Resources

Current knowledge of cultural resources on the NNSS results from numerous cultural resources studies completed over the last 30 years. Many of these studies were completed prior to NNSS activities, but most were completed within the framework of the NNSS Cultural Resources Management Program. Over 600 cultural resources studies have been conducted on the NNSS and almost 2,000 cultural resources sites have been recorded (see **Table 4–47**). Approximately 4 percent of the NNSS has been surveyed for cultural resources. Surveys are generally completed as part of Section 110 inventory requirements or Section 106 compliance for NNSS projects. In the past, projects were frequently conducted at the higher elevations in the northern end of the NNSS; therefore, the amount of acreage surveyed in these areas, along with the number of identified cultural resources, is greater in the north relative to other portions of the NNSS. However, over the past 10 years, most projects and their associated cultural resources studies have occurred at lower elevations. While all areas of the NNSS have the potential to possess cultural resources, the areas with higher numbers of recorded cultural resources are Rainier and Pahute Mesas in the northwest, followed by Jackass Flats in the southwest, and Yucca Flat in the east (DOE 2010a).

Table 4–47 Nevada National Security Site Cultural Resources Sites by Site Type and Hydrographic Basin

	Prehistoric Site Types							*Historic Site Types*		*Untyped Sites*		
Hydrographic Basin	RB	TC	EL	PL	LO	CA	STA	HI	NT	UT	***Total Sites***	***NRHP-Eligible***
Mercury Valley	0	0	0	0	3	0	0	1	2	0	6	2
Rock Valley	0	1	1	1	15	0	0	0	1	0	19	4
Fortymile Canyon–Jackass Flats	1	36	17	62	243	7	1	8	8	9	392	120
Fortymile Canyon–Buckboard Mesa	0	111	7	109	211	6	1	3	0	54	502	346
Oasis Valley	0	14	1	20	90	0	0	1	0	2	128	49
Gold Flat	0	25	1	97	131	10	0	2	1	1	268	169
Kawich Valley	0	9	1	25	37	0	0	2	0	8	82	58
Emigrant Valley/Groom Lake Valley	0	0	0	0	5	0	0	0	0	0	5	0
Yucca Flat	4	68	10	37	132	57	1	44	25	17	395	176
Frenchman Flat	1	3	2	43	60	0	0	11	34	0	154	58
Total Sites	**6**	**267**	**40**	**394**	**927**	**80**	**3**	**72**	**71**	**91**	**1,951**	**982**

CA = cache; EL = extractive locality; HI = historic site; LO = locality; NRHP = National Register of Historic Places; NT = nuclear testing; PL = processing locality; RB = residential base; STA = station; TC = temporary camp; UT = untyped.
Note: This table does not include isolated artifacts or features. This table does include sites recorded within environmental restoration sites in the Nevada Test and Training Range adjacent to the NNSS.

Prehistoric archaeological sites make up 90 percent of recorded cultural resources. The remaining 10 percent are historic archaeological sites and structures, more-recent facilities and locations associated with scientific research, or sites of unknown age (DOE 2010a). Numerous evaluations of nuclear weapons testing facilities have been conducted since the *1996 NTS EIS* was completed, resulting in 38 sites and historic districts associated with NNSS activities becoming eligible for listing in the NRHP.

The types of cultural resources found on the NNSS include prehistoric and historic sites, features, and artifacts. These resources provide a range of information about past human activity. The terminology used to describe these resources is derived from site type definitions used by the Desert Research Institute (DOE 2010a) and adapted from the *1996 NTS EIS* (DOE 1996c). Prehistoric sites consist of residential bases, temporary camps, extractive localities, processing localities, uncategorized localities, caches, and stations. Historic site types are presented here in two categories: historic sites reflecting mining, ranching, communications, or transportation activities, and those sites and features associated with nuclear weapons testing of the Cold War era. Untyped sites lack enough information to assign a more specific category. Isolated artifacts consist of single prehistoric or historic artifacts or features that lack context and provide limited information about past human activity.

Residential bases are locations of extended occupation of prehistoric people. Temporary camps are occasional operational centers of prehistoric populations or task-oriented groups. These sites served as bases for resource collection and processing, tool manufacture and maintenance, and living activities. The wide range of artifact categories and features at these sites provides important data reflecting the diverse activities conducted by prehistoric populations. Extractive localities are sites where resources were procured. These sites may consist of quarries, water sources, plant-gathering areas, and hunting blinds. Processing localities are areas where groups brought procured resources, such as plant and animal resources or toolstone material, for processing or manufacture. Uncategorized localities lack sufficient information to determine what type of activity is represented. These three locality site types are areas of focused activity that lack the diverse artifact assemblages that residential bases or temporary camps possess. Caches are places used for storing tools or plant and animal resources. Stations are areas where information about game movement, travel routes, or ritual activity was shared and may consist of cairns marking travel routes, geoglyphs, rock art, and observation points.

Historic sites reflect broad categories of activities that occurred after European Americans arrived in the area. These activities are reflected in material remains at mining sites and ranching sites, and on transportation and communication routes.

Documents providing further information used to assess cultural resources located on the NNSS include prehistoric overviews (Pippin 1986, 1995; DuBarton and Drollinger 1996; Drollinger et al. 2000; Jones 2001), ethnographic and historical studies (DuBarton and Drollinger 1996; Pippin 1998a; Johnson et al. 1999; Zedeno et al. 1999; Drollinger and Nials 1996; Jones 2001; Drollinger 2003), and studies associated with nuclear testing (Beck et al. 1996; Johnson and Edwards 2000; Johnson et al. 2000; Jones et al. 2005; Drollinger et al. 2009; and others). The following discussion presents a brief description of known cultural resources on the NNSS, most documented as a result of cultural resource compliance studies associated with DOE/NNSA activities. Because the NNSS covers a large geographic area, cultural resources are grouped by the 10 hydrographic basins located within the NNSS boundary (NDWR 2010a) (see Figure 4–15 and Table 4–47). The cultural resources described below consist of archaeological sites and historic NNSS facilities; isolated artifacts and features are not discussed.

4.1.10.1.1 Mercury Valley

Mercury Valley is bounded by the Spotted Range and the Specter Range. Twenty-six cultural resources studies have been conducted within the portion of Mercury Valley that lies within the NNSS. Approximately 338 acres have been surveyed for cultural resources. Only six sites have been recorded as a result of these surveys. Of these, three are prehistoric localities and one is a historic site, none of which is eligible for listing in the NRHP. One historic district associated with nuclear testing, the Camp Desert Rock Historic District, was recorded, evaluated, and determined to be eligible for listing in the NRHP. The Camp Desert Rock Historic District contains building foundations and features associated with the administration and housing of troops who participated in the Desert Rock atmospheric exercises (Edwards 1997).

4.1.10.1.2 Rock Valley

Rock Valley is bounded by the Specter Range to the south and Skull and Little Skull Mountains to the north. The majority of Rock Valley lies within the NNSS boundary. Eleven archaeological reconnaissance surveys have been conducted within Rock Valley and approximately 445 acres have been surveyed for cultural resources. A total of 19 sites have been recorded as a result of these studies, including 1 temporary camp, 1 extractive locality, 1 processing locality, 15 uncategorized localities, and 1 event associated with nuclear testing. Of these 19 sites, 4 are eligible for listing in the NRHP, 1 of which exhibits occupation from the prehistoric, ethnographic, and historic periods (Jones 2001).

4.1.10.1.3 Fortymile Canyon–Jackass Flats

The Fortymile Canyon–Jackass Flats Hydrographic Basin is bounded by Skull and Little Skull Mountains to the south and the Shoshone Mountains to the north. Almost the entire basin falls within the NNSS boundary. A total of 167 cultural resources studies have been conducted within this area, covering approximately 575 acres. The number of cultural resources identified in this basin is high, reflecting the extensive cultural resources studies associated with NNSS activities in the area. A total of 392 cultural resources sites have been recorded as a result of these studies. This number includes 1 residential base, 36 temporary camps, 17 extractive localities, 62 processing localities, 243 uncategorized localities, 7 caches, 1 station, 9 untyped sites, 8 historic sites, and 8 sites related to nuclear testing. To date, 120 sites are eligible for listing in the NRHP.

4.1.10.1.4 Fortymile Canyon–Buckboard Mesa

This hydrographic basin includes Buckboard Mesa and a portion of Pahute Mesa. It is bounded by the Shoshone Mountains to the west and the Eleana Range to the east. Sixty-nine cultural resources studies have been conducted within the portion of Buckboard Mesa that lies within the NNSS boundary. Approximately 6,138 acres have been surveyed for cultural resources. Buckboard Mesa possesses the highest number of recorded archaeological sites on the NNSS. To date, 502 sites have been recorded in the Fortymile Canyon–Buckboard Mesa Hydrographic Basin. This total includes 111 temporary camps, 7 extractive localities, 109 processing localities, 211 uncategorized localities, 6 caches, 1 station, 3 ranching sites, and 54 untyped archaeological sites. Of these resources, 346 sites are eligible for listing in the NRHP. The large number of prehistoric sites, particularly localities and temporary camps, suggests that this region was intensively used by prehistoric hunter-gatherers.

4.1.10.1.5 Oasis Valley

The eastern portion of the Oasis Valley Hydrographic Basin lies within the NNSS boundary and includes portions of Pahute Mesa. A total of 32 cultural resources investigations have been conducted within the portion of Oasis Valley that lies within the NNSS boundary, and 10 studies have been conducted on environmental restoration sites within the Nevada Test and Training Range adjacent to the NNSS. Approximately 3,477 acres have been surveyed for cultural resources. To date, 128 cultural resources have been recorded in this portion of Oasis Valley. These include 14 temporary camps, 1 extractive locality, 20 processing localities, 90 uncategorized localities, 1 historic period site, and 2 untyped sites. Of these, 49 sites are eligible for listing in the NRHP.

4.1.10.1.6 Gold Flat

The southern portion of the Gold Flat Hydrographic Basin lies within the NNSS boundary and includes part of Pahute Mesa. Fifty-two cultural resources studies have been conducted in the portion of Gold Flat that lies within the NNSS. Approximately 6,371 acres have been surveyed for cultural resources. To date, 268 sites have been recorded as a result of these studies. These sites include 25 temporary camps, 1 extractive locality, 97 processing localities, 131 uncategorized localities, 10 caches, 2 historic sites, 1 site associated with a nuclear testing event, and 1 untyped site. Of these, 169 prehistoric sites are eligible for listing in the NRHP.

4.1.10.1.7 Kawich Valley

The southern part of Kawich Valley lies within the NNSS boundary and includes a portion of Pahute Mesa. Twenty-two cultural resources studies have been conducted in the portion of this basin that lies within the NNSS boundary. Approximately 2,635 acres have been surveyed for cultural resources. To date, 82 sites have been recorded as a result of cultural resources studies. These sites include 9 temporary camps, 1 extractive locality, 25 processing localities, 37 uncategorized localities, 2 historic sites, and 8 untyped sites. Of these sites, 58 are eligible for listing in the NRHP.

4.1.10.1.8 Emigrant Valley

A very small portion of the Emigrant Valley Hydrographic Basin lies within the NNSS boundary. This basin includes a portion of the Belted Range. Two cultural resources surveys have been conducted in the portion of the basin that lies within the NNSS boundary and one study has been conducted on an environmental restoration site on the Nevada Test and Training Range just northeast of the NNSS. Approximately 60 acres have been surveyed for cultural resources. Five prehistoric localities have been recorded in this area, none of which is eligible for listing in the NRHP.

4.1.10.1.9 Yucca Flat

Most of the Yucca Flat Hydrographic Basin lies within the NNSS boundary and is bounded by the Eleana Hills to the west and the Halfpint Range to the east. Yucca Dry Lake lies at the southern end of the basin. To date, 150 cultural resources studies have been conducted in Yucca Flat. Approximately 9,030 acres have been surveyed for cultural resources. To date, 395 sites have been recorded within Yucca Flat. These sites consist of 4 residential bases, 68 temporary camps, 10 extractive localities, 37 processing localities, 132 uncategorized localities, 57 caches, 1 station, 44 historic sites, 25 sites associated with nuclear testing, and 17 untyped sites. Currently, 176 sites are eligible for listing in the NRHP, 18 of which are associated with nuclear testing. One site, Sedan Crater, is already listed in the NRHP. Numerous structures associated with atmospheric nuclear testing are eligible for listing in the NRHP, such as the Yucca Flat Historic District (Jones et al. 2005; Johnson and Edwards 2000; Drollinger et al. 2009).

4.1.10.1.10 Frenchman Flat

Frenchman Flat is bounded by the Spotted Range to the east; Mine Mountain and Massachusetts Mountain to the north; the Shoshone Mountains, Lookout Peak, and the Skull Mountains to the west; and the Ranger Mountains to the south. The western half of the Frenchman Flat Hydrographic Basin lies within the NNSS boundary. Sixty-three cultural resources studies have been completed for the portion of Frenchman Flat that lies within the NNSS boundary. Approximately 9,047 acres have been surveyed for cultural resources. To date, 154 sites have been recorded as a result of these studies. These sites consist of 1 residential base, 3 temporary camps, 2 extractive localities, 43 processing localities, 60 uncategorized localities, 11 historic sites, and 34 sites associated with nuclear testing and research. Of these, 58 sites are eligible for listing in the NRHP, 8 of which are associated with nuclear testing. One of these is the Frenchman Flat Historic District; it includes buildings, structures, and features associated with nuclear atmospheric testing (Johnson et al. 2000).

4.1.10.2 Sites of American Indian Significance

In compliance with Federal laws and DOE policy, the DOE/NNSA NSO conducts an ongoing American Indian consultation program to address American Indian concerns about archaeological sites, plant and animal resources, traditional cultural properties, and sacred sites on the NNSS that hold great cultural value. This program has been in place since 1987 and recognizes the government-to-government relationship between the DOE/NNSA NSO and American Indians. The DOE/NNSA NSO consults with representatives of 16 tribal groups and 1 American Indian organization representing 3 ethnic groups (Western Shoshone, Southern Paiute, and Owens Valley Paiute) who have cultural and historic ties to the NNSS area. These American Indian groups are collectively known as the CGTO. Representatives express their respective tribal concerns and perspectives to DOE/NNSA and provide input regarding the protection and management of sites and resources that hold important cultural values for CGTO (DOE 2010a).

Ongoing consultation with CGTO, consisting of meetings, interviews, and site visits, has resulted in several studies that identify sites and locations throughout the NNSS that possess cultural significance for contemporary American Indians (Stoffle et al. 1989a, 1989b, 1994). These sites and locations consist of numerous ethnoarchaeological, ethnobotanical, and ethnozoological sites; rock art sites; and sites of spiritual significance (DOE 2010a). These consultation efforts have resulted in a better understanding of the cultural significance these sites and locations possess in relation to traditional cultural landscapes (Zedeno et al. 1999; Stoffle et al. 1996; Stoffle et al. 2001).

4.1.10.3 American Indian Cultural Resources

As a part of consultation efforts conducted for this SWEIS, the CGTO American Indian Writers Subgroup documented American Indian perspectives on cultural resources on the NNSS, in relation to the proposed undertaking. This information is presented in the following text box.

Cultural Resources—American Indian Perspective

American Indians consider cultural resources to include not only archaeological remains left by their ancestors but also natural resources and geologic formations in the region, such as plants, animals, water sources, minerals, and natural landforms that mark important locations for keeping their history alive and for teaching their children about their culture. The Consolidated Group of Tribes and Organizations (CGTO) knows, based upon its collective knowledge of Indian culture and past American Indian studies, that American Indian people view cultural resources as being interconnected.

The Nevada National Security Site (NNSS) area and nearby lands were significant to the Western Shoshone, Southern Paiute, and Owens Valley Paiute and Shoshone people. The lands were central in the lives of these people and were mutually shared for religious ceremony, resource use, and social events. When Europeans encroached on these lands, the numbers of Indian people, their relations with one another, and the condition of their traditional lands began to change. European diseases killed many Indian people; European animals replaced Indian animals and disrupted fields of natural plants; Europeans were guided to and then assumed control over Indian minerals; and Europeans took Indian agricultural areas. Indian people believe that the natural state of their traditional lands was what existed before European contact, when Indian people were fully responsible for the continued use and management of these lands.

The withdrawal of Nevada's lands for military purposes in the 1940's, followed by use of the land by the U.S. Department of Energy (DOE) continued the process of Euroamerican encroachment on Indian lands. Land-disturbing activities followed, thus causing some places to become unusable again for Indian people. On the other hand, many places were protected by this land withdrawal because "pothunters" were kept from stealing artifacts from rock shelters and European animals were kept from grazing on Indian plants. The forced removal of Indian people from the land was combined with their involuntary registration and removal to distant reservations in the early 1940s. Indian people were thus removed from lands that had been central to their lives for thousands of years.

DOE has supported several cultural resource studies at the NNSS, most occurring as a result of recommendations made by the CGTO in the 1996 NTS FEIS and commitments made by DOE in the subsequent Record of Decision. Many of these studies are cited throughout Appendix C of the SWEIS. These studies were also designed to comply with various federal laws and executive orders, including the American Indian Religious Freedom Act, Native American Grave Protection and Repatriation Act, and Executive Order 13007, *Indian Sacred Sites.*

Through these studies, the CGTO confirmed that American Indians used traditional sites in the NNSS area to make tools, stone artifacts, and ceremonial objects; many sites are also associated with traditional healing ceremonies and power places. Several areas in the NNSS region are recognized as traditionally or spiritually important. For example, Fortymile Canyon was an important crossroad where trails from such distant places as Owens Valley, Death Valley, and the Avawatz Mountain came together. Black Cone, in Crater Flat, is an important religious site that is considered to be an entry to the underworld. Alice Hill, (refine location with acceptable language) is also regarded as a culturally important place. Prow Pass was an important ceremonial site and, because of this religious significance, tribal representatives have recommended that DOE avoid affecting this area. Oasis Valley was another important area for trade and ceremonies. In 1993, tribal members visited a rockshelter site containing perishable basketry and crookneck staff on the NNSS, and recommended that the items be left in place, with annual monitoring to assess their condition. Gold Meadows is also extremely important to the Indian people. Other areas are considered important based on the abundance of artifacts, traditional-use plants and animals, rock art, and possible burial sites.

See Appendix C for more details.

4.1.11 Waste Management

Introduction

Radioactive and nonradioactive wastes are generated and managed at the NNSS as part of operations in support of National Security/Defense and Nondefense Mission programs; decontamination and demolition of unneeded structures and facilities; and the Environmental Restoration Program, including remediation of soil sites and industrial facilities and, to a small extent, the UGTA Project.[8] Radioactive wastes generated and/or managed at the NNSS include LLW and MLLW, and TRU waste. The Waste Management Program also manages nonradioactive hazardous waste regulated under the Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 6901 et seq.); wastes containing asbestos or polychlorinated biphenyls (PCBs) regulated under the Toxic Substances Control Act (TSCA) (15 U.S.C. 2601 et seq.); explosive wastes; and nonhazardous wastes, including sanitary solid waste, construction and demolition debris, and hydrocarbon-contaminated soil and debris. These wastes are defined in Chapter 12, "Glossary."

Nevada National Security Site (NNSS) Low-Level and Mixed Low-Level Radioactive Waste Management Programs

The NNSS low-level radioactive waste (LLW) management program addresses waste containing radioactive constituents (LLW as defined in Chapter 12, "Glossary"), as well as LLW containing regulated (friable) asbestos, polychlorinated biphenyls (PCBs) in low concentrations (e.g., radioactive PCB bulk product waste containing PCBs in concentrations less than 50 parts per million), or hydrocarbon-contaminated soil and debris. The NNSS mixed low-level radioactive waste (MLLW) program addresses waste containing both radioactive and hazardous constituents (MLLW as defined in Chapter 12, "Glossary"), as well as radioactive waste containing PCBs in sufficient concentrations (e.g., radioactive PCB remediation waste containing PCBs in large capacitors or fluorescent light ballasts).

LLW and MLLW managed at the NNSS include wastes generated by activities within the NNSS or other in-state locations such as the TTR, as well as wastes received from authorized out-of-state DOE and DoD generators, including classified wastes.[9] The NNSS also accepts for disposal selected nonradioactive classified wastes that result from cleanup of current and former DOE weapons production facilities. Wastes thus generated or received may be disposed within authorized and/or permitted disposal units located at the NNSS Area 5 RWMC and the Area 3 RWMS. (The Area 3 RWMS has been in standby mode since July 1, 2006.)

MLLW received from authorized out-of-state generators must be treated in accordance with EPA land disposal restriction requirements before delivery to the NNSS. MLLW generated at the NNSS or by other authorized in-state generators may be treated at the Area 5 RWMC, then disposed, provided the treated waste meets the acceptance criteria for disposal. In-state-generated MLLW that cannot be properly treated at the NNSS is transferred to offsite treatment, storage, or disposal facilities.[10] In-state-generated LLW containing regulated PCBs in sufficient concentrations, asbestos, or hydrocarbon-contaminated soil and debris may be disposed at the NNSS in state-permitted disposal units, provided the waste meets the NNSS waste acceptance criteria for disposal.[11]

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[8] *The NNSS Environmental Restoration Program includes compliance with the FFACO, which was entered into in 1996 by DOE, DoD, and the State of Nevada (NDEP 1996). DOE's Office of Legacy Management has responsibility for the Central Nevada Test Area and Project Shoal and became a signatory to the FFACO in August 2006. The FFACO provides a process for identifying sites that have potential historic contamination, implementing state-approved corrective actions, and instituting closure actions for remediated sites.*

[9] *Some LLW or MLLW consists of classified material that has not been sanitized, demilitarized, or declassified. In addition, the NNSS is designated as a Classified Waste Disposal Facility and accepts low-level classified waste (with or without hazardous constituents) for disposal without sanitization.*

[10] *MLLW treated at offsite facilities may be disposed off site or returned to the NNSS for disposal.*

[11] *Hydrocarbon-contaminated LLW received from out-of-state generators may be disposed in any LLW disposal unit.*

TRU waste generated as part of ongoing NNSS operations or from in-state environmental restoration programs is sent to the Area 5 RWMC for temporary storage before shipment off site for further characterization and/or final disposition.

Tritiated liquids generated by environmental restoration or other in-state DOE activities are managed by evaporation.

Hazardous waste (and waste regulated under the TSCA or other statutes) generated at the NNSS may be sent directly from the point of generation to permitted offsite treatment, storage, or disposal facilities. Waste may be temporarily stored in the Area 5 RWMC and consolidated, pending shipment to offsite treatment, storage, or disposal facilities. The waste may also be sent off site for recycle or reuse as part of the NNSS Pollution Prevention and Waste Minimization Program.

Small quantities of explosives or wastes containing explosives may be treated at the Area 11 Explosives Ordnance Disposal Unit in accordance with a RCRA permit.

Nonhazardous waste generated at the NNSS or by other in-state generators may be recycled, reused, or disposed in permitted landfills such as those operating in Areas 6, 9, and 23 of the NNSS.

Waste management construction, storage, treatment, and disposal activities at the NNSS are summarized in **Table 4–48** and discussed in this section. The status column in the table relates the current status of the listed activity with respect to its analyses in the *1996 NTS EIS* (DOE 1996c) and the *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE 2002g).

Table 4–48 Current Nevada National Security Site Waste Management Activities

Activity	*Status* [a]	*Remarks*
Area 3 Radioactive Waste Management Site		
Disposal		
DOE/NNSA NSO-generated LLW	On standby	The Area 3 RWMS would be used for specific waste streams for which it would be economically or environmentally advantageous to dispose at that facility.
Other LLW		
Closure		
Disposal Crater Complex U3ax/bl	Complete	Facility closure as a RCRA-regulated MLLW disposal unit was completed in 1999.
Disposal Craters U3ah/at and U3bh	On standby	Additional crater disposal is possible pending final closure in accordance with an integrated closure and monitoring plan.
Construction		
Future LLW disposal units	Not developed	Additional existing subsidence craters would be developed as needed if the Area 3 RWMS is re-opened.
Expanded support facility	Not constructed	This project to double the size of an existing support building by adding a prefabricated structure was not implemented. It may be needed in the future if the Area 3 RWMS is re-opened.
Truck decontamination facility	Not constructed	This facility was not constructed but may be needed in the future if the Area 3 RWMS is re-opened.
Area 5 Radioactive Waste Management Complex		
Disposal		
DOE/NNSA NSO-generated LLW	Ongoing	Disposal is expected to continue for as long as needed by the U.S. Department of Energy complex in a variety of types of disposal units constructed with consideration of the radiological and chemical characteristics of the wastes to be disposed (e.g., deeper disposal for high-activity wastes).
LLW received from other authorized generators		
MLLW	Ongoing	Disposal of in-state- and out-of-state-generated MLLW continues at the Area 5 RWMC in a new NDEP-permitted Mixed Waste Disposal Unit (Cell 18) [b]. Previously used Pit 3 ceased acceptance of MLLW on November 30, 2010, and was closed as part of the existing 92-Acre Area closure.

Activity	***Status*** [a]	***Remarks***
Greater confinement disposal	Complete	The performance assessment for existing greater confinement disposal boreholes was completed, and no new waste has been disposed in them. The boreholes were closed as part of closure of the existing 92-Acre Area.
Regulated asbestos LLW	Ongoing	LLW containing regulated asbestos (also called asbestiform waste) was accepted for disposal in Pit 6, but Pit 6 was closed as part of closure of the existing 92-Acre Area. Disposal of this waste continues in a new Mixed Waste Disposal Unit (Cell 18) at the Area 5 RWMC.
Nonradioactive classified waste	Ongoing	Nonradioactive classified waste is accepted for disposal from current and former DOE weapons production facilities.
Storage		
Mixed waste	Ongoing	DOE/NNSA NSO possesses a RCRA permit for temporary storage of in-state and out-of-state MLLW.
TRU waste	Ongoing	Except for two TRU spheres, all stored legacy TRU wastes were shipped off site for characterization at INL and/or disposal at WIPP. The TRU spheres will be stored pending offsite shipment. Experiments at JASPER generate small annual quantities of TRU waste. Environmental restoration activities may also generate TRU waste. All TRU wastes will be safely stored pending offsite shipment for characterization at INL and/or disposal at WIPP.
Hazardous waste	Ongoing	DOE/NNSA NSO possesses a RCRA permit for temporary storage of hazardous waste before shipment to offsite treatment, storage, or disposal facilities.
Treatment		
Macroencapsulation Microencapsulation	Ongoing	Treatment technologies are currently performed on debris generated by in-state environmental restoration programs to meet disposal requirements such as RCRA land disposal restrictions. Treatment occurs at the TRU Waste Storage Pad.
Facility Construction Activities		
Real-Time Radiography	Complete	A real-time radiography unit is operational for nondestructive examination of LLW and MLLW.
TRU Waste Certification Facility TRU Waste Handling and Loading Facility	Complete	Also known as the Waste Examination Facility. Within the Waste Examination Facility, modifications were made to the Visual Examination and Repackaging Building to support repackaging of TRU waste for offsite shipment, which has been completed. The facility is available for future use for waste treatment projects.
LLW disposal units	Ongoing	New disposal units are typically constructed as needed, based on waste forecasts and baseline operating budgets. The current threshold for new disposal unit construction is when remaining total capacity falls below 3.5 million cubic feet.
MLLW disposal units	Ongoing	DOE/NNSA received an NDEP-issued RCRA permit in December 2010 for a new MLLW disposal unit (Cell 18). Cell 18 is in operation.
Hazardous waste storage unit (expansion)	Not constructed	If needed in the future, increase to 0.138 acres, with a capacity of 55,000 gallons.
Maintenance building	Not constructed	This 3,200-square-foot storage facility for equipment and machinery was not constructed, but may be needed in the future.
LLW Storage Facility	Not constructed	This 3,000-square-foot curbed concrete pad was not constructed, but may be needed in the future.
Closure Activities		
Close LLW disposal units Close MLLW disposal units	Ongoing	Individual disposal units are operationally closed as they are filled to capacity with waste. The existing 92-Acre Area was closed in 2011 under the approved 92-Acre Area closure plan. Closure of current and future disposal units will occur in accordance with a formal plan addressing the entire Area 5 RWMC.
Close greater confinement disposal units	Complete	All existing disposal units were operationally closed, filled to grade as needed, and closed in 2011 as part of closure of the existing 92-Acre Area.

Activity	***Status*** [a]	***Remarks***
	Area 6	
Storage Activities		
PCB-contaminated waste	Ongoing	The Area 6 facility operated temporarily as part of an NNSS program to collect and dispose PCB-contaminated waste. Currently, in-state-generated PCB-contaminated waste may be stored at the Hazardous Waste Storage Unit in the Area 5 RWMC before offsite shipment for disposal. LLW and MLLW containing regulated PCBs in concentrations greater than or equal to 50 parts per million are disposed in the Mixed Waste Disposal Unit (Cell 18).
Disposal Activities		
Hydrocarbon landfill	Ongoing	Hydrocarbon-contaminated soils and materials generated at the NNSS are disposed at this NDEP-permitted facility. Small quantities of hydrocarbon waste may also be disposed at the U10c Landfill in Area 9. Hydrocarbon-contaminated LLW is disposed at the Area 5 RWMC.
	Area 9	
Disposal Activities		
U10c Landfill	Ongoing	Accepts inert debris and small quantities of hydrocarbon-contaminated soil and debris.
	Area 11	
Treatment Activities		
Explosives Ordnance Disposal Unit	Ongoing	This RCRA-permitted treatment unit may detonate up to 100 pounds of approved waste per hour, and up to 4,100 pounds in a year.
	Area 23	
Disposal Activities		
Landfill	Ongoing	Accepts less than 20 tons daily of sanitary solid waste.

DOE/NNSA = U.S. Department of Energy/National Nuclear Security Administration; INL = Idaho National Laboratory; JASPER = Joint Actinide Shock Physics Experimental Research Facility; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NDEP = Nevada Division of Environmental Protection; NNSS = Nevada National Security Site; NSO = Nevada Site Office; PCB = polychlorinated biphenyl; RCRA = Resource Conservation and Recovery Act; RWMC = Area 5 Radioactive Waste Management Complex; RWMS = Area 3 Radioactive Waste Management Site; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.

[a] Status relative to the analysis performed for these activities in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE 1996c) and the *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE 2002g).

[b] Waste disposed in the Mixed Waste Disposal Unit (Cell 18) includes classified MLLW, LLW containing regulated PCBs in concentrations greater than or equal to 50 parts per million, and LLW containing regulated asbestos.

Source: Clark et al. 2005; Di Sanza and Carilli 2006; DOE 1996c, 2002g; Gordon 2009b.

4.1.11.1 Radioactive Waste Management

This section addresses NNSS management of LLW and MLLW, and TRU waste.

4.1.11.1.1 Low-Level and Mixed Low-Level Radioactive Waste Management and Disposal

LLW management and disposal currently occurs within the Area 5 RWMC. The Area 5 RWMC is also used for management and disposal of MLLW, and for management of TRU and hazardous wastes. The Area 3 RWMS has been used for disposal of LLW, but is currently in standby mode.

The NNSS receives for disposal LLW and MLLW generated within the DOE complex from numerous DOE sites across the United States, including the NNSS, as well as from DoD sites that carry a national security classification[12] (DOE/NV 2009d). In DOE's December 1996 ROD (61 FR 65551) for the *1996 NTS EIS*, DOE selected the Expanded Use Alternative for most activities, but selected the Continue Current Operations (No Action) Alternative for LLW and MLLW management (61 FR 65551) pending a

[12] *A security classification is a category to which national security information and material are assigned to denote the degree of damage that unauthorized disclosure would cause to national defense or foreign relations of the United States and to denote the degree of protection required.*

decision reached through the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (*WM PEIS*) (DOE 1997). On February 25, 2000 (65 FR 10061), in the fourth ROD for the *WM PEIS*, DOE established the NNSS as one of two regional LLW and MLLW disposal sites for the DOE complex. This 2000 ROD also modified DOE's December 1996 ROD (61 FR 65551) for the *1996 NTS EIS* by selecting the Expanded Use Alternative for management of LLW and MLLW (see Chapter 1, Section 1.4).

4.1.11.1.1.1 Area 3 Radioactive Waste Management Site

The Area 3 RWMS is located in the northwestern quadrant of Area 3 (see **Figure 4–33**). It covers about 120 acres and includes two support buildings (an office trailer and a change area), as well as land dedicated to waste disposal. It is an access-controlled facility surrounded by a wire fence and earthen berms to mitigate potential flooding (DOE/NV 2007c). The Area 3 RWMS includes five disposal units configured from seven subsidence craters caused by underground weapons testing (see **Table 4–49**). Opened in the late 1960s, it was used for disposal of bulk and containerized LLW, such as contaminated soil and debris. The facility has been unutilized since July 1, 2006 (Di Sanza and Carilli 2006; DOE/NV 2011). Under the Expanded Operations Alternative, the Area 3 RWMS could be opened to receive LLW generated from environmental restoration and other activities at DOE/NNSA sites within the State of Nevada. Specifically, this action could be triggered by a need for additional disposal space beyond that available in the Area 5 RWMC for disposal of large on-site remediation debris, or soils from clean-up activities on the NTTR. While there is no near-term need to use the Area 3 RWMS, However, should DOE/NNSA need to activate the Area 3 Radioactive Waste Management Site, it would first undergo detailed consultation with the State of Nevada, and would limit disposal to in-state generated LLW.

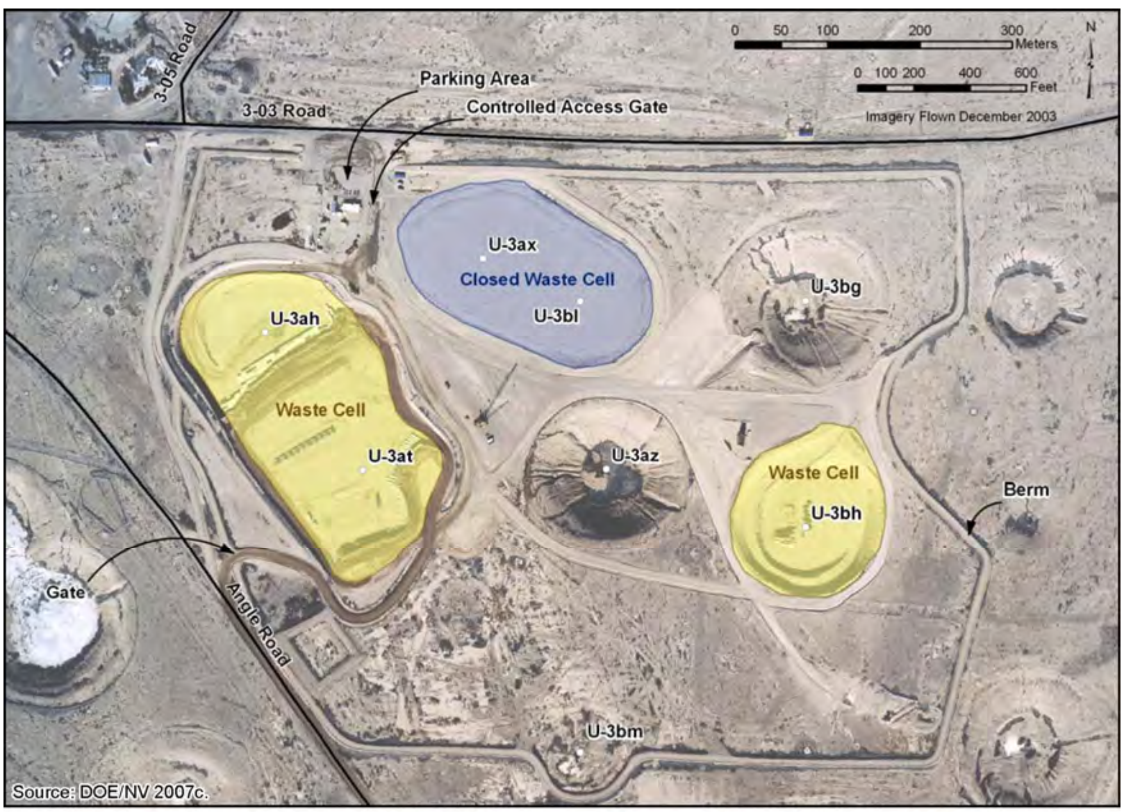


Figure 4–33 Area 3 Radioactive Waste Management Site

Table 4–49 Area 3 Radioactive Waste Management Site Disposal Units

Available Disposal Units [a]	*Closed Disposal Units*	*Undeveloped Disposal Units*
U-3ah/at [b] U-3bh	U-3ax/bl [b]	U-3az U-3bg

[a] As of July 1, 2006, these two disposal units were placed into inactive status.
[b] These disposal units were configured from two subsidence craters.
Source: DOE/NV 2011.

In FY 2001, the U-3ax/bl disposal unit, which contains hazardous constituents regulated under RCRA (CAU 110), was closed in accordance with a closure plan approved by NDEP. In FY 2001, a lysimeter, which measures water content in soil, was constructed at the Area 3 RWMS to gain data to be used to design final closure covers for NNSS disposal areas.

4.1.11.1.1.2 Area 5 Radioactive Waste Management Complex

In 1961, an area northwest of Frenchman Lake was reserved as an LLW disposal site under regulatory provisions derived from the Atomic Energy Act of 1954, as amended. In 1977, the area was designated the Area 5 Radioactive Waste Management Site (DOE 1996c). Since then, activities at the area have been expanded to include management or disposal of other types of waste. The entire complex of waste treatment, storage, management, disposal, and support capacity is termed the Area 5 RWMC (see **Figure 4–34**). Current operations at the Area 5 RWMC include LLW and MLLW examination, repackaging if necessary, and disposal; temporary hazardous and MLLW storage; treatment of some MLLW before disposal; and temporary storage of in-state-generated TRU waste pending offsite shipment.

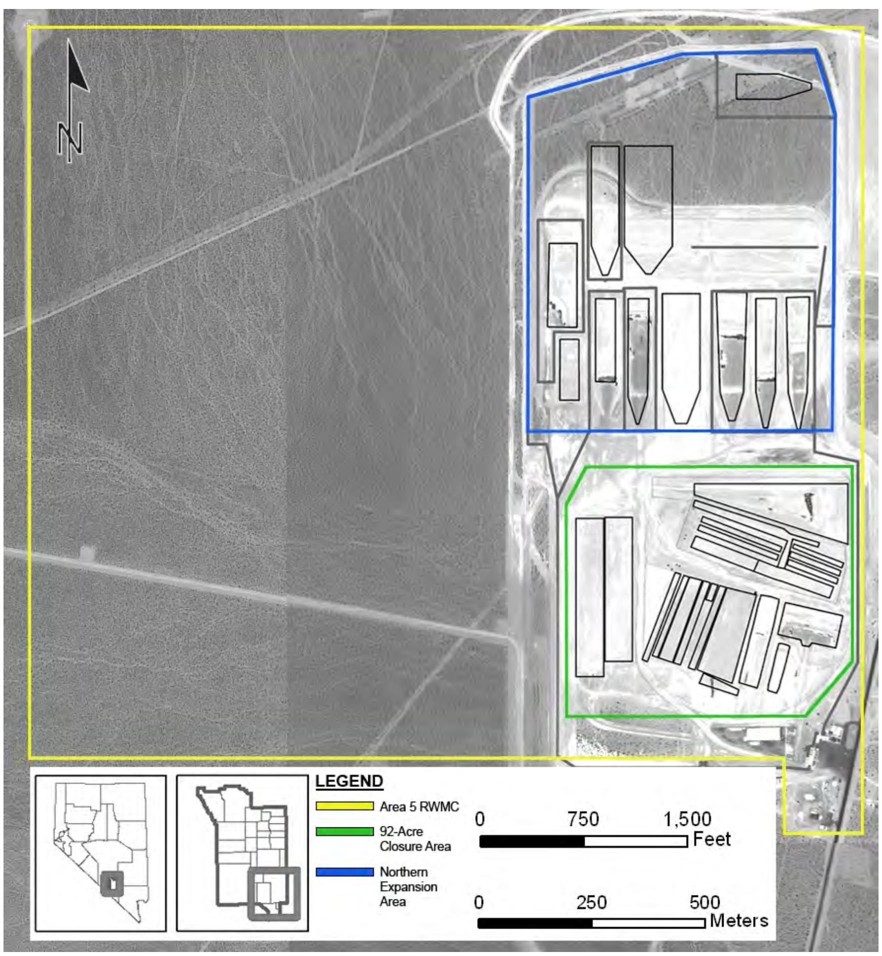


Figure 4–34 Area 5 Radioactive Waste Management Complex

Past and current waste disposal operations are summarized in this section. Additional information about activities at the Area 5 RWMC is provided in the following sections:

- Section 4.1.11.1.1.3, Waste Disposal Support Activities
- Section 4.1.11.1.2, Mixed Low-Level Radioactive Waste Management
- Section 4.1.11.1.3, Transuranic Waste Management
- Section 4.1.11.2.1, Hazardous Waste Management

The Area 5 RWMC covers about 740 acres of DOE/NNSA-owned land[13] and is surrounded by a 1,000-foot-wide buffer zone. The Area 5 RWMC includes several equipment storage yards, as well as structures that are used for offices, laboratories, utilities, and routine operations. Support facilities include:

- Real-Time Radiography Facility (used for verification of MLLW using x-ray technology)
- TRU Waste Storage Pad and Pad Cover Building (used for storage of TRU waste)
- Waste Examination Facility (used to examine and repackage TRU waste for offsite shipment)
- Mixed Waste Storage Units
- Visual Examination and Repackaging Building (located within the Waste Examination Facility)
- Area 5 Hazardous Waste Storage Unit

In addition, a lysimeter facility located southwest of the Area 5 RWMC has been in operation since 1994; data from this facility will be used along with data recorded at the Area 3 RWMS lysimeter to design final disposal covers for NNSS disposal areas.

Waste disposal within the Area 5 RWMC started within a 92-acre area in the southern portion of the site (the "92-Acre Area"), but disposal operations have expanded to the north of this area. The total area used to date for waste disposal, including operational disposal units, covers about 200 acres. The 92-Acre Area consists of 31 pits and trenches and 13 greater confinement disposal (GCD) boreholes. Additional pits have been constructed in the northern expansion area (see **Table 4–50**). The 92-Acre Area was closed under an NDEP-approved Corrective Action Decision Document and Corrective Action Plan that addressed all waste disposed in the 92-Acre Area (see Section 4.1.11.1.1.3).

Table 4–50 Area 5 Radioactive Waste Management Complex Disposal Units [a]

Pits and Trenches	***GCD Boreholes***
Active	
7 cells authorized for LLW 1 cell authorized for MLLW, asbestiform LLW, and LLW containing regulated PCBs in concentrations greater than or equal to 50 ppm (Cell 18)	Not applicable
Permanently Closed	
17 LLW cells 11 LLW and MLLW cells 1 pit permitted for MLLW (Pit 3) 2 cells permitted for asbestiform LLW (Pits 6A and 7)	4 boreholes containing no waste 4 boreholes containing TRU waste 5 boreholes containing LLW

GCD = greater confinement disposal; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; PCB = polychlorinated biphenyl; ppm = parts per million; TRU = transuranic.
[a] As of September 2011.

[13] *In November 2009, permanent ownership of and accountability for the land encompassing the Area 5 RWMC was transferred from BLM to DOE (see Section 4.1.1.3).*

New disposal units will continue to be constructed to the north and west of the 92-Acre Area. It is estimated that the currently unused portion of the Area 5 RWMC could accommodate disposal of several million cubic yards of waste. Disposal services are expected to continue at the Area 5 RWMC for as long as the DOE complex requires them (Di Sanza and Carilli 2006; DOE 2008f; DOE/NV 2008b, 2009d).

Seven disposal units are currently active for LLW, and one disposal unit is active for disposal of MLLW, LLW containing regulated asbestos (also called asbestiform LLW), and LLW containing regulated PCBs in concentrations greater than or equal to 50 parts per million (Cell 18).[14] Thirty-one pits and trenches and all GCD boreholes have been permanently closed with construction of a final closure cover over the 92-Acre Area (see Section 4.1.11.1.1.3).

Of the 31 pits and trenches, 11 pits and trenches contain LLW that also contain constituents that are regulated under RCRA or TSCA. One pit (Pit 3) was operated under RCRA interim status for disposal of MLLW. Two pits contain LLW with regulated asbestos. Seventeen pits and trenches contain LLW that does not include constituents regulated under RCRA or TSCA. One of the trenches, however, is a classified materials trench that contains TRU waste that was inadvertently disposed in 1986. This inadvertent disposal involved two waste shipments containing approximately 102 55-gallon drums (about 1,100 cubic feet) of classified waste originally thought to be LLW (DOE/NV 2006b).

Thirteen GCD boreholes were constructed in the 1980s as an experimental concept for disposal of wastes that were not considered appropriate for near-surface disposal. Of these, nine boreholes were used to dispose TRU waste and some high-activity LLW, and the remaining four boreholes were never used. The boreholes were constructed to depths of about 120 feet. After waste placement, the boreholes containing about 10,350 cubic feet of combined waste were backfilled with at least 60 feet of fill (DOE 1996c; DOE/NV 2001a).

Under current operations, LLW received at the Area 5 RWMC is disposed without further treatment. Some onsite-generated MLLW, however, is repackaged and/or treated at the Area 5 RWMC before disposal (see Section 4.1.11.1.2). Offsite-generated MLLW must be treated to comply with RCRA land disposal restrictions prior to receipt at the NNSS; this waste is disposed without further treatment.

Disposal units are excavated, used, and operationally closed as needed, and are used for disposal of waste typically delivered to the site in drums, soft-sided containers, large cargo containers, and boxes. Currently, one to two new LLW disposal units are excavated each year, as needed. The designs of the waste disposal units vary depending on waste characteristics, as do operational procedures. Some wastes may require special handling or disposal because of size or weight, or because of radiological or chemical characteristics. For example, cover material over wastes in some disposal units may be thicker. In other instances, the disposal unit may be designed for easy offloading of physically large or long wastes, or to safely accommodate high-activity or high-exposure-rate waste packages (e.g., trenches dug within disposal units). Operational practices, such as remote waste placement using large cranes, or placement of waste containers into prepared pockets nested within a dedicated disposal unit, have also been used. Some disposal units may be dedicated for particular types of waste. Examples include Cell 18, used for disposal of MLLW, and pits and trenches used for disposal of classified waste or material (Clark et al. 2005; Di Sanza and Carilli 2006; DOE/NV 2011).

[14] LLW containing non-regulated PCBs in concentrations less than 50 parts per million can be disposed in any active LLW disposal unit.

All LLW and MLLW disposed at the NNSS must meet the NNSS waste acceptance criteria for disposal. In addition, all MLLW must meet applicable RCRA land disposal restrictions.[15] The most recent version of the NNSS waste acceptance criteria was issued in February 2012 and requires generators to provide specific information about the characteristics of the wastes, including volume, radionuclide content and quantity, treatment history, and waste form (DOE/NV 2012b). Candidate waste forms for NNSS disposal include (but are not limited to) those listed in the following text box, which illustrates the large variety of different forms in which LLW and MLLW may exist. Some of the listed waste forms (e.g., aqueous liquid) must be processed (e.g., solidified) or specially packaged before receipt and acceptance at the NNSS for disposal. Specific processing and packaging requirements are provided in the NNSS waste acceptance criteria.

Examples of Low-Level and Mixed Low-Level Radioactive Waste Forms Accepted for Nevada National Security Site Disposal[1]

Charcoal	Cation exchange media	Compactable trash
Incinerator ash	Anion exchange media	Noncompactable trash
Soil	Mixed bed ion-exchange media	Animal carcasses
Gas	Contaminated equipment	Biological material (except animal carcasses)
Oil	Organic liquid (except oil)	Activated material (except activated metal)
Aqueous liquid	Glassware or labware	Activated metal
Filter media	Sealed source or device	Other
Mechanical filter	Paint or plating	
EPA hazardous	Evaporator bottoms, sludges, or concentrates	
Demolition rubble		

[1] This list does not include all radioactive waste forms accepted for disposal at the NNSS but provides examples for informational purposes only.
Source: DOE/NV 2009b.

As of 1996, DOE was operating under RCRA interim-status conditions for disposal of MLLW generated by DOE within the state of Nevada (DOE 1996c). By 2002, DOE had applied for a RCRA Part B permit for disposal of MLLW from DOE generators from inside and outside the state of Nevada (DOE 2002g). Pit 3 operated under interim status for disposal of MLLW until it was permanently closed in 2010, and a permit reissued in 2005 removed the restriction on accepting MLLW from outside Nevada. Pursuant to the permit, the NNSS could accept no more than 20,000 cubic meters (about 706,300 cubic feet) of MLLW from outside the state of Nevada and had to permanently close Pit 3 by December 2010, whichever situation occurred first (DOE/NV 2006a).

Waste was received for disposal at Pit 3 through November 30, 2010. Because not all disposal space would have been used by that time, the DOE/NNSA NSO also disposed LLW, as well as MLLW, in Pit 3. After disposal operations in Pit 3 ceased, remaining disposal space was filled with native soil and the disposal unit was closed in 2011 as part of final closure of the 92-Acre Area. Postclosure monitoring started in the same year (DOE/NV 2008b, 2011, 2012a).

On September 29, 2009, DOE submitted an application to NDEP for a new RCRA Part B permit for a new disposal unit for MLLW, including LLW containing PCBs in concentrations greater than or equal to 50 parts per million. The DOE/NNSA NSO received final permit approval from the state in December 2010. The permitted capacity of Cell 18, the new Mixed Waste Disposal Unit, is approximately 900,000 cubic feet. It began operation in January 2011.

[15] *Wastes containing radionuclides and regulated TSCA constituents must also meet any applicable treatment requirements before NNSS disposal.*

The *1996 NTS EIS* projected disposal of about 40,310,000 cubic feet (1,141,422 cubic meters) of LLW and about 10,600,000 cubic feet (300,500 cubic meters) of MLLW over a period of 10 years (DOE 1996c). However, from 1996 through 2008, the NNSS actually disposed about 21,400,000 cubic feet of LLW and about 225,000 cubic feet of MLLW. About 60 percent of this waste was disposed at the Area 5 RWMC and the rest at the Area 3 RWMS. Over these 13 years, annual LLW disposal volumes ranged from about 400,000 cubic feet in 1998 to 3,740,000 cubic feet in 2004, and averaged about 1,540,000 cubic feet; annual MLLW disposal volumes ranged from zero in 1997, 2001, 2003, 2004, and 2005, to about 154,000 cubic feet in 2007, and averaged about 17,300 cubic feet. Since July 1, 2006, all LLW and MLLW disposal has occurred in the Area 5 RWMC. From 2004 through 2008, annual LLW volumes ranged from about 919,000 to 3,630,000 cubic feet, and averaged about 1,698,000 cubic feet; annual MLLW volumes ranged from zero to about 154,000 cubic feet, and averaged about 41,600 cubic feet (Gordon 2009b).

Radioactive Waste Acceptance Program

The U.S. Department of Energy/National Nuclear Security Administration Nevada Site Office Radioactive Waste Acceptance Program (RWAP) ensures that low-level and mixed low-level radioactive wastes (LLW and MLLW) disposed at the Nevada National Security Site (NNSS) meets the NNSS Waste Acceptance Criteria, which includes requirements set forth by the U.S. Department of Energy, the U.S. Department of Transportation, the Resource Conservation and Recovery Act, and other appropriate Federal laws and regulations. The RWAP process consists of two parts: A waste generator evaluation and a waste acceptance process.

4.1.11.1.1.3 Waste Disposal Support Activities

Management and disposal of LLW is regulated by DOE through its authority under the Atomic Energy Act of 1954, as amended. Management and disposal of MLLW containing hazardous constituents is regulated by DOE under the Atomic Energy Act and by EPA and the State of Nevada under RCRA. Management and disposal of LLW containing regulated PCBs in sufficient concentrations, asbestos, or hydrocarbon-contaminated soil and debris is regulated by DOE under the Atomic Energy Act and by EPA and the state under statutes such as TSCA. Safe disposal is assured through operational procedures; compliance with the NNSS waste acceptance criteria; the Radioactive Waste Acceptance Program (RWAP); risk assessments; air, groundwater, and soil monitoring; and disposal unit closure.

Waste Acceptance. Approval to ship waste to the NNSS for disposal may be granted only after a waste generator demonstrates that it has a waste characterization and certification program that meets the requirements stated in the NNSS waste acceptance criteria. These criteria include specific requirements for waste form, characterization, packaging, and transportation. RWAP personnel provide assistance, interpretation, guidance, and technical expertise on the waste acceptance criteria. Through onsite facility evaluations, RWAP personnel are also responsible for verifying that a waste generator has an established program that complies with regulations regarding the characterization, management, and transportation of radioactive waste. Waste is not accepted at the NNSS until the generator meets the prescribed approval process and a specific waste profile has been reviewed and approved (Gordon 2009a).

The waste disposal process begins when a generator (e.g., DOE or DoD) site proposes a specific waste stream for disposal. If initial discussions with the DOE/NNSA NSO indicate that the proposed waste stream may meet NNSS eligibility and waste acceptance criteria, RWAP personnel conduct an evaluation to ensure that the generator has implemented a waste certification program that is compliant with the NNSS waste acceptance criteria. During this evaluation, RWAP personnel complete an onsite examination of the waste generator's processes and procedures through all stages of waste management, including waste generation, characterization, packaging, and shipment. Potential waste generators must also provide documentation demonstrating the implementation of the NNSS waste acceptance criteria in their program. If issues are identified during the facility evaluations, corrective actions must be approved and implemented prior to waste certification program approval and eventual waste shipment and disposal (Gordon 2009a).

Once a generator has been authorized as an approved generator, it is required to maintain a Quality Assurance Program Plan (QAPP) demonstrating compliance with the current revision of the NNSS waste acceptance criteria; DOE Order 435.1, *Radioactive Waste Management*; DOE Order 414.1D, *Quality Assurance*; and/or 10 CFR 830.122, *Quality Assurance*. Generators are required to submit their current revision of the QAPP to the RWAP manager. Generators must also prepare and submit an NNSS Waste Acceptance Criteria Implementation Crosswalk to the RWAP manager each year. This document references the applicable procedures, processes, or methods affecting quality and personnel directly responsible for implementation of the generator's program. In addition, the generator must submit a written list that identifies key site personnel who certify that the waste meets the NNSS waste acceptance criteria and is safely packaged, marked, and labeled in accordance with U.S. Department of Transportation regulations. RWAP personnel verify the qualifications of these key personnel through the review of training records during the facility evaluations.

Approved waste generators are required to submit documentation (waste profiles) to validate that each proposed waste stream is in compliance with the NNSS waste acceptance criteria. These waste profiles must be in the format prescribed by the DOE/NNSA NSO and include information on waste origin, quantity, composition, and packaging, and the analytical and preparatory methods used to characterize the waste. Waste Acceptance Review Panel personnel review these profiles to ensure that established waste form criteria are met. Copies of the waste profiles are routed to NDEP for concurrent evaluation (Gordon 2009a).

Upon arrival of an LLW or MLLW shipment at the NNSS, the shipment documentation is reviewed to ensure consistency with the pre-approved waste stream profile(s). While this document verification is being conducted, the trucks and trailers carrying the waste are monitored to determine whether external radiation and surface contamination levels are below required limits. As a trailer is unloaded, inspectors verify the physical integrity of the waste packages and check to ensure that container marking and labeling meet NNSS waste acceptance criteria requirements. In addition, onsite real-time radiography (x-ray technology) may be used to visually verify waste package contents, as discussed below.

MLLW requiring treatment prior to disposal may be subject to independent waste verification (real-time radiography examination, visual verification at the generating facility) and chemical screening conducted by RWAP personnel, as determined by the Waste Acceptance Review Panel during the waste profile approval process.[16] At the discretion of the Waste Acceptance Review Panel, LLW may also undergo examination by real-time radiography.

At the Area 5 RWMS, real-time radiography may be performed on pre-selected MLLW and LLW streams, subject to container size and weight limitations associated with the analytical mounting fixture. The procedure is conducted on a predetermined percentage of received containers of waste, based on approved profile specifications, to confirm that the waste form meets the approved profile.

These waste verification activities ensure that the waste form listed on shipment documentation is consistent with the waste form received for disposal. In the unlikely[17] event that any actual waste shipment is deemed not compliant with the NNSS waste acceptance criteria, it is returned to the waste generator for corrective action, consistent with DOE policy (Gordon 2009a).

Disposal Authorization and Performance Assessment

Waste disposal occurs in accordance with authorizations issued by DOE and with permits for MLLW issued by external regulatory agencies. The authorization and permit approval processes are based on formal, quantitative analyses of worker and public health and safety during construction, operation, and closure, as well as consideration of possible long-term (thousands of years) impacts on the public and the

[16] *NDEP participates on the Waste Acceptance Review Panel.*
[17] *For example, during FYs 2004 through 2008, only two shipments were returned to the waste generators (DOE/NV 2005b, 2005g, 2007a, 2007e, 2009a).*

environment after the disposal facilities are closed. The results of the analyses must determine that disposal activities would comply with all applicable regulatory requirements.

These analyses include performance assessments and composite analyses prepared in compliance with DOE Order 435.1. The Area 3 RWMS performance assessment and composite analysis were issued in October 2000 (DOE/NV 2000b); the Area 5 RWMC performance assessment, in 1998 (DOE/NV 1998a); and the Area 5 RWMC composite analysis, in September 2001 (DOE/NV 2001a). An addendum to the Area 5 RWMC composite analysis was also issued in November 2001 (DOE/NV 2001d). The scenarios and waste acceptance criteria for the Area 5 RWMC were updated through an April 2000 addendum to the 1998 performance assessment (DOE/NV 2000a). A second addendum to the Area 5 RWMC performance assessment was issued in 2006 and was reviewed by DOE's Low-Level Radioactive Waste Federal Review Group. This review group recommended, without conditions, DOE's approval of the performance assessment, which confirms that it meets the requirements of DOE Order 435.1 (Carilli and Krenzien 2007).

DOE has also conducted analyses of TRU waste disposal to assess compliance with EPA's TRU waste disposal requirements in 40 CFR Part 191. In 2003, DOE approved an analysis addressing disposal of TRU and other waste in the GCD boreholes, concluding that the long-term performance of the boreholes would comply with 40 CFR Part 191 (Colarusso et al. 2003). An additional analysis also concluded compliance with 40 CFR Part 191, as well as with all applicable requirements in DOE Manual 435.1-1 for TRU waste that had been inadvertently disposed in an Area 5 RWMC trench (Colarusso et al. 2003; Shott, Yucel, and Desotell 2008). DOE/NNSA has closed the trench containing the TRU waste as part of permanent closure of the 92-Acre Area (see below).

The performance assessments and composite analyses support the continued operation of the disposal facilities. DOE requires that performance assessments and composite analyses be maintained after their preparation. The maintenance process includes performing annual reviews, carrying out special analyses, and revising the performance assessments and composite analyses as necessary. A maintenance plan for the Area 3 and 5 performance assessments and composite analyses has been issued (DOE/NV 2002a).

Decision Support System

A decision support system has been implemented that allows rapid assessment and documentation of the consequences of waste management decisions using current site characterization information, the radionuclide inventory, and a conceptual model. The core of the decision support system is a probabilistic inventory and performance assessment model that supports multiple graphic capabilities for documentation of data sources, conceptual model, mathematical implementation, and results. The combined models can be used to estimate disposal site inventory, contaminant concentrations in environmental media, and radiological doses to hypothetical members of the public at various locations. The model is routinely used to provide annual updates of site performance, evaluate the consequences of disposal of new waste streams, develop waste concentration limits, optimize the design of new disposal units, and assess the adequacy of environmental monitoring programs (Shott et al. 2006).

The decision support system maintains a database of the inventories of specific radionuclides on both an actual and a projected basis. Generators proposing to dispose waste at the NNSS must submit a waste profile setting forth projected waste volumes and radionuclide distributions. This information is checked through screening analyses, and more-detailed analyses as needed, to enable a determination that proposed disposal of the waste would not result in impacts that would exceed any of the performance objectives or other numerical criteria for the disposal facility.[18] Waste inventory data are routinely updated in the site database as disposal occurs and as new projections of waste inventories are received.

[18] Pursuant to DOE Order 435.1, DOE disposal sites must be operated so that disposal would be in compliance with a number of performance objectives. For example, there are limits on the radiation dose that may be received by a potential future member of the public as determined by performance assessment modeling.

The performance assessment model is updated annually with the latest inventory estimates, and new estimates of the performance measures are calculated. In this way, the DOE/NNSA NSO ensures that final closure of the site when it is filled to capacity will be in compliance with applicable disposal requirements.

Area 3 and 5 Monitoring

DOE/NNSA's environmental monitoring program for the Area 3 and Area 5 disposal sites includes monitoring of radiation exposure, air, groundwater, meteorology, vadose zone, subsidence, and biota. Monitoring data for calendar year (CY) 2008 indicated that the Area 3 and Area 5 disposal sites were performing within the expectations of the model and parameter assumptions for the facility performance assessments (DOE/NV 2009c).

Closure

Final closure of the Area 3 RWMS and Area 5 RWMC will occur in accordance with integrated closure and monitoring plans that are intended to ensure that closure will be in compliance with all applicable standards, including DOE Order 435.1, DOE Manual 435.1-1, 40 CFR Part 191, 40 CFR Part 265, *Nevada Administrative Code* (NAC) 444.743, and RCRA requirements as incorporated into NAC 444.9632. Final closure of the U3ax/bl disposal unit at the Area 3 RWMS has occurred, as has final closure of the 92-Acre Area at the Area 5 RWMC. Current and future disposal units at Area 3 and Area 5 will be operationally closed when appropriate, and their final closure will occur in accordance with the integrated closure and monitoring plans.

Closure plans have been developed and updated over several years, considering schedules, waste inventories, NNSS and facility characterization data, and final cover designs. An integrated closure and monitoring plan for the Area 3 RWMS and Area 5 RWMC was issued in 2001 (DOE/NV 2001b) and updated in 2005 (DOE/NV 2005d). A closure strategy for the Area 5 RWMC was issued in 2007 (DOE/NV 2007b), and updated closure plans for the Area 3 RWMS and Area 5 RWMC were issued in 2007 (DOE/NV 2007c) and 2008 (DOE/NV 2008b), respectively.

The closure plan for the Area 3 RWMS specifically addresses closure of the U-3ah/at and U-3bh disposal units. (A final closure cover has already been placed over unit U-3ax/bl [CAU 110].) The final cover will consist of a monolayer evapotranspiration layer expected to be somewhat less than 10 feet thick. The requirements of postclosure maintenance and monitoring will be determined in the final closure plan, which will address the applicable monitoring requirements prescribed by DOE directives and other Federal regulations and NDEP (DOE/NV 2007c).

The closure plan for the Area 5 RWMC addresses closure of the 92-Acre Area, as well as the remainder of the Area 5 RWMC. As noted in Section 4.1.11.1.1.2, final closure of the 92-Acre Area addressed 31 inactive pits and trenches and all 13 GCD boreholes. The GCD boreholes were filled to grade and the area comprising the pits, trenches, and boreholes was covered with an 8-foot-thick monolayer evapotranspiration cap. This activity was largely completed by May 2011. In October 2011, major portions of the 92-Acre Area were reseeded, and in December, a temporary watering system was installed to sustain germinated vegetation until springtime (DOE/NV 2012a).

The balance of the Area 5 RWMC used for waste disposal will be closed with covers in a fashion similar to the 92-Acre Area, and adjacent areas between the cover systems will be graded for proper drainage. Following final closure of the entire Area 5 RWMC, institutional controls—including control of public access, cover maintenance, and monitoring—will continue thereafter in accordance with applicable Federal and state requirements. Long-term monitoring provisions for the Area 5 RWMC will be developed as part of its final closure plan (DOE/NV 2008b).

4.1.11.1.2 Mixed Low-Level Radioactive Waste Management

MLLW generated at the NNSS may be stored at the Area 5 RWMC. In November 2010, the DOE/NNSA NSO received an NDEP permit for temporary storage of MLLW (Area 5 RWMC) from authorized out-of-state generators.

Onsite treatment of in-state-generated MLLW may occur at the Area 5 RWMC. The treated and/or repackaged waste is then disposed in the Area 5 RWMC (Gordon 2009b).

Disposal of MLLW at the NNSS is described in Section 4.1.11.1.1.2.

4.1.11.1.3 Transuranic Waste Management

For several years, the NNSS stored legacy TRU waste received from Lawrence Livermore National Laboratory, Rocky Flats Environmental Technology Site, Lawrence Berkeley Laboratory, and EG&G, and from environmental restoration at the NNSS and the TTR. In recent years, however, DOE completed a program to repackage, characterize, and ship this legacy waste to WIPP, near Carlsbad, New Mexico, for disposal. Most waste was shipped directly to WIPP, and some waste was shipped to Idaho National Laboratory for final characterization before transfer to WIPP.

Remaining TRU waste consists of two 3-foot-diameter steel spheres that were used in subcritical experiments. The spheres cannot be shipped in their current configuration in approved Transuranic Package Transporter Model 2 (TRUPACT-II) casks because their plutonium content exceeds the current TRUPACT-II limit of 325 grams. The spheres are being stored pending the availability of suitable processing capability.

Currently, small quantities of TRU waste are generated annually from experiments at JASPER and temporarily stored pending offsite shipment. As of December 2010, 25 standard waste boxes (about 1,660 cubic feet) containing this waste were in storage. Environmental restoration at the NNSS or other in-state locations is also expected to occasionally generate small quantities of TRU waste.

The legacy spheres and accumulated TRU waste from JASPER are temporarily stored at the Area 5 RWMC. Most TRU waste at the Area 5 RWMC is stored in a steel-framed, fabric-covered structure known as the TRU Pad Cover Building. This structure rests on a 2.1-acre asphalt pad containing a protective waterproof layer, plus an 8-inch curb to prevent run-on and runoff (DOE/NV 2006c). Classified TRU material is stored in a separate storage building.

4.1.11.1.4 Tritium Waste Disposal by Evaporation

Liquids containing tritium continue to be disposed at the NNSS by evaporation into the air from ponds and open tanks. The sources of the tritium include tritium-containing water removed from tunnels in Area 12 and from onsite wells that were contaminated from past nuclear tests. In recent years, tritiated water to be evaporated has included air conditioning condensate removed from a sump in the basement of a building at NLVF.[19] Some of this tritiated water is evaporated at NLVF, and the remainder is transported to the NNSS for disposal in NNSS sewage lagoons. The tritium inventory for all sources discharged for evaporation at the NNSS ranged from about 9.5 to 130 curies per year from 1996 through 2008, and averaged about 42 curies per year. From 2004 through 2008, the tritium inventory ranged from about 9.5 to 35 curies per year, averaging about 17 curies (DOE/NV 1997b, 1998c, 1999, 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d).

[19] *As addressed in Section 4.3.12, a 1995 accident resulted in a release of tritium within the basement of Building A-1. Although the contamination was cleaned up to the extent practical, some of the tritium penetrated into the concrete floor of the basement. Tritium emanating from the concrete as water vapor is condensed by the building cooling system.*

4.1.11.2 Nonradioactive Waste Management

Nonradioactive wastes include hazardous waste, nonhazardous waste, explosive waste, and classified nonradioactive waste from DOE weapons production facilities.

4.1.11.2.1 Hazardous Waste Management

Hazardous and toxic materials used or stored at the NNSS are controlled and managed through the use of a Hazardous Substance Inventory database, which facilitates compliance with the operational and reporting requirements of TSCA; the Federal Insecticide, Fungicide, and Rodenticide Act; the Emergency Planning and Community Right-to-Know Act; and the Nevada Chemical Catastrophe Act. Chemicals to be purchased are subject to a requisition compliance review process.

Hazardous waste (and certain PCB wastes regulated under TSCA as discussed below) generated through NNSS activities may be sent to offsite treatment, storage, or disposal facilities; recycled; or reused. Much of these wastes derives from environmental restoration activities (DOE/NV 2009d). Waste shipped to offsite treatment, storage, or disposal facilities is addressed below; recycle and reuse is addressed in Section 4.1.11.3.

Non-bulk (packaged) hazardous waste generated at the NNSS may be stored temporarily in the RCRA-permitted Hazardous Waste Storage Unit located in proximity to the Area 5 RWMC.[20] NNSS-generated waste containing only PCBs in sufficient amounts, or PCBs mixed with hazardous constituents regulated under RCRA, may also be stored in the Hazardous Waste Storage Unit pending shipment off site for treatment and disposal. PCB-contaminated waste is not routinely generated during operations at the NNSS, but is sometimes generated during environmental restoration and decontamination and decommissioning activities at the NNSS or other in-state locations, and may be received mixed with LLW. Nonradioactive waste containing PCBs in concentrations less than 50 parts per million may generally be disposed as nonhazardous solid waste in a permitted NNSS landfill. Waste quantities shipped off site for treatment and disposal from 2004 through 2008 ranged from 10.8 to 399 tons per year, averaging 111 tons per year (DOE/NV 2005f, 2006a, 2007d, 2008a, 2009d).

4.1.11.2.2 Explosive Ordnance Disposal

Nonradioactive explosive ordnance generated at the NNSS from tunnel operations, the NNSS Security firing range, the resident national laboratories, and other DOE/NNSA activities may be treated by open detonation at the Explosives Ordnance Disposal Unit in Area 11.[21] The Explosives Ordnance Disposal Unit is a detonation pit permitted under RCRA (NEV HW0101) and surrounded by an earthen pad with dimensions of about 25 feet by 100 feet. It includes ancillary equipment such as a bunker, electric shot box, and electric wire. DOE/NNSA is permitted to detonate a maximum of 100 pounds of approved waste at a time, not to exceed one detonation event per hour. The maximum annual treatment capacity is 4,100 pounds.

Annual quantities treated have been much smaller than permitted levels. From 2004 through 2008, the maximum quantity treated was 4.9 pounds in 2004; no wastes were treated in other years (DOE/NV 2005f, 2006a, 2007d, 2008a, 2009d).

[20] Much of the environmental restoration waste is delivered directly as bulk shipments (dump trucks, roll-off boxes) to offsite treatment, storage, or disposal facilities. The Hazardous Waste Storage Unit only manages packaged (non-bulk) hazardous waste.

[21] Explosive waste is not accepted for treatment from offsite sources. Any explosive waste generated at the TTR, for example, is treated at the TTR under Emergency Treatment Permits obtained from NDEP.

4.1.11.2.3 Nonhazardous Waste Management

Nonhazardous wastes annually generated through NNSS activities may be sent to NNSS landfills to be disposed, recycled, or reused. NNSS disposal is addressed below; recycle and reuse is addressed in Section 4.1.11.3.

The NNSS operates three permitted landfills for disposal of nonhazardous wastes: the Area 6 Hydrocarbon Disposal Site (Permit SW-13-097-02), Area 9 U10c Landfill (Permit SW-13-097-03), and Area 23 Landfill (Permit SW-13-097-04).[22] Soils and sludge contaminated with hydrocarbons are disposed in the Area 6 Hydrocarbon Disposal Site, while inert debris, such as construction waste and demolition debris, is disposed in the Area 9 U10c Landfill. The Area 9 U10c Landfill can also accept small quantities of hydrocarbon-contaminated waste, as well as nonfriable asbestos waste. The Area 23 Landfill can accept less than 20 tons daily (based on an annual average) of sanitary solid waste, including friable, nonradioactive asbestos waste. All landfills only accept waste from the NNSS and offsite Nevada locations under DOE/NNSA NSO control (DOE 2002g).

From 2004 through 2008, the Area 6 Hydrocarbon Disposal Site received 19 to 1,166 tons of waste for disposal per year, averaging 548 tons per year. Over this time period, the Area 9 U10c Landfill received 4,569 to 15,446 tons of waste for disposal per year, averaging 8,200 tons per year. The Area 23 Landfill received 573 to 1,819 tons of waste for disposal per year, averaging 963 tons per year (DOE/NV 2005f, 2006a, 2007d, 2008a, 2009d). According to a 2008 survey of remaining landfill capacity, the estimated remaining waste capacities for the landfills are as follows: Area 6 Hydrocarbon Disposal Site, 2.8 million cubic feet; Area 9 U10c Landfill, 15 million cubic feet; and Area 23 Landfill, 13 million cubic feet (Gordon 2009b).

4.1.11.2.4 Nonradioactive Classified Waste

The NNSS accepts for disposal in the Area 5 RWMC select nonradioactive classified wastes resulting from cleanup of current or former DOE weapons production facilities.

4.1.11.3 Pollution Prevention and Waste Minimization

DOE/NNSA's pollution prevention and waste minimization initiatives entail processes to reduce the volume and toxicity of waste generated at the NNSS and its satellite facilities. The processes also ensure that proposed methods of treatment, storage, and disposal minimize potential threats to human health and the environment. These initiatives address the requirements of several Federal and state regulations applicable to operations at the NNSS. The goals are to minimize the generation, release, and disposal of pollutants to the environment by implementing cost-effective pollution protection technologies, practices, and policies. Pollution prevention and waste minimization components include source reduction, recycling, reuse, affirmative procurement, and employee and public awareness. Impetus was given to these initiatives by the October 5, 2009, Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*.

The accomplishments of the Pollution Prevention and Waste Minimization Program at the NNSS and satellite facilities are documented in the annual NNSS environmental reports. **Table 4–51** illustrates the types and quantities of hazardous and nonhazardous wastes that were managed by other means than disposal for the years 2006 through 2008.

[22] *An additional permit (SW-13-097-02) is for landfill disposal of LLW containing regulated asbestos in Pit P06UA in the Area 5 RWMC.*

Table 4–51 Waste Reduction Activities, Calendar Years 2006–2008

Activity	Calendar Year Quantities (tons)		
	2006	2007	2008
Hazardous Waste [a]			
Bulk used oil sent to an offsite vendor for recycling	108.2	84.4	84.2
Lead acid batteries shipped to an offsite vendor for recycling	38.0	53.2	196.8
Computer equipment returned to vendor to be refurbished and resold	6.4	42.1	13.3
Spent fluorescent light bulbs and mercury, metal hydride, and sodium lamps sent to an offsite vendor for recycling	3.4	2.3	1.4
Rechargeable batteries sent to an offsite vendor for recycling	1.8	0.3	0.2
Lead scrap metal sold for reuse/recycle	5.7	0.9	b
Lead tire weights reused instead of being disposed as hazardous waste	0.8	0.8	b
Hazardous chemicals relocated to new users through the Material Exchange Program, diverting them from disposal	0.3	b	b
Total:	**164.7**	**184.1**	**296.0**
Nonhazardous Waste			
Scrap ferrous metal sold to a vendor for recycling	593.8	872.8	92.8
Mixed paper and cardboard sent off site for recycling	170.2	668.2	177.5
Food waste from cafeterias sent off site to be reused as pig feed	73.9	52.4	49.2
Shipping materials, including pallets, Styrofoam, bubble wrap, and shipping containers, that were reused	22.8	17.6	9.5
Scrap nonferrous metal sold to a vendor for recycling	19.2	256.1	6.6
Spent toner cartridges sent off site for recycling	2.9	3.2	3.0
Nonhazardous chemicals, equipment, and supplies relocated to new users through the Material Exchange Program, diverting them from disposal	2.0	1.2	3.7
Aluminum cans sent off site for recycling	0.4	0.8	0.8
Total:	**885.1**	**1,872.3**	**343.0**

[a] In accordance with regulations issued pursuant to the Resource Conservation and Recovery Act, the Toxic Substances Control Act, or other applicable Federal or state statutes.
[b] Not reported for this year.
Source: DOE/NV 2007d, 2008a, 2009d.

4.1.12 Human Health and Safety

The health and safety of the general public and site workers are discussed in this section. Environmental health risks from NNSS activities include the effects of environmental noise and acute and chronic exposures to ionizing radiation and hazardous chemicals. Regular programs are administered to monitor releases and evaluate associated potential health impacts. Additionally, studies have been conducted to assess the exposure pathways and potential risks of radionuclide and toxic chemical releases during past NNSS operations. These studies focused on the impacts of releases in terms of health risks to site workers and the general public. Results of current assessments and historic studies indicate (1) there is little risk of enhanced carcinogenesis (the production or manifestation of cancer) due to radionuclide and chemical releases during site operations; (2) doses from site radionuclide releases tend to be far lower than those from natural background radiation; and (3) chemical exposures are well within established guidelines. To optimally protect vulnerable populations, DOE maintains a comprehensive Emergency Management Program that features hazard-specific plans, procedures, and controls (DOE Order 151.1C).

4.1.12.1 Public Radiation Exposure and Safety

4.1.12.1.1 General Site Description

Major sources of background radiation and average doses from background radiation exposure to individuals in the NNSS vicinity are shown in **Table 4–52**.[23] The average annual dose from background radiation is approximately 670 millirem. About half of the annual dose is from ubiquitous, natural background sources (355 millirem) that can vary depending on geographic location, individual buildings in a geographic area, and age, but are all essentially from space or naturally occurring in the Earth. About half of the dose is from medical exposure to radiation (300 millirem), including computed tomography, interventional fluoroscopy, x-rays and conventional fluoroscopy, and nuclear medicine (use of unsealed radionuclides for diagnosis and treatment). Another approximately 14 millirem per year are from consumer products and other sources (nuclear power, security, research, and occupational exposure) (NCRP 2009). Average background radiation doses from these sources are expected to remain fairly constant over the period of the proposed actions. Background radiation doses identified in Table 4–52 are unrelated to NNSS operations.

Table 4–52 Sources of Radiation Exposure of Individuals Unrelated to Nevada National Security Site Operations [a]

Source	***Effective Dose (millirem per year)*** [a]
Natural Background Radiation	
Cosmic and external terrestrial radiation [b]	98
Internal radiation	29
Radon in homes (inhaled)	228
Other Background Radiation	
Diagnostic x-rays and nuclear medicine	300
Consumer products	13
Industrial, Security, Medical, Educational, and Research	0.3
Occupational	0.5
Total (rounded)	670

[a] Except for cosmic and external terrestrial radiation, values are averages for an individual in the United States.
[b] The dose from cosmic and external terrestrial radiation is based on field readings using a pressurized ion chamber (DOE/NV/2009d).
Source: DOE/NV 2009d; NCRP 2009.

Releases of radionuclides to the environment from NNSS operations provide another potential source of radiation exposure to individuals in the vicinity of the NNSS. Types and estimated quantities of radionuclides released from NNSS operations in 2008 are listed in the *Nevada Test Site Environmental Report, 2008* (DOE/NV 2009d). Estimated doses to the public resulting from these releases are presented in **Table 4–53**. The reported total dose to the maximally exposed individual (MEI) is a conservative estimate. It is based on the concentration of radionuclides at a location on the NNSS (referred to as a "critical receptor station") where a member of the public could not live and includes the assumed consumption of game animals collected on the NNSS (not at offsite locations). MEI doses estimated in a similar manner for the years 2004 through 2008 range from 2 to 2.9 millirem per year. These doses fall within the limits invoked by DOE Order 458.1, Change 2, and are much lower than those due to background radiation.

[23] *Average doses from cosmic and terrestrial sources of background radiation are measured by a pressurized ion chamber in the vicinity of the NNSS. Other background doses are assumed to approximate the average dose to an individual in the U.S. population.*

Table 4–53 Radiation Doses to the Public from Nevada National Security Site Operations in 2008 (Total Effective Dose Equivalent)

Receptor	***Atmospheric Releases*** [a]	***Liquid Releases*** [b]	***Game Animals***	***Total*** [c]
Maximally exposed individual (millirem)	1.9	0	0.5	2.4 [d]
Population within 50 miles (person-rem) [e]	< 1 (0.47)	0	(d)	< 1 (0.47)
Average individual within 50 miles (millirem) [f]	< 0.02	0	(d)	< 0.02

rem = roentgen equivalent man.
[a] DOE Order 458.1, Change 2, invokes the Clean Air Act regulations in 40 CFR Part 61, Subpart H, which establish a compliance limit of 10 millirem per year to a maximally exposed individual.
[b] There is no dose to the public from surface-water or groundwater pathways.
[c] DOE Order 458.1, Change 2, establishes a dose limit of 100 millirem per year to individual members of the public exposed through all pathways.
[d] The dose from the ingestion of contaminated game (cottontail rabbit or doves) is applicable to the maximally exposed individual only.
[e] In 2008, site reports did not present a calculated population dose; however, a population dose exceeding 1 person-rem is very unlikely (DOE 2008b). In 2004, the last year that a specific population dose was reported, the estimated dose to a population of 42,871 living within 50 miles of the Area 6 Control Point was 0.47 person-rem (DOE/NV 2005a).
[f] The average dose to an individual was obtained by dividing the population dose by the number of people living within 50 miles of the site.
Source: DOE 2008b; DOE/NV 2005a, 2009d; Warren 2011.

Using a risk coefficient of 600 cancer deaths per 1 million person-rem (or 0.0006 latent cancer fatalities [LCFs] per rem) (DOE 2003c), the risk of an LCF to the MEI due to radionuclide releases from NNSS operations in 2008 was estimated to be 1.4×10^{-6}. That is, the probability of this person dying of cancer at some time in the future as a result of a radiation dose associated with emissions from 1 year of NNSS operations is about 1 chance in 710,000. The hypothetical MEI is a person whose place of residence and lifestyle make it unlikely that any other member of the public would receive a higher radiation dose from NNSS releases. This person was assumed to be exposed to radionuclides in the air and on the ground from NNSS emissions at the Schooner critical receptor station, a location in the far northwestern corner of the NNSS.

Using the same risk coefficient, the calculated LCF risk to the estimated population for 2004 (the last year in which a population dose was estimated) was 0.00028 (DOE/NV 2005a). This low calculated risk implies that no LCFs are expected as a result of radioactive emissions. For comparison, the annual risk of a cancer in the U.S. population in the year 2000 was about 200 deaths per 100,000 people, or 0.2 percent per year (Weir et al. 2003). At that rate, expected fatalities from all cancers in the population living within 50 miles of the NNSS would be 86.

No members of the public receive direct gamma radiation exposure that is above background levels as a result of past or present NNSS operations. Gamma radiation exposure rates measured at areas accessible to the public are comparable to natural background rates from cosmic and terrestrial radiation. Radioactively contaminated areas on the NNSS are isolated from members of the general public, given the considerable distances between these areas and the site boundary, so members of the public are not exposed to any measurably contaminated soil, either directly or through resuspension (DOE/NV 2009d).

Radiation Basics

What is radiation? Radiation is energy emitted from unstable (radioactive) atoms in the form of 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 produced by the process of unstable (radioactive) atoms trying to become stable. 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 µCi).

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 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 a thick wall 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.

Manmade sources of radiation – Medical radiation (x-rays, medical isotopes), consumer products (TVs, luminous dial watches, 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 of 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 measured in units of rad or rem. Smaller fractions of the rem are the millirem (1 millirem = 1/1,000 rem) and the microrem (1 µrem = 1/1,000,000 rem).

Regarding groundwater monitoring programs, annual monitoring has detected tritium-contaminated groundwater in a well beyond the NNSS boundary. The well is a monitoring well that is on federally controlled land (the Nevada Test and Training Range), and there are no indications that contaminated groundwater has migrated to any wells that supply water to members of the public. Consequently, there is no radiation dose incurred by the public from the groundwater pathway. Groundwater monitoring programs are discussed in more detail in Section 4.1.6.2.

Radioactive airborne emissions at the NNSS are monitored on site to ensure compliance with NESHAPs under CAA. A network of 19 air sampling stations and a network of 109 thermoluminescent dosimeters are located throughout the NNSS, primarily within operational areas where historic nuclear testing has occurred or where current radiological operations occur. Air sampling stations monitor tritium, manmade radionuclides, and gross alpha and beta activity in airborne particulates that result either from current site operations or from activities such as environmental restoration that resuspend material at legacy testing locations. Thermoluminescent dosimeters monitor direct gamma radiation exposure.

The total amounts of manmade radionuclides that were emitted to the air from all sources on the NNSS in 2008 were estimated to be 440 curies of tritium, 0.047 curies of americium-241, 0.050 curies of plutonium-238, 0.29 curies of plutonium-239 and -240, and 0.60 curies of depleted uranium. Since the cessation of atmospheric nuclear testing, the annual releases into the air have ranged from 48 to

2,200 curies for tritium, 0.0018 to 0.40 curies for plutonium, and 0.039 to 0.049 curies for americium. These emissions cannot be distinguished from the background airborne radiation measured in communities surrounding the NNSS. Potential radioactive emissions are monitored at stations in selected towns and communities within 240 miles of the NNSS by the independent CEMP. Its purpose is to provide monitoring for radionuclides that may be released beyond the confines of the NNSS boundary. A network of 29 CEMP stations is in use; these stations monitor gross alpha and beta activity, gamma radiation, and meteorological parameters (see Section 4.2.8.3) (DOE/NV 2009d).

4.1.12.2 Occupational Radiation Exposure and Safety

NNSS workers receive the same dose as the general public from background radiation, but they receive an additional dose from working in and near facilities or areas with radioactive material. The average dose to the individual worker and the cumulative dose to all workers at the NNSS from operations in 2008 are presented in **Table 4–54**. Using a risk coefficient of 0.0006 LCFs per person-rem, the projected LCF risk among NNSS workers from normal operations in 2008 was 0.0033. The largest dose received by a worker in 2008 was 451 millirem (Enyeart 2009); the increased risk of an LCF from this dose was 0.00027.

The average dose of 70 millirem in 2008 is comparable to the average doses over the prior 5-year period (2003–2007) of 46 to 81 millirem (DOE 2006a, 2009n).

Table 4–54 Radiation Doses to Workers from Nevada National Security Site Normal Operations in 2008 (Total Effective Dose Equivalent)

Workers	*Onsite Releases and Direct Radiation*	
	Standard [a]	*Actual*
Maximally exposed worker (millirem)	5,000	451
Average radiation worker (millirem)	None	70
Total of all radiation workers (person-rem) [b]	None	5.2

rem = roentgen equivalent man.

[a] No standard is specified for an "average radiation worker"; however, the maximum dose to a worker is limited as follows: The dose limit for an individual worker is 5,000 millirem per year (10 CFR Part 835). However, DOE's goal is to maintain radiation exposure as low as is reasonably achievable (ALARA). DOE has, therefore, established an Administrative Control Level of 2,000 millirem per year; the site contractor sets facility administrative control levels below the DOE level, with 500 millirem per year considered a reasonable goal for trained radiation workers.

[b] There were 75 workers with measurable doses in 2008.

Note: Total radiation worker dose presented in the table slightly differs from that calculated from data shown due to rounding.

Source: 10 CFR 835.202; DOE 1999e, 2009n; Enyeart 2009.

Worker occupational risks are generally associated with activities such as waste handling, construction, environmental restoration, and decontamination and decommissioning. DOE's Computerized Accident/Incident Reporting System provides statistics on worker injury and illness information, including accidents involving government-owned vehicles. Although the total number of hours worked showed an upward trend between 1996 and 2005, the rate of total recorded cases per 200,000 hours worked remained fairly stable, as did the rates of accident cases causing days away from work, restricted work, or job transfer (DART cases). These accident statistics are comparable to those for the DOE complex as a whole. In 2006, the total recorded accident/incident case rate at the NNSS was 2.3, and the DART case rate was 0.9; the comparative rates for 2006 over the entire DOE complex were 1.6 and 0.7, respectively. From 1996 through 2004, accident rates for government vehicles at the NNSS averaged 0.5 accidents per million vehicle miles, while the overall DOE/NNSA accident rates over this period averaged 1.7 accidents per million vehicle miles. In addition, it is noteworthy to mention that a key Lessons Learned (DOE 2002b) implemented in 2002, which consisted of holding a weekly roundtable discussion focused on safety between managers and staff, was responsible for eliminating injury incidents for the better part of the following annual period. This implementation focused on the initiation of regular weekly roundtable discussions between managers and workers during scheduled safety meetings. It is these types of programs and recognition that are regularly set in place at the NNSS in an effort to keep an accident goal of "zero accidents/incidents" with "zero work-days lost" (DOE 2008f, 2009m).

4.1.12.3 Chemical Exposure and Risk

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media, through which people may come in contact with hazardous chemicals. Hazardous chemicals can cause cancer and non-cancer-related health effects.

Because of the NNSS's remote location and large size, there is no risk of chemical exposure to the surrounding public population resulting from normal site operations. Nevertheless, monitoring efforts and baseline studies are regularly performed. However, certain workers at the NNSS are at risk of chemical exposure depending on their job function and proximity to various sources.

Of key concern at the NNSS is exposure to beryllium. Beryllium can cause acute respiratory disease (for which a workplace air concentration limit has long been in place), and chronic beryllium exposure can cause lung disease. In December 1999, DOE promulgated the Chronic Beryllium Disease Prevention Program (64 FR 68853), and in February 2006, DOE included the program in worker safety and health regulations established to govern contractor activities at DOE sites (71 FR 6857). DOE/NNSA has implemented the program at the NNSS to reduce the number of workers potentially exposed to beryllium and establish a medical surveillance program for early detection of the disease. DOE sponsors and funds a screening program for former DOE workers who may have been exposed to beryllium at the NNSS and other DOE sites.

As discussed in Section 4.1.8, common sources of chemical air pollutants at the NNSS include various particulate matter from construction activities, aggregate production, surface disturbances, fuel-burning equipment, state-authorized open burning, fuel storage facilities, and chemical release tests conducted at NPTEC. An estimated 6.05 tons of criteria air pollutants were released on the NNSS in 2008. The majority of the emissions comprised nitrogen oxides from diesel generators. Total air emissions of lead were 4.56 pounds, and the total quantity of hazardous air pollutants released in 2008 was 0.09 tons. Other emitters included carbon monoxide, sulfur dioxide, and volatile organic compounds, all in quantities well below emission criteria limits (DOE/NV 2009d).

As for monitoring potential chemicals released to drinking water and wastewater systems at the NNSS, six permitted wells on the NNSS serve the drinking water needs of NNSS workers and visitors. The wells are regularly monitored for potability and purity. In 2008, water samples from these wells (in addition to potable-water hauling trucks) met all national primary and secondary drinking water standards. In addition, site operating lagoon systems are tested for biochemical oxygen demand, pH, total suspended solids, and a suite of toxic chemicals; all lagoon water measurements were found to be within permit limits in 2008. Discharge water at the site is also tested for a host of potential contaminants. In 2008, no contaminants were detected at levels that exceeded permit limits (DOE/NV 2009d).

Regarding risks from handling toxic or hazardous chemicals, worker safety programs at the NNSS are enforced via required adherence to Federal and state laws; DOE Orders; Occupational Safety and Health Administration requirements; EPA guidelines; and plans and procedures for performing work, including training, monitoring, use of personal protective equipment, and administrative controls. Although chemical inventories have varied to a limited extent over recent years, administrative controls continually ensure that quantities do not approach levels that pose undue risk due to storage, concentration, bulk quantity, or logistical factors. Any amounts that potentially exceed threshold planning quantities require reporting under Federal regulations (40 CFR Part 355; 40 CFR Part 370).

4.1.12.4 Health Effects Studies

There have been numerous studies conducted over the years examining the potential health effects that U.S. populations may have incurred from exposure to fallout associated with the NNSS atmospheric nuclear tests. Most notable are those discussed below.

A 1979 study reported in the *New England Journal of Medicine* concluded that a significant excess of leukemia deaths occurred in children up to 14 years of age living in Utah between 1959 and 1967. This excess was concentrated in the cohort of children born between 1951 and 1958, and was most pronounced in those residing in Utah counties receiving high fallout. Mortality increased by 2.44 times (95 percent confidence, 1.18 to 5.02) to just slightly above that of the United States in the high-exposure cohort residing in the high-fallout counties, and was greatest in 10- to 14-year-old children. For other childhood cancers, no consistent pattern was found in relation to fallout exposure (NEJM 1979).

In 1994, DOE published a report entitled *Development of the Town Data Base: Estimates of Exposure Rates and Times of Fallout Arrival Near the Nevada Test Site* in an effort to model public radiation exposure rates in populated areas of Nevada, California, Arizona, and Utah at the time of fallout arrival and at 12-hour intervals thereafter. This report only focused on empirical exposure rate data (e.g., intensity isopleths across land areas) and did not convey interpretations of associated resulting health effects on potentially affected populations (DOE/NV 1994). In a 1997 report by the National Cancer Institute, it was determined that 90 atmospheric tests at the NNSS deposited high levels of iodine-131 (149 million curies) across a large portion of the contiguous United States during the 1950s and 1960s, especially in 1952, 1953, 1955, and 1957; the resulting doses were large enough to produce 10,000 to 75,000 cases of thyroid cancer and had the potential of being the causational link for up to 212,000 cases. Results of the study show that, depending on their age at the time of the tests, where they lived, and what foods they consumed, particularly milk, Americans were exposed to varying levels of iodine-131 (which accumulates in the thyroid gland) for about 2 months following each of the 90 tests, after which the isotope decayed to essentially harmless levels. Rain, wind, and the food supply spread iodine-131 from these tests across the United States, with the largest deposits immediately downwind of the NNSS and the lowest on the west coast, upwind of the NNSS. The average cumulative thyroid dose to approximately 160 million people who lived in the United States during the testing era was about 2 rad, about five times the radiation dose emitted by a mammogram. Americans were exposed to varying levels depending on their residence, age, and food consumption. People who lived in the western states to the north and east of the NNSS, such as Colorado, Idaho, Montana, South Dakota, and Utah, had the highest per capita thyroid doses, ranging from 9 to 16 rad. Children between 3 months and 5 years old in these high-fallout areas probably received three to seven times the average dose for the population in their county because they had smaller thyroids and tended to drink more milk than adults (NCI 1997).

Milk was a major exposure vehicle because iodine-131 was deposited on pasture grasses and then consumed by cows. However, an estimated 20,000 people who drank goats' milk during the testing years were at an even greater risk because the iodine-131 was more concentrated in goats' milk than cows' milk. Thyroid doses to the individuals who drank goats' milk could be 10 to 20 times greater than those to residents of the same county who were the same age and gender, and drank an equal amount of cows' milk. Other pathways included inhaling contaminated air or ingesting tainted leafy vegetables, cottage cheese, and eggs. However, the relationship between iodine-131 and thyroid cancer still is not fully known. It makes up less than 1 percent of cancer cases nationwide each year, and cancer registries do not indicate that fallout has caused an epidemic, although record-keeping did not start until the early 1970s (NCI 1997).

A Centers for Disease Control and Prevention report states that fallout from the NNSS, combined with nuclear tests conducted overseas by the United States and other countries, could ultimately be responsible for an additional 17,000 cancer deaths (CDC/NCI 2001).

Studies investigating potential impacts on American Indians from exposure to iodine-131 suggest that doses to this group could have been larger than those calculated for the general population. For the general population, the major exposure pathway was the ingestion of milk; additional exposure pathways considered were inhalation of contaminated air and ingestion of contaminated greens, cheese, and eggs. Evaluations show that exposures via the wild game pathway may have an increased food-chain-related thyroid dose and consequent risk. Therefore, for people eating a diet heavy in small wild game, the major exposure route may be the wild game. The analysis suggests that Duckwater, Nevada (north of the NNSS), residents, who were exposed to contaminated milk in addition to contaminated game, experienced a greater thyroid cancer risk than people whose primary exposure pathway was cows' milk (Russ et al. 2005).

In regard to potential health effects on onsite military and DoD civilian participants during the testing years, the Nuclear Test Personnel Review Program, administered by the U.S. Defense Threat Reduction Agency, was implemented to (1) confirm veteran participation in U.S. atmospheric nuclear tests from 1945 to 1962 and (2) upon confirmation, provide either an actual or estimated radiation dose received by the veteran, leading to potential financial dispensation (via the U.S. Department of Veterans Affairs) associated with a presumptive adverse health condition resulting from this dose. Each dose assessment, thousands of which have been conducted since the program's inception in 1978, can be interpreted as an independent radiation exposure health effects study. Outside of the Nuclear Test Personnel Review Program, there have been numerous other financial claims independently submitted against the Federal Government by employees at the NNSS, alleging similar adverse health effect manifestations resulting from their involvement or presence during the testing era.

There are no studies that indicate adverse health effects in populations near the NNSS as a result of activities or operations supporting the current NNSS missions.

4.1.12.5 Accident History

Nuclear testing began at the NNSS in 1951. There were 100 atmospheric nuclear explosions before the Limited Test Ban Treaty was implemented in 1963. Nuclear tests were conducted underground until October 1992, when the nuclear testing moratorium was implemented. Since 1970, there have been 126 nuclear tests that released approximately 54,000 curies of radioactivity to the atmosphere. Of this amount, 11,500 curies were accidental due to containment failure (massive releases or seeps) and late-time seeps (small releases after a test, when gases diffuse through pore spaces of overlying rock). The remaining 42,500 curies were operational releases. From the perspective of human health risk, if the same person had been standing at the boundary of the NNSS in the area of maximum concentration of radioactivity for every test since 1970, that person's total exposure would be equivalent to 32 extra minutes of normal background exposure, or the equivalent of one-thousandth of a single chest x-ray (OTA 1989).

As with nuclear testing, accidents have occurred in the past that are associated with the unique type of work and experiments performed at the NNSS. Because of the change in the work performed on the NNSS, similar accidents have no or little likelihood of occurring in the future.

- Collapses of the ground surface above underground nuclear tests have resulted in worker injury.
- Explosive accidents have occurred and resulted in injuries to workers; for example, a hydrogen explosion during a post-test re-entry resulted in worker injuries.

In addition to the above accidents that were unique to the NNSS, other accidents similar to those that might occur at a large industrial site have also occurred at the NNSS.

- Vehicle accidents have occurred, ranging from minor accidents resulting only in property damage to more severe accidents resulting hospital treatment of injuries, and in a few cases, fatalities. Inclement weather contributed to difficult driving conditions in some of the accidents.

- Workers have been exposed to hazardous materials during the course of their work. Incidences have included exposure to radioactive materials, for example, during borehole management, and exposure to chemicals, for example, during a training exercise.
- Accidents involving energized electrical systems have occurred, resulting in near misses or worker shock. For example, workers have cut cables or penetrated buried cables that were energized; other instances involved workers performing inspections, maintenance, or repairs on panels or equipment that were not fully secure (loose wires, systems that were thought to be de-energized).
- A variety of industrial accidents have occurred, resulting in employee impacts ranging from mild injuries to severe injuries to fatalities. Examples include sprains, strains, or fractures from accidents associated with lifting or walking over difficult terrain; lacerations or cuts (including a severed fingertip) when equipment that was being worked on moved unexpectedly; hazards from collapse of excavation walls, falls from scaffolding/elevated platforms, and failure of rigging; and injuries from working near or with pressurized systems that fail, impacting workers.
- Natural phenomena have resulted in accidents, some that have threatened or impacted workers. Lightning has caused fires on the NNSS, as well as injuring an employee. High winds have caused damage to buildings, trailers, and utility poles, thereby posing a threat to workers.

4.1.12.6 Emergency Preparedness

Each DOE site has established an Emergency Management Program, developed in accordance with DOE Order 151.1C, *Comprehensive Emergency Management System*, that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response for postulated accident conditions and to provide response efforts for accidents not specifically considered. The Emergency Management Program incorporates activities associated with emergency planning, preparedness, and response. The DOE/NNSA NSO Consolidated Emergency Plan is designed to document all aspects of the site's Emergency Management Program, including provisions to effectively and efficiently respond to an operational emergency, and minimize the consequences of an emergency event for the health and safety of workers, responders, the public, and the environment. The plan integrates all emergency planning into a single entity to minimize overlap and duplication and to ensure proper responses to emergencies not covered by a plan or directive. DOE/NNSA coordinates emergency response planning and training with local governments. In accordance with the National Incident Management System, the coordination ensures that communications systems and equipment are interoperable and that personnel and equipment can be effectively deployed in the event of an emergency. The DOE/NNSA NSO Site Manager has the responsibility to respond, manage, and recover from an emergency occurring at the NNSS.

The plan provides for identification and notification of personnel for any emergency that may develop during operational and nonoperational hours. DOE/NNSA receives warnings, weather advisories, and any other communications that provide advance warning of a possible emergency. The plan is based upon current DOE/NNSA vulnerability assessments, resources, and capabilities regarding emergency preparedness.

4.1.12.7 Environmental Noise

The acoustic environment in areas adjacent to the NNSS is characteristic of uninhabited desert areas or small rural communities where natural phenomena, such as wind and rain, account for most of the background noise. Manmade noise in some areas of the ROI is caused by vehicles traveling along public highways and an occasional military aircraft. The Creech Air Force Base and the Desert Rock Airstrip are located near the southern border of the NNSS and generate intermittent increases in noise levels in the surrounding area. Although no ambient noise data are available, monitoring measurements from communities with similar environmental settings show that day–night average noise levels from such communities typically range from 45 to 65 decibels, A-weighted[24] (DOE 2008d).

Major sources of noise at the NNSS include equipment and machines, blasting and explosives experiments, aircraft operations, and vehicles. Explosives at BEEF and other areas in the Nuclear and High Explosives Test Zone (Areas 1, 2, 3, 4, 12, and 16), Areas 5 and 26, and the Explosives Ordnance Disposal Unit in Area 11 occasionally result in increased acute noise levels (less than 10 times per year at each site) (Morris 2009). Because of the NNSS's remote location, large size, access restrictions, and lack of a nearby population, the general public has little to no exposure to noise generated within the NNSS. The closest sensitive receptors to the site boundary are residences located approximately 1 mile to the south, in Amargosa Valley. At the NNSS boundary, away from most facilities, noise from most sources within the NNSS is barely distinguishable above background noise levels. Traffic generated by personnel commuting to and from work and occasional aircraft operations are the main NNSS-related contributors to increased noise levels in nearby communities.

Section 4 of the Noise Control Act of 1972, as amended (42 U.S.C. 4901 et seq.), directs Federal agencies to carry out programs in their jurisdictions "to the fullest extent within their authority" and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare. The Occupational Safety and Health Administration regulations (Occupational Noise Exposure; Hearing Conservation Amendment, 29 CFR 1910.95) require hearing conservation and protection for all employees potentially exposed to criteria noise levels. Standards issued under the authority of the DOE Manual 440.1-1A, *DOE Explosives Safety Manual*, establish safety requirements applicable to operations involving the development, testing, handling, and processing of explosives, including noise protection guidelines during the detonation of explosives (DOE 2006c). High-explosives experiments must be conducted in accordance with this directive. Except for the prohibition of nuisance noise, neither the State of Nevada nor local governments have established specific environmental noise standards. Occupational noise exposure is regulated to the extent required by law.

4.1.13 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental impacts of Federal programs, policies, and activities on minority and low-income populations.

This section presents a summary of the demographic analysis prepared to analyze the potential impacts on low-income and minority populations affected by the programs discussed in this SWEIS. Demographic analysis is the first step in determining disproportionately high and adverse human health or environmental effects on low-income and minority populations. This analysis sets the stage for the impacts analysis presented in Chapter 5. Demographic analysis includes defining the ROI, census block groups, low-income populations, and minority communities.

The ROI for analyzing environmental justice in this SWEIS comprises Nye and Clark Counties, Nevada. DOE/NNSA did not consider areas outside Clark and Nye Counties because any impacts extending beyond this area would impact the population equally and would not have a disproportionately adverse impact on low-income or minority communities.

CGTO has also identified areas and nearby lands as culturally important to American Indian peoples. Although many of the American Indian groups live outside Clark and Nye Counties, American Indian peoples continue to value and recognize traditional ties to the NNSS and surrounding area. In recognition of these traditional ties, DOE/NNSA has established a relationship with CGTO. Specific aspects of the

[24] *A decibel is a unit that expresses the relative intensity of sounds on a logarithmic scale where 0 is below human perception and 130 is above the threshold of pain to humans. The A-weighted decibel scale corresponds approximately to the frequency response of the human ear and thus correlates well with loudness.*

participation of the group in DOE/NNSA cultural resources management projects are discussed in Section 4.1.10.2. CGTO has also presented additional viewpoints on environmental justice in Chapters 4 and 5 and Appendix C of this SWEIS.

4.1.13.1 Methodology

DOE/NNSA used the Council on Environmental Quality definition of low-income and the annual statistical poverty thresholds from the U.S. Census Bureau in its environmental justice analysis. A low-income community exists when the percentage of low-income people in the area of interest is meaningfully greater than the corresponding percentage in the general population. For purposes of analysis, DOE/NNSA used the state-wide average of 11.2 percent to define the percentage of low-income people in the general population. To identify low-income populations, DOE/NNSA used Census Bureau data for census block groups (USCB 2000, 2008b) where the percentage of low-income people exceeded the state average (sorted into ranges of 11–20, 21–30, and greater than 30 percent). The census block group, which typically consists of between 600 and 3,000 people, with an optimal size of 1,500 people, is the smallest census unit for which the Census Bureau releases income data (to protect confidentiality).

DOE/NNSA followed the Council on Environmental Quality guidance, which considers a minority population to exist where either (1) minority individuals in the affected area exceed 50 percent of the population or (2) the percentage of minority individuals in the affected area is meaningfully greater than the corresponding percentage in the general population or other appropriate unit of geographic analysis. The state-wide percentage of minority individuals (used to represent the general population) is 38.2 percent. For purposes of analysis, DOE/NNSA identified census block groups where the percentage of minority individuals was greater than 50 percent.

4.1.13.2 Low-Income Populations

Poverty thresholds are dollar amounts the Census Bureau uses to determine poverty status. In 2008, the weighted average threshold for households with two people was $14,051; that for households with three people was $17,163.

In 2008, the average household size for Clark County was 2.66; that for Nye County was 3.22. For purposes of analysis, DOE/NNSA rounded the average household size for the counties within the ROI—an average household size of 3 was used for Clark and Nye Counties.

Census data were available for the number of households with an income less than $15,000 and those with an income between $15,000 and $24,999. DOE/NNSA used the combined number of households with incomes less than $24,999 as the poverty threshold for Clark and Nye Counties.

Analysis of the data (see **Figure 4–35**) illustrates that there are numerous census block groups with low-income populations between 11 and 20 percent (that is, at or above the state-wide average) distributed throughout the ROI, including large (but sparsely populated) block groups adjacent to the NNSS. Block groups with low-income populations in the 21–30 and greater-than-30 percent ranges are found further to the east in the Las Vegas metropolitan area, closer to the RSL and NLVF facilities (see Sections 4.2.13 and 4.3.13).

4.1.13.3 Minority Populations

There are no block groups in Nye County (the county the NNSS is located within) with minority populations greater than 50 percent. Within the ROI, the closest block group to the NNSS with a minority population greater than 50 percent is Census Tract 5818, Block Group 1, in Clark County; approximately 2 miles east of the southeastern corner of the NNSS (see **Figure 4–36**). Additional block groups with minority populations greater than 50 percent are found further to the east in the Las Vegas metropolitan area, closer to the RSL and NLVF facilities (see Sections 4.2.13 and 4.3.13).

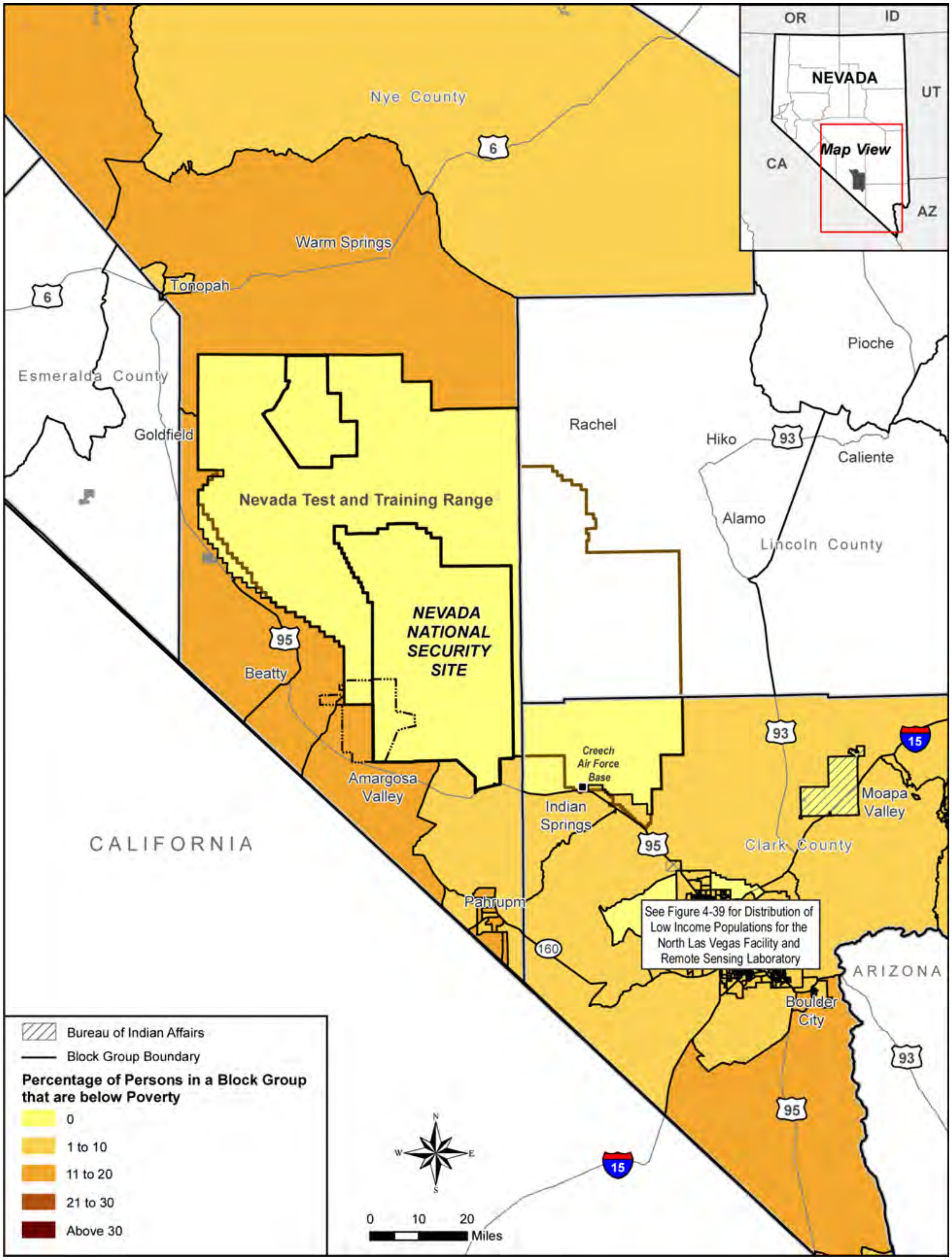


Figure 4–35 Distributions of Low-Income Populations for the Nevada National Security Site and the Tonopah Test Range

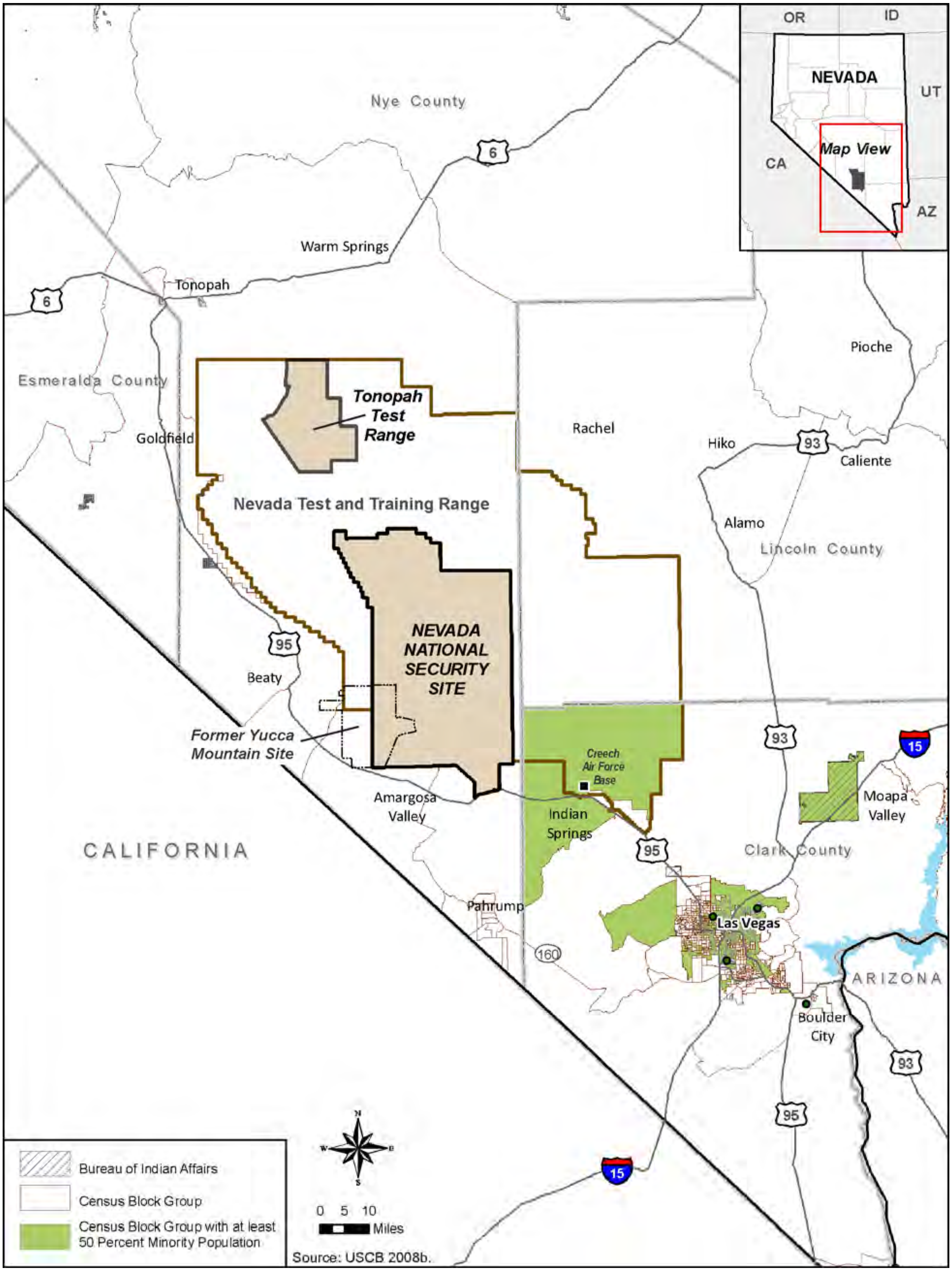


Figure 4–36 Nevada National Security Site and Tonopah Test Range Distributions of Minority Populations Greater than 50 Percent

4.2 Remote Sensing Laboratory

This section describes the existing environmental conditions at RSL. RSL is located adjacent to the main runway on Nellis Air Force Base, in North Las Vegas, Nevada. RSL provides emergency response resources for incidents involving weapons of mass destruction through the development and customization of state-of-the-art instruments and remote sensing technologies.

4.2.1 Land Use

RSL, located on Nellis Air Force Base, is approximately 8.5 miles northeast of the center of Las Vegas. This land is federally owned and withdrawn from the public for military use. Nellis Air Force Base is located adjacent to the city of North Las Vegas to the north and west, the city of Las Vegas to the south and west, and public lands managed by BLM to the east and south. In accordance with a Memorandum of Agreement with the USAF, DOE/NNSA leases the land under a 25-year lease (starting in 1989), with an option for two term extensions (DOE 2009f). The facility, initially occupied in 1989, is located on approximately 35 secured acres and comprises seven buildings used for research, testing, and fabrication laboratories and shops. RSL totals 168,012 gross square feet (DOE 2008f, 2008i). There is no public access to RSL.

Federal regulations and the Integrated Natural Resources Management Plan for Nellis Air Force Base and the Nevada Test and Training Range, developed in May 2007, restrict land use on Nellis Air Force Base. This resource plan was developed to provide guidance for the conservation of natural resources on the installation. The guidelines have been developed within the context of the military mission at Nellis Air Force Base. Private development on the base is not allowed under this mission. Through the guidelines and recommendations in the resources plan, land conservation and natural resource protection is imposed; however, mission needs take precedent (USAF 2007c).

4.2.1.1 Adjacent Land Use

Nellis Air Force Base entirely surrounds RSL. Nellis Air Force Base is a secured military installation and is currently used for aircraft operations and maintenance, weapons storage, rock quarrying, and housing and offices. A large portion of the installation is undeveloped.

The 11,300-acre Nellis Air Force Base is divided into three major functional areas. RSL is within Nellis Air Force Base Area III, which is located just east of Las Vegas Boulevard and adjacent to Nellis Air Force Base Area I. Area III contains housing, a hospital, a runway, and open space (USAF 2010c). The surrounding land to the east and portions to the north of Nellis Air Force Base are managed by BLM's Southern Nevada District Office.

4.2.2 Infrastructure and Energy

4.2.2.1 Infrastructure and Utilities

This section discusses the RSL buildings and transportation infrastructure; potable water, wastewater, and communications utilities; and support services, including law enforcement and security, fire protection, and health care. Further transportation-related information is discussed in Section 4.2.3. Solid waste collection is discussed in Section 4.2.11. Energy systems (electricity, natural gas, and liquid fuels) are discussed in Section 4.2.2.2.

4.2.2.1.1 Infrastructure

Facilities. As stated above, RSL comprises seven DOE/NNSA buildings, all leased from the USAF. The total floor space at RSL is approximately 161,528 square feet, as shown in **Table 4–55**, presented according to building function.

Table 4–55 Remote Sensing Laboratory Building Floor Space by Function

Function	*Floor Space (square feet)*
Administrative	0
Storage	16,454
Industrial/Production/Process	0
Research and Development	144,059
Service Buildings	0
Other	1,015
TOTAL	161,528

Source: NNSA/NSO 2009b.

Transportation Systems. RSL is located on Nellis Air Force Base, adjacent to the runway. There are no railroads at RSL. According to an agreement with the USAF, RSL has access to and use of the runway for mission purposes.

4.2.2.1.2 Utilities

Water Supply. Potable water sources at Nellis Air Force Base include five active government-owned and -operated wells (three wells located off base and two wells located on base) and water purchased from the Southern Nevada Water Authority via bulk-supply pipelines from Lake Mead (NAFB 2005). The base also purchases a small quantity from the City of North Las Vegas Water District. The existing water supply at Nellis Air Force Base is considered adequate.

The water system at RSL suffers from low pressure and limited supply capability. DOE/NNSA is working with Nellis Air Force Base officials to address these issues (DOE 2008f). See Section 4.2.6 for more information on the water supply.

Wastewater Collection and Treatment Systems. RSL wastewater is discharged to existing municipal sewage systems. RSL holds an Industrial Wastewater Discharge Permit (Permit Number CCWRD-080) from the Clark County Water Reclamation District (DOE/NV 2009d).

Communication Systems. RSL has standard communications services (e.g., telephone, internet). RSL has recently undergone extensive fiber optic communications and LAN systems upgrades, bringing the facility up to technological standards, so that it is currently able to function at peak efficiency.

4.2.2.2 Energy

4.2.2.2.1 Electrical Energy

Electrical energy at RSL is supplied by three sources as follows: 65 percent by NV Energy; 10 percent by Western Area Power Administration (Hydropower); and 25 percent by Solar Star, Inc. (the Nellis Air Force Base Solar photovoltaic project). In FY 2009, RSL's electrical usage was 4,850 megawatt-hours (NNSA/NSO 2010b). The existing electrical distribution system at RSL is capable of supporting present demands (DOE 2008f). According to the *FY 2009 NNSA/NSO Ten-Year Site Plan*, the RSL electrical distribution system is slated for improvements in 2014 (DOE 2008i).

As part of energy conservation efforts under Energy Saving Performance Contract funding, buildings at RSL have been retrofitted with low-energy light fixtures (NSTec 2008b).

4.2.2.2.2 Natural Gas

Natural gas at RSL is provided by the Southwest Gas Corporation via 2-inch-high pressure gas lines. Natural gas is regulated to low pressure at three locations. In FY 2009, RSL used 33,673 therms of natural gas (NNSA/NSO 2010b). There is adequate capacity to serve current demands, and the condition of the gas lines is satisfactory (NSTec 2010i).

4.2.2.2.3 Liquid Fuels

RSL maintains liquid-fueled boilers, water heaters, and emergency generators. The underground storage tank program at RSL/Nellis Air Force Base consists of two active permitted tanks (one 550-gallon gasoline tank and one 550-gallon diesel fuel tank), one inactive tank (empty used oil tank), one deferred tank (as per 40 CFR 280.10(d)) for emergency power generation, and three unregulated tanks. The permitted and deferred tanks are located at Building 2211 (DOE/NV 2009d). The two permitted tanks supply RSL with fuel used for the various forklifts, generators, and other onsite needs.

RSL maintains five aircraft that carry out remote sensing operations. These aircraft use approximately 111,030 gallons of JP-8 jet fuel annually (NNSA/NSO 2010b). Nellis Air Force Base provides all JP-8 jet fuel for RSL assets (NSTec 2010i). RSL currently does not use any alternative form of fuel (e.g., E85).

4.2.3 Transportation

4.2.3.1 Onsite Transportation

RSL is located within Nellis Air Force Base, which has several access gates. RSL can be accessed by most of the gates at the base. Hollywood Gate is the gate closest to RSL and may be used by authorized personnel to access the base during designated morning and afternoon hours. As shown in **Figure 4–37**, Access Road provides traffic circulation around RSL facilities and parking areas.

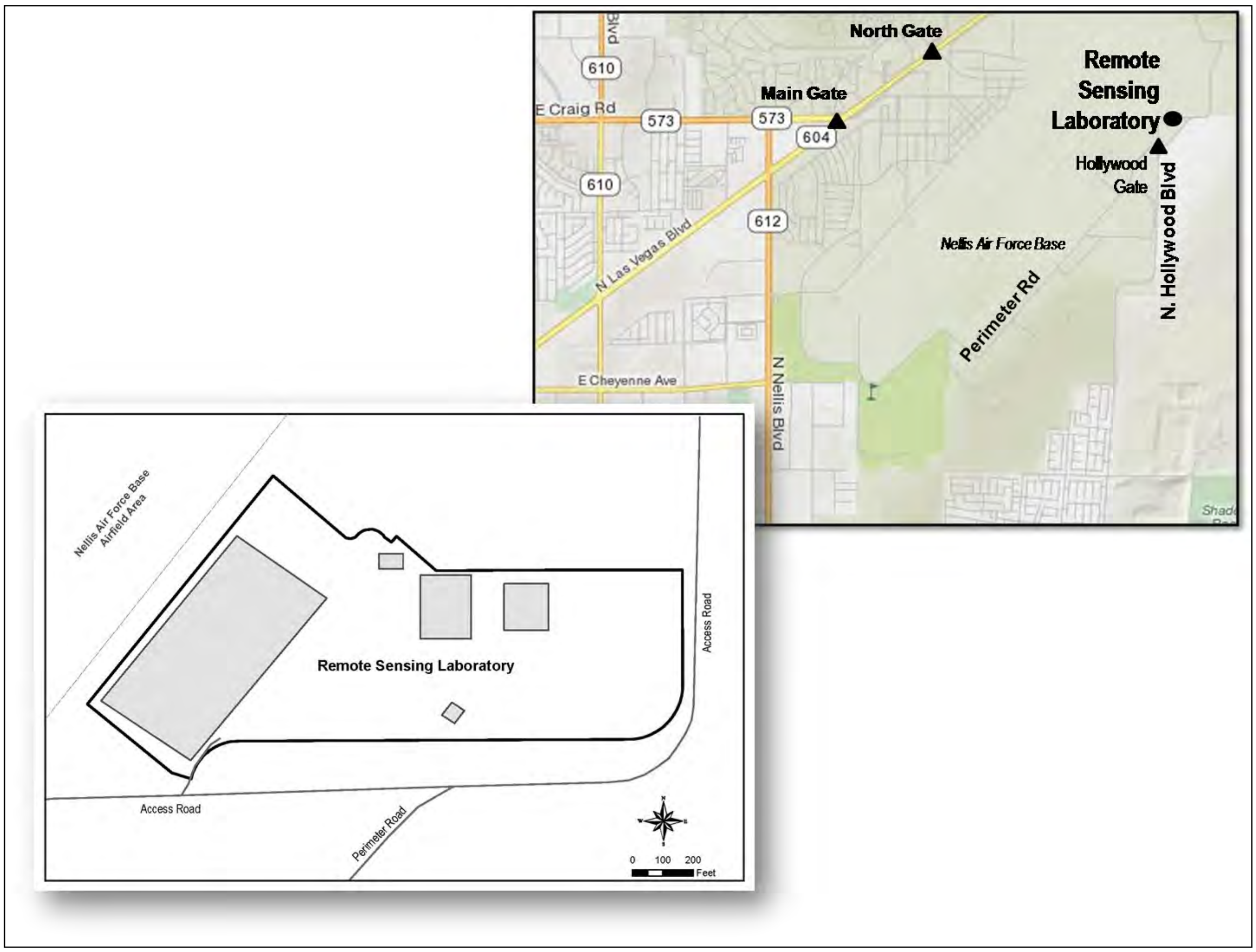


Figure 4–37 Remote Sensing Laboratory Roadways

4.2.3.2 Regional Transportation

The primary access points are the Main Gate and North Gate, which are both located on North Las Vegas Boulevard (see Figure 4–37). The Main Gate is open 24 hours daily, and the North Gate is open from 5:00 A.M. to 5:00 P.M. daily. Access to RSL is provided by Perimeter Road, near Nellis Boulevard (also known as Nevada State Route 612) in the eastern portion of the North Las Vegas region. Traffic volumes and levels of service on roadways in the Las Vegas metropolitan area are discussed in Section 4.1.3.2.2. Traffic volumes near RSL are represented by Las Vegas Boulevard and Nellis Boulevard, presented in Table 4–11; these roadways experience moderate-to-high daily traffic volumes and are operating at levels of service A and B, respectively.

4.2.4 Socioeconomics

General existing socioeconomic conditions within the ROI of RSL (Clark County) are presented in Section 4.1.4.

Police Protection. The USAF provides security services on the wider Nellis Air Force Base, but WSI, a private contractor, provides security services at RSL, following guidelines established by DOE/NNSA NSO Safeguards and Security. Nellis Air Force Base Security Forces respond to RSL when called. The Police Services portion of the current Inter-Service Support Agreement between DOE/NNSA and Nellis Air Force Base, dated January 2006, reads, “In the event of an emergency, Nellis Security Forces response will be limited to securing the exterior of the facility only.”

Fire Protection. Fire protection is provided by Nellis Air Force Base.

Health Care. RSL does not have a medical facility. In the event of a medical emergency at RSL, Nellis Air Force Base would dispatch an ambulance from the base hospital (99th Medical Group).

The 99th Medical Group provides medical care for the military community to ensure maximum wartime readiness and combat capability. The group’s functions include flight medicine, surgical services, maternal and child care, pharmacy, laboratory, radiology, dental care, medical benefits and information, and diagnostic and therapeutic services.

Emergency calls (9-1-1) reach the Base Fire Department emergency dispatch station directly. Depending on the nature of the emergency, the appropriate response organization is dispatched (e.g., fire department, ambulance).

4.2.5 Geology and Soils

4.2.5.1 Physiography

RSL is located in the northeastern section of the city of Las Vegas on Nellis Air Force Base. Las Vegas is situated in the Las Vegas Valley, a broad northwest–southeast trending basin in the Basin and Range Physiographic Province. The valley was formed during the extensional tectonics and gradually filled with sedimentary deposits that eroded from the surrounding mountain ranges. The deepest sediments are Tertiary in age, and gradually become younger, up to the Quaternary lake bed and stream deposits. The Las Vegas Valley is bounded by the Las Vegas shear zone to the north, by Frenchman Mountain to the east, by the Spring Mountains to the west, and by the McCollough and Bird Spring Ranges to the south (Rodgers et al. 2005).

Nellis Air Force Base is located northwest of Sunrise and Frenchman Mountains, which form the eastern border of the city of Las Vegas. The topography is generally flat at Nellis Air Force Base, although there is a gradual slope to the south. RSL is located approximately 1,850 feet above sea level.

4.2.5.2 Geology

The geologic history for the Las Vegas Valley is described in Section 4.1.5.2. Nellis Air Force Base is located on a series of alluvial fans formed from eroded sediments from the Sunrise, Las Vegas, and Dry

Lake Mountain Ranges. The surrounding mountain ranges are primarily composed of Permian-age limestone, mixed with sandstone, shale, dolomite, and gypsum interbedded with quartzite. Gravity and seismic tests have estimated the maximum thickness of the alluvial deposits in Las Vegas Valley to be up to 3.1 miles thick (Rodgers et al. 2005). The alluvium is approximately 1.86 miles deep beneath RSL (Rodgers et al. 2005).

The alluvial fans around Nellis Air Force Base overlap and are carved by numerous drainage channels. The grain size is largest and poorly sorted closer to the source bedrock, and becomes increasingly finer and well sorted at a farther distance from the mountain range. The deposits found in the alluvium at RSL are pink to pale-brown sand and pebble to cobble conglomerate.

4.2.5.2.1 Structural History

The Las Vegas Valley is bounded to the north by the Las Vegas Valley shear zone, which is a subsidiary zone in the larger Walker Lane shear zone, described in Section 4.1.5.1. The mountain ranges that bound the valley to the east, west, and south are all bounded by normal faults from the extensional tectonics described in Section 4.1.5.2.

The closest normal fault sequence to RSL is the Frenchman Mountain Fault, which creates a structural boundary between Frenchman Mountain and the Las Vegas Valley. The Frenchman Mountain Fault stretches from the northwest to southeast, and gradually curves to the east. The normal fault is typical of the Basin and Range sequence of faults that forms the basin topography. Scarps in the Quaternary-aged alluvium suggest that there has been movement within the last 130,000 years (Anderson 1999b).

In addition to the normal faults at the edge of the Las Vegas Valley, there are several scarp sequences that trend north–south through metropolitan Las Vegas. The scarps can be up to 98.4 feet high and 16.8 miles long. It is unclear if the scarps are related to past tectonic activity or internal basin features (Anderson 1999a). Most of the scarps have been modified by the development of Las Vegas. One prominent scarp in the northwestern section of the Las Vegas Valley is named the Eglington Fault, and may be related to faults within the basin bedrock (Anderson 1999c).

4.2.5.2.2 Faulting and Seismic Activity

An earthquake database search was performed for the area within 30 miles of the center of Las Vegas from 1973 to the present. Because the NNSS is outside of this 30-mile radius, the seismic tests from nuclear testing were not included in the database search. There have been 44 seismic events recorded around Las Vegas since 1973 (USGS 2010c). None of the earthquakes had a magnitude larger than 3.9, and approximately half of the earthquakes had a magnitude of less than 3. Section 4.1.5.2.3 presents a history of the seismic activity in the NNSS area and the greater Basin and Range region, which includes the Las Vegas Valley. Seismic design requirements are discussed in Section 4.1.5.2.3.

Due to the proximity of Las Vegas to the NNSS, seismic effects from nuclear testing have been a concern. Starting in the 1960s, a series of seismic stations were distributed throughout the Las Vegas Valley to measure the shockwaves from earthquakes and nuclear testing at the NNSS. Recordings were taken from 1968 through 1989, when the greatest number of tests occurred at the NNSS. The amount of ground motion recorded at the seismic station network correlated with the size of the nuclear test. The largest explosions at the NNSS (Boxcar, Handley, Muenster, and Fontina) generated the greatest ground motion in Las Vegas. These largest explosions were typically felt as IV or less on the Modified Mercalli Intensity Scale, which is used to measure the felt intensity of an earthquake (Rodgers et al. 2005). At that point, shaking is felt on the ground, but there is generally little to no damage to structures. The Modified Mercalli Intensity IV rating is roughly equivalent to a Richter magnitude of 4.0 (Rodgers et al. 2005). Smaller tests (e.g., Bambwell) generated minimal ground motion in the Las Vegas Valley; typically below 20 square centimeters per second (approximately 2 percent of the coefficient of gravity), which would be felt as weak motion with a low potential for structural damage (Rodgers 2008).

4.2.5.2.3 Geotechnical Hazards

RSL is located on the flat portion of the alluvial fans that fill the Las Vegas Valley. Sunrise Mountain is approximately 1.5 miles to the southeast of the facility. Runoff from Sunrise Mountain and Nellis Air Force Base collects in gullies to the south of RSL, which indicates that RSL would not be affected by landslides.

Section 4.1.5.2.4 describes how soils with shrink-swell properties could affect construction. RSL is located on Glencarb silt loam, which contains moderate amounts of clays and has a moderate shrink-swell potential (USDA 1985).

4.2.5.2.4 Geologic Resources

RSL is located on thick alluvial fans in the Las Vegas Valley. Gravel from alluvial deposits is the only geologic resource in the immediate vicinity of the facility.

4.2.5.3 Soils

The soils at Nellis Air Force Base and RSL have been labeled as Glencarb silt loam by the Natural Resources Conservation Service soil survey. The soil forms on the alluvial deposits from the surrounding mountain ranges and is often eroded and reworked by water. The soil is well drained, with a light, sandy loam with gravel and clay-rich sand in the upper layer. Up to 60 inches beneath the surface is a layer of caliche, which restricts root growth (USDA 1985). Due to the high percentage of clay, the soil does have some shrink-swell properties; however, this does not prevent construction of small commercial buildings. The topsoil is very susceptible to erosion by wind, as the fine-grained silt can be easily stripped from the coarser deposits. This soil is not classified as a prime farmland soil by the U.S. Department of Agriculture.

4.2.5.4 Radiological Sources as a Result of Testing

There has been no nuclear testing at Nellis Air Force Base or RSL; therefore, the soils are not contaminated with radioactive materials.

4.2.6 Hydrology

4.2.6.1 Surface Hydrology

RSL is located on Nellis Air Force Base in the northern portion of the Las Vegas Valley, which extends in a northwest-to-southeast direction and drains through the Las Vegas Wash into Lake Mead (USAF 2007c).

Surface-Water Features. No natural perennial streams, lakes, or springs are found on Nellis Air Force Base due to low precipitation, high evaporation rates, and low humidity. Water erosion is rare in the Las Vegas Valley, but can be somewhat prominent along alluvial fans. Nellis Air Force Base contains several ephemeral streams or washes that eventually flow into the Las Vegas Wash. One ephemeral stream originates near the northeastern corner of the RSL site (USAF 2007c).

Flood Hazards. The Federal Emergency Management Agency Flood Insurance Rate Map covering RSL (Map Number 32003C2200 E) indicates that the facility is located within Zone X. Zone X indicates an area of minimal flood hazard, which is determined to be above the 500-year flood level (FEMA 2002b).

Water Discharges and Regulatory Compliance. RSL holds an Industrial Wastewater Discharge Permit (Permit Number CCWRD-080) from the Clark County Water Reclamation District. The permit includes water chemistry limits and requires quarterly monitoring and reporting (DOE/NV 2011). In 2010, no permit limits were exceeded (see **Table 4–56**).

4.2.6.2 Groundwater

Hydrogeologic Setting. RSL is located on Area 1 of Nellis Air Force Base and is under lease to DOE/NNSA. Nellis Air Force Base is located on the eastern side of the Las Vegas Valley Hydrographic Basin, an intermountain basin within the Basin and Range Physiographic Province of the United States within the Colorado River Basin. The Las Vegas Valley Hydrographic Basin is approximately 1,600 square miles, with an estimated perennial yield of 25,000 acre-feet per year (NDWR 2010b). Groundwater flow within the Las Vegas Valley Hydrographic Basin is generally from west to east (USAF 2007c).

The little precipitation that is captured on site is drawn into the valley's principal basin-fill aquifer, shallow aquifers, and the Colorado River. Nellis Air Force Base is underlain by carbonate rock aquifers of the Colorado aquifer system, which is hydrologically connected to shallower alluvial aquifer systems composed of sand and gravels. The principal aquifer in the Las Vegas Valley Hydrographic Basin is naturally recharged by 30,000 to 35,000 acre-feet per year mostly from the Spring Mountains on the west valley boundary. Recharge of the shallow aquifers also occurs, primarily as a result of irrigation water percolating into the ground (USAF 2008c).

Table 4–56 Water Quality Results for Remote Sensing Laboratory Industrial Wastewater Discharges in 2010

Contaminant	*Permit Limit*	*Outfall*
Ammonia (ppm)	No limit listed	22.1
Cadmium (ppm)	0.35	0.00076
Chromium (total) (ppm)	1.7	0.00209
Copper (ppm)	3.36	0.330
Cyanide (total) (ppm)	1	<0.006
Lead (ppm)	0.99	0.0017
Nickel (ppm)	10.08	0.00426
Oil and Grease (ppm)	100	<5.0
Phosphorus (ppm)	No limit listed	6.2
Silver (ppm)	6.3	0.0011
Total Dissolved Solids (ppm)	No limit listed	1,094
Total Suspended Solids (ppm)	No limit listed	411
Zinc (ppm)	23.06	0.463
pH (Standard Units)	5.0–11.0	8.28
Temperature (degrees Fahrenheit)	140	76.3

pH = a measure of acidity or basicity; ppm = parts per million.
Note: Permit limits are set forth in Clark County Water Reclamation District Industrial Wastewater Discharge Permit (Permit Number CCWRD-080).
Source: DOE/NV 2011, Tables A–7 and A–8.

Groundwater Supply. Sources of groundwater are available from the principal alluvial-fill aquifer underlying the Las Vegas Valley. Approximately 29 percent of the Nellis Air Force Base water supply comes from groundwater, and the base is allotted 7.1 million gallons per day of surface water and groundwater (USAF Air Combat Command 2008). Potable water sources at Nellis Air Force Base include five active government-owned and -operated wells (three wells located off base and two wells located on base) and water purchased from Southern Nevada Water Authority via bulk-supply pipelines from Lake Mead. Virtually all of the water in Lake Mead begins as snowmelt in the Rocky Mountains and arrives via the Colorado River. All the water drawn from Lake Mead is sent to the Alfred Merritt Smith or River Mountains water treatment facilities.

The water supplied by the Southern Nevada Water Authority is supplemented by a small percentage of groundwater from wells located on the base and near the base within the northeastern part of the valley. This groundwater comes from the Las Vegas Valley Aquifer (NAFB 2005). The base also purchases a small quantity from the City of North Las Vegas Water District. The existing water supply at Nellis Air Force Base is considered adequate.

The raw water from base wells is chlorinated and then mixed with the Southern Nevada Water Authority water prior to use as drinking water. The two on-base wells have arsenic concentrations that exceed the MCL, but, when blended with the Southern Nevada Water Authority water and off-base well water, the resultant arsenic concentration is below the current arsenic MCL of 10 parts per billion. The revised arsenic MCL regulation became effective in January 2006 (NAFB 2005).

The water system supplying RSL, located on Nellis Air Force Base, suffers from low pressure and limited supply capability. DOE/NNSA is working with Nellis Air Force Base officials to address these issues (DOE 2008f). No expansion or addition of water-consuming facilities can be made at RSL until a new water source can be installed.

Nellis Air Force Base announced a water loop project in 2008, which is to take place within 5 years, and invited DOE/NNSA to participate. In the interim, Nellis Air Force Base has offered to allow DOE/NNSA to obtain water from the water line running to Area 2 and to extend the line approximately 4,000 feet from Perimeter Road to the compound. Eventually, this interim line could be capped and the same connection used on the new loop that would be adjacent to the property. The most economical new source for Nellis Air Force Base is approximately 1 mile east of the compound and belongs to the Southern Nevada Water Authority (DOE 2007c).

Groundwater Monitoring and Quality. Technicians collect and analyze water samples monthly from Nellis Air Force Base's drinking water and water treatment facilities. The water is tested more frequently and extensively than the Safe Drinking Water Act and the *Nevada Administrative Code* require (NAFB 2005).

Nellis Air Force Base had two regulatory compliance violations in 2005 (June and September). In June 2005, two samples tested positive for total coliform and one tested positive for *Escherichia coli* bacteria. In September 2005, two samples tested positive for total coliform. Public notifications were issued after both instances, and all subsequent test results were negative for total coliform and *E. coli* bacteria (NAFB 2005).

4.2.7 Biological Resources

RSL is in the Southern Basin and Range Ecoregion. This facility is located in an urban setting that includes buildings, pavement, and landscaping. No original undisturbed native vegetation remains on the site; current vegetation on the site consists of urban landscape. Few wildlife species exist at the site because it is located in an urban area and contains little vegetation.

4.2.7.1 Flora

This facility is located in an urban setting; no native vegetation within a natural setting occurs at this site.

4.2.7.2 Fauna

This facility is located in an urban setting; only urban-adapted wildlife occurs at this site. The only species that exist in this habitat include those that are adapted to urban habitats, which may include small mammals such as the house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*), as well as ubiquitous bird species such as the northern mockingbird (*Mimus polyglottos*), European starling (*Sturnus vulgaris*), house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), ruby-crowned kinglet (*Regulus calendula*), mourning dove (*Zenaida macroura*), and rock dove (*Columba livia*).

4.2.7.3 Threatened and Endangered Species

This facility is located in an urban setting; no threatened, endangered, or rare species are expected to occur at this site. No designated critical habitats for federally listed species exist at RSL. The urban areas of Clark County are not considered tortoise habitat.

4.2.7.4 Other Species of Concern

No other species of concern inhabit RSL.

4.2.7.5 Effects of Past Radiological Tests and Project Activities

This facility is located in an urban setting; no past radiological tests or project activities are anticipated to affect wildlife or vegetation at this site.

4.2.8 Air Quality and Climate

4.2.8.1 Meteorology

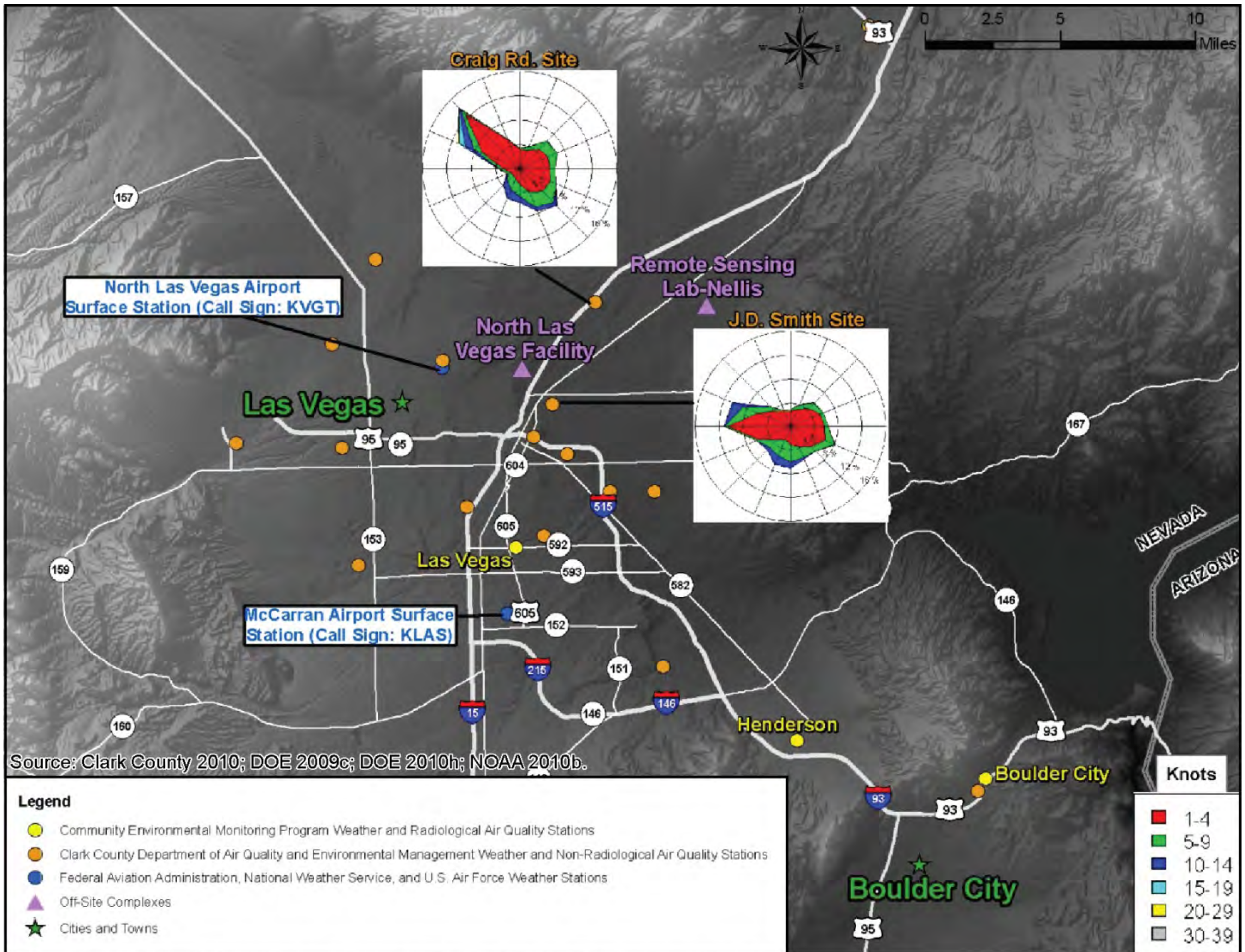
Downtown Las Vegas is located in Clark County, Nevada, about 56 miles southeast of the southeastern edge of the NNSS. RSL, at Nellis Air Force Base, is about 14 miles northeast of downtown. RSL is located in the Las Vegas Valley, which is situated in the northeastern corner of the Mojave Desert and in the rain shadow (lee) of the southern Sierra Nevada mountain range.

The Las Vegas Valley has the general climatic characteristics of a mid-latitude desert area, with relatively little precipitation throughout the year and low humidity, large diurnal and seasonal temperature ranges, and intense solar radiation in the summer. The generally dry, desert conditions specific to the area can occasionally be modified by the southwestern monsoon and convective thunderstorms during the summer months and Eastern Pacific tropical storm remnants in the late summer and fall. The dry conditions also tend to be moderated during strong *El Niño* cycles, which generally bring more rainfall to the area.

The average maximum temperatures range from about 95 to 105 °F in the summer and from about 55 to 65 °F in the winter. The average minimum temperatures range from about 70 to 80 °F in the summer and from about 35 to 45 °F in the winter, based on average temperatures recorded from 1971 through 2000 at the Las Vegas Weather Service Office Airport (NCDC 2009).

The Las Vegas Valley ranges in elevation from about 2,300 to 2,620 feet above mean sea level and is bounded by mountains to the north, south, and especially to the west, where the Spring Mountains peak above about 6,560 feet. This terrain causes wind flows in the Las Vegas Valley to be dominated by upslope and downslope conditions. The Clark County Department of Air Quality and Environmental Management (DAQEM) maintains an ambient air monitoring site (the J.D. Smith monitor, at 1301 East Tonopah Road) near RSL. **Figure 4–38** shows the wind roses for the J.D. Smith and E. Craig Road (at 4701 Mitchell Street) Clark County DAQEM sites for 2004 through 2008 (Clark County 2010) and the average wind direction and speed data surrounding both RSL and NVLF for the same time period. For additional information regarding the meteorological characteristics of RSL, see Appendix D, Section D.1.2.1.

The nearest upper-air measurements, used in estimating atmospheric stability, are available from the National Weather Service Desert Rock site located in the southern end of the NNSS about 58 miles northwest of downtown Las Vegas. Based on data recorded from 1978 through 2004 at Desert Rock, stable conditions dominate at night, though stronger windspeeds will tend to mix in the atmosphere, leading to neutral conditions. As greater solar radiation leads to greater instability, unstable conditions dominate the daytime hours and the months with the highest solar radiation (summer). These stability patterns are slightly modified within the Las Vegas Valley because of the lower elevation and slightly higher temperatures, windspeed differences, and potential differences in local cloud cover relative to what occurs at Desert Rock (Soulé 2006). A limited comparison study between Desert Rock and Las Vegas upper-air measurements suggests that differences above the first few tens of meters are minimal (Lehrman et al. 2006).



Note: To convert knots to meters per second, multiply by 0.5144. To convert knots to miles per hour, multiply by 1.151. The percentage rings indicate frequency of occurrence. Wind directions are from which the wind is blowing.

Figure 4–38 Wind Roses for J. D. Smith and E. Craig Road Clark County DAQEM Sites, 2004–2008

4.2.8.2 Ambient Air Quality

4.2.8.2.1 Region of Influence

RSL is located about 60 miles southeast of the southern border of the NNSS. The ROI for air quality and climate for RSL operations comprises northern Clark County. Historic data on pollutant emission inventories and compliance status for the State of Nevada are calculated at the resolution of county or hydrographic areas; these data provide a basis for determining existing air quality in the ROI and a metric for emission comparison assessments.

4.2.8.2.2 Existing Air Quality

Current Ambient Air Quality Standards. See Section 4.1.8.2.2 for a discussion on the current national and Nevada ambient air quality standards.

Air Quality Status. RSL is within Hydrographic Area 212. Clark County is in nonattainment for 8-hour ozone[25] and 24-hour PM_{10}.[26] Clark County is no longer in nonattainment for 8-hour carbon monoxide.[27] All other pollutants are in attainment.

PSD is a regulation incorporated into CAA that limits increases of certain pollutants in clean air areas (attainment areas) to certain increments even though ambient air quality standards are being met. CAA has three classes of areas with different increments. The smallest increments allowed are Class I areas, which are areas of special value (natural, scenic, recreational, or historic). Any degradation of existing air quality in these areas should be minimized. The closest PSD Class I areas are Grand Canyon National Park (about 65 miles to the east) and Sequoia National Park (about 165 miles to the west). RSL currently has no sources of pollution large enough to be subject to PSD requirements. However, because RSL is located in a nonattainment area, it could potentially be subject to nonattainment new source review if the emissions were of sufficient strength; however, they have been determined not to meet the threshold for new source review. Nonattainment new source review requirements are customized for the classification and type of air pollutant nonattainment area.

Emissions Due to RSL Operations. Title V of CAA gives states the authority to use air quality permits to regulate stationary source emissions of criteria pollutants. At RSL, a Facility 348 Authority to Construct/Operating Permit regulates emissions from sources such as boilers, water heaters, cooling towers, emergency generators, a spray paint booth, and a vapor degreaser. Except for 1.3 tons of nitrogen oxides emitted in 2004, emissions of carbon monoxide, nitrogen oxides, PM_{10}, sulfur dioxide, volatile organic compounds, and hazardous air pollutants were each less than 1 ton annually from 2003 through 2008. Total emissions of these pollutants over this 6-year period are about 6 tons (DOE 2004b, 2005b, 2006a, 2007b, 2008j, 2009c).

Table 4–57 shows the onsite emissions due to stationary sources and aircraft-related sources, as well as Clark County emissions due to RSL commuters and commercial vendors. The onsite stationary sources include both permitted sources and natural gas combustion used principally for heating. See Appendix D, Section D.1.2.2.2, for further details and a discussion of the methodology used to determine the stationary source emissions, aircraft emissions, commuter vehicle emissions, and commercial vendor emissions.

[25] Classified as marginal for 8-hour ozone under former Subpart 1 with a nonattainment area that includes those portions of Clark County that lie in Hydrographic Areas 164A, 164B, 165, 166, 167, 212, 213, 214, 216, 217, and 218, but excludes the Moapa River Indian Reservation and the Fort Mojave Indian Reservation. However, on March 29, 2011, EPA made the determination that Clark County is in attainment with 1997 ozone NAAQS (76 FR 17343). EPA is expected to redesignate the area's status to attainment upon approval of the Ozone Redesignation Request and Maintenance Plan submitted to EPA Region 9 in early April 2011.

[26] Designated as serious nonattainment for PM_{10}. The nonattainment area covers Hydrographic Area 212. However, on August 3, 2010, EPA made the determination that the Las Vegas Valley is in attainment with the PM_{10} NAAQS based on monitoring data (75 FR 45485). EPA is expected to redesignate the area's status to attainment upon approval of the maintenance plan and request for redesignation that Clark County is expected to submit.

[27] A CO Maintenance Plan and formal request for resdesignation to attainment was submitted to the EPA in 2008 and approved on September 7, 2010 (75 FR 59090).

Table 4–57 Estimated 2008 Air Emissions of Criteria Pollutants and Hazardous Air Pollutants Due to Remote Sensing Laboratory Activities

	Annual Air Emissions (tons per year)						
	Stationary Sources	*Aircraft-Related Sources*	*RSL Commuters*	*Commercial Vendors*	*Total*		
	Clark County						
Pollutant	*On-RSL*	*On-RSL*	*Off-RSL*	*Off-RSL*	*On-RSL*	*Off-RSL*	*Total*
PM_{10}	0.038	0.00040	0.030	0.043	*0.038*	*0.073*	***0.11***
$PM_{2.5}$	0.038	0.00037	0.016	0.04	*0.038*	*0.056*	***0.094***
CO	0.36	0.88	3.1	0.18	*1.2*	*3.3*	***4.5***
NO_x	0.9	0.045	0.76	0.4	*0.95*	*1.2*	***2.1***
SO_2	0.01	0.016	0.0084	0.00074	*0.026*	*0.0091*	***0.035***
VOCs	0.032	>0.17	0.062	0.058	*~0.2*	*0.12*	***~0.32***
Lead	<0.01	0.00040	0.0000020	0.00000068	*~0.01*	*0.0000027*	***~0.010***
Criteria Pollutant Total	*1.4*	*~1.1*	*4.0*	*0.68*	*~2.4*	*4.7*	***~7.2***
HAPs	0.0071	~0.17	0.0048	0.0076	*~0.18*	*0.012*	***~0.19***

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; RSL = Remote Sensing Laboratory; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Measurements of Ambient Air Concentrations on and near RSL. The Clark County DAQEM maintains an air quality monitoring network. The E. Craig Road monitor (at 4701 Mitchell Street) is about 3 miles west of RSL. It monitors hourly ozone and PM_{10} levels. **Table 4–58** shows (1) maximum 8-hour average concentrations of ozone and (2) maximum 24-hour average and annual average concentrations of PM_{10} measured at the E. Craig Road monitor from 2006 through 2008. Sulfur dioxide, carbon monoxide, and $PM_{2.5}$ values shown are the highest concentrations measured in the Las Vegas Valley. For ozone and PM_{10}, about 25 percent of the 2008 observations were missing, so the maximum concentration numbers for that year could potentially be higher than what is shown; however, the maximum concentration over the past 3 years is likely representative of the current conditions. The ambient air quality standards are also shown in the table. See Table 4–40 for more information on the standards. Note that the E. Craig Road monitor may be moved about 7 miles south in 2010; if that happens, the closest Clark County DAQEM monitor to RSL would be the J.D. Smith monitor (1301 East Tonopah Road), about 5 miles southwest of RSL.

Ozone measurements at the E. Craig Road monitor (at 4701 Mitchell Street) exceeded the 8-hour ozone NAAQS in 2006 and 2007. The largest 8-hour ozone concentration was 0.084 parts per million (ppm) (in 2006), which is 0.009 ppm larger than the current NAAQS (0.075 ppm). Maximum ambient ozone concentration levels have generally remained constant at this and other nearby monitors since at least 1998 (DAQEM 2009). The second-highest 24-hour average PM_{10} concentration at the E. Craig Road monitor (at 4701 Mitchell Street) was 168 micrograms per cubic meter (in 2008), which is 18 micrograms higher than the NAAQS of 150 micrograms per cubic meter. The largest annual average PM_{10} concentration was 35 micrograms per cubic meter (in 2006), well below the Nevada ambient air quality standard of 50 micrograms per cubic meter (there is no national PM_{10} annual average standard). This monitor typically observes the largest PM_{10} concentrations of all the PM_{10} monitors in the Las Vegas Valley.

All other criteria pollutants are well below NAAQS. No lead monitoring data are available in the Las Vegas Valley.

Table 4–58 Ambient Air Quality Monitoring Data in the Vicinity of the Remote Sensing Laboratory, 2006–2008

Year	*2nd Max 1-hour CO (ppm)*	*2nd Max 8-hour CO (ppm)*	*Annual Mean NO_2 (ppm)*	*2nd Max 1-hour NO_2 (ppm)*	*4th Max 8-hour O_3 (ppm)*	*2nd Max 1-hour SO_2 (ppm)*	*2nd Max 24-hour SO_2 (ppm)*	*Annual Mean SO_2 (ppm)*	*98th percentile $PM_{2.5}$ (μg/m³)*	*Annual Mean $PM_{2.5}$ (μg/m³)*	*2nd Max 24-hour PM_{10} (μg/m³)*	*Annual Mean PM_{10} (μg/m³)*
2006	6.3	5	0.021	0.080	**0.084**	0.015	0.007	0.002	24.3	9.4	124	35
2007	4.6	3.8	0.020	0.066	**0.081**	0.007	0.003	0.001	22.6	10.3	120	34
2008	4.7	3.7	0.016	0.062	**0.080**	0.006	0.001	0.001	22.5	9.1	**168**	33
NAAQS	35.0	9.0	0.053	0.100	0.075	0.075	0.030	0.140	35.0	15.0	150	None

$\mu g/m^3$ = micrograms per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; O_3 = ozone; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; ppm = parts per million; SO_2 = sulfur dioxide.

Note: Monitored values are from the E. Craig Road monitor (at 4701 Mitchell Street) for O_3 and PM_{10}; other values are the highest monitored values in the Las Vegas Valley. All exceedances of the NAAQS are shown in **bold** font.

Source: EPA 2010a.

4.2.8.3 Radiological Air Quality

Radiation sources currently used at RSL at Nellis Air Force Base are sealed in locations that prevent the release of radionuclides or any elevated gamma radiation from reaching the public. Therefore, radiation monitoring for public health is not performed (DOE 2009e), and exposure levels are at natural background levels. See Section 4.1.8.3 for more information on radiation sources and radiation monitoring on and near the NNSS.

4.2.8.4 Climate Change

This section describes the affected environment in terms of current and anticipated trends in greenhouse gas emissions and climate. The effects of emissions on the climate involve very complex processes and interact with natural cycles, complicating the measurement and detection of change. Recent advances in the state of the science, however, are contributing to an increasing body of evidence that anthropogenic greenhouse gas emissions affect climate in detectable and quantifiable ways.

For information on greenhouse gas emissions in the United States, please see Section 4.1.8.4.1. Greenhouse gas emissions at RSL are discussed in the next section. Details on the methodology used to determine these emissions are discussed in Appendix D, Section D.2.2.1.1.

4.2.8.4.1 Greenhouse Gas Emissions

Table 4–59 provides greenhouse gas emissions due to RSL-related activities for 2008. The greenhouse gas emissions are presented in carbon-dioxide-equivalent form and are partitioned by various mobile and stationary source types. These emissions were derived from fuel use, vehicle activity, and power consumption data. The greenhouse gas emissions were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010b). These emissions were compared with a reference amount of 25,000 metric tons (27,558 tons), which is the threshold for which a quantitative assessment may be meaningful (CEQ 2010).

Table 4–59 Carbon-Dioxide-Equivalent Emissions of Greenhouse Gases from Remote Sensing Laboratory Activities in 2008

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 25,000 Metric Tons* [a]
STATIONARY SOURCES		
Power generation	2,046	0.07
Natural gas heating	203	0.01
All stationary sources, except air conditioning/refrigeration and natural gas heating	11	0.01
All Stationary Sources	*2,260*	*0.08*
MOBILE SOURCES		
Aircraft and ground support equipment	1,184	0.04
Commuting	473	0.02
Commercial vendors	138	0.01
All Mobile Sources	*1,795*	*0.07*
Total	***4,055***	***0.15***

[a] 25,000 metric tons are equal to about 27,558 short tons.

Electricity consumption is by far the largest single source of greenhouse gas emissions related to RSL activities, emitting approximately 2,046 carbon-dioxide-equivalent tons of greenhouse gases, or 50 percent of the RSL-related greenhouse gas emissions total. Stationary sources altogether emitted about 2,260 carbon-dioxide-equivalent tons of greenhouse gases. Mobile sources emitted about 1,795 carbon-dioxide-equivalent tons. Overall, RSL-related activities created about 4,055 carbon-dioxide-equivalent tons of greenhouse gas emissions in 2008, which in itself is well below the threshold reporting level.

4.2.8.4.2 Current Changes in Climate

For a discussion of climate change impacts in the region, please see Section 4.1.8.4.2.

4.2.9 Visual Resources

RSL is located at Nellis Air Force Base, to the east of the northern end of the runways. This area is primarily developed, with the RSL facilities, adjacent runways, and infrastructure such as roadways, fences, and utility lines. The immediate surrounding land is undeveloped desert shrubland of the lower Mojave Desert (USAF 2006c). Public access to the airfield and RSL is restricted.

The area surrounding RSL is Nellis Air Force Base land. Public, middleground views exist from Las Vegas Boulevard North, located over a mile north of RSL, but development along the roadway and infrastructure associated with the airfield are more readily visible. RSL blends with this visual environment. Visible portions of RSL are considered to have a Class C scenic quality rating (see Section 4.1.9 for information on the visual impact rating system) due to the developed nature of the landscape, combined with high intrusion of manmade elements and lack of elements that help to improve aesthetics, such as landscaping. There is no immediate public visual access to the foreground of RSL.

4.2.10 Cultural Resources

For introductory information regarding cultural resources, see Section 4.1.10. Unless otherwise noted, the information in this section is derived from the *1996 NTS EIS* (DOE 1996c).

RSL is situated in the northern Las Vegas Valley, within the Las Vegas Valley Hydrographic Basin, an intermountain basin within the Basin and Range Physiographic Province of the United States (NDWR 2010a). RSL is located in Area III of Nellis Air Force Base, adjacent to the northern end of the Nellis Air Force Base runway. The facility is constructed in a highly built military setting that includes operations buildings, maintenance structures, paved runways, and ornamental landscaping. There is no original undisturbed ground surface on RSL.

The area of influence for cultural resources includes all areas where facilities, operations, and maintenance of DOE/NNSA programs would take place. For the purposes of this SWEIS, the area of influence includes the entire 35-acre RSL facility.

4.2.10.1 Recorded Cultural Resources

There are no recorded cultural resources within the boundary of RSL.

4.2.10.2 Sites of American Indian Significance

There are no known sites of American Indian significance within the boundary of RSL. As part of the preparation of this SWEIS, DOE/NNSA consulted with CGTO to determine whether any sites of American Indian significance exist within RSL.

4.2.11 Waste Management

RSL is a small-quantity generator of hazardous waste that also generates sanitary solid waste and recyclable materials. Hazardous wastes are stored on site at RSL for no more than 90 days before being transferred as needed to an offsite facility. As the landlord for RSL, the USAF provides waste management services, including removal and disposal of miscellaneous laboratory and process equipment wastes. Sanitary solid waste is collected and disposed by a municipal waste service. DOE occasionally ships scrap metal to the NNSS to be combined with other accumulated scrap metal at the NNSS and recycled under the NNSS Pollution Prevention and Waste Minimization Program (see Section 4.1.11.3).

4.2.12 Human Health and Safety

No human health impacts on the public or workers are associated with the regular operation of RSL. Because RSL is located within the Nellis Air Force Base, the greatest contributors to background noise conditions are aircraft operations and vehicular traffic. No environmental noise data are available at RSL; however, because of the surrounding land uses, it is assumed that background noise levels are those typical of an industrial land use area, ranging from 50 to 65 decibels, A-weighted (EPA 1974).

4.2.13 Environmental Justice

As seen in **Figure 4–39**, Nellis Air Force Base (the host installation for the RSL) directly borders several block groups where the low-income population is between 11 and 20 percent, and additional block groups in the 21–30 and greater-than-30 percent range are located further to the southwest. RSL is located in an area where the majority of block groups have minority populations exceeding 50 percent (see **Figure 4–40**).

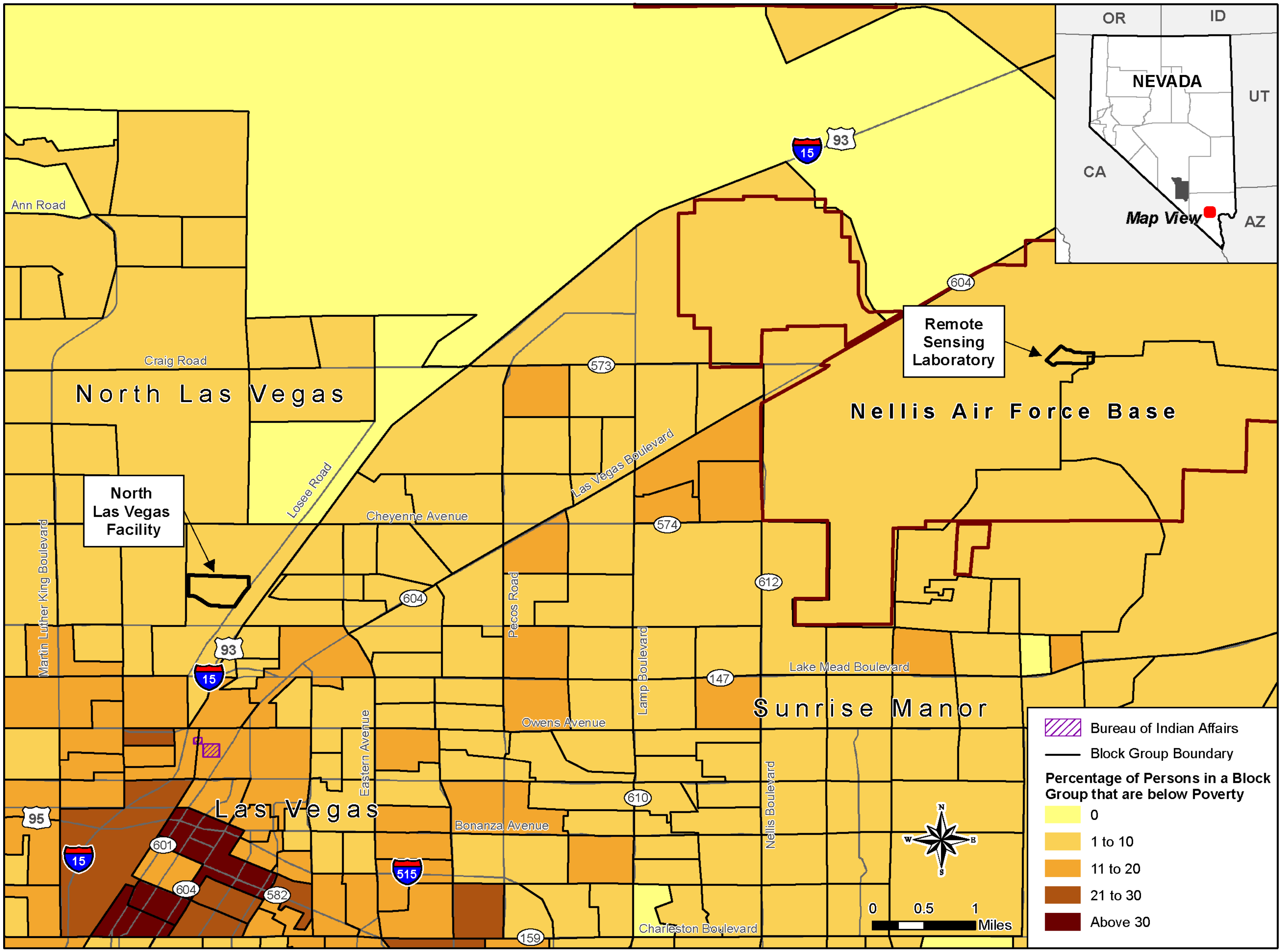


Figure 4–39 Distributions of Low-Income Populations for the North Las Vegas Facility and Remote Sensing Laboratory

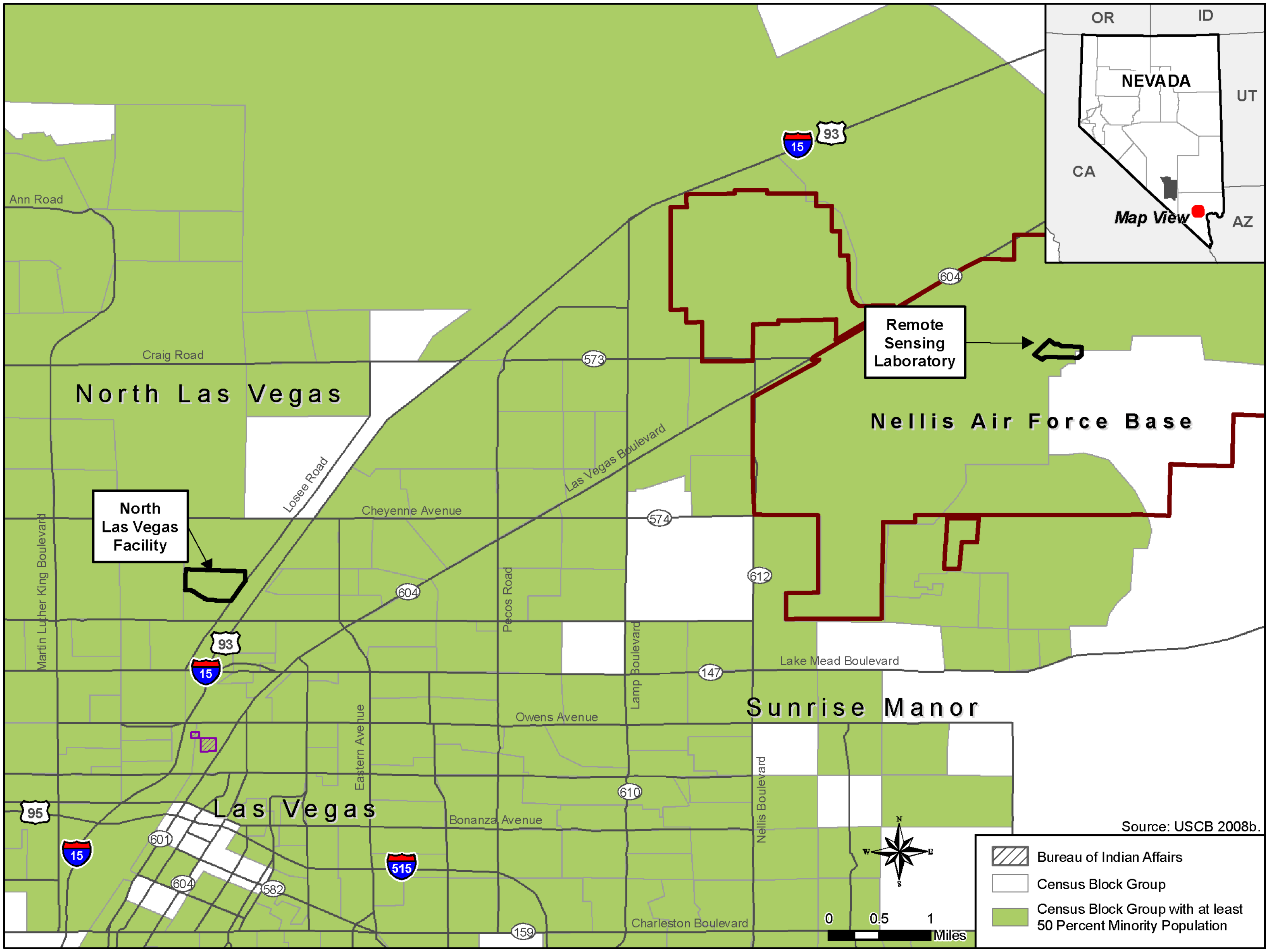


Figure 4–40 North Las Vegas Facility and Remote Sensing Laboratory Distributions of Minority Populations Greater than 50 Percent

4.3 North Las Vegas Facility

This section describes the existing environmental conditions at NLVF. NLVF is located in North Las Vegas, Nevada, and occupies 80 acres along Losee Road, about 0.2 miles west of Interstate 15 (Las Vegas Freeway) and a railroad corridor. Many of the NNSS project management, diagnostic development and testing, designing, engineering, procurement, and environmental compliance activities take place at NLVF. The DOE/NNSA NSO support facility is also located within NLVF. Public access to NLVF is restricted (DOE 2008i).

4.3.1 Land Use

NLVF consists of 30 buildings, parking lots or paved surfaces, and one trailer within the fenced complex. The existing structures account for 665,988 gross square feet of developed space. Buildings A-1 and C-3 provide space for communications, test fabrication and assembly, radiography, and other diagnostics. Building A-1 houses machine shops and overhead cranes that would be essential if nuclear tests were conducted in the future. Building C-3 houses a laboratory, stockpile stewardship experimental facilities, and readiness assets (DOE 2009f). The property is located within a heavy industrial land use area, and the property is zoned for general industry.

4.3.1.1 Adjacent Land Use

The primary land uses adjacent to NLVF are industrial and include manufacturing, processing, warehousing, storage, shipping, and other uses similar in function or intensity. Secondary uses include office uses and commercial uses supporting industrial development.

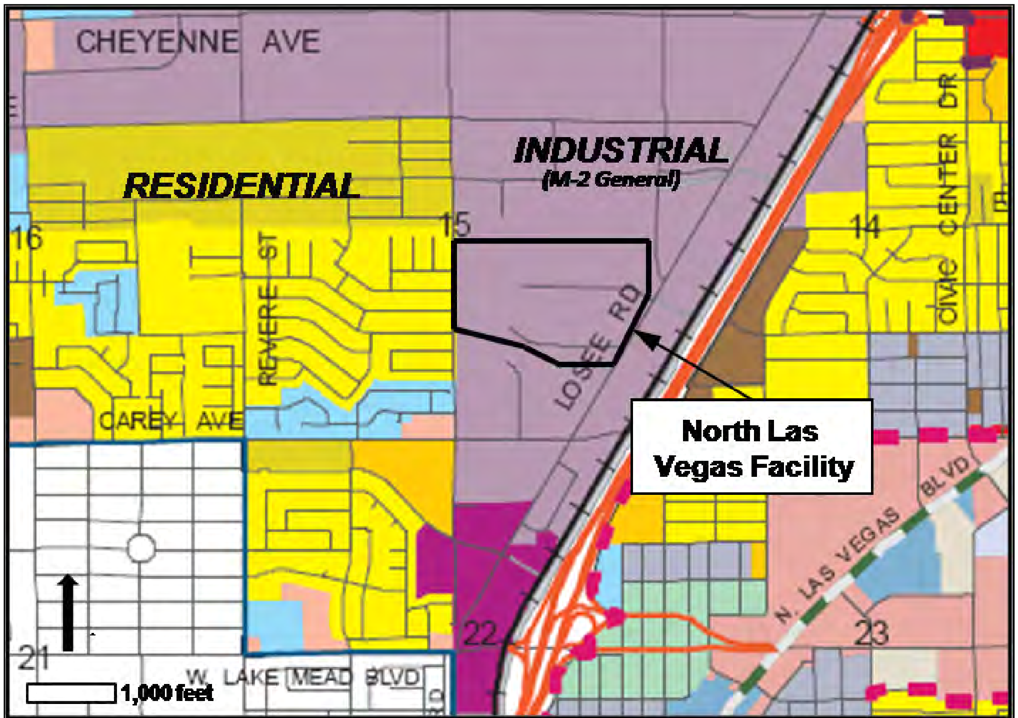
With the exception of the residential area just west of the NLVF western boundary, across North Commerce Street, the land uses adjacent to NLVF consist primarily of businesses in the manufacturing and distribution sectors, with warehouse and office buildings occupying the properties. Products manufactured in this area include automobile engines and transmissions, electrical equipment, and component parts.

The City of North Las Vegas manages land use. Regulations are imposed on the city through the North Las Vegas *2006 Comprehensive Plan*, adopted in 2006. This plan establishes policy and guiding principles for the city for the next 20 years, including a balanced land use mix, a diverse economic base, and thriving and attractive commercial and business centers. Leaders use this plan to help them make decisions about development, programs, and investments in the city. This plan identifies three Specific Planning Areas (SPAs) to help implement and achieve goals of the City of North Las Vegas. The three types of SPAs are as follows (NLV 2006):

- Residential neighborhoods – includes older neighborhoods, areas still under construction and areas yet to be developed
- Activity centers – includes areas planned for mixed-use development, which will serve as key areas of social, commercial, and employment activity for the community
- Employment districts – includes the industrial and primary employment corridors within the city of North Las Vegas and the lands planned for these uses in the future

NLVF is zoned for a general industrial district (M-2) and is within the Employment District SPA, and specifically, within the Industrial District. The M-2 designation provides an area for the development of uses that would not be compatible with those in most other zoning districts because of the nature of the operations, appearance, traffic generation, or emissions associated with industrial activities. These activities are necessary and desirable to the city and are typically located in close proximity to each other (NLV 2010).

Figure 4–41 depicts NLVF and zoning in the city of North Las Vegas.



Source: NLV 2006.

Figure 4–41 Zoning in the City of North Las Vegas and the North Las Vegas Facility

4.3.2 Infrastructure and Energy

4.3.2.1 Infrastructure and Utilities

NLVF facilities are divided into three distinct areas. The first area covers 20 acres and supports the Lawrence Livermore National Laboratory test program. The second area covers 20 acres and supports the Los Alamos National Laboratory test program. The third area covers 38.3 acres and supports a computer center and administrative and engineering support facilities.

4.3.2.1.1 Infrastructure

This section discusses the NLVF buildings and transportation infrastructure; potable water, wastewater, and communications utilities; and support services, including law enforcement and security, fire protection, and health care. Further transportation-related information is discussed in Section 4.3.3. Solid waste collection is discussed in Section 4.3.11. Energy systems (electricity, natural gas, and liquid fuels) are discussed in Section 4.3.2.2.

Facilities. NLVF is a fenced complex composed of 30 buildings (including one trailer), with a total of 665,988 square feet of floor space. **Table 4–60** presents this space according to building function.

Table 4–60 North Las Vegas Facility Building Floor Space by Function

Function	*Floor Space (square feet)*
Administrative	444,090
Storage	22,179
Industrial/Production/Process	58,969
Research and Development	136,079
Service Buildings	4,023
Other	648
Total	665,988

Source: NNSA/NSO 2009b.

Transportation Systems. NLVF consists of a network of approximately 4,000 feet of roadway providing access to the buildings and parking lots. These roads and parking lots are in poor condition and will require replacement or rehabilitation in the near future. There are no railroads or aircraft facilities at NLVF.

4.3.2.1.2 Utilities

Water Supply. Potable water at NLVF is adequately supplied from city services by the Las Vegas Valley Water District (DOE 2008f). NLVF conserves water by using only desert landscaping, which requires minimal use of potable water.

Wastewater Collection and Treatment Systems. NLVF wastewater is discharged to existing municipal sewage systems of the City of North Las Vegas. NLVF holds National Pollutant Discharge Elimination System (NPDES) Permit NV0023507 and Class II Wastewater Contribution Permit VEH-112 (DOE 2008k).

Communication Systems. NLVF has standard communications infrastructure, including telephone, internet, data transmission and storage, radio systems, etc. The telephone communication systems equipment was installed over 20 years ago and is functional but less than adequate; however, some upgrades have been recently installed. Projects are currently under way to modernize NLVF data movement needs.

4.3.2.2 Energy

4.3.2.2.1 Electrical Energy

Electrical energy at NLVF is supplied by NV Energy from the Miller Substation. The main switch is 12.47 kilovolts at 1,200 amperes. The power is distributed throughout the site through an underground distribution system to multiple pad-mounted switches and step-down transformers, where it is transformed to usable 480-volt power (NSTec 2010i). In FY 2009, NLVF's electrical usage was 15,447 megawatt-hours (NNSA/NSO 2010b). The peak demand recorded in 2008 and 2009 was approximately 3,200 kilowatts, recorded in August 2008 during on-peak afternoon hours.

NNSA has met the requirements for installing electrical meters (as set forth in Section 103 of the Energy Policy Act of 2005) for 90 percent of the electricity used by NNSS and NLVF (NSTec 2011c). The metering allows for better tracking of NLVF's use of electricity, water, and gas, thus improving its ability to identify conservation opportunities.

As part of energy conservation efforts under Energy Saving Performance Contract funding, buildings at NLVF have been retrofitted with low-energy light fixtures. All NLVF buildings are equipped with an energy management system that controls lighting and heating, ventilation, and air conditioning 24 hours a day, 7 days a week (NSTec 2008b).

4.3.2.2.2 Natural Gas

Natural gas at NLVF is provided by Southwest Gas Corporation via 2-inch-high pressure gas lines (NSTec 2010i). In FY 2009, the North Las Vegas Complex used 25,947 therms and the Nevada Site Facility (part of the North Las Vegas Complex) used 22,226 therms, for a total natural gas usage of 48,173 therms at NLVF (NNSA/NSO 2010b). There is adequate capacity to serve current demands, and the condition of the gas lines is satisfactory.

4.3.2.2.3 Liquid Fuels

NLVF maintains liquid-fueled boilers and emergency generators. There are currently two liquid fuel storage tanks at NLVF: a diesel tank (267 gallons) and a gasoline tank (391 gallons) (NSTec 2010i; DOE 2008k).

4.3.3 Transportation

4.3.3.1 Onsite Transportation

As shown in **Figure 4–42**, Atlas Drive and Energy Way provide access from Losee Road to NLVF; security gates are located on these roadways. Energy Way provides the main access point for personnel. Paved roads and parking lots at the facility are deteriorating and require replacement or rehabilitation (DOE 2007c).

4.3.3.2 Regional Transportation

NLVF is located on Losee Road, which is adjacent and parallel to Interstate 15 to the east. Traffic volumes and levels of service on roadways in the Las Vegas metropolitan area are discussed in Section 4.1.3.2.2. Traffic volumes on Losee Road are presented in Table 4–11; this roadway experiences moderate levels of daily traffic volumes and is currently operating at level of service B near NLVF.

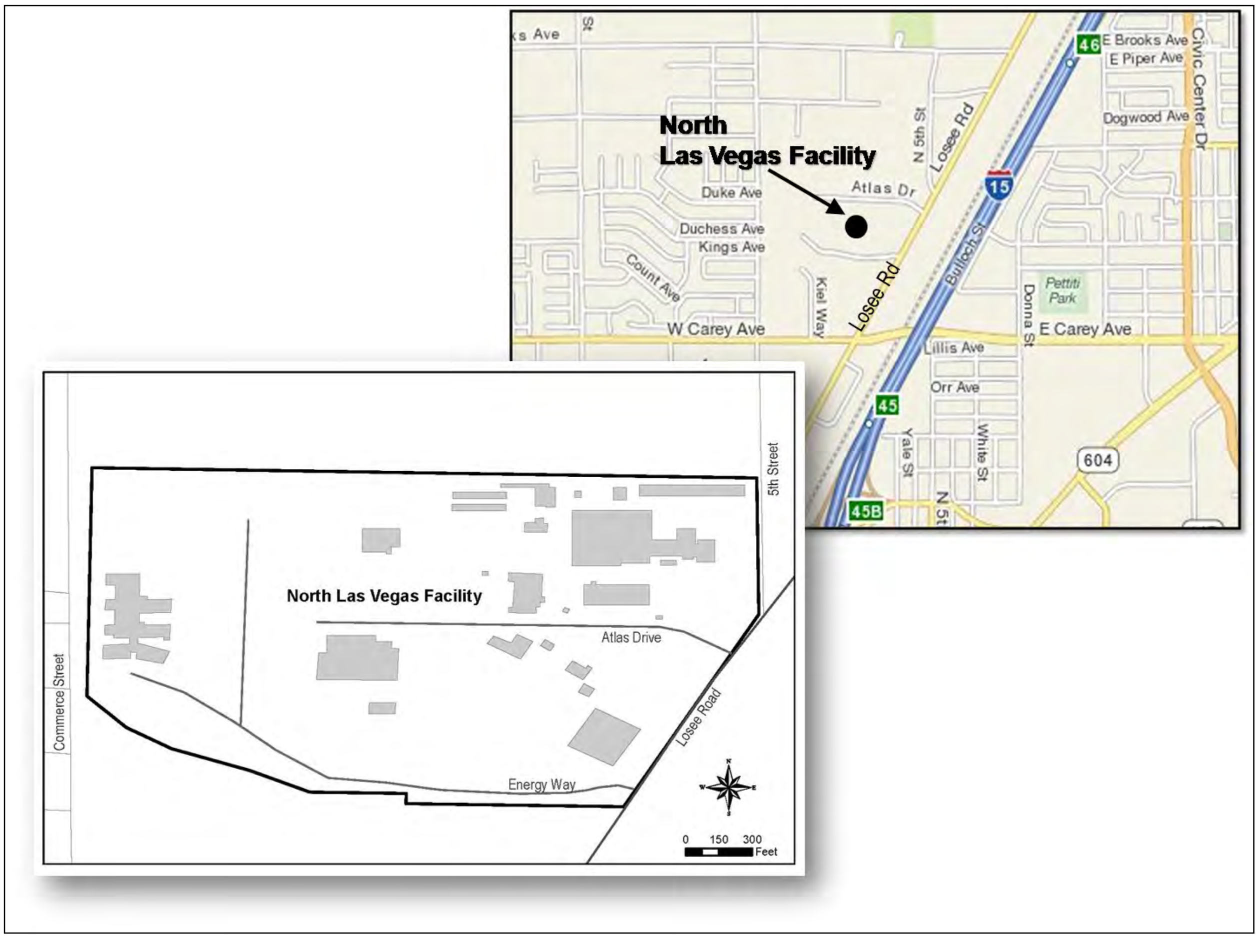


Figure 4–42 North Las Vegas Facility Roadways

4.3.4 Socioeconomics

General existing socioeconomic conditions within the ROI of NLVF (Clark County) are presented in Section 4.1.4.

Police Protection. NLVF is a controlled-access area. WSI, a private contractor, provides security enforcement at NLVF, following guidelines established by DOE/NNSA NSO Safeguards and Security.

Law enforcement at NLVF is provided by the North Las Vegas Police Department.

Fire Protection. Fire protection is provided by the North Las Vegas Fire Department.

Health Care. NLVF has a fully operational occupational medicine center with diagnostic and laboratory support facilities. The center offers a complete array of certification and surveillance exams and has rooms for urgent care, Employee Assistance Program, and ergonomic services. This occupational medicine center can respond to normal and emergency medical situations in North Las Vegas.

4.3.5 Geology and Soils

4.3.5.1 Physiography

NLVF is located in the northern section of the city of Las Vegas. As it is also located in the Las Vegas Valley, the physiography is similar to that described for RSL in Section 4.2.5.1. The facility property has been graded for the construction of its buildings; however, there is a slight grade from west to east. The elevation at the site is approximately 2,000 feet above sea level. The location is surrounded by other urban lands that have also been graded.

4.3.5.2 Geology

NLVF is located on alluvial sediments eroded from the surrounding mountain ranges, as described in Section 4.2.5.2. Although the sediment depth becomes shallower closer to the edges of the valley, the alluvial deposits for most of the valley are at least 0.62 miles deep (Rodgers et al. 2005).

4.3.5.2.1 Structural History

Section 4.2.5.2.1 presents the structural history for the Las Vegas Valley, which includes NLVF. NLVF is located approximately 4.8 miles from the Eglington Fault scarps in northwestern Las Vegas.

4.3.5.2.2 Faulting and Seismic Activity

Section 4.2.5.2.2 presents the faulting and seismic activity for the Las Vegas Valley, which includes NLVF.

4.3.5.2.3 Geotechnical Hazards

The geotechnical hazards would be similar to those discussed in the NNSS and RSL discussions. NLVF is located well within the city boundaries and away from the mountain ranges. Gypsum can generate electrochemical reactions in normal concrete, so foundations for new structures would require concrete resistant to sulfate corrosion (USDA 1985). The presence of several inches of hardpan indicates that heavy machinery would be required for deep excavation.

4.3.5.2.4 Geologic Resources

There are no geologic resources at NLVF.

4.3.5.3 Soils

Soils surveys of the area show that soils at NLVF range from stiff to very stiff, silty and sandy clay, and clay with interbedded medium-dense clayey and silty sand. These soils have been determined acceptable for standard construction (DOE 1996c).

NLVF is located in an urban location, where the soils have previously been disturbed. Two soil associations are found at NLVF. Neither is classified as prime farmland soil. Approximately 60 percent of the site is Las Vegas-McCarran-Grapevine Complex on 0 to 4 percent slopes. The Las Vegas-McCarran-Grapevine Complex is a sandy loam, typically found in basin floor remnants. The soil complex contains three soil associations that are typically too intermingled to define individually. The soil develops in alluvium from limestone, sandstone, and lake bed sediments. The soil profile can be shallow to deep but is generally well drained. The upper section of the soil is typically brown fine, sandy loam that gradually becomes coarser at the bottom. A root-restricting later of hardpan gypsum or lime can be found within approximately 11 inches of the surface (USDA 1985).

The rest of the soils at NLVF constitute Skyhaven very fine sandy loam on 0 to 4 percent slopes. The Skyhaven association is a moderately deep, well-drained soil found on relic alluvial flats. The soil consists of fine, sandy loam over light-brown clay loam that becomes coarser at depth. The soil forms on a variety of rock parent materials, as long as they are rich in lime. A root-constricting layer of lime-cemented materials is found within 15 inches of the surface (USDA 1985).

4.3.5.4 Radiological Sources as a Result of Testing

There has been no nuclear testing at NLVF; therefore, soils are not contaminated with radioactive materials.

4.3.6 Hydrology

4.3.6.1 Surface Hydrology

NLVF is located in the Las Vegas Valley, which has a drainage area of 2,200 square miles in a desert region between sharp, rugged mountain ranges. The lowest point of the valley is the Las Vegas Wash, which drains the area toward Lake Mead (NPS 2001).

Surface-Water Features. There are no surface-water features located at or in close proximity to NLVF.

Flood Hazards. The Federal Emergency Management Agency Flood Insurance Rate Map covering NLVF (Map Number 32003C2160 E) indicates that the facility is located within Zone X. Zone X indicates an area of minimal flood hazard, which is determined to be above the 500-year flood level. There is an area approximately 500 feet north of the facility noted as Zone A, which indicates this location has a 1 percent chance of flooding annually (i.e., a 100-year floodplain) (FEMA 2002a).

Water Discharges and Regulatory Compliance. NLVF has an extensive storm drainage system, consisting of a retention basin, a network of slotted drains, storm drains of reinforced concrete pipe, directed sheetflow, and manmade channels. Stormwater pollution prevention is managed through a variety of measures including, but not limited to, general good housekeeping; spill prevention and response measures (including the implementation of a spill prevention, control, and countermeasures plan); sediment and erosion control measures; and employee training and education (DOE n.d.). NLVF has a "No Exposure Certification" for exclusion from NPDES stormwater permitting, which is afforded to certain facilities where potential contamination sources are protected from exposure to precipitation (Radack 2009).

Wastewater permits for NLVF include a Class II Wastewater Contribution Permit (Permit Number VEH-112) from the City of North Las Vegas for discharges to the city sewer system. This permit specifies concentration limits for contaminants in the wastewater discharges. In 2010, no exceedances of permit limits occurred at either of the two outfalls to the city sewer system (DOE/NV 2011) (see **Table 4–61**).

NLVF also operates under an NPDES permit (Permit Number NV0023507) issued by EPA, which is used for dewatering operations to control rising groundwater levels that surround the facility. Four dewatering wells pump groundwater into a storage tank. The permit allows for the discharge of water from the storage tank to groundwater via percolation, when used for landscape irrigation and dust suppression, and into the Las Vegas Wash via direct discharge into the City of North Las Vegas stormwater drainage system. In accordance with permit requirements, water chemistry analyses are performed quarterly, annually, and biennially for samples collected from the storage tank. In 2010, no permit limits were exceeded (see **Table 4–62**) (DOE/NV 2011).

Table 4–61 Water Quality Results for North Las Vegas Facility Sewer Discharges in 2010

Contaminant	*Permit Limit*	*Outfall A*	*Outfall B*
Ammonia (ppm)	61.0	48.5	22.5
Arsenic (ppm)	2.3	0.00146 [a]	<0.003
Barium (ppm)	13.1	0.140	0.195
Beryllium (ppm)	0.02	<0.00025	0.0000621 [a]
Cadmium (ppm)	0.15	0.000307 [a]	<0.0025
Chromium (hexavalent) (ppm)	0.10	<0.02	0.06
Chromium (total) (ppm)	5.60	<0.001	<0.001
Copper (ppm)	0.60	0.086	0.285
Cyanide (total) (ppm)	19.9	<0.005	<0.005
Lead (ppm)	0.20	<0.0015	<0.0015
Mercury (ppm)	0.001	<0.000066	0.00013
Nickel (ppm)	1.10	0.00301 [a]	0.00348 [a]
Oil and Grease (animal or vegetable) (ppm)	250	<10.0	<10.0
Oil and Grease (mineral or petroleum) (ppm)	100	<10.0	<10.0
Organophosphorous or Carbamate Compounds (ppm)	1.0	0.168	0.168
pH (Standard Units)	5.0–11.0	8.22	7.93
Phenols (ppm)	33.6	<0.05	<0.05
Phosphorus (total) (ppm)	0.50	4.48	4.61
Selenium (ppm)	2.70	<0.0025	<0.0025
Silver (ppm)	8.20	<0.00075	<0.00075
Zinc (ppm)	13.1	0.176	0.264

< = less than; pH = a measure of acidity or basicity; ppm = parts per million.

[a] Estimated concentration; the concentration between the method detection limit and the method reporting limit.

Note: Permit limits set forth in City of North Las Vegas Class II Wastewater Contribution Permit (Permit Number VEH-112).

Source: DOE/NV 2011, Table A-2.

Table 4–62 Water Quality Results for North Las Vegas Facility Dewatering Operations Measured at Water Storage Tank in 2010

Parameter	*Sample Frequency*	*Permit Limit*	*First Quarter*	*Second Quarter*	*Third Quarter*	*Fourth Quarter*
Daily Maximum Flow (MGD)	Continuous	0.005184	0.002486	0.002238	0.002342	0.002401
Total Petroleum Hydrocarbons (ppm)	Annually (4th Quarter)	1.0	NS	NS	NS	ND
Total Suspended Solids (ppm)	Quarterly	135	ND	ND	ND	ND
Total Dissolved Solids (ppm)	Quarterly	1,900	975	985	995	963
Total Inorganic Nitrogen as N (ppm)	Quarterly	20.0	1.38	0.165	0.929	0.965
pH	Quarterly	6.5–9.0	7.81	7.70	8.22	7.64
Tritium (pCi/L)	Annually (4th Quarter)	MR	NS	NS	NS	ND

MGD = million gallons per day; MR = monitor and report; ND = not detected; NS = sample not required that quarter; pCi/L = picocuries per liter; pH = a measure of acidity or basicity; ppm = parts per million.

Note: Permit limits set forth in U.S. Environmental Protection Agency National Pollutant Discharge Elimination System permit (Permit Number NV0023507).

Source: DOE/NV 2011, Table A-3.

4.3.6.2 Groundwater

Hydrogeologic Setting. NLVF is located within the center region of the Las Vegas Valley Hydrographic Basin, an intermountain basin within the Basin and Range Physiographic Province. The Las Vegas Valley Hydrographic Basin is approximately 1,600 square miles, with an estimated perennial yield of 25,000 acre-feet per year (NDWR 2010b). The basin is bordered by Spring Mountains (west), Frenchman Mountains (east), the McCullough Range (south), and the Sheep Range (north). Groundwater flow within the Las Vegas Valley is generally from west to east (USAF 2007c).

Groundwater Supply. All of the utility service lines at the NLVF complex (i.e., power, water, sewage, and natural gas) are owned by DOE/NNSA. NLVF receives its potable water from the Las Vegas Valley Water District, which is a member agency of the Southern Nevada Water Authority (SNWA). Southern Nevada gets nearly 90 percent of its water from the Colorado River. The other 10 percent comes from groundwater that is obtained from production wells in Clark County (LVVWD 2010b). Groundwater comes from three major aquifer zones (underground rock or sediment that is permeable and can conduct water) of the Las Vegas Valley aquifer, generally situated from 300 to 1,500 feet below land surface. Groundwater in the Las Vegas Valley aquifer is naturally recharged from precipitation in the Spring Mountains and the Sheep Range. This drinking water supply is protected from surface contamination by a layer of clay and fine-grained sediments throughout most of the Las Vegas Valley (LVVWD 2010a).

Groundwater Monitoring and Quality. EPA sets national standards for drinking water to protect public health. SNWA requires public drinking water systems to meet these health-based water standards and send customers an annual water quality report. While EPA requires water systems to monitor for approximately 90 regulated contaminants, the Las Vegas Valley Water District monitors for these contaminants as well as about 30 additional unregulated contaminants. Water delivered by the Las Vegas Valley Water District meets or surpasses all Federal and state drinking water standards (LVVWD 2009).

The water table at NLVF occurs at shallow depths ranging from approximately 13 to 50 feet from ground surface. In 1995, a release of tritium occurred in the basement of Building A-1, resulting in the contamination of groundwater that was not discovered until 1999 (Radack 2010b). Remediation was initiated in 2001, when a sump well was installed in the basement of Building A-1. The sump well was used to capture contaminated groundwater until 2002, when remedial operations were completed. All contaminated groundwater was disposed at the NNSS Area 5 sewage lagoon. In early 2003, the sump well was again used intermittently to support NLVF's Dewatering Program. The Dewatering Program was established to control encroaching groundwater beneath Building A-1 (DOE/NV 2011). Although the levels of tritium are now one-tenth of the SNWA limit, water that is pumped from the sump well is disposed at the NNSS Area 5 sewage lagoon in the winter months and is evaporated through swamp coolers located at NLVF during the summer months (DOE/NV 2011; Radack 2010a).

Under the NLVF Dewatering Program, water table elevation monitoring is conducted at 12 monitoring wells, and water levels are monitored continuously at the sump well in Building A-1. In addition, the total volume of groundwater discharged and groundwater chemistry are monitored in accordance with the NPDES permit (NV0023507) (DOE/NV 2011; Radack 2010a).

Groundwater Control. In 1999, groundwater intruded into the elevator pit of Building A-1 (DOE/NV 2008a). As a result of this groundwater intrusion, DOE/NNSA initiated groundwater studies and eventually instituted a Dewatering Program to control rising groundwater levels surrounding the facility. Groundwater studies conducted in 2002 and 2003 revealed a complex hydrogeologic setting. Borehole data from the studies indicate that fine-grained sediments represent a low-energy, mid-valley alluvial and fluvial environment. Individual lithologic units are complexly interbedded, and several normal faults have been mapped in the vicinity.

The hydrogeologic setting suggests that the source of the rising groundwater is water flowing upward along local faults from deeper confined aquifers. This condition is considered a long-term adjustment that can be attributed to a combination of causes, including a seasonal water injection program conducted by SNWA and shifting of regional pumping centers away from the vicinity of NLVF (Bechtel Nevada 2005).

The Dewatering Program at NLVF is regulated under an NPDES permit (NV0023507), which establishes contaminant and discharge limitations. Dewatering wells (NLVF-13, -15, -16, and -17) pump groundwater into a 10,500-gallon storage tank. The permit allows for the discharge of water from the storage tank to groundwater via percolation, when used for landscape irrigation and dust suppression, and into the Las Vegas Wash via direct discharge into the City of North Las Vegas stormwater drainage system (see Section 4.3.2.1.2 for more information regarding discharges). In accordance with the permit, sampling and analyses of discharge water are performed quarterly, annually, and biennially (DOE/NV 2011).

Discharge rates have not exceeded NPDES permit limits. In 2008, the four dewatering wells produced a total of 2,553 gallons per day (average daily flow) that were directed into the storage tank. The pumping rates varied from 0.72 to 0.24 gallons per minute. The average combined discharge from all four wells was about 78,000 gallons per month (DOE/NV 2009d).

4.3.7 Biological Resources

NLVF is in the Southern Basin and Range Ecoregion. It was built on cleared, previously disturbed land that now consists of an urban setting that includes buildings, pavement, and landscaping. No original undisturbed native vegetation remains on the site. Current vegetation at NLVF consists of urban landscape. Few wildlife species exist at NLVF because it is located in an urban area and contains little vegetation.

4.3.7.1 Flora

This facility is located in an urban setting; no native vegetation within a natural setting occurs at this site.

4.3.7.2 Fauna

This facility is located in an urban setting; only urban-adapted wildlife occurs at this site. Wildlife species would be similar to those described in Section 4.2.7.2 for RSL.

4.3.7.3 Threatened and Endangered Species

NLVF is located in urban Las Vegas, Nevada, on previously disturbed land within a fenced site. No threatened, endangered, or rare species are expected to exist at this site. No designated critical habitats for federally listed species exist at NLVF. The urban areas of Clark County are not considered tortoise habitat.

4.3.7.4 Other Species of Concern

No other species of concern inhabit NLVF.

4.3.7.5 Effects of Past Radiological Tests and Project Activities

This facility is located in an urban setting; no past radiological tests or project activities are anticipated to affect wildlife or vegetation at this site.

4.3.8 Air Quality and Climate

4.3.8.1 Meteorology

Downtown Las Vegas is located in Clark County, Nevada, about 56 miles southeast of the southeastern edge of the NNSS. NLVF is about 10 miles northeast of downtown. The facility is located in the Las Vegas Valley, which is situated in the northeastern corner of the Mojave Desert and in the rain shadow (lee) of the southern Sierra Nevada mountain range.

The Las Vegas Valley has the general climatic characteristics of a mid-latitude desert area, with relatively little precipitation throughout the year and low humidity, large diurnal and seasonal temperature ranges, and intense solar radiation in the summer. The generally dry desert conditions specific to the area can occasionally be modified by the southwestern monsoon and convective thunderstorms during the summer months and Eastern Pacific tropical storm remnants in the late summer and fall. The dry conditions can also be moderated by strong *El Niño* cycles, which generally bring more rainfall to the area.

The Las Vegas Valley ranges in elevation from about 2,300 to 2,620 feet above mean sea level and is bounded by mountains to the north, south, and especially to the west, where the Spring Mountains peak above about 6,560 feet. This terrain causes wind flows in the Las Vegas Valley to be dominated by upslope and downslope conditions. The Clark County DAQEM maintains an ambient monitoring site (the J.D. Smith monitor, at 1301 East Tonopah Road) near the North Las Vegas Campus. For more information regarding the meteorological characteristics of NLVF, see Appendix D, Section D.1.2.1.

4.3.8.2 Ambient Air Quality

4.3.8.2.1 Region of Influence

NLVF is located about 55 miles southeast of the NNSS. The ROI for air quality and climate for NLVF operations comprises northern Clark County. Historic data on pollutant emissions inventories and compliance status for the State of Nevada are calculated at the resolution of county or hydrographic areas. These data provide a basis for determining existing air quality in the ROI and a metric for emission comparison assessments.

4.3.8.2.2 Existing Air Quality

Ambient Air Quality Standards. See Section 4.1.8.2.2 for a discussion on the current national and Nevada ambient air quality standards.

Air Quality Status. NLVF is within Hydrographic Area 212. Clark County is in nonattainment for 8-hour ozone[28] and 24-hour PM_{10}.[29] Clark County is no longer in nonattainment for 8-hour carbon monoxide.[30] All other pollutants are in attainment.

PSD is a regulation incorporated into CAA that limits increases of certain pollutants in clean air areas (attainment areas) to certain increments even though ambient air quality standards are being met. CAA has three classes of areas with different increments. The smallest increments allowed are Class I areas, which are areas of special value (natural, scenic, recreational, or historic). Any degradation of existing air quality in these areas should be minimized. The closest PSD Class I areas are Grand Canyon National Park (about 65 miles to the east) and Sequoia National Park (about 165 miles to the west). NLVF currently has no sources of pollution large enough to be subject to PSD requirements. However, because NLVF is located in a nonattainment area, it could potentially be subject to nonattainment new source review if the emissions were of sufficient strength; however, they have been determined not to meet the threshold for new source review. Nonattainment new source review requirements are customized for the classification and type of air pollutant nonattainment area.

[28] *Classified as marginal for 8-hour ozone under former Subpart 1 with a nonattainment area that includes those portions of Clark County that lie in Hydrographic Areas 164A, 164B, 165, 166, 167, 212, 213, 214, 216, 217, and 218, but excludes the Moapa River Indian Reservation and the Fort Mojave Indian Reservation. However, on March 29, 2011, EPA made the determination that Clark County is in attainment with 1997 ozone NAAQS (76 FR 17343). EPA is expected to redesignate the area's status to attainment upon approval of the Ozone Redesignation Request and Maintenance Plan submitted to EPA Region 9 in early April 2011.*

[29] *Designated as serious nonattainment for $PM_{10.}$ The nonattainment area covers Hydrographic Area 212. However, on August 3, 2010, EPA made the determination that the Las Vegas Valley is in attainment with the PM_{10} NAAQS based on monitoring data (75 FR 45485). EPA is expected to redesignate the area's status to attainment upon approval of the maintenance plan and request for redesignation that Clark County is expected to submit.*

[30] *A CO Maintenance Plan and formal request for resdesignation to attainment was submitted to the EPA in 2008 and approved on September 7, 2010 (75 FR 59090).*

Emissions Due to NLVF Operations. Title V of CAA gives states the authority to use air quality permits to regulate stationary source emissions of criteria pollutants. At NLVF, a Source 657 Authority to Construct/Operating Permit regulates emissions from sources such as an aluminum sander, an abrasive blaster, emergency generators, boilers, cooling towers, and a spray paint booth. The emissions of carbon monoxide, nitrogen oxides, PM_{10}, sulfur dioxide, volatile organic compounds, and hazardous air pollutants were each less than 1 ton annually from 2003 through 2008 for these permitted facilities. Total emissions of these pollutants over this 6-year period are about 4.4 tons (DOE 2004b, 2005b, 2006a, 2007b, 2008j, 2009c).

Table 4–63 shows the onsite emissions due to stationary sources, as well as emissions due to NLVF commuters, commercial vendors, and radioactive waste trucks in Clark County and in Nye County both on the NNSS and off the NNSS, where appropriate. The onsite stationary sources include both permitted sources and natural gas combustion for heating. See Appendix D, Section D.3.2.1, for more information on mobile and stationary source emission methodology.

Measurements of Ambient Air Concentrations on and near NLVF. The Clark County DAQEM maintains an air quality monitoring network throughout Clark County. The J.D. Smith monitor (at 1301 East Tonopah Road) is located about 1 mile northwest of NLVF. It monitors hourly ozone, carbon monoxide, and nitrogen dioxide levels and daily PM_{10}, and $PM_{2.5}$ levels. **Table 4–64** shows these results along with the highest sulfur dioxide value monitored in the Las Vegas Valley. Note that at least 25 percent of the 2008 observations were missing, so the maximum concentrations could potentially be higher than what is shown for that year. The ambient air quality standards are also shown in the table. See Table 4–40 for more information on the standards.

Ozone measurements at the J. D. Smith monitor (at 1301 East Tonopah Road) exceeded the 8-hour ozone NAAQS in 2006 and 2007. The largest 8-hour ozone concentration was 0.081 ppm (in 2006), which is 0.006 ppm larger than the current NAAQS of 0.075 ppm. Maximum ambient ozone concentration levels have generally remained constant at this level and other nearby monitors since at least 1998 (DAQEM 2009).

PM_{10} measurements at the J.D. Smith monitor (at 1301 East Tonopah Road) indicated that the second-highest 24-hour average PM_{10} concentration was 136 micrograms per cubic meter (in 2006), which is 14 micrograms lower than the NAAQS of 150 micrograms per cubic meter. Although this 24-hour PM_{10} concentration is below the NAAQS, other monitoring locations within the Las Vegas Valley exceed the standard and the entire valley has been designated as nonattainment for PM_{10}. The largest annual average PM_{10} concentration was 33 micrograms per cubic meter (in 2006), which is well below the Nevada ambient air quality standard of 50 micrograms per cubic meter (there is no national PM_{10} annual average standard).

All other criteria pollutants are well below NAAQS. No lead monitoring data are available for the Las Vegas Valley.

Table 4–63 Estimated 2008 Air Emissions of Criteria Pollutants and Hazardous Air Pollutants Due to North Las Vegas Facility Activities

	Annual Air Emissions (tons/year)											
	Stationary Sources	*NLVF Commuters*		*Commercial Vendors*	*Radiological Waste Trucks*			*Total*				
	Clark County	*Clark County*	*Nye County*	*Clark County*	*Clark County*	*Nye County*		*Clark County*		*Nye County*		
Pollutant	***On-NLVF***	***Off-NLVF***	***Off-NNSS***	***Off-NLVF***	***Off-NLVF***	***On-NNSS***	***Off-NNSS***	***On-NLVF***	***Off-NLVF***	***On-NNSS***	***Off-NNSS***	***Total***
PM_{10}	0.037	0.25	0.0015	0.19	0.0051	0.00032	0.00048	*0.037*	*0.45*	*0.00032*	*0.0020*	***0.48***
$PM_{2.5}$	0.037	0.13	0.00086	0.17	0.0048	0.0003	0.00045	*0.037*	*0.30*	*0.00030*	*0.0013*	***0.34***
CO	0.19	25.5	0.16	0.76	0.02	0.0013	0.0019	*0.19*	*26.3*	*0.0013*	*0.16*	***26.6***
NO_x	0.73	6.2	0.042	1.7	0.069	0.0045	0.0068	*0.73*	*8.0*	*0.0045*	*0.049*	***8.8***
SO_2	0.017	0.069	0.00039	0.0032	0.000098	0.0000062	0.0000094	*0.017*	*0.072*	*0.0000062*	*0.00040*	***0.090***
VOCs	0.028	0.51	0.0032	0.25	0.0033	0.00021	0.00032	*0.028*	*0.76*	*0.00021*	*0.0035*	***0.80***
Lead	<0.01	<0.01	<0.01	0.0000029	<0.01	<0.01	<0.01	*<0.01*	*~0.020*	*<0.01*	*<0.01*	***~0.060***
Criteria Pollutant Total	1.0	32.5	0.21	0.76	0.097	0.0064	0.0096	*1.0*	*33.4*	*0.0064*	*0.22*	***34.6***
HAPs	0.0026	0.04	0.00026	0.033	0.00043	0.000028	0.000042	*0.0026*	*0.073*	*0.000028*	*0.00030*	***0.076***

CO = carbon monoxide; HAP = hazardous air pollutant; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table 4–64 Ambient Air Quality Monitoring in the Vicinity of the North Las Vegas Facility, 2006–2008

Year	*2nd Max 1-hour CO (ppm)*	*2nd Max 8-hour CO (ppm)*	*Annual Mean NO_2 (ppm)*	*2nd Max 1-hour NO_2 (ppm)*	*4th Max 8-hour O_3 (ppm)*	*Max 1-hour SO_2 (ppm)*	*2nd Max 24-hour SO_2 (ppm)*	*Annual Mean SO_2 (ppm)*	*98th Percentile $PM_{2.5}$ (μg/m^3)*	*Annual Mean $PM_{2.5}$ (μg/m^3)*	*2nd Max 24-hour PM_{10} (μg/m^3)*	*Annual Mean PM_{10} (μg/m^3)*
2006	4.8	3.7	0.021	0.072	**0.081**	0.015	0.007	0.002	22.1	8.2	136	33
2007	4.5	2.8	0.020	0.066	**0.080**	0.007	0.003	0.001	19.7	8.8	110	32
2008	3.6	2.4	0.016	0.062	0.068	0.006	0.001	0.001	18.8	8.9	109	31
NAAQS	35.0	9.0	0.053	0.100	0.075	0.075	0.030	0.140	35.0	15.0	150	None

μg/m^3 = micrograms per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; O_3 = ozone; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; ppm = parts per million; SO_2 = sulfur dioxide.
Note: Monitored values are from the J.D. Smith monitor (at 1301 East Tonopah Road), except for SO_2, which was the highest monitored value in the Las Vegas Valley.
All exceedances of the NAAQS are shown in bold font.
Source: EPA 2010a.

4.3.8.3 Radiological Air Quality

Direct radiation monitoring is conducted near Buildings A-1 (Source Range Laboratory) and C-3 (High Intensity Source) at NLVF. These are the two locations at NLVF that currently use radioactive sources or are where radiation-producing operations are conducted. These and other historical radiation measurements show that radiological doses to the public from NLVF activities are indistinguishable from background radiation (DOE 2009e). **Table 4–65** presents the total estimated radionuclide emissions from NLVF in 2007 and 2008. Based on the 2008 emission rate of 0.011 curies, the estimated radiation dose to the nearest offsite public access point to NLVF was 0.00006 millirem per year. This is well below the NESHAPs dose limit for the general public of no greater than 10 millirem per year. **Table 4–66** presents statistics on radiation exposure measurements taken once per quarter at the NLVF boundary and control locations. These results both include and are indistinguishable from doses from natural background radiation near NLVF.

Table 4–65 Estimated Annual Air Releases of Radionuclides at the North Las Vegas Facility

	Estimated Annual Emissions (curies)	
	2007	***2008***
Tritium	0.012	0.011
Reference	DOE 2008c	DOE 2009c

Note that parts of the Building A-1 basement were contaminated with tritium in 1995. The release led to a very small potential exposure (less than 0.001 millirem per year) to an offsite person; the NESHAPs dose limit for exposure of the public is 10 millirem per year (40 CFR Part 61, Subpart H). Tritium continues to be emitted at low levels (e.g., 5.3×10^{-4} curies in 2009 [NSTec 2010b]) from the parts of the building that were exposed to the initial release (DOE 2009d).

An accidental release also occurred at NLVF in 2004; this release involved the improper disposal of tritium-contaminated water into a public sewer system. These levels were also well below the level of concern. However, in response to this incident, the DOE/NNSA NSO has developed several procedures to prevent this type of accidental discharge in the future (DOE 2005b).

4.3.8.4 Climate Change

This section describes the affected environment in terms of current and anticipated trends in greenhouse gas emissions and climate. The effects of emissions on the climate involve very complex processes and interact with natural cycles, complicating the measurement and detection of change. Recent advances in the state of the science, however, are contributing to an increasing body of evidence that anthropogenic greenhouse gas emissions affect climate in detectable and quantifiable ways.

For information on greenhouse gas emissions in the United States, please see Section 4.1.8.4.1. Greenhouse gas emissions at NLVF are discussed in the next section. Details on the methodology used to determine these emissions are discussed in Appendix D, Sections D.2.3.1.1, D.2.3.2.1, and D.2.3.3.1.

Table 4–66 Average Annual Average and Maximum Annual Average Radiation Levels Among the North Las Vegas Facility Boundary Monitors and Control Monitors Operating in a Given Year

	Radiation Level (millirem per year)											
	1997	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***
Maximum annual average	0.0808	0.0624	0.0619	0 (no data)	0 (no data)	0 (no data)	0.0640	0.0700	0.0740	0.0700	0.0740	0.0920
Annual average for all monitors	0.0610	0.0500	0.0536				0.0635	0.0653	0.0690	0.0660	0.0697	0.0917
Reference	DOE/NV 1998d, pp. 4-32 and 4-33	DOE/NV 1999, p. 4-32	DOE/NV 2000c, p. 4-31	DOE/NV 2001c, p. 1-11	DOE/NV 2002b, p. 1-11	DOE/NV 2003a, p. 1-10	DOE/NV 2004a, p. B-11	DOE/NV 2005f, p. B-11	DOE/NV 2006a, p. A-11	DOE/NV 2007d, p. A-10	DOE/NV 2008a, p. A-9	DOE/NV 2009d, p. A-8

Note: These radiation measurements are taken once per quarter year (DOE 2009e).

4.3.8.4.1 Greenhouse Gas Emissions

Table 4–67 provides greenhouse gas emissions due to NLVF-related activities for 2008. The greenhouse gas emissions are presented in carbon-dioxide-equivalent form and are partitioned by various mobile and stationary source types. These emissions were derived from fuel use, vehicle activity, and power consumption data. The greenhouse gas emissions were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010b). These emissions were compared with a reference amount of 25,000 metric tons (27,558 tons), which is the threshold for which a quantitative assessment may be meaningful (CEQ 2010).

Electricity consumption is by far the largest single source of greenhouse gas emissions related to NLVF activities, emitting approximately 8,392 carbon-dioxide-equivalent tons of greenhouse gases, or 63 percent of the NLVF-related greenhouse gas emissions total. Stationary sources altogether emitted about 8,563 carbon-dioxide-equivalent tons of greenhouse gases. Mobile sources emitted about 4,792 tons, so that overall, NLVF-related activities created about 13,355 carbon-dioxide-equivalent tons of greenhouse gas emissions in 2008, which is about 52 percent below the threshold reporting level.

Table 4–67 Carbon-Dioxide-Equivalent Emissions of Greenhouse Gases from North Las Vegas Facility Activities in 2008

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 25,000 Metric Tons* [a]
STATIONARY SOURCES		
Power generation	8,392	0.30
Natural gas heating	157	0.01
All stationary sources, except air conditioning/refrigeration and natural gas heating	15	0.00
All Stationary Sources	*8,563*	*0.31*
MOBILE SOURCES		
Commuting	3,896	0.14
Hazardous waste transport (nongoverment)	7	<0.01
Commercial vendors	889	0.03
All Mobile Sources	*4,792*	*0.17*
Total	***13,355***	***0.48***

[a] 25,000 metric tons are equal to about 27,558 short tons.

4.3.8.4.2 Current Changes in Climate

For a discussion of climate change impacts in the region, please see Section 4.1.8.4.2.

4.3.9 Visual Resources

The area around NLVF is highly developed, primarily with commercial and warehouse facilities. The visual environment comprises infrastructure, such as buildings, roadways, and utilities. **Figure 4–43** shows the locations from which photographs of the area around NLVF were taken and the sensitivity levels of the roadways in the area (see Section 4.1.9). Vegetation in the area is limited to street landscaping, such as palm and evergreen trees and various shrubs (see **Figure 4–44**, View 1).

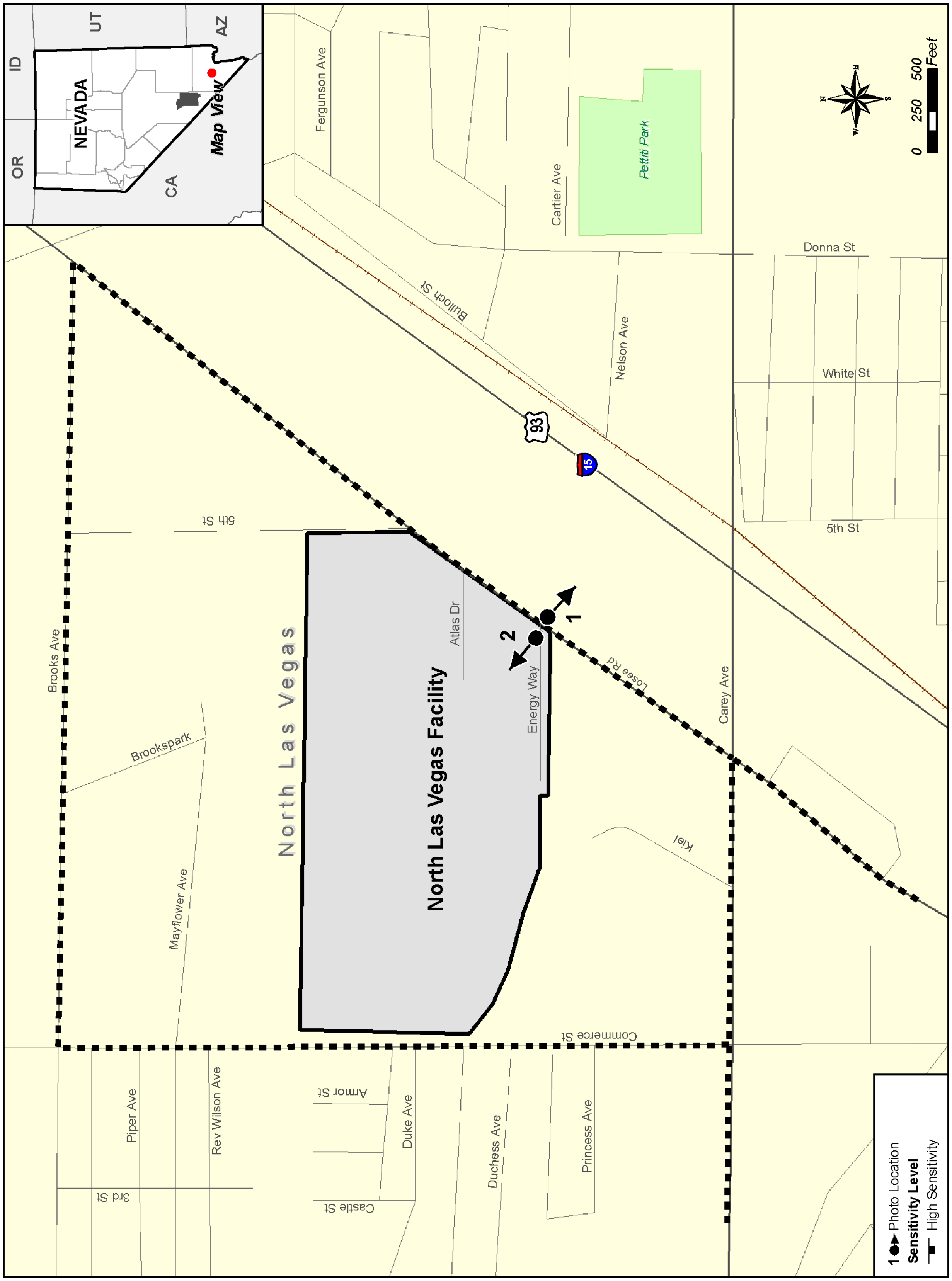


Figure 4–43 Photograph Locations and Sensitivity Levels near the North Las Vegas Facility

View 1

View 2

Figure 4–44 Landscape Photographs near North Las Vegas Facility

The areas surrounding NLVF are developed, with warehouse and commercial facilities; visual access to these areas is limited to views from public roadways and sidewalks in the area. On local streets, such as near NLVF, speed limits are lower, yet surrounding development is dense and there is much more traffic. These elements combine so views are not focused on a specific facility that is visually similar to its surroundings, but on driving and views immediate to the road corridor. There is no public visual access to the interior of NLVF (see Figure 4–44, View 2). The area is primarily visible from Losee Road and may have limited views from Commerce Street, Brooks Avenue, and 5th Street. Visible portions of the area are considered to have a Class C scenic quality rating (see Section 4.1.9 for information on the visual impact rating system) due to the developed nature of the landscape, as described above, combined with high intrusion of manmade elements and lack of elements that help to improve aesthetics, such as landscaping.

4.3.10 Cultural Resources

For introductory information regarding cultural resources, see Section 4.1.10.

NLVF is located in northern Las Vegas Valley, within the center region of the Las Vegas Valley Hydrographic Basin, an intermountain basin within the Basin and Range Physiographic Province of the United States (NDWR 2006). NLVF consists of an 80-acre complex of 30 buildings and 1 trailer located in a highly developed area zoned for generalized industrial activity. It was built on cleared, previously disturbed land that now consists of an urban setting comprising buildings, pavement, and ornamental landscaping. The area of influence at NLVF includes the entire footprint of the facility.

4.3.10.1 Recorded Cultural Resources

There are no recorded cultural resources within the boundary of NLVF.

4.3.10.2 Sites of American Indian Significance

No sites of American Indian significance have been identified within the boundary of NLVF. As part of the preparation of this SWEIS, DOE/NNSA consulted with CGTO to determine whether sites of American Indian significance exist within NLVF.

4.3.11 Waste Management

DOE/NNSA operations do not generate LLW, MLLW, or TRU waste at NLVF. DOE/NNSA does generate, however, water that is slightly contaminated with tritium and collected as air conditioning condensate from the basement sump of one of the buildings. The water is either disposed by evaporation at NLVF or transported in tanker trucks to the NNSS for disposal by evaporation in NNSS sewage lagoons (DOE/NV 2011; NSTec 2009c).

The quantities of hazardous waste that were generated at NLVF and disposed or recycled during CYs 2005 through 2008 are listed in **Table 4–68** (Duke 2009). This waste includes recycled oil and antifreeze, other hazardous waste, such as universal waste, and waste that is regulated under other regulatory authorities, such as TSCA. Hazardous wastes include universal wastes, i.e., materials such as computer equipment, batteries, and fluorescent lamps. (The Regulated Management Program for universal waste is streamlined compared to that for other hazardous wastes and emphasizes material reuse or recycle.) All hazardous and toxic wastes are disposed or recycled at offsite facilities.

Table 4–68 Annual Hazardous and Toxic Waste Disposal or Recycle Quantities for the North Las Vegas Facility (tons)

Waste	*Calendar Year*			
	2005	*2006*	*2007*	*2008*
Recycled oil and antifreeze	a	0.21	a	7.4
Other hazardous waste [b]	0.57	0.98	0.34	1.36
Other waste [c]	a	a	a	0.26

[a] Not reported for this year.
[b] Hazardous waste, including universal wastes such as computer equipment, batteries, and fluorescent lamps that are generated in a wide variety of settings; are not solely industrial; are generated by a large community; and are present in significant volumes in nonhazardous management systems. The Regulated Management Program for universal waste is streamlined compared to that for other hazardous wastes and emphasizes material reuse or recycle.
[c] Waste regulated under the Toxic Substances Control Act or statutory authorities other than the Resource Conservation and Recovery Act.
Source: Duke 2009.

Most hazardous waste comes from the machine shop. Routine hazardous waste streams include lead- and solvent-contaminated rags and lead metal shavings and debris. Nonroutine hazardous waste streams include non-empty aerosol cans; lab-packs of unused, out-of-date chemicals from various locations; and wastes from occasional demolition activities. Universal waste, such as light bulbs and batteries, come from facility maintenance and cleanup activities. Recycled materials include used oil and antifreeze. The used oil is typically generated by draining or replacing quenching or cooling oils at the machine shop and is occasionally generated as part of draining equipment or replacing hydraulic fluid, as well as from facility maintenance projects (Duke 2009).

Finally, NLVF generates sanitary solid waste, which is generally collected and disposed by a municipal waste service. For security reasons, however, some solid waste is collected by the DOE/NNSA NSO and sent for disposal at the NNSS Area 23 Landfill (see Section 4.1.11.2.3).

In the future, waste may be generated as part of decommissioning unneeded structures.

4.3.12 Human Health and Safety

NLVF provides calibration and other services using specialized radiation fields for a variety of instrument packages in support of NNSS operations. The radiation fields are provided by sealed sources containing cobalt-60, cesium-137, or plutonium-239 that are stored in heavily shielded configurations in the below-grade portion of Building A-1. Because these are sealed sources, they do not release radioactive material that could pose a risk to the workers or the public. There is no direct exposure to the public as a result of the shielding provided by the engineered structure and the location below ground level. Worker exposure is managed by the shielding and administrative controls that limit access to the below-grade area where the sealed sources are stored.

An accident in 1995 resulted in the release of more than 1 curie of tritium into the basement area of Building A-1. The release occurred when a container of tritium-aluminum foils was improperly opened in the Atlas Facility in NLVF. The tritium release was cleaned up, but residual tritium continues to emanate from the basement floor. In 2008, the estimated dose to a hypothetical MEI near NLVF was 0.0006 millirem. Since the accident, the highest annual dose to the MEI was 0.0018 millirem in a year; since 2005, the dose has been less than 0.0001 millirem per year. This dose is magnitudes less than the 10 millirem annual limit under NESHAPs (40 CFR Part 61, Subpart H). A detailed discussion of the radiation environment, including radionuclide releases and associated potential doses to an MEI, is presented in the *Nevada Test Site National Emission Standards for Hazardous Air Pollutants – Radioactive Emissions, Calendar Year 2008* (DOE 2009d).

Chemical exposure pathways to NLVF workers during normal operations may include inhaling the workplace atmosphere, drinking NLVF potable water, and possible other contact with hazardous materials associated with work assignments. The potential for health impacts varies from facility to facility. Workers are protected from hazards specific to the workplace through appropriate training, protective equipment, monitoring, and management controls. NLVF adheres to Occupational Safety and Health Administration and EPA occupational standards (see Chapter 9) that limit atmospheric and drinking water concentrations of potentially hazardous chemicals. Appropriate monitoring, which reflects the frequency and amounts of chemicals utilized in the operational processes, ensures that these standards are not exceeded.

In August 2003, beryllium was found in NLVF Buildings B-1, B-2, and B-3. It was determined that the material was from copper-beryllium alloys milled in Building B-1 during the 1980s. Buildings B-1 and B-2 were demolished in 2004.

The greatest contributor to background noise at NLVF is vehicular traffic, as the facility is located near Interstate 15 (just east of the site) and is buffered on the north, south, and east by general industrial zoning. No environmental noise data are available at NLVF; however, because of its proximity to an interstate and the common occurrence of traffic congestion in the surrounding area, it is estimated that background noise levels range from 60 to 70 decibels, A-weighted (EPA 1974).

4.3.13 Environmental Justice

As seen in Figure 4–39, there are numerous block groups to the south and east of the NLVF where the low-income population is between 11 and 20 percent, and several additional block groups in the 21–30 and greater-than-30 percent range further to the south. The NLVF is located in an area where the majority of block groups have minority populations exceeding 50 percent (see Figure 4–40).

4.4 Tonopah Test Range

This section describes the existing environmental conditions found at the TTR. The TTR comprises approximately 280 square miles (179,200 acres) and is surrounded on three sides by the Nevada Test and Training Range. The Nevada Test and Training Range is located approximately 30 miles from the town of Tonopah, Nevada. The TTR, which is operated by Sandia National Laboratories, offers a unique test bed for DOE and DoD weapons systems. The primary mission of DOE/NNSA at the TTR is to ensure that the Nation’s nuclear weapons systems meet the highest standards of safety and reliability.

4.4.1 Land Use

TTR is located in Nye County, Nevada, near the northwestern corner of the Nevada Test and Training Range, approximately 12 miles north of the nearest NNSS boundary. The TTR is 22 miles east of Goldfield and 140 miles north of Las Vegas. The TTR is located in a remote, broad, flat valley with scattered former lake beds between the Cactus Range to the west and Kawich Range to the east.

The main operational area for the TTR is within the Cactus Flat Valley, which has outcrops of low hills in the south and consists of hundreds of buildings, structures, and equipment. Many of these buildings and structures are prefabricated; only a handful are permanent structures or buildings. An airport is located just north of the built-up complex, and an additional airstrip is located just south of the built-up complex. The airport and airstrip are not open for public use.

Adjacent Land Use. The TTR is located within a portion of the 1,302,000-acre Nevada Wild Horse Range, which extends across the northern portions of the Nevada Test and Training Range and southward to the NNSS. The Nevada Test and Training Range is primarily used for weapons development and flight training. BLM manages the wild horses on the Nevada Test and Training Range; management of wild horses is a secondary use of these lands. Visitor access is not permitted due to security reasons.

Sparsely populated public lands north of the TTR boundary are jointly administered by BLM and the U.S. Forest Service and are currently used for cattle grazing, recreation, and other uses. The nearest population to the TTR is approximately 22 miles west of the site, in the town of Goldfield.

Historical Use. The TTR was used extensively between 1956 and 1989. It was one of the primary test facilities during the Cold War era due to its isolation and size. The Atomic Energy Commission began testing weapons systems, research rockets, and artillery on the TTR in 1957. TTR capabilities evolved to include nonnuclear field-testing of nuclear weapons design, stockpile surveillance, and research.

Current Use. Principal DOE/NNSA activities at the TTR include stockpile reliability testing; research and development; and support for a variety of testing, including arming, fusing, and firing systems testing. No nuclear devices are tested at the TTR (DOE 2008k).

DOE/NNSA activities at the TTR are conducted through the DOE/NNSA Sandia Site Office under a land use permit from the USAF. Principal activities are conducted within a smaller area (176,000 acres) known as the "Permitted Premises." Revisions to the TTR boundary and the land use permit area for the Sandia Site Office operations area at the TTR would need to be coordinated with the USAF. The current land use permit granting DOE/NNSA use of this portion of the TTR extends through 2019 (USAF 2002).

Characterization and remediation of industrial sites at the TTR are ongoing, and the majority of the industrial sites have been closed (DOE 2008f).

4.4.1.1 Public Land Orders and Withdrawals

The following Memorandum of Understanding, Withdrawal Act, and land permit are applicable to the TTR.

Memorandum of Understanding. The Memorandum of Understanding, signed in 1956, designated approximately 370,000 acres to support research related to the weapons development program.

Military Lands Withdrawal Act of 1999, Public Law 106-65. Enacted on October 5, 1999, this act extended the withdrawn lands set aside by previous public land orders (about 3 million acres in total) for defense use as part of the Nevada Test and Training Range, including the TTR, for another 20 years. Although no nuclear devices are tested at the TTR, this land is an integral part of DOE/NNSA operations within the Nevada Test and Training Range.

Sandia Land Permit. This permit, effective from April 26, 2002, until October 5, 2019, grants DOE/NNSA permission for use, operation, and occupancy of a portion of the Nevada Test and Training Range at the TTR. This permit is re-evaluated at 5-year intervals to review the requirements that established the need for this permit. This permit does not allow activities that significantly interfere with the Nevada Test and Training Range and requires both entities to work cooperatively to accomplish their respective missions. Activities that occur on this leased land must comply with applicable laws and regulations related to the environment, occupational health and safety, handling and storage of hazardous materials, and disposal of hazardous materials.

4.4.2 Infrastructure and Energy

4.4.2.1 Infrastructure and Utilities

This section discusses the TTR buildings and transportation infrastructure; potable water, wastewater, and communications utilities; and support services, including law enforcement and security, fire protection, and health care. Further transportation-related information is discussed in Section 4.4.3. Solid waste collection is discussed in Section 4.4.11. Energy systems (electricity, natural gas, and liquid fuels) are discussed in Section 4.4.2.2.

4.4.2.1.1 Infrastructure

Facilities. The TTR contains 105 major buildings, providing approximately 161,500 square feet of floor space, and approximately 90 smaller buildings, including towers and small sheds (DOE 1996c).

Transportation Systems. See Section 4.4.3.1 for a discussion of the onsite transportation infrastructure at the TTR.

The USAF maintains an active base and airport on the TTR in support of its missions. This airport building is approximately 10,000 square feet. The existing 12,000-foot runway and navigation aids are open to DOE on an as-needed basis. The Mellan Airstrip is located on the southern portion of the TTR. This airstrip supports DOE and USAF training programs and is used sporadically. There are no support facilities associated with the Mellan Airstrip.

4.4.2.1.2 Utilities

Water Supply. The PWS at the TTR is registered with NDEP as a Nontransient, Noncommunity PWS (see text box in Section 4.1.6.2 for PWS definitions).

The following are three active water wells used by the TTR: (1) Production Well 6, (2) Well 7, and (3) the Roller Coaster Well. The most active are Production Well 6 and the Roller Coaster Well. Production Well 6 supplies drinking water to the TTR Main Compound in Area 3; this well is routinely sampled and analyzed per NDEP requirements to demonstrate conformance with primary drinking water standards. Outlying areas and buildings without potable water service use bottled water (DOE 2009a). Nonpotable wells, particularly the Roller Coaster Well, service the TTR for construction and industrial activities. Some impoundments at the TTR are used to store water during activities. Annual water usage at the TTR is approximately 6 million gallons for the entire range, including water used by the USAF at the TTR (DOE 2008l). See Section 4.4.6 for more information on the water supply.

Wastewater Collection and Treatment Systems. Industrial (primarily discharge from an oil-water separator) and sanitary wastewater generated at the TTR is collected and pumped to a USAF facultative sewage lagoon treatment unit located approximately 1.5 miles southwest of the main gate. The industrial flows are combined with sanitary flows for final treatment using biological processes in two lined aerated ponds, which are permitted by NDEP and operated by the USAF under an NPDES permit (Permit Number NEV20001) (DOE 2009a). Five active septic tank systems are used in remote areas of the TTR for domestic sanitary sewage treatment; there is also one inactive septic tank system in one area (DOE 2009a). Annual wastewater samples are taken at the point where wastewater leaves the TTR property and enters the USAF system (DOE 2009a).

Communication Systems. Communications at the TTR are supported by a regional system. The TTR telecommunication system employs digital telephone switching, fiber optic transmission, microwave, two-way radio, voice privacy, data transmission systems, general- and special-purpose data communications, and teleconferencing services. The TTR also has a ground-to-air communication system that supports all air-to-ground testing programs. The VHF [very-high-frequency] and UHF [ultra-high-frequency] communication capability is reliable within a 200-mile radius of the TTR, depending on the altitude, while high-frequency communication can be reliable for thousands of miles.

4.4.2.2 Electrical Energy

Power to DOE/NNSA facilities at the TTR is supplied by NV Energy. NV Energy has two supply lines to the TTR: the primary line is 120 kilovolts, and a backup line is 60 kilovolts. NV Energy transformers step the voltage down to 13.8 kilovolts for the DOE/NNSA distribution system. The remaining power line supplies the USAF facilities. All remote operations are supplied with electrical power by portable generators.

4.4.2.2.1 Natural Gas

There is no infrastructure for natural gas supply at the TTR.

4.4.2.2.2 Liquid Fuels

The TTR uses various types of liquid fuel for its energy needs, including gasoline, diesel, and propane. There are currently no aboveground storage tanks at the TTR requiring registration with the State of Nevada (DOE 2009a); however, there are a number of fuel storage tanks that are listed as non-permit equipment in the TTR NDEP Class II Air Quality Operating Permit (AP8733-0680.02). The Non-Permit

Equipment List indicates that the TTR maintains diesel-fired generators, gasoline generators, and propane-fired boilers. The TTR has onsite propane storage tanks, as presented in **Table 4–69**, with a permitted collective storage capacity of 23,563 gallons (NDEP 2007).

Table 4–69 Tonopah Test Range Propane Storage Tank Capacities

Equipment	*Quantity*	*Size*
Propane Storage Tanks	22	1 × 119 gallons 1 × 250 gallons 5 × 495 gallons 2 × 500 gallons 5 × 1,000 gallons 1 × 1,050 gallons 3 × 1,150 gallons 1 × 1,500 gallons 1 × 2,000 gallons 1 × 3,000 gallons 1 × 3,219 gallons

Source: NDEP 2007.

4.4.3 Transportation

4.4.3.1 Onsite Transportation

The TTR's onsite roadway network consists of 118 miles of primary paved roads, 23 miles of secondary paved roads, 113 miles of primary compacted dirt roads, and 39 miles of secondary compacted dirt roads (DOE 1996c). The two primary paved roads on the TTR (one traversing north–south and one east–west) support the majority of the daily traffic, as well as traffic during operations. See **Figure 4–45** for primary paved roads. Traffic within the TTR mainly occurs on Main Road South. Dirt roads are used for secondary daily travel, but are primarily used during experimental activities.

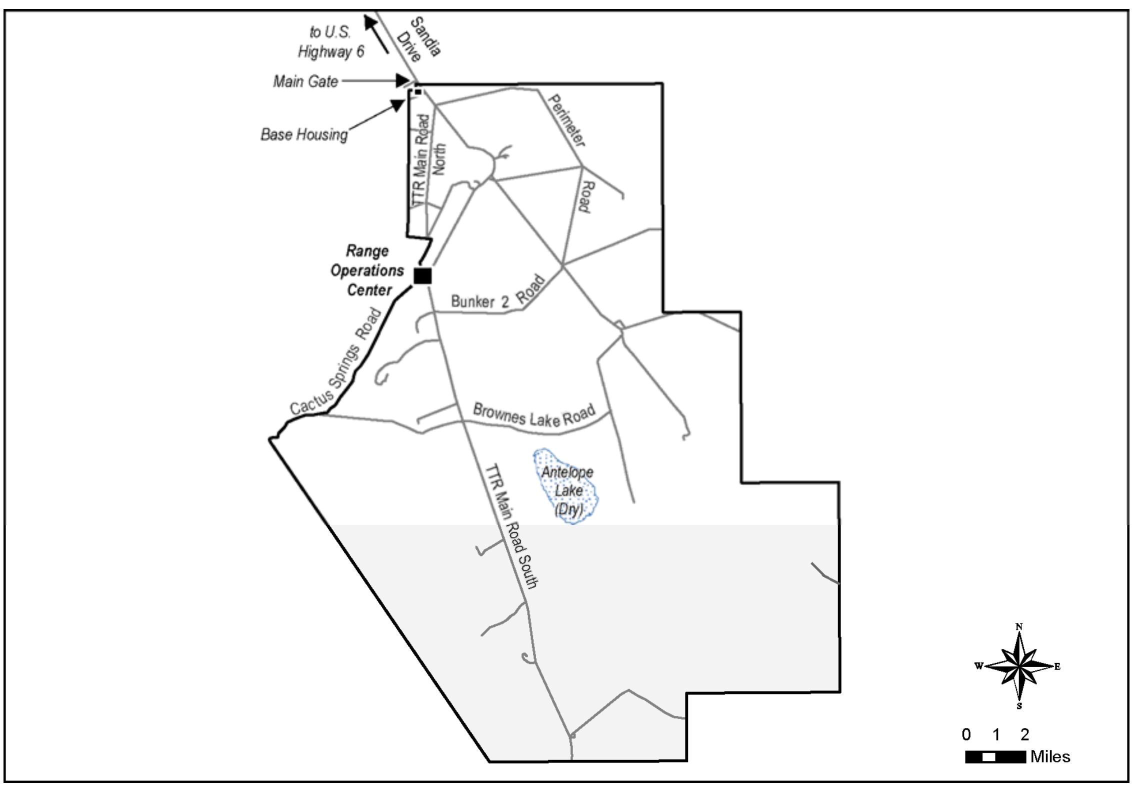


Figure 4–45 Tonopah Test Range Roadways

The roadway system on the TTR is jointly maintained by DOE/NNSA and the USAF. Generally, no privately owned vehicles are permitted on the site; however, privately owned vehicle passes are occasionally issued to offsite personnel and visitors that temporarily reside in the housing area located near the main entrance. Workers either drive government-supplied vehicles from the main entry of the TTR or ride government-supplied bus transportation to the work site. The majority of the onsite traffic is attributed to security support and facility operations (DOE 1996c).

4.4.3.2 Regional Transportation

The TTR is bounded by the Nevada Test and Training Range on the east, west, and south. Although there are access points to areas of the Nevada Test and Training Range through other gates, access to the site is normally through the Main Gate at the northern boundary. North of the Main Gate, Main Road North becomes Sandia Drive (also known as State Route 504), which connects to U.S. Route 6 about 20 miles to the north. Traffic volumes and levels of service on roadways in Nye County, including those near the TTR, are discussed in Section 4.1.3.2.2. Because the TTR is located in an isolated, rural area, traffic volumes on nearby public roadways are low. Daily traffic volumes on U.S. Route 6 are presented in Table 4–11; this roadway is currently operating at level of service B near the TTR.

4.4.4 Socioeconomics

General existing socioeconomic conditions within the ROI of the TTR (Nye County) are presented in Section 4.1.4.

Police Protection. Law enforcement for the TTR is provided by the Nye County Sheriff's Department. Onsite security is provided by Advanced Security, Inc.

Fire Protection. Fire protection services for the TTR are provided by Sandia National Laboratories and the USAF.

Health Care. Currently Sandia National Laboratories provides the TTR with the following emergency operations (fire, rescue, and medical) personnel: 1 registered nurse, 4 emergency medical technicians (intermediate), and 2 emergency medical technicians (basic). If serious care is required, the patient would be either transferred to the town of Tonopah or airlifted to Las Vegas, depending on the medical needs.

4.4.5 Geology and Soils

4.4.5.1 Physiography

The TTR is also located within the southern section of the Great Basin, as described in Section 4.1.5.1. The TTR is located in the lowest sections of Cactus Flat and Stonewall Flat, which are separated by Cactus Range. The TTR is bounded by Stone Cabin Valley to the north, by the Kawich Range to the east and northeast, by Goldfield Hills to the west, and by Stonewall Mountain to the south. Elevations vary dramatically throughout the TTR, from 8,000 feet above sea level at the top peak of the Kawich Range and 8,275 feet above sea level at Stonewall Mountain to 5,400 feet above sea level at the base of Cactus Flat (DOE 1996c). Other features in the area include Gold Flat, which is separated to the south of Cactus Flat by the hills around Gold Mountain.

Within the basins, the topography is flat to gradually sloping. Cactus Flat is a closed basin, so salts and playa deposits form in the deepest sections of the basin. Stonewall Flat is open, so water flows to the west, although playas may form in depressions as well. Because of the high salt concentration in the playa deposits, little vegetation grows in the valleys.

4.4.5.2 Geology

Geologic deposits at the TTR primarily consist of volcanic rocks and alluvium. Alluvial fans composed of eroded volcanic bedrock and ash from the surrounding mountain ranges fill the flats with unconsolidated deposits. Although the total depth of the alluvial deposits is unknown, exploratory wells have determined that basin sediment thickness is at least 1,000 feet (DOE 1996c).

The mountain ranges are primarily composed of Tertiary volcanic rocks, in a sequence of welded and nonwelded ash-flow tuffs and associated basalts, andesites, dacites, and rhyolites. The southern edge of the TTR comprises the Southwestern Volcanic field described in Section 4.1.5.2. The Cactus Range is an exception to the basic volcanic sequences, as it is a fault block bounded by a sequence of elliptical rings, suggesting that it is the center of a major collapsed volcanic cauldron. Basalt dikes and sills have infiltrated the fractures, which cut through Paleozoic sedimentary rocks, granite intrusions, and other Tertiary rocks. The rocks associated with the eruption sequence are approximately 6 million years old. A sequence of small hills to the south and southeast of the range are made up of lavas and tuff valleys and capped by weathered breccias (DOE 1996c).

4.4.5.2.1 Structural History

The Walker Lane shear zone transects the TTR from the northwest to southeast and eventually connects to the Las Vegas Valley shear zone to the southeast (DOE 1996c). The shear zone is a series of transcurrent faults that connect volcanic centers, such as the Cactus Range and Stonewall Mountain.

The main fault sequences at the TTR include the Cactus Flat, Stonewall Mountain, and Gold Flat Faults and a few unnamed Cactus Faults located between Cactus Flat and Gold Flat. The Cactus Flat Fault strikes mostly north, with west-facing scarps. The fault is estimated to have moved within the last 130,000 years (Anderson 1998d). In addition, there are several scattered and unnamed faults in the western section of Cactus Flat (Anderson 1998e).

The Stonewall Mountain Fault forms the structural border between Stonewall Flat and Stonewall Mountain. These faults appear to connect to a fault block sequence and also may have moved within the Late Quaternary period (Anderson 1998f).

4.4.5.2.2 Faulting and Seismic Activity

The TTR is included within the seismic activity review found in Section 4.1.5.2.3, which identified at least 11,988 seismic events within 120 miles of the NNSS. Most of the earthquakes immediately around the TTR have been in the magnitude 2.0 to 3.0 range. Two earthquakes had magnitudes of 4.2 and 4.5. The closest earthquake with a magnitude over 5.0 was the 1992 earthquake near Little Skull Mountain, which is described in Section 4.1.5.2.3. Seismic design requirements are discussed in Section 4.1.5.2.3.

4.4.5.2.3 Geotechnical Hazards

The geologic hazards at the TTR are very similar to those outlined in Section 4.1.5.2.4, specifically surface instability. The geotechnical hazards do not generate extreme constraints on construction in the TTR. In addition, the high concentration of salts in the soils may affect concrete, as discussed in Section 4.3.5.2.3.

4.4.5.2.4 Geologic Resources

Economic geologic resources in and around the TTR include metallic ore and aggregate. Several historic mining districts are located at the TTR, including Silver Bow, Antelope Springs, Cactus Springs, Wilsons, and Mellan (SAIC/DRI 1991). The TTR is also adjacent to a number of other mining districts, most notably the Goldfield Gold Crater, Stonewall, Gold Reed, and Jamestown districts (SAIC/DRI 1991). The Silver Bow district has produced appreciable quantities of silver and gold, while the Antelope Springs district has produced silver and minor amounts of gold. Cactus Springs produced small quantities of silver, although turquoise, gold, and copper are also mined in the area. The Wilsons district produced small quantities of gold and silver in the early 1900s. Minor production of gold and silver came from the Mellan district. Of the mining districts, only the Silver Bow mine is classified as having high potential for economic mineral ores (DOE 1996a).

There is low potential for oil, gas reserves, or other petroleum products at the TTR or adjacent areas on the Nevada Test and Training Range (SAIC/DRI 1991). No geothermal resources have been identified at the TTR (SAIC/DRI 1991). Aggregate used for construction is present at the TTR in the form of sand

and gravels; however, it can be mined from multiple alluvial fans throughout the Basin and Range area; therefore, the resources at the TTR are not considered unique (SAIC/DRI 1991).

4.4.5.3 Soils

Soils at the TTR form in the alluvial fans, ephemeral washes, valley floors, and dry lake beds. The parent material of the soils is the igneous tuff and sedimentary rocks eroded from the surrounding ranges. A major feature of the soils is a silica-cemented duripan, precipitated from the silica-rich igneous parent materials (DOE 1996c).

In 1977, a high-level soil survey was performed at the TTR. Soils were mapped to the soil series throughout the area. Three main soil orders were found at the TTR: (1) mollisols, (2) aridisols, and (3) entisols (DOE 1996c). Mollisols are found in semiarid environments and have well-developed organic horizons. Aridisols are more typical in arid environments, and have little organic matter. Entisols are younger soils that have little or no development in soil horizons. The soils at the TTR would be categorized into three main categories based on their physiographic position in the local topography: (1) playas in valley bottoms and dry lake beds; (2) alluvial fans, the upper alluvial fans; and (3) mountains and hills. **Table 4–70** presents the soil families that were identified at the TTR during the 1977 soil inventory.

Table 4–70 Soil Families Identified in the Tonopah Test Range

Soil Families	*Example Soil Series*	*Physiographic Position*	*General Description of Soils in Physiographic Position*
Typic Salorhids	Saltair	Valley bottom and dry lake beds	Very deep, poorly drained fine-grained soils with concentrated salts and alkali deposits. Shallow groundwater table. Shrink-swell properties from high percentage of clays. Cement corrosion potential from salt concentration.
Typic Haplaquolls	Hutton	Valley bottom and dry lake beds	
Typic Torriorthents	Fang and Cliffdown	Alluvial fan	Deep to very deep, well-drained, sand to sandy loam/loam and gravelly soils on 2 to 4 percent slopes up to 8 to 15 percent slopes. Soils with higher concentrations of gravel are located in ephemeral washes.
Typic Camborthids	Alcorn and Dun Glen	Alluvial fan	
Calciorthids	Puddle	Alluvial fan	
Xerollic Durothids	Ursine	Upper erosional alluvial fan	Very shallow to moderately deep, moderately to well-drained, very coarse to sandy loam/loam and gravelly soils. Some soils may contain an old, rich concentrated clay horizon. Duripan present below the surface. Slopes range from 4 to 8 percent to 15 to 30 percent.
Xerollic Durargids	Ratto, Olson, Indian Creek, and Deer Lodge	Upper erosional alluvial fan	

Source: DOE 1996c.

The upland mountains and hill primarily consist of exposed rock outcrops, cobble or pebble pavement, or steep slopes with thin layers of alluvial deposits. These soils are typically very thin, young, and have little to no horizon definition.

4.4.5.4 Radiological Sources as a Result of Testing

4.4.5.4.1 Soils

Soils have been contaminated by radioactivity from testing at the TTR. Safety tests were performed at the NNSS and the TTR from 1954 to 1963. Section 4.1.5.4 describes the safety tests and the resulting contamination of the soils. Three safety tests were conducted on the TTR as part of the Clean Slate experiments under Project Roller Coaster. The Clean Slate 1, 2, and 3 experiments used open detonation on a concrete pad and detonation in igloo-like structures with varying amounts of earth cover to simulate accidents in open storage and weapon magazines (DOE 1996c). Depleted uranium and plutonium were used as tracers for the tests. Each test location has a concentrated center where the test occurred and a tail of decreasing contamination to the southeast of each test site. As a result of these tests, approximately 670 acres were contaminated, with an estimated plutonium contamination of 65 curies (DOE 1996c). An initial cleanup of each Clean Slate site was conducted shortly after each test (DOE 2009a). Test-related debris was buried at the test ground zero. Each location where radioactive contamination has exceeded 1,000 micrograms per square meter of plutonium has been fenced off and posted as radioactively contaminated. Although the Clean Slate 1 site is still fenced and posted, contamination above about 400 picocuries per gram of soil or higher was remediated. Further remediation at the Clean Slate sites is pending. Figure 4–13 depicts the areas of the Clean Slate sites that are fenced and posted. Further studies of the ground contamination were performed to determine the extent of the wind-carried contamination (DOE 2009a). Further remediation of the contaminated soil will be completed under the Soils Project. Section 4.1.5.4.1 describes the Soils Project in more detail.

Soils have been routinely tested for pollutants deposited from air or contaminants transported and deposited from moving water. Nonradiological sampling of the soils is periodically conducted at the TTR. In 2010, soil samples were collected from 26 offsite, 10 perimeter, and 13 onsite locations. The soil samples were compared to the Target Analyte List metals with no anomalies identified (DOE 2011b).

4.4.6 Hydrology

4.4.6.1 Surface Hydrology

Five hydrographic basins are within the boundaries of the TTR, including most of Cactus Flat and parts of Stone Cabin Valley, Ralston Valley, Stonewall Flat, and Gold Flat (see **Figure 4–46**). In terms of land area, Cactus Flat is the most extensive hydrographic basin within the TTR. These basins are typically internally drained—runoff collects in playas at the low points of valleys (USAF 1999).

Surface-Water Features. No perennial streams exist on the TTR. There are numerous washes that drain upland areas that occasionally convey ephemeral flow. The ephemeral flows pond in playa areas, which collect and dissipate runoff from these basins. Water typically only exists in the playas for periods of hours following summer storms and weeks following winter storms. Little water is recharged to the groundwater system due to a high rate of evaporation (USAF 1999).

There are three small springs within the TTR's boundaries: (1) Cactus Springs, (2) Antelope Springs, and (3) Silverbow Springs. Water from these springs does not travel more than several tens of yards before it dissipates through evaporation and infiltration (DOE 2009a).

Surface-Water Characteristics. No site-specific water quality data are available for surface waters on the TTR. In general, water quality of the ephemeral waters is poor because of naturally high sediment loads and dissolved solids. The water quality of springs and seeps is primarily controlled by the physical and chemical characteristics of the rocks through which the groundwater flows prior to discharge to the surface. Once the water reaches the surface, other environmental factors affect water quality, such as precipitation, evapotranspiration, erosion, and chemical characteristics of the underlying rock or soil (USAF 1999).

In July 2007, 71 wild horses died at the TTR. The horses were from a herd that frequently drank from a manmade depression on a dry lake bed controlled by DOE/NNSA through Sandia National Laboratories. Initial sampling and necropsy results indicated that high nitrate levels may have caused the deaths. Subsequently, the Desert Research Institute was commissioned by BLM, the USAF, and DOE/NNSA to sample water and soil on the TTR to determine the source of the nitrates that may have caused the deaths. This sampling was conducted in February of 2008. The conclusion of the report reinforced the original theory, specifying that the nitrate most likely came from natural sources concentrated by evaporation of the water within the depression during the heat of the summer (DOE/NV 2008a). In July of 2008, BLM gathered the horses within range of the TTR. During 2008 and 2009, DOE/NNSA drained the manmade depression and filled it with clean soils (SNL 2010b).

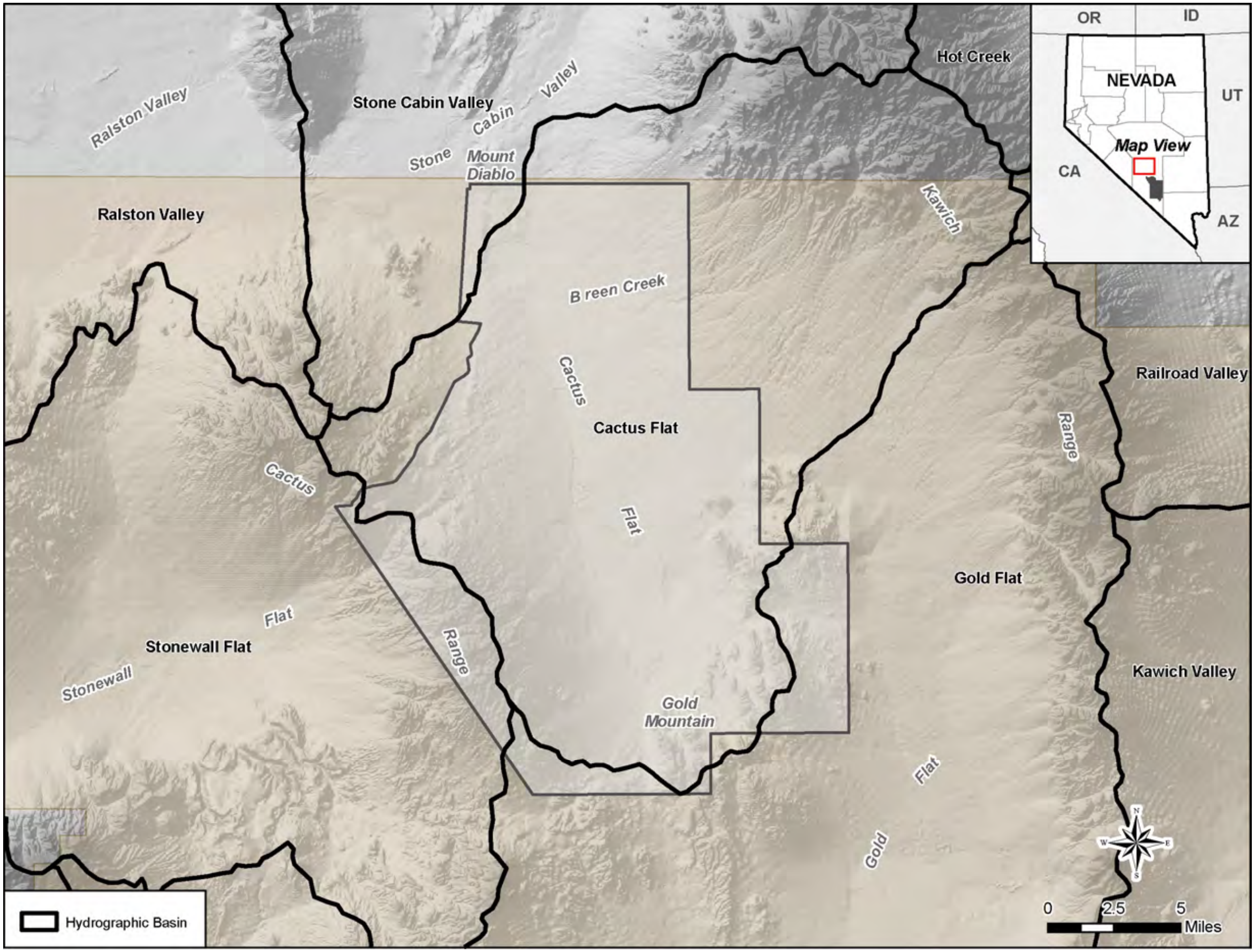


Figure 4–46 Hydrographic Basins on the Tonopah Test Range

Flood Hazards. The USAF has identified and mapped floodplain areas throughout the TTR, thus resulting in the delineation of potential 100-year flood event locations associated with playas, alluvial fans, and valley collectors (i.e., valleys that have relatively large drainage areas or several smaller tributaries that discharge to the main collector). On the TTR, floodplains are associated with two playas near the middle portion of the range (Main Lake and Antelope Lake) and a valley connector running north to south between the two playas, which roughly parallels the main access road on its eastern side. In addition, there are three valley connector floodplains and one alluvial fan floodplain that drain to the Main Lake and Antelope Lake playa system from the east and the south (USAF 1999).

Water Discharges and Regulatory Compliance. Wastewater discharges from TTR activities conducted at facilities in the main compound of Area 3 are conveyed to the USAF facultative sewage lagoon for treatment. The USAF holds an NPDES permit for the facultative sewage lagoon (Permit Number NEV20001) (DOE 2009a). Combined sanitary and pretreated industrial wastewater flows into two lined aerated ponds with treatment by biological processes. This is a zero-discharge treatment facility, by which water is lost through evaporation. For the period from June 2007 through June 2008, effluent water quality was within permitted limits and averaged 33 ppm carbonaceous biochemical oxygen demand, 49 ppm total suspended solids, and 0.4 ppm total petroleum hydrocarbon, and one metal was detected (barium at 0.019 ppm) (Kaminski 2008). All analytical results for wastewater sampled at Area 3 were within regulatory limits from 2008 through 2010 (DOE 2009a; SNL 2010b, 2011). No NPDES stormwater permitting is required at the TTR due to the lack of significant stormwater runoff discharging into waters of the United States (DOE 2009a).

4.4.6.2 Groundwater

Hydrogeologic Setting. The TTR lies between two Great Basin mountain ranges, the Cactus Range to the west and the Kawich Range to the east. The valley is typical of the high desert of the Basin and Range Physiographic Province. The north–south axis of the valley, known as Cactus Flat, consists of a string of playas at an elevation of approximately 5,300 feet above mean sea level. Cactus Flat is a closed basin; surface runoff following precipitation flows toward the playas, with no discharge off of the TTR (SNL 1992). Stonewall Flat is bounded on the south by Stonewall Mountain and on the west by Goldfield Hills. On the valley floors of both Cactus and Stonewall Flat, the dominant features are a number of small playas and the many washes that drain the upland areas (see Section 4.4.6.1 for more information) (DOE 2006d).

The TTR encompasses portions of five hydrographic basins (Cactus Flat, Gold Flat, Stonewall Flat, Ralston Valley, and Stone Cabin Valley) that make up portions of two regional groundwater systems. Past DOE operations have been concentrated in two areas: Stonewall Flat and the lowland portions of Cactus Flat (DOE 2008l).

Groundwater that originates as precipitation over the Kawich Range flows west and then southwest under the TTR, ultimately discharging in Death Valley through springs and evapotranspiration. Some groundwater may flow northwest off the TTR and into the Southern Marshes flow system, with discharge at Mud Lake, Alkali Flat, and Clayton Valley. The generalized directions of regional groundwater flow are shown in **Figure 4–47**. Groundwater in Cactus Flat is derived from precipitation over the upland areas, and there is no subsurface recharge from neighboring basins. The total recharge has been estimated at only 600 acre-feet per year. Depth to groundwater ranges from 90 to 450 feet below the land surface. Groundwater under Stonewall Flat is derived from recharge over the upland areas and is estimated at 100 acre-feet per year. Depth to groundwater ranges from 100 to 275 feet below the land surface (DOE 1996c).

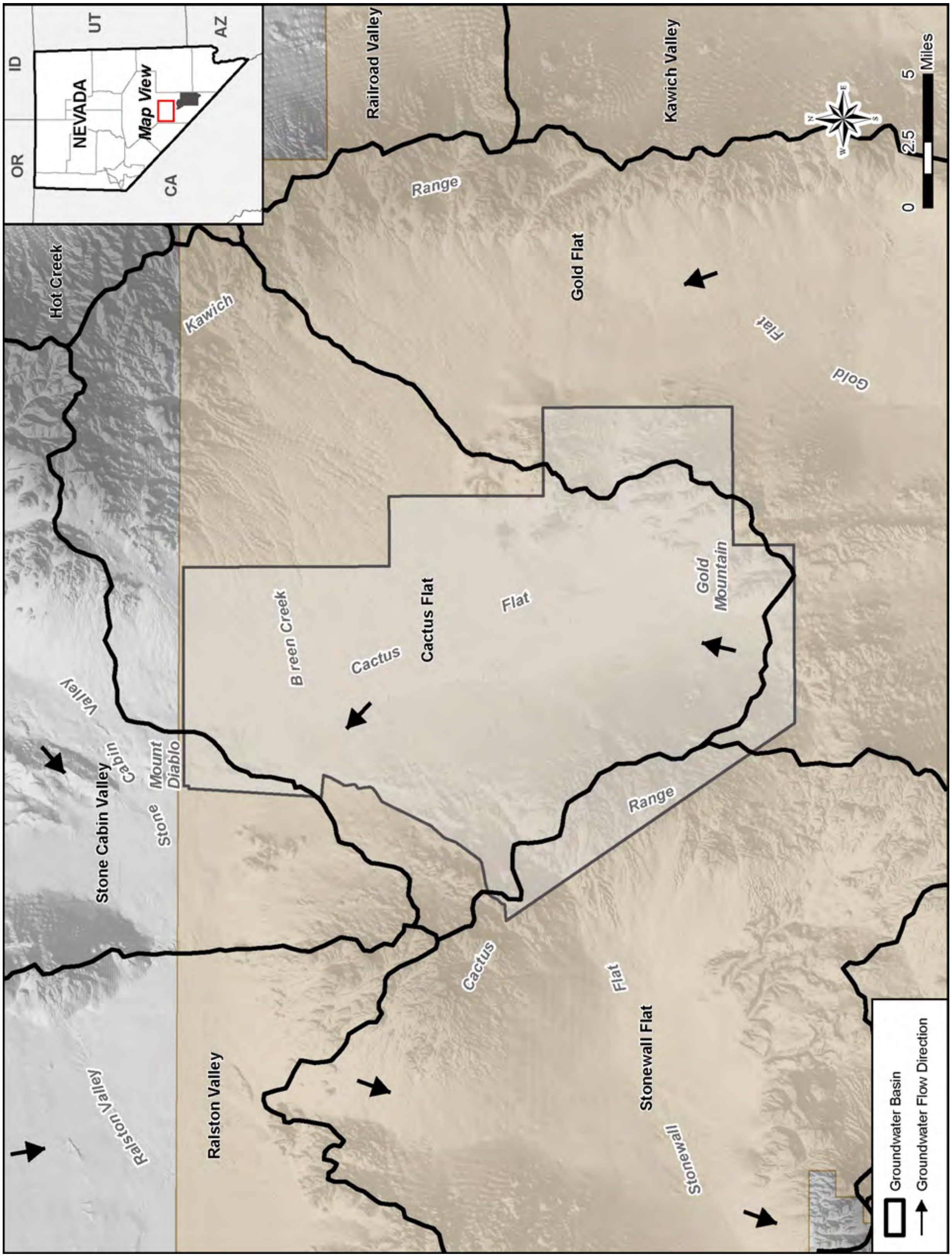


Figure 4–47 Groundwater Basins and Flow at the Tonopah Test Range

Groundwater Supply. Groundwater at the TTR has been used for domestic, industrial, and construction purposes. Groundwater is pumped from a number of wells, depending on the location of range activities and the total demand for water. The following three active wells are used at the TTR: (1) Production Well 6, (2) Production Well 7, and (3) the Roller Coaster Well.

Production Well 6 supplies drinking water and fire water distribution systems at the TTR Main Compound in Area 3 and is the only well that has been sampled for contaminants. It pumps water to an elevated water tank in Area 3 that holds 200,000 gallons (Lacy 2011). In June 2008, a new carbon dioxide (pH) adjusting treatment system for arsenic removal became operational in Area 3 of the TTR (Lacy 2011). Outlying areas and buildings without water service use bottled water. Production Well 7 and Roller Coaster Well are used only for nonpotable purposes (construction and dust suppression), and there is no regulatory sampling requirement. The water use (for the entire TTR, including the USAF) for operations is approximately 6 million gallons per year (DOE 2008l). The static water level at Well 6 is approximately 350 feet (SNL 2010b).

The water conservation plan for the TTR complies with State Water Resources Division regulations requiring a water conservation plan for permitted water systems and major water users in Nevada. An updated Water Conservation Plan for the TTR (SNL 2011) was approved by the Nevada Division of Water Resources in January 2011 and can be found at http://water.nv.gov/programs/planning/plans.cfm.

There are about 15,000 acre-feet per year of water rights in the five hydrographic basins associated with the TTR. Approximately 10,300 acre-feet per year of this total are surface-water rights (see Section 4.4.6.1); the remainder (almost 4,700 acre-feet) represents groundwater rights. Currently, defense-related water appropriations total 1,775 acre-feet per year, 148 acre-feet of which are surface-water rights. **Table 4–71** lists the water yield and resources for each of the basins that encompass portions of the TTR.

Water appropriations are limited to two basins: (1) Cactus Flat and (2) Stone Cabin Valley, and total 200 acre-feet (65,170,200 gallons) per year. Both basins are over-appropriated (i.e., the appropriations exceed the perennial yield in each basin). It is unlikely that additional water rights can be obtained in the area without groundwater mining (the removal of groundwater from storage) (DOE 2008l).

Table 4–71 Water Rights Status for Hydrographic Basins at the Tonopah Test Range

Hydrographic Basin	*Hydrographic Basin Number*	*Perennial Yield (acre-feet per year)*	*Total Committed Groundwater Resources (acre-feet per year)*	*TTR water rights/use (acre-feet per year)*
Cactus Flat	148	300	619	Estimated TTR water rights 160
Gold Flat	147	1,900	95	Estimated TTR water rights 40
Stonewall Flat	145	100	12	No TTR water rights
Ralston Valley	141	6,000	1,917	No TTR water rights
Stone Cabin Valley	149	2,000	2,033	Estimated TTR water rights 240

TTR = Tonopah Test Range.
Source: DOE 2008l; NDWR 2010c.

Groundwater Monitoring and Quality. The lithology of the rocks controls the water chemistry observed in the wells. Potential sources of groundwater contamination existing on the TTR include French drains, septic tanks and leach fields, underground storage tanks, landfills, and sewage lagoons (DOE 2008l). The quality of water at the TTR is generally good and is suitable for domestic purposes, livestock, and wildlife use (DOE 1996c). The nuclear safety tests conducted at the Clean Slate sites on the TTR have resulted in surface soil contamination; however, groundwater contamination has not been detected at the TTR (see Section 4.4.5.4.1 for soil contamination). Infiltration is limited by the depth to groundwater (90 to 150 feet), low rainfall, and high evaporation rate. The small quantities of liquid water that may have been disposed or released will, therefore, attenuate in the soil and are unlikely to affect groundwater. Soil was sampled for explosive residues from unexploded ordnance remedial activities; however, no reference can be found for groundwater sampling for perchlorate (DOE 2008l).

Water analyses are conducted at various times at several locations throughout the TTR to characterize water quality. None of the constituents that have been analyzed have exceeded the recommended health standards set by the Nevada Division of Health, with the exception of pH. Although the pH values slightly exceeded the standard, the waters do not pose health problems. The Roller Coaster Well is classified as a sodium-bicarbonate-chloride-type water, while the remaining wells are classified as sodium-bicarbonate-type waters (DOE and U.S. Air Force 1988).

4.4.7 Biological Resources

The following description of vegetation was taken from EG&G Energy Measurements (1995), unless otherwise stated. The scientific names of plants and animals mentioned in this section are given in Section 4.1.7.

The TTR is within the Great Basin Desert. The lowest elevation on the TTR is approximately 5,250 feet; the highest elevation is approximately 7,550 feet.

The DOE/NNSA Sandia Site Office has an Ecology Program that serves to conserve flora and fauna at the TTR (NNSA/SSO 2010). The primary objectives of the Ecology Program include:

- Collect ecological resource inventory data to support site activities, while preserving ecological resources, and maintaining regulatory compliance
- Collect information on plant and animal species present to further the understanding of ecological resources on site
- Collect biota contaminant data on an as-needed basis in support of site projects and regulatory compliance
- Assist Sandia organizations in complying with regulations and laws
- Provide information to employees regarding ecological resource conservation
- Support Sandia organizations with biological surveys in support of site activities

Enhancement measures that have been utilized in the past include installing artificial nest platforms, boxes, and perches.

In 2010, an Avian Protection Plan was adopted and implemented at the TTR (Lacy 2011). The Avian Protection Plan was developed to describe procedures that would be taken by DOE/NNSA at the TTR to address potential impacts of its associated transmission and distribution lines on avian species that are known to occur in the area (NNSA/SSO 2010).

4.4.7.1 Flora

There are four general vegetation types on the TTR: dwarf shrubland, shrubland, woodland, and bare or disturbed areas (see **Figure 4–48**). The dominant flora of the valley bottoms on the TTR include shadscale, budsage, winterfat, and galleta grass (*Pleuraphis* Torr.). Less-common plant species are horsebrush, greasewood, desert globemallow (*Sphaeralcea ambigua*), and desert prince's plume (*Stanleya pinnata*). Big sagebrush occurs in wash bottoms and near the playa on the southwestern corner of the site. On the bajadas above the valley floor, Nevada jointfir, green rabbitbrush, shadscale, budsage, winterfat, and Indian ricegrass are dominant. At higher elevations, greasewood, wolfberry, hopsage, and desert prince's plume are common. Pinyon-juniper woodlands occur at the highest elevations.

4.4.7.2 Fauna

Animal species on the TTR include all species found in the Great Basin Desert on the NNSS. Some of the most common animal species include side-blotched lizards, desert-horned lizards, horned larks, chisel-toothed kangaroo rats, little pocket mice, and wild horses (Bradley and Moor 1975). State-designated game animals that occur on the TTR include mule deer, bighorn sheep, pronghorn, mountain lions, desert and Nuttall's cottontails, chukar, and mourning dove. The gray fox and bobcat are species known to occur at the TTR that are listed by the state as furbearers (SNL 2010a).

Bird species typically found in the valley floor of the TTR are those associated with the sagebrush community and include sage thrasher (*Oreoscoptes montanus*), sage sparrow (*Amphispiza belli*), horned lark, and common raven. Less-frequently observed species include the green-tailed towhee (*Pipilo chlorurus*), western meadowlark (*Sturnella neglecta*), mourning dove, greater roadrunner (*Geococcyx californianus*), and common nighthawk (*Chordeiles minor*) (NNSA/SSO 2010).

Bird species diversity increases with elevation at the TTR, to include birds such as loggerhead shrike, mourning dove, black-throated sparrow, and juniper titmouse (*Baeolophus ridgwayi*). Scott's orioles (*Icterus spurius*), western kingbirds, and ash-throated flycatchers (*Myiarchus cinerascens*) are occasionally observed nesting in the Joshua trees. In the rocky slopes of the steep terrain, chukars (introduced into the area) and rock wrens (*Salpinctes obsoletus*) are sometimes encountered (NNSA/SSO 2010).

Raptor species are present throughout the TTR and include red-tailed hawk, golden eagle, prairie falcon, American kestrel, common barn owl, great horned owl, Swainson's hawks, and ferruginous hawks (*Buteo regalis*). Known nesting raptors include red-tailed hawk, golden eagle, and great horned owl (NNSA/SSO 2010).

The Nevada Wild Horse Range and other wild horse land use areas constitute a significant portion of the Nevada Test and Training Range, including the TTR, with herds common in Cactus and Gold Flats, Kawich Valley, Goldfield Hills, and the Stonewall Mountains (SNL 2010a). The Nevada Wild Horse Range is managed by BLM, but wild horse and burro management does not affect national security activities at the TTR to a great extent, as the USAF mission still has precedence over BLM management (USAF 2007e). The draft *Integrated Resource Management Plan for Nellis Air Force Base and the Nevada Test and Training Range* (USAF 2007e) recommended that BLM continue annual censuses of the wild horse population and conduct wild horse gathers as necessary to maintain the current appropriate management level for the Nevada Wild Horse Range of 300 to 500 horses. Hundreds of wild horses graze freely throughout the TTR, and activities on site have had little effect on the horse population or their grazing habits. BLM routinely rounds up a portion of the herds for auction through the Wild Horse and Burro Adoption Program (SNL 2010a).

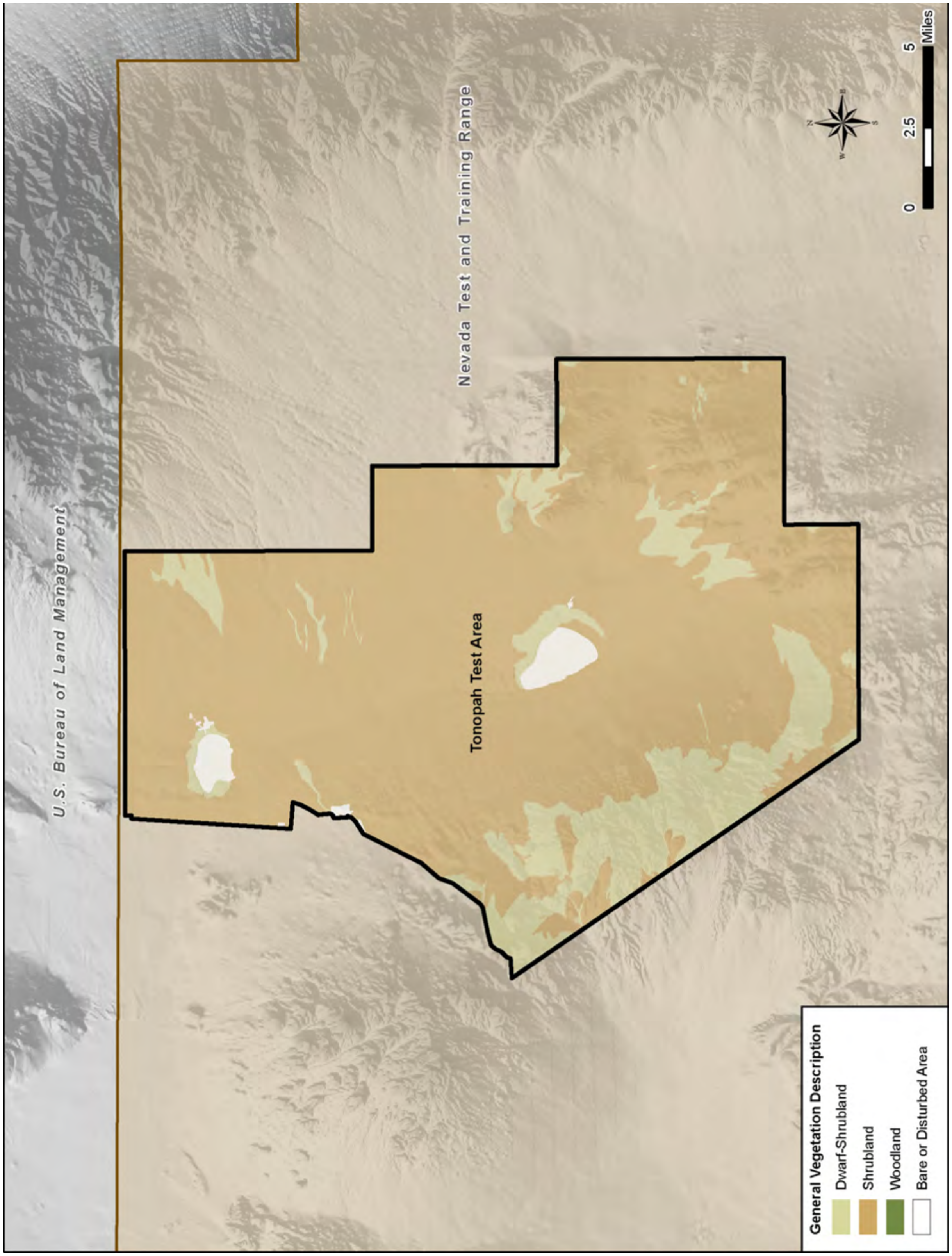


Figure 4–48 Vegetation Types on the Tonopah Test Range

Wild horses have altered the TTR and Nevada Test and Training Range vegetation composition and production where they graze, and compete with native species, such as mule deer, pronghorn, and bighorn sheep, for water and vegetation. An extreme example of the potential negative impacts of wild horse grazing may be seen in the Kawich Valley. Where wild horses are present in this area, the Great Basin scrub vegetation has been uniformly cropped over many acres to less than 8 inches high. It is clear that the closely cropped plants in the Kawich Valley do not represent the condition of the vegetation before the horses were introduced (USAF 2007c). On the TTR, the Clean Slate 1, 2, and 3 environmental remediation sites have been fenced for other purposes, but the fences also serve to prevent grazing by wild horses. These excluded areas have regrown with abundant native vegetation, which is not affected by wild horse grazing (USAF 2007c).

4.4.7.3 Threatened and Endangered Species

No current federally listed threatened, endangered, or candidate plant or animal species are known to occur on the TTR.

4.4.7.4 Other Species of Concern

The western burrowing owl, a state-protected bird, is known to occur on this site. No other species of concern are known to inhabit the TTR.

4.4.7.5 Effects of Past Radiological Tests and Project Activities

Vegetation samples were collected on the TTR in 1973 and again in 1990 and 1991 (EG&G/EM 1993). These studies found that plutonium levels in samples of vegetation ranged from 4.0×10^{-5} to 3.9×10^{-2} nanocuries per gram of dry vegetation, and the plutonium levels had not changed substantially over the past 25 years. Many studies in arid and semiarid environments (Francis 1973; Hakonson 1975; Hanson 1975; Price 1973; Romney and Wallace 1977) have shown that most of the plutonium remains in the soil and is not readily transported. Very little of the contamination is incorporated into the biological components of the ecosystem in similar arid areas (Hakonson and Nyhan 1980). Plutonium contamination of vegetation at the TTR and the NNSS is concentrated mainly on the surface of vegetation and is generally not taken up by the roots and concentrated internally. Small mammals were collected from the TTR for plutonium contamination analyses from 1974 through 1975 (Bradley and Moor 1975) and from other contaminated areas on the NNSS and off site (Gilbert et al. 1988). From these studies, the following general conclusions can be made: very low levels of contamination (from undetectable levels to a few hundred femtocuries [10^{-15} curies] per gram) were found in animals; desert rodents (which represent the primary consumer trophic level) have very low plutonium levels; most of the radioactivity in rodents is associated with the pelt and gastrointestinal tract and not internal organs or carcasses; and the plutonium contamination does not appear to bioaccumulate in the food chain.

4.4.8 Air Quality and Climate

4.4.8.1 Meteorology

As with the NNSS, the TTR is located in the southwestern corner of the Great Basin and in the rain shadow (lee) of the southern Sierra Nevada mountain range. The TTR has the general climatic characteristics of a mid-latitude desert area, with relatively little precipitation and low humidity, large diurnal and seasonal temperature ranges, and intense solar radiation in the summer. The generally dry desert conditions specific to the TTR are occasionally modified by the southwestern monsoon and convective thunderstorms during the summer months and Eastern Pacific tropical storm remnants in the late summer and fall. The dry conditions can be further modified from time to time during strong *El Niño* cycles, which generally bring more rainfall to the area.

Significant climate differences within the TTR stem largely from differences in elevation. The TTR is generally characterized by a broad, flat valley bordered by two north–south mountain ranges: the Cactus Range to the west and the Kawich Range to the east. Elevations range from 5,347 feet above mean sea level in the valley floor to about 7,484 feet above mean sea level at Cactus Peak (DOE 2009a). Wind flows are strongly affected by the surrounding topographical influences. Temperatures are coolest at the higher elevations and warmest in the valley floor. Precipitation is generally sparse, with about 4 inches of annual average rainfall in the valley floors, though as much as about 12 inches of frozen and liquid precipitation can occur on mountain ridges (SORD 2002).

At the Tonopah Test Range Airport in the north-central portion of the TTR (at an elevation of about 5,548 feet above mean sea level), a long-term meteorological station operates. The average daily maximum temperature typically ranges from about 85 to 90 °F in the summer and from about 40 to 50 °F in the winter; likewise, average minimum temperatures tend to be about 50 to 60 °F in the summer and about 15 to 25 °F in the winter (SORD 2002). The annual average temperature is 52 °F. The Desert Research Institute began operating a meteorological station in July 2008 at the northern edge of the Clean Slate 3 site.

Precipitation falls most often during the spring period (due to passing East Pacific storms) and during the mid- to late-summer period (due to convective thunderstorms, monsoons, and occasional tropical storms). Nevada on the whole has been in a long-term drought for most of the last 100 years, with precipitation amounts below normal. However, much of the 1980s and 1990s were wetter than normal (DOE 2008j). For more information regarding precipitation patterns at the TTR, please see Appendix D, Section D.1.4.1.

Wind conditions are perhaps the most complex of the meteorological conditions on the TTR. The surface winds show strong diurnal variations with distinct drainage in the valley and mountain slopes. The Cactus Range is to the west of the Tonopah Test Range Airport and is closer to the airport than the Kawich Range; as the Cactus Range is oriented north-northwest to south-southeast, these nighttime drainage winds tend to be from the northwest at the airport (DOE 2009a). Localized terrain gradients that are not north to south modify this nighttime wind flow, as do occasional low overcast conditions or conditions with extensive nighttime vertical mixing. **Figure 4–49** shows wind direction and speed data for the TTR. For more information regarding the wind patterns at the TTR, please see Appendix D, Section D.1.4.1.

4.4.8.2 Ambient Air Quality

4.4.8.2.1 Region of Influence

The TTR is located about 15 to 40 miles northwest of the NNSS. The ROI for air quality and climate for TTR operations comprises north-central Nye County, with prevailing downwind impacts extending into western Lincoln County. Historic data on pollutant emissions inventories and the compliance status for the State of Nevada are calculated at the county level; these data provide a basis for determining both existing air quality in the ROI and a metric for emission comparison assessments.

4.4.8.2.2 Existing Air Quality

Ambient Air Quality Standards. See Section 4.1.8.2.2 for a discussion on the national and Nevada ambient air quality standards. The TTR is within the Nevada Intrastate Air Quality Region 147. All of the TTR is within Nye County, for which there are insufficient data to determine attainment status, so the TTR is designated as an unclassified area. However, EPA treats unclassified areas as if they are in attainment for regulatory purposes. See Section 4.1.8.2.2 for more information on nearby NAAQS nonattainment areas. No ambient air quality data have been measured on the TTR; however, the ambient air quality characteristics are anticipated to be better than or similar to those of the NNSS, given the lower vehicle and stationary source activity levels.

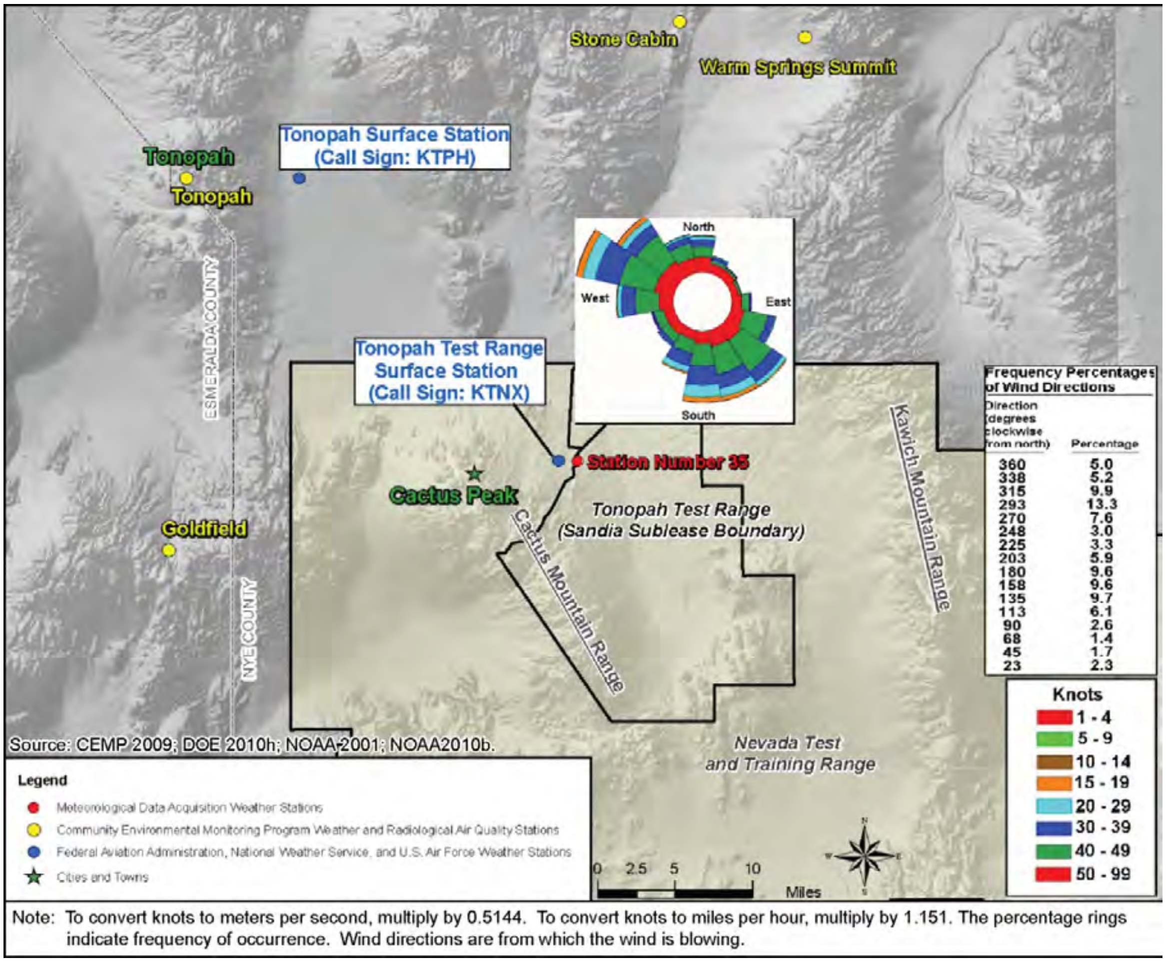


Figure 4–49 Wind Rose for Tonopah Test Range Airport Surface Station, 2004–2008

Emissions Due to TTR Operations. Title V of CAA gives states the authority to use air quality permits to regulate stationary source emissions of criteria pollutants. At the TTR, there is one Class II Air Quality Operating Permit. Class II permits are issued for "minor" sources and limit annual emissions in one of the following ways: (1) annual emissions of any one criteria pollutant must not exceed 100 tons; (2) annual emissions of any one hazardous air pollutant must not exceed 10 tons (including lead); or (3) annual emissions of any combination of hazardous air pollutants must not exceed 25 tons (including lead). The emissions limits associated with the TTR's Class II Air Quality Operating Permit are occasionally re-evaluated and reissued—most recently in 2009. The TTR facilities regulated by this permit include screening plants and maintenance shops (including those for painting, welding, and carpentry).

From 2001 through 2008, the TTR reported total annual emissions of less than 1 ton from permitted facilities (DOE 2002a, 2003a, 2004a, 2005a, 2009a; SNL 2007). In 2008, the TTR reported a total of only 0.21 tons of criteria and hazardous air pollutants. As of 2007, when operating at maximum permitted capacity, stationary sources on the TTR are allowed to emit as much as about 21 tons of emissions (comprising 3 tons from permitted facilities and 18 tons from nonpermitted facilities[31]) (NDEP 2007). For more details on how these maximum allowed emissions were determined, see Appendix D, Section D.1.4.2. The Class II permit also requires that the best practical method be used to limit the resuspension of soil dust into the air during construction, repair, demolition, work, or the use of

[31] *A nonpermitted source is a stationary source that, by regulation, does not require an air operating permit. Examples include emergency stationary generators that operate for less than 500 hours per year and propane storage tanks.*

unpaved or untreated areas without applying the measures described in the dust control plan (NDEP 2007).

Table 4–72 shows the onsite emissions due to the stationary sources, as well as emissions due to government-owned vehicles on the TTR, TTR commuters, and commercial vendors servicing the TTR. These emissions are partitioned into Clark County and Nye County (both on the TTR and off the TTR), where appropriate. See Appendix D, Section D.1.4.2, for further detail on the methodology for determining the emissions from commuter and vendor activities.

4.4.8.3 Radiological Air Quality

Radiation monitoring from 1996 through 1997 indicated a concentration of 1.6×10^{-18} microcuries per milliliter of plutonium-238, 9.5×10^{-19} microcuries per milliliter of plutonium-239 and -240, and 4.10×10^{-18} microcuries per milliliter of americium-241. These radiation levels would cause an MEI (either on site or off site) to receive an effective dose equivalent of 0.024 millirem per year (DOE/NV 1997a, 1997b; DOE 2009a). This dose level is approximately 400 times less than the EPA NESHAPs standard of 10 millirem per year (DOE 2009d). These results are indistinguishable from the natural background radiation level on or near the TTR.

Ambient air quality radiation monitoring had not been performed at the TTR since 1997 because operations at the TTR do not involve activities that release radioactive emissions into the air from point sources or from diffuse sources such as outdoor testing. However, the Desert Research Institute began monitoring air quality for radioactive contaminants at the TTR in July 2008 (DOE 2009c) to address concerns about fugitive radioactive emissions from the possible resuspension of americium and plutonium present at the Clean Slate environmental restoration sites. One site is located near the Range of Operations Center and the other at the northwestern end of the Clean Slate 3 site. Since May 2009, neither site has detected any anthropogenic gamma-emitting radionuclides, which would potentially indicate the presence of americium and/or plutonium. Other environmental restoration sites with minor radioactive contamination, such as depleted uranium, do not produce significant air emission sources from resuspension (DOE 2009a).

4.4.8.4 Climate Change

This section describes the affected environment in terms of current and anticipated trends in greenhouse gas emissions and climate. The effects of emissions and the corresponding processes that affect climate involve very complex processes with considerable variability, complicating the measurement and detection of change. Recent advances in the state of the science, however, are contributing to an increasing body of evidence that anthropogenic greenhouse gas emissions affect climate in detectable and quantifiable ways.

For information on greenhouse gas emissions in the United States, please see Section 4.1.8.4.1. Greenhouse gas emissions at the TTR are discussed in the next section. Details on the methodology used to determine these emissions are discussed in Appendix D, Sections D.2.4.1.1, D.2.4.2.1, and D.2.4.3.1.

Table 4–72 Estimated 2008 Air Emissions of Criteria Pollutants and Hazardous Air Pollutants Due to Tonopah Test Range Activities

Pollutant	Annual Air Emissions (tons per year)												
	Stationary Sources	Government-Owned Vehicles	TTR Commuters			Commercial Vendors			Total				
	Nye County	Nye County	Clark County	Nye County		Clark County	Nye County		Clark County	Nye County		Total
	On-TTR	On-TTR		On-TTR	Off-TTR, Off-NNSS		On-TTR	Off-TTR, Off-NNSS		On-TTR	Off-TTR, Off-NNSS	
PM_{10}	<3.7	0.065	0.0087	0.0010	0.037	0.12	0.0066	0.54	0.13	<3.8	0.58	<4.5
$PM_{2.5}$	<3.7	0.050	0.0048	0.00061	0.021	0.11	0.0061	0.5	0.12	<3.8	0.52	<4.4
CO	<2.9	3.6	0.91	0.047	4.1	0.49	0.027	2.2	1.4	<6.6	6.3	<14.3
NO_x	<13.3	0.97	0.22	0.030	1.0	1.1	0.058	4.7	1.3	<14.4	5.7	<21.4
SO_2	<0.91	0.0071	0.0024	0.00028	0.0095	0.002	0.00011	0.0087	0.0044	<0.92	0.018	<0.94
VOCs	<0.96	0.10	0.018	0.0022	0.075	0.16	0.0088	0.72	0.18	<1.1	0.80	<2.0
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	0.0000019	0.00000011	0.0000089	<0.01	<0.03	<0.01	<0.05
Criteria Pollutant Total	*<21.8*	*4.7*	*1.2*	*0.08*	*1.2*	*1.9*	0.10	*8.2*	*3.1*	*<26.7*	*9.4*	*<39.2*
HAPs	<1.1	0.0097	0.0014	0.00019	0.0063	0.021	0.0012	0.095	0.022	<1.1	0.10	<1.2

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

4.4.8.4.1 Greenhouse Gas Emissions

Table 4–73 provides greenhouse gas emissions due to TTR-related activities for 2008. The greenhouse gas emissions are presented in carbon-dioxide-equivalent form and are partitioned by various mobile and stationary source types. These emissions were derived from fuel use, vehicle activity, and power consumption data. The greenhouse gas emissions were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010b). These emissions were compared with a reference amount of 25,000 metric tons (27,558 tons), which is an indicator for when a quantitative assessment may be warranted (CEQ 2010).

Commercial vendors are by far the largest single source of greenhouse gas emissions related to TTR activities, emitting approximately 2,210 carbon-dioxide-equivalent tons of greenhouse gases, or 53 percent of the TTR-related greenhouse gas emissions total. Mobile sources altogether emitted about 3,396 carbon-dioxide-equivalent tons of greenhouse gases, which is 88 percent less than the threshold reporting level. Overall, TTR-related activities created about 4,166 carbon-dioxide-equivalent tons of greenhouse gas emissions in 2008, an amount well below the threshold level.

Table 4–73 Carbon-Dioxide-Equivalent Emissions of Greenhouse Gases Due to Tonopah Test Range Activities in 2008

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 25,000 Metric Tons* [a]
STATIONARY SOURCES		
Power consumption	275	0.01
Natural gas heating	0	0.00
All stationary sources, except air conditioning/refrigeration and natural gas heating	495	0.02
All Stationary Sources	*771*	*0.03*
MOBILE SOURCES		
Onsite government vehicles	454	0.02
Commuting	732	0.03
Commercial vendors	2,210	0.08
All Mobile Sources	*3,396*	*0.12*
Total	***4,166***	***0.15***

[a] 25,000 metric tons are equal to about 27,558 short tons.

4.4.8.4.2 Current Changes in Climate

For a discussion of climate change impacts in the region, please see Section 4.1.8.4.2.

4.4.9 Visual Resources

The TTR is visually similar to areas of the NNSS with higher elevations and is only visible from an access road off U.S. Route 6 (DOE 1996c). The portion of the area visible from U.S. Route 6 is considered to have a Class B scenic quality rating (see Section 4.1.9 for information on the visual impact rating system) due to the lack of visual intrusions and picturesque views of the natural landscape that vary throughout the day and seasonally, combined with the commonality of these views to the region.

4.4.10 Cultural Resources

For introductory information regarding cultural resources, see Section 4.1.10. Unless otherwise noted, the information in this section is derived from the *1996 NTS EIS* (DOE 1996c). Additional information regarding cultural resources on the TTR was obtained from the Desert Research Institute (DOE 2010a), which provides Cultural Resources Program support to the DOE/NNSA NSO and to the USAF. Information sources provided by the Desert Research Institute include short report summaries, lists of recorded sites on the TTR and their NRHP eligibility status, and excerpts from cultural resources studies conducted on the TTR.

The TTR lies within the Southern Great Basin physiographic region and encompasses portions of five hydrographic basins (Cactus Flat, Gold Flat, Stonewall Flat, Ralston Valley, and Stone Cabin Valley) (NDWR 2010a) (see **Figure 4–50**). The TTR area possesses a long history of American Indian occupation and more-recent European-American settlement and American military use. Archaeological research indicates humans have used the area within the TTR for the last 10,000 years. When European-American explorers first entered this area in the mid-nineteenth century, groups of Western Shoshone occupied the region. Historic period activity consisted of mining and ranching; more-recent activity has focused on military use of the TTR area.

The area of influence for the TTR is defined as all ground areas that would experience direct or indirect impacts of construction, maintenance, or operations of program facilities and activities occurring on the TTR. Based on current knowledge of cultural resources within the TTR, all areas have the potential to contain cultural resources. Therefore, the area of influence for this SWEIS includes the entire area within the TTR boundary.

4.4.10.1 Recorded Cultural Resources

Current knowledge about cultural resources on the TTR is largely the result of project-specific cultural resources studies completed for DOE activities. Cultural resources studies that included large portions of the TTR include Bergin et al. 1979 and DuBarton and Johnson 1996. Past DOE operations have been concentrated in two areas: (1) the lowland portions of Cactus Flat and (2) Stonewall Flat (DOE 2008l). As a result, these areas of the TTR have been intensively surveyed for cultural resources (Pippin 2005). One area in particular, along the Breen Creek drainage at the southern end of Cactus Flat, is highly sensitive for prehistoric and historic cultural resources (DuBarton and Johnson 1996). Other areas, however, have undergone little or no cultural resources inventory. Consequently, there is no overarching archaeological cultural resources overview for the TTR (Pippin 2005). Cultural resources sites from all chronological periods and site types have been recorded on the TTR. However, the greatest number of recorded sites consists of prehistoric extractive and processing localities, as well as historic mining and ranching sites. One historic building survey resulted in the development of a comprehensive Cold War era historic context and 59 properties recommended for eligibility for the NRHP as a historic district (Ullrich et al. 2005).

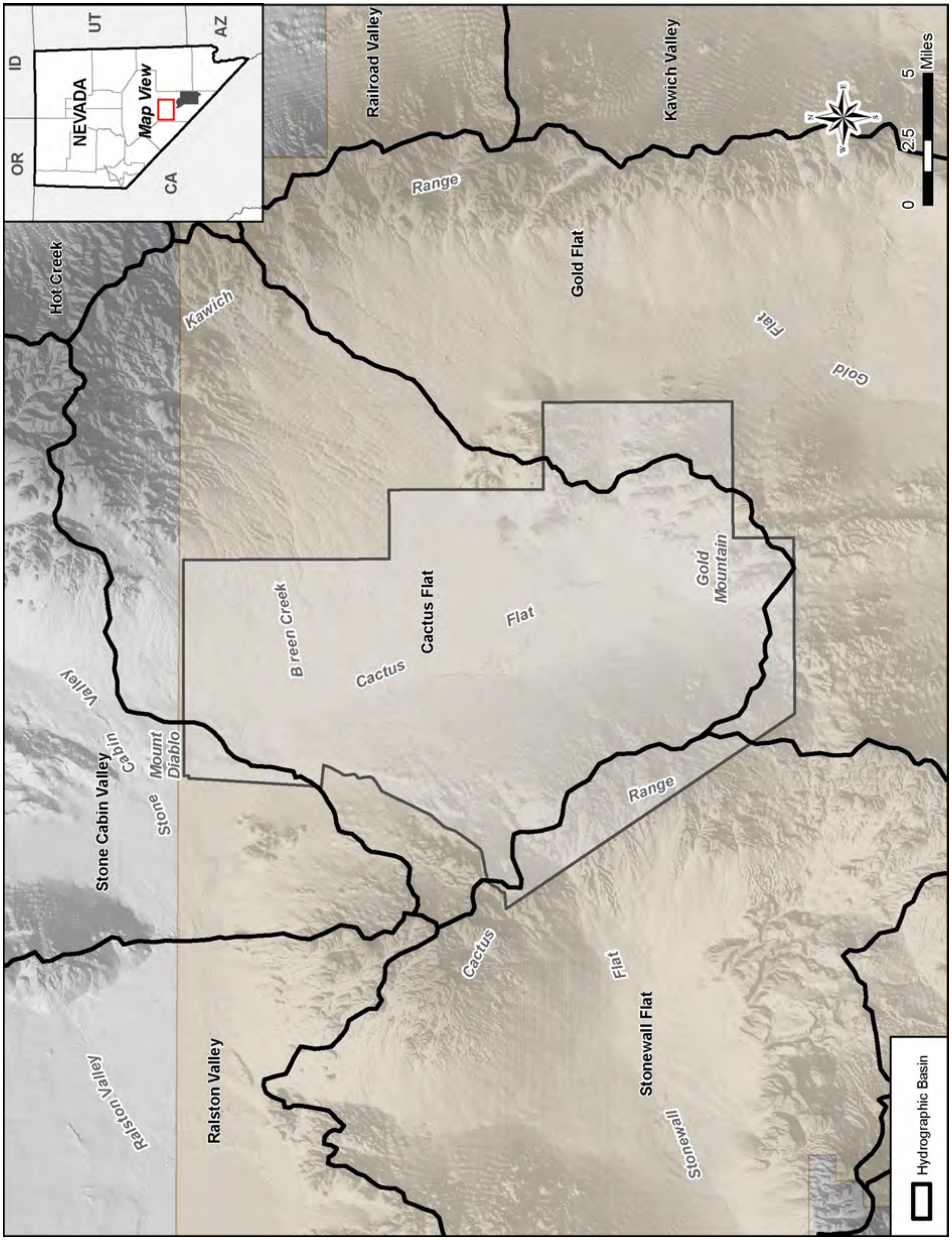


Figure 4–50 Hydrographic Basins Within the Tonopah Test Range Boundary

Less than 4 percent of the TTR has been surveyed for cultural resources. Seventy-one cultural resources studies have been completed on the TTR, and 330 cultural resources sites have been recorded. Prehistoric archaeological sites make up 87 percent, or 288 sites, of recorded sites on the TTR; the remaining 13 percent, or 42 sites, are historic archaeological sites and structures related to mining and ranching, and 1 site associated with military and scientific research (DOE 2010a). Sixty-seven percent, or 222 sites, are eligible for listing in the NRHP. Cultural resources are grouped by the five hydrographic basins located within the TTR (see **Table 4–74**).

Table 4–74 Tonopah Test Range Cultural Resources Sites by Site Type and Hydrographic Basin

Hydrographic Basin	*Prehistoric Site Types*							*Historic Sites*		*Untyped Sites*	*Total Sites*	*NRHP-Eligible*
	RB	*TC*	*EL*	*PL*	*LO*	*CA*	*STA*	*HI*	*NT*	*UT*		
Gold Flat	0	4	0	0	31	0	0	9	0	0	44	40
Stonewall Flat	0	0	0	0	3	0	1	9	0	0	13	13
Ralston Valley	0	2	0	0	36	0	0	2	0	0	40	38
Cactus Flat	0	19	0	3	93	0	0	18	1	0	134	68
Stone Cabin Valley	0	3	0	6	87	0	0	3	0	0	99	63
Total	**0**	**28**	**0**	**9**	**250**	**0**	**1**	**41**	**1**	**0**	**330**	**222**
Total Sites	**330**											**222**

CA = cache; EL = extractive locality; HI = historic site; LO = locality; NRHP = National Register of Historic Places; NT = nuclear testing; PL = processing locality; RB = residential base; STA = station; TC = temporary camp; UT = untyped.
Note: This table does not include isolated artifacts or features.

4.4.10.1.1 Gold Flat

While most of the Gold Flat Hydrographic Basin lies south of the TTR, a portion of Gold Flat lies in the southeastern corner of the TTR. Within the TTR, Gold Flat is divided from the Cactus Flat Hydrographic Basin by the Breen Creek drainage. Seven cultural resources studies have been conducted within the TTR portion of Gold Flat. Approximately 950 acres have been surveyed for cultural resources. To date, 44 cultural resources sites have been recorded, including 4 temporary camps, 31 uncategorized localities, and 9 historic sites associated with mining and ranching. Of these, 40 sites are eligible for listing in the NRHP.

4.4.10.1.2 Stonewall Flat

A small portion of the Stonewall Flat Hydrographic Basin lies within the southwestern TTR area. Stonewall Flat is separated from Cactus Flat by the Cactus Range. One cultural resources survey covering 215 acres has been completed on the TTR portion of Stonewall Flat. A total of 13 sites have been recorded, including 3 uncategorized localities, 1 station, and 9 historic sites associated with mining and ranching. All 13 sites are eligible for listing in the NRHP.

4.4.10.1.3 Ralston Valley

Only the southeastern corner of the Ralston Valley Hydrographic Basin falls within the TTR boundary. The Monitor Hills separate Ralston Valley from the Stone Cabin Valley Hydrographic Basin. One cultural resources survey covering 170 acres has been completed on the TTR portion of Ralston Valley. A total of 40 sites have been recorded, including 2 temporary camps, 36 uncategorized localities, and 2 historic sites. To date, 38 of these sites are eligible for listing in the NRHP.

4.4.10.1.4 Cactus Flat

The majority of the Cactus Flat Hydrographic Basin lies within the TTR boundary. Cactus Flat is bounded by the Cactus Range to the west, the Kawich Range to the east, Gold Mountain to the south, and

Mount Diablo to the north. Cactus Flat is the location of the Tonopah Test Range Airport and support facilities and, therefore, has been intensively surveyed for cultural resources. Fifty-six cultural resources studies have been conducted within Cactus Flat. Approximately 14,057 acres have been surveyed for cultural resources. A total of 134 cultural resources sites have been recorded, including 19 temporary camps, 3 processing localities, 93 uncategorized localities, 18 historic sites associated with mining and ranching, and 1 site associated with nuclear testing. Of these, 68 sites are eligible for listing in the NRHP.

4.4.10.1.5 Stone Cabin Valley

The southern end of Stone Cabin Valley Hydrographic Basin extends into the northern portion of the TTR. The basin is bounded by the Monitor Hills to the west and the Kawich Range to the east. Six cultural resources surveys have been conducted within the TTR portion of Stone Cabin Valley. Approximately 420 acres have been surveyed for cultural resources. To date, 99 cultural resources sites have been recorded, including 3 temporary camps, 6 processing localities, 87 uncategorized localities, and 3 historic sites. Of these, 63 sites are eligible for listing in the NRHP.

4.4.10.2 Sites of American Indian Significance

For a general description of consultation efforts between DOE/NNSA and CGTO, see Section 4.1.10.

DOE/NNSA consultation with CGTO included a site visit to Cactus Flat in 1997 by members of CGTO. The goal of the visit was to provide recommendations for DOE/NNSA site restoration activities in relation to potential sites of American Indian significance (Stoffle et al. 2001). This and other ongoing consultation efforts have resulted in a better understanding of the cultural significance these sites and locations possess in relation to traditional cultural landscapes (Zedeno et al. 1999; Stoffle et al. 2001).

4.4.11 Waste Management

A variety of wastes are generated during TTR operations in support of DOE/NNSA’s Weapons Ordnance Program, as well as during environmental restoration activities at the TTR and the Nevada Test and Training Range. Although most wastes so generated are shipped off site for disposal, some sanitary solid waste and construction debris are disposed in onsite landfills.

Waste Generation. Hazardous waste from TTR operations that was disposed or recycled off site during CYs 2006 through 2008 is listed in **Table 4–75** (Schade 2010). Hazardous waste sent off site for disposal includes waste regulated under RCRA; asbestos- and PCB-contaminated waste regulated under TSCA; and waste regulated under other authorities, such as liquids or medical waste. This waste was accumulated and shipped off site for disposal at permitted disposal facilities.[32]

TTR pollution prevention and waste minimization activities include programs to recycle and recover materials such as antifreeze, Freon®, solvents, electronic components, oil, batteries, fluorescent and sodium bulbs, and mercury-containing equipment. Antifreeze is recycled and Freon® is recovered at an onsite unit. Other materials were sent off site for recycling, as shown in Table 4–75.

[32] *The TTR is a small-quantity generator of hazardous waste.*

Table 4–75 Tonopah Test Range Operations Hazardous Waste Disposed or Recycled, Calendar Years 2006–2008 (tons)

Waste Type	Calendar Year		
	2006	2007	2008
Hazardous waste	0.354	1.17	0.765
TSCA waste (asbestos/PCBs)	(a)	0.0353	(a)
Non-RCRA- or TSCA-regulated waste [b]	0.864	3.01	2.01
Recycled waste [c]	3.80	0.465	4.35

PCB = polychlorinated biphenyl; RCRA = Resource Conservation and Recovery Act; TSCA = Toxic Substances Control Act.
Note: Data from the cited source were rounded to three significant figures.
[a] Not reported for this year.
[b] Includes liquids, medical wastes, and other toxic solids that are not regulated under RCRA or TSCA.
[c] Includes materials such as batteries, fluorescent lights, or electronic equipment that are regulated under RCRA or other statutory authorities and were shipped off site for recycling.
Source: Schade 2010.

Solid wastes from TTR operations disposed from 2006 through 2008 are summarized in **Table 4–76**. Construction debris and municipal solid waste may be disposed within TTR landfills operated by the USAF (see Table 4–76). Tires and scrap metal waste generated from cleanup of the TTR Salvage Yard were surveyed by radiation control technicians and disposed by shipment to the Apex Landfill near Las Vegas, Nevada. By disposing this waste at a commercial landfill, possible impacts on TTR or NNSS landfill capacity were avoided.

Table 4–76 Tonopah Test Range Operations Solid Wastes Disposed, Calendar Years 2006–2008 (tons)

Waste Type	Calendar Year		
	2006	2007	2008
Tires and scrap metal	63 [a, b]	47.5 [b]	290.2 [b]
Construction debris	21.5	4.87 [c]	1.6 [c]
Sanitary solid waste	25.6	19.9 [c]	23.9 [c]

[a] Measured in cubic yards.
[b] Generated from cleanup of the TTR Salvage Yard. After being surveyed by radiation control technicians and cleared for release, the waste was shipped to the Apex Landfill near Las Vegas, Nevada, for disposal.
[c] The construction debris was disposed at the USAF Construction Landfill at the TTR, while the sanitary landfill waste was disposed at the USAF Sanitary Landfill at the TTR.
Source: DOE 2009a; SNL 2007, 2008.

Table 4–77 presents a summary of the environmental restoration waste generated at the TTR and disposed during CYs 2006 through 2008 (DOE 2009a; SNL 2007, 2008). During these years, TTR environmental restoration activities generated no RCRA- or TSCA-regulated wastes and no TRU or mixed wastes. In 2006, the TTR generated a small quantity of solid waste, consisting of personal protective equipment, such as paper and plastic, that was transferred to the NNSS for disposal. In addition, in 2005, closure activities for CAU 489 (World War II unexploded ordnance sites) generated 75.5 tons of scrap metal that in 2006 was transported to and disposed at the NNSS. In 2006 and 2007, the TTR disposed materials consisting of unexploded ordnance and debris from an Honest John M-50 rocket. During these years, depleted uranium recovered from the rocket was disposed at the NNSS as LLW and included debris and soil, personal protective equipment, and some material from the rocket. In 2007, 17 tons of inert unexploded ordnance and metal debris were disposed by the USAF (6 tons of inert unexploded ordnance) or shipped to and disposed at a Nevada Test and Training Range unexploded ordnance pile (11 tons of metal debris). Also in 2007, three metal structures were dismantled, and the metal scrap (10.5 tons) was shipped to the NNSS Area 3 Sandia Salvage Yard for reuse or recycle.

In 2008, environmental restoration activities were focused on planning activities for CAU 408 (Bomblet Target Area) and a sampling effort on Main Lake. The sampling effort on Main Lake was conducted to support characterization of approximately 40 soil-filled plastic bags that were ultimately disposed as sanitary solid waste. In 2008, however, the TTR generated 24 tons of hydrocarbon-contaminated soil that was shipped off site for disposal at the NNSS hydrocarbon landfill in Area 6.

Table 4–77 Environmental Restoration Wastes Disposed or Recycled, Calendar Years 2006–2008 (tons)

Waste Type	*Calendar Year*		
	2006	*2007*	*2008*
Scrap metal	75.5	(a)	(a)
Inert UXO and metal rocket debris	142	17.0	(a)
Nonradioactive solid waste	0.244 [c]	(a)	(b)
Recycled metal debris	(a)	10.5	(a)
Hydrocarbon-contaminated soil	(a)	(a)	24.0
Low-level radioactive waste (DU-contaminated)	742	407	(a)

DU = depleted uranium; UXO = unexploded ordnance.

[a] Not reported for this year.

[b] This material consisted of approximately 40 bags of soil that were sampled and ultimately disposed as sanitary solid waste.

[c] Consists of nonimpacted personal protective equipment (plastic, paper, Tyvek®, gloves, etc.) transported to the NNSS for disposal.

Source: DOE 2009a; SNL 2007, 2008.

Landfills. At the TTR, the USAF operates a landfill for disposal of construction debris, as well as an expanded Class II sanitary landfill for disposal of municipal solid waste (DOE 2009a). The original sanitary landfill was transferred from DOE to USAF operation in 1992, and was recently expanded. The landfill is authorized to receive no more than 20 tons of municipal solid waste per day, and is projected to have a total license expectancy of 30 years (USAF 2007a).

4.4.12 Human Health and Safety

The health and safety of the general public and workers at the TTR are discussed in this section. Environmental health risks from TTR activities include the effects of environmental noise and acute and chronic exposures to ionizing radiation and hazardous chemicals. Regular programs are administered to monitor releases and evaluate associated potential health impacts. Additionally, studies have been conducted to assess the exposure pathways and potential risks of radionuclide and toxic chemical releases during past TTR operations. These studies focused on the impacts of releases in terms of health risks to the general public and workers at the TTR. Results of current assessments and historic studies indicate (1) there is little risk of enhanced carcinogenesis due to radionuclide and chemical releases during site operations; (2) exposures to site radionuclide releases tend to be far lower than those due to natural background radiation; and (3) chemical exposures are well within established guidelines. In keeping with the goal of optimal protection of vulnerable populations, DOE maintains a comprehensive Emergency Management Program that features hazard-specific plans, procedures, and controls (DOE Order 151.1C).

4.4.12.1 Public Radiation Exposure and Safety

4.4.12.1.1 General Site Description

Major sources of background radiation and average doses from background radiation exposure to individuals in the TTR vicinity are the same as those for the NNSS (see Table 4–52). The average annual dose from background radiation is approximately 670 millirem. About half of the annual dose is from ubiquitous, natural background sources (355 millirem) that can vary depending on geographic location, individual buildings in a geographic area, and age, but essentially all comes from space or naturally occurring sources in the Earth. About half of the dose is from medical exposure to radiation (300 millirem), including computed tomography, interventional fluoroscopy, x-rays and conventional fluoroscopy, and nuclear medicine (use of unsealed radionuclides for diagnosis and treatment). Another approximately 14 millirem per year are from consumer products and other sources (nuclear power, security, research, and occupational exposure) (NCRP 2009). Average annual background radiation doses to individuals are expected to remain fairly constant over the time period of the proposed actions. Background radiation doses identified in Table 4–52 are unrelated to TTR operations.

Releases of radionuclides to the environment from TTR operations provide another source of radiation exposure to individuals in the vicinity of the TTR. The only sources of radionuclide emissions from the TTR consist of the resuspension of plutonium and americium from past test activities (DOE 2009a). Doses to the public estimated from historic monitoring at the TTR are presented in **Table 4–78**. These doses fall within the limits established in DOE Order 458.1 and are much lower than those due to background radiation.

Table 4–78 Radiation Doses to the Public from Tonopah Test Range Operations in 2008 (Total Effective Dose Equivalent)

Members of the Public	***Atmospheric Releases*** [a]	***Liquid Releases*** [b]	***Total*** [c]
Maximally exposed individual (millirem)	0.024	0	0.024
Population within 50 miles (person-rem) [d]	<1	0	<1
Average individual within 50 miles (millirem) [e]	<0.024	0	<0.024

rem = roentgen equivalent man.

[a] Clean Air Act regulations in 40 CFR Part 61, Subpart H, establish a compliance limit of 10 millirem per year to a maximally exposed individual.

[b] There is no dose to the public from surface-water or groundwater pathways.

[c] DOE Order 458.1 establishes a dose limit of 100 millirem per year to individual members of the public exposed through all pathways.

[d] A population dose was not reported in the *Calendar Year 2008 Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii* (DOE 2009a). The estimated population within 50 miles of the Tonopah Test Range was only about 5,000 in the year 2008; if every member of that population received the same dose as the Tonopah Test Range maximally exposed individual, the population dose would be much less than 1 person-rem.

[e] The dose to the maximally exposed individual was based on an exposure location at the Tonopah Test Range Airport. Members of the population are further away from the sources of airborne radioactive material and are exposed to lower concentrations; therefore, the average dose to an individual of the 50-mile population is significantly lower than that to the maximally exposed individual.

Source: DOE 2009a; SNL 2009a.

Using a risk coefficient of 600 cancer deaths per 1 million person-rem (0.0006 LCFs per person-rem) (DOE 2003c), the risk of an LCF to the MEI due to radionuclide releases from TTR operations in 2008 was estimated to be 1.4×10^{-8}. That is, the probability of this person dying of cancer at some time in the future as a result of a radiation dose associated with emissions from 1 year of TTR operations is about 1 in 70 million. The hypothetical MEI is a person whose place of residence and lifestyle make it unlikely that any other member of the public would receive a higher radiation dose from TTR releases. This person was assumed to be exposed to radionuclides in the air and on the ground from TTR emissions and was assumed to be located at the Tonopah Test Range Airport (DOE 2009a).

No members of the public receive direct gamma radiation exposure that is above background levels as a result of past or present TTR operations. Gamma radiation exposure rates measured at areas accessible to the public are comparable to natural background rates from cosmic and terrestrial radiation. Radioactively contaminated areas at the TTR are isolated from members of the public, given the considerable distances between these areas and the TTR boundary.

In regard to groundwater monitoring programs, there is no TTR radiation dose incurred by the public from the groundwater pathway. Annual monitoring indicates that no contaminated groundwater has migrated beyond the TTR boundary into surrounding water supplies used by the public (DOE 2009a).

Operations at the TTR do not involve activities that release radioactive emissions from either point sources (stacks/vents) or diffuse sources (outdoor testing). However, diffuse radioactive emissions are produced from the resuspension of americium and plutonium present at sites of previous testing activities. Other locations at the TTR with minor radioactive contamination, such as depleted uranium, are not significant sources of radioactive air emissions from resuspension (DOE 2009a).

4.4.12.2 Occupational Radiation Exposure and Safety

Workers at the TTR receive the same dose as the general public from background radiation, but they potentially receive an additional dose from working in or around areas with radioactive material. No worker dose data have been reported since the year 2002, and no workers received a measurable dose between 1998 and 2002. The average annual worker dose measured between 1991 and 2002 was 12 millirem (DOE 2009i).

Worker occupational risks at the TTR are generally associated with activities such as waste management, environmental restoration, terrestrial surveillance, and environmental monitoring. DOE's Computerized Accident/Incident Reporting System provides statistics on worker injury and illness information, including accidents involving government-owned vehicles. There were no reportable occurrences in 2008 at the TTR. A reportable occurrence is defined as an unanticipated event that leads to a near-miss, injury, or death of an occupational worker.

4.4.12.3 Chemical Exposure and Risk

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media, through which people may come in contact with hazardous chemicals. Hazardous chemicals can cause cancer and non-cancer-related health effects.

Because of the TTR's remote location and large size, there is no risk of chemical exposure to the surrounding public population resulting from normal site operations. Nevertheless, monitoring efforts and baseline studies are regularly performed. However, certain TTR workers may be at risk to chemical exposure depending upon their job function and proximity to various sources.

Common sources of chemical pollutants and RCRA materials at the TTR include solvents, fuels and oil, pesticides, septic sludge, heavy metals, various munitions materiel, lead-acid batteries, and mercury-containing items. Particulate matter from the TTR portable screen and the TTR maintenance shops (which include painting, welding, and carpentry activities) was released in limited quantities in 2008. The portable screen was operated for 220 hours during 2008 and contributed 0.01 tons of particulate matter emissions. Maintenance shops operated for 282 hours or less in 2008 and contributed less than 0.2 tons of emissions (from particulate matter, hazardous air pollutants, and volatile organic compounds) in total (DOE 2009a).

As for monitoring potential chemicals released to TTR drinking water and wastewater systems, a single well (Well 6) supplies the drinking water needs to TTR workers and visitors, and is monitored annually for potability and purity. Water samples from this well continue to meet all national primary and secondary drinking water standards. In addition, the TTR sewage lagoon systems are tested for biochemical oxygen demand, pH, and total suspended solids, as well as for a suite of toxic chemicals. In the two most recent years for which results have been reported, all wastewater measurements were found to be within permit limits (DOE 2009a; SNL 2010b).

To manage risks from handling toxic or hazardous chemicals, TTR worker safety programs are established to comply with Federal and state laws, DOE Orders, Occupational Safety and Health Administration requirements, and EPA guidelines. Sandia National Laboratories plans and procedures for performing work ensure worker protection through training, monitoring, use of personal protective equipment, and administrative controls. Although chemical inventories have varied to a limited extent over recent years, administrative controls continually ensure that quantities do not approach levels that pose undue risk due to storage, concentration, bulk quantity, or logistical factors. Any amounts that potentially exceed threshold planning quantities require reporting under Federal regulations.

4.4.12.4 Health Effects Studies

To date, apart from the NNSS-related studies described in Section 4.1.12.4, no studies have analyzed potential epidemiological effects resulting from past TTR operations. There are no studies that indicate adverse health effects in populations near the TTR as a result of activities or operations supporting current TTR missions.

4.4.12.5 Accident History

The only significant incident on record to have occurred at the TTR in recent years is the following: Five USAF personnel were killed when a Beechcraft 1900C crashed at the Tonopah Test Range Airport. It was determined that the incident was due to the pilot undergoing cardiac arrest during landing maneuvers (ASN 2004).

4.4.12.6 Emergency Preparedness

Each DOE site has established an Emergency Management Program, developed in accordance with DOE Order 151.1C, *Comprehensive Emergency Management System*, that would be activated in the event of an accident. This program has been developed and maintained to ensure adequate response for postulated accident conditions and to provide response efforts for accidents not specifically considered. The Emergency Management Program incorporates activities associated with emergency planning, preparedness, and response. The TTR Emergency Preparedness Plan is designed to minimize or mitigate the impact of any emergency upon the health and safety of employees and the public. The plan integrates all emergency planning into a single entity to minimize overlap and duplication and to ensure proper responses to emergencies not covered by a plan or directive. DOE/NNSA coordinates emergency response planning and training with local governments. In accordance with the National Incident Management System, the coordination ensures that communications systems and equipment are interoperable and that personnel and equipment can be effectively deployed in the event of an emergency. The DOE/NNSA manager is responsible for managing, countering, and recovering from an emergency occurring at the TTR.

The plan provides for identification and notification of personnel for any emergency that may develop during operational and nonoperational hours. DOE/NNSA receives warnings, weather advisories, and any other communications that provide advance warning of a possible emergency. The plan is based upon current DOE/NNSA vulnerability assessments, resources, and capabilities regarding emergency preparedness.

4.4.12.7 Environmental Noise

The acoustic environment adjacent to the TTR is similar to that described for land areas adjacent to the NNSS. The nearest residents are located in the towns of Goldfield, approximately 22 miles west of the site boundary, and Tonopah, approximately 30 miles northwest of the site. The main sources of noise at the TTR include air- and ground-launched rockets, gun firing, and explosives experiments. An airbase is located within the TTR in support of Nevada Test and Training Range activities. Because of access restrictions and lack of a nearby population, public exposure to these noise sources is limited to occasional sonic booms produced by supersonic overflights of military aircraft. Principal sources of noise to residents of nearby towns include vehicular traffic on U.S. Routes 6 and 95 and aircraft operations.

4.4.13 Environmental Justice

There are no block groups in Nye County (the county the TTR is located within) with minority populations greater than 50 percent. Within the ROI, the closest block group to the NNSS with a minority population greater than 50 percent is more than 60 miles to the southeast of the TTR, near the southeastern corner of the NNSS (see Figure 4–36). Additional block groups with minority populations greater than 50 percent are found further to the southeast in the Las Vegas metropolitan area, closer to the RSL and NLVF facilities (see Sections 4.2.13 and 4.3.13).

Census data were available for the number of households with an income less than $15,000 and those with an income between $15,000 and $24,999. DOE used the combined number of households with incomes less than $24,999 as the poverty threshold for Nye County. Analysis of the data (see Figure 4–36) illustrates that there are numerous census block groups with low-income populations between 11 and 20 percent (that is, at or above the state-wide average) distributed throughout the ROI, including large (but sparsely populated) block groups adjacent to the TTR.

4.5 Former Yucca Mountain Site Affected Environment

DOE analyzed a proposed action to construct, operate, monitor, and eventually close a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain in Nye County, Nevada, in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (*Yucca Mountain EIS*) (DOE/EIS-0250F) (DOE 2002e), and in the *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1) (DOE 2008g). The area evaluated for the repository is an approximately 150,000-acre area of land that comprises land administered by DOE (79,000 acres of the NNSS); the USAF (24,000 acres of the Nevada Test and Training Range); and BLM (44,000 acres), as well as private land (a 200-acre Cind-R-Lite Patented Mining Claim). The Nevada Test and Training Range is closed to public access and use. The BLM-administered land outside of the Nevada Test and Training Range is open to public use, with the exception of approximately 4,250 acres. A number of unpatented mining claims are located on the BLM land.

The area evaluated for the repository is in the southern part of the Great Basin, which is characterized by generally north-trending, linear mountain ranges separated by intervening valleys or basins. Within this setting, Yucca Mountain is part of the southwestern Nevada volcanic field, a volcanic plateau that formed between about 14 and 11.5 million years ago. Yucca Mountain is a product of both volcanic activity and faulting. The crest of Yucca Mountain reaches elevations from 4,900 feet to 6,300 feet above sea level. Crater Flat is located on the BLM-administered land to the west of Yucca Mountain and contains four prominent volcanic cinder cones.

Thirty-six species of mammals have been recorded in and around Yucca Mountain. None of these mammals are classified as threatened or endangered by the USFWS. Twenty-seven species of reptiles have been found at and near Yucca Mountain. The desert tortoise (*Gopherus agassizii*) is listed as threatened under the Endangered Species Act. Yucca Mountain is at the northern edge of the range of the desert tortoise. The western chuckwalla (*Sauromalus obesus*) and the western red-tailed skink (*Eumeces gilberti rubricaudatus*) are classified as sensitive species in Nevada by BLM. More than 120 species of birds have been recorded at Yucca Mountain and the surrounding region, including 15 species of raptors. Several bird species are classified as sensitive species in Nevada by BLM. Native plants at Yucca Mountain below an elevation of about 4,000 feet are typical of the Mojave Desert. Above 4,000 feet is a vegetation transition zone between the Mojave Desert and the colder Great Basin Desert. About 30 invasive, nonnative plant species also occur in the Yucca Mountain region.

There are no perennial streams, natural bodies of water, or naturally occurring wetlands in the area evaluated. Solitario Canyon Wash collects drainage from the west side of Yucca Mountain and runs through the Nevada Test and Training Range and BLM-administered lands. Drill Hole Wash and Busted Butte (Dune) Wash collect drainage from the east side of Yucca Mountain and drain into Fortymile Wash on the NNSS. Fortymile Wash drains to the south. The washes only carry water during intense rain and rapid snowmelt. These washes drain into the ephemeral Amargosa River, which terminates in the Badwater Basin in Death Valley.

More than 530 archaeological sites and over 550 isolated artifacts have been discovered at or near Yucca Mountain. Collectively, they indicate that the Yucca Mountain region has been occupied by American Indian populations for at least 12,000 years. According to American Indians, the Yucca Mountain area is part of the holy lands of the Western Shoshone, Southern Paiute, and Owens Valley Paiute and Shoshone people.

BLM assigns visual resource values to the lands it manages on a scale of Class I to Class IV, with Class IV representative of the lowest visual values. DOE has previously determined that the lands to the west and south of Yucca Mountain, which are visible from portions of U.S. Route 95, are Class III and Class IV lands, which are common to the region.

The air quality in the area is characterized as unclassifiable due to limited air quality data. However, data collected by DOE indicate that the air quality is within applicable NAAQS.

CHAPTER 5
ENVIRONMENTAL CONSEQUENCES

5.0 ENVIRONMENTAL CONSEQUENCES

This chapter provides the scientific and analytical basis for the comparison of the alternatives identified in this *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 (NNSS SWEIS)*. This discussion addresses the potential direct and indirect effects of each of the alternatives. Within this chapter, the analysis is organized based on the following geographic sites covered within this site-wide environmental impact statement (SWEIS): the Nevada National Security Site (NNSS); the Remote Sensing Laboratory (RSL) at Nellis Air Force Base; the North Las Vegas Facility (NLVF); and the Tonopah Test Range (TTR). For each geographic site, potential environmental consequences are then addressed for the following environmental resource areas:

- Land Use
- Infrastructure and Energy
- Transportation
- Socioeconomics
- Geology and Soils
- Hydrology
- Biological Resources
- Air Quality and Climate
- Visual Resources
- Cultural Resources
- Waste Management
- Human Health
- Environmental Justice

Within each environmental resource area, this SWEIS analyzes the potential environmental consequences associated with the three alternatives (No Action, Reduced Operations, and Expanded Operations) identified in Chapter 3 of this SWEIS. Under each alternative, the potential environmental consequences are also described in relation to the three major missions (National Security/Defense, Environmental Management, and Nondefense) described in Chapter 3 of this SWEIS. For some environmental resource areas, additional technical information used to support the analysis is contained in separate appendices. A summary comparison of the mission-based program activities under each of the proposed alternatives is presented in Chapter 3, Table 3–1, of this *NNSS SWEIS*. Section 5.5 provides the combined impacts of all four U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) sites in Nevada for certain resource areas. In Section 3.4, DOE/NNSA identified its Preferred Alternative. DOE/NNSA's Preferred Alternative is a "hybrid" alternative comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Chapter 3, Table 3–3, of this *NNSS SWEIS* provides a comparison of mission-based program activities under the three alternatives and visually identifies which elements of the three alternatives were selected for the Preferred Alternative. Tables 3–4, 3–5, 3–6, and 3–7 also summarize the potential environmental consequences associated with implementing the Preferred Alternative.

Throughout this chapter, the perspectives of American Indian tribes and groups regarding the environmental consequences of DOE/NNSA activities in Nevada are summarized in shaded and marked text boxes identified with a Consolidated Group of Tribes and Organizations (CGTO) feather icon. The full text of American Indian perspectives is contained in Appendix C of this SWEIS, which was prepared by the American Indian Writers Subgroup of the CGTO.

The impact analysis for this SWEIS is based on the best data available, considering current environmental conditions, activities, and facilities. This SWEIS considers ongoing and proposed programs, capabilities, and projects (i.e., activities) at DOE/NNSA facilities in Nevada over the next 10 years. The nature of ongoing activities and their relationship to associated environmental impacts are well understood. In contrast, however, the nature of proposed activities is less well known. In the interest of disclosing potential environmental impacts that could occur at the NNSS and offsite locations over the next 10 years, this SWEIS includes ongoing activities, as well as a number of activities that are in planning and development.

To assess potential environmental impacts from all such activities, it was necessary for DOE/NNSA to estimate at a programmatic level certain aspects of the proposed activities, such as the potential area of land disturbance or the amount of groundwater that may be required. DOE/NNSA incorporated these programmatic-level estimates, along with more-detailed information on ongoing, better-understood activities, into the analysis of impacts. For instance, estimated areas of land disturbance for both proposed and well-defined activities were used to determine the potential impacts on resources such as soils (area of disturbance and erosion), cultural resources (number of sites potentially affected), and biology (vegetation/habitat loss, number of desert tortoises affected).

DOE/NNSA understands that the level of National Environmental Policy Act (NEPA) analysis conducted for some proposed activities may not be sufficient to permit implementation, and such activities could require additional NEPA analysis. These activities are identified in Chapter 3. DOE/NNSA will conduct NEPA reviews for these activities, as appropriate, in the future. DOE/NNSA's NEPA review procedures are described in Chapter 9, Section 9.1.1.

In this SWEIS, DOE/NNSA analyzed potential environmental impacts resulting from proposed activities that may occur within a 10-year planning window, including long-term as well as short-term effects. The durations of impacts vary for individual resource areas, and are dependent upon whether the impacts are due to construction activities, which typically would last no more than a few years, from the operation of facilities, which would last for many years, or from actions for which impacts could last for hundreds of years or longer. For some resource areas, such as biological and cultural resources, potential impacts are primarily dependent on the amount of land that would be newly disturbed due to ongoing or proposed projects and activities; these impacts would occur "one time" and would not change over time. For other resource areas, such as air quality, potential impacts are dependent primarily on the duration of project construction in the short term, and the level of operations in the longer term; such longer-term impacts would occur on an annual basis, and would continue for as long as these projects and activities continue. Although some activities may eventually cease, such as disposal of low-level radioactive waste (LLW), potential impacts would not appear for many decades, but would then last for hundreds or thousands of years. The presentation of potential environmental impacts in this *NNSS SWEIS* reflects these durations for each resource area, as appropriate.

In 2008, DOE/NNSA estimated that approximately 80,000 acres (9 percent) of NNSS land had been disturbed. **Table 5–1** shows the potential amount of additional land disturbance that would result under each of the three alternatives addressed in this SWEIS. Under each alternative in the table, areas of potential land disturbances are noted by mission area, program, and activity. The data used to develop the table were derived from the descriptions in Chapter 3; these data include disturbances associated with ongoing and proposed activities that were used as a basis for an adequate NEPA analysis, as well as disturbances associated with potential activities that are less well developed at this time. In addition, all of these potential land disturbances were assumed to affect previously undisturbed land; however, in some cases, lands that are currently disturbed would be used for proposed and potential activities. For these reasons, the land disturbance areas displayed in Table 5–1 provide one of the bases for a conservative analysis of potential impacts.

Table 5–1 Potential Area of Land Disturbance at the Nevada National Security Site for Each Mission Area, Program, and Activity by Alternative [a]

Project or Activity	*Number of "Events" Over 10 Years [b]*	*Disturbance per "Event" [c] (acres)*	*Disturbance by Project or Activity [d] (acres)*	*Total Disturbance by Program [e] (acres)*	*Total Disturbance by Mission and Alternative [f] (acres)*
NO ACTION ALTERNATIVE					
NATIONAL SECURITY/DEFENSE MISSION					
Stockpile Stewardship and Management Program					
Dynamic Experiments in Boreholes	5	20	100		
Explosive Experiments	100	5	500		
Drillback Operations	5	5	25		
OST Training and Exercises [g]	60	1	60		
Total Stockpile Stewardship and Management Program				685	
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs					
Releases of Chemicals and Biological Simulants	15	1	15		
Total Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs				15	
Work for Others Program					
Total Work for Others Program				0	
TOTAL NATIONAL SECURITY/DEFENSE MISSION					**700**
ENVIRONMENTAL MANAGEMENT MISSION					
Waste Management Program					
Area 5 RWMC	1	190	190		
Total Waste Management Program				190	
Environmental Restoration Program					
UGTA Project Characterization and Monitoring Wells [h]	50	10	500		
Soils Projects [i]	1	420	420		
Total Environmental Restoration Program				920	
TOTAL ENVIRONMENTAL MANAGEMENT MISSION					**1,110**

Project or Activity	*Number of "Events" Over 10 Years* [b]	*Disturbance per "Event"* [c] *(acres)*	*Disturbance by Project or Activity* [d] *(acres)*	*Total Disturbance by Program* [e] *(acres)*	*Total Disturbance by Mission and Alternative* [f] *(acres)*
NONDEFENSE MISSION					
General Site Support and Infrastructure Program					
Total General Site Support and Infrastructure Program				0	
Conservation and Renewable Energy Program					
Total Conservation and Renewable Energy Program				0	
TOTAL NONDEFENSE MISSION					**0**
TOTAL NO ACTION: DOE/NNSA					**1,810**
Commercial/Demonstration					
Commercial 240-Megawatt Solar Power Generation Facility [j]	1	2,650	2,650		
Total Commercial/Demonstration				2,650	
TOTAL NO ACTION					**4,460**
EXPANDED OPERATIONS ALTERNATIVE					
NATIONAL SECURITY/DEFENSE MISSION					
Stockpile Stewardship and Management Program					
Dynamic Experiments in Boreholes	5	20	100		
Explosives Experiments	500	5	2,500		
Depleted Uranium Experiment Sites	3	40	120		
Drillback Operations	5	5	25		
OST Training and Exercises [g]	60	1	60		
OST Training Facility	1	10,000	10,000		
Total Stockpile Stewardship and Management Program				12,805	
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs					
Arms Control Treaty Verification Test Bed [k]	1	100	100		
Urban Warfare Complex [k]	1	100	100		
Releases of Chemicals and Biological Simulants	15	1	15		
Total Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs				215	
Work for Others Program					
IED Research and Defeat Facility [k]	1	75	75		
Miscellaneous Aviation Facilities	1	15	15		
Active Interrogation Facilities [k]	1	125	125		
Radioactive Tracer Experiments	1	20	20		

Project or Activity	Number of "Events" Over 10 Years [b]	Disturbance per "Event" [c] (acres)	Disturbance by Project or Activity [d] (acres)	Total Disturbance by Program [e] (acres)	Total Disturbance by Mission and Alternative [f] (acres)
Miscellaneous Test Bed Facilities [k]	1	200	200		
Total Work for Others Program				435	
TOTAL NATIONAL SECURITY/DEFENSE MISSION					**13,455**
ENVIRONMENTAL MANAGEMENT MISSION					
Waste Management Program					
Area 5 RWMC	1	600	600		
Sanitary Landfill Area 23	1	15	15		
Sanitary/D&D/Construction Waste Landfill Area 25	1	20	20		
Total Waste Management Program				635	
Environmental Restoration Programs					
UGTA Project Characterization and Monitoring Wells [h]	50	10	500		
Soils Project [i]	1	420	420		
Total Environmental Restoration Program				920	
TOTAL ENVIRONMENTAL MANAGEMENT MISSION					**1,555**
NONDEFENSE MISSION					
General Site Support and Infrastructure Program					
138-kilovolt Transmission Line Rebuild [l]	38.5 miles	12	467		
Total General Site Support and Infrastructure Program				467	
Conservation and Renewable Energy Program					
5- Megawatt Photovoltaic Solar Power Generation Facility, Area 6	1	50	50		
Total Conservation and Renewable Energy Program				50	
TOTAL NONDEFENSE MISSION					**517**
TOTAL DOE/NNSA					**15,527**
Commercial/Demonstration					
Commercial 1,000-Megawatt Solar Power Generation Facility(ies) [j]	1	10,300	10,300		
Geothermal Demonstration Project	1	50	50		
Total Commercial/Demonstration				10,350	
TOTAL EXPANDED OPERATIONS					**25,877**

Project or Activity	*Number of "Events" Over 10 Years* [b]	*Disturbance per "Event"* [c] *(acres)*	*Disturbance by Project or Activity* [d] *(acres)*	*Total Disturbance by Program* [e] *(acres)*	*Total Disturbance by Mission and Alternative* [f] *(acres)*
REDUCED OPERATIONS ALTERNATIVE					
NATIONAL SECURITY/DEFENSE MISSION					
Stockpile Stewardship and Management Program					
Dynamic Experiments in Boreholes	5	20	100		
Explosives Experiments	50	5	250		
Drillback Operations	5	5	25		
OST Training and Exercises [g]	40	1	40		
Total Stockpile Stewardship and Management				415	
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs					
Releases of Chemicals and Biological Simulants	15	1	15		
Total Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs				15	
Work for Others Program					
Total Work for Others Program				0	
TOTAL NATIONAL SECURITY/DEFENSE MISSION					**430**
ENVIRONMENTAL MANAGEMENT MISSION					
Waste Management Program					
Area 5 RWMC	1	190	190		
Total Waste Management Program				190	
Environmental Restoration Program					
UGTA Project Characterization and Monitoring Wells [h]	50	10	500		
Soils Project [i]	1	420	420		
Total Environmental Restoration Program				920	
TOTAL ENVIRONMENTAL MANAGEMENT MISSION					**1,110**
NONDEFENSE MISSION					
General Site Support and Infrastructure Program					
Total General Site Support and Infrastructure Program				0	
Conservation and Renewable Energy Program					
Total Conservation and Renewable Energy Program				0	
TOTAL NONDEFENSE MISSION					**0**
TOTAL DOE/NNSA					**1,540**

Project or Activity	*Number of "Events" Over 10 Years* [b]	*Disturbance per "Event"* [c] *(acres)*	*Disturbance by Project or Activity* [d] *(acres)*	*Total Disturbance by Program* [e] *(acres)*	*Total Disturbance by Mission and Alternative* [f] *(acres)*
Commercial/Demonstration					
Commercial 100-Megawatt Solar Power Generation Facility [j]	1	1,200	1,200		
Total Commercial/Demonstration				1,200	
TOTAL REDUCED OPERATIONS					**2,740**

D&D = decontamination and decommissioning; IED = Improvised Explosive Device; OST = Office of Secure Transportation; RWMC = Radioactive Waste Management Complex; UGTA = Underground Test Area.

[a] This table includes potential projects and activities that could impact previously undisturbed land but excludes those, such as a new Security Building in Area 23 or Reconfiguration of Mercury, that DOE/NNSA is certain would be located in previously disturbed areas. In addition, some activities, such as explosive experiments and experiments involving releases of chemicals and/or biological simulants, may be conducted in either previously disturbed or undisturbed land. In these cases, a reasonable estimate was made of the number of such experiments that would result in disturbance of previously undisturbed land.

[b] Number of "Events" Over 10 Years is the estimated maximum number of times a proposed or potential project or activity would be conducted over the next 10 years or the number of facilities that would be developed for a type of activity.

[c] Disturbance per "Event" (acres) is the estimated area of land disturbance, in acres, resulting from a single occurrence of a proposed or potential project or activity.

[d] Total Disturbance by Activity equals Disturbance per "Event" × Disturbance per "Event" for a particular proposed project or activity.

[e] Total Disturbance by Program is the aggregated total of acres of potentially disturbed land in the Total Disturbance by Activity column for the specified program.

[f] Total Disturbance by Mission and Alternative is the aggregated total of acres of potentially disturbed land for all programs within a particular mission area and the cumulative total for a specified alternative.

[g] For OST exercises it was conservatively assumed that, for each event, 1 acre of land immediately adjacent to an existing road would be disturbed by overland vehicle movements

[h] UGTA Project characterization and monitoring wells would be located on the NNSS, Nevada Test and Training Range, and possibly on Bureau of Land Management (BLM) land and private property.

[i] Soils Project land disturbance includes sites on the NNSS and Nevada Test and Training Range (except for the TTR).

[j] The acres of disturbance for the commercial solar power generation facility(ies) under each alternative include estimated disturbance to construct the necessary electrical transmission lines to interconnect the facilities to the main transmission grid.

[k] These projects are included in the analysis on a "programmatic" level; however, additional NEPA review would be required as specific projects are developed beyond a conceptual stage.

[l] Disturbance for rebuilding the "backbone" electrical transmission line on the NNSS assumes 100 feet of disturbance along the entire 38.5 miles of the project.

5.1 Nevada National Security Site

The following sections describe the potential environmental consequences associated with the proposed alternatives in this SWEIS, as well as ongoing programs at the NNSS.

5.1.1 Land Use

Land use impacts are considered broadly in this SWEIS to include both land and airspace. The following criteria are used in this analysis of potential impacts on land use and airspace resources resulting from activities of DOE/NNSA in the State of Nevada:

- Compatibility of proposed activities with existing land use and land use designations both on the NNSS and in the surrounding areas
- Availability of sufficient land within the appropriate land use zone for the proposed activities and facilities
- Compatibility of proposed airspace activities with existing airspace use and airspace classifications with both civilian and military airspace use
- Compatibility of proposed activities at RSL, NLVF, and the TTR with surrounding area land uses (determined by the evaluation of existing and future land use or resource management plans)

Impacts on land use were assessed by comparing the compatibility of proposed land uses with existing land uses, current and potential activities within the land use zone designations developed by the DOE/NNSA, and the assessment of land availability. Land use compatibility is defined here as the ability of two or more land uses to coexist without significant conflict. Examples of significant conflicts include interference of proposed activities with existing activities (including airspace activities); insufficient availability of facilities, infrastructure, and/or resources to safely accommodate a proposed activity; and activities resulting in human health and safety issues due to poor siting. Frequently, compatibility between land uses exists in varying degrees based on the frequency, duration, and intensity of a proposed activity. The land use zone designations preclude proposed activities from being located within a designated zone that would be incompatible with the current or proposed uses. However, an activity could be collocated within a land use zone that it is not normally associated with based on evaluation of its compatibility with nearby activities, including consideration of the availability of facilities and infrastructure, safety of personnel, and sensitive environments. All zones are considered compatible with environmental restoration activities. Potential impacts on land use compatibility are based on qualitative assessments and, to the extent possible, quantitative assessments, of the range of activities that could occur under the three missions. Land disturbance within a given land use zone is not considered a land use impact under these criteria unless the disturbance results from a project that is incompatible with the land use designation. Impacts associated with land disturbance that affect resources such as soil, biological resources, and cultural resources, are presented in their respective resource impact sections in this chapter. The following subsections present analyses of the land use impacts under each alternative by mission and program.

Potential development of commercial solar power generation facilities in Area 25 of the NNSS is addressed at varying levels under all three alternatives in this *NNSS SWEIS*. There is no specific schedule for constructing one or more solar power generation facilities at the NNSS, and the analysis of impacts in this *NNSS SWEIS* is included to enable DOE/NNSA to make a decision about whether to make land and infrastructure now under DOE/NNSA control available for another use by a commercial entity.

Impacts on the surrounding land uses near the NNSS, RSL, NLVF, and the TTR were evaluated by assessing existing and future land use and resource management plans to determine whether land uses at these DOE/NNSA site locations are compatible with the surrounding land uses. The primary land uses adjacent to the NNSS and the TTR include additional military training and exercises within the Nevada Test and Training Range lands, as well as grazing, mining, and recreation on the Bureau of Land Management (BLM)-managed lands. The assessment showed that NNSS operations would be compatible with surrounding land uses because NNSS activities would occur within appropriately designated land use zones and existing and proposed experiments and activities would be sited to prevent incompatibility with adjacent land uses. Land use at NLVF would be compatible with surrounding land use because no changes are proposed under any of the alternatives and NLVF is located within an area that is suitably zoned for DOE/NNSA's activities. As RSL is located on Nellis Air Force Base and any activities occurring at this facility would be compatible with the U.S. Air Force's (USAF's) mission and would occur on land withdrawn for the purpose of military training and exercises, no impacts on surrounding land uses would occur. Therefore, discussion of the impacts of each alternative will focus on compatibility with DOE/NNSA land use designations.

Land Use—American Indian Perspective

During the evaluation of the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)*, the Consolidated Group of Tribes and Organizations (CGTO) noted repeated nuclear testing activities had resulted in severe disturbances to the land on large portions of the Nevada National Security Site (NNSS). This seemingly irreparable damage has made certain areas unfit for human use and inaccessible to American Indians who have relied on it for food, medicine, and ceremonies. Sedan Crater, for example, continues to be a dead site; the spirits of the site and resources on it were destroyed in 1962 and the loss can still be felt by members of the CGTO.

One elder from the Moapa Paiute Tribe in Nevada responded to the potential impacts of radioactive contamination of his traditional land as follows: *"You non-Indians can move if you pollute the land on which you live, but we were created for this place, so we must face whatever happens here. We cannot move and continue to be Paiute people – this is our land – we are this land".* This view is shared by other culturally-affiliated tribes within the CGTO. The CGTO maintains we have Creation-based rights to protect, use, and have access to lands of the NNSS and the immediate area.

See Appendix C for more details.

Impacts on airspace were assessed by reviewing the existing airspace classifications and users within the region. Potential impacts on airspace are based on qualitative assessments of the range of potential activities under the three missions that could conflict with existing airspace classifications and existing airspace use. Accordingly, the only activities that would affect airspace would be defense-related. Therefore, only the National Security/Defense Mission is discussed and evaluated in this section for airspace impacts resulting from implementation of the alternatives.

The variety of DOE/NNSA programs requiring occasional flights of helicopters and fixed-wing aircraft carrying supplies and personnel would continue to occur under all three alternatives. The NNSS would continue to host the use of aerial platforms (airplanes and helicopters) for research and development, training, and exercises. The inherent constraints of the existing restricted airspace over the NNSS and Nevada Test and Training Range would continue to require nonparticipating civil and military aircraft to be routed around both sites, as necessary. NNSS use of airspace is contingent on joint-use status, operations in progress, and air traffic considerations. DOE/NNSA is required to coordinate scheduling of airspace activities through the Nellis Air Traffic Control Facility, which controls the movement of military aircraft in and out of restricted airspace. While the USAF does not own NNSS airspace, NNSS airspace is controlled by Nellis Air Force Base under agreement between DOE/NNSA and the USAF.

The current level of air traffic control and radar, radio, and navigational aid services would likely be maintained or improved under normal upgrade programs. Based on past trends and improvements in communication, no increased impacts on civilian air traffic are expected.

5.1.1.1 No Action Alternative

Under the No Action Alternative, current activities and operations would continue and the land use zone designations would remain unchanged, except for the Solar Enterprise Zone, which would be redesignated as the Renewable Energy Zone. **Figure 5–1** depicts the land use zone designations on the NNSS under the No Action Alternative. No proposed changes would occur to affect existing and surrounding land use resources associated with the NNSS. Land use impacts resulting from the development of the Renewable Energy Zone in Area 25 are not expected because the facility would be within a land use zone designated for solar power development and would not impact surrounding land use resources.

The impacts on land use for the missions under the No Action Alternative are discussed below.

5.1.1.1.1 National Security/Defense Mission

There would be no land use impacts resulting from the continuation of National Security/Defense Mission activities at the current levels of operations under the No Action Alternative because activities under this alternative would not change. This section further discusses the potential impacts of the No Action Alternative on National Security/Defense Mission programs and use of airspace.

Stockpile Stewardship and Management Program. Activities associated with research, design, development, and testing of nuclear weapons components and the assessment and certification of their safety and reliability would continue within the applicable land use zones. The NNSS would maintain readiness to conduct underground nuclear tests, if directed by the President. The continuation of stockpile stewardship management activities would include disposition of damaged U.S. nuclear weapons, staging of nuclear weapons, and disassembly of nuclear weapons. Drillback operations, which were routinely conducted after an underground nuclear test to obtain samples within the explosive cavity region, would continue for the purposes of exercising and maintaining this capability and obtaining data for groundwater studies. Drillback operations would occur near the site of a former underground nuclear test event.

The No Action Alternative assumes the continuation of Stockpile Stewardship and Management Program operations at current levels, consistent with existing NNSS land use designations; therefore, no overall adverse land use impacts are expected.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Because the No Action Alternative assumes the continuation of these programs' current operations and these operations are consistent with existing land use designations, no new impacts on land use are expected.

Work for Others Program. This program is hosted by DOE/NNSA and provides other Federal agencies, state and local government agencies, and nongovernmental organizations with the shared use of certain facilities on the NNSS. Because the No Action Alternative assumes the continuation of this program's current operations and these operations are consistent with existing land use designations, no new impacts are expected.

Airspace. Under the No Action Alternative, activities at the NNSS would continue at the level of current operations; therefore, no new impacts are expected from anticipated airspace activities and requirements. DOE/NNSA would continue to coordinate the use of airspace with the controlling entity responsible for NNSS airspace, the Nellis Air Traffic Control Facility.

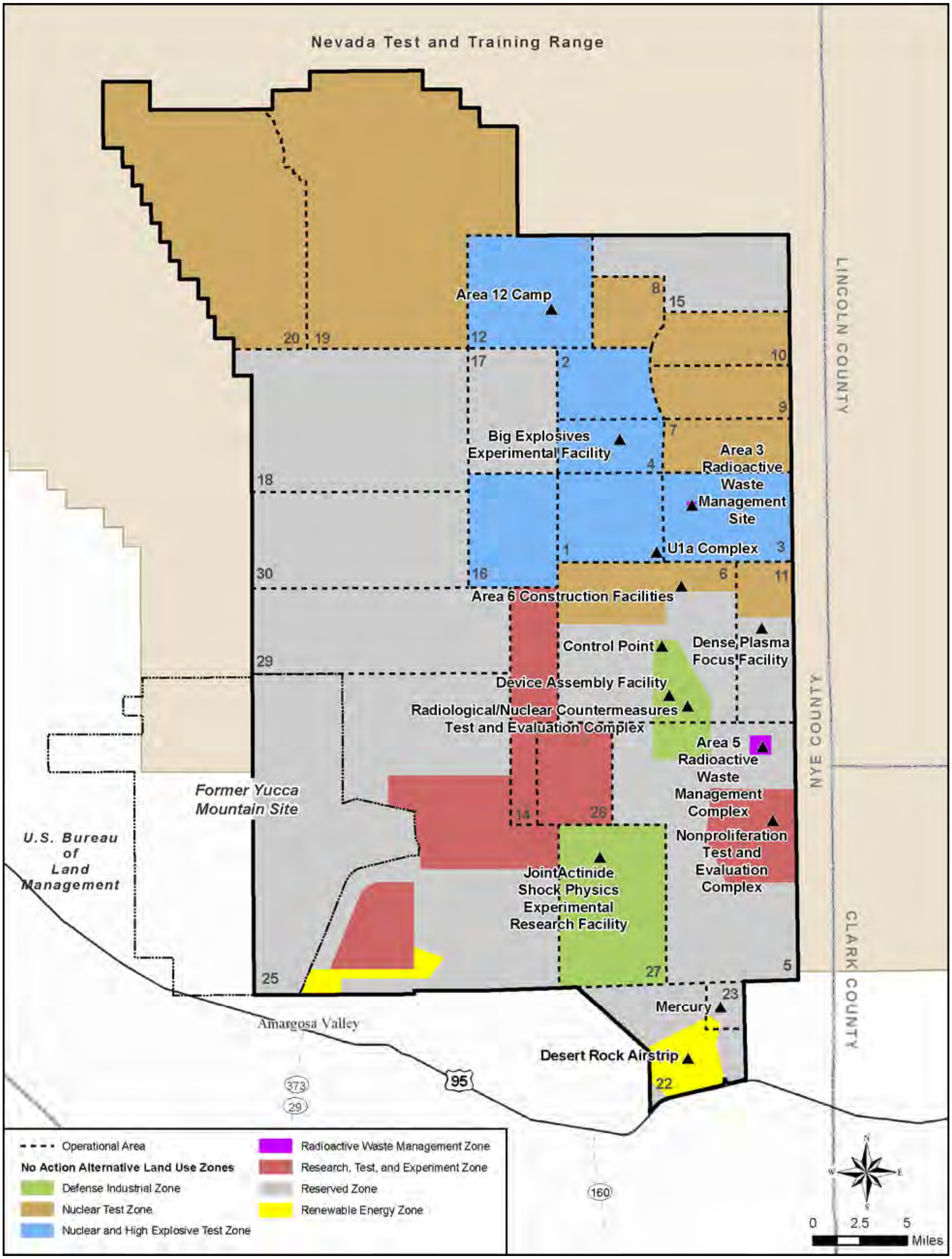


Figure 5–1 Land Use Zones on the Nevada National Security Site Under the No Action Alternative

5.1.1.1.2 Environmental Management Mission

There would be no land use impacts resulting from the continuation of Environmental Management Mission activities at the current levels of operations under the No Action Alternative because activities would not change. This section further discusses the potential impacts of the No Action Alternative on Environmental Management Mission activities.

Waste Management Program. Waste management activities would continue at all existing NNSS facilities in accordance with applicable regulatory requirements.

Environmental Restoration Program. Current Environmental Restoration Program activities would continue. These activities include the identification, characterization, and remediation of contaminated soils and facilities. Additional drilling of characterization and monitoring wells also is expected to continue under this program. Underground Test Area (UGTA) Project activities would occur on the NNSS, the Nevada Test and Training Range, BLM-managed lands, and privately owned land as necessary and as permission is obtained. These activities would not all occur in areas specifically zoned for this type of activity. There could be a temporary impact if restoration activities are carried out in areas that are not consistent with the designated land use identified for that land area; however, coordination with the Nevada Test and Training Range or BLM-managed lands and private landowners prior to the commencement of UGTA Project activities would reduce the impacts resulting from this activity.

5.1.1.1.3 Nondefense Mission

There would be no land use impacts resulting from the continuation of Nondefense Mission activities at the current levels of operations or foreseeable actions under the No Action Alternative because activities under this alternative would not change. This section further discusses the potential impacts of the No Action Alternative on Nondefense Mission activities.

General Site Support and Infrastructure Program. The substantial infrastructure of the NSSS provides all site support activities. This program includes those activities that are necessary to support mission-related programs, such as the construction and maintenance of facilities and warehousing. The infrastructure necessary to support the mission of the NNSS would continue to be maintained, repaired, and replaced as necessary. General Site Support and Infrastructure Program activities would not result in any changes to land use, so no land use impacts are expected.

Conservation and Renewable Energy Program. Under this program, DOE/NNSA would continue to ensure that new construction and renovation projects implement design, construction, maintenance, and operation practices that support high-performance building goals.

Land preparation activities associated with the development of a 240-megawatt commercial solar power generation facility and associated transmission lines within the Renewable Energy Zone in Area 25 would disturb an area of approximately 2,650 acres. Although a portion of Area 22 was identified in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)* (DOE 1996c) for the Solar Enterprise Zone (now redesignated as the Renewable Energy Zone), with the currently available renewable energy technology, it is no longer considered a viable location to host a solar power generation facility because of the potential impacts that might result from groundwater withdrawal at Devils Hole, a sensitive environmental area that is downgradient from Area 22. Section 5.1.6.2 discusses impacts on groundwater under each alternative. No impacts on land use resulting from this foreseeable action are expected because a solar power generation facility would be located within a compatible land use zone.

Other Research and Development Programs. The NNSS supports scientific research projects conducted by academic entities and other parties under this program, which is currently inactive. Under the No Action Alternative, the NNSS would continue to support this program and, if activated in the future, these activities would occur in locations consistent with NNSS land use zone designations. Therefore, no impacts on land use are expected.

5.1.1.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, the following two changes would occur in the NNSS land use zone designations:

- The designated use for Area 15 would be changed from "Reserved" to "Research, Test, and Experiment."
- Approximately 36,900 acres within Area 25 would be designated as a Renewable Energy Zone, a change that would increase the area available for development of a solar power generation facility by about 32,800 acres.

Figure 5–2 depicts land use zones and major facilities at the NNSS under the Expanded Operations Alternative. The proposed revisions to the total acreage of the land use zones under the Expanded Operations Alternative are shown in **Table 5–2**.

Table 5–2 Changes in Land Use Zones Under the Expanded Operations Alternative

Land Use Zone	*Current Acreage*	*Proposed Acreage*	*Percent Change in Acreage*
Reserved Zone	410,100	387,500	-5.5
Research, Test, and Experiment Zone	76,200	92,200	+21
Renewable Energy Zone [a]	11,900	44,700	+276

[a] The Solar Enterprise Zone was expanded and renamed the Renewable Energy Zone.

Although land use zones under the Expanded Operations Alternative would change, this change is not considered an adverse impact. The NNSS developed the land use zones for internal organizational and functional uses and to group similar uses and activities into specific areas based on the support needs of NNSS missions, as determined by previous and anticipated uses. The Renewable Energy Zone would reserve a larger land area under the Expanded Operations Alternative than under the No Action Alternative.

5.1.1.2.1 National Security/Defense Mission

There would be no land use impacts resulting from the increased National Security/Defense Mission activities under the Expanded Operations Alternative because the changes would be compatible with the land use zones. This section discusses the potential impacts of the Expanded Operations Alternative on National Security/Defense Mission programs and use of airspace.

Stockpile Stewardship and Management Program. This section highlights proposed projects for the Expanded Operations Alternative and provides an analysis of whether the projects are compatible with the land use designations.

As part of the Stockpile Stewardship and Management Program, DOE/NNSA would add additional equipment and ancillary features within the existing Big Explosives Experimental Facility (BEEF) to support activities occurring in the Nuclear and High Explosives Test Zone. Depleted uranium experiment sites would occupy 40 acres per experiment, with up to three experiments conducted during the period of analysis, while high-explosives experiments would occupy 5 acres per experiment, with up to 500 experiments conducted during the period of analysis. The areas for these experiments would be located in appropriately zoned operational areas on the NNSS; however, reserving these areas for the depleted uranium and high-explosives experiments would prevent other activities or uses from occurring within these reserved areas. Because this activity would occur in an already disturbed area at an active facility zoned for this type of activity, no additional impacts on land use are expected.

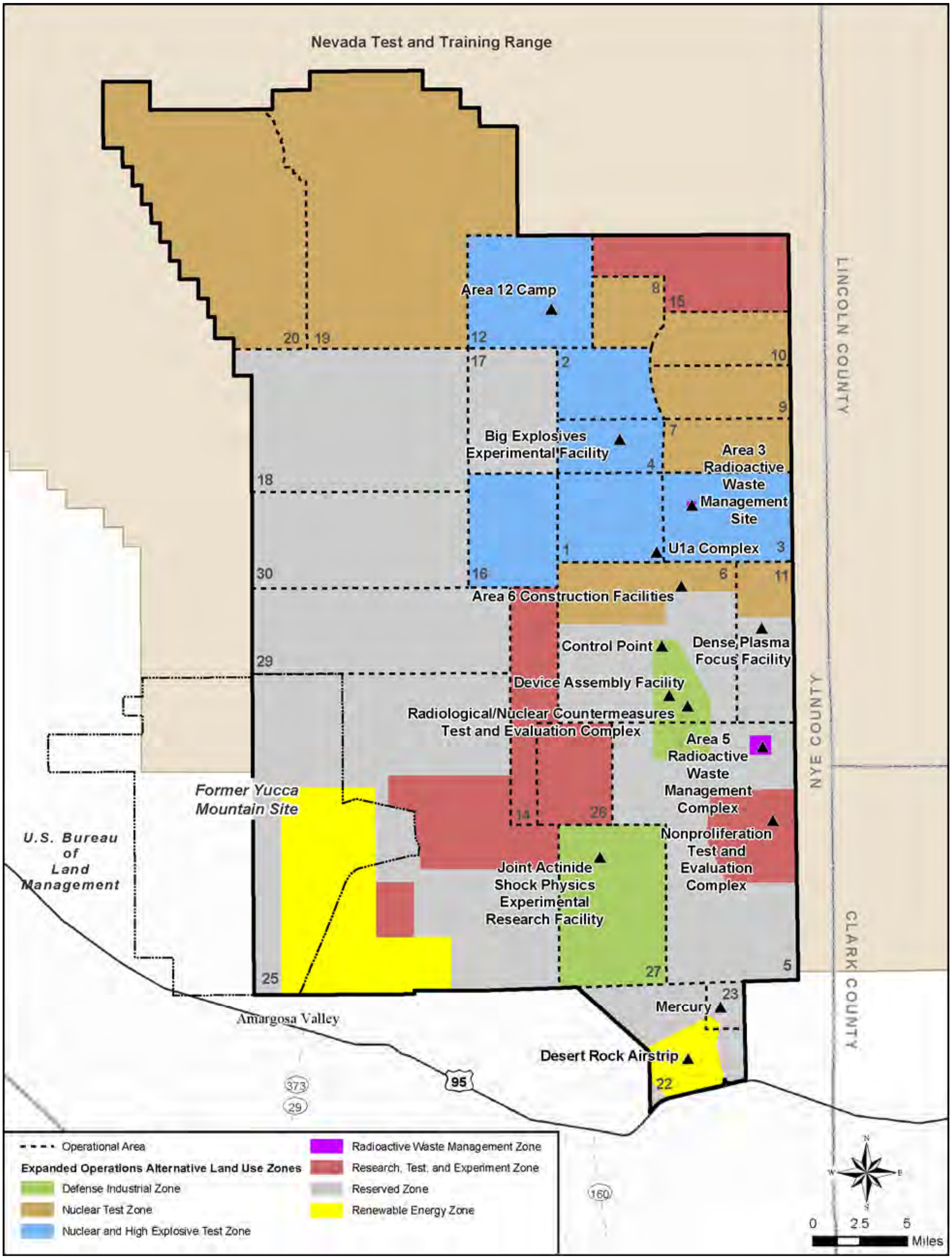


Figure 5–2 Expanded Operations Alternative and Major Facilities

Construction activities for new support facilities for the Office of Secure Transportation training would occur in Area 17. The training area would reserve about 10,000 acres of currently undisturbed land for use as an active training area with development of firing ranges and other training facilities and supporting infrastructure. Additionally, the Office of Secure Transportation would expand facilities in one of the following: Area 12 (12 Camp), Area 6 (Control Point Complex), or Area 23 (Mercury). Because these activities would be located in an area zoned for this type of activity, no land use impacts resulting from construction and utilization are expected.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. This section highlights proposed projects for the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs under the Expanded Operations Alternative and provides an analysis of whether the projects are compatible with the land use designations. The Disposition Forensics Evidence Analysis Team under the multi-agency Disposition and Disposition Forensics Programs would be deployed to the NNSS, as needed for training, exercises, or an actual event. Impacts on land use resulting from disposition activities are not expected because the NNSS already provides facilities for disposition of improvised nuclear devices. Facilities and activities associated with this program would be sited in compatible land use zone designations to minimize land use conflicts.

Additional arms control, nonproliferation, and counterterrorism facilities would be needed to undertake the anticipated enhanced activities. These facilities are still conceptual in nature and their locations are unknown; however, they would be constructed in operational areas within compatible land use zones, which would result in minimal impacts. The land acreage needed for these facilities, to the extent known, are listed below:

- Arms control – Facilities would be sited at various locations at the NNSS and would require approximately 100 acres of land. An additional building encompassing 10,000 square feet (0.2 acres) would be integrated with other buildings.
- Nonproliferation – A new Nonproliferation Test Bed would be developed.
- Counterterrorism – In addition to utilizing existing facilities, an Urban Warfare Complex would be constructed on approximately 100 acres in a remote area on the NNSS.

Work for Others Program. In general, land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.1. This section highlights additional Work for Others Program projects that could have impacts under the Expanded Operations Alternative.

Counterterrorism activities would require the development of new test bed facilities (roads, intersections, small towns, etc.). To support this need, the disturbance of approximately 75 acres of land is expected. Construction of these facilities would require new buildings with about 10,000 square feet (0.2 acres) of new floor space, resulting in approximately 25 acres of land disturbance. These facilities would be constructed in operational areas within compatible land use zones; thus, no land use impacts are expected.

DOE/NNSA would provide support for the National Aeronautics and Space Administration (NASA) deep space propulsion system development. This activity would use existing boreholes for testing nuclear rocket motors; however, it is not expected that testing would occur within the 10-year planning period evaluated in this SWEIS. These facilities would be constructed in operational areas within compatible land use zones; thus, no land use impacts are expected.

Anticipated land disturbance resulting from the construction of additional hangars, shops, and buildings would total approximately 200,000 square feet (4.6 acres) at Desert Rock Airport. A 20,000-square-foot (0.5-acre) hangar would be constructed at the Area 6 Operations Facility. Activities and facilities would be sited in appropriately zoned areas and no land use impacts are anticipated.

Because of the increased activities occurring at the Radiological/Nuclear Countermeasures Test and Evaluation Complex (RNCTEC) by the U.S. Department of Homeland Security (DHS) under this alternative, other Federal agencies performing activities involving active interrogation to detect nuclear materials would require an additional facility, most likely located in Area 12 or 16. Construction of this new facility would disturb about 100 acres of previously undisturbed land. No impacts on land use are expected because this facility would be sited in a compatible land use zone.

Approximately 200 acres of land would be used to support additional test bed applications. New buildings would occupy approximately 50,000 square feet (1.1 acres). These facilities would be constructed in operational areas within compatible land use zones; thus, no land use impacts are expected.

Airspace. Under the Expanded Operations Alternative, usage of a variety of aerial platforms, such as airplanes and helicopters, would increase for research and development and training purposes. In addition, airspace use would increase, which could result in conflicts with use of airspace over the NNSS by Nellis Air Force Base. However, impacts resulting from the increased use of NNSS airspace would be minimized through scheduling and coordination with the Nellis Air Traffic Control Facility, which manages airspace activities occurring within Nevada Test and Training Range and NNSS airspace.

5.1.1.2.2 Environmental Management Mission

Overall impacts on Environmental Management Mission activities under the Expanded Operations Alternative would be minimal because such activities would occur in specified areas that are compatible with the land use designations and there is sufficient available land within the designated zones. Additionally, an activity could be collocated within a land use zone that is capable of adequately co-hosting the activity. This section further discusses the potential impacts of the Expanded Operations Alternative on Environmental Management Mission activities.

Waste Management Program. In general, potential land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.1. This section highlights additional projects anticipated for the Waste Management Program under the Expanded Operations Alternative that could have land use impacts.

Waste disposal activities would increase, including the storage (pending treatment or disposal) of mixed low-level radioactive waste (MLLW) received from authorized generators. New disposal units would be constructed, filled, and closed to accommodate the waste volumes and types. Because all existing waste management facilities on the NNSS are located within areas designated for their specific uses, there would be no impacts on land use from activities at existing facilities. Development of new sanitary landfills in Area 23 and Area 25 would convert a combined total of 35 acres of currently unused land into waste management facilities and preclude that land from other uses.

Environmental Restoration Program. Impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.2.

5.1.1.2.3 Nondefense Mission

No land use impacts were identified resulting from the increased Nondefense Mission activities under the Expanded Operations Alternative because the changes would be compatible with the land use zones. This section further discusses the potential impacts of the Expanded Operations Alternative on Nondefense Mission programs.

General Site Support and Infrastructure Program. In general, land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.3. This section highlights additional infrastructure projects anticipated under the Expanded Operations Alternative that were analyzed for land use impacts. Increasing capacities and capabilities or extending the ranges of facilities and/or services to accommodate new operational programs and projects would result in additional infrastructure enhancements under the Expanded Operations Alternative. The following infrastructure enhancements would likely be implemented:

- Rebuild 38.5 miles of the main 138-kilovolt transmission line between Mercury Switchyard in Area 23 and Valley Substation in Area 2.

- Construct an 85,000-square-foot (1.9-acre), two-story security building in Area 23 to consolidate and replace outdated security facilities built in the 1950s and 1960s. The building would include space for administrative offices, computer infrastructure, training, and emergency response to support NNSS operations.
- Expand the cellular telecommunication system through the addition of cell towers.
- Reconfigure Mercury to provide the necessary modern facilities and infrastructure.

These changes would be compatible with the land use zones.

Conservation and Renewable Energy Program. In general, land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.3. DOE/NNSA would pursue renewable energy projects and provide support for demonstration and/or commercial projects using geothermal and solar energy. Under the Expanded Operations Alternative, DOE/NNSA proposes to build a 5-megawatt photovoltaic solar power generation facility, which would require approximately 50 acres of land near the Area 6 Construction Facilities. This solar power generation facility would likely be located within the Nuclear Test Zone and would preclude DOE/NNSA from conducting weapons-related testing or other outdoor experiments in close proximity to this new facility. However, locating this facility within this area would not affect DOE/NNSA's ability to conduct an underground nuclear test or any other weapons-related tests or experiments in other parts of the Nuclear Test Zone or Nuclear and High Explosives Test Zone. Additionally, DOE/NNSA would allow development of one or more commercial solar power generation facilities to be located within the 39,600-acre Renewable Energy Zone, with a maximum combined generating capacity of 1,000 megawatts. These facilities would be constructed in operational areas within compatible land use zones.

A Geothermal Demonstration Project would be developed as a laboratory that would both supply power to the NNSS and conduct research to improve similar systems. The NNSS would evaluate potential locations based on NNSS land use zone compatibility and other factors, including environmental considerations. Approximately 30 to 50 acres of land would be disturbed for construction of the enhanced geothermal power system. No land use impacts are expected because the geothermal power system would be sited in an appropriate land use zone.

5.1.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, the following changes to the NNSS land use zone designations would occur: the designated use for Areas 18, 19, 20, 29, and 30 would be changed from "Reserved" to "Limited Use" for military training and exercise use only.

The proposed revisions to the total acreage of the land use zones under the Reduced Operations Alternative are shown in **Table 5–3**. Although land use zones under the Reduced Operations Alternative would change, these changes are not considered adverse impacts. This is not an adverse impact on land use because the NNSS developed the land use zones for internal organizational and functional uses and to group similar uses and activities into specific areas based on the support needs of the NNSS mission, as determined by previous and anticipated uses.

Table 5–3 Changes in Land Use Zones Under the Reduced Operations Alternative

Land Use Zone	*Current Acreage*	*Proposed Acreage*	*Percent Change in Acreage*
Limited Use	0	289,800	Not applicable
Reserved Zone	410,100	120,200	-70.7

Figure 5–3 depicts the NNSS land use zones and major facilities under the Reduced Operations Alternative.

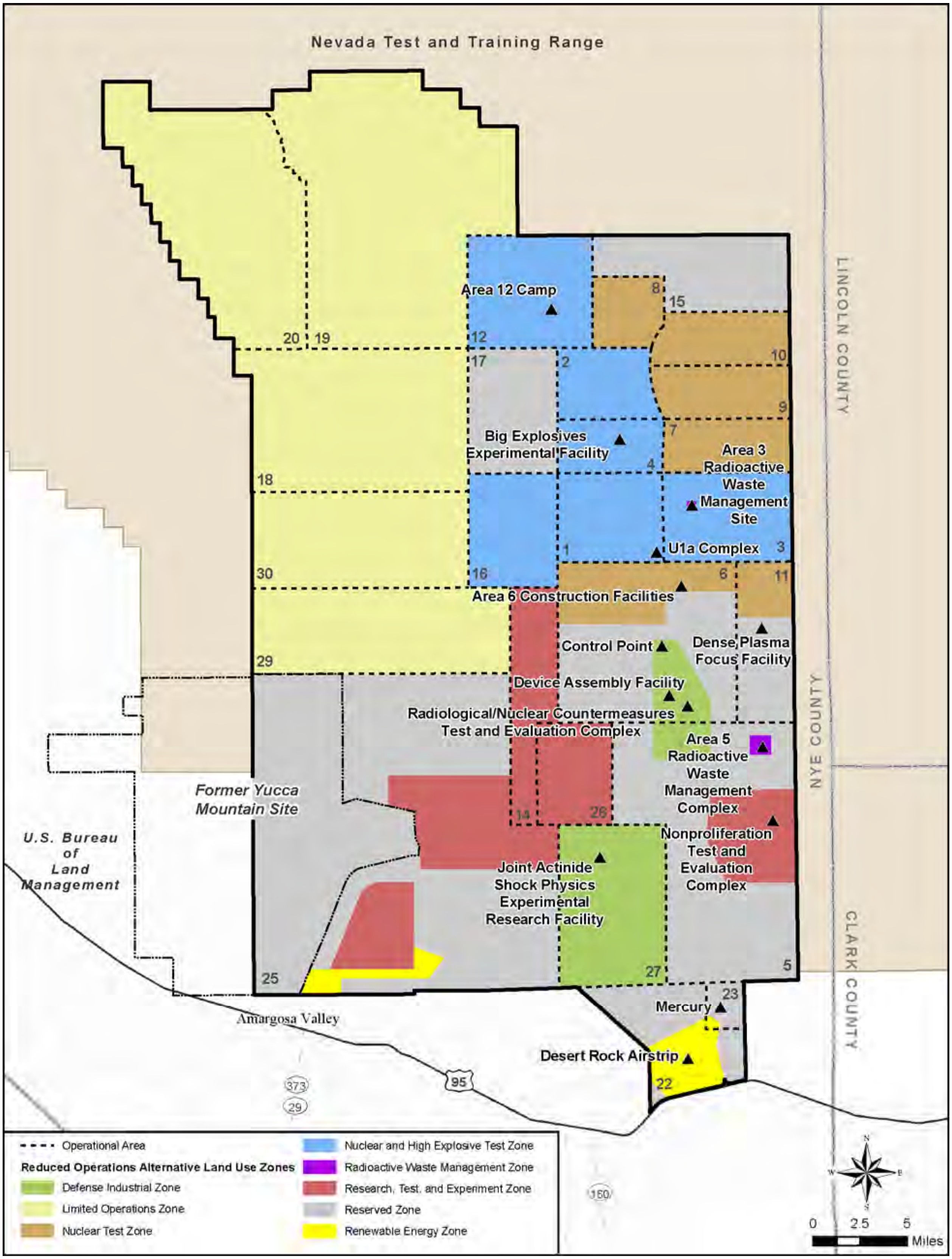


Figure 5–3 Reduced Operations Alternative and Major Facilities

5.1.1.3.1 National Security/Defense Mission

No land use impacts from National Security/Defense Mission activities under the Reduced Operations Alternative are expected because the activities would be compatible with the land use zones and there is sufficient available land within the designated zones. This section further discusses the potential impacts of the Reduced Operations Alternative on National Security/Defense Mission programs and use of airspace.

Stockpile Stewardship and Management Program. Stockpile stewardship and management activities would not be conducted in Areas 18, 19, 20, 29, and 30. There would be an approximately 10 percent decrease in activities relating to maintaining readiness to conduct underground nuclear tests and underground nuclear weapons experiments. Additionally, the Atlas Facility would be decommissioned and dispositioned. These changes would be compatible with the designated land use zones.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.1; however, no impacts are expected because activities have been curtailed.

Work for Others Program. Land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.1; however, no impacts are expected because activities have been curtailed.

Airspace. Land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.1.

5.1.1.3.2 Environmental Management Mission

Land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.2 for both the Waste Management Program and the Environmental Restoration Program.

5.1.1.3.3 Nondefense Mission

In general, land use impacts resulting from decreased Nondefense Mission activities under the Reduced Operations Alternative are not expected because the changes would be compatible with the land use zones. This section further discusses the potential impacts of the Reduced Operations Alternative on Nondefense Mission programs.

General Site Support and Infrastructure Program. Land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.1 (i.e., there would be no impacts on land use under the Reduced Operations Alternative).

Conservation and Renewable Energy Program. In general, land use impacts would be similar to those described under the No Action Alternative in Section 5.1.1.1.1. DOE/NNSA would continue to support development of a commercial solar power generation facility in Area 25, which would be sited on 2,400 acres of land; however, the net generating capacity under the Reduced Operations Alternative would be 100 megawatts. No impacts on land use are expected because this facility would be sited within a compatible land use designation zone.

5.1.2 Infrastructure and Energy

5.1.2.1 Infrastructure

This subsection presents the proposed new or expanded facilities and infrastructure projects under each alternative and addresses the potential impacts on the NNSS resulting from increases in personnel, as well as facility and project utility needs. Potential impacts are evaluated for transportation systems infrastructure, water supply infrastructure, wastewater treatment systems, and communication systems. Energy-related impacts are discussed in Section 5.1.2.2. Activities under an alternative would have an adverse impact on infrastructure and utilities if their implementation would result in any of the following effects:

- Projected increases in onsite vehicular and truck traffic, aircraft use, and parking needs would exceed the design capacity of the roads, airports, and parking lots, requiring them to be substantially expanded and improved. (Impacts on transportation system infrastructure are briefly discussed in this subsection and are analyzed in detail in Section 5.1.3, including impacts resulting from increased traffic congestion and delays, road maintenance requirements, and road safety risks.)
- Projected increases in personnel and activities would create a potable water demand exceeding the design capacity of the NNSS water supply system infrastructure, which require substantial unplanned water supply infrastructure improvements. (Impacts on water supply infrastructure are briefly discussed in this subsection and are analyzed in detail in Section 5.1.6, including impacts on groundwater aquifers.)
- Projected personnel increases would generate wastewater amounts exceeding the capacity of existing (or proposed) NNSS wastewater treatment systems, which would require substantial unplanned upgrades of sewer mains, treatment lagoons, or septic tank and leach field systems. Potential impacts on wastewater treatment systems were assessed by comparing projections of wastewater generation under each alternative against onsite treatment capacities.
- Communications infrastructure and capabilities become insufficient to support mission needs and would require substantial unplanned upgrades to resume normal functions.

5.1.2.1.1 No Action Alternative

Potential infrastructure impacts from construction and operation under the No Action Alternative are discussed below in regard to facilities, transportation systems, water supply, wastewater treatment systems, and communication systems.

Facilities. Under the No Action Alternative, DOE/NNSA would continue to maintain, repair, and replace facilities and infrastructure, as needed and within funding limits, as well as conduct small projects to maintain the present capabilities of the DOE/NNSA Nevada Site Office (NSO) facilities. Existing buildings and other facilities would be used and modified as necessary to accommodate the ongoing activities. The only significant new facility considered would be construction and operation of a 240-megawatt solar power generation facility and associated transmission lines by an outside commercial entity. DOE/NNSA estimates this facility would utilize approximately 2,000 acres (disturbing approximately 2,650 acres), including the mirror fields.

The DOE/NNSA NSO is committed to providing a smaller, safer, more-secure, and less-expensive infrastructure that leverages the scientific and technical capabilities of the workforce and meets national security requirements. To this end, ongoing operations at the NNSS aim to eliminate facility redundancies and dramatically improve efficiencies. This is being accomplished by dispositioning excess buildings that are no longer needed to support DOE/NNSA's missions, programs, or support requirements and by consolidating personnel and programs into enduring buildings, thereby optimizing building use at the NNSS. The *Ten-Year Site Plan*, the *Space Management Plan* (NSTec 2009b), and other DOE/NNSA studies delineate recommendation for building disposition and program consolidation. Up to approximately 20 percent of the existing managed building square footage at the NNSS could be dispositioned under the No Action Alternative (NNSA/NSO 2010d).

New or future projects would be reviewed pursuant to requirements in DOE "National Environmental Policy Act Implementing Procedures" (10 CFR Part 1021) and Council on Environmental Quality NEPA regulations (40 CFR Parts 1500–1508).

Furthermore, DOE/NNSA would ensure that existing facilities, as well as all new construction and renovation projects, implement design, construction, maintenance, and operation practices in conformance with the high-performance building goals and statutory requirements of Executive Order 13423 (including those of Executive Order 13514, which expands on Executive Order 13423).

Executive Order 13514 includes a requirement for Federal agencies to prepare an annual Strategic Sustainability Performance Plan. DOE Order 436.1, *Departmental Sustainability*, establishes a requirement for each DOE site to prepare a Site Sustainability Plan. DOE/NNSA's Site Sustainability Plan for the NNSS, RSL, and NLVF includes projected performance (i.e., goals) and reports accomplishment in meeting *High Performance and Sustainable Building Guidance of the Interagency Sustainability Working Group* (ISWG 2008).

Transportation Systems. The transportation infrastructure at the NNSS would be maintained for mission-related uses. Under the No Action Alternative, there would be no changes to the transportation infrastructure; therefore, no infrastructure and energy impacts are expected. The existing transportation infrastructure was designed for a considerably larger workforce and truck traffic than are expected under the No Action Alternative; therefore, it is expected to be sufficient for both present and projected future needs (see Chapter 4, Section 4.1.3, Transportation and Traffic, for further discussion of transportation issues). Transportation infrastructure maintenance expectations under the No Action Alternative are summarized below:

- Roads – DOE/NNSA would continue to maintain mission-essential and other NNSS roadways as resources permit.
- Air facilities – DOE/NNSA would continue to maintain mission-essential NNSS air facilities as resources permit.
- Parking lots – The parking infrastructure at the NNSS would be maintained.

Water Supply Infrastructure. Potable water at the NNSS is supplied through groundwater wells and a network of distribution systems, as described in Chapter 4, Section 4.1.2.1.2, Utilities. Under the No Action Alternative, water system infrastructure may require major recapitalization to meet long-term deterioration issues. Future system upgrades would be undertaken as needed, in accordance with physical infrastructure project needs; these upgrades would be conducted after appropriate NEPA review. (See Section 5.1.6 for a discussion of water supply capacity under the No Action Alternative.)

The impact of the No Action Alternative on water supply resources would be further reduced due to a concerted water conservation effort (see the discussion on water conservation in Chapter 4, Section 4.1.2), in compliance with Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and DOE Order 436.1, *Departmental Sustainability*. The NNSS expects to reduce water consumption by 16 percent from 2007 levels by 2015, an average reduction in water consumption of approximately 2 percent per year.

Under the No Action Alternative, the NNSS would continue installing water-conserving products (toilets, urinals, faucets, showerheads, boiler systems, and other water-using appliances and fixtures) when existing units require replacement. The NNSS also would continue implementing water conservation practices, including xeric landscaping, water-efficient irrigation, system audits, leak repairs, use of nonpotable water for dust suppression when possible, and the institution of 4-day workweeks (NSTec 2011c).

Wastewater Treatment Systems. Under the No Action Alternative, wastewater treatment needs would typically be maintained at current levels, except for the possible construction and operation of the solar power generation facility. The number of construction workers required for the No Action Alternative, predominantly for construction of the solar power generation facility, would average 500 workers over 35 months, with a peak of 1,000 workers. The sanitary needs of construction workers would be addressed through portable toilets and hand-washing stations, from which the sanitary waste would be transported off site by contracted septic haulers to a permitted sewage treatment facility. The sanitary needs of construction workers for this solar power generation facility would be managed by the commercial entity responsible for the project; the sanitary waste would be transported and disposed off site in accordance with all applicable regulations.

As discussed in Chapter 4, Section 4.1.2, the wastewater treatment systems at the NNSS (which include 2 wastewater treatment lagoons and 23 septic systems) are currently utilized collectively at 17 percent capacity. The existing systems have adequate capacity to handle the workers' wastewater treatment needs. Maintenance of the NNSS sanitary system's lagoons and septic systems would continue to ensure effective operation. Future system upgrades would be undertaken as needed, in accordance with physical infrastructure projects conducted after appropriate NEPA review.

The commercial solar power generation facility would include its own wastewater treatment system, for which the design and potential impacts would be defined in a subsequent NEPA review, should a project proponent come forward.

Communication Systems. The telecommunications information infrastructure is technologically dated and has been degraded in many locations (DOE 2008f). Under the No Action Alternative, the communications systems at the NNSS would be upgraded within existing utility corridors and facilities (i.e., there would be no new land disturbances) to improve the communications network in order to meet ongoing mission requirements.

5.1.2.1.2 Expanded Operations Alternative

The Expanded Operations Alternative includes the proposed new or expanded infrastructure for program support presented in **Table 5–4**. The modifications and improvements proposed to the existing infrastructure under the Expanded Operations Alternative would be adequate to accommodate the increased demand. Additional information on infrastructure demand and impacts during normal operations for the Expanded Operations Alternative is provided below. Please also see Chapter 3, "Description of Alternatives," and Appendix A, "Detailed Description of Alternatives," for further information on the Expanded Operations Alternative, as well as Section 5.1.2.2 for further discussion of energy-related infrastructure improvements. Potential infrastructure and energy impacts from construction and operation under the Expanded Operations Alternative are discussed below in regard to facilities, transportation systems infrastructure, water supply infrastructure, wastewater treatment systems, and communication systems.

In addition to impacts from DOE/NNSA activities under the Expanded Operations Alternative, Section 5.1.2.2 discusses how development of one or more commercial solar power generation facilities within the Fortymile Canyon–Jackass Flats Hydrographic Basin, as well as a Geothermal Demonstration Project that would be sited at a location to be determined, would impact the infrastructure at the NNSS. There is no specific schedule for constructing commercial-scale solar power generation facilities or a Geothermal Demonstration Project at the NNSS. The potential impacts of these projects are addressed in this *NNSS SWEIS* to enable DOE/NNSA to make a decision about whether to make land and infrastructure that is now under DOE/NNSA control available for another use by a commercial entity.

Facilities. Under the Expanded Operations Alternative, infrastructure-related activities would include increasing the capacities and capabilities or extending the ranges of facilities and/or services to accommodate new operational programs, projects, and activities, as well as repairs, replacements, and small projects required to maintain the present capabilities of the NNSS (discussed under the No Action Alternative). DOE/NNSA would also continue its commitment to eliminating facility redundancies and improving operating efficiencies by dispositioning excess buildings and consolidating personnel and programs into enduring buildings, thereby optimizing building use at the NNSS (NSTec 2009b). Up to approximately 28 percent of the existing managed building square footage at the NNSS could be dispositioned under the Expanded Operations Alternative (NNSA/NSO 2010d, 2010e).

Table 5–4 Proposed New Infrastructure for Program Support Under the Expanded Operations Alternative

Stockpile Stewardship and Management Program	
Office of Secure Transportation Complex	
Area 17	
Administrative Offices	5,000 square feet
Mock Town	870,000 square feet
Shooting House	8,000–20,000 square feet
Two Modular Training Facilities with Restrooms	4,000 square feet (2,000 square feet each)
Two Butler Buildings	10,000 square feet (5,000 square feet each)
Electrical Substation	100 square feet
Communications Trailer	300 square feet
Potable Water Tank	10,000–20,000 gallons
Septic System with Leach Field	Size not yet determined – additional NEPA review would be required
Roads (single-lane dirt roads with shoulders, including up to 4 miles of paved asphalt double-lane roads with shoulders) and Firebreaks	25 miles
Electrical Power Line	4.5 miles (approximate)
Potable Water Pipeline	4.5 miles (approximate) from existing well
Area 6, 12, or 23 (Mercury)	
Maintenance Buildings	20,000 square feet
Administrative Buildings	10,000 square feet
Dormitory	20,000 square feet
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs	
Arms Control Mission	
Indoor and Outdoor Laboratory Space and Test Ranges	100 acres
New Facility for Data Fusion, Analysis, and Visualization	10,000 square feet
Nonproliferation Mission	
New Facility	Size not yet determined – additional NEPA review would be required
Counterterrorism Mission	
Urban Warfare Complex (located in remote location on the NNSS)	100 acres (approximate)
Work for Others Program	
Counterterrorism	
Test Ranges to Include Roads, Intersections, Small Towns	75 acres
Buildings	10,000 square feet
Future Training Facilities to support U.S. Department of Homeland Security Counterterrorism Operations Support	125 acres
Buildings	10,000 square feet
Miscellaneous Work for Others	
Additional Facilities at Desert Rock Airport: Hangars, Shops, Other Buildings	200,000 square feet
Area 6 Aerial Operations Facility: Hangar	20,000 square feet
Pahute Mesa Airstrip Operations Support Building	Size not yet determined – additional NEPA review would be required
Other Locations to Support Air Operations	5,000 square feet
Active Interrogation to Detect Nuclear Material: Support Facilities in Area 12 or 16	125 acres
Test Bed Applications	200 acres
New Facilities	50,000 square feet

Stockpile Stewardship and Management Program	
Waste Management Program [a]	
Radioactive Waste Management Complex in Area 5	600 acres
Sanitary Landfill in Area 23	15 acres
Construction and Demolition Waste Landfill in Area 25	20 acres
Nondefense Mission	
New Security Building in Area 23	85,000 square feet
Photovoltaic Solar Power Generation Facility (5 megawatts) in Area 6	50 acres
Possible Commercial Energy Projects	
Commercial Solar Power Generation Facilities (1,000 megawatts) in Area 25, [b] including associated on- and offsite transmission lines	10,300 acres
Geothermal Demonstration Project	50 acres

NEPA = National Environmental Policy Act; NNSS = Nevada National Security Site.
[a] See Section 5.1.11 for discussion of waste management impacts.
[b] The commercial solar power generation facilities and Geothermal Demonstration Project would be developed, if at all, by others. Acreages for energy projects are given for land area potentially disturbed. Actual footprints may be up to 15 percent lower.

Additional programs, projects, and activities considered under the Expanded Operations Alternative may require modification and/or expansion of existing facilities and construction of new facilities. As discussed in Chapter 3, "Description of Alternatives," and Appendix A, "Detailed Description of Alternatives," the Expanded Operations Alternative would require implementation of the following facility enhancements:

- **Security building construction** – A new security building in Area 23 would be constructed adjacent to existing security facilities. This project would consolidate security facilities (Buildings 1000, 1001, 1002, 114, 701, 1103, 1106, 1107, and 1108 and portions of Control Points 41, 111, and 525) and their functions into a new, approximately 85,000-square-foot, two-story facility. The facility would include space for administrative offices, computer servers for systems supporting NNSS operations, training, emergency response, locker rooms, restrooms, storage, an armory, technology development, electronic security system engineering and maintenance, and classified work areas. The new building would replace outdated facilities, most of which were built in the 1950s and 1960s, and decrease external exposure to critical security facilities. Buildings that are replaced would be evaluated and either demolished or used for another purpose.
- **Mercury reconfiguration** – Mercury would be reconfigured to provide the modern facilities and infrastructure needed to support advanced experimentation and production at the NNSS. Although undefined at this time, this proposed project would (1) demolish facilities that are no longer needed or are not economically salvageable; (2) identify functional zones to facilitate groupings of similar activities; (3) replace obsolete buildings that are needed to support NNSS activities; and (4) improve selected facilities and infrastructure to extend useful life to accommodate existing and future support requirements. Because the reconfiguration of Mercury is conceptual in nature, an appropriate level of NEPA review and documentation would be required before it may be implemented.

Transportation Systems. Under the Expanded Operations Alternative, the current transportation infrastructure at the NNSS would be maintained for mission-related uses, and new roads and air facilities would be constructed, expanded, or improved, as discussed below. Higher numbers of personnel and activities at the NNSS would generate increased regional traffic from privately owned vehicles and trucks transporting materials and waste (see Section 5.1.3 for a discussion of traffic issues under the Expanded Operations Alternative). Transportation infrastructure maintenance expectations under the Expanded Operations Alternative are summarized below:

- **Roads –** Under the Expanded Operations Alternative, new roadways would be constructed on the NNSS, when necessary, to access newly constructed facilities and accommodate the increased traffic on the roads.

  The proposed training complex for the Office of Secure Transportation would include 25 miles of new road and firebreak construction (as shown in Table 5–4). Most of these roads and firebreaks would be scraped-dirt, single-lane roads with shoulders, with eventually up to 4 miles of paved-asphalt, double-lane roads with shoulders. The main access to the complex would be from Tippipah Highway.

  Overall, the increased traffic at the NNSS under the Expanded Operations Alternative would be acceptably handled within the design capacity of the roadway infrastructure. The existing infrastructure was designed for a much larger workforce and increased program activities. Roads that are currently classified as substandard (DOE 2008f) would require improvements. However, traffic impacts would be mitigated by construction of new roads to the new facilities, as well as maintenance and improvements to the existing roads used most frequently for mission-related purposes. Because the incremental increase in onsite traffic volumes would be moderately high (see Section 5.1.3), the number of repairs and required maintenance on NNSS roadways would increase at a higher rate than currently experienced.

- **Air facilities –** Under the Expanded Operations Alternative, various aircraft facilities potentially would be used, expanded, or improved. The following infrastructure projects associated with these aircraft facilities were described previously under "Facilities" and are shown in Table 5–4:

  - Desert Rock Airport expansion
  - Aerial Operations Facility expansion
  - Pahute Mesa Airstrip improvements
  - New Air Operations Facility construction

  These planned expansions and improvements to the air facilities under the Expanded Operations Alternative would improve aviation operations at the NNSS. These actions would be undertaken after appropriate NEPA review.

- **Parking lots –** Additional parking areas would be provided to accommodate anticipated needs at new facilities or new uses of existing facilities.

Water Supply. Under the Expanded Operations Alternative, the NNSS water supply system would be expanded as necessary to connect to new facilities. Increased potable water demand due to a 25 percent increase in workforce over current levels would affect the existing water supply infrastructure, which is currently in need of repair and upgrade. However, future system upgrades would be undertaken as needed in accordance with physical infrastructure projects conducted after appropriate NEPA review (see Section 5.1.6 for a discussion of water supply capacity under the Expanded Operations Alternative). DOE/NNSA would also continue to implement water conservation efforts under the Expanded Operations Alternative (see the discussion of water conservation in Chapter 4, Section 4.1.2).

Wastewater Treatment Systems. Under the Expanded Operations Alternative, new facilities would be connected to existing permitted wastewater treatment systems when possible, or appropriately sized and permitted wastewater treatment systems would be constructed for the new facilities. The construction phase of the Expanded Operations Alternative would require an average of 750 workers over 42 months, with a peak of 1,500 workers. The sanitary needs of the construction workers would be addressed through portable toilets and hand-washing stations, from which the sanitary waste would be transported off site by contracted septic haulers to a permitted sewage treatment facility. Sanitary waste management required for the construction of one or more commercial solar power generation facilities would be managed by the commercial entities responsible for the projects, and the sanitary waste would likely be transported and disposed off site in accordance with all applicable regulations.

During operations under the Expanded Operations Alternative, the workforce at the NNSS would increase by approximately 25 percent to about 2,575 persons, including permanent NNSS personnel, employees for solar power generation facilities, and an additional estimated 250 construction workers to implement the various construction projects proposed under the Expanded Operations Alternative.

As discussed in Chapter 4, Section 4.1.2.1, the wastewater treatment systems at the NNSS include two active sewage lagoon systems (the Mercury lagoon in Area 23 and the Yucca Lake lagoon in Area 6) and 23 currently permitted septic tank systems. These lagoons and septic tank systems have an estimated collective capacity of 199,260 gallons per day. To quantify the impact of the Expanded Operations Alternative, the capacity of each of the two lagoon systems was quantified with a projected 25 percent increase in wastewater inflow. As shown in **Table 5–5**, both sewage lagoon systems have adequate capacity to handle the estimated increase, as the Mercury lagoon would be operating at 45 percent of its capacity and the Yucca Lake lagoon at 12 percent of its capacity. New facilities proposed under this alternative are located in areas that currently use septic tank systems and would be either served by their own new septic tanks and leach fields or connected to existing septic tank systems with sufficient capacity if they are located in the vicinity.

The commercial solar power generation facilities would include their own wastewater treatment system, for which the design and potential impacts would be defined in a subsequent NEPA review, should a project proponent come forward.

Table 5–5 also shows the estimated capacity of the collective site-wide NNSS wastewater treatment systems, based on the projected new workforce population under the Expanded Operations Alternative. Given this site-wide scenario, an employee population of 2,575 workers would result in total wastewater generation of approximately 51,500 gallons per day, which amounts to 26 percent of the capacity of the collective existing wastewater treatment systems at the NNSS. Future system upgrades or installation of additional treatment systems would be undertaken as needed, in accordance with physical infrastructure projects conducted after appropriate NEPA review.

Table 5–5 Wastewater Treatment Capacity at the Nevada National Security Site Under the Expanded Operations Alternative

Sewage Lagoon	*Permit Capacity*	*Current Volume Treated (2009) (gallons per day)*	*Projected Volume Treated (25 percent increase) (gallons per day)*	*Percentage of Capacity Used*
Mercury	73,407	26,550	33,188	45
Yucca Lake	10,850	1,049	1,311	12
Workers	*Wastewater Generation (gallons per day)* [a]	*Capacity of NNSS Wastewater Treatment System (gallons per day)*	*Percentage of Capacity Used*	
2,575	51,500	199,260	26	

NNSS = Nevada National Security Site.

[a] Based on 20 gallons per day per person (see discussion in Chapter 4, Section 4.1.2.1) (CMU 2004, Table 9, p. 58; Lui and Liptak 1997, Tables 7.1.3 and 7.1.4, p. 518).

Communication Systems. Under the Expanded Operations Alternative, the NNSS telecommunication system would be upgraded to replace the existing wired telephone switch with a new one that would seamlessly transition between the older and newer technologies. The wireless elements of the trunked radio infrastructure also would be upgraded to interface with the packet-switched technology. This project would transition the subscriber units (telephones, radios, and cell phones) in a time-phased replacement program to blend all elements of the wired and wireless systems into an integrated telecommunications hierarchy (NNSA/NSO 2010c). These improvements would benefit the communications network at the NNSS and would have no adverse impact on offsite resources. DOE/NNSA would continue to participate with local governments to ensure that reliable communications interconnectivity and interoperability are achieved in accordance with the National Incident Management System.

5.1.2.1.3 Reduced Operations Alternative

For construction associated with the Reduced Operations Alternative, the facilities, transportation systems infrastructure, water supply infrastructure, wastewater treatment systems, and communication systems are adequate to handle the temporary increased demands. Under the Reduced Operations Alternative, the DOE/NNSA NSO workforce would decline, thereby reducing use of infrastructure compared to the No Action Alternative, as discussed below.

Facilities. Under the Reduced Operations Alternative, DOE/NNSA would continue to maintain, repair, and modify operating facilities and infrastructure, as needed and within funding limits, and conduct small projects to maintain the present capabilities of DOE/NNSA NSO facilities (described under the No Action Alternative). In addition, under the Reduced Operations Alternative, most activities would cease in the northwestern portion of the NNSS within Areas 18, 19, 20, 29, and 30, with the exception of maintenance and operation of the Echo Peak, Motorola, and Shoshone communications facilities; the Echo Peak, Castle Rock, and Stockade Wash Substations, including electrical transmission lines interconnecting these substations; and Well 8. DOE/NNSA would continue environmental restoration, environmental monitoring, site security operations, and military training and exercises within these areas. No infrastructure projects would be conducted in these northwestern areas beyond maintaining the noted mission-essential facilities and critical electrical and communications systems. The only significant new facility considered under the Reduced Operations Alternative would be construction and operation of a 100-megawatt solar power generation facility by an outside commercial entity in Area 25. DOE/NNSA estimates this facility would utilize approximately 1,020 acres (disturbing approximately 1,200 acres), including the mirror fields.

Transportation Systems. Under the Reduced Operations Alternative, transportation-related infrastructure at the NNSS would be maintained only for mission-related uses. Only mission-essential roadways would be maintained, and all other roadways on the NNSS would be allowed to deteriorate. This would have a minor adverse impact on the regional transportation infrastructure; however, under this alternative, the roadways would rarely be used (see Section 5.1.3 for a discussion of traffic issues under the Reduced Operations Alternative). In addition, under the Reduced Operations Alternative, there would be no change compared with the No Action Alternative regarding use of air facilities and parking lots.

Water Supply. Under the Reduced Operations Alternative, the workforce would decrease by approximately 10 percent from current levels. This smaller workforce would reduce the requirement for potable water at the NNSS, which would beneficially impact groundwater resources. The reduced workforce would decrease the requirement for potable water at the NNSS, thus creating an approximate 10 percent reduction in groundwater usage (see Section 5.1.6 for a discussion of water supply capacity under the Reduced Operations Alternative). There would be no change compared with the No Action Alternative regarding water conservation practices.

Wastewater Treatment Systems. The construction phase of the Reduced Operations Alternative would require an average of 400 workers over 32 months, with a peak of 800 workers. The sanitary needs of construction workers would be addressed through portable toilets and hand-washing stations, from which the sanitary waste would be transported off site by contracted septic haulers to a permitted sewage treatment facility. The sanitary needs of construction workers for the solar power generation facility would be managed by the commercial entity responsible for the project, and the sanitary waste would be transported and disposed off site in accordance with all applicable regulations.

During operations under the Reduced Operations Alternative, the workforce would decrease by approximately 10 percent from current levels. This smaller workforce would require less wastewater treatment at the NNSS than current levels, so there would be more than adequate capacity. As the workforce is reduced and activities and facility use are curtailed, wastewater treatment systems would be deactivated as demand decreases.

The commercial solar power generation facility would include its own wastewater treatment system, for which the design and potential impacts would be defined in a subsequent NEPA review should a project proponent come forward.

Communication Systems. There would be no change in communication systems compared with the No Action Alternative within those areas that continue to operate under the Reduced Operations Alternative. All communication operations would cease in the northwestern portion of the NNSS within Areas 18, 19, 20, 29, and 30, including the Echo Peak, Motorola, and Shoshone communications facilities. DOE/NNSA would maintain only the critical infrastructure for these facilities.

5.1.2.2 Energy

This subsection addresses potential impacts on the energy resources and distribution systems that serve the NNSS. Activities under an alternative would have an adverse impact on energy resources if their implementation would result in any of the following effects:

- Peak electrical power demands would exceed the supply capacity of local or regional distribution systems, resulting in damage to system components, voltage fluctuations, and/or temporary loss of service at frequencies beyond historical averages.
- Growth in average electrical demand would strain the supply capacity of local or regional distribution systems, resulting in the need for unplanned upgrades or diversion of supply from other planned uses.
- Peak demand for liquid fuels would exceed the capacity of onsite fuel storage systems or planned resupply schedules.
- Long-term demand for liquid fuels would strain the capacity of regional or national supply systems.

Potential impacts on energy resources were assessed by comparing projections of utility resource requirements under each alternative against utility system capacities. While some NNSS facilities do not meter utility use, annual site-wide demands are known and were used to make projections for each of the alternatives considered in this SWEIS. Additional information on policies and programs that would beneficially modify energy use patterns (conservation, energy efficiency, renewable energy development, transportation/fleet management, and high-performance, sustainable buildings) are also provided in this subsection. Unless noted otherwise, these impact criteria and methods of analysis apply to all geographic locations and action alternatives within this SWEIS.

5.1.2.2.1 No Action Alternative

Under the No Action Alternative, activities at the NNSS would primarily continue at frequencies and levels consistent with those experienced since 1996. DOE/NNSA would continue to maintain and repair facilities and associated infrastructure as needed to maintain the present capabilities of DOE/NNSA facilities. The only significant new facility considered would be construction of a large solar power generation facility by an outside commercial entity. Specific activities and their potential effects are discussed in the following subsections.

Electrical Energy. Electrical service at the NNSS is supplied by two commercial power sources: NV Energy and the Valley Electric Association (DOE 2008f). Previous studies have suggested that the onsite distribution system can support a theoretical load of approximately 72 megawatts based on the thermal limits of the smallest conductor, but outside utilities could only furnish approximately 36 megawatts because of the NNSS system's voltage constraints (DOE 2007c).

While recent estimates suggest that the maximum operating capacity is closer to 40 megawatts (NNSA/NSO 2010a), capacity at the NNSS is also limited by load demands on commercial power suppliers from other users outside the NNSS, not simply the condition of the NNSS system. Valley Electric Association's line serves additional loads including Pahrump, Lathrop Wells, and Beatty. These outside utility loads have increased at a high rate over the past decade, and the spare capacity of the 138-kilovolt transmission system available for NNSS loads has remained static or effectively decreased, despite reductions in NNSS demand.

From 2003 through 2006, annual electrical energy usage at the NNSS ranged from 57,000 to 95,000 megawatt-hours, averaging 81,000 megawatt-hours (DOE 2008f), while the total electrical usage during fiscal year (FY) 2009 was approximately 84,600 megawatt-hours. Although peak power demand at the NNSS has reached as high as 42 megawatts while nuclear testing programs were active, recent power demand typically averages 20 megawatts, with a peak demand of 27 megawatts (NNSA/NSO 2010a).

Excluding construction and operation of a commercial solar power generation facility (described in subsequent paragraphs), average power demand would likely remain near 20 megawatts, with peak demand of 27 megawatts. However, power demands in any particular year can be affected by unplanned factors, including summer temperatures that would increase power needed for facility air conditioning.

For purposes of analysis, DOE/NNSA estimated that not more than a 10 percent increase in average and peak demand would occur under the No Action Alternative, resulting in average and peak power demands of 22 and 30 megawatts, respectively. Furthermore, a 10 percent increase over DOE/NNSA's 2009 average electrical demand of 84,600 megawatt-hours would amount to approximately 93,000 megawatt-hours. During 2009, NV Energy and Valley Electric Association provided about 21,675,000 megawatt-hours, collectively. Under the No Action Alternative, DOE/NNSA's use of electricity would represent approximately 0.43 percent of the regional electrical demand (NSOE 2010).

Considering the average and peak power demands (22 and 30 megawatts, respectively) and a total NNSS system capacity of 36 megawatts, the NNSS distribution system would be adequate (with 55 to 75 percent of capacity consumed) to support power needs under the No Action Alternative. However, if future demand from offsite users on the commercial power suppliers were to increase rapidly, then the spare capacity of the NNSS distribution could potentially be reduced, resulting in adverse impacts, including voltage fluctuations and blackouts. Such impacts would limit the NNSS's ability to conduct mission-essential experiments while operating support facilities. This impact could be reduced or avoided by negotiating additional power purchases from commercial suppliers. In addition, the physical condition and reliability of the NNSS distribution system would deteriorate over time, although basic maintenance would continue under this alternative. If basic maintenance activities were insufficient to maintain system reliability, DOE/NNSA would pursue more-significant system upgrades (including replacement of some line sections, as described under the Expanded Operations Alternative) based on appropriate NEPA review and decisions.

DOE/NNSA may enter into an agreement with a commercial entity to construct a solar power generation facility within Area 25. Currently, there are no specific proposals from private applicants for construction of a commercial-scale solar power generation facility at the NNSS. To support an NNSS decision allowing commercial-level power production as a land use, DOE/NNSA has analyzed a notional design based on other proposed facilities in southern Nevada. Were a specific design to be proposed by a private applicant, additional project-level NEPA review would be required. Under the No Action Alternative, a proponent would construct a commercial solar power generation facility with a net generating capacity of 240 megawatts and would utilize a "dry" parabolic mirror technology.

This solar power generation facility would result in an additional power demand during the construction phase (estimated to last 35 months); some of this power demand would be met by using portable diesel-fuel-fired generators. This temporary power demand would likely be covered within the estimated

10 percent increase over existing levels assumed for this alternative. When this solar power generation facility is brought on line, it was assumed that it would supply a portion of its generating capacity to support NNSS needs, with the balance supplied to the outside commercial power grid.

The details of any power-sharing arrangements and the need for additional transmission lines to supply the commercial grid are not known at this time, but would be addressed in a project-specific NEPA review. The age and condition of the NNSS power system and the resulting voltage limitations would likely prevent expansion of the NNSS system's power capacity much beyond 40 megawatts, unless significant upgrades were made to the system that are not proposed within this alternative. However, any power supplied to the NNSS from this solar power generation facility would likely offset the potential losses from other commercial providers noted above and avoid adverse impacts on the NNSS distribution system. In addition, use of power from a solar power generation facility would reduce the NNSS's reliance on fossil-fuel-generated power, resulting in an indirect beneficial impact on air quality.

The existing regional electrical transmission system does not have sufficient capacity to accommodate an additional 1,000 megawatts of power. Development of the solar power generation facilities in Area 25 would require construction of additional transmission infrastructure in the region. Independent of and unrelated to the commercial solar power generation facilities considered in this *NNSS SWEIS*, NV Energy, a commercial electrical energy company, and Renewable Energy Transmission Company are planning separate, new large-capacity transmission line projects that would accommodate the additional electrical generation (see Chapter 6, Section 6.2.4.4, for additional information).

Liquid Fuels. Table 5–6 illustrates liquid fuel consumption at the NNSS for FY 2009, which DOE/NNSA estimates as representative of annual consumption rates under the No Action Alternative. The trend over the last several years has been a decline in petroleum-based fuel usage. The majority of the NNSS fleet currently operates on alternative fuels; E85 fuel is used for Alternative Fuel Vehicles (AFVs) and B-20 biodiesel is used for all diesel vehicles and off-road equipment. Biodiesel is used in all equipment except emergency generators and boilers, representing the maximum foreseeable usage level for the current equipment inventory. As of December 2008, the NNSS has 548 AFVs that are E85-capable, which equates to 94 percent of the NNSS vehicle fleet.

Table 5–6 Estimated Annual Liquid Fuel Usage Under the No Action Alternative

Fuel Type	***Quantity***
#2 Red Dye Fuel Oil for Heating	66,000 gallons
Unleaded Gasoline	427,000 gallons
Ethanol/E85	217,000 gallons
#2 Diesel	65,000 gallons
Biodiesel	343,000 gallons

Source: NNSA/NSO 2010b.

The NNSS has two service stations, each capable of storing 10,000 gallons of unleaded gasoline and 9,500 gallons of biodiesel for vehicle fueling. Each service station is collocated with an E85 fueling station. The bulk storage tanks in Area 6 are capable of storing approximately 100,000 gallons of biodiesel and 40,000 gallons of unleaded gasoline (DOE 2008l). Both bulk storage tanks are filled and maintained to support four weeks of biodiesel consumption and two weeks of unleaded fuel consumption in case of a fuel shortage (NSTec 2009e).

Under the No Action Alternative, the NNSS would not experience significant increases in workforce, fleet vehicles, or the number or size of facilities (excluding the construction and operation of the commercial solar power generation facility). DOE/NNSA has not identified any activities that would result in long-term increases or large peak demands for liquid fuels under the No Action Alternative. Fuel consumption rates are expected to remain similar to the levels seen in FY 2009. Given the volume of existing storage capacity and existing commercial supply arrangements, DOE/NNSA does not foresee difficulty in obtaining liquid fuels from regional suppliers to meet its needs. The NNSS's annual fuel demands make up a very small proportion of total fuel use in the state for most liquid fuels (e.g., less than 0.05 percent of unleaded gasoline use) and are not expected to strain local and regional fuel supply networks (NSOE 2009). However, the NNSS is a major consumer of biodiesel in Nevada, making up approximately 60 percent of the statewide total demand of 575,000 gallons (NSOE 2009). Although not anticipated, if demand were to exceed regional supply, the NNSS could temporarily switch to petroleum-based diesel for most applications until biodiesel is available again.

Construction of a commercial solar power generation facility would result in large numbers of personal vehicles, construction equipment, and diesel generators operating on the NNSS for up to 35 months. However, these activities are not expected to use NNSS fuel supplies; fuel for this activity would be the responsibility of the commercial entity conducting the construction. Similarly, small quantities of fuel may be needed for the operation of the solar power generation facility (supporting heaters, emergency generators, etc.), but this demand would be met by the commercial operator of the facility.

Energy Conservation. Under all alternatives, DOE/NNSA would continue to identify and implement energy conservation measures and renewable energy projects in compliance with all applicable Executive Orders and DOE Orders and policies. These initiatives would serve to reduce consumption of electrical power and liquid fuels on a per-unit basis, suggesting that the estimates for total consumption under this alternative are conservative in nature, as well as potentially avoid adverse impacts related to energy capacity. These measures would also result in a greater proportion of energy use coming from renewable sources, reducing dependence on fossil fuels, and potentially resulting in indirect beneficial impacts on air quality and other environmental resources. The following are some specific examples of energy conservation measures:

- DOE/NNSA would improve energy efficiency and reduce greenhouse gas emissions through reduction of energy intensity by 3 percent annually and a total of 30 percent through the end of FY 2015, relative to the energy use baseline in FY 2003. Energy intensity is the energy consumption per gross square foot of building space, including industrial and laboratory facilities.
- DOE/NNSA would continue installation of advanced electric metering systems to the extent practicable at all NNSS buildings, as well as implementation of a centralized data collection, reporting, and management system.
- DOE/NNSA would maximize installation of onsite renewable energy projects at the NNSS where technically and economically feasible, with the goal of acquiring at least 7.5 percent of the NNSS's annual electricity and thermal consumption from onsite renewable sources.
- DOE/NNSA would ensure that new construction and renovation projects include design, construction, maintenance, and operation practices in support of the high-performance building goals of Executive Order 13423.

5.1.2.2.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, the NNSS would experience a workforce increase of approximately 25 percent, support several new or expanded facilities, and see an overall increase in the frequency and scope of defense experiments and other activities. These changes have the potential to noticeably increase long-term demands for electrical power and liquid fuels, as well as produce demand peaks during major construction efforts or specific experiment events. However, DOE/NNSA is also proposing upgrades to the electrical distribution system, development of onsite renewable energy sources, consolidation or closure of unused facilities, and measures to improve energy conservation and efficiency that would collectively reduce or avoid adverse impacts on energy capacity or supply. Specific activities and their potential effects are discussed in the following subsections.

Electrical Energy. DOE/NNSA is proposing new or expanded facilities in locations including Areas 6, 12, 16, 17, and 23 (Mercury), as well as the Desert Rock and Pahute Mesa Airstrips. Section 5.1.2.1

provides a detailed description of facility sizes, configurations, and locations. All construction or renovation activities would result in temporary increases in electrical power demand; some of this temporary demand would be met by using portable generators rather than tie-ins to the NNSS electrical distribution system. As noted in Chapter 3 of this SWEIS, some facilities are still in the conceptual planning phase and would be analyzed in future NEPA documents when planning and design have evolved.

Operation of new facilities that would support new mission elements or capabilities would result in a clear increase in electrical power demand on the NNSS. However, these new facilities would likely be more energy-efficient than existing buildings, due to implementation of more energy-efficient components and practices. In cases where new facilities would be constructed to relocate or consolidate existing functions (e.g., consolidation of security functions in Area 23), long-term power demand associated with those functions would likely be lower than previous levels.

Proposals under the Expanded Operations Alternative could result in development of more than 400,000 square feet of building space (added to the approximate 2.45 million square feet currently managed) on the NNSS, or an approximate 16 percent increase. It is reasonably foreseeable that DOE/NNSA would also decommission any existing buildings that are no longer needed, as it has committed to an ongoing reduction of the total building footprint through its Facility and Infrastructure Assessment Process. Up to approximately 28 percent of the existing managed building square footage at the NNSS could be dispositioned under the Expanded Operations Alternative (NNSA/NSO 2010d, 2010e). However, the period between completion of a new construction project and initiation of decommissioning activities is unknown; when dispositioning occurs, it would further reduce the electrical energy demand.

To account for any uncertainties regarding changes in building square footage and associated power demands in any particular year, implementation of energy efficiency measures to new and existing buildings, and an anticipated 25 percent increase in NNSS workforce numbers, DOE/NNSA estimates that average power demand would increase by no more than 25 percent from that analyzed under the No Action Alternative in any year, while peak power demand (including demand associated with construction or renovation activities) would increase by no more than 35 percent. A 35 percent increase over DOE/NNSA's 2009 average electrical demand of 84,600 megawatt-hours would amount to approximately 105,700 megawatt-hours. During 2009, NV Energy and Valley Electric Association provided about 21,675,000 megawatt-hours, collectively. Under the Expanded Operations Alternative, NNSS use of electricity would represent approximately 0.49 percent of the regional electrical demand (NSOE 2010).

The projected increases would result in an average power demand of approximately 28 megawatts, with a peak demand of approximately 41 megawatts. The capacity of the existing NNSS distribution system (estimated at approximately 36 megawatts) would be sufficient to meet average demand, but peak demand periods could exceed the capacity, potentially resulting in voltage fluctuations or blackouts. As noted under the No Action Alternative, any reduction in supply to the NNSS from commercial power suppliers would also reduce the effective supply to the NNSS, making these adverse effects more likely.

Under the Expanded Operations Alternative, DOE/NNSA would propose to upgrade the existing 138-kilovolt electrical distribution system to better provide for this projected demand, increase service reliability, and leave capacity to support any future growth on the NNSS. About 39 miles of the existing system would be replaced between Mercury Switching Center in Area 23 and Valley Substation in Area 2. The replacement transmission line would be constructed on steel towers on a right-of-way generally paralleling the existing system. Sufficient separation between the existing transmission line and the new line would be required to ensure electrical safety during construction of the new line and demolition of the old line.

The transmission line replacement project would occur in three distinct and separately operable stages: (1) Mercury Switching Center to Frenchman Flat Substation, with a loop tap at Mercury Distribution Substation (approximately 15 miles); (2) Frenchman Flat Substation to Tweezer Substation in Area 6 (approximately 9.5 miles); and (3) Tweezer Substation to Valley Substation in Area 2 (approximately 14 miles). DOE/NNSA would coordinate this upgrade, or distinct stages of it, with other proposed activities under this alternative to ensure that additional system capacity and reliability were in place prior to significant additional power demands coming on line.

The new transmission line would increase the capacity of the system from the current level of about 36 megawatts up to approximately 100 megawatts and improve the efficiency of the system (NNSA/NSO 2010c). However, to utilize any capacity above the current level of 36 megawatts, DOE/NNSA would need to purchase additional power from a supplier and could seek to negotiate additional power through an offsite commercial provider, such as NV Energy or Valley Electric Association, if the onsite solar power generation facility is not constructed. If additional power is available from these outside commercial providers, the NNSS's distribution system would be adequate to meet all projected demands, and no adverse impacts are expected. However, it is not known whether these commercial providers would be able to accommodate NNSS's additional power demands at that time.

Under the Expanded Operations Alternative, DOE/NNSA may allow the construction and operation of one or more solar power generation facilities similar to the facility described under the No Action Alternative, but with a net generating capacity of approximately 1,000 megawatts. If these facilities were constructed, DOE/NNSA would likely seek to purchase a portion of the facilities' power, while the balance would be exported to the commercial power grid. This arrangement would allow NNSS's electrical distribution system to meet all projected demands, and no adverse impacts are expected. Such a power-sharing agreement would also enable the NNSS to better meet its goals for use of renewable energy sources, as well as reduce the NNSS's reliance on fossil-fuel-generated power, resulting in an indirect beneficial impact on air quality and other environmental resources.

In addition, under the Expanded Operations Alternative, DOE/NNSA would construct a 5-megawatt photovoltaic solar power generation facility near the Area 6 Construction Facilities. While this project would result in a temporary additional demand for electrical power during construction (covered within the increases estimated under this alternative), it would later provide an additional source of power for the NNSS distribution system and further DOE/NNSA's progress toward reducing dependence on fossil-fuel-based electricity.

DOE/NNSA would also evaluate the feasibility of demonstrating a pilot-scale, enhanced geothermal power system (also referred to as a "Geothermal Demonstration Project"). The primary objective would be to demonstrate the viable recovery of a practical operating level energy (5 to 50 megawatts) from rock that is hot (greater than 180 degrees Celsius [ºC]), but does not contain mobile water. The size of the pilot-scale geothermal power system would be unique to each site's geothermal characteristics and based on the optimal balance of temperature, rock reservoir size, heat exchange rate, water pressure, and flow rate, among other factors. If this pilot-scale Geothermal Demonstration Project were found to be technically feasible, it would then serve as a testing facility for improvements applicable to similar systems elsewhere, as well as supply some additional electrical power to the NNSS. A decision on the best location for a geothermal power system would depend on a combination of the system's power generation potential, environmental constraints, and economic considerations. Because there are no location-specific proposals for development of a geothermal power system on the NNSS at this time, additional NEPA review would be required before such work could be conducted.

Liquid Fuels. DOE/NNSA is proposing new or expanded facilities in locations including Areas 6, 12, 16, 17, and 23 (Mercury), as well as Desert Rock and Pahute Mesa Airstrips. Section 5.1.2.1 provides a detailed description of facility sizes, configurations, and locations. All construction or renovation activities would result in temporary increases in liquid fuel demand. In some cases, long-term increases in total fuel usage may be required to operate additional buildings and equipment and meet the greater vehicle fuel needs associated with the increased frequency of certain experiments and training activities.

However, the planned consolidation of certain functions (e.g., consolidation of security functions in Area 23) would reduce the need to travel between locations, thereby reducing associated vehicle requirements and fuel consumption. All new buildings are also expected to be more fuel-efficient on a square-foot basis due to the inclusion of "green" technologies in building design. As noted in Chapter 3 of this SWEIS, some other facilities are still in the conceptual planning phase and would be analyzed in future NEPA documents when planning and design have evolved further.

To account for changes in building square footage, the timing of construction projects, implementation of energy efficiency measures, and an anticipated 25 percent increase in NNSS workforce numbers, DOE/NNSA estimates that annual liquid fuel demand would increase by no more than 25 percent from that analyzed under the No Action Alternative in any year. While additional demand associated with vehicles would likely be associated with nonpetroleum fuels (E85 and biodiesel), it is reasonably foreseeable that other uses (boilers, emergency generators) would increase the use of petroleum-based fuels (heating oil, #2 diesel, unleaded gasoline) if they could not be configured for alternative fuels. **Table 5–7** presents estimated annual liquid fuel demand under the Expanded Operations Alternative.

Table 5–7 Estimated Annual Liquid Fuel Usage Under the Expanded Operations Alternative

Fuel Type	*Quantity*
#2 Red Dye Fuel Oil for Heating	83,000 gallons
Unleaded Gasoline	534,000 gallons
Ethanol/E85	271,000 gallons
#2 Diesel	81,000 gallons
Biodiesel	429,000 gallons

New facilities with boilers or liquid-fuel-fired heating units would include adjacent fuel storage tanks in their designs. DOE/NNSA would also retain the vehicle service stations and the Area 6 bulk storage tanks (kept filled to 80 percent capacity) described under the No Action Alternative. Given the volume of existing storage tanks and existing commercial supply arrangements, DOE/NNSA does not foresee difficulty in obtaining liquid fuels from regional suppliers to meet its needs. The NNSS's projected annual fuel demands would make up a very small proportion of the current, total fuel use in the state for most liquid fuels (e.g., approximately 0.05 percent of unleaded gasoline use) and are not expected to strain local and regional fuel supply networks (NSOE 2009). However, the NNSS is a major consumer of biodiesel in Nevada, making up approximately 60 percent of the statewide total demand of 575,000 gallons (NSOE 2009); under this alternative, DOE/NNSA would increase consumption of biodiesel to about 75 percent. Although not anticipated, if demand were to exceed regional supply, the NNSS could temporarily switch to petroleum-based diesel for most applications until biodiesel is available again.

Construction of one or more commercial solar power generation facilities with a 1,000-megawatt combined capacity would result in large numbers of personal vehicles, construction equipment, and diesel generators operating on the NNSS for up to 42 months. However, these activities are not expected to use NNSS fuel supplies; fuel for this activity would be the responsibility of the commercial entity conducting the construction. Similarly, small quantities of fuel may be needed for operation of the commercial solar power generation facilities (supporting heaters, emergency generators, etc.), but this demand would be met by the commercial operator of the facility.

Construction and operation of the 5-megawatt photovoltaic solar power generation facility in Area 6 and the Geothermal Demonstration Project (no specific location proposed at this time) would also use small quantities of liquid fuel to supply emergency generators, heaters, and/or boilers. DOE/NNSA estimates that the fuel demand from these activities would be captured within the 25 percent overall demand increase associated with this alternative.

Energy Conservation. DOE/NNSA would continue to identify and implement the energy conservation measures and renewable energy projects described under the No Action Alternative. These initiatives would serve to reduce consumption of electrical power and liquid fuels on a per-unit basis, suggesting that the estimates for total consumption under this alternative are conservative in nature and would potentially avoid adverse impacts related to energy capacity. These measures would also result in a greater proportion of energy use coming from renewable sources, reducing dependence on fossil fuels, and potentially resulting in indirect beneficial impacts on air quality and other environmental resources.

5.1.2.2.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, the NNSS would operate below current levels, and a number of facilities would be decommissioned, thereby reducing energy needs. Conservation and renewable energy goals would continue to be pursued, further reducing energy demand.

DOE/NNSA would continue to maintain, repair, and modify operating facilities and infrastructure, as needed and within funding limits, and would conduct small projects to maintain the present capabilities of DOE/NNSA NSO facilities (described under the No Action Alternative). Under the Reduced Operations Alternative, however, all activities would cease in the northwestern portion of the NNSS within Areas 18, 19, 20, 29, and 30, with the exception of maintenance and operation of the Echo Peak, Motorola, and Shoshone communications facilities; the Echo Peak, Castle Rock, and Stockade Wash Substations, including electrical transmission lines interconnecting these substations; and Well 8. DOE/NNSA would continue environmental restoration, environmental monitoring, site security operations, and military training and exercises within these areas. No infrastructure projects would be conducted in these northwestern areas beyond maintaining mission-essential facilities and critical electrical and communication systems. The Reduced Operations Alternative also includes a 100-megawatt commercial solar power generation facility in Area 25.

Additional information on energy use (electrical and liquid fuels) and energy conservation and efficiency is provided below.

Electrical Energy. Under the Reduced Operations Alternative, net NNSS power demand would be reduced as numerous activities across the NNSS were scaled back or eliminated. Based on a projected 10 percent decrease in staffing at the NNSS and the eventual closure of several facilities, DOE/NNSA estimated that average power demand would decrease by 10 percent (to 20 megawatts) compared to demand under the No Action Alternative, and peak demand would decrease by 10 percent (to 27 megawatts). A 10 percent decrease from DOE/NNSA's 2009 average electrical demand of 85,600 megawatt-hours would reduce demand to approximately 76,140 megawatt-hours. During 2009, NV Energy and Valley Electric Association provided about 21,675,000 megawatt-hours, collectively. Under the Reduced Operations Alternative, use of electricity would represent approximately 0.35 percent of the regional electrical demand (NSOE 2010). These projected demand reductions, along with ongoing implementation of energy efficiency measures, would make the current distribution system capacity of 36 megawatts adequate for both average and peak power demands.

As noted under other alternatives, any reduction in power to the NNSS from commercial suppliers would reduce the effective power supply on the NNSS, which would make adverse effects (e.g., voltage fluctuations and temporary loss of service) possible, but still unlikely. In addition, the physical condition and reliability of the NNSS distribution system would deteriorate over time, although basic maintenance would continue under this alternative. If basic maintenance activities were insufficient to maintain system reliability, DOE/NNSA would pursue the more significant system upgrades (including replacement of some line sections) as described under the Expanded Operations Alternative, based on a future NEPA review and decision.

Under the Reduced Operations Alternative, DOE/NNSA may allow construction and operation of a solar power generation facility similar to that described under the No Action Alternative. However, the size of this facility would be reduced, resulting in a net generating capacity of approximately 100 megawatts. If this facility were constructed, DOE/NNSA would likely seek to purchase a portion of this facility's power, and the balance would be exported to the commercial power grid. This arrangement would allow NNSS's distribution system to meet all projected demands with more confidence, and no adverse impacts are expected. Such a power-sharing agreement would also enable the NNSS to better meet its goals for use of renewable energy sources by reducing the NNSS's reliance on fossil fuel-generated power, resulting in an indirect beneficial impact on air quality and other environmental resources.

Liquid Fuels. Under the Reduced Operations Alternative, liquid fuel demand from all uses would decrease as activity and staffing levels were reduced. DOE/NNSA estimates that demand for all fuel types would decrease by approximately 10 percent from the levels seen in the No Action Alternative. **Table 5–8** presents estimated annual fuel demand under the Reduced Operations Alternative.

Table 5–8 Estimated Annual Liquid Fuel Usage Under the Reduced Operations Alternative

Fuel Type	*Quantity*
#2 Red Dye Fuel Oil for Heating	59,000 gallons
Unleaded Gasoline	384,000 gallons
Ethanol/E85	195,000 gallons
#2 Diesel	59,000 gallons
Biodiesel	309,000 gallons

Given the volume of existing storage tanks (described under the No Action Alternative) and existing commercial supply arrangements, DOE/NNSA does not foresee difficulty in obtaining liquid fuels from regional suppliers to meet its needs. The NNSS's projected annual fuel demands would make up a very small proportion of current, total fuel use in the state for most liquid fuels (for example, less than 0.04 percent of unleaded gasoline use) and are not expected to strain local and regional fuel supply networks (NSOE 2009). However, the NNSS is a major consumer of biodiesel in Nevada, making up approximately 60 percent of the statewide total demand of 575,000 gallons (NSOE 2009); under this alternative, DOE/NNSA would decrease consumption of biodiesel to about 54 percent. Although not anticipated, if demand were to exceed regional supply, the NNSS could temporarily switch to petroleum-based diesel for most applications until biodiesel is available again.

Construction of a commercial 100-megawatt solar power generation facility would result in large numbers of personal vehicles, construction equipment, and diesel generators operating on the NNSS for up to 32 months. However, these activities are not expected to use NNSS fuel supplies; fuel for this activity would be the responsibility of the commercial entity conducting the construction. Similarly, small quantities of fuel may be needed for operation of the solar power generation facility (supporting heaters, emergency generators, etc.), but this demand would be met by the commercial operator of the facility.

Energy Conservation. DOE/NNSA would continue to identify and implement the energy conservation measures and renewable energy projects described under the No Action Alternative. These initiatives would reduce consumption of electrical power and liquid fuels on a per-unit basis, suggesting that the estimates for total consumption under this alternative are conservative in nature, and would potentially avoid adverse impacts related to energy capacity. These measures would also result in a greater proportion of energy use coming from renewable sources, reducing dependence on fossil fuels, and potentially resulting in indirect beneficial impacts on air quality and other environmental resources.

5.1.3 Transportation and Traffic

Section 5.1.3.1 evaluates both radiological and nonradiological impacts from shipment of radioactive waste to the NNSS, onsite shipment of radioactive waste, and shipment of other radioactive materials to and from the NNSS; only nonradiological impacts would result from shipment of nonradioactive materials. Radiological impacts are those associated with the effects of low levels of radiation emitted during incident-free transportation and those resulting from the accidental release of radioactive materials; radiological impacts are expressed as additional latent cancer fatalities (LCFs). Nonradiological impacts are independent of the nature of the cargo being transported and are expressed as traffic accident fatalities when there is no release of radioactive material. Note that all shipments must meet U.S. Department of Transportation (DOT) regulations, and the packaging of radioactive materials must meet U.S. Nuclear Regulatory Commission regulations, as discussed in Appendix E, Sections E.3.1 and E.3.2. NNSS shipments have never exceeded regulatory requirements for transportation radiation limits.

Section 5.1.3.2 discusses the traffic impacts that would result from changes in the current numbers of personnel trips and trucks transporting radioactive and nonradioactive materials due to the differing activity levels among alternatives. Traffic impacts are expressed as the percent change in the number of onsite and regional (i.e., offsite) daily vehicle trips and changes in roadway levels of service associated with transporting personnel, materials, and waste.

Transportation—American Indian Perspective

CGTO Indian reservations within the region of influence are located in remote areas with limited access by standard and substandard roads. Should an emergency situation arise resulting from Nevada National Security Site (NNSS)-related activities, including the transportation of hazardous and radioactive waste, it could result in the closure of the main transportation artery to that land. If a major (only) road into a reservation closes, numerous adverse social and economic impacts could occur. For example, Indian students who have to travel an unusually high number of miles to or from school could realize delays or separation from their families or support systems. Delays could also occur for regular deliveries of necessary supplies for inventories needed by tribal enterprises and personal use or medical supplies. Emergency medical services en route to or from the reservation, and purchases by patrons of tribal enterprises could be dramatically impeded. Potential investors interested in expanding tribal enterprises, as well as on-going considerations by tribal governments for future or current tribal enterprises, may significantly diminish because of the real and perceived risks from the transportation of hazardous and radioactive waste associated with NNSS-related activities.

Because of these potential transportation impacts relating directly to NNSS activities, the Consolidated Group of Tribes and Organizations (CGTO) recommends the U.S. Department of Energy (DOE) collaborate with potentially affected tribes to develop emergency response measures regarding transportation.

See Appendix C for more details.

The following criteria are used to analyze the risks of potential transportation activities during incident-free operations and accidents:

- Radiation dose and risk to the public, including cumulative effects on the population and effects on maximally exposed individuals (MEIs)
- Radiation dose and risk to workers, including cumulative effects on the worker population and effects on MEIs
- Number of traffic fatalities resulting from traffic accidents (not related to the radioactive cargo)

These criteria are used to evaluate potential impacts on onsite and regional traffic conditions:

- Percent change in average daily traffic for onsite and regional traffic conditions
- Degree of change in the volume-to-capacity and resulting level of service for key roadways under regional traffic conditions

Increases in nonradioactive pollutants from traffic emissions are discussed in Section 5.1.8. Appendix E contains a more detailed description of the transportation analysis and results.

5.1.3.1 Transportation

Methodology and Assumptions. Shipping packages containing radioactive materials emit low levels of radiation; the amount of radiation depends on the kind and amount of transported materials. DOT regulations (49 CFR Part 173 Subpart I) require shipping packages containing radioactive materials to have sufficient radiation shielding to limit the radiation to 10 millirem per hour at a distance of 6.6 feet from the transporter. For incident-free transportation, the potential human health impacts of the radiation field surrounding the transportation packages were estimated for transportation workers and the general population along the route (off-traffic, or off-link), as well as for people sharing the route (in-traffic or on-link) and at rest areas and other stops along the route. The Radioactive Material Transportation Risk Assessment Code 6 (RADTRAN) computer program (SNL 2009b) was used to estimate the impacts on transportation workers, the public, and an MEI (e.g., a person stuck in traffic, a gas station attendant, an inspector).

Transportation accidents involving radioactive materials present both nonradiological and radiological risks to workers and the public. Nonradiological impacts of transportation accidents include traffic accident fatalities. Radioactive material would be released during transportation accidents only when the package carrying the material is subjected to forces that exceed the package design standard. Only a severe fire and/or a powerful collision, both events of extremely low probability, could damage a transportation package of the type used to transport radioactive material to the extent that radioactivity would be released to the environment with significant consequences.

The radiological impact of a specific accident is expressed in terms of probabilistic risk (i.e., dose-risk), which is defined as the accident probability (accident frequency) multiplied by the accident consequences (dose). The overall radiological risk estimate is obtained by summing the individual radiological risks from all reasonably conceivable accidents. Analysis of accident risks accounts for a spectrum of accident severities, ranging from high-probability accidents of low severity (e.g., fender benders) to hypothetical high-severity accidents that have a low probability of occurrence. In addition to calculating the radiological risks that would result from all reasonably conceivable accidents during transportation of radioactive materials, this SWEIS assesses the highest consequences of a maximum reasonably foreseeable accident with a radioactive release frequency greater than 1×10^{-7} (1 chance in 10 million) per year in an urban or suburban population area along the route. This latter analysis used the

Waste Transportation through the Las Vegas Valley

Historically, the U.S. Department of Energy (DOE) committed to the State of Nevada that it would avoid shipping low-level radioactive waste (LLW) through the Interstate 15/U.S. Route 95 interchange in Las Vegas, Nevada. This commitment was made when major highways, such as Interstate 15 and U.S. Route 95, were unable to accommodate increased traffic volumes. The commitment, as stated in the Waste Acceptance Criteria (WAC) for the Nevada National Security Site (NNSS), avoided Hoover Dam and Las Vegas. In compliance with this requirement, commercial carriers of LLW used alternate shipping routes, such as Nevada State Route 160.

Now, the transportation infrastructure throughout metropolitan Las Vegas, such as Interstate 15 and U.S. Route 95, has been expanded and improved. In addition, the 215 Beltway was built to take traffic around the center of Las Vegas. Moreover, highways that continue to be used to transport waste, such as Nevada State Route 160, have experienced increased traffic as the population has grown in that area of the valley.

The National Nuclear Security Administration (NNSA) has analyzed two transportation cases: one that reflects the existing commitment (Constrained Case) and one that permits shipments through the greater metropolitan Las Vegas area (Unconstrained Case). This analysis was undertaken to develop a greater understanding of the potential environmental consequences of shipping such waste through and around metropolitan Las Vegas and to provide information relevant to consideration of potential highway routing-related revisions to NNSS's WAC. Although an analysis of LLW/mixed low-level radioactive waste (MLLW) shipping routes is included in this site-wide environmental impact statement, individual decisions on routing will not be made as part of this National Environmental Policy Act process. Such decisions are developed in accordance with NNSA's standard practices, which include consultation with the State of Nevada, and, when finalized, become publicly available through publication on the NNSS website.

After consultation with the Nevada Division of Environmental Protection as part of the WAC revision process, DOE/NNSA announced in September 2012 (www.nv.doe.gov) that it would retain the current highway routing restrictions for shipments of LLW/MLLW in the greater Las Vegas metropolitan area and, therefore, there would be no need to revise the WAC in this regard (DOE 2012).

Risks and Consequences of Radioactive Material Transport (RISKIND) computer program to estimate doses to individuals and populations (Yuan et al. 1995).

Incident-free radiological health impacts are expressed in terms of additional LCFs. Radiological health impacts from accidents are also expressed as additional LCFs. Nonradiological accident impacts are expressed as additional immediate (traffic accident) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by a dose conversion factor of 0.0006 LCFs per rem or person-rem of exposure (DOE 2003d). The health impacts associated with the shipment of radioactive wastes were calculated assuming that all wastes would be transported using either truck or rail transport. Health impacts associated with the shipment of special nuclear material (SNM) and nuclear weapons were calculated assuming these materials would be transported by DOE safeguards transporters.

In determining transportation risks, per-shipment risk factors were calculated for incident-free and accident conditions using the RADTRAN 6 computer program (SNL 2009b) 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 2000 U.S. census. The population density estimates were escalated to 2016 population density estimates using state-level 2000 and 2010 census data and assuming population growth between 2000 and 2010 would continue through 2016. The region of influence 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 on modeling and parameter selections are provided in Appendix E of this SWEIS.

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). Statistics specific to DOE safeguards transporters are used for safeguards transporters shipments (Phillips, Clauss, and Blower 1994). The methodology for obtaining and using accident and fatality rates is provided in Appendix E, Section E.6.2.

This *NNSS SWEIS* presents transportation analyses of two cases: a Constrained Case and an Unconstrained Case.

Maximally Exposed Individual (MEI) – A hypothetical individual whose location and habits result in the highest total radiological exposure (and thus dose) from a particular source for all relevant exposure routes (e.g., inhalation, ingestion, direct exposure).

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 using 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. The average dose to an individual in the United States received primarily from natural background sources of radiation is about 310 millirem per year; the national average, including medical sources, is about 620 millirem per year.

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. This site-wide environmental impact statement focuses on LCFs as the primary means of evaluating health risk from radiation exposure. The values reported for LCFs are the increased risk of a fatal cancer for an MEI or noninvolved worker or the increased risk of a single fatal cancer occurring in an identified population.

Constrained Case

For the Constrained Case, DOE/NNSA was assumed to maintain current operational practices by avoiding transporting waste and materials across the Colorado River near the Hoover Dam and on the interstate system within Las Vegas. It was further assumed that shipments approaching the NNSS from the south (via Interstate 40 [I-40]) would use U.S. Route 95 to Nevada State Route 164, to I-15, to Nevada State Route 160, to U.S. Route 95. Shipments approaching the NNSS from the north would use U.S. Routes 50, 6, and 95. Shipments from the TTR would use U.S. Routes 6 and 95. The Constrained Case is analyzed for all alternatives and addresses both radioactive waste and other radioactive material transports.

As appropriate, for each SWEIS alternative, transportation impacts were evaluated for transport of (1) LLW and MLLW to the NNSS for disposal and from the NNSS to a treatment facility and then returned; (2) transuranic (TRU) waste from the NNSS to Idaho National Laboratory (INL) for treatment and certification; (3) SNM to and from the NNSS; (4) nuclear weapons to and from the NNSS for exchange of limited life components; (5) nuclear weapons to the NNSS for dismantlement and subsequent transport of plutonium to Pantex, canned subassemblies to the Y-12 Plant, and milliwatt generators to Los Alamos National Laboratory; (6) sealed sources from San Antonio, Texas, to the NNSS; and (7) nonradioactive hazardous and sanitary waste and recyclables from the NNSS. The numbers of transports of LLW and MLLW to the NNSS were based on DOE/NNSA projections as estimated by waste generators (see Appendix E, Table E–3). The numbers of transports for other wastes and materials were based on programmatic needs as described in Appendix A.

For the Expanded Operations Alternative, LLW and MLLW volumes from waste generators were determined using data from the Waste Management Information System. These waste volumes were apportioned to containers and number of shipments using historical data regarding the types of containers typically received (note that containers may be used to transport waste to the NNSS that were not assumed as part of this analysis, as described in Appendix E, Table E–4). These volumes were apportioned to regions of the United States (see Appendix E, Figure E–2) based on the locations of the waste generators. The following regions were used for analyzing radioactive waste shipments: Northeast, South, Southeast, Upper Midwest, Southwest, Mountain West, West, and Northwest (see Appendix E, Figure E–2, for a depiction of the regions). The transportation analysis was based on the regional waste volume totals so that waste generators would not be limited to those obtained from the Waste Management Information System. The waste volume from each region was assumed to be received from a regional location that would provide a conservative estimate of the impacts from transporting from that region based on distance traveled and population density along the route. This approach was used because not all potential waste generators may be identified in the Waste Management Information System and to account for the amount of uncertainty in the magnitude of waste volume projections.

For the No Action Alternative and Reduced Operations Alternative, it was assumed that the total amount of LLW to be received over a 10-year period, 15,000,000 cubic feet, would be based on the average annual volumes received between FY 1997 and the end of FY 2010. The volume of MLLW analyzed under the No Action and Reduced Operations Alternatives is 900,000 cubic feet, which was based on the permitted volume of Cell 18 at the Area 5 Radioactive Waste Management Complex (RWMC) (the actual permitted volume is 899,996 cubic feet). This volume was apportioned to the waste generators shown in Appendix E, Table E–3, using the percentage of the total volume each waste generator contributed to the waste projections under the Expanded Operations Alternative.

DOE has completed NEPA documentation for other projects in the DOE Complex in which waste was projected to be transported to the NNSS; these documents have not yet been included in the Waste Management Information System. These waste streams are included under the Expanded Operations Alternative with their transportation impacts shown separately. These waste streams include conversion products from Portsmouth, Ohio, and Paducah, Kentucky (DOE 2004e, 2004d), decommissioning waste from the West Valley Demonstration Project (DOE 2010c), and uranium-233 downblending waste from Oak Ridge National Laboratory (DOE 2010b).

To assess incident-free and transportation accident impacts related to radioactive waste shipments, radioactive waste shipments were assumed to be conducted by truck or by a combination of rail and truck. Rail transport to the NNSS is not possible; therefore, rail cargo must be transferred to trucks at a transfer station. DOE/NNSA is not proposing to construct or procure construction of any new rail-to-truck transfer facilities to accommodate shipments of radioactive waste or materials under any of the alternatives considered in this SWEIS. For purposes of analysis only for the Constrained Case, two transfer station sites were assumed: Parker, Arizona, and West Wendover, Nevada. These stations are those outside of Las Vegas, but nearest to the NNSS, at which transfers have occurred in the past. The overall transportation impacts associated with using transfer stations at Parker and West Wendover would be comparable to other locations in the vicinity of the NNSS. For instance, use of a transfer station at Arden, south of Las Vegas, would yield comparable results because it is located along the truck route between Parker and the NNSS. For LLW and MLLW waste shipments, Appendix E, Figure E–3, depicts the analyzed truck and rail routes from each region of the United States while Appendix E, Figure E–4, depicts the analyzed truck routes from the transfer stations at Parker, Arizona, and West Wendover, Nevada, to the NNSS.

The NNSS would send TRU waste to INL for treatment and certification before shipping it to the Waste Isolation Pilot Plant (WIPP) in New Mexico. Rail transport was not analyzed for TRU waste. The INL contractor would assume responsibility for treating, certifying, and transporting the TRU waste to WIPP.

Nuclear weapons and SNM would be transported to and from the NNSS by safeguards transporters. Types of SNM are identified in Appendix A, Section A.2.1.1. Truck routes between specific origination and destination sites were analyzed for the transportation of SNM. For nuclear weapons, routes from different regions of the United States were analyzed, and the route that yielded the highest impacts was used for the analysis.

Unconstrained Case. In the Unconstrained Case, both all truck and combined rail-truck transportation were analyzed to consider all routes within the bounds of the existing regulatory parameters and legal constraints, as well as to reflect major changes and upgrades made to the Las Vegas Valley highway infrastructure over the past 15 years.

(a) All truck: Impacts were analyzed for two route segments. The first segment is from the originating regional site to an entry point to Las Vegas (see Appendix E, Figure E–5). These entry points are Henderson (at the intersection of I-515 and U.S. Route 95), Apex (on I-15 north of Las Vegas), and Arden (on I-15 just south of the junction of I-15 and I-215). Only some of the offsite shipments were analyzed to each entry point, with the sum entering all three points being 100 percent of the shipments. This provides a more realistic analysis such that truck shipments would only enter the Las Vegas area from a direction that makes the most sense (for example, shipments from the West region would not go to Henderson, but would enter the Las Vegas area at Arden). The second segment consists of different routes from these entry points to the NNSS. It was assumed there would be no route limitations in the Las Vegas area; shipments could proceed through or around Las Vegas on several different possible routes, as depicted in **Figure 5–4**. Truck routes were analyzed in segments to make it easier to analyze multiple routes (different segments can be added together).

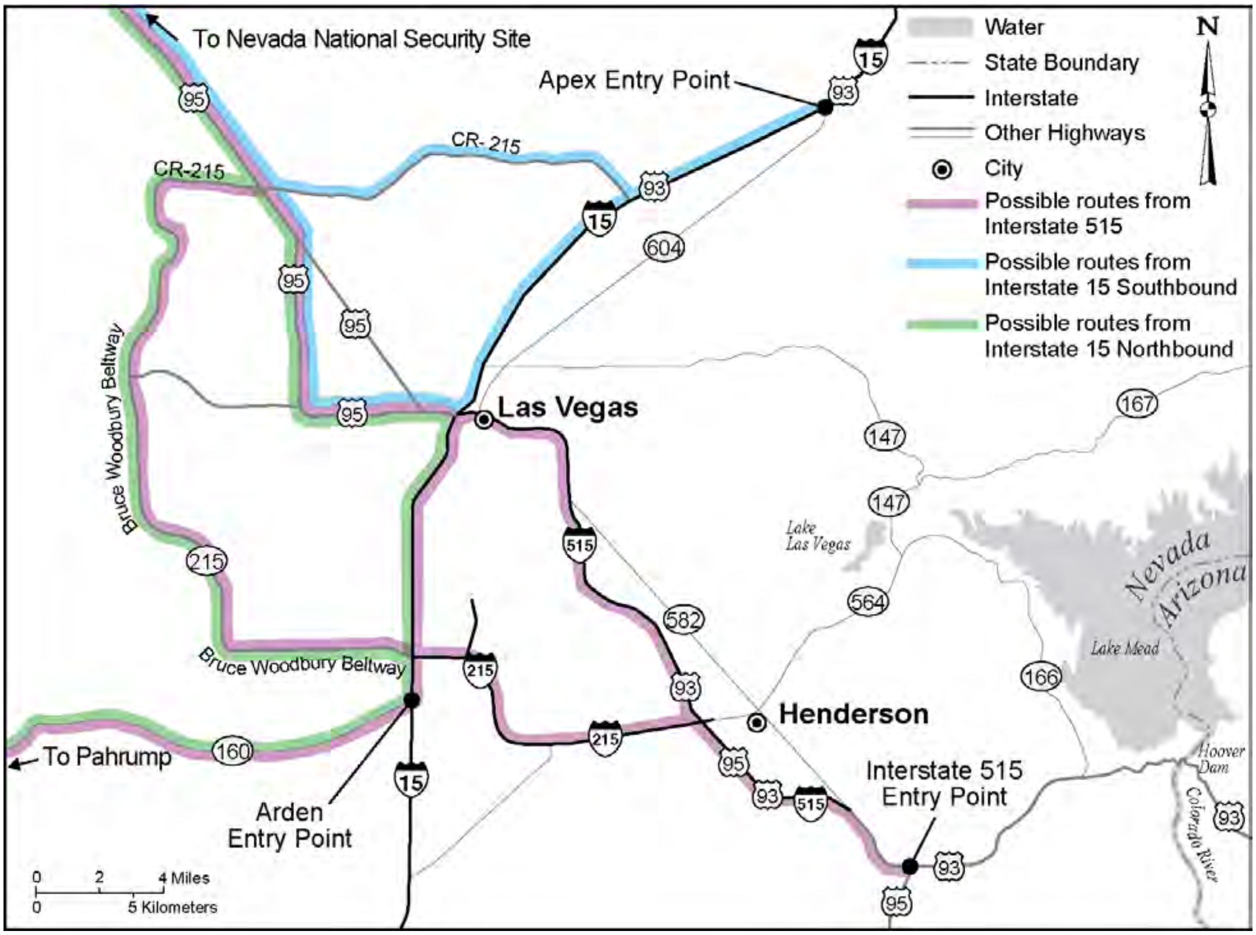


Figure 5–4 Transportation Routes Analyzed in Las Vegas for the Transport of Low-Level and Mixed Low-Level Radioactive Waste for the Unconstrained Case

- Rail-Truck: Rail-truck transportation impacts were also analyzed by route segment. The first segment is rail transport from each region of the United States to a transfer station location in the Las Vegas region. All of the rail shipments were assumed to be transported to five different transfer station locations, where they would be transferred to truck. As depicted in **Figure 5–5**, these five locations are West Wendover, Apex, and Arden, Nevada; and Parker and Kingman, Arizona. [Note: In practice, the location at which shipments would be received would be dependent on arrangements made by the shipper. The actual impacts would fall within the range of results determined in this analysis. In addition, as noted above, DOE/NNSA is not proposing to construct or procure construction of any new rail-to-truck transfer facilities to accommodate shipments of radioactive waste or materials under any of the alternatives considered in this SWEIS.] Appendix E, Figures E–7 and E–8, show the rail routes to each transfer station location. When analyzing rail-to-truck transportation, truck transport from an analyzed transfer station to a Las Vegas entry point (identified in (a) above) was evaluated as a segment, as depicted in Appendix E, Figure E–9. Note that the truck segment from the transfer station to the entry point is only applicable to West Wendover, Parker, and Kingman because the transfer stations at Apex and Arden are already located at an entry point to Las Vegas. Truck transport from West Wendover would proceed to the Apex entry point; truck transport from Parker would proceed to Henderson via U.S. Route 95; and truck transport from Kingman would proceed to Henderson via U.S. Route 93 over the bridge downstream of the Hoover Dam. The final segment is truck travel from a Las Vegas entry point to the NNSS as described in (a) above and depicted in Figure 5–4.

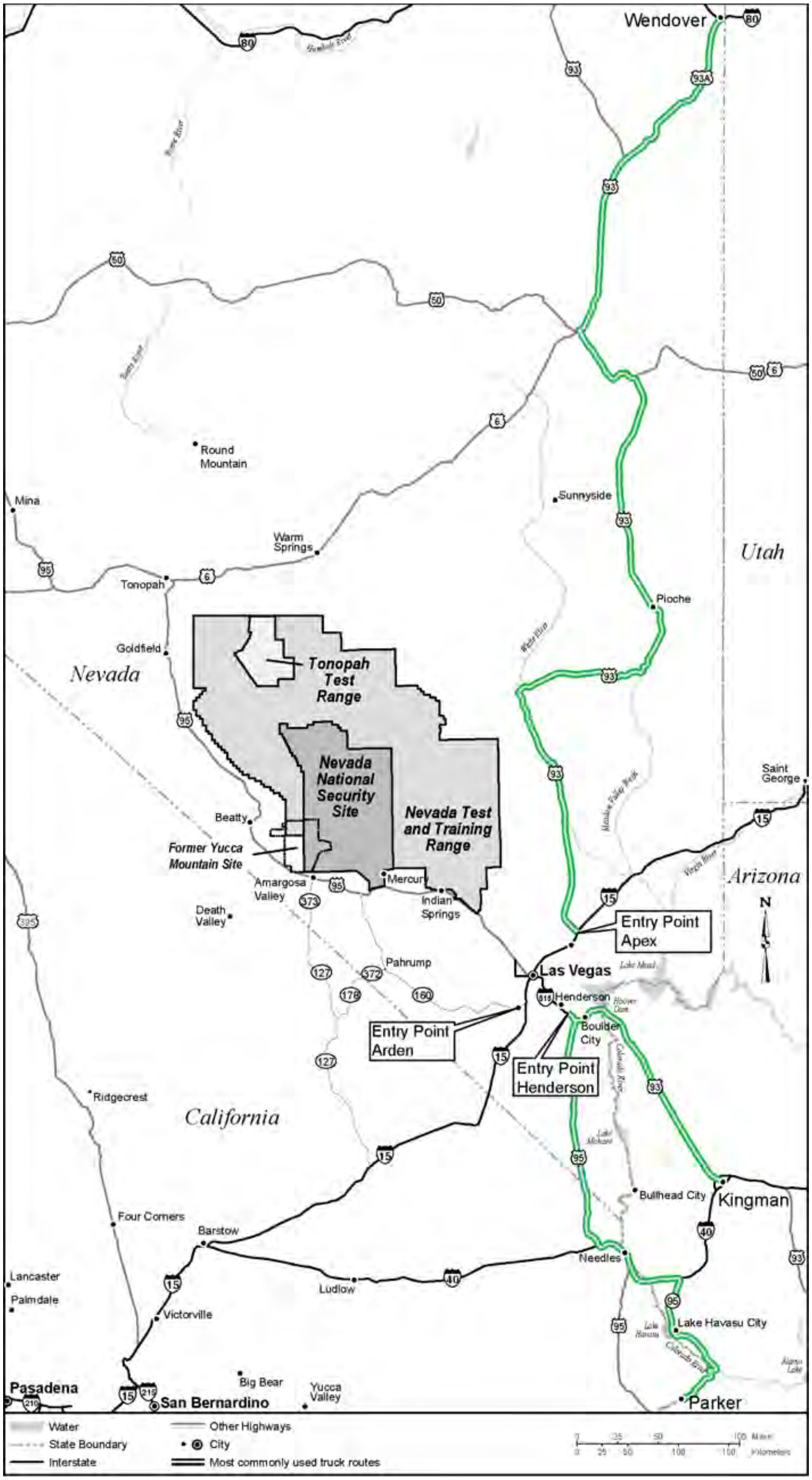


Figure 5–5 Transfer Station Locations and Analyzed Routes from These Locations to Las Vegas for the Unconstrained Case

In addition to analyzing the use of transfer stations in the Las Vegas region, truck-to-rail transfer station locations were analyzed for three different regions of the United States: Southwest region, Northeast region, and West region (see Appendix E, Figure E–2, for a depiction of the regions). This analysis was performed to provide representative impacts associated with transporting LLW/MLLW from generating sites in these regions to a regional transfer station. These regions were selected because there are known possible LLW and/or MLLW generating sites in these regions that do not have direct access to rail.

Comparison of Impacts. **Table 5–9** provides the estimated number of waste truck shipments under each alternative from each region, by container type for LLW and MLLW. A shipment is defined as the amount of waste transported on a single truck or a single railcar. The number of rail shipments would be half of the number of truck shipments. The different types of containers shown in the table are described in Appendix E, Section E.4.2.

TRU waste would be generated at the NNSS under all alternatives. Projected TRU waste shipments would include waste in storage, TRU waste generated by the Joint Actinide Shock Physics Experimental Research Facility (JASPER) operations from 2011 through 2020, and waste from environmental restoration activities at the TTR and the Nevada Test and Training Range. **Table 5–10** shows the number of shipments of TRU waste, radioisotopic thermoelectric generators, sealed sources, SNM, and nuclear weapons under each alternative.

Impacts are presented for the Constrained Case for the No Action, Reduced Operations, and Expanded Operations Alternatives for transport of all radioactive waste and materials. **Tables 5–11** and **5–12** present the estimated impacts associated with the Constrained Case for each alternative for radioactive waste and radioactive materials, respectively. Section 5.1.3.1.2.2 presents the estimated impacts associated with the Unconstrained Case.

Table 5–9 Estimated Numbers of Truck Shipments of Low-Level and Mixed Low-Level Radioactive Waste Under Each Alternative Over a 10-Year Period [a]

In-State/Out-of-State Source	Total Number of Shipments	Container Type				
		Drums	B-25 Box	Sealand [b]	B-12 Box	Type B Container [c]
No Action and Reduced Operations Alternative						
Northeast	140	14	89	41	0	0
South	8,200	520 [d]	1,500	2,300	0	3,900
Southeast	120	15	26	76	0	0
Upper Midwest	9,700	490	2,500	6,700	0	7
Southwest	3,100	3,100	9	10	0	0
Mountain West	1,200	1	320	350	480	96
West	1,100	670	120	270	0	0
Northwest	7	1	2	4	0	0
Other Out-of-State Shipments [e]	1,600	N/A	N/A	1,600	N/A	N/A
Total – Out-of-State Waste	**25,000**	**4,800**	**4,600**	**11,000**	**480**	**4,000**
In-State [f]	2,300	790	0	1,500	0	0
Total – All [g]	**27,000**	**5,600**	**4,600**	**13,000**	**480**	**4,000**
Expanded Operations Alternative						
Northeast	290	31	180	82	0	0
South	19,000	2,800 [d]	3,100	5,000	0	8,200
Southeast	310	30	100	180	0	0
Upper Midwest [h]	20,000	1,000	5,100	14,000	0	14
Southwest	7,800	7,800	20	19	0	0
Mountain West	3,100	1	1,200	740	990	190
West	3,000	2,200	250	560	0	0
Northwest	24	4	16	4	0	0
Other Out-of-State Shipments [i]	26,000	N/A	N/A	N/A	N/A	N/A
Total – Out-of-State Waste [j]	**80,000**	**14,000**	**10,000**	**21,000**	**990**	**8,400**
In-State [f]	15,000	100	0	15,000	0	0
Total – All [g]	**95,000**	**15,000**	**10,000**	**36,000**	**990**	**8,400**

N/A = not applicable.

[a] Number of rail shipments was assumed to be one-half of the number of truck shipments, except for the number of rail shipments for transporting depleted uranium conversion products (see footnote g).

[b] For purposes of analysis, it was assumed that bulk bags would be transported in International Organization for Standardization (Sealand) containers.

[c] A Type B container is used to transport remote-handled LLW or MLLW.

[d] Includes shipment of MLLW from the NNSS to the Oak Ridge, Tennessee, area for treatment, as well as return of the treated waste to the NNSS.

[e] Includes shipments analyzed in other NEPA documents, such as 1,026 truck shipments from Paducah, Kentucky, in the South region (DOE 2002e, 2004d) and 553 truck shipments from Portsmouth, Ohio, in the Upper Midwest region (DOE 2002e, 2004e). These shipments were assumed to consist of Sealand containers transporting depleted uranium conversion products.

[f] Includes radioactive waste generated by environmental restoration activities at the Nevada Test and Training Range and Tonopah Test Range (230 shipments of Sealand containers for the No Action and Reduced Operations Alternatives and 13,000 shipments of Sealand containers for the Expanded Operations Alternative).

[g] Total may not equal the sum of contributions due to rounding.

[h] In addition to shipments estimated from the DOE Waste Management Information System, these numbers include estimated shipments of waste from operation and decontamination and decommissioning of the U.S. Enrichment Corporation lead cascade fuel enrichment facility and operation of the U.S. Enrichment Corporation fuel enrichment full-scale facility.

[i] Includes shipments analyzed in other NEPA documents as follows: 12,243 truck shipments from the West Valley Demonstration Project in the Northeast region (DOE 2010c); 367 shipments of uranium-233 downblending waste from Oak Ridge National Laboratory in the South region (DOE 2010b); and uranium oxide conversion product consisting of 7,240 truck shipments from Paducah, Kentucky, in the South region (DOE 2004d) and 5,834 truck shipments from Portsmouth, Ohio, in the Upper Midwest region (DOE 2004e). For the uranium oxide conversion products, the number of truck shipments is based on depleted uranium hexafluoride cylinders being filled with uranium oxide conversion product, two cylinders per truck. The numbers of rail shipments required for shipment of uranium oxide conversion products are 5,963 from Paducah (DOE 2004d) and 3,216 from Portsmouth (DOE 2004e). This does not include shipments that would occur after 2020.

[j] The total values provided for each container type include 26,000 'Other Out-of-State Shipments.' See footnote i for details.

Table 5–10 Estimated Numbers of Shipments of Transuranic Waste, Radioisotopic Thermoelectric Generators, Sealed Sources, and Special Nuclear Material Over a 10-Year Period [a]

Origin or Activity	*Number of Shipments No Action*	*Number of Shipments Expanded Operations*	*Number of Shipments Reduced Operations*
Transuranic Waste			
JASPER [b]	16	36	11
Environmental Restoration	6	6	6
Radioisotopic Thermoelectric Generators			
Norfolk, Virginia	3	10	3
Sealed Sources			
San Antonio, Texas	120	240	120
Special Nuclear Material			
LLNL (Global Security SNM)	3	3	3
LLNL (HEU)	1	1	1
LANL (Uranium-233)	0	1	0
INL (ZPPR)	0	7	0
INL (ZPPR) – plutonium material	0	8	0
ORNL (Uranium-233)	0	32	0
LLNL (target material for JASPER)	120	240	60
Nuclear Weapons			
Transport to/from the NNSS	0	8,200 [c]	0
Weapon Component Disposition [d]	0	2,010	0

HEU = highly enriched uranium; INL = Idaho National Laboratory; JASPER = Joint Actinide Shock Physics Experimental Research Facility; LANL = Los Alamos National Laboratory; LLNL = Lawrence Livermore National Laboratory; NNSS = Nevada National Security Site; ORNL = Oak Ridge National Laboratory; SNM = special nuclear material; ZPPR = zero power plutonium reactor.

[a] Number of shipments are for one-way transport. The analysis accounts for any return trips or if material is forwarded to another site.

[b] Includes number of shipments related to transuranic waste in storage.

[c] Includes 100 shipments per year for transporting nuclear weapons to the NNSS for disassembly and 360 shipments per year of nuclear weapons to the NNSS to support component exchange, as well as return shipments of refurbished weapons.

[d] Includes 100 shipments per year of canned subassemblies to the Y-12 National Security Complex and plutonium to the Pantex Plant, as well as 1 shipment per year of milliwatt generators to LANL.

Table 5–11 Risks of Transporting Radioactive Waste Under Each Alternative – Constrained Case [a]

Region	Transport Mode	Number of Shipments	One-Way Kilometers Traveled (million)	One-Way Miles Traveled (million)	Incident-Free Conditions: Crew Dose (person-rem)	Incident-Free Conditions: Crew Risk [b]	Incident-Free Conditions: Population Dose (person-rem)	Incident-Free Conditions: Population Risk [b]	Accident Conditions: Radiological Risk [b]	Accident Conditions: Roundtrip Nonradiological Risk [b]
No Action Alternative										
Northeast	Truck	140	0.7	0.4	8.5	5×10^{-3}	2.7	2×10^{-3}	3×10^{-6}	2×10^{-2}
	Rail only [c]	70	0.4	0.2	2.6	2×10^{-3}	1.1	7×10^{-4}	1×10^{-6}	6×10^{-2}
	Rail/Truck [d]	220	0.4	0.3	3.5	2×10^{-3}	1.4	8×10^{-3}	1×10^{-6}	6×10^{-2}
South	Truck	9,200	32.2	20	1,500	9×10^{-1}	220	1×10^{-1}	6×10^{-5}	1
	Rail only [c]	4,500	17.1	10.6	340	2×10^{-1}	120	7×10^{-2}	2×10^{-5}	3
	Rail/Truck [d]	13,700	22.1	13.7	560	3×10^{-1}	150	9×10^{-2}	3×10^{-5}	3
Southeast	Truck	120	0.5	0.3	6.8	4×10^{-3}	2.0	1×10^{-3}	2×10^{-6}	1×10^{-2}
	Rail only [c]	60	0.2	0.15	1.8	1×10^{-3}	0.69	4×10^{-4}	7×10^{-7}	4×10^{-2}
	Rail/Truck [d]	180	0.3	0.19	2.7	2×10^{-3}	0.92	6×10^{-4}	8×10^{-7}	2×10^{-3}
Upper Midwest	Truck	10,200	34.3	21.3	520	3×10^{-1}	130	8×10^{-2}	1×10^{-4}	1
	Rail only [c]	5,100	16.7	10.4	120	7×10^{-2}	33	2×10^{-2}	3×10^{-5}	3
	Rail/Truck [d]	15,300	22.2	13.8	210	1×10^{-1}	52	3×10^{-2}	4×10^{-5}	3
Southwest	Truck	3,100	4.4	2.7	65	4×10^{-2}	28	2×10^{-2}	9×10^{-6}	1×10^{-1}
	Rail only [c]	1,600	2.7	1.7	22	1×10^{-2}	6.0	4×10^{-3}	3×10^{-6}	4×10^{-1}
	Rail/Truck [d]	4,700	4.4	2.8	42	3×10^{-2}	15	9×10^{-3}	5×10^{-6}	5×10^{-1}
Mountain West	Truck	1,200	1.6	1.0	28	2×10^{-2}	6.1	4×10^{-3}	2×10^{-6}	5×10^{-2}
	Rail only [c]	620	0.3	0.2	5.7	3×10^{-3}	2.4	1×10^{-3}	4×10^{-7}	5×10^{-2}
	Rail/Truck [d]	1,900	1.3	0.8	22	1×10^{-2}	5.5	3×10^{-3}	6×10^{-7}	8×10^{-2}
West	Truck	1,100	1.2	0.8	16	1×10^{-2}	6.0	4×10^{-3}	5×10^{-6}	4×10^{-2}
	Rail only [c]	530	0.5	0.3	5.2	3×10^{-3}	2.1	1×10^{-3}	2×10^{-6}	8×10^{-2}
	Rail/Truck [d]	1,600	1.1	0.7	13	8×10^{-3}	4.7	3×10^{-3}	3×10^{-6}	1×10^{-1}
Northwest	Truck	7	0.02	0.01	0.25	1×10^{-4}	0.085	5×10^{-5}	1×10^{-7}	6×10^{-4}
	Rail only [c]	4	0.01	0.01	0.08	5×10^{-5}	0.029	2×10^{-5}	3×10^{-8}	2×10^{-3}
	Rail/Truck [d]	10	0.01	0.01	0.13	8×10^{-5}	0.04	3×10^{-5}	4×10^{-8}	2×10^{-3}
Total – LLW/MLLW from out-of-state regions	Truck	25,100	74.8	46.48	2,100	1.3	400	2×10^{-1}	2×10^{-4}	2
	Rail only [c]	12,500	38	23.6	500	3×10^{-1}	160	1×10^{-1}	6×10^{-5}	6
	Rail/Truck [d]	37,600	51.8	32.2	850	5×10^{-1}	230	1×10^{-1}	8×10^{-5}	6
Onsite	Truck	2,000	0.05	0.03	4.0	2×10^{-3}	1.5	9×10^{-4}	2×10^{-8}	1×10^{-3}
ER Waste (TTR/Nevada Test and Training Range)	Truck	230	0.09	0.05	0.015	9×10^{-6}	0.0020	1×10^{-6}	1×10^{-12}	2×10^{-3}
TRU waste [e]	Truck	22	0.03	0.02	1.1	6×10^{-4}	0.36	2×10^{-4}	5×10^{-8}	9×10^{-4}
RTGs	Truck	3	0.01	0.01	0.37	2×10^{-4}	0.49	3×10^{-4}	2×10^{-8}	2×10^{-3}
Total – radioactive waste transport	Truck	27,400	75.0	46.6	2,100	1	400	2×10^{-1}	2×10^{-4}	2
	Rail/Truck [d]	40,000	52.0	32.3	860	5×10^{-1}	230	1×10^{-1}	8×10^{-5}	6
Transport through Nevada [f]	Truck	25,100	8.2	5.1	210	1×10^{-1}	38	2×10^{-2}	4×10^{-6}	2×10^{-1}

Region	Transport Mode	Number of Shipments	One-Way Kilometers Traveled (million)	One-Way Miles Traveled (million)	Incident-Free Conditions				Accident Conditions	
					Crew		Population			
					Dose (person-rem)	Risk [b]	Dose (person-rem)	Risk [b]	Radiological Risk [b]	Roundtrip Nonradiological Risk [b]
Expanded Operations Alternative										
Northeast	Truck	300	1.4	0.9	18	1×10^{-2}	5.7	3×10^{-3}	6×10^{-6}	5×10^{-2}
	Rail only [c]	150	0.7	0.5	5.3	3×10^{-3}	2.3	1×10^{-3}	2×10^{-6}	1×10^{-1}
	Rail/Truck [d]	450	0.9	0.6	7.2	4×10^{-3}	2.8	2×10^{-3}	3×10^{-6}	1×10^{-1}
South	Truck	19,300	67.3	41.8	3,500	2	470	3×10^{-1}	4×10^{-5}	2
	Rail only [c]	9,600	36.2	22.5	700	4×10^{-1}	240	1×10^{-1}	5×10^{-5}	6
	Rail/Truck [d]	28,900	46.7	29.0	1,200	7×10^{-1}	310	2×10^{-1}	6×10^{-5}	6
Southeast	Truck	310	1.2	0.8	17	1×10^{-2}	5.1	3×10^{-3}	5×10^{-6}	4×10^{-2}
	Rail only [c]	160	0.7	0.4	4.8	3×10^{-3}	1.9	1×10^{-3}	2×10^{-6}	1×10^{-1}
	Rail/Truck [d]	470	0.8	0.5	7.2	4×10^{-3}	2.5	1×10^{-3}	2×10^{-6}	5×10^{-3}
Upper Midwest	Truck	20,100	67.6	42.0	1,000	6×10^{-1}	260	2×10^{-1}	2×10^{-4}	2
	Rail only [c]	10,100	32.9	20.4	250	1×10^{-1}	64	4×10^{-2}	5×10^{-5}	5
	Rail/Truck [d]	30,200	43.8	27.2	410	2×10^{-1}	100	6×10^{-2}	8×10^{-5}	5
Southwest	Truck	7,800	10.9	6.8	160	1×10^{-1}	70	4×10^{-2}	2×10^{-5}	3×10^{-1}
	Rail only [c]	3,900	6.9	4.3	56	3×10^{-2}	15	9×10^{-3}	7×10^{-6}	1
	Rail/Truck [d]	11,700	11.1	6.9	110	6×10^{-2}	37	2×10^{-2}	1×10^{-5}	1
Mountain West	Truck	3,100	4.0	2.5	64	4×10^{-2}	15	9×10^{-3}	6×10^{-6}	1×10^{-1}
	Rail only [c]	1,600	0.8	0.5	14	8×10^{-3}	5.8	3×10^{-3}	9×10^{-7}	1×10^{-1}
	Rail/Truck [d]	4,700	3.1	2.0	50	3×10^{-2}	13	8×10^{-3}	2×10^{-6}	2×10^{-1}
West	Truck	3,000	3.5	2.2	44	3×10^{-2}	18	1×10^{-2}	1×10^{-5}	1×10^{-1}
	Rail only [c]	1,500	1.5	0.9	15	9×10^{-3}	6.0	4×10^{-3}	4×10^{-6}	2×10^{-1}
	Rail/Truck [d]	4,500	3.2	2.0	36	2×10^{-2}	14	8×10^{-3}	7×10^{-6}	3×10^{-1}
Northwest	Truck	24	0.06	0.04	0.7	4×10^{-4}	0.3	1×10^{-4}	3×10^{-7}	2×10^{-3}
	Rail only [c]	12	0.04	0.02	0.24	1×10^{-4}	0.1	6×10^{-5}	7×10^{-8}	5×10^{-3}
	Rail/Truck [d]	36	0.05	0.03	0.39	2×10^{-4}	0.14	8×10^{-5}	9×10^{-8}	5×10^{-3}
Total –LLW/MLLW from out-of-state regions	Truck	54,000	156	96.9	4,900	3	850	5×10^{-1}	3×10^{-4}	5
	Rail only [c]	26,900	79.7	49.5	1,000	6×10^{-1}	340	2×10^{-1}	1×10^{-4}	13
	Rail/Truck [d]	80,900	110	68.4	1,800	1	480	3×10^{-1}	2×10^{-4}	13
Onsite	Truck	2,300	0.06	0.04	4.2	2×10^{-3}	1.5	9×10^{-4}	2×10^{-8}	2×10^{-3}
ER Waste (TTR/Nevada Test and Training Range)	Truck	13,100	4.9	3.0	0.8	5×10^{-4}	0.3	2×10^{-4}	6×10^{-11}	1×10^{-1}
TRU waste [e]	Truck	42	0.05	0.03	2.1	1×10^{-3}	0.7	4×10^{-4}	9×10^{-8}	2×10^{-3}
RTGs	Truck	10	0.05	0.03	1.2	7×10^{-4}	1.6	1×10^{-3}	5×10^{-8}	7×10^{-3}
Paducah DUF_6 DOE/EIS-359 [g]	Truck	7,200	20.4	12.7	120	7×10^{-2}	80	5×10^{-2}	3×10^{-3}	5×10^{-1}
	Rail	2,900	9.9	6.2	370	2×10^{-1}	14	8×10^{-3}	2×10^{-3}	2×10^{-1}
Portsmouth DUF_6 DOE/EIS-360 [g]	Truck	5,800	19.6	12.2	120	7×10^{-2}	78	5×10^{-2}	7×10^{-3}	4×10^{-1}
	Rail	2,300	9.4	5.84	330	2×10^{-1}	14	9×10^{-3}	3×10^{-3}	3×10^{-1}

Region	Transport Mode	Number of Shipments	One-Way Kilometers Traveled (million)	One-Way Miles Traveled (million)	Incident-Free Conditions				Accident Conditions	
					Crew		Population			
					Dose (person-rem)	Risk [b]	Dose (person-rem)	Risk [b]	Radiological Risk [b]	Roundtrip Nonradiological Risk [b]
West Valley DOE/EIS-0226 [g]	Truck	12,000	48.0	29.9	230	1×10^{-1}	64	4×10^{-2}	9×10^{-6}	9×10^{-1}
	Rail	6,100	26.5	16.5	9.3	6×10^{-3}	14	8×10^{-3}	3×10^{-6}	2
ORNL (uranium-233) DOE/EA-1651 [h]	Truck	367	No data	No data	No data	No data	9.5	6×10^{-3}	7×10^{-12}	<1
Total – radioactive waste transport	Truck	94,800	249	155	5,300	3.1	1,100	7×10^{-1}	1×10^{-2}	7
	Rail/Truck [d]	108,000	160	100	2,500	1.5	530	3×10^{-1}	5×10^{-3}	16
Transport through Nevada [f]	Truck	54,100	17.9	11.1	430	3×10^{-1}	84	5×10^{-2}	9×10^{-6}	5×10^{-1}
Reduced Operations Alternative										
Total – LLW/MLLW from out-of-state regions	Truck	See No Action Alternative								
	Rail	See No Action Alternative								
	Rail/Truck	See No Action Alternative								
TRU waste [e]	Truck	17	0.02	0.01	0.8	5×10^{-4}	0.3	2×10^{-4}	4×10^{-8}	7×10^{-4}
Onsite	Truck	See No Action Alternative								
RTGs	Truck	See No Action Alternative								
ER Waste (TTR/Nevada Test and Training Range)	Truck	See No Action Alternative								
Transport through Nevada [f]	Truck	See No Action Alternative								

< = less than; DUF_6 = depleted uranium hexafluoride; EA = environmental assessment; ER = Environmental Restoration; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; ORNL = Oak Ridge National Laboratory; rem = roentgen equivalent man; RTG = radioisotope thermoelectric generator; TRU = transuranic; TTR = Tonopah Test Range.

[a] LLW and MLLW were assumed to be transported in 55-gallon drums, B-25 boxes, B-12 boxes, and 20-foot International Organization for Standardization (Sealand) containers based on historical information regarding prevalence of use.

[b] Risk is expressed in terms of LCFs, except for nonradiological risk, where it refers to the number of traffic accident fatalities. Accident dose risk can be calculated by dividing the risk values by 0.0006 (DOE 2003d).

[c] These values reflect only the portion of the routes traveled by railcar.

[d] These values reflect the combined use of rail and truck after rail transporting radioactive waste to the NNSS vicinity.

[e] Transuranic waste is first transported to Idaho National Laboratory for characterization and then transported back to the NNSS with final disposal at WIPP.

[f] The cited risk values are representative of the portion of the routes used for transporting LLW and MLLW within Nevada to the NNSS, excluding shipments identified in other National Environmental Policy Act documentation. The stated risks for travel within Nevada are included in the risks for the regional routes shown in the table. The values for the Reduced Operations Alternative are similar to those for the No Action Alternative.

[g] The risks from transporting Paducah, Kentucky, and Portsmouth DUF_6 conversion wastes and the West Valley Demonstration Project wastes to the NNSS are cited directly from their respective site EISs (DOE 2004d, 2004e, 2010c), proportionally adjusted for a 10-year period. The rail transport risk values for these analyses consider direct transport to the NNSS; therefore, the risks do not include truck transport from a transfer station. If rail-truck transport were used for these shipments, the incident-free risk would be lower, but the accident risk would be slightly higher, given the results of transporting LLW and MLLW. Transportation risks from transporting wastes associated with these waste streams generated beyond this 10-year period are included in the cumulative impacts (see Chapter 6 of this *NNSS SWEIS*).

[h] DOE 2010b.

Note: To convert kilometers to miles, multiply by 0.62137. Total may not equal the sum of the contributions due to rounding. Also due to rounding, the cited risk values are different from multiplication of dose by a dose risk factor of 0.0006 LCFs per person-rem.

Table 5–12 Risks of Transporting Radioactive Materials Under Each Alternative – Constrained Case

Material	*Number of Shipments*	*One-Way Kilometers Traveled (million)*	*One-Way Miles Traveled (million)*	*Incident-Free Conditions*				*Accident Conditions*	
				Crew		*Population*			
				Dose (person-rem)	*Risk* [b]	*Dose (person-rem)*	*Risk* [a]	*Radiological Risk* [b]	*Roundtrip Nonradiological Risk* [a]
No Action Alternative									
Special Nuclear Material	120	0.1	0.09	0.13	8×10^{-5}	0.09	6×10^{-5}	8×10^{-8}	5×10^{-3}
Special Nuclear Material – in Nevada	120	0.04	0.02	0.028	2×10^{-5}	0.015	9×10^{-6}	1×10^{-8}	9×10^{-5}
Sealed Sources	120	0.3	0.2	17	1×10^{-2}	4.3	3×10^{-3}	1×10^{-7}	9×10^{-3}
Sealed Sources – in Nevada	120	0.04	0.02	2.2	1×10^{-3}	0.55	3×10^{-4}	3×10^{-9}	1×10^{-3}
Expanded Operations Alternative									
Special Nuclear Material	290	0.4	0.3	1.3	8×10^{-4}	0.77	5×10^{-4}	2×10^{-7}	1×10^{-2}
Special Nuclear Material – in Nevada	290	0.09	0.06	0.17	1×10^{-4}	0.11	7×10^{-5}	2×10^{-8}	2×10^{-4}
Weapon Component Disposition	2,000	3.5	2.2	10	6×10^{-3}	12	7×10^{-3}	7×10^{-7}	1×10^{-2}
Weapon Component Disposition – in Nevada	2,000	0.6	0.38	1.2	7×10^{-4}	1.4	8×10^{-4}	5×10^{-8}	2×10^{-3}
Weapon Transport	8,200	38.2	23.7	210	1×10^{-1}	240	1×10^{-1}	2×10^{-5}	1×10^{-1}
Weapon Transport – in Nevada	8,200	2.5	1.6	14	9×10^{-3}	16	1×10^{-2}	4×10^{-7}	6×10^{-3}
Sealed Sources	240	0.5	0.34	33	2×10^{-2}	8.5	5×10^{-3}	2×10^{-7}	2×10^{-2}
Sealed Sources – in Nevada	240	0.07	0.05	4.4	3×10^{-3}	1.1	7×10^{-4}	6×10^{-9}	2×10^{-3}
Reduced Operations Alternative									
Special Nuclear Material	60	0.07	0.05	0.083	5×10^{-5}	0.069	4×10^{-5}	4×10^{-8}	5×10^{-3}
Special Nuclear Material – in Nevada	60	0.02	0.01	0.015	9×10^{-6}	0.0084	5×10^{-6}	7×10^{-9}	5×10^{-5}
Sealed Sources	See No Action Alternative								
Sealed Sources – in Nevada	See No Action Alternative								

rem = roentgen equivalent man.

[a] Risk is expressed in terms of latent cancer fatalities, except for the nonradiological risk, where it refers to the number of traffic accident fatalities. Accident dose risk can be calculated by dividing the risk values by 0.0006 (DOE 2003d).

Table 5–13 provides the estimated dose and risk to an individual and population from a maximum foreseeable truck or rail transportation accident with the highest consequences under each alternative. The highest consequences for the maximum foreseeable accident would be from accidents involving a severe collision with a truck or railcar carrying LLW or MLLW in a 20-foot International Organization for Standardization (ISO) container in conjunction with a long-lasting fire. The calculated population doses shown are based on the maximum population density.

Table 5–13 Estimated Dose to the Population and to Maximally Exposed Individuals Under Most Severe Accident Conditions [a]

Alternative/ Transport Mode [b]		*Waste Material in the Accident With the Highest Consequences*	*Likelihood of the Accident (per year)*	*Population [c]*		*MEI [d]*	
				Dose (person-rem)	*Risk (LCF)*	*Dose (rem)*	*Risk (LCF)*
No Action and Reduced Operations	Truck	LLW/MLLW in 20-foot ISO container	3.2×10^{-7}	180	0.1	0.034	2×10^{-5}
Expanded Operations	Truck	LLW/MLLW in 20-foot ISO container	6.1×10^{-7}	180	0.1	0.034	2×10^{-5}
Transport within Nevada [e]		LLW/MLLW in 20-foot ISO container	3.7×10^{-6}	27	0.02	0.034	2×10^{-5}

ISO = International Organization for Standardization; LCF = latent cancer fatality; LLW = low-level radioactive waste; MEI = maximally exposed individual; MLLW = mixed low-level radioactive waste; rem = roentgen equivalent man.

[a] The likelihood of accidents is based on the annual estimated number of transports from each region to the NNSS. The cited likelihood of accidents is the highest calculated value among all transports. Note that the likelihood of rail accidents is less than 10^{-7} per year; therefore, rail accident impacts are not shown.

[b] The maximum probability for a rail accident is less than 1 in 10 million per year; therefore, no consequences are presented for rail transportation in this table.

[c] Population extends at a uniform density to a radius of 50 miles. The weather condition was assumed to be Pasquill Stability Class D with a wind speed of 8.8 miles per hour. Unless otherwise noted, the population doses and risks are presented for an urban area on the transportation route.

[d] The MEI was assumed to be 330 feet downwind from the accident and exposed to the entire plume of the radioactive release. The weather condition was assumed to be Pasquill Stability Class F, with a wind speed of 2.2 miles per hour.

[e] Population dose and risk are for a suburban area along the route. The probability of a maximum foreseeable accident in an urban area along the transportation route is less than 10^{-7} per year. The cited likelihood of an accident is for the Expanded Operations Alternative. The likelihood of accidents under the No Action and Reduced Operations Alternatives is 1.2×10^{-6} per year.

5.1.3.1.1 No Action Alternative (Constrained Case)

Under the No Action Alternative, approximately 27,400 truck shipments of LLW and MLLW over a 10-year period would be transported to disposal facilities at the NNSS, 25,100 of which would come from outside Nevada. Approximately 20 shipments of TRU waste would be made to INL; after treatment, this waste would be transported to WIPP. About 240 shipments associated with radioisotopic thermoelectric generators and sealed sources would be made.

Impacts of Incident-Free Transportation. Under this alternative, the impacts of transporting LLW and MLLW by truck would be about double the impacts of rail-truck transport (rail-truck transport is the use of rail to move waste and materials to a transfer station in the Nevada region where it is transferred to trucks to complete the trip to the NNSS), as discussed below. Transportation of LLW or MLLW from outside of Nevada would be the primary contributor to the total radiological and nonradiological impacts of transportation activities. The following sections discuss the impacts of incident-free transportation on transportation crewmembers, intermodal workers, and the public.

- Crew – The transport of LLW and MLLW by truck from out of state would incur about 2,100 person-rem of exposure, resulting in approximately 1 (1.3) LCF to a crewmember, assuming no administrative controls were implemented. The contributions from transporting TRU waste and radioisotopic thermoelectric generators are minimal (about 1.5 person-rem). If rail-truck transport were used, the cumulative dose to rail and truck crewmembers during the transportation of waste under this alternative would be about 860 person-rem (500 person-rem to rail crew and 360 person-rem to truck crew), resulting in 1 (0.5) additional LCF.

Transport of sealed sources and SNM would contribute only a very small additional increment to the total crew exposures (about 20 person-rem, resulting in less than 1 [0.01] LCF) compared to transport of LLW and MLLW because there would be fewer shipments.

Impacts on individual crewmembers would be managed through the implementation of administrative controls to minimize radiation exposure. A transportation worker would be restricted to an exposure level of 100 millirem per year unless that individual were a trained radiation worker subject to administrative procedures that would limit his or her annual dose to 2 rem (DOE 1999e). The potential risk of a trained radiation worker developing an LCF from the maximum annual exposure is 0.0012. Therefore, an individual transportation worker is not expected to develop a lifetime LCF from radiation exposure during these activities.

- Transfer station workers – Workers at transfer stations would be exposed to external radiation fields surrounding the waste shipping containers. The dose estimates per unit handling (person-rem per container) for transferring LLW or MLLW containers from railcars to trucks were based on the estimates provided in the *NTS Intermodal Study* (DOE 1999d). For waste containers with an exposure rate of 1 millirem per hour at 3.3 feet, the worker dose per transfer was estimated to be 3.4×10^{-4} person-rem. The number of container transfers under the No Action Alternative would be 25,100, leading to a total transfer station worker population dose of about 8.5 person-rem, or a risk of less than 1 (0.005) LCF.
- Public – The cumulative dose to the general population during transportation of LLW and MLLW by truck from out of state would be about 400 person-rem, resulting in less than 1 (0.2) additional LCF. If rail-truck transport were used, the cumulative dose to the general population would be about 230 person-rem (160 person-rem to the population along the rail route and 70 person-rem to the population along the truck route), resulting in less than 1 (0.1) additional LCF. The contributions from transporting TRU waste and radioisotopic thermoelectric generators are minimal (about 1 person-rem). Rail-truck transport would lead to lower doses to the general population because (1) the number of rail shipments would be about half of the shipments using all trucks, and (2) truck transports would occur primarily in areas of low population density and over shorter distances.

Transport of sealed sources, SNM, and nuclear weapons would contribute only a very small additional amount of population dose (about 5 person-rem, resulting in less than 1 [0.003] LCF) compared to transport of LLW and MLLW from out of state.

Impacts of Transportation Accidents. As described previously, two sets of radiological transportation accident impacts were analyzed: (1) impacts of maximum reasonably foreseeable accidents (accidents with radioactive release probabilities greater than 1×10^{-7} [1 chance in 10 million] per year) and (2) impacts of all conceivable accidents (total transportation accidents).

For waste shipped under any of the alternatives, the maximum reasonably foreseeable offsite truck or rail transportation accident with the highest consequences would be a severe collision involving a truck or railcar carrying LLW or MLLW in a 20-foot ISO container (Sealand container) in conjunction with a long-lasting fire. The calculated population doses are based on the maximum population density.

The probabilities of a truck or railcar accident involving this type of waste shipment are slightly different. Transportation accident probabilities were calculated for all route segments (rural, suburban, urban), and maximum consequences were determined for those route segments with a likelihood of release frequency exceeding 1 in 10 million per year. The maximum reasonably foreseeable probability of a truck accident involving this waste type would be 3.2×10^{-7} per year in an urban area, while the maximum probability for a rail accident would be 8.4×10^{-8} per year in an urban area. Because the maximum probability for a rail accident is less than 1 in 10 million per year, no consequences are presented for rail in Table 5–13. The consequences of the truck transport accident in terms of population dose would be about 180 person-rem. Such exposures could result in less than 1 (0.1) additional LCF among the exposed population. The maximum dose from a truck accident to an MEI located 330 feet from the accident and exposed to the accident plume for 2 hours would be about 0.034 rem, with a risk of 0.00002 LCFs.

Under the No Action Alternative, estimates of the total transportation accident risks for all projected accidents are as follows: a radiological dose risk[1] to the general population of 0.33 person-rem if all trucks are used to transport all radioactive waste and materials, and 0.13 person-rem if a combination of rail and truck are used. This would result in less than 1 LCF (0.0002 LCFs for all trucks and 0.00008 LCFs for a combination of rail and truck). The accident dose risk to the general population if a combination of rail and truck is used is therefore about half of the dose risk associated with using only trucks. Nonradiological accident risks for transporting LLW and MLLW would range from 2 to 6 fatalities to the general population for all truck transport and a combination of rail and truck transport, respectively. Nonradiological risks for all radioactive shipments other than LLW and MLLW would be less than 1 (0.01) fatality.

Accidents at transfer stations have also been considered. Railcars or trucks carrying LLW or MLLW while on the property of a transfer station would have the potential for some of the same accidents that could occur outside of transfer stations. The low speeds at which they would be traveling would result in impacts much less severe than those possible while traveling at higher speeds outside the transfer station. However, transfer station activities introduce an additional accident scenario associated with the transfer of containers between railcars and trucks. Shipments and transfer of LLW or MLLW would not present unique nonradiological risks to workers at a transfer station as containers are moved between trucks and railcars. Transfer facilities routinely receive materials shipped in large containers (for example, ISO containers) and have established procedures for safely transferring them between transport vehicles. In the course of transferring containers, there is the possibility of a mechanical or human error that could result in a dropped container. This presents a physical hazard to workers involved in the transfer, but use of safe working practices should prevent workers from being in locations where they could be hit by a falling container.

There would be a small possibility of an environmental release of radioactive material resulting from a dropped container. In order to cause a release to the environment, the drop would have to cause a breach of the outer container, as well as a failure of the packaging within the container (for example, 55-gallon drums or soft-sided containers). Assuming that such a release did occur, however, the released material would result only in localized contamination; the drop of a container would not have sufficient energy to eject material and cause widespread contamination. There would be a potential for a dose to workers in the immediate vicinity of such an accident, but the magnitude of the dose could vary widely depending on the size of the breach, proximity of workers, and air currents. No impact on a noninvolved worker or a member of the public is expected due to the expected small release amount and distance to these receptors. A more severe accident with enough energy to spread radioactive material beyond the immediate vicinity (e.g., a drop and breach followed by a fire) could result in impacts beyond the immediate vicinity of the accident; impacts would be comparable to or less than those calculated above for the maximum reasonably foreseeable truck accident.

Impacts of Nonradioactive Waste Transport. The impacts of transporting sanitary waste, hazardous waste, and other wastes and recyclables generated at NNSS facilities to onsite or offsite disposal or reuse facilities were also evaluated (including impacts from construction and operation of a commercial solar

[1] *The term "dose risk" is used because the value includes both the likelihood of the accident and the consequence of that accident. The likelihood arises from the accident rate and the probability of container failure along with the potential for the quantities being released and becoming airborne.*

power generation facility), with results shown in Appendix E, Table E–19. The estimated transportation impacts under this alternative would be 2 (1.5) traffic accidents and less than 1 (0.06) traffic accident fatality in 2.0 million two-way miles traveled.

Impacts within the State of Nevada. For both truck and rail-truck transport, crewmembers transporting radioactive materials and waste in Nevada would receive a cumulative dose of about 210 person-rem, resulting in less than 1 (0.1) LCF; this dose would be managed and minimized using administrative controls, as discussed in the previous paragraphs. The public in Nevada would receive a cumulative population dose of about 38 person-rem, resulting in less than 1 (0.02) LCF.

Estimates of the total transportation accident risks that would occur in Nevada under this alternative for all projected accidents involving radioactive materials and waste shipments, regardless of waste type, are as follows: a maximum radiological dose risk to the general population of 0.007 person-rem over the life of expected shipments, resulting in less than 1 (0.000004) LCF, and a maximum nonradiological accident risk of less than 1 (0.2) fatality in the general population over 5.0 million one-way miles traveled.

5.1.3.1.2 Expanded Operations Alternative

5.1.3.1.2.1 Constrained Case

Under the Expanded Operations Alternative, a total of about 94,800 truck shipments of LLW and MLLW would be made to disposal facilities at the NNSS, about 79,300 of which would come from offsite locations. About 42 shipments of TRU waste would be made to INL for treatment; after treatment, this waste would be transported to WIPP. There would be 290 shipments of SNM, 8,200 shipments of nuclear weapons to and from the NNSS for either component replacement or disassembly, and about 2,000 shipments of disassembled parts from weapon dismantlement. There would also be 240 shipments of sealed sources.

Impacts of Incident-Free Transportation

Under this alternative, the radiological impacts of transporting LLW and MLLW by truck would be greater than the impacts of rail-truck transport. Transportation of LLW and MLLW from offsite locations would be the primary contributor to the total radiological and nonradiological impacts of transportation activities. Impacts on crewmembers, transfer station workers, and the public are discussed below.

- Crew – Transport of LLW and MLLW by truck would incur about 5,300 person-rem of exposure, resulting in approximately 3 (3.1) additional LCFs to crewmembers, assuming no administrative controls were implemented. The contributions from transporting TRU waste and radioisotopic thermoelectric generators are minimal (about 3.3 person-rem). If rail-truck transport were used, the cumulative dose to crewmembers during the transportation of waste under this alternative would be about 2,500 person-rem, resulting in about 2 (1.5) additional LCFs.

  The transportation of sealed sources, SNM, and nuclear weapons would contribute only a very small additional amount to total crew exposures (about 250 person-rem, resulting in less than 1 [0.2] LCF) compared to the transport of LLW and MLLW because there would be fewer shipments.

- Transfer station worker – Workers at transfer facilities would be exposed to external radiation fields surrounding the waste shipping containers. As stated under the No Action Alternative, a dose rate of 3.4×10^{-4} person-rem per container transfer from railcar to truck was used. The number of container transfers under the Expanded Operations Alternative would be about 54,000, leading to a total transfer station worker dose of about 18 person-rem.

- Public – The cumulative dose to the general population during transportation of LLW and MLLW by truck would be about 1,100 person-rem, resulting in about 1 (0.7) additional LCF. If rail-truck transport were used, the cumulative dose to the general population would be about 530 person-rem (about 370 person-rem to the population along the rail route and 160 person-rem to the population along the truck route), resulting in less than 1 (0.3) additional LCF. The contributions from transporting TRU waste and radioisotopic thermoelectric generators are minimal (about 2.4 person-rem). Rail-truck transport would lead to lower doses to the general population because (1) such shipments would be fewer and (2) truck transports would occur primarily in areas of low population density and over shorter distances. Transportation of SNM, sealed sources, and nuclear weapons would contribute about an additional 260 person-rem to the dose to the general population, resulting in less than 1 (0.2) LCF.

Impacts of Transportation Accidents. As described previously, the maximum reasonably foreseeable offsite truck or rail transportation accident with the highest consequences would be a severe collision involving a truck or railcar carrying LLW or MLLW in a 20-foot ISO container in conjunction with a long-lasting fire. The calculated population doses are based on the maximum population density. These waste shipments are expected to occur over the 10-year period. The impacts in terms of dose and risks to the public and individuals are the same as those provided under the No Action Alternative in Section 5.1.3.1.1, although with a greater foreseeable probability of 6.1×10^{-7} per year in an urban area (about twice the probability as compared to the No Action Alternative).

Under the Expanded Operations Alternative, estimates of the total transportation accident risks for all projected accidents are as follows: a radiological dose risk to the general population of 17 person-rem if all trucks are used to transport LLW and MLLW and 8 person-rem if a combination of rail and truck are used. This would resulting in less than 1 LCF (0.01 LCFs for all trucks and 0.005 LCFs for a combination of rail and truck). The dose risk to the general population for transporting wastes and materials other than LLW and MLLW would be about 0.035 person-rem, resulting in less than 1 (0.00002) LCF if all trucks are used. Nonradiological accident risks for transporting LLW and MLLW would range from 7 to 16 fatalities to the general population for all truck transport and a combination of rail and truck transport, respectively. Nonradiological risks for all radioactive wastes and materials other than LLW and MLLW would cause less than 1 (0.2) fatality.

Impacts of Nonradioactive Waste Transport. The impacts of transporting sanitary waste, hazardous waste, and other wastes and recyclables generated at NNSS facilities to onsite or offsite disposal or reuse facilities were also evaluated (including impacts from concentration and operation of one or more commercial solar power generation facilities), with results shown in Appendix E, Table E–19. The estimated transportation impacts under this alternative would be 3 (2.8) traffic accidents and less than 1 (0.11) traffic accident fatality in 3.8 million two-way miles traveled.

Impacts within the State of Nevada. Transport of all radioactive materials and waste through Nevada would incur less than one-tenth of the total incident-free radiological impacts. For both truck and rail-truck transport, crewmembers transporting wastes and radioactive materials in Nevada would receive a cumulative dose of about 450 person-rem, resulting in less than 1 (0.3) LCF; this dose would be managed using administrative controls, as discussed in the previous paragraphs. The public in Nevada would receive a cumulative population dose of about 100 person-rem, resulting in less than 1 (0.06) LCF.

Under the Expanded Operations Alternative, estimates of the total transportation accident risks that would occur in Nevada for all projected accidents involving radioactive materials and waste shipments, regardless of waste type, would be a maximum radiological dose risk to the general population of 0.013 person-rem over the life of expected shipments, resulting in less than 1 (0.000008) LCF for rail-truck transport, and a maximum nonradiological accident risk of about 1 (0.5) fatality to the general population for rail-truck transport over 12 million one-way miles traveled.

5.1.3.1.2.2 Unconstrained Case

The Unconstrained Case addresses the transportation of offsite LLW/MLLW from regions of the United States to the NNSS by (a) all truck, and (b) a combination of rail-truck, as described in Section 5.1.3.1. Appendix E provides more-detailed data regarding the analysis of the Unconstrained Case. While DOE/NNSA is not making any decisions for specific waste transportation routes through this NEPA process, DOE/NNSA sought to understand the differences in potential environmental effects between different routing options, communicate those differences to the public, and seek stakeholder comments on the range of transportation routes. Subsequently, DOE/NNSA determined that it would retain the current highway routing restrictions for shipments of LLW/MLLW in the greater Las Vegas metropolitan area and, therefore, there would be no need to revise the waste acceptance criteria in this regard (DOE 2012).

All Truck: Table 5–14 summarizes the range of impacts for transporting offsite LLW/MLLW to the NNSS and compares these impacts to the comparable impacts from the Constrained Case (from Table 5–11). The range of impacts reflects multiple routes that could be taken from the Las Vegas entry point to the NNSS. A range is only shown where there is a measurable difference due to using different routes. Based on Table 5–14, if routes are unconstrained, the incident-free risks and accident-related radiological and nonradiological risks would be about the same as those for the Constrained Case.

Table 5–14 Range of Risks for Unconstrained Truck Transport from U.S. Regions to the Nevada National Security Site [a]

From Regions Through Entry Points Below to the NNSS	*Number of Shipments*	*Incident-Free*				*Accident*	
		Crew		*Population*			
		Dose (person-rem)	*Risk (LCF)*	*Dose (person-rem)*	*Risk (LCF)*	*Radiological Risk (LCF)*	*Nonradiological Risk (fatalities)*
Apex [b]	23,500	960 – 970	0.6	230 – 240	0.1	0.0002	2
Arden [b]	3,040	38 – 39	0.2 – 0.3	14	0.008 – 0.009	5×10^{-6} – 7×10^{-6}	0.07
Henderson [b]	27,400	3,000 – 3,100	2	530	0.3	0.0002	2
Total (unconstrained)	**54,000**	**4,000 – 4,100**	**2 – 3**	**770 – 780**	**0.5**	**0.0003 – 0.0004**	**4**
Total (constrained) [c]	**54,000**	**4,900**	**3**	**850**	**0.5**	**0.0003**	**5**

LCF = latent cancer fatality; NNSS = Nevada National Security Site; rem = roentgen equivalent man.
[a] Ranges are shown only where there are differences in results among the routes, assuming three significant figures for shipments, two significant figures for dose, and one significant figure for risk.
[b] There would be two possible routes from Apex, Nevada, three possible routes from Arden, Nevada, and four possible routes from Henderson, Nevada, to the NNSS, as analyzed in this *NNSS SWEIS*.
[c] Results are from Table 5–11. The results do not reflect shipments of LLW/MLLW analyzed in other NEPA documents.
Note: Totals may not sum due to rounding.

Rail-Truck: Rail transport of offsite LLW/MLLW to five possible transfer station locations in the Las Vegas region were analyzed: Apex, Arden, and West Wendover in Nevada; and Kingman and Parker in Arizona. This analysis assumed all rail shipments would go to each of these transfer stations. **Table 5–15** summarizes the range of impacts for transporting offsite LLW/MLLW to each of these transfer stations, trucking the waste from each transfer station to Las Vegas, and subsequently traveling through Las Vegas to the NNSS using different routes, as shown in Figure 5–4. Based on the results in Table 5–15, the incident-free dose to the rail and truck crews would be highest if a transfer station were located at West Wendover because of the longer distance traveled by truck, as compared to other transfer station locations. The risk to the crews, however, would be about the same (1 LCF) for all locations analyzed. While the incident-free population dose and risk can vary somewhat, these differences are small. There would be small differences in radiological accident risks among the different transfer station alternatives. The risk for traffic fatalities would range from 12 to 14, with the use of a transfer station at Parker incurring the highest risk.

Table 5–15 Range of Risks for Unconstrained Rail-Truck Transport from U.S. Regions to the Nevada National Security Site [a]

From Regions to Transfer Stations Below to the NNSS	*Number of Shipments*	*Incident-Free*				*Accident*	
		Crew		*Population*			
		Dose (person-rem)	*Risk (LCF)*	*Dose (person-rem)*	*Risk (LCF)*	*Radiological Risk (LCF)*	*Non-radiological Risk (fatalities)*
Apex	81,000	1,300	0.8	360 – 380	0.2	0.0001 – 0.0002	13
Arden	81,000	1,300	0.8	380 – 390	0.2	0.0001 – 0.0002	13
Kingman [b]	81,000	1,400 – 1,500	0.8 – 0.9	440 – 450	0.3	0.0002	12
Parker [c]	81,000	1,700 – 1,800	1	490 – 500	0.3	0.0002	14
West Wendover [d]	81,000	1,900	1	430 – 450	0.3 – 0.4	0.0001 – 0.0002	12
Constrained Case [e]	81,000	1,800	1	480	0.3	0.0002	13

LCF = latent cancer fatality; NNSS = Nevada National Security Site; rem = roentgen equivalent man.
[a] Ranges are shown only where there are differences in results among the routes, assuming three significant figures for shipments, two significant figures for dose, and one significant figure for risk.
[b] Truck transports from Kingman, Arizona, would use U.S. Route 93 (across the bridge downstream of the Hoover Dam) and enter the Las Vegas area through Henderson, Nevada, from which there would be four possible routes to the NNSS.
[c] Truck transports from Parker, Arizona, would use U.S. Route 95 and enter the Las Vegas area through Henderson, from which there would be four possible routes to the NNSS.
[d] Truck transports from West Wendover, Nevada, would enter the Las Vegas area through Apex, Nevada, from which there would be two possible routes to the NNSS.
[e] Results are from Table 5–11 and represent the combined use of a transfer station at Parker and one at West Wendover. The results do not reflect shipments of LLW/MLLW analyzed in other NEPA documents.
Note: Totals may not sum due to rounding.

Regional Transfer Stations: It is possible that a waste generator may want to transport LLW/MLLW to the NNSS for disposal by rail, but does not have onsite access to rail. In this case, the waste generator would transport waste by truck to a rail-truck transfer station in the generator's region. At least one known waste generator without direct rail access within the Southwest, Northeast, and West regions exists. There would be transportation impacts associated with transport of wastes from these waste generators to a regional transfer station. Because of the uncertainty in whether currently known or unknown waste generators would use a regional transfer station, impacts were estimated for the Southwest, Northeast, and West regions in such a way that would be generally representative of use of a regional transfer station located within a given distance of a generator. **Table 5–16** shows these impacts, assuming a number of shipments that are forecasted to be received from a known generator. Note that these impacts can be proportionally adjusted for other numbers of shipments.

Table 5–16 Transport to Regional Transfer Stations – Impacts

Region	*One-way Distance [a] (km/miles)*	*Number of Shipments*	*One-way Travel (million km/million miles)*	*Incident Free [b]*				*Accident [b]*	
				Crew		*Population*			
				Dose (rem)	*Risk (LCF)*	*Dose (person-rem)*	*Risk (LCF)*	*Radiological Risk (LCF)*	*Traffic Fatality (roundtrip)*
Southwest	155/96	7750	1.20/0.75	15	8×10^{-3}	6.7	4×10^{-3}	4×10^{-6}	3×10^{-5}
Northeast	54/34	25	0.0014/0.00087	0.014	8×10^{-6}	0.0071	4×10^{-6}	2×10^{-8}	7×10^{-6}
West	104/65	360	0.037/0.023	0.66	4×10^{-4}	0.28	2×10^{-4}	9×10^{-7}	1×10^{-5}

km = kilometers; LCF = latent cancer fatality; rem = roentgen equivalent man.
[a] It was assumed that the one-way distance for each region encompasses a reasonable distance from a waste generator to a regional transfer station.
[b] The incident-free and accident impacts were calculated using rural, suburban, and urban population densities considered to be representative of the region.

5.1.3.1.3 Reduced Operations Alternative (Constrained Case)

Under the Reduced Operations Alternative, the same number of shipments of LLW and MLLW, and radioisotopic thermoelectric generators would occur as that projected under the No Action Alternative. There would be a reduction in the number of shipments of TRU waste (17 shipments under the Reduced Operations Alternative versus 20 under the No Action Alternative) and SNM (60 shipments under the Reduced Operations Alternative versus 120 under the No Action Alternative). Because the total number of shipments for all waste and materials under these two alternatives is essentially the same, the potential radiological and nonradiological impacts under the Reduced Operations Alternative would be equivalent to the risks under the No Action Alternative.

The impacts of transporting sanitary waste, hazardous waste, and other wastes and recyclables generated at NNSS facilities to onsite or remote disposal or reuse facilities would be slightly less than those under the No Action Alternative, with results shown in Appendix E, Table E–19. The potential impacts under this alternative would be 1 (1.4) traffic accident and less than 1 (0.05) traffic accident fatality in 1.8 million two-way miles traveled.

5.1.3.2 Traffic

5.1.3.2.1 Methodology and Assumptions

Onsite traffic. Onsite traffic impacts at the NNSS were analyzed by evaluating changes in the traffic volume of privately owned vehicles, trucks transporting radioactive waste and nonradioactive waste, and miscellaneous service vehicles. The estimated changes in daily onsite traffic volumes are presented in **Table 5–17**. It was assumed that rates of bus usage by employees under all alternatives would be similar to current conditions; that is, 50 percent of personnel would commute to and from the NNSS using the bus service (see Chapter 4, Section 4.1.3.1). The majority of the truck trips were assumed to transport wastes, based on waste projections. Daily truck shipments of radioactive wastes and materials were estimated based on projections presented in Section 5.1.3.1.

Table 5–17 Incremental Change in Onsite Daily Vehicle Trips on Mercury Highway at the Nevada National Security Site

Segment of Mercury Highway	*No Action*		*Expanded Operations*		*Reduced Operations*	
	POVs	*Trucks*	*POVs*	*Trucks*	*POVs*	*Trucks*
Between U.S. Route 95 and Mercury	+0	+20	+670	+130	-170	+20
Between Mercury and Tippipah Highway	+0	+20	+410	+140	-100	+10
North of Tippipah Highway	+0	+10	+270	+100	-70	+5

POVs = privately owned vehicles.
Note: These estimates do not include traffic volumes associated with the construction and operation of any solar power generation facilities because this traffic would access facilities from a gate located on Lathrop Wells Road and would not likely contribute to traffic volumes on Mercury Highway.

The only available onsite traffic data come from a 1999 traffic study of Mercury Highway (PBS&J 1999); therefore, the onsite traffic impacts in this section are discussed in terms of impacts on Mercury Highway. The study recorded daily traffic volumes on three segments of Mercury Highway. Because Mercury Highway is the main roadway at the NNSS, it was assumed that impacts on this highway represent an upper bound to potential traffic impacts that could occur on other key roadways at the NNSS.

For this analysis, the percent change in the number of daily vehicle trips associated with personnel vehicles and truck transport of miscellaneous wastes and materials reflects the degree of impact on baseline traffic conditions at the NNSS. A “trip” is defined as a one-way vehicle movement from an origin to a destination. Current traffic conditions on Mercury Highway were estimated based on the 1999 onsite traffic study, as discussed in Chapter 4, Section 4.1.3.1. Approximately 90 percent of vehicles currently accessing the NNSS on a daily basis are privately owned vehicles used by commuting workers.

The remaining 10 percent of vehicles are trucks (PBS&J 1999). The number of trips made per day and per peak morning and evening hours were estimated for each alternative and compared with current traffic volumes. To evaluate potential impacts on other principal roadways within the NNSS, the total daily vehicle trips projected to occur on Mercury Highway under each alternative were compared with the capacities of these roadways (main roadways throughout the NNSS were estimated to have capacities exceeding 2,000 vehicles per hour for both directions combined).

Regional traffic. The impacts analysis of regional (i.e., offsite) traffic was based on a determination of the number of personnel and truck trips that would occur under each alternative. Offsite traffic impacts in the region were assessed by estimating the changes in the numbers of daily vehicle trips made under each alternative and applying the changes to baseline traffic volumes on key roadways (for comparison to future baseline conditions, see Chapter 4, Table 4–11, for projected traffic volumes to the year 2020). The estimated changes in daily traffic volumes that were used for the regional traffic analysis are the same as those listed for "Between U.S. Route 95 and Mercury" in Table 5–17, as they reflect the incremental increase in daily traffic volumes that could occur off site. In addition, under the No Action, Expanded Operations, and Reduced Operations Alternatives, vehicles associated with one or more solar power generation facilities were added to these estimates (1,000; 1,500; and 800 daily vehicle trips were respectively added to represent peak construction traffic for conservative estimates). Current traffic volumes, or "average daily traffic," for 2008 were obtained from the Nevada Department of Transportation (NDOT 2008a, 2008b) (see Chapter 4, Table 4–9, for the 2008 average daily traffic volumes).

The *2000 Highway Capacity Manual* defines six categories of **level of service** that reflect the level of traffic congestion and qualify the operating conditions of a roadway or intersection. The six levels are given letter designations ranging from *A* to *F*, with "*A*" representing the best operating conditions (free flow, little delay) and "*F*" the worst (congestion, long delays) (TRB 2000).

The region of influence (ROI) for the regional traffic analysis includes the principal roadways leading to the NNSS and offsite project locations, with emphasis on the areas surrounding each site; the ROI is limited to Nye and Clark Counties. The geographic distribution of additional vehicle trips is based on the location of main entry points for each of the locations (the NNSS, NLVF, RSL, and TTR) and travel patterns. To determine the travel patterns of future personnel, it was assumed that residential choices for new personnel would correspond to the ratio of current personnel (NSTec 2009d). The geographic distribution of vehicle trips from trucks transporting radioactive waste was based on routes described in Chapter 4, Section 4.1.3.2. Routes for miscellaneous trucks (such as vendors) were assumed to originate and end in the Las Vegas metropolitan area.

To account for increases in traffic from population growth, baseline traffic volumes were projected to the year 2020, assuming an annual increase in traffic volumes of 5 percent for Nye County and Clark County (NV State Demographer's Office 2008). To better reflect operating conditions of the roadways, volume-to-capacity ratios and levels of service on key roadways were determined for the peak hour (see Chapter 4, Table 4–10, for the level of service designations for associated ratio values).

5.1.3.2.2 Summary of Impacts (Nevada National Security Site)

Onsite traffic. Onsite potential impacts from increased daily vehicle trips would include increased traffic congestion and delays, increased need for road maintenance and improvements, and increased risks regarding road safety. Table 5–17 summarizes the incremental changes in daily vehicle trips projected under each alternative that would result from trips made by privately owned vehicles and trucks along the three analyzed segments of Mercury Highway. **Table 5–18** presents the total daily traffic volumes projected under each alternative along the three analyzed segments of Mercury Highway.

Table 5–18 Projected Traffic Volumes on Mercury Highway

Traffic Volume Component	*Segment of Mercury Highway*		
	Between U.S. Route 95 and Mercury Highway	*Between Mercury Highway and Tippipah Highway*	*North of Tippipah Highway*
Baseline Conditions			
Average Daily Traffic	1,748	1,151	764
A.M. Peak Hour	349	172	75
P.M. Peak Hour	349	172	152
No Action Alternative			
Average Daily Traffic	1,768	1,171	774
A.M. Peak Hour	354	176	78
P.M. Peak Hour	354	176	155
Expanded Operations Alternative			
Average Daily Traffic	2,548	1,701	1,134
A.M. Peak Hour	511	255	113
P.M. Peak Hour	511	255	226
Reduced Operations Alternative			
Average Daily Traffic	1,598	1,061	699
A.M. Peak Hour	319	159	70
P.M. Peak Hour	319	159	140

Regional traffic. For regional traffic impacts, increases in traffic volumes could potentially result in traffic congestion and delays, degradation of operating capacities on roadways, degradation of road surfaces and increased frequency in road maintenance, and increased traffic accidents. For each of the alternatives, **Tables 5–19** and **5–20**, located at the end of this section, summarize the projected average daily traffic volumes for 2020, the percent of traffic volume change expected to occur, the volume-to-capacity ratios, and the levels of service for key roadways in Nye and Clark Counties, respectively.

Under future baseline conditions (i.e., traffic conditions in the year 2020 without the NNSS activities proposed under the alternatives), it is predicted that the majority of roadways analyzed would remain similar to current levels of service (see Chapter 4, Table 4–11). As noted in Tables 5–19 and 5–20, the contribution of additional vehicle volumes associated with NNSS activities is considered relatively low (under the No Action and Reduced Operations Alternatives) to moderately high (under the Expanded Operations Alternative) when compared to projected traffic volumes in the region. Only Mercury Highway, which provides direct access to the NNSS from U.S. Route 95, is predicted to experience a degradation of level of service—from level A to B under the Expanded Operation Alternative—as a result of new NNSS activities. Potential impacts on the regional traffic system resulting from construction and operation of renewable energy projects and other development in the area are discussed in Chapter 6, Section 6.3.3.

5.1.3.2.3 No Action Alternative

Onsite traffic. The total daily vehicle trips projected for Mercury Highway under the No Action Alternative would increase by approximately 2 percent from current conditions. The additional traffic volumes on Mercury Highway would be attributable to trucks transporting wastes and materials; minimal incremental traffic increases are expected from privately owned vehicles because the only personnel increase would occur from the proposed solar power generation facility in Area 25, which is not expected to use Mercury Highway at the NNSS. Based on the traffic volumes during peak hours, it is expected that Mercury Highway would operate at a level of service of A. It was assumed that peak traffic volumes on key onsite roadways throughout the NNSS would not exceed the levels projected for Mercury Highway;

therefore, no capacity issues are expected on other key roadways, except possibly for those serving the commercial solar power generation facility in Area 25.

The projected traffic volumes presented in Tables 5–19 and 5–20 do not include potential increases in traffic volumes from construction and operation of the solar power generation facility because personnel and trucks associated with the facility would access the facility from a gate located on Lathrop Wells Road and would not likely contribute to traffic volumes on Mercury Highway. Approximately 500 and 1,000 workers were estimated to be required for construction of this facility during average and peak construction conditions, respectively. Assuming that 50 percent of the construction workers would carpool to the site, approximately 250 (average) and 500 (peak) additional vehicle trips could occur during the peak commute hours (or a total of 500 and 1,000 additional vehicle trips could occur on a daily basis during average and peak construction activities, respectively) on roads leading up to the project site in Area 25. The addition of these vehicles and associated construction trucks on a daily basis (estimated to occur over a 35-month period) would increase the rate of pavement deterioration and degrade levels of service and could require increased road maintenance and upgrades for roads in the project area.

Regional traffic. U.S. Route 95, State Route 160, and State Route 372 would experience the greatest percent increases in daily traffic volumes because these roadways serve an area that is considered characteristically rural and generally experiences relatively low daily traffic volumes. The volume-to-capacity ratios would remain similar for all roadways analyzed, and levels of service are predicted to be the same as those under future baseline traffic volumes (see Chapter 4, Table 4–11). The similarity of traffic conditions under the No Action Alternative and future baseline conditions reflect the minor contribution of NNSS-related activities to overall traffic volumes in the region. The increase in daily trips under this alternative would have minor impacts on traffic congestion in the ROI. Coordination with public safety and maintenance agencies would aid in planning for and mitigating delays resulting from the anticipated increase in traffic volumes.

5.1.3.2.4 Expanded Operations Alternative

Onsite traffic. The total daily vehicle trips projected for the three segments of Mercury Highway analyzed under the Expanded Operations Alternative would increase by approximately 50 percent above current traffic levels, mainly due to the 25 percent increase in NNSS personnel and traffic from construction-related vehicles. Based on the traffic volumes during peak hours, it is expected that Mercury Highway would operate at a level of service of B or better and other key roadways would not have any capacity issues. Drivers accessing the main entry gate would experience longer delays during the peak morning and evening traffic hours, and increased traffic congestion would occur throughout Mercury due to the increase in privately owned vehicles. Drivers on Mercury Highway could experience longer delays or reduced travel speeds due to the high increase in daily truck traffic. Because the incremental increase in onsite traffic volumes would be moderately high, the number of repairs and required maintenance on NNSS roadways would increase at a greater rate than currently experienced.

The projected traffic volumes presented in Tables 5–19 and 5–20 do not include potential increases in traffic volumes from the construction of one or more solar power generation facilities. Personnel and trucks associated with the solar power generation facilities would access the facility from a gate located on Lathrop Wells Road. Approximately 750 and 1,500 workers were estimated to be required for construction of this facility during average and peak construction conditions, respectively. Assuming that 50 percent of the workers would carpool to the site, approximately 375 (average) and 750 (peak) additional vehicle trips could occur during the peak commute hours (or a total of 750 and 1,500 additional vehicle trips could occur on a daily basis during average and peak construction activities, respectively) on roads leading up to the project site in Area 25. The addition of these vehicles and associated construction trucks on a daily basis (estimated to occur over a 42-month period) would increase the rate of pavement deterioration, degrade levels of service, and could require increased road maintenance and upgrades for roads in the project area.

Regional traffic. Roadways in Nye and Clark Counties would generally experience higher increases in traffic volumes. When compared to the No Action Alternative, Mercury Highway and segments of Nevada State Route 372, State Route 160, U.S. Route 95, and State Route 164 would experience moderately high percent increases in daily traffic; however, the operating capacities would remain similar to those under future baseline traffic volumes (see Chapter 4, Table 4–11). Only Mercury Highway would experience a substantially high increase in traffic (an approximately 80 percent increase) and degrade in level of service (from a Level A to a Level B). As most of the increases in daily traffic volumes during the peak hours would be attributable to workers commuting to the NNSS, any detectable changes in traffic volumes would primarily occur during the main commuting hours and at the entry gates of the NNSS (the main entrance gate for regular NNSS employees and Gate 510 for those associated with the construction and operation of the commercial solar power generation facilities in Area 25). Coordination with public safety and maintenance agencies would aid in planning for and mitigating delays resulting from the anticipated increase in traffic volumes.

Table 5–19 includes traffic volumes from the truck transport of radioactive waste and materials under the Unconstrained Case (as discussed in Section 5.1.3.1). Under the Constrained Case, it was assumed that DOE/NNSA would maintain its current operational practice of avoiding transporting waste and materials on the interstate system within Las Vegas. Table 5–20 denotes which study locations would not experience these additional truck volumes under the Constrained Case.

5.1.3.2.5 Reduced Operations Alternative

Onsite traffic. The total daily vehicle trips projected for Mercury Highway under the Reduced Operations Alternative would decrease by approximately 10 percent from current conditions mainly because the number of NNSS workers is expected to decrease by 10 percent. Compared with current conditions, the number of daily trips from privately owned vehicles would decline. Impacts under this alternative would be similar or slightly reduced compared to those under the No Action Alternative; key roadways, including Mercury Highway, would operate well below maximum capacities.

The projected traffic volumes presented in Tables 5–19 and 5–20 do not include potential increases in traffic volumes from the construction and operation of the solar power generation facility because personnel and trucks associated with the facility would enter from a gate located on Lathrop Wells Road and would not likely contribute to traffic volumes on Mercury Highway. Approximately 400 and 800 workers were estimated to be required for construction of this facility during average and peak construction conditions, respectively. Assuming that 50 percent of the workers would carpool to the site, approximately 200 (average) and 400 (peak) additional vehicle trips could occur during the peak commute hours (or a total of 400 and 800 additional vehicle trips could occur on a daily basis during average and peak construction activities, respectively) on roads leading up to the project site in Area 25. The addition of these vehicles and associated construction trucks on a daily basis (estimated to occur over a 32-month period) would increase the rate of pavement deterioration, degrade levels of service, and could require increased road maintenance and upgrades for roads in the project area.

Regional traffic. Under the Reduced Operations Alternative, traffic volumes would increase slightly during peak hours on almost all of the roadways analyzed because the number of personnel at the NNSS would be reduced and most of the additional traffic volumes would be attributable to vehicles associated with the construction and operation of the commercial solar power generation facility. Impacts on regional traffic under this alternative would therefore be slightly less or similar to those described under the No Action Alternative; volume-to-capacity ratios and levels of service would remain unchanged from future baseline conditions (see Chapter 4, Table 4–11).

Table 5–19 Traffic Volumes and Level of Service Impacts on Key Roads in Nye County During Peak Hour Conditions [a]

		No Action Alternative				*Expanded Operations Alternative*				*Reduced Operations Alternative*			
Route	***Location***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***
U.S. Route 6	0.3 miles east of Nevada State Route 375 (Warm Springs Road)	364	2	0.02	A	394	10%	0.02	A	361	1	0.02	A
	200 feet west of Nevada State Route 375 (Warm Springs Road)	495	1	0.03	A	524	7%	0.03	A	492	1	0.03	A
	0.2 miles east of Nevada State Route 376 (Tonopah-Austin Road)	1,020	6	0.06	A	1,008	5%	0.06	A	975	1	0.06	A
	0.2 miles west of Nevada State Route 376	1,851	3	0.11	A	1,838	3%	0.11	A	1,806	1	0.11	A
Nevada State Route 373	0.5 miles south of U.S. Route 95	1,511	2	0.09	A	1,509	2%	0.09	A	1,492	1	0.09	A
Nevada State Route 372	0.8 miles west of Nevada State Route 160	19,748	1	0.58	C	19,987	2%	0.59	C	19,673	1	0.58	C
	0.1 miles east of Nevada–California state line	1,537	15	0.10	A	1,776	33%	0.12	A	1,462	9	0.10	A
U.S. Route 95	In Tonopah, 100 feet south of Bryan Avenue	11,275	0	0.43	B	11,248	0%	0.43	B	11,245	0	0.43	B
	500 feet north of Cemetery Road, north of Tonopah	6,877	1	0.53	D	6,850	0%	0.53	D	6,847	0	0.53	D
	0.2 miles south of U.S. Route 6 in Tonopah	8,820	0	0.34	B	8,837	0%	0.34	B	8,805	0	0.34	B
	9 miles south of Scotty's Junction (State Route 267)	3,774	1	0.22	B	3,794	1%	0.22	B	3,758	0	0.22	B
	1 mile north of Beatty (State Route 374)	4,101	1	0.24	B	4,124	1%	0.24	B	4,085	0	0.24	B
	0.2 miles west of Amargosa Valley (State Route 373)	4,264	1	0.25	C	4,276	1%	0.25	C	4,245	0	0.25	C
	1.5 miles east of Amargosa (State Route 373)	4,753	1	0.28	C	4,765	1%	0.28	C	4,734	0	0.28	C
	4 miles west of Mercury Interchange	4,951	5	0.29	C	5,100	8%	0.30	C	4,858	3	0.29	C
Mercury Highway	0.2 miles north of Mercury Interchange on U.S. Route 95	1,116	1	0.07	A	2,886	162%	0.19	B	962	-13	0.06	A

		No Action Alternative				*Expanded Operations Alternative*				*Reduced Operations Alternative*			
Route	***Location***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***
Nevada State Route 160	0.1 miles south of U.S. Route 95	1,864	14	0.11	A	2,179	34%	0.12	A	1,783	9	0.10	A
	7.7 miles north of Nevada State Route 372	2,842	9	0.17	B	3,156	21%	0.19	B	2,761	6	0.16	A
	0.1 miles north of Nevada State Route 372 (near Pahrump)	37,700	1	1.11	F	38,015	1%	1.12	F	37,619	0	1.11	F
	200 feet south of Nevada State Route 372 (near Pahrump)	34,442	1	1.01	F	34,755	2%	1.02	F	34,361	0	1.01	F
	0.3 miles north of the Clark–Nye County Line	14,732	2	0.43	B	15,046	4%	0.44	B	14,651	1	0.43	B

AADT = annual average daily traffic; LOS = level of service; V/C = volume-to-capacity ratio.
Note: See Chapter 4, Table 4–11, for future (i.e., 2020, without new NNSS activities) baseline traffic volumes, volume-to-capacity ratios, and levels of service.
[a] Source: NDOT 2008a, Nye County.
[b] Percent change in annual average daily traffic under future conditions (i.e., in the year 2020) due to the change in the number of vehicle trips predicted under an alternative.

Table 5–20 Traffic Volumes and Level of Service Impacts on Key Roads in Clark County During Peak Hour Conditions [a]

Route	Location	No Action Alternative				Expanded Operations Alternative				Reduced Operations Alternative			
		AADT in 2020	*Percent Change* [b]	*V/C*	*LOS*	*AADT in 2020*	*Percent Change* [b]	*V/C*	*LOS*	*AADT in 2020*	*Percent Change* [b]	*V/C*	*LOS*
Nevada State Route 160	12 miles west of Interstate 15	11,190	3	0.44	D	11,549	6%	0.45	D	11,075	2	0.43	D
	4 miles west of Interstate 15	29,870	1	0.66	D	30,230	2%	0.67	D	29,755	1	0.66	D
	200 feet west of Interstate 15	48,685	1	0.48	B	49,044	1%	0.48	B	48,570	0	0.48	B
U.S. Route 95	West of Indian Springs	5,542	15	0.11	A	6,459	34%	0.13	A	5,238	8	0.10	A
	4 miles east of Indian Springs [c]	9,305	8	0.18	A	10,222	19%	0.20	A	9,001	5	0.18	A
	0.5 miles south of Snow Mountain Interchange (in northwest Las Vegas) [c]	13,068	6	0.26	A	13,985	13%	0.27	A	12,764	3	0.25	A
	0.4 miles north of Ann Road Interchange (in northwest Las Vegas) [c]	113,593	1	1.48	F	114,510	1%	1.50	F	113,289	0	1.48	F
	0.5 miles west of Interstate 15 (between Rancho Drive and Martin Luther King Boulevard) [c]	285,614	0	2.24	F	286,532	1%	2.25	F	285,310	0	2.24	F
	0.5 miles east of Interstate 15 (between Las Vegas Boulevard and Main Street) [c]	237,233	0	2.33	F	238,151	1%	2.33	F	236,929	0	2.32	F
	Between Russell Road and Sunset Road (in southwest Las Vegas) [c]	149,448	0	1.95	F	149,762	0%	1.96	F	149,338	0	1.95	F
	0.8 miles north of State Route 163 (west of Bullhead City)	10,895	0	0.43	B	10,942	1%	0.43	B	10,895	0	0.43	B
	1 mile south of Nevada State Route 163 (Nevada–California state line)	4,310	0	0.17	B	4,357	3%	0.17	B	4,309	0	0.17	B

Route	Location	No Action Alternative				Expanded Operations Alternative				Reduced Operations Alternative			
		AADT in 2020	***Percent Change*** [b]	***V/C***	***LOS***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***	***AADT in 2020***	***Percent Change*** [b]	***V/C***	***LOS***
Interstate 215	Between Green Valley Parkway and Valle Verde Drive (in southwest Las Vegas) [c]	191,109	0	1.87	F	191,424	0%	1.88	F	191,000	0	1.87	F
	Between Decatur Boulevard and Interstate 15 (in central south Las Vegas) [c]	203,204	0	1.99	F	203,519	0%	2.00	F	203,095	0	1.99	F
	0.2 miles north of State Route 159 (in central west Las Vegas) [c]	62,093	0	1.22	F	62,408	1%	1.22	F	61,916	0	1.21	F
Losee Road	0.3 miles south of Cheyenne Avenue (north of NLVF)	20,159	0	0.52	C	20,511	2%	0.53	C	20,223	0	0.52	C
	0.2 miles south of Carey Avenue (south of NLVF)	22,847	0	0.59	C	23,423	3%	0.60	C	22,814	0	0.59	C
Las Vegas Boulevard	0.3 miles south of Nellis Boulevard (west of RSL)	17,529	0	0.45	B	17,621	1%	0.45	B	17,499	0	0.45	B
Nellis Boulevard	300 feet north of Cheyenne Avenue (west of RSL)	36,286	0	0.62	C	36,308	0%	0.62	C	36,277	0	0.62	C
Nevada State Route 164	1.1 miles west of U.S. Route 95 (west of Searchlight)	937	2	0.04	A	983	12%	0.05	A	936	2	0.04	A

Route	Location	No Action Alternative				Expanded Operations Alternative				Reduced Operations Alternative			
		AADT in 2020	Percent Change [b]	V/C	LOS	AADT in 2020	Percent Change [b]	V/C	LOS	AADT in 2020	Percent Change [b]	V/C	LOS
Interstate 15	At the Nevada–California state line	51,078	0	1.00	E	51,125	0%	1.00	E	51,078	0	1.00	E
	5 miles north of Interstate 215 (in south central Las Vegas) [c]	353,748	0	3.47	F	354,161	0%	3.47	F	353,536	0	3.47	F
	1 mile north of Interstate 515 (in central Las Vegas) [c]	197,894	0	1.55	F	198,387	0%	1.56	F	197,744	0	1.55	F
	5 miles north of Interstate 515 (near central Las Vegas) [c]	96,983	0	0.95	E	97,411	1%	0.96	E	96,848	0	0.95	E
	5.5 miles north of Interstate 515 (in north central Las Vegas) [c]	45,914	0	0.90	D	46,342	1%	0.91	D	45,779	0	0.90	D
	North of West Mesquite Interchange (Nevada–Utah state line)	25,534	0	0.50	B	25,600	0%	0.50	B	25,508	0	0.50	B

AADT = annual average daily traffic; LOS = level of service; NLVF = North Las Vegas Facility; RSL = Remote Sensing Laboratory; V/C = volume-to-capacity ratio.
Note: See Chapter 4, Table 4–11, for future (i.e., 2020 without new NNSS activities) baseline traffic volumes, volume-to-capacity ratios, and levels of service.
[a] Source: NDOT 2008b, Clark County.
[b] Percent change in annual average daily traffic under future conditions (i.e., in the year 2020) due to the change in the number of vehicle trips predicted under an alternative.
[c] Under the Constrained Case for the Expanded Operations Alternative, trucks transporting radioactive waste and material would not pass through this location. Therefore, the daily traffic volumes shown for this alternative could be reduced by up to 30 trips.

5.1.4 Socioeconomics

This section addresses potential impacts on the region's socioeconomic conditions. The discussion focuses on the region's economic activity, population, and housing, public finances, and public services. DOE/NNSA assessed the potential for impacts, both beneficial and adverse, based on whether the proposed activities would directly or indirectly result in any of the following:

- Alterations in the projected rates of population growth
- Effects on the housing market
- Effects on local businesses and the economy
- Displacement of existing jobs
- Effects on local employment or the workforce

5.1.4.1 No Action Alternative

5.1.4.1.1 Economic Activity, Population, and Housing

Under the No Action Alternative, a 240-megawatt solar power generation facility would be constructed. Operation of this solar power generation facility would be the sole source of new permanent employment at the NNSS, adding 150 full-time equivalent (FTE) positions to the current employment level of 1,699 (see **Table 5–21** and **Table 5–22**).

Table 5–21 Onsite Employment

Alternative	*NNSS*		*NLVF*	*RSL*	*TTR*	*Total*
	NNSS Only	*Including Solar Power Generation Facility Employees*				
No Action	1,699	1,849	1,442	132	106	3,379
Expanded Operations	2,124 [a]	2,324	1,803 [a]	132	43	4,102
Reduced Operations	1,529 [b]	1,654	1,298 [b]	132	39 [c]	2,998

NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; RSL = Remote Sensing Laboratory; TTR = Tonopah Test Range.
[a] Current employment number plus 25 percent.
[b] Current employment number minus 10 percent.
[c] Number from the *Complex Transformation Supplemental Programmatic Environmental Impact Statement* minus 10 percent.

Table 5–22 Construction Employment

Alternative	*NNSS* [a]	*NLVF*	*RSL*	*TTR*
No Action	For commercial solar facility, average of 500 FTE positions over 35 months, peak of 1,000 FTE positions.	0	0	0
Expanded Operations	For commercial solar facilities, average of 750 FTE positions over 42 months, peak of 1,500 FTE positions. 250 additional FTE positions from other projects.	0	0	0
Reduced Operations	For commercial solar facility, average of 400 FTE positions over 32 months, peak of 800 FTE positions.	0	0	0

FTE = full-time equivalent; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; RSL = Remote Sensing Laboratory; TTR = Tonopah Test Range.
[a] NNSA Plant Construction Numbers based on Amargosa Farm Road Solar Energy Project.

Approximately 10 percent of the 150 FTE positions, or 15 individuals, are expected to relocate as a result of the No Action Alternative. It was assumed that 77 percent would live in Clark County (12 workers) and 23 percent in Nye County (3 workers), consistent with current workforce demographics (NSTec 2009d). Projected rates of population growth would not be altered as a result of the No Action Alternative. Sufficient housing exists in the area (208,275 and 3,202 housing vacancies in Clark and Nye Counties, respectively) to support an increase in population of 15 people. This would result in a

0.01 percent reduction in housing vacancy rates in Clark County and a 0.1 percent reduction in Nye County.

The remaining 135 individuals filling the new jobs are expected to be already living in Clark and Nye counties. Of the 135 individuals, it was assumed that 77 percent would live in Clark County (104 workers) and 23 percent in Nye County (31 workers), consistent with current workforce demographics (NSTec 2009d). This would decrease unemployment in Clark County by 0.07 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). It also would decrease unemployment in Nye County by about 0.99 percent (a total of 3,133 Nye County residents were unemployed as of August 2010).

Daily spending by these new employees would positively affect the immediate area of the NNSS. Purchases made would typically include gasoline, automobile servicing, food and beverages, laundry services, and other retail items. Therefore, a minor beneficial impact on economic activity would occur under the No Action Alternative due to the increase in employment.

The Regional Input-Output Modeling System II (RIMS II) developed for the U.S. Department of Commerce, Bureau of Economic Analysis, was used to evaluate the indirect economic impact on employment of constructing the solar power generation facility. RIMS II provides two types of multipliers, final-demand and direct-effect, for estimating the impacts of changes on employment. An estimate of the change in the total number of jobs in a region's economy was calculated by multiplying the initial change in jobs by a direct-effect employment multiplier. By adding 150 FTE positions to support the solar power generation facility, the analysis showed that approximately 394 secondary jobs would be created. The combined effect of direct and indirect employment would result in a decrease in unemployment in Clark County of about 0.3 percent and about 3.9 percent in Nye County.

Approximately 500 FTE positions over 35 months, with a peak of 1,000 FTE positions, would be filled for construction of the solar power generation facility. Given the high unemployment rates in Clark and Nye Counties (14.7 and 17.2 percent, respectively, as of August 2010), it was assumed that the majority of construction workers hired for construction of the solar power generation facility would currently be living in the area. Between January 2009 and January 2010, 29,800 construction jobs were lost in the State of Nevada (LVRJ 2010). Because relocation of construction workers is unlikely, an increase in population and a decrease in housing availability are not anticipated; only negligible impacts on population and housing are anticipated during construction.

The addition of construction jobs would have a direct economic impact on employment in the region. As construction firms are hired to support the solar power generation facility, regional economic activity (purchases of building materials, construction supplies, and equipment, as well as spending by the construction workers) would also increase. Therefore, construction would have a minor beneficial impact on employment and the local economy.

As described previously, RIMS II was used to calculate the indirect economic impact of the project on employment. An estimate of the change in the total number of jobs in a region's economy was calculated by multiplying the initial change in jobs by a direct-effect employment multiplier. By adding 500 to 1,000 FTE positions, the analysis showed that approximately 930 to 1,860 secondary jobs would be created as a result of construction of the solar power generation facility (DOC 2010). This would reduce the unemployment rate in the region and temporarily benefit the economy and employment in the region.

Public finance. Increased sales transactions for the purchase of materials and supplies for construction of the solar power generation facility would generate some additional revenues for local governments. These impacts would be minor, but beneficial. In addition, revenues for Clark and Nye Counties would increase due to increases in personal income and total employment, which could lead to increased spending.

5.1.4.1.2 Public Services

Public education. For the 2009 to 2010 school year, the Clark County School District student–teacher ratio was 21:1. The student–teacher ratio for the Nye County School District was 18.6:1. Under the No Action Alternative, a total of 28 children could relocate to the area based on a state average of 1.89 children per family (USCB 2000). This represents an increase of 22 children in the Clark County School District (77 percent of the children would reside in Clark County, consistent with current NNSS workforce demographics [NSTec 2009d]) and an increase of 6 children in the Nye County School District (23 percent of the children would reside in Nye County). It is unlikely that all students relocating to the area would be the same age and living in the same neighborhood. However, based on an increase of 22 children to the Clark County School District, one additional teacher may be required in Clark County to maintain the 21:1 student-teacher ratio. No new teachers would be required in Nye County as a result of the No Action Alternative.

Police protection. Under the No Action Alternative, the number of daytime occupants on the NNSS would increase, which could result in more calls for police services. Civilian law enforcement at the NNSS is provided under a contract with the Nye County Sheriff's Department. To maintain the existing level of service, the NNSS would need to increase the number of civilian law enforcement officers under contract due to the increase of 150 permanent employees. Because the increase in number of employees that would relocate to Clark and Nye Counties is only 15 total, there would be no effect on levels of service at the Las Vegas Metropolitan Police Department, the North Las Vegas Police Department, or the Nye County Sheriff's Department. In addition, law enforcement is not provided by the Las Vegas Metropolitan Police Department or the North Las Vegas Police Department.

Fire protection. Construction and operation of the solar power generation facility would increase building density on the NNSS, which could result in additional calls for fire protection. NNSS Fire and Rescue operates out of two fire stations: one in Mercury and a newly constructed station in Area 6 that provides rapid response to emergencies in the forward areas of the NNSS. This impact is expected to be minor and would not affect levels of service at the Clark County Fire Department, the Las Vegas Fire Department, or the Nye County volunteer fire departments.

Health care. It was assumed that the majority of the 150 employees hired to operate the solar power generation facility would be currently living within the ROI. Therefore, the current person-to-hospital-bed ratio within the ROI would remain the same. Construction and operation of the solar power generation facility under the No Action Alternative would not displace any health care facilities or conflict with local and regional plans for health care or emergency services. Therefore, construction and operation of the solar power generation facility would not increase the need for hospital personnel.

5.1.4.2 Expanded Operations Alternative

5.1.4.2.1 Economic Activity, Population, and Housing

Under the Expanded Operations Alternative, it was assumed that operation of commercial solar power facilities, as well as other permanent positions created at the NNSS, would increase employment from 1,699 to 2,324, which would be an increase of 625 jobs (see Table 5–21).

Approximately 10 percent, or 63 individuals, are expected to relocate as a result of the Expanded Operations Alternative. It was assumed that 77 percent would live in Clark County (49 workers) and 23 percent in Nye County (14 workers), consistent with current workforce demographics (NSTec 2009). Projected rates of population growth would not be altered as a result of the Expanded Operations Alternative. Sufficient housing exists in the area (208,275 and 3,202 housing vacancies in Clark and Nye Counties, respectively) to support an increase in population of 63 people. This would result in a 0.02 percent reduction in housing vacancy rates in Clark County and a 0.4 percent reduction in Nye County.

The remaining 563 individuals filling the jobs are expected to be already living in the region. Of these 563 jobs, it was assumed that 77 percent (a total of 434) would live in Clark County and 23 percent (a total of 130) in Nye County, consistent with current workforce demographics (NSTec 2009d).

The 434 jobs added in Clark County would decrease unemployment by 0.31 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). In Nye County, the 130 new jobs would decrease unemployment by about 4.2 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). These additional jobs would represent a minor beneficial impact on employment in Clark County and a moderately beneficial impact on Nye County.

As described under the No Action Alternative, RIMS II was used to calculate the indirect economic impact of the project on employment. By adding 625 direct jobs under the Expanded Operations Alternative, approximately 920 indirect jobs would be created in the ROI. The combined effect of direct and indirect employment would result in a decrease in unemployment in Clark County of about 0.8 percent and about 11.0 percent in Nye County.

Daily spending by new employees would positively affect the immediate area of the NNSS. Purchases made would typically include gasoline, automobile servicing, food and beverages, laundry, and other retail items. Therefore, a minor beneficial impact on economic activity would occur under the Expanded Operations Alternative due to the increase in employment.

Approximately 750 FTE positions over 42 months, with a peak of 1,500 FTE positions, would need to be filled for construction of one or more solar power generation facilities. Other construction projects at the NNSS would require approximately 250 FTE positions over the next 10 years. Given the high unemployment rates in Clark and Nye Counties (14.72 and 17.2 percent, respectively, as of August 2010), it was estimated that the majority of the construction workers would come from within the region. This would temporarily reduce the unemployment rate in the region and would have a short-term beneficial impact on the economy and employment in the region.

RIMS II was used to calculate the indirect economic impact on employment resulting from solar power generation facility construction and other construction projects at the NNSS. An estimate of the change in the total number of jobs in a region's economy was calculated by multiplying the initial change in jobs by a direct-effect employment multiplier. By adding 750 to 1,500 FTE positions, approximately 1,400 to 2,790 jobs would be created as a result of solar power generation facility construction. The other construction projects would add 250 FTE positions, which would create approximately 466 jobs in the ROI. This would have a moderately beneficial impact on the economy and employment in the region during the period of construction.

As described under the No Action Alternative, regional economic activity would increase as construction firms are hired to support the solar power generation facilities due to the purchase of building materials and construction supplies and equipment, as well as spending by the construction workers. Therefore, construction would have a minor beneficial impact on employment and the economy under the Expanded Operations Alternative due to the increase in employment.

Public finance. As described under the No Action Alternative, increased sales transactions from purchases of materials and supplies for construction of the solar power generation facilities would generate additional revenues for local governments. These impacts would be minor but beneficial. In addition, property taxes collected as a result of the relocation of 49 households in Clark County and 14 in Nye County would increase revenue for local governments.

5.1.4.2.2 Public Services

Public education. As described under the No Action Alternative, for the 2009 to 2010 school year, the Clark County School District student–teacher ratio was 21:1. The student–teacher ratio for the Nye County School District was 18.6:1. Under the Expanded Operations Alternative, a total of 119 children could relocate to the area based on an average of 1.89 children per family (USCB 2008b). This represents an increase of 92 children in the Clark County School District (77 percent of the children would reside in Clark County) and an increase of 27 children in the Nye County School District (23 percent of the children would reside in Nye County). Four additional teachers would be needed in Clark County to maintain the current student–teacher ratio. One new teacher would be required in Nye County under the Expanded Operations Alternative.

Police protection. Under the Expanded Operations Alternative, the number of daytime occupants on the NNSS would increase by 625 employees, which could result in more calls for police services. To maintain the existing level of service, the NNSS would need to increase the number of civilian law enforcement officers under contract due to the increase of 625 permanent employees. As described under the No Action Alternative, this impact on police and public safety is expected to be negligible. It would not affect levels of service at the Las Vegas Metropolitan Police Department, the North Las Vegas Police Department, or the Nye County Sheriff's Department because law enforcement is handled under a separate contract.

Fire protection. Activities under the Expanded Operations Alternative could result in additional calls for fire protection. NNSS Fire and Rescue operates out of two fire stations: one in Mercury and a newly constructed station in Area 6, which provides rapid response to emergencies in the forward areas of the NNSS. This impact is expected to be minor and would not impact levels of service at the Clark County Fire Department, the Las Vegas Fire Department, or the Nye County volunteer fire departments.

Health care. The addition of 625 employees would have only a minor impact on area hospitals and hospital personnel. An eight-bed dispensary in Mercury serves as a clinic for the NNSS. The activities associated with the Expanded Operations Alternative are not anticipated to increase the need for hospital care or personnel within the ROI. However, due to the increase in the number of employees at the NNSS, the clinic in Mercury may need to expand its number of beds.

5.1.4.3 Reduced Operations Alternative

5.1.4.3.1 Economic Activity, Population, and Housing

Under the Reduced Operations Alternative, it was assumed that total employment at the NNSS would decrease from the current level of 1,699 to 1,654, with employment from the operation of the solar power generation facility offsetting most losses associated with a reduction in activity associated with other NNSS programs. This decrease would be equal to about 45 jobs lost: 35 in Clark County and 10 in Nye County. In Clark County, this would increase unemployment by about 0.02 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). In Nye County, the increase in unemployment would be about 0.32 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). Daily spending in the immediate area of the NNSS would decrease correspondingly, which would have a minor adverse impact on economic activity. Housing vacancies would increase and demand for public services would decrease due to the reduction in the permanent workforce.

Approximately 400 FTE positions over 32 months, with a peak of 800 positions, would need to be filled for construction of the commercial solar power generation facility. As described under the No Action Alternative, RIMS II was used to calculate the indirect economic impact of the project on employment. An estimate of the change in the total number of jobs in a region's economy was calculated by multiplying the initial change in jobs by a direct-effect employment multiplier. By adding 400 to 800 FTE positions, approximately 745 to 1,490 jobs would be created as a result of the solar power generation facility construction (DOC 2010), which would have a moderately beneficial impact on the economy and employment in the region.

As described under the No Action Alternative, regional economic activity would increase as construction firms are hired by the commercial sponsor of the solar power generation facility due to purchases of building materials and construction supplies and equipment, as well as spending by construction workers. Therefore, construction would have a minor beneficial impact on employment and the economy under the Reduced Operations Alternative due to the increase in employment.

Public finance. As described under the No Action Alternative, increased sales transactions from purchases of materials and supplies for construction of the solar power generation facility would generate some additional revenues for local governments under the Reduced Operations Alternative. These impacts would be minor, but beneficial.

5.1.4.3.2 Public Services

Public education. For the 2009 to 2010 school year, the Clark County School District student–teacher ratio was 21:1. The student–teacher ratio for the Nye County School District was 18.6:1. Under the Reduced Operations Alternative, no individuals are expected to relocate to these counties; therefore, no new students would enroll in Clark County or Nye County schools and no new teachers would be required as a result of the Reduced Operations Alternative.

Police protection. Under the Reduced Operations Alternative, the number of daytime occupants on the NNSS would decrease, which could result in fewer calls for police services, which would be a minor beneficial impact on police protection resources.

Fire protection. Construction and operation of the solar power generation facility would result in increased building density on the NNSS, which could result in additional calls for fire protection. NNSS Fire and Rescue operates out of two fire stations, one in Mercury and a newly constructed station in Area 6, which provides rapid response to emergencies in the forward areas of the NNSS. This impact is expected to be minor and would not impact levels of service at the Clark County Fire Department, the Las Vegas Fire Department, or the Nye County volunteer fire departments.

Health care. Under the Reduced Operations Alternative, a small staff reduction of 45 people is anticipated, but would not result in any impact on health care in the region. Existing levels of services would be maintained.

Socioeconomics—American Indian Perspective

Indian people prefer to live in our traditional homelands. One primary reason for this is because Indian people have special ties to our traditional lands and a unique relationship with each other. When Indian people receive employment near our reservations, we can remain on the reservations while commuting to work. This pattern of employment tends to have positive benefits for both the Indian community and tribal enterprises like housing. The reservation Indian community has the participation of the individual and his (her) financial contribution. The individual payment for housing is tied to income level, so the more a person earns with the job, the more they pay to the tribal housing office, and thus making tribally sponsored housing more economically sustainable and attractive for tribal governments.

When employment opportunities decline on reservations, however, Indian families must often move away from our reservations to seek employment elsewhere. As Indian people move away, Indian culture is threatened because the number of families living on reservations declines. Tribal members who choose to relocate from their reservations impact reservation economies, school, housing, and emergency services. Both schools and economies are impacted because federal funding available to tribes is based on population statistics.

With local employment opportunities such as those offered by the Nevada National Security Site (NNSS) for eligible tribal representatives, prices of tribal housing rise because they are based on income. If a positive balance between increased income and increased cost of living in tribal reservations is achieved, then both individual members and the tribe benefit from employment opportunities.

Tribal housing programs become jeopardized if vacancies occur in rental properties and dwellings remain unoccupied. If vacancies occur, tribal revenues and federal funding are adversely impacted and making it more difficult to expand housing programs in future years.

Additionally, vacant units require more maintenance. If tribal members are unavailable to occupy a tribal housing unit, then tribes make units available to non-Indians, and this, too, potentially impacts Indian culture. The increased presence of non-Indians on a reservation or in an Indian community reduces the privacy needed for the conduct of certain ceremonies and traditional practices. When non-Indian children are in constant interaction with Indian children, it creates a situation that potentially disrupts the perpetuation of cultural learning opportunities that occur in everyday life.

When Indian people move away from our reservations several dilemmas occur. Typically, Indian people experience a feeling of isolation from their tribe, culture, and family. When an Indian person relocates to an off-reservation area, the individual finds that there are fewer people of their tribe and culture around them. As a result, Indian people must decide on the appropriateness of practicing traditional ceremonies in the presence of non-Indian people. Indian people are continually torn between the decision to stay in the city or return to the reservation to participate in traditional ceremonies and interact with other tribal members. This dilemma occurs on a regular basis and potentially impacts the livelihood and cultural well-being of off-reservation employees and their families. When off-reservation individuals choose to return to our homelands to participate in traditional ceremonies or renew familial ties, they risk losing their jobs or being subjected to disciplinary actions against their children who attend public schools due to excessive absenteeism.

Under federal and tribal law, American Indian children can be educated in tribally-controlled and federally-certified schools located on Indian reservations (also known as Indian Trust Land). Federal funds are available through the Indian Education Act for the education of Indian children. Compensation from the federal government is provided to any school district that has entered into a cooperative agreement with federally-recognized tribes, whether it be public, private, or an Indian-controlled school.

Small rural Indian reservations must have a sufficient number of people to generate an emergency response capability. The need for emergency services will decline as people move away from the reservation. Tribal members employed in these emergency service occupations may move away because of their marketable skills. Tribal revenues for administration, school, housing, and emergency services will be reduced accordingly, due to a decline in population size.

Indian reservations within the region of influence are located in remote areas with limited access by standard and substandard roads. Should an emergency situation occur resulting from NNSS-related activities, including the transportation of hazardous and radioactive waste, it could result in the closure of the main or only transportation artery to our land. If a major (only) road into a reservation closes, numerous adverse social and economic impacts could occur. For example, Indian students who have to travel an unusually high number of miles to or from school could realize delays. Delays also could occur for regular deliveries of necessary supplies for inventories needed by tribal enterprises and personal use. Emergency medical services en route to or from the reservation, and purchases by patrons of tribal enterprises could be dramatically impeded. Potential investors interested in expanding tribal enterprises, as well as on-going considerations by tribal governments for future tribal enterprises, may significantly diminish because of the real and perceived risks from the transportation of hazardous and radioactive waste associated with NNSS-related activities.

See Appendix C for more details.

5.1.5 Geology and Soils

This section addresses the impacts on geology and soils under the No Action, Expanded Operations, and Reduced Operations Alternatives. Under each alternative, the impact discussion is broken down into the missions and associated programs. The physical setting under review in this section includes the topography, physiography, economic mineral resources, unique geologic features, soils, and local geologic hazards.

Impact Assessment Criteria. Activities under an alternative would have an adverse impact on the geology or soils if they result in any of the following effects:

- Substantial soil erosion or loss of topsoil
- Direct conversion of prime and unique farmland to nonagricultural uses
- Loss of availability of a known mineral resource that would be of value to the region and/or the residents of the state
- Increased instability of a geologic unit or soil due to project activities, potentially leading to an onsite or offsite landslide, subsidence, or collapse
- Exposure of people or structures to substantial adverse effects from seismic activity
- Contamination of soil or mineral resources

Maps, past studies, and regional models were used to determine the impacts from the alternatives on the physical setting based on the criteria described above. Activities that would occur in already established facilities, tunnels, or laboratories generally would not have an impact on the geologic resources. Mitigation measures used to minimize adverse impacts on the physical setting are presented in Chapter 7.

5.1.5.1 No Action Alternative

Chapter 3 describes the activities that would occur under the No Action Alternative. Many of the activities are similar to those described in the ROD for the *1996 NTS EIS* (and subsequent amendments) and other completed NEPA documents. The NNSS was withdrawn from public access and entry. This withdrawn status prevents exploration for economic minerals at the NNSS. The existence of past mines prior to the land withdrawal suggests that metallic and other economic minerals are present at the NNSS. However, the activities outlined under the No Action Alternative are not expected to affect the presence of economic mineral deposits, which would allow their extraction in the future. The unavailability of the minerals and other economic materials from the NNSS has had little effect on Nevada's mining, manufacturing, and construction industries and would probably have little effect on those industries in the future.

Open borrow pits at the NNSS may continue to be used to supply the NNSS with fill for construction or operations purposes. No new borrow pits would be opened under the No Action Alternative. Removing alluvial materials for fill would not substantially reduce the aggregate resources in the region. The NNSS has a low potential for oil and gas resources, so there would be no impact on the regional energy mineral resources.

The Natural Resources Conservation Service has not characterized soils at the NNSS, and the presence of prime farmland is not known. As agriculture production in Nevada requires irrigation, the best potential for prime farmland soils would be located in the deepest sections of Yucca Flat, Frenchman Flat, and Plutonium Valley (see Chapter 4, Section 4.1.5.3). However, as there are no plans for irrigating the valley floors, the presence of prime farmland soils at the NNSS is extremely unlikely. Therefore, the actions under all of the alternatives would not have an impact on regional prime farmland soil availability.

The following discussion presents the potential for impacts from the programs and activities proposed under the No Action Alternative that could affect geologic or soil resources.

5.1.5.1.1 National Security/Defense Mission

Stockpile Stewardship and Management Program. Under the No Action Alternative, DOE/NNSA would maintain the capability to conduct underground nuclear weapons testing. As maintenance of the facilities and utilities would occur at already disturbed outdoor or enclosed locations, maintaining this capability and the nuclear weapons stockpile would not impact geologic or soil resources.

There would be no impact on the physical setting from conducting dynamic experiments at the U1a Complex, or in unused vertical emplacement holes or other locations within the Nuclear Test and Nuclear and High Explosives Test Zones. These experiments would occur within areas previously excavated for facility construction or past tests. Some alluvial materials may need to be excavated if the U1a Complex needs additional experiment alcoves. However, the excavated material could be used for construction or as fill at the NNSS, which would reduce the overall need for alluvial materials from other borrow pits.

Conducting conventional high-explosives experiments would impact soils and geology. Activities would consist of up to 20 conventional high-explosives experiments per year at BEEF and up to 10 per year at other locations at the NNSS. Open-air high-explosives experiments at BEEF would occur on a constructed firing table in locations previously disturbed through construction and past tests, which would preclude impacts on the soil and alluvial geologic deposits. However, surface soils would be disturbed if an open-air detonation were to occur at previously undisturbed locations. This would increase the potential for soil erosion by wind and water at the experiment location. Depending on the type of experiments and composition of the high-explosive material that would be used, soils could be contaminated with chemicals, heavy metals, hydrocarbons, or small amounts of radiological isotopes. Additional impacts would be seen through the alteration of natural drainage paths, which would result in a potential for preferential erosion of alluvial deposits and increased sediment deposition in the valleys. However, the potential experiment locations (Areas 1, 2, 3, 4, 12, and 16) have been previously disturbed, so the surface disturbance would be minor. If soils were significantly contaminated by explosives experiments, they would be identified as a corrective action site and would be remediated as necessary.

There would be no impact on the physical setting from DOE/NNSA's conduct of shock physics experiments under the No Action Alternative. The experiments would occur within existing facilities at JASPER in Area 27 and the U1a Complex in Area 1. Any additional construction required at the U1a Complex to accommodate the Large-Bore Powder Gun would occur in areas that were previously disturbed by surface construction and would likely use alluvial materials previously excavated from the complex.

The physical setting would not be impacted by conducting criticality experiments, training, and other activities or pulsed-power and plasma physics and fusion experiments because these tests would occur within current facilities. Stockpile management activities at the NNSS would also occur within existing facilities and would not require additional surface or subsurface disturbance.

Some localized impacts on the surface soil structure would occur in off-road locations from DOE/NNSA and the U.S. Department of Defense (DoD) conducting training activities for the Office of Secure Transportation in off-road locations. Driving vehicles through undisturbed soils and vegetation would disturb the soil structures and increase soil erosion by wind.

DOE/NNSA would perform up to five drillback operations during the next 10 years. Each operation would disturb approximately 5 acres for the construction laydown area, borehole, and temporary storage of excavated material. The drillback sites would be located adjacent to an existing UGTA, so the surface disturbance would be minimal compared to the original test area.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Most of the activities under these programs would be located at existing disturbed areas and developed facilities at the NNSS and, therefore, would not impact the physical setting. Support for the following activities would not impact the physical setting: consequence management through the Federal Radiological Monitoring and Assessment Center, Accident Response Group, and Radiological Assistance Program, as well as weapons of mass destruction emergency responder training. The disposition of improvised nuclear and radiological dispersion devices would also occur within existing facilities and would not result in land disturbance.

Some nonproliferation- and counterterrorism-related activities would use existing facilities at the NNSS, so they would not impact the physical setting. An Arms Control Treaty Verification Test Bed would use existing capabilities, such as the Nonproliferation Test and Evaluation Complex (NPTEC), BEEF, various tunnels, laboratories, and training facilities, to support design and certification of treaty verification technology, training of inspectors, and development of arms control confidence-building measures. An existing building at Mercury would be retrofitted for uses not supplied by the other facilities. No impacts on the physical setting would occur because the activities would occur at existing structures at the NNSS.

Nonproliferation programs would use several areas and facilities at the NNSS as a base of operations for collaboration and experiments. Unique facilities at the NNSS, including NPTEC, previously contaminated surface locations, and tunnels, would be used to support training and exercises. Although some exercises would likely cause minor soil disturbance, it would be in areas already disturbed by historical testing. Nuclear forensics activities would occur in previously disturbed areas and existing facilities and would not impact soils or geologic media.

The NNSS would also be used for a counterterrorism training program with various U.S. agencies and possibly international participants. This program would be conducted at BEEF, NPTEC, and other locations at the NNSS. Some high explosives would be used as part of the training, so the impacts would be similar to those described for the high-explosion experiments under the Stockpile Stewardship and Management Program. There would be a potential for increased soil erosion and surface instability where training occurs in the rugged terrain and previously undisturbed areas of the NNSS.

Work for Others Program. Several projects are included in the Work for Others Program. Some of the activities would use existing facilities and would not impact the physical setting. Others may require construction or experiments that would introduce additional surface disturbances at the NNSS.

No impacts would occur from DOE/NNSA hosting activities for treaty verification, including research and development, because the activities would occur within the existing facilities.

Conventional weapons effect tests (including live drop and static high-explosive detonations) using up to 30,000-pound-class weapon systems with up to 20,000 pounds of TNT [2,4,6-trinitrotoluene]-equivalent explosives would be performed within the Nuclear and High Explosives Test Zone. Other types of explosives experiments would occur in various locations at the NNSS, as described in Chapter 3, Section 3.1.1.3. Surface soils would be disturbed if an open-air explosive experiment were to occur at a previously undisturbed location. This would increase the potential for soil erosion by wind and water at the testing location. Surface drainage may be altered, which would increase the potential for erosion from increased gullying. Many locations in Areas 1, 2, 3, 4, 12, and 16 have been disturbed by past tests, so the surface disturbance would not be unique to these areas.

Other activities, such as development and demonstration of capabilities and technologies against deeply buried hardened targets, would be based primarily in the U16b Tunnel of Area 16, but could also be conducted at other existing locations at the NNSS. Elsewhere, up to 20 controlled chemical and biological simulant release experiments would be conducted annually to test sensors and train first responders. The location of these experiments has not been determined. The release of simulants would not affect the physical setting.

Joint counterterrorism training between DoD, DHS, and other Federal agencies would occur in the remote areas of the NNSS. Small arms live-fire and small explosions would be used as part of the training; however, the impacts would be similar to those described for the high-explosion experiments under the

Stockpile Stewardship and Management Program. There would be a potential for increased soil erosion and surface instability where training occurs in the rugged terrain and previously undisturbed areas of the NNSS. Other training would include overland navigation techniques, which would introduce more soil disturbance to locations that may not be previously disturbed. This would generate minor soil impacts by increasing the potential for erosion and introducing some surface instability to the area.

The criticality experiments for NASA and the miscellaneous Work for Others Program activities would not introduce impacts because they would use existing facilities.

5.1.5.1.2 Environmental Management Mission

Waste Management Program. DOE/NNSA operates facilities at the NNSS to manage radioactive waste generated both within Nevada and out of state by DOE/NNSA and other authorized generators. The Area 5 RWMC evaluates, processes, stores, and disposes LLW and MLLW. The facility uses excavated trenches, pits, and boreholes in an approximately 740-acre area.

On December 1, 2010, the Nevada Division of Environmental Protection (NDEP) issued a permit to the DOE/NNSA NSO for a new MLLW Disposal Unit at the Area 5 RWMC. The new MLLW Disposal Unit consists of a single lined cell (Cell 18) with a capacity of about 900,000 cubic feet (actual permitted disposal volume is 899,996 cubic feet). Construction of Cell 18 is complete and it began accepting MLLW for disposal in January 2011.

Under the No Action Alternative, less than 50 percent of the approximately 740-acre Area 5 RWMC would be used for LLW and MLLW disposal cells over the next 10 years. Once filled, disposal cells would be operationally capped, pending final closure. Preshipment storage of TRU waste, mixed TRU waste, MLLW, and hazardous wastes at the NNSS would not generate impacts on soils because the wastes would be stored on existing storage pads.

The Area 3 Radioactive Waste Management Site (RWMS) was constructed by excavating underground nuclear test subsidence craters that met specific design criteria and would be closed with an engineered cap. The Area 3 RWMS is not active, although it would be reactivated, if necessary, and its existing craters would be used for disposal of onsite LLW or nonhazardous solid waste.

Open-air detonation of old or unusable explosives would continue at the Explosives Ordnance Disposal Unit in Area 11 and would not result in additional soil disturbance.

The hydrocarbon-contaminated waste disposal sites (Area 6 Hydrocarbon Solid Waste and U10c Solid Waste Disposal sites) would continue to operate under their respective permits issued by NDEP and would not create any additional impacts on geologic resources or soils.

Environmental Restoration Program. The Soils Project under the Environmental Restoration Program would continue to investigate, characterize, and close contaminated soil sites previously identified in the corrective action units. Under the Environmental Restoration Program, each contaminated site is prioritized and evaluated to determine the appropriate corrective action. Depending on the nature and extent of the contamination, either a streamlined or complex corrective action process would be used. Some soil sites may be closed in place with appropriate controls; others may be closed with other actions, such as stabilization and/or excavation of contaminated soil and disposal (FFACO 2008). Closure of these sites is conducted under the Federal Facility Agreement and Consent Order (FFACO) with approval by NDEP. If the appropriate corrective action includes contaminated soil removal, there would be a temporary increase in erosion from the disturbance of the soil. This would increase the potential that soil could be moved by wind and water processes.

Under the Soils Project outlined in the *1996 NTS EIS* (DOE 1996c), approximately 3,257 acres of plutonium-contaminated soils would be dispositioned at the NNSS, the TTR, and the Nevada Test and Training Range (formerly the Nellis Air Force Range Complex) (DOE 1996d). As of 2009, several corrective action sites in Frenchman Flat, Oak Spring, Yucca Flat, and Buckboard Mesa were declared closed by a corrective action document (FFACO 2009). DOE/NNSA anticipates that all identified Soils Project sites would be closed under the Environmental Restoration Program by the end of 2022.

Drilling additional monitoring wells under the UGTA Project would result in localized erosion around the drilling locations. Similar impacts would result from the decontamination and demolition of industrial sites, remediation of Defense Threat Reduction Agency (DTRA) sites, and the Borehole Management Program.

Because petroleum fuels, lubricants, and a variety of chemicals are used and stored at the NNSS, there is a chance that an accidental spill could contaminate the soil surface. If an accidental release of hydrocarbons were to occur, the soils contaminated with hydrocarbons would be removed and disposed in permitted and approved landfills. With spill prevention and mitigation measures in place, the potential for soil contamination would be reduced.

5.1.5.1.3 Nondefense Mission

General Site Support and Infrastructure Program. Under the No Action Alternative, infrastructure-associated activities would be primarily limited to projects that maintain the present facility capabilities, such as repairs and replacements. There would be no increasing of the capabilities or extending the ranges of the existing infrastructure. Although repairs may require some surface disturbance around the existing facilities, it would be limited to areas that were previously disturbed, and would not significantly increase surface erosion around at the NNSS.

Conservation and Renewable Energy Program. Under the No Action Alternative, implementing efficiency and conservation for energy and water, continuing transportation and fleet management, and upgrading the facilities at the NNSS to high-performance, sustainable buildings under the NNSS Conservation and Renewable Energy Program would result in no impacts on the local geology or soils.

A 240-megawatt commercial solar power generation facility would be constructed in Area 25 under the No Action Alternative. Construction of the commercial solar power generation facility and associated transmission lines could disturb up to 2,650 acres. Most of the soils in Area 25 have not been modified through construction or other uses, so construction of the solar power generation facility would affect topsoil and increase the potential for erosion in Jackass Flats.

Other Research and Development Programs. DOE/NNSA would continue to host environmental research projects at the NNSS, but would not actively promote the National Environmental Research Park Program. Each research project would be reviewed by DOE/NNSA on a case-by-case basis. Although minor amounts of soil may be disturbed during the data-gathering or research procedures, the effects would be temporary.

5.1.5.2 Expanded Operations Alternative

The potential impacts of implementing the Expanded Operations Alternative would largely be similar to those discussed above under the No Action Alternative. However, some additional facilities and activities are proposed, and some activities would be expanded or increased, which could magnify the impacts of the No Action Alternative. The sections below present the alternative activities that have different impacts from those described in Section 5.1.5.1.

5.1.5.2.1 National Security/Defense Mission

Stockpile Stewardship and Management Program. There would be no additional impacts from DOE/NNSA's maintenance of the potential to conduct underground nuclear weapons testing under the Expanded Operations Alternative. Several activities under the Stockpile Stewardship and Management Program would remain the same as those under the No Action Alternative, including disposition of damaged U.S. nuclear weapons, criticality experiments, and drillback operations. The potential impacts would be the same as those described under the No Action Alternative.

Under the Expanded Operations Alternative, the number of dynamic experiments would increase to 20 per year, all within the Nuclear Test and Nuclear and High Explosives Test Zones at the NNSS. The increase would not impact the physical setting because the experiments would occur within existing facilities. At BEEF, up to 100 conventional explosives experiments would occur every year. A new firing table and ancillary facilities would also be constructed to support the additional experimental needs. These features would be constructed within the existing developed BEEF facility area. Therefore, the potential for erosion would likely be minor. DOE/NNSA would increase the size and number of high explosives at the Nuclear and High Explosives Test Zone. The impacts are described further in the Work for Others Program section below.

DOE/NNSA would establish up to three areas dedicated to conducting explosive experiments with depleted uranium in Areas 2, 4, 12, or 16. Up to 20 experiments would be performed each year using a cumulative maximum of 4,000 pounds of depleted uranium and 12,000 pounds (TNT-equivalent) of high explosives. These detonations would impact soils in the area because the explosions would remove the topsoil and increase the potential for erosion by wind. The use of depleted uranium in the experiments would increase the radioactivity in the soils at the experiment locations. These experiments would be located in research areas that have previously hosted extensive underground and atmospheric testing. Some of the experiment sites would likely be located on areas (e.g., Yucca Flat, Rainier Mesa, and Shoshone Mountain) that had undergone previous underground nuclear testing. After the experiments and cleanup, radiation monitoring would determine whether a site would need to be included in the Soils Project of the Environmental Restoration Program.

There would be no impact on the physical setting from DOE/NNSA's increasing the number of shock physics experiments under the Expanded Operations Alternative. The experiments would occur within existing facilities, and opening the facilities to academic and other research would not require constructing new buildings. There would be no impacts on the physical setting from increasing the number of pulsed-power experiments at the Atlas Facility. There would be no impact from the staging of SNM under the stockpile management activities because it also would occur within existing facilities on NNSS property.

No impact on the physical setting would occur by expanding the use of the NNSS Dense Plasma Focus machine. There is no indication that moving the machine to another building in Area 6 would require the construction of additional facilities, so moving the equipment to a new location would not disturb soils or affect unique geologic resources. The old building in Area 11 would be placed on standby.

Under the Expanded Operations Alternative, DOE/NNSA would construct new support facilities near Eleana Ridge in Area 17 to support the Office of Secure Transportation training programs. The new facilities, consisting of buildings and training areas, would occupy approximately 10,000 acres, including about 25 miles of internal roads and firebreaks around the active training areas. A 4.5-mile utility corridor for electrical lines and a water pipeline would be built to support the new facility. As a result, there would be temporary impacts on soils from construction surface disturbance. Additionally, facilities would be expanded in the Area 12 Camp, Area 6 Control Point, or in Mercury (Area 23), which would temporarily increase the soil erosion around the construction site.

Soils would be disturbed from grading the facilities' location, developing roads, and excavating the pipeline trench, as well as from construction equipment moving across the desert surface. Soils disturbed during construction would have a potential for increased erosion from wind and water, and some soils would be permanently disturbed underneath the new structures and roads. The utility corridor would be restored by replacing topsoil and encouraging native vegetation growth. Some of the roads would not be paved; the existing soil structure would be compacted for stability. The facilities would be sited and designed to minimize the geotechnical hazards (e.g., shrink-swell soils, slope instability) that could affect the new structures.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Under the Expanded Operations Alternative, there would be no changes compared with the No Action Alternative for the following projects and activities under the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs: consequence management support for the Federal Radiological Monitoring and Assessment Center, the Accident Response Group, and the Radiological Assistance Program; weapons of mass destruction emergency responder training; assistance for the Emergency Communications Network; and improvised nuclear device dispositioning and forensics.

Some of the nonproliferation- and counterterrorism-related activities would remain similar to those under the No Action Alternative; however, new facilities would be constructed to support program requirements. These new facilities, described below, are still conceptual in nature, so additional NEPA review may be required once locations and plans are finalized. The Arms Control Treaty Verification Test Bed project would need both indoor and outdoor laboratory and test areas, which would require a total of 100 acres of land. The facilities would be sited at various locations within the NNSS. Approximately 0.23 acres would be needed to construct a new facility for data fusion analysis and visualization. This facility would be located near the other Arms Control Treaty Verification facilities. Construction of the new facilities would increase the potential for erosion of the soils and permanently disturb about 100 acres of soils. This would result in minor impacts on soils.

A new facility would be constructed to contain a nonproliferation test bed, which would simulate clandestine chemical and radiological releases. The impacts on the soils would be similar to the impacts of the Arms Control Treaty Verification facilities, i.e., about 100 acres of land disturbance.

In addition to conducting counterterrorism training at existing facilities, an Urban Warfare Complex would be constructed at the NNSS. This complex would include full-scale, modular replicas of the types of urban areas where terrorists and insurgents typically seek refuge. The Urban Warfare Complex would be constructed on about 100 acres in a remote area on the NNSS. The impacts on the soils would be similar to the Arms Control Treaty Verification facilities. Further NEPA review would be required once more information about the proposed facilities and locations becomes available.

Work for Others Program. The treaty verification activities under the Work for Others Program would be the same as those described under the No Action Alternative; as a result, they would have no impact on the physical setting. The Nonproliferation Projects and Counterproliferation Research and Development would add additional sensor technologies and active interrogation programs to detect nuclear material. The impacts would be the same as those described under the No Action Alternative.

New facilities would be constructed to support counterterrorism activities. Approximately 75 acres of land would be disturbed to build test beds (roads, intersections, small towns, etc.) and support facilities for research and development of improvised explosive device sensors. Additional DHS counterterrorism operations support facilities would disturb 25 acres of land. As a result, there would be minor, temporary impacts on soils from construction activities. Further NEPA review would be required after more information about the proposed facilities and locations becomes available.

DOE/NNSA would support NASA nuclear rocket motor development by allowing the use of an existing borehole for tests of a prototype nuclear rocket motor. As an existing borehole would be used, impacts would be limited to surface disturbance around the test site. Although it is not likely that NASA would test an actual nuclear rocket motor, spiked xenon may be used for proof-of-concept tests. As a result, soils would be contaminated with short-lived xenon isotopes with half-lives of a few hours to days.

Several new facilities would be constructed to support the increased use of aerial platforms at the NNSS. Approximately 4.6 acres would be disturbed at Desert Rock Airport for support hangars and other buildings. Another 4.6 acres would be disturbed at the Area 6 Aerial Operations Facility, and minor improvements would be made to the Pahute Mesa Airstrip. Other aerial platform facilities at other locations at the NNSS would disturb up to a total of 0.11 acres. In addition, 100 acres of previously undisturbed land in Area 6 would be needed for expansion of the RNCTEC facility for DHS.

Construction would disturb soils and increase the potential for erosion, especially in previously disturbed locations.

Radioactive tracer experiments would be conducted under the Expanded Operations Alternative. Underground releases of radioactive noble gases with noncritical detonations would temporarily contaminate the subsurface with radiological isotopes. However, these isotopes have short half-lives, typically 5 to 36 days. Up to 12 experiments involving open-air releases would be conducted each year. There would be temporary impacts on soils from contamination by these short-half-life radioisotopes.

New research and development test beds supporting national security initiatives would be constructed on 200 acres of previously undisturbed land throughout the NNSS. The test beds would be used by several agencies and for a variety of uses. Construction would disturb soils and increase the potential for their erosion, especially in previously disturbed locations. This would cause a minor impact on the soils, as surface disturbance would increase the potential for erosion.

5.1.5.2.2 Environmental Management Mission

Waste Management Program. Under the Expanded Operations Alternative, the greatest impact on geologic media and soils would result from the increased volumes of LLW and MLLW that would be disposed at the Area 5 RWMC (and potentially the Area 3 RWMS). New disposal cell construction for the increased volumes of LLW and MLLW, combined with previously constructed cells, would use essentially all of the available land within the Area 5 RWMC. To handle the increased volumes and increased shipment rates of LLW and/or MLLW, a waste off-loading and a container staging area would be built at the Area 5 RWMC. Construction of the new waste off-loading and a container staging area would increase surface disturbance and increase soil erosion; it would be located within the approximately 740-acre area of the Area 5 RWMC. The Area 3 RWMS would be reopened, which may result in additional surface disturbance.

DOE/NNSA would construct a new sanitary waste landfill in Area 23. Fifteen acres of land would be required for construction and operation of the new landfill. A construction and demolition debris landfill would be constructed in Area 25, which would require 20 acres of surface disturbance. These landfills would not impact the subsurface geology, although the surface disturbance would increase the potential for soil erosion around the construction site. Once the landfills are operational, soil erosion would be negligible.

Environmental Restoration Program. Under the Expanded Operations Alternative, the Environmental Restoration Program would continue, in compliance with the FFACO. Therefore, the impacts would be the same as those described under the No Action Alternative. The UGTA, Soils, and Industrial Sites Projects; remediation of DTRA sites; and Borehole Management Program would also continue.

5.1.5.2.3 Nondefense Mission

General Site Support and Infrastructure Program. The Expanded Operations Alternative would implement the same small projects to maintain the present capabilities at the NNSS; as a result, these projects would have similar impacts on soils as those described under the No Action Alternative. In addition to these maintenance activities, new infrastructure enhancements, which could affect soils by disturbing the topsoil during construction and demolition activities, would be implemented. Outdated facilities in Area 23 would be replaced with a new security building. Construction of this security building would disturb up to an acre of soils, which would increase the potential for erosion. The outdated structures would be demolished or used for other purposes. Other projects would include replacing about 35 miles of the existing 138-kilovolt electrical transmission system, increasing the number of cell towers at the NNSS, and constructing/demolishing buildings in Mercury. Each of these projects would disturb topsoil and increase the potential for erosion during construction and demolition. In remote locations with fewer structures and more previously undisturbed land, such as the cell-tower locations, the potential for erosion and soil disturbance would be higher.

Conservation and Renewable Energy Program. DOE/NNSA would implement energy efficiency conservation and water measures, continue transportation and fleet management efforts, and upgrade the facilities at the NNSS under the NNSS Conservation and Renewable Energy Program. These activities would not affect the local geology or soils.

Under the Expanded Operations Alternative, DOE/NNSA would build a 5-megawatt photovoltaic solar power generation facility near the Area 6 Construction Facilities. Based on a similar project on Nellis Air Force Base, construction and operation of this solar power generation facility would disturb 50 acres of land (USAF 2006c). DOE/NNSA would also permit one or more commercial solar power generation facilities with a generating capacity of up to 1,000 megawatts in Area 25. These commercial solar power facilities would disturb approximately 10,300 acres of land. Additional construction would be needed to update and add electrical transmission capacity off the NNSS. As there are no specific designs or private-sector proponents for the commercial solar power generation facilities, additional NEPA review would be required prior to its construction.

A geothermal laboratory could be developed on NNSS property. Exploratory studies at the NNSS would evaluate the feasibility of implementing such a project. The location of the facility would vary depending on the geothermal potential, zone use restrictions, environmental and economic considerations, and other factors. If an appropriate location on the NNSS were identified, the facility would be used to test an enhanced Geothermal Demonstration Project. Approximately 30 to 50 acres of land would be disturbed during construction of the facility. An excavated, lined sump to hold drilling water would be built adjacent to the main structures. Drilling the geothermal wells would remove some of the bedrock within the construction disturbance area. However, the drilling would not impact geologic features unique to the area. Operating the facility would not impact the geology or soils. The data gained during construction and operation of the Geothermal Demonstration Project may be considered a beneficial impact. A separate, but related facility, a Geothermal Research Center, would not affect the soils because it would be built in a previously disturbed area at Mercury.

Other Research and Development Programs. Additional research projects would be performed at the NNSS as part of the National Environmental Research Park Program. Each research project would be reviewed by DOE/NNSA on a case-by-case basis. Although minor amounts of soil may be disturbed during the data gathering or research procedures, the effects would be temporary.

5.1.5.3 Reduced Operations Alternative

The Reduced Operations Alternative includes all of the activities actually conducted at the NNSS since 1996. For most of the programs, the activity levels and frequencies would be limited to those ongoing since 1996. The Reduced Operations Alternative would also curtail all activities other than environmental restoration, environmental monitoring, site security operations, military training and exercises, and maintenance of Well 8 and critical communications and electrical transmission systems in Areas 18, 19, 20, 29, and 30 in the northwestern NNSS.

Soils would experience a general beneficial impact from the cessation of all activities except for Environmental Restoration Program activities, environmental monitoring, and other site maintenance activities. Maintenance of old roads would be discontinued, allowing previously disturbed soils to reform their structure. There would be no impacts on economic minerals or energy resources, although public access would continue to be restricted at the NNSS. The following discussion presents the programs and activities that would have different impacts than those under the No Action Alternative.

5.1.5.3.1 National Security/Defense Mission

DOE/NNSA would continue its readiness to conduct an underground nuclear test, so the impacts would be similar to those described under the No Action Alternative. There would be no change compared with the No Action Alternative for the following activities: shock physics experiments, disposition of damaged nuclear weapons, criticality experiments, training support for the Office of Secure Transportation, staging of SNM, and readiness-related training and exercises using various kinds of nuclear weapon simulators.

The conventional high-explosives experiments at BEEF and other locations in the Nuclear and High Explosives Test Zone, including hydrodynamic and explosively driven pulsed-power experiments that directly support the Stockpile Stewardship and Management Program, would continue; however, all other high-explosives experiments would be curtailed. The high-explosives experiments at BEEF would have similar impacts on the soils to those under the No Action Alternative; however, the effects would be less because there would be fewer experiments overall. The other experiments would not affect the physical setting because they would be located in already existing facilities.

No impacts would result from conducting up to 10 dynamic experiments at the NNSS. Dynamic experiments would not be conducted in the Limited Use Zone on the NNSS.

There would be minor impacts on the soils from the conventional high-explosives experiments under the Reduced Operations Alternative. Up to 10 experiments per year would be conducted to directly support the Stockpile Stewardship and Management Program, less than the number under the No Action Alternative. The experiment locations would primarily be at BEEF. Minor soil impacts would result from decommissioning and dispositioning the Atlas Facility. Construction equipment used to dismantle the facility would disturb soils directly around the facility. This would increase the potential for erosion; however, the cleared facility location would allow the soils to redevelop.

There would be no impact on the physical setting from DOE/NNSA's conduct of shock physics experiments under the Reduced Operations Alternative. No more than 12 shock physics experiments would occur within existing facilities at JASPER, and 10 would be conducted at the Large-Bore Powder Gun at the U1a Complex.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. There would be no change in programmatic activities compared with the No Action Alternative, so the impacts would be the same.

Work for Others Program. Under the Work for Others Program, DOE/NNSA would still host the projects of other Federal agencies, state and local governments, and nongovernmental organizations; however, certain activities, primarily those requiring high-explosives testing or involvement, would not be conducted. No Work for Others Program activities, except military training and exercises, would be conducted in Areas 18, 19, 20, 29, and 30. This would reduce impacts on soils and geologic media at the NNSS, compared to those under the No Action Alternative.

5.1.5.3.2 Environmental Management Mission

The Waste Management and Environmental Restoration Programs under the Reduced Operations Alternative would function the same as under the No Action Alternative. Therefore, the impacts would be the same as those described in the Environmental Management Mission section in Section 5.1.5.1.

5.1.5.3.3 Nondefense Mission

General Site Support and Infrastructure Program. Under the Reduced Operations Alternative, fewer repair and replacement activities would occur at the NNSS. Only critical infrastructure within Areas 18, 19, 20, 29 and 30 would be maintained. Roads within these areas would only be maintained to provide access necessary to maintain the noted infrastructure (maintenance and operation of the Echo Peak, Motorola, and Shoshone communications facilities; the Echo Peak, Castle Rock, and Stockade Wash Substations, including electrical transmission lines interconnecting these substations; and Well 8). Because of fewer enhancements and maintenance activities, the soils would be affected to a lesser degree than under the No Action Alternative.

Conservation and Renewable Energy Program. DOE/NNSA would permit the construction of a 100-megawatt commercial solar power generation facility in Area 25, disturbing approximately

1,200 acres of soils. Construction would temporarily increase the potential for erosion of the topsoil, and additional NEPA review would be required after site selection occurs.

Other Research and Development Programs. DOE/NNSA would continue to host environmental research projects at the NNSS, but would not actively promote the National Environmental Research Park Program. Each research project would be reviewed by DOE/NNSA on a case-by-case basis. Although minor amounts of soil may be disturbed during the data-gathering or research procedures, the effects would be temporary.

Geology and Soils

During the evaluation of the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)*, the Consolidated Group of Tribes and Organizations (CGTO) noted repeated nuclear testing activities had resulted in severe disturbances to the geology and soils, or minerals, in large portions of the Nevada National Security Site (NNSS). This seemingly irreparable damage has made certain areas unfit for human use and inaccessible to American Indians who have relied on the earth and rocks for medicine and religious purposes. Sedan Crater, for example, continues to be a dead site; the spirits of the site and resources on it were destroyed in 1962 and the loss can still be felt by members of the CGTO.

The CGTO visited the NNSS in February 2010 and believes the geology and soils are in even poorer condition than they were during the *1996 NTS EIS* due to the continued drought. Drought conditions, ground disturbing site activities, and damage to the soil from previous underground nuclear testing are significantly enhancing erosion. Negative impacts to these resources are long-lasting.

Activities that alter geologic structure also alter hydrologic systems. Such actions result in changes to important geologic and soil features that directly connect the tribes to their homelands in specific, spiritual ways. These changes require spiritual and cultural intervention necessary for restoring balance.

According to tribal elders, *"Bombs have melted the soil. It turned to glass…Severe disturbances are still out there. Everything is still suffering from it. …All Tribes are in agreement that they want to be here to do what they can to help stop this terrible pressure put on the earth and to sing the songs to help the site and to say prayers. The land has its own songs and when you sing the songs to the land, it'll sing back to you. These songs must be sung to help heal the earth and to restore harmony and balance."*

See Appendix C for more details.

5.1.6 Hydrology

5.1.6.1 Surface-Water Hydrology

Impacts on surface hydrology were assessed by reviewing the proposed activities described in Chapter 3 to determine whether they have the potential to directly or indirectly affect surface-water resources. Impacts are based on qualitative assessments of the range of potential activities that may occur under the three missions for the three alternatives. Activities under an alternative would have an adverse impact on surface-water resources if they result in any the following effects:

- Alteration of natural drainage pathways (pools, channels, or the ground surface)
- Contamination of surface waters with chemical and/or biological agents
- Sedimentation to surface waters
- Conflict with the provisions of approved water discharge permits
- Alteration of 100-year or 500-year floodplains or other flood hazard areas in a manner that would endanger lives and property

It is important to note that, as described in Chapter 4, Section 4.1.6.1, springs are the only perennial sources of surface water at the NNSS; therefore, the only perennial surface waters occur as pools at some large springs. Springs are located outside of locations used for testing and training events and are generally upgradient. In addition, onsite springs are fed by locally derived or "perched" groundwater (Hansen et al. 1997; Moore 1961) (i.e., groundwater in a saturated zone of material separated from other groundwater bodies by a relatively impervious zone) that is not hydrologically connected to any of the aquifers that may be affected by underground nuclear tests (Bechtel Nevada 1998a; DOE/NV 1999); therefore, no potential impacts are anticipated to occur to perennial surface waters at the NNSS under any of the alternatives.

As described in Chapter 4, Section 4.1.6.1, ephemeral flows in surface-water features on the NNSS occur rarely, with no flow occurring in some years. During infrequent heavy precipitation events, runoff is typically of short duration; however, large peak discharge rates can result. Flooding events on site have the potential to affect offsite locations downgradient. The primary hydrographic basin on site with the potential to affect offsite areas is the Fortymile Canyon; a storm event in 1995 resulted in the temporary closing of U.S. Route 95 due to flooding in Fortymile Wash. Ephemeral features in the Rock Valley and Mercury Valley basins also have the potential to flow off site.

Overall, sites containing nonradiological or both radiological and nonradiological contamination total approximately 2,580 acres of land, or about 0.3 percent of the total area of the NNSS. Currently, a total of 14 sites contain nonradiological soil contamination within the Fortymile Canyon Hydrographic Basin and 7 contain both radiological and nonradiological contamination. The majority (10) of the nonradiological sites consist of landfill locations that either are known to contain contamination or could possibly contain it. The four non-landfill sites are all located in the Jackass Flats subdivision of Fortymile Canyon and contain total petroleum hydrocarbons (TPH), tetrachloroethene (TCE), or hydraulic oil. The two TPH and TCE sites contain subsurface contamination below the ground surface, while the hydraulic oil contamination is within underground tunnels. The radiological sites, which are also contaminated by lead, include five locations in Area 18 (Buckboard Mesa subdivision of Fortymile Canyon), where nuclear weapons tests occurred; one in Area 30 (Buckboard Mesa subdivision of Fortymile Canyon), where Project Buggy (a Plowshare Program experiment) was conducted; and one in Area 25 (Jackass Flats subdivision of Fortymile Canyon), where nuclear reactor research was conducted for the space program.

None of these sites is particularly close to Fortymile Wash, the primary pathway for which surface water may exit the NNSS. The closest is the radiologically contaminated site in Area 30, which is approximately 1 mile from Fortymile Wash. Topopah Wash lies to the east of Fortymile Wash in the Jackass Flats subdivision of Fortymile Canyon and has the potential for flow off site, though flow rates and frequencies are typically considerably lower. Eight sites are located in the general vicinity of Topopah Wash or its tributaries, one of which is the radiologically contaminated site in Area 25.

There are five sites containing nonradiological contamination in the Mercury Valley Hydrographic Basin. Two of these contain TPH contamination below the ground surface; two are landfill locations that are either known to contain contamination or could possibly contain it; and one is an area with subsurface contamination by TPH, benzo(a)pyrene, dibenz(a,h)anthracene, and TCE. Each of these sites is in the general area of ephemeral features that flow off site to the south. There are no radiologically contaminated sites in the Mercury Valley Hydrographic Basin and no contaminated sites within the Rock Valley Hydrographic Basin.

Each of the aforementioned contaminated sites has been closed with restrictions on its use. When a contaminated site is closed in place, a risk-based assessment is conducted to determine the potential for spread of contamination from the site. The level of contamination that remains, the stability of each site, and location of each site preclude the potential for release of contaminants at levels that would pose a risk. Most of the sites contain subsurface contamination, which does not have the potential to be spread via surface water. In addition, precipitation events generating flows large enough to make onsite ephemeral water flow off site are rare occurrences. Thus, there is a negligible potential for existing onsite contamination to be transported off site via surface water or through flood events. The following sections address the potential for surface-water transport of contaminants under the three alternatives.

Overall, impacts would be minimized through use of the mitigation measures described in Chapter 7. For example, impacts related to surface disturbances (e.g., sedimentation to ephemeral waters) would be mitigated on a site-specific basis depending on several factors (e.g., soil characteristics); erosion and sediment controls would include a variety of measures, such as use of filter or silt berms or fences and timely revegetation of exposed surfaces. Where practicable, DOE/NNSA would use areas disturbed by past activities to minimize erosion.

5.1.6.1.1 No Action Alternative

The following sections describe impacts associated with the various activities that may potentially occur under the three missions. With respect to the aforementioned impact criteria, no activities are expected to conflict with the provisions of approved water discharge permits or cause alteration to 100- or 500-year floodplains or other flood hazard areas in a manner that would endanger lives and property.

The following activities are not expected to alter natural drainage pathways: dynamic experiments, drillback operations, and training activities for the Office of Secure Transportation under the Stockpile Stewardship and Management Program; counterterrorism activities under the Work for Others Program; UGTA, Soils, and Industrial Sites Projects activities, remediation of the DTRA sites, and Borehole Management under the Environmental Restoration Program; and activities under the General Site Support and Infrastructure Program.

The following activities are not expected to contaminate surface waters with radioactive materials, chemicals, and/or biological simulants: dynamic experiments, drillback operations, and training activities for the Office of Secure Transportation under the Stockpile Stewardship and Management Program; counterterrorism activities under the Work for Others Program; LLW, MLLW, and sanitary solid waste management activities under the Waste Management Program; Industrial Sites Project and Borehole Management Program activities under the Environmental Restoration Program; activities under the General Site Support and Infrastructure Program; and activities under the Other Research and Development Programs.

The following activities are not expected to deposit sediment in surface waters: dynamic experiments and conventional high-explosives experiments under the Stockpile Stewardship and Management Program; nonproliferation projects and counterproliferation research and development under the Work for Others Program; LLW and MLLW management activities and explosives waste treatment under the Waste Management Program; remediation of DTRA sites and Borehole Management Program activities under the Environmental Restoration Program; and activities under the General Site Support and Infrastructure Program.

5.1.6.1.1.1 National Security/Defense Mission

Stockpile Stewardship and Management Program – Dynamic Experiments. Up to 10 dynamic experiments would be conducted per year at locations within the Nuclear Test and Nuclear and High Explosives Test Zones. Experiments using SNM coupled with conventional explosives would be conducted underground and/or in confinement vessels and would not cause surface disturbances that could alter natural drainage pathways or contaminate ephemeral waters.

Stockpile Stewardship and Management Program – Conventional High-Explosives Experiments. Up to 20 conventional high-explosives experiments per year would be conducted at BEEF, and up to 10 per year would be conducted at other locations within the Nuclear and High Explosives Test Zone. Experiments at BEEF would be conducted on the firing table and are not expected to cause surface contamination or significant changes in natural drainage pathways. Detonations would be contained within the firing table, which generally consists of a 66-foot by 66-foot gravel area 6 to 8 feet deep, though it can be extended or deepened if an experiment warrants it. Materials dispersed during experiments would consist of solid debris that is recovered following the experiment or contained within the gravel, which would be periodically removed and replaced. For experiments at other locations within the Nuclear and High Explosives Test Zone, some minor alteration of natural drainage pathways for storm-generated sheetflow and flows in ephemeral waters (if located in close proximity to the experiment location) could occur due to surface disturbances resulting from detonations. In addition, experiments conducted at or above the ground surface could cause surface contamination and, ultimately, some contamination of ephemeral waters. Any potential surface contamination would be located within hydrographic basins that drain internally within the NNSS and would not affect offsite areas during rare flooding events.

Stockpile Stewardship and Management Program – Drillback Operations. Up to five drillback operations may take place during the 10-year planning period. Drillback operations would occur within the area of a former underground nuclear test event and would require approximately 5 acres of land. Earth-disturbing activities during site preparation and drilling (e.g., vehicle and equipment movements) could result in a small degree of sedimentation in nearby ephemeral waters.

Stockpile Stewardship and Management Program – Training for Office of Secure Transportation. Training for the Office of Secure Transportation would occur on existing roads and nearby off-road areas on the NNSS. Should off-road training activities occur in areas near ephemeral waters, particularly those involving vehicle maneuvers, a small degree of sedimentation may occur in those waters from nearby land surface disturbances.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs – Nonproliferation and Counterterrorism-Related Activities. Under the No Action Alternative, a Nonproliferation and Counterterrorism Training Program would be established. Experiments and training events using explosives may cause surface disturbances that could alter natural drainage pathways in terms of storm-generated sheetflow and flows in ephemeral waters. Overall, no permanent change in surface-water quality is expected because springs are located outside of experiment and training areas and are generally upgradient. Ephemeral flows could experience decreases in water quality from the introduction of chemical contaminants; however, these impacts would be localized to the experiment or training area and would occur only when local surface-water features contain water (e.g., after a storm event). Any potential surface contamination would be located within hydrographic basins that drain internally within the NNSS and would not affect offsite areas during rare flooding events. Should off-road training activities, particularly those involving vehicle maneuvers, occur in areas near ephemeral waters, a small degree of sedimentation may occur in those waters from nearby land surface disturbances.

Work for Others Program – Nonproliferation Projects and Counterproliferation Research and Development. Under this program, DOE/NNSA would support other agencies on nonproliferation projects and counterproliferation research and development. These projects would include high-explosives detonations, which may cause surface disturbances that could alter natural drainage pathways in terms of storm-generated sheetflow and flows in ephemeral waters. Overall, no permanent change in surface-water quality is expected because springs are located outside of experiment areas and are generally upgradient. Ephemeral flows could experience decreases in water quality from the introduction of chemical contaminants; however, these impacts would be localized to the experiment area and would occur only when local surface-water features contain water (e.g., after a storm event). Any potential surface contamination would be located within hydrographic basins that drain internally within the NNSS and would not affect offsite areas during rare flooding events.

Up to 20 controlled chemical and biological simulant releases would occur per year. These releases would have no impact on natural water bodies. Chemicals would not be released to any surface-water bodies. Biological simulants could be released into Cambric Ditch, an existing manmade ditch; however, most liquid releases would be to lined sewage lagoons or ponds. No releases to natural springs or ephemeral waters would occur (DOE 2004c).

Work for Others Program – Counterterrorism. Under this program, DOE/NNSA would support other agencies on counterterrorism projects. These could include training for engaging and neutralizing adversaries. Off-road activities (e.g., training exercises, ordnance development, and vehicle testing) could cause a small degree of sedimentation to ephemeral waters located near training areas from nearby land surface disturbances.

5.1.6.1.1.2 Environmental Management Mission

Waste Management Program – Low-Level Radioactive Waste and Mixed Low-Level Radioactive Waste Management. Waste management operations would continue to include LLW and MLLW management, including the development of new disposal cells at the Area 5 RWMC and, potentially, a new MLLW facility. Chapter 4, Section 4.1.6.1, describes potential flood hazards on the NNSS. Flood protection is an important issue when siting waste management facilities; thus, consideration of flood potential would be necessary when siting and designing new disposal cells in the Area 5 RWMC (estimated to occur at a rate of two to three new cells per year) or a new MLLW storage facility. There is a 100-year flood hazard area along the southwest corner of the Area 5 RWMC associated with Barren Wash (Schmeltzer et al. 1993) that would be avoided. Continued operation of the Area 5 RWMC would continue to alter natural drainage pathways due to engineered berms designed to prevent run-on to the site, though this would not significantly alter the overall drainage of the area. Should the Area 3 RWMS become operational in the future, it would likely have a minimal beneficial impact on local drainage patterns because craters developed during past underground nuclear tests would continue to be used to dispose materials. Continued filling of craters and their engineered closure would restore the natural topography and drainage patterns in the affected portions of Area 3.

Waste Management Program – Explosives Waste Treatment. DOE/NNSA would treat old and/or unusable explosives by open-air detonation at the Explosives Ordnance Disposal Unit in Area 11. Open-air detonations could cause surface contamination through deposition of explosive residues and, ultimately, some contamination of ephemeral waters. Any potential surface contamination would be located within hydrographic basins that drain internally within the NNSS and would not affect offsite areas during rare flooding events.

Waste Management Program – Manage Sanitary Solid Waste. DOE/NNSA would continue to operate existing waste disposal sites, with no additional land disturbance expected and therefore no impact on drainage pathways.

Environmental Restoration Program – Underground Test Area Project. This project would monitor groundwater quality and evaluate closure strategies in areas of groundwater contamination. The UGTA Project would produce water from characterization and monitoring wells, which could only be discharged to the surface if the water complies with the requirements of the NDEP-approved UGTA Fluid Management Plan (DOE 2009k). The water would be monitored and sediment erosion would be reduced through the use of onsite sumps and designated infiltration areas as needed, thereby eliminating most impacts on natural drainage pathways or downgradient springs and surface impoundments. Accidental discharges of water contaminated with radionuclides or other hazardous substances could occur, potentially contaminating the surface. This is considered unlikely, however, because the standard practice is to contain discharged water from near-field wells in lined sumps. Continued strict adherence to the UGTA Fluid Management Plan requirements would ensure no surface contamination would affect offsite areas during rare flooding events.

Environmental Restoration Program – Soils Project. This project would continue to investigate soil sites to determine whether contamination exists and to perform corrective actions as needed. Land-disturbing activities associated with these corrective actions (e.g., vehicular and equipment movements) could cause some minor sedimentation to ephemeral waters. During corrective action activities, excavated or exposed contaminated materials could potentially be transported to downgradient land surfaces during storm events that generate runoff. Appropriate site-specific dust and drainage controls would be implemented for each corrective action (e.g., establishing temporary diversion berms), which would minimize the potential for impacts to occur; however, it is possible that moderate impacts on the water quality of ephemeral surface waters could occur if contaminants were transported to such features. As described in Appendix A, Section A.1.2.2, the Soils Project employs surface-water contaminant transport studies while investigating soils sites and plans accordingly. Thus, any movement of contaminated soils could possibly affect ephemeral surface waters locally; however, drainage control measures would be employed that would ensure no offsite impacts would occur during rare flooding events.

Environmental Restoration Program – Industrial Sites Project. This project would continue to identify, characterize, and remediate industrial sites. Following the remediation of industrial sites, the facilities would be demolished with foundations normally left in place. Land-disturbing activities associated with demolition (e.g., vehicular and equipment movements) could cause some minor sedimentation to ephemeral waters.

Environmental Restoration Program – Defense Threat Reduction Agency Sites. Surface disturbing activities for the DTRA sites have been completed, and only environmental monitoring, such as water sampling, would continue. Monitoring would not result in any changes to the physical environment.

Environmental Restoration Program – Borehole Management Program. Unneeded boreholes would continue to be plugged; it was estimated that 183 would be plugged from 2010 through 2013. Open boreholes may capture a small proportion of the surface water that would otherwise continue to flow across the surface as sheetflow. Therefore, plugging of these unneeded boreholes is expected to have a minor beneficial impact in terms of restoring the natural hydrology of these locations.

5.1.6.1.1.3 Nondefense Mission

General Site Support and Infrastructure Program. Infrastructure-associated activities would continue to maintain facilities' present capabilities. Continued wastewater discharges to the Area 6 Yucca Lake and Area 23 Mercury sewage lagoon systems, as well as the E-Tunnel Waste Water Disposal System ponds, are not expected to affect natural surface-water resources. Wastewater would be contained within the lagoons and ponds and would not be released to the ground surface or any natural water bodies. In 2009, all contaminant concentrations in discharged effluent were within permitted levels.

Conservation and Renewable Energy Program – Renewable Energy. A large-scale commercial solar power generation facility covering approximately 2,400 acres could be established in Area 25. It was assumed that, if developed, this facility would be sited to avoid disturbing larger ephemeral waters located in Area 25, such as Fortymile Wash, Topopah Wash, and Rock Valley Wash.

Land preparation associated with the development of solar power generation facility (e.g., land grading) could cause sedimentation in ephemeral waters, as well as long-term alteration of natural drainage pathways. Considering the relatively large land area that the facility would cover, it is likely that some smaller ephemeral waters would be altered; however, as previously stated, it was assumed that larger surface-water features would not be disturbed.

Stormwater runoff from an operational solar power generation facility would be diverted to an appropriately sized detention basin, as well as to appropriate conveyance features (e.g., ditches and culverts), to contain flows from storm events on site. The potential for surface contamination resulting from the use of process chemicals would be minimized through the use of standard best management practices and standard operating procedures (e.g., providing secondary containment around petroleum storage areas and responding to spills as soon as possible), as well as establishment of a bioremediation area to manage any soils contaminated with toxic materials. Onsite stormwater detention would preclude the possibility for any onsite surface contamination to impact offsite areas during rare flooding events.

Other Research and Development Programs. The DOE National Environmental Research Park Program would continue to perform environmental research activities. It is possible that ground-disturbing activities associated with developing and performing experiments could result in sedimentation to ephemeral waters and alterations of natural drainage pathways; however, assuming research projects are conducted in an environmentally responsible manner, these impacts could be minimized.

5.1.6.1.2 Expanded Operations Alternative

The following sections describe impacts associated with the various activities that may potentially occur under the three missions. With respect to the aforementioned impact criteria, no activities are expected to conflict with the provisions of approved water discharge permits or cause alteration to 100- or 500-year floodplains or other flood hazard areas in a manner that would endanger lives and property.

The following activities are not expected to alter natural drainage pathways: dynamic experiments and drillback operations under the Stockpile Stewardship and Management Program; NASA support under the Work for Others Program; and UGTA, Soils, and Industrial Sites Projects activities, remediation of DTRA sites, and Borehole Management under the Environmental Restoration Program.

The following activities are not expected to contaminate surface waters with radioactive materials, chemicals, and/or biological simulants: dynamic experiments, drillback operations, and training activities for the Office of Secure Transportation under the Stockpile Stewardship and Management Program; counterterrorism and miscellaneous activities under the Work for Others Program; LLW, MLLW, and sanitary solid waste management activities under the Waste Management Program; Industrial Sites Project and Borehole Management Program activities under the Environmental Restoration Program; activities under the General Site Support and Infrastructure Program; and activities under the Other Research and Development Programs.

The following activities are not expected to deposit sediment in surface waters: dynamic experiments under the Stockpile Stewardship and Management Program; nonproliferation projects, counterproliferation research and development, and NASA support under the Work for Others Program; LLW and MLLW management and explosives waste treatment under the Waste Management Program; and remediation of DTRA sites and Borehole Management Program activities under the Environmental Restoration Program.

5.1.6.1.2.1 National Security/Defense Mission

Stockpile Stewardship and Management Program – Dynamic Experiments. Up to 20 dynamic experiments could be conducted per year. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1; therefore, no impacts on surface hydrology are expected.

Stockpile Stewardship and Management Program – Conventional High-Explosives Experiments. DOE/NNSA would conduct up to 100 high-explosives experiments per year at BEEF and various locations in the Nuclear and High Explosives Test Zone and would develop new facilities and features within the already developed areas of BEEF. Impacts of these experiments would be similar to those described under the No Action Alternative (see Section 5.1.6.1.1.1), but would be intensified because the number of experiments would increase. Therefore, no impacts are expected as a result of experiments conducted at BEEF; however, experiments at other locations within the Nuclear and High Explosives Test Zone could cause impacts. In comparison to the impacts described under the No Action Alternative, the additional tests would likely result in increased amounts of sedimentation to ephemeral waters, alterations of natural drainage pathways, and instances of surface contamination and other impacts that could occur over a larger land area as a result of the greater number of experiments. New facility construction activities at BEEF could cause some minor sedimentation in ephemeral waters and alteration of natural drainage pathways by introducing structures that would impede natural flows.

DOE/NNSA would establish up to three 40-acre sites within Areas 2, 4, 12, or 16 to conduct explosives experiments using depleted uranium. These experiments could cause surface disturbances that could alter natural drainage pathways in terms of storm-generated sheetflow and flows in ephemeral waters. Overall, no permanent change in surface-water quality is expected because springs are located outside of the experiment areas and are generally upgradient. Ephemeral flows could experience decreases in water quality resulting from the introduction of pollutants (e.g., sedimentation and chemicals); however, these impacts would be localized to the experiment area and would occur only when local surface-water features contain water (e.g., after a storm event). However, depending on their size and location, these experiments could cause more significant surface contamination (lead and depleted uranium primarily). Any potential surface contamination would be located within hydrographic basins that drain internally within the NNSS and would not affect offsite areas during rare flooding events.

Stockpile Stewardship and Management Program – Drillback Operations. Impacts of drillback operations would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1.

Stockpile Stewardship and Management Program – Training for Office of Secure Transportation. Activities associated with training for the Office of Secure Transportation would include development of several new facilities and expansions of existing facilities. Construction of new facilities and support infrastructure (e.g., roads, utility lines, and a firing range) to support training activities in Area 17 could cause sedimentation in ephemeral waters and short-term alterations of natural drainage pathways because it is likely that ephemeral waters would be crossed by linear features (e.g., pipelines), thus causing short-term disturbances to local surface-water features. Natural topographies would be restored following construction, to the extent practicable. Operation of the training areas could also result in a small degree of sedimentation in ephemeral waters, primarily from vehicular movement. New construction proposed for Area 17 (37,400 square feet of facilities) could cause long-term alterations of natural drainage pathways by introducing structures that would impede natural flows. In addition, construction of the support infrastructure would likely cause long-term alterations of natural drainage pathways, primarily due to new roads and land-grading associated with development of the firing range. Expansion of facilities in Areas 6, 12, 17, or 23 could also cause long-term alterations of natural drainage pathways by introducing structures that would impede natural flows.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs – Nonproliferation and Counterterrorism-Related Activities. Impacts of nonproliferation and counterterrorism-related activities would be similar to those described under the No Action Alternative (see Section 5.1.6.1.1.1). Impacts of experiments and training events also would be the same as those described under the No Action Alternative (alterations of natural drainage pathways, sedimentation to ephemeral waters, and surface chemical contamination); however, in addition, new construction of nonproliferation and counterterrorism facilities would occur in additional locations (more than 200 acres). Construction of the facilities could cause sedimentation in ephemeral waters, and the presence of the new facilities could cause long-term alterations of natural drainage pathways by impeding natural flows.

Work for Others Program – Nonproliferation Projects and Counterproliferation Research and Development. Impacts of nonproliferation projects and counterproliferation research and development would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1.

Work for Others Program – Counterterrorism. Impacts of counterterrorism activities would be similar to those described under the No Action Alternative in Section 5.1.6.1.1.1 (sedimentation to ephemeral waters). However, in addition, new facility construction activities would disturb approximately 100 acres of land, which could cause localized sedimentation in ephemeral waters and long-term alteration of natural drainage pathways by introducing structures that would impede natural flows.

Work for Others Program – Support for the National Aeronautics and Space Administration. DOE/NNSA would provide support to NASA on nuclear rocket motor development. The use of boreholes to sequester the emissions of a prototype nuclear rocket motor could result in minimal amounts of localized surface contamination, which could be introduced to ephemeral waters; however, because this activity would likely occur in the Yucca Flat area, any surface contamination would be confined to the NNSS.

Work for Others Program – Miscellaneous Work for Others. Activities would include increased research, development, and use of aerial platforms, as well as construction of additional facilities at Desert Rock Airport, the Area 6 Aerial Operations Facility, Pahute Mesa, and other locations. Additional construction could cause localized sedimentation in ephemeral waters from construction-related land disturbing activities and long-term alteration of natural drainage pathways by introducing structures that would impede natural flows. Minimal impacts are expected. Experiments using releases of biological simulants into water are expected to have no impact on natural water bodies because releases would be contained in manmade features (i.e., Cambric Ditch or sewer and septic systems).

5.1.6.1.2.2 Environmental Management Mission

Waste Management Program – Low-Level Radioactive Waste and Mixed Low-Level Radioactive Waste Management. Impacts would be similar to those described under the No Action Alternative in Section 5.1.6.1.1.2; however, these impacts would increase somewhat because waste disposal volumes would increase, so more disposal cells would be developed. In addition, the Area 3 RWMS would be reactivated, as opposed to its possible reactivation under the No Action Alternative. Therefore, impacts at the Area 5 RWMC under the Expanded Operations Alternative would likely be the same as those under the No Action Alternative because engineered berms would continue to alter natural drainage pathways; no flood hazard impacts are expected because flood hazard areas would be avoided. Increased use of the Area 3 RWMS would have a greater beneficial impact on natural drainage pathways compared to the impact under the No Action Alternative because additional craters would be filled to manage greater waste volumes, thus restoring natural surface topographies and drainage patterns over a larger area.

Waste Management Program – Explosives Waste Treatment. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Waste Management Program – Manage Sanitary Solid Waste. DOE/NNSA would continue to operate existing waste disposal sites and develop a new landfill on approximately 15 acres of land. In addition, a 20-acre construction/demolition debris landfill would be established in Area 25. Chapter 4, Section 4.1.6.1, describes potential flood hazards on the NNSS. Flood protection is an important issue when siting waste management facilities. DOE/NNSA would consider flood potential when siting and designing new landfills. Land preparation activities associated with the development of new landfills (e.g., land grading) could alter natural drainage pathways and cause sedimentation in ephemeral waters.

Environmental Restoration Program – Underground Test Area Project. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Environmental Restoration Program – Soils Project. Impacts would be similar to those described under the No Action Alternative in Section 5.1.6.1.1.2; however, these impacts could be greater because activities could occur at an accelerated rate. Therefore, compared to the No Action Alternative, an increased potential for surface contamination would occur, as well as increased sedimentation to ephemeral waters under the Expanded Operations Alternative. No water-quality impacts on offsite areas are expected during rare flooding events.

Environmental Restoration Program – Industrial Sites Project. Impacts would be similar to those described under the No Action Alternative in Section 5.1.6.1.1.2; however, these impacts could be greater because activities could occur at an accelerated rate. Therefore, compared to the No Action Alternative, more work would be done to restore natural topographies and drainage patterns in areas where remediated facilities are demolished and increased sedimentation to ephemeral waters would occur.

Environmental Restoration Program – DTRA Sites. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Environmental Restoration Program – Borehole Management Program. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

5.1.6.1.2.3 Nondefense Mission

General Site Support and Infrastructure Program. Infrastructure-related activities would cause impacts similar to those described under the No Action Alternative in Section 5.1.6.1.1.3. Therefore, continued wastewater discharges are not expected to cause any impacts on surface hydrology. However, there would be additional impacts associated with several new facility construction projects and expansion of some existing facilities. Demolition and construction of facilities and infrastructure could cause short-term sedimentation and increased loads of inorganic compounds in ephemeral waters, as well as long-term alteration of natural drainage pathways. Improvements within and adjacent to existing developed areas would likely have lower impacts compared to those resulting from improvements in more pristine areas.

Conservation and Renewable Energy Program. Impacts resulting from construction and operation of one or more commercial solar power generation facilities with up to 1,000 megawatts of combined capacity in Area 25 would be similar to the impacts described under the No Action Alternative in Section 5.1.6.1.1.3; however, these impacts would occur to a larger area of land because the facilities would be considerably larger, occupying a land area of approximately 10,300 acres. Therefore, compared to the No Action Alternative, increased amounts of long-term alterations to natural drainage pathways would occur over a larger land area, as well as sedimentation to ephemeral waters. In addition, the potential for surface contamination would apply to a larger land area. Onsite stormwater detention would preclude the possibility of onsite surface contamination affecting offsite areas during rare flooding events.

In addition to the large-scale solar power generation facilities, a 5-megawatt photovoltaic solar power generation facility would be developed near the Area 6 Construction Facilities on 50 acres of land. Geothermal energy production would also be explored. Development of a Geothermal Demonstration Project would require approximately 30 to 50 acres of land and would include an excavated, lined sump to store water during drilling and reservoir development. Land preparation activities associated with development of the photovoltaic solar power generation facility and construction of geothermal power system facilities (e.g., land grading) could cause sedimentation and increased loads of inorganic compounds in ephemeral waters, as well as long-term alteration of natural drainage pathways.

Other Research and Development Programs. Operation of the Nevada National Environmental Research Park would continue and could include new research and development projects. Impacts would be similar to those described under the No Action Alternative in Section 5.1.6.1.1.3; however, the development of additional research projects could result in somewhat greater impacts or could generate additional ones. Therefore, compared to the No Action Alternative, increased amounts of alterations of natural drainage pathways, as well as sedimentation to ephemeral waters, could occur under the Expanded Operations Alternative.

5.1.6.1.3 Reduced Operations Alternative

The following sections describe impacts associated with the various activities that may potentially occur under the three missions. With respect to the aforementioned impact criteria, no activities are expected to conflict with the provisions of approved water discharge permits or cause alteration to 100- or 500-year floodplains or other flood hazard areas in a manner that would endanger lives and property.

The following activities are not expected to alter natural drainage pathways: dynamic experiments, drillback operations, and training activities for the Office of Secure Transportation under the Stockpile Stewardship and Management Program; counterterrorism activities under the Work for Others Program; UGTA, Soils, and Industrial Sites Projects activities, remediation of DTRA sites, and Borehole Management Program activities under the Environmental Restoration Program; and activities under the General Site Support and Infrastructure Program.

The following activities are not expected to contaminate surface waters with radioactive materials, chemicals, and/or biological simulants: dynamic experiments, pulsed-power experiments, drillback operations, and training activities for the Office of Secure Transportation under the Stockpile Stewardship and Management Program; counterterrorism activities under the Work for Others Program; LLW, MLLW, and solid waste management activities under the Waste Management Program; Industrial Sites Project and Borehole Management Program activities under the Environmental Restoration Program; activities under the General Site Support and Infrastructure Program; and activities under the Other Research and Development Programs.

The following activities are not expected to deposit sediment in surface waters: dynamic and conventional high-explosives experiments under the Stockpile Stewardship and Management Program; nonproliferation projects and counterproliferation research and development under the Work for Others Program; LLW and MLLW management and explosives waste treatment under the Waste Management Program; remediation of DTRA sites and Borehole Management Program activities under the Environmental Restoration Program; and activities under the General Site Support and Infrastructure Program.

5.1.6.1.3.1 National Security/Defense Mission

Stockpile Stewardship and Management Program – Dynamic Experiments. Up to six dynamic experiments could be conducted per year. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1; therefore, no impacts on surface hydrology are expected.

Stockpile Stewardship and Management Program – Conventional High-Explosives Experiments. Up to 10 conventional high-explosives experiments could be conducted per year. Impacts would be similar to those described under the No Action Alternative in Section 5.1.6.1.1.1; however, these impacts would generally be reduced because the number of experiments conducted would be lower. Therefore, no impacts are expected for experiments conducted at BEEF; however, experiments at other locations within the Nuclear and High Explosives Test Zone could cause impacts. In comparison to the impacts described under the No Action Alternative, the additional tests would likely result in decreased amounts of sedimentation to ephemeral waters and alterations of natural drainage pathways; instances of surface contamination and impacts could occur over a smaller land area (if possible) if fewer experiments are conducted. Any potential surface contamination would be located within hydrographic basins that drain internally within the NNSS and would not affect offsite areas during rare flooding events.

Stockpile Stewardship and Management Program – Pulsed-Power Experiments. Pulsed-power experiments at the Atlas Facility would be discontinued and the facility would be decommissioned. Earth-disturbing activities during decommissioning (e.g., facility demolition) could cause a small degree of sedimentation in ephemeral waters; however, should the facility be demolished to ground level, decommissioning could restore the natural topography and drainage patterns at location of the Atlas Facility.

Stockpile Stewardship and Management Program – Drillback Operations. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1.

Stockpile Stewardship and Management Program – Training for Office of Secure Transportation. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs – Nonproliferation and Counterterrorism-Related Activities. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1.

Work for Others Program – Counterterrorism. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.1.

5.1.6.1.3.2 Environmental Management Mission

Waste Management Program – Low-Level Radioactive Waste and Mixed Low-Level Radioactive Waste Management. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Waste Management Program – Explosives Waste Treatment. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Waste Management Program – Manage Sanitary Solid Waste. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Environmental Restoration Program – Underground Test Area Project. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Environmental Restoration Program – Soils Project. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Environmental Restoration Program – Industrial Sites Project. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Environmental Restoration Program – DTRA Sites. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

Environmental Restoration Program – Borehole Management Program. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.2.

5.1.6.1.3.3 Nondefense Mission

General Site Support and Infrastructure Program. Impacts would be the same as those described under the No Action Alternative in Section 5.1.6.1.1.3; therefore, no impacts on continued wastewater discharges are expected.

Conservation and Renewable Energy Program. Impacts of the commercial solar power generation facility in Area 25 would be similar to those described for a similar facility under the No Action Alternative in Section 5.1.6.1.1.3. However, these impacts would generally be reduced because the facility would have less than one-half the generating capacity and occupy a smaller land area of approximately 1,200 acres. In addition, due to the smaller overall facility size, about 12 acres would be devoted to stormwater detention ponds. Therefore, compared to the No Action Alternative, decreased amounts of long-term alterations to natural drainage pathways would occur over a smaller land area, as well as sedimentation to ephemeral waters. In addition, the potential for surface contamination would occur over a smaller land area, and onsite stormwater detention would preclude the possibility of onsite surface contamination affecting offsite areas during rare flooding events.

Other Research and Development Programs. DOE/NNSA would continue to host existing environmental research projects at the NNSS, but would not actively promote the Nevada National Environmental Research Park. Impacts would be similar to those described under the No Action Alternative in Section 5.1.6.1.1.3; however, these impacts would generally be reduced because fewer research projects would be performed overall. Therefore, compared to the No Action Alternative, alterations of natural drainage pathways and sedimentation to ephemeral waters could decrease.

5.1.6.2 Groundwater

Groundwater impacts were assessed by reviewing the proposed activities described in Chapter 3 to determine whether they have the potential to directly or indirectly affect groundwater resources. Activities under an alternative would have an adverse impact on groundwater resources if they result in any the following effects:

- Noncompliance with applicable water quality standards
- Water level declines in areas adjacent to operating wells that adversely affect other uses in that aquifer
- Alteration of groundwater recharge to another downgradient aquifer to the degree that it reduces that aquifer's sustainable yield or adversely affects current uses of that aquifer
- Exceedance of the sustainable withdrawal capacity of an aquifer

Impacts on groundwater availability were analyzed by comparing current groundwater demand for each individual basin found throughout the NNSS, as discussed in Chapter 4, Section 4.1.6, to the sustainable yield of each individual basin, under each alternative. Chapter 4, Table 4–24, presents the sustainable yield (the perennial yield of the basin minus any rights already committed to other users by the State Engineer) of each basin, and Table 4–30 presents the percentage of total NNSS water demand historically met by withdrawals from each basin. DOE/NNSA has made the following assumptions for purposes of analysis of the impacts on groundwater supply:

- Future groundwater withdrawals at the NNSS would continue to occur in the four basins that are currently developed (Frenchman Flat, Yucca Flat, and the Buckboard Mesa and Jackass Flats subdivisions of Fortymile Canyon). Of the remaining six basins underlying the NNSS, most only slightly overlap the NNSS near its borders and are not likely to be developed in the future due to their remote location relative to existing and proposed facilities. Any future project requiring water withdrawals from a new basin would require NEPA review. The Mercury Valley Basin is not considered viable for new withdrawals under any alternative at this time.
- Recent patterns of water use distribution among the four developed basins (i.e., the percent of the NNSS's total demand met from each basin) would be representative of future water withdrawal patterns under each alternative, with the exception of a commercial solar power generation facility, whose additional demand would be met solely through withdrawals from the Jackass Flats subdivision of Fortymile Canyon (Basin 227a).
- The sustainable yield used for each basin is based only on the recharge from precipitation within that basin and does not include recharge associated with subsurface inflow from upgradient basins. Annual water withdrawals from a basin that are below the sustainable yield of that basin were generally assumed not to reduce outflow (recharge) to other downgradient basins. In cases where withdrawals approach sustainable yield, or where other site-specific aspects affect the potential for reduction of recharge to other basins, DOE/NNSA would consider flow modeling efforts and studies to reach determinations about the potential for adverse impacts.

Potential impacts on water quality (e.g., contamination resulting in exceedance of water quality standards) were assessed qualitatively by examining a project or activity's potential for release of hazardous constituents and the likely pathways for contaminants to reach groundwater resources.

5.1.6.2.1 No Action Alternative

Under the No Action Alternative, activities at the NNSS would primarily continue at frequencies and levels consistent with those experienced since 1996. DOE/NNSA would continue to maintain and repair facilities and associated infrastructure as needed to maintain the present capabilities of DOE/NNSA facilities. The only significant new facility considered would be construction of a large solar power generation facility by an outside commercial entity.

From 2005 through 2009, measured annual water usage at the NNSS from the active wells ranged from approximately 173 million to 225 million gallons per year, with an average of approximately 198 million gallons per year. DOE/NNSA estimates that total water withdrawals across all programs (excluding construction or operation of a commercial solar power generation facility) would not exceed 225 million gallons per year, the highest measured value since 2005. However, the implementation of water conservation efforts in support of the NNSS Energy Executable Plan (see Section 5.1.6.1.3) would result in a downward trend in potable water consumption. Therefore, an amount of 225 million gallons per year (691 acre-feet per year) is viewed as a conservative estimate of total water consumption for activities excluding construction or operation of a solar power generation facility. As an acre-foot is the conventional unit of measurement for capacity of an aquifer, acre-feet are used in the remainder of this analysis in lieu of gallons per year.

Annual water withdrawals from each basin on the NNSS between 2005 and 2009 are presented in Chapter 4, Table 4–27. For purposes of analysis, the 5-year average of the percentage of total water demand met by each basin (e.g., 68.6 percent of total demand on Frenchman Flat) was used to estimate the future demand on each basin. **Table 5–23** presents the individual demands on each basin to support a total demand of 691 acre-feet per year, as well as additional demands associated with a commercial solar power generation facility (discussed in subsequent paragraphs), and compares these demands to the sustainable yield of each basin.

Table 5–23 Impacts on Groundwater Supply Under the No Action Alternative

Basin	***Water Demand, Excluding Solar Power Generation Facility (acre-feet per year)***	***Water Demand, Including Construction Demand from Solar Power Generation Facility (acre-feet per year)***	***Water Demand, Including Operational Demand from Solar Power Generation Facility (acre-feet per year)***	***Sustainable Yield of Basin (acre-feet per year)***	***Maximum Percentage of Sustainable Yield Consumed During Construction***	***Maximum Percentage of Sustainable Yield Consumed During Operation***
Frenchman Flat (160)	474	474	474	100	474%	474%
Fortymile Canyon, Buckboard Mesa subdivision (227b)	42	42	42	3,600	1%	1%
Fortymile Canyon, Jackass Flats subdivision (227a)	47	397	297	4,000	10%	7%
Yucca Flat (159)	128	128	128	350	37%	37%

Source: Derived from Chapter 4, Tables 4–24, 4–27, and 4–30.

A commercial solar power generation facility was analyzed in the *1996 NTS EIS*, but was never implemented. In the *1996 NTS EIS*, both Areas 25 and 22 were analyzed as potential facility sites. A sensitive environmental area, Devils Hole, exists downgradient from Area 22; therefore, potential groundwater impacts from large-scale pumping would be much higher in Area 22 compared to Area 25. For that reason, Area 22 is no longer considered a viable option for siting a commercial solar power generation facility.

Currently, there are no specific proposals from private applicants for a commercial-scale solar power generation project at the NNSS. To support an NNSS decision regarding allowing commercial-level power production as a land use, DOE/NNSA has analyzed a notional design based on other proposed facilities in southern Nevada. Were a specific design to be proposed by a private applicant, additional project-level NEPA review would be required. The existing NNSS water system may be used to convey water from the point of extraction.

Construction and operation of a 240-megawatt commercial solar power generation facility would represent the largest water demand from any single activity or project on the NNSS. Operation of a 240-megawatt solar power generation facility in Area 25 would add an additional demand of approximately 250 acre-feet per year. During construction of the solar power generation facility, there would be a temporary demand of approximately 350 acre-feet per year for 35 months to support dust suppression, soil compaction, and other facility construction needs. This analysis assumes that all water demand for the solar power generation facility would be withdrawn from the Jackass Flats subdivision of Fortymile Canyon (Basin 227a).

As illustrated in Table 5–23, annual withdrawals from each basin under the No Action Alternative would be below the sustainable yield of each basin, with the exception of Frenchman Flat. The greatest demand would likely be placed on Frenchman Flat, with approximately 474 percent of the basin's sustainable yield consumed on an annual basis. As discussed in Chapter 4, Section 4.1.6.2, the Nevada State Engineer estimated a perennial yield of only 100 acre-feet per year for Frenchman Flat (NDWR 2010a), based on previous assumptions that little or no groundwater recharge from precipitation occurred in Basin 160. More-recent studies suggest that in-basin recharge does occur in Basin 160 and perennial yield values are much higher than 100 acre-feet per year. DOE/NNSA has extensively studied the groundwater recharge in Frenchman Flat using a model from the UGTA Project, two U.S. Geological Survey (USGS) models (Hevesi et al. 2003), and two Desert Research Institute models (Russell and Minor 2002). All of these models provide revised estimates of precipitation-driven recharge (and thus perennial yield) of Frenchman Flat using more-rigorous analytical methods and more-recent data. For example, the UGTA Project model estimates a perennial yield of 1,070 acre-feet per year for Frenchman Flat, and the USGS and Desert Research Institute models estimate perennial yields of 1,830 and 1,920 acre-feet per year, respectively. As it stands now, the NNSS appears to be overdrawing water from Frenchman Flat by a large percentage; however, water levels have remained static and have not shown a downward trend of water drawdown, even during peak water usage of 3,375 acre-feet per year in 1989 at the NNSS. This suggests that the perennial yield of Frenchman Flat is significantly higher than 100 acre-feet per year, and more likely in the range of the yields calculated by other DOE and USGS models.

Construction and operation of a commercial solar power generation facility would result in a marked increase in water consumption in Basin 227a (and likely the single largest use of water on the NNSS), resulting in a demand of 10 percent of the sustainable yield of Basin 227a. While the Nevada State Engineer lists the perennial yield of the Jackass Flats Subdivision of Fortymile Canyon as 4,000 acre-feet per year, this value actually represents an aggregation of yield values for several basins adjacent to Basin 227a (i.e., a regional yield value). Studies conducted by DOE/NNSA show a range of values as low as 880 acre-feet per year (DOE 2008d). However, for purposes of this analysis, the perennial yields listed by the Nevada State Engineer were used for all basins.

These demands on each basin would be unlikely to reduce groundwater recharge to another downgradient aquifer to the degree that it reduces that aquifer's sustainable yield or adversely affects current uses of that aquifer. However, DOE/NNSA would still continue to monitor groundwater levels and flow patterns across the NNSS, would employ site-specific modeling to estimate specific impacts of future projects, and would modify the points of diversion and pumping rates if needed to avoid adversely impacting any single aquifer. Therefore, no adverse effects on groundwater supply are expected under the No Action Alternative.

No proposed activities under the No Action Alternative are expected to result in violations of water quality standards, water level drawdowns precluding other uses of an aquifer, or alterations of groundwater recharge adversely affecting downgradient aquifers. Ongoing maintenance of the quality of waters that are currently clean will continue to be managed by the NNSS through implementation of the Groundwater Management Protection Plan. The Groundwater Management Protection Plan includes measures such as ensuring the continued sustainable use of groundwater through the installation, closing, or buffering of wells to prevent groundwater contamination from testing activities; locating equipment maintenance and fueling areas away from groundwater wells; and conducting periodic groundwater sampling to identify adverse impacts on groundwater during current operations. Aspects of specific projects and activities under the NNSS missions, particularly water quality effects, are discussed in the remainder of Section 5.1.6.2.

5.1.6.2.1.1 National Security/Defense Mission

Past underground nuclear testing has contaminated some groundwater resources at the NNSS, as discussed in Chapter 4, Section 4.1.6. The NNSS must maintain the capability to conduct nuclear tests under the Stockpile Stewardship and Management Program.

Under the Stockpile Stewardship and Management Program, the NNSS would conduct up to 10 dynamic experiments per year in Areas 1–4, 6–12, 16, 19, and 20 and would perform up to 30 conventional high-explosives experiments per year at BEEF and other locations in Areas 1–4, 12, and 16. While these types of experiments can release hazardous materials at or below ground surface, the NNSS operates under standard operating procedures that ensure no experiments are conducted within approximately 300 feet of the groundwater table. Given these operational restrictions and the depth of groundwater at the NNSS (up to 2,000 feet below the ground surface), these experiments are not expected to result in any adverse impacts on groundwater quality.

The NNSS would conduct five “post-shot” drillback operations over the next 10 years under the Stockpile Stewardship and Management Program. Drillback operations provide essential data on the results and post-shot underground environment of areas previously used for an underground nuclear test. Drillback activities have been conducted since the end of underground nuclear testing as a means of exercising the capability to do such drilling (maintenance of capability) and to obtain data for groundwater studies. There is the potential for small quantities of drilling fluids to be introduced to groundwater during drillback operations. However, the drillback operations are conducted in former underground nuclear test sites that are already contaminated, and any contamination resulting from the drillback activities would not result in any new violation of water quality standards.

DOE/NNSA’s Office of Secure Transportation conducts exercises on the NNSS to maintain the skills of personnel transporting nuclear weapons. Convoy exercises may be conducted up to six times annually and could include activities such as refueling of vehicles in off-road areas. Any potential impacts associated with substances (i.e., fuels, oils, and other lubricants) leaking into soils and entering groundwater aquifers would be avoided through the use of best management practices (BMPs) to prevent spills or leaks, as well as the extreme depth to groundwater at most locations. Such BMPs would include regular inspection of vehicles and routine maintenance checks to limit adverse impacts.

Under the Work for Others Program, the DOE/NNSA NSO would support DoD in unmanned aerial system field-testing and training activities. Should unmanned aerial system operations encounter complications (e.g., an emergency landing), there is the possibility that aircraft fuel or other hazardous materials could leak and result in localized soil contamination. However, the depth to groundwater and existing procedures for emergency response and site remediation make it highly unlikely that contaminants would impact groundwater resources.

While other activities under the National Security/Defense Mission require the use of hazardous materials, or would generate hazardous or radioactive wastes, these activities are performed in contained locations and use operational procedures that preclude the release of contaminants to groundwater.

5.1.6.2.1.2 Environmental Management Mission

Groundwater monitoring at the Area 5 RWMC indicates that no contamination of groundwater resources has occurred as a result of waste management activities. Annual modeling exercises used to support the performance assessment for the Area 5 RWMC conclude that no groundwater pathway exists for this disposal facility (NSTec 2010f). Given the depth to groundwater at waste disposal facilities at Area 3 and the stringent operating controls and monitoring programs, LLW and MLLW disposal operations are not expected to adversely affect groundwater resources.

Hazardous waste generated at the NNSS would be stored up to 1 year prior to shipment for offsite treatment. Additionally, JASPER would generate approximately 24 cubic meters of TRU waste per year that would be stored at the TRU Storage Pad pending characterization and shipment off site. While small releases of hazardous or TRU waste are possible during storage or transportation, stringent operating procedures would reduce the likelihood of such an event. The depth to groundwater in most areas of the NNSS and the stringent operating controls and inspection programs in place would preclude contamination of groundwater resources from a release.

Environmental Restoration Program activities at the NNSS include the UGTA Project, which monitors groundwater in the interest of developing groundwater flow and transport models to assist in remediation strategies. Groundwater use during environmental activities under the UGTA Project would be limited to dust control, drilling and testing of wells, decontamination of sampling materials, and purging of wells prior to sampling. The greatest demand for nonpotable water would be during drilling of a new well. It was estimated that water demand for drilling of a new well would be approximately 6 acre-feet. Through 2020, it is expected that a maximum of 5 new wells a year would be drilled throughout the NNSS, totaling an annual nonpotable demand of approximately 30 acre-feet per year. This demand is included with the estimate of total demand across the NNSS for this alternative.

The Industrial Sites Project would continue decontaminating and decommissioning facilities through 2012. Decommissioning of facilities is unlikely to affect groundwater due to the short duration of these activities, the small quantity of contaminants that could be released, and the extreme depth of the groundwater. Nonpotable water demands for dust suppression during decontamination and decommissioning (D&D) would be temporary and minor (estimated at less than 1 percent of total water use).

The Borehole Management Program plugs unneeded boreholes that exist throughout the NNSS. Based on the current schedule, DOE/NNSA would complete plugging by 2013 (see Table A–3). This activity would serve to eliminate potential pathways for contaminants to reach groundwater resources.

5.1.6.2.1.3 Nondefense Mission

DOE/NNSA may enter into an agreement with a commercial entity to construct a solar power generation facility within Area 25. The additional water demand associated with this project is presented in the previous overview subsection for this alternative, and is not expected to result in adverse impacts related to groundwater supply. While numerous hazardous materials (e.g., fuel, lubricants, heat transfer fluid) would be stored and used during both construction and operation of the commercial solar power generation facility, any releases are not expected to adversely impact groundwater quality. These materials would be handled and stored in accordance with established spill prevention and response procedures, and any releases would be promptly contained, and contaminated soil managed appropriately.

DOE/NNSA would continue to employ water conservation measures at the NNSS as described in annual Site Sustainability Plans prepared in accordance with DOE Order 436.1, *Departmental Sustainability*. Goals under the fiscal year 2012 plan include achieving by fiscal year 2020 a 26 percent reduction in water use intensity and a 20 percent reduction in water consumption for industrial landscaping.

As per the DOE/NNSA NSO Energy Executable Plan of December 2008, the goal is to reduce potable water production by at least 16 percent from the 2007 level. This reflects an average reduction in water consumption of approximately 2 percent per year (see **Table 5–24**). To accomplish this positive effect on groundwater resources, the NNSS began saving water through several water conservation measures and BMPs for water efficiency. Examples include the installation of water-conserving products (more-efficient toilets, urinals, faucets, showerheads, boiler systems, and other items), xeric landscaping, water-efficient irrigation, system audits and repairs of leaks, use of nonpotable water for dust suppression when possible, and institution of 4-day workweeks.

Table 5–24 Potable Water Production Goals

Year	Potable Water Production Goals (millions of gallons)	Cumulative Percent Reduction	Actual Water Production (millions of gallons)
2007	210.6	Base Year	225.2
2008	206	2	172.6
2009	202	4	190
2010	198	6	N/A
2011	194	8	N/A
2012	190	10	N/A
2013	185	12	N/A
2014	181	14	N/A
2015	177	16	N/A

Source: NSTec 2009e.

5.1.6.2.2 Expanded Operations Alternative

This section describes the proposed changes to activities under the Expanded Operations Alternative and their associated impacts on groundwater resources.

Under the Expanded Operations Alternative, the NNSS workforce would increase by approximately 25 percent from the No Action Alternative, activity levels of existing programs would increase, and some new facilities and operations would be phased in over the 10-year planning period. The NNSS water supply system would also be expanded as necessary to connect to new facilities that would be constructed.

As potable water uses would likely continue to represent the majority of total water demand (see Chapter 4, Section 4.1.6.2), it was estimated that total water use (i.e., potable and nonpotable) (excluding construction and operation of one or more solar power generation facilities) would increase by approximately 25 percent from the value analyzed under the No Action Alternative. This results in an estimate of approximately 862 acre-feet per year for all activities excluding construction or operation of commercial solar power generation facilities. However, the implementation of water conservation efforts in support of the NNSS Energy Executable Plan would likely result in more efficient potable and nonpotable water uses, making this a conservative estimate.

Under the Expanded Operations Alternative, one or more commercial solar power generation facilities with a combined capacity of up to 1,000 megawatts would add an additional demand of approximately 700 acre-feet per year. During construction of the solar power generation facilities, there would be a temporary demand of approximately 1,000 acre-feet per year for 42 months to support dust suppression, soil compaction, and other facility construction needs.

Table 5–25 summarizes the demand on each basin associated with a withdrawal of 862 acre-feet per year, as well as additional demands associated with commercial solar power generation facilities (discussed in subsequent paragraphs), and compares these demands to the sustainable yield of each basin.

As illustrated in Table 5–25, annual withdrawals from each basin under the Expanded Operations Alternative would be well below the sustainable yield of each basin, with the exception of Frenchman Flat. The greatest demand from DOE/NNSA activities would be placed on Frenchman Flat, with approximately 591 percent of the basin's sustainable yield consumed on an annual basis. As discussed in Section 5.1.6.2.1, although the Frenchman Flat basin appears to be overdrawn, there is no evidence of a downward trend of water drawdown in the basin, and the perennial yield is believed to be much higher when groundwater recharge into the basin is considered. The UGTA Project has the most conservative estimate of perennial yield for Basin 160 (1,070 acre-feet per year), compared to those of the USGS and the Desert Research Institute models (1,830 and 1,920 acre-feet per year, respectively). Construction of one or more commercial solar power generation facilities would result in a temporary marked increase in water consumption in Basin 227a (with construction demand exceeding all other uses of water on the NNSS), resulting in a demand of 27 percent of the sustainable yield of Basin 227a. Operation of the commercial solar power generation facilities would also result in a marked increase in water consumption in Basin 227a, resulting in a demand of 19 percent of the sustainable yield of Basin 227a.

Table 5–25 Impacts on Groundwater Supply Under the Expanded Operations Alternative

Basin	Water Demand, Excluding Solar Power Generation Facilities (acre-feet per year)	Water Demand, Including Construction Demand from Solar Power Generation Facilities (acre-feet per year)	Water Demand, Including Operational Demand from Solar Power Generation Facilities (acre-feet per year)	Sustainable Yield of Basin (acre-feet per year)	Maximum Percentage of Sustainable Yield Consumed During Construction	Maximum Percentage of Sustainable Yield Consumed During Operation
Frenchman Flat (160)	591	591	591	100	591%	591%
Fortymile Canyon, Buckboard Mesa subdivision (227b)	53	53	53	3,600	1%	1%
Fortymile Canyon, Jackass Flats subdivision (227a)	59	1,059	759	4,000	27%	19%
Yucca Flat (159)	159	159	159	350	46%	46%

Source: Derived from Chapter 4, Tables 4–24, 4–27, and 4–30.

The demands on each basin would be unlikely to reduce groundwater recharge to another downgradient aquifer to the degree that it reduces that aquifer's sustainable yield or adversely affects current uses of that aquifer because the flow out of each basin would be less than the flow into each basin. However, DOE/NNSA would continue to monitor groundwater levels and flow patterns across the NNSS, would employ site-specific modeling to estimate specific impacts of future projects, and would modify the points of diversion and pumping rates if needed to avoid adversely impacting any single aquifer.

No proposed activities under the Expanded Operations Alternative are expected to result in violations of water quality standards, water-level drawdowns precluding other uses of an aquifer, or alterations of groundwater recharge adversely affecting downgradient aquifers. Aspects of specific projects and activities under the NNSS missions, particularly water quality effects, are discussed in the remainder of Section 5.1.6.2.2.

5.1.6.2.2.1 National Security/Defense Mission

New facilities. DOE/NNSA is proposing 39,000 square feet of permanent facilities for the Office of Secure Transportation in Area 17 to support training activities, as well as a mock town and live-fire training area. The Office of Secure Transportation also proposes to construct 30,000 square feet of maintenance and administrative buildings and a 20,000-square-foot dormitory in Area 6, 12, or 23. Approximately 85,000 square feet of new facilities are also proposed under the Nuclear Emergency Response, Nonproliferation, Counterterrorism, and Work for Others Programs, collectively disturbing an additional 500 acres of land, although locations for these facilities are not yet known. Depending on the exact location and final design of these facilities, additional water supply infrastructure, such as distribution pipelines and water storage tanks would also be constructed. It is not known at this time whether additional water supply wells would be required to support these facilities.

Various types and quantities of hazardous materials (e.g., fuel, lubricants, and paints) would be stored and used at construction sites, and small spills or leaks could possibly occur. Adherence to established spill control procedures would reduce the likelihood of such an event, and the depth to groundwater across most of the NNSS would generally preclude such spills from reaching groundwater sources. Additionally, the location of the permanent facilities and construction sites would also be evaluated for their proximity to water supply wells to avoid wellhead contamination. Therefore, impacts on groundwater quality are not expected to occur from facility construction activities.

Construction would require water for activities such as mixing concrete, washing equipment, dust control and soil compaction, and meeting the sanitary needs of construction employees. It is anticipated that this water would be obtained from the NNSS's groundwater distribution system via a temporary service connection or would be trucked to the point-of-use, especially during the early stages of construction. Although the timing and intensity of individual construction activities are not known at this time, it was estimated that approximately 250 construction employees (excluding those associated with one or more proposed commercial solar power generation facilities) would be present at the NNSS at any given time (see Section 5.1.4). Assuming that construction workers would each use approximately 30 gallons of potable water per day, total potable water demand for these workers was estimated at approximately 1.8 million gallons (5.5 acre-feet) annually. However, use of portable toilets by construction personnel could greatly reduce this demand.

Annual nonpotable water demands from these construction projects would vary greatly, depending on the type of facility and the construction phase of each project, and are not well known at this time. However, the assumption of a 25 percent increase in all water uses (including nonpotable uses) from the No Action Alternative provides a conservative estimate of demand associated with these and other nonpotable uses in any given year. Given the remaining sustainable capacity of the water supply system at the NNSS, no adverse impacts are expected on aquifer supply and recharge from these construction activities.

The design of new facilities would include more-efficient water conservation design and measures (e.g., installation of WaterSense™ products [toilets, urinals, faucets, showerheads, boiler systems, and other items] and xeric landscaping) combined with demolition of existing facilities under the Environmental Management Mission, which would help offset water use once these facilities become operational. The estimate of a 25 percent increase in total annual water consumption noted in the introduction to Section 5.1.6.2.2 incorporates the demand from personal and nonpersonal uses of water once new facilities are occupied.

Experiments and activities. Under the Expanded Operations Alternative, DOE/NNSA proposes increases in both the frequency and intensity of ongoing activities described under the No Action Alternative. For example, within the Stockpile Stewardship and Management Program, the number of conventional high-explosive detonations would increase to as high as 100 per year (from 20), and the size of the charges would increase to up to 120,000 pounds (from 70,000 pounds) of TNT-equivalent explosives. This increase in operational tempo would also result in increased levels of waste generation (e.g., a three-fold increase in TRU waste from experiments at JASPER) throughout the NNSS. However, the same factors that preclude impacts on groundwater quality (e.g., contained and/or aboveground nature of experiments, depth to groundwater, operational controls, and groundwater monitoring programs) under the No Action Alternative would continue to all ongoing activities in the Expanded Operations Alternative. DOE/NNSA does not estimate any additional impacts on groundwater quality from activities under the Expanded Operations Alternative.

Several new or significantly revised activities are also proposed under the Expanded Operations Alternative. Within the Stockpile Stewardship and Management Program, DOE/NNSA would establish up to three areas at the NNSS for conducting explosive experiments with depleted uranium. While the locations and operational parameters of these experiments have not been fully defined, DOE/NNSA would consider site- and project-specific criteria (e.g., local groundwater depth and movement rates, solubility of potential contaminants) in the planning process to ensure that depleted uranium or other chemical contaminants would not adversely affect groundwater resources.

Under the Work for Others Program, DOE/NNSA would support NASA nuclear rocket motor development, including the use of existing boreholes to test their suitability for sequestering of emissions. Although testing of an actual nuclear rocket is not planned at this time, NASA may conduct a proof-of-concept experiment using a surrogate, such as xenon, in a borehole. Any radioactive materials released in the subsurface in this or other related experiments (such as radioactive tracer experiments) would have short half-lives and would be used well above the groundwater table; as such, they are not expected to adversely affect groundwater quality.

As noted in Chapter 3 of this SWEIS, there are several activities and facilities considered for the NNSS that are still conceptual in nature; no detailed design or siting information is available at this time. These include construction of test beds and support facilities for nonproliferation and counterterrorism activities; new counterterrorism training facilities and reconfiguration of the RNCTEC facility for DHS; and additional facilities for nuclear material detection training for DHS and other Federal agencies. These types of conceptual facilities and activities would undergo an appropriate level of NEPA review and documentation before they would be implemented.

5.1.6.2.2.2 Environmental Management Mission

Waste management activities on the NNSS would increase under the Expanded Operations Alternative, with up to 44,498,253 cubic feet of LLW and 2,790,583 cubic feet of MLLW disposed at the Area 5 RWMC and Area 3 RWMS. TRU waste amounts stored at the TRU Storage Pad pending characterization and shipment off site would increase to approximately 1,766 cubic feet. Annual modeling exercises used to support performance assessments for the Area 5 RWMC and Area 3 RWMS conclude that no groundwater pathway exists for these disposal facilities (NSTec 2010f). Although the waste management activities would increase, the absence of a groundwater pathway, the depth to groundwater at waste disposal facilities at Areas 3 and 5, and the stringent operating controls and monitoring programs, LLW and MLLW disposal operations are not expected to adversely affect groundwater resources.

DOE/NNSA would construct sanitary solid waste disposal facilities as needed in Area 23, and develop a new sanitary solid waste disposal site in Area 25 to support environmental restoration activities, as well as the construction associated with potential solar energy projects in Area 25. These facilities would incorporate contaminant containment strategies in their design, and are not expected to result in adverse impacts on groundwater quality during their construction or operational phases.

No changes to environmental restoration activities are proposed under the Expanded Operations Alternative.

5.1.6.2.2.3 Nondefense Mission

Infrastructure-related activities, including repairs and replacements, would include increasing the capacities, capabilities, and ranges of facilities to accommodate expanded operations. Approximately 300,000 square feet of new facilities would be constructed to support air operations, Desert Rock Airport, and security requirements. Similar to the construction activities described in Section 5.1.6.1.2, these activities are not expected to result in any adverse impacts on groundwater quality or supply.

Any facilities that are no longer required and economically salvageable would be decommissioned. Decommissioning activities are unlikely to affect groundwater quality due to their short durations, operational controls applied, and the depth of the groundwater. Nonpotable water demands for dust suppression during decommissioning would be smaller than those required for construction activities, and would not strain the sustainable capacity of the NNSS. The estimated 25 percent increase in total water use under the Expanded Operations Alternative incorporates any water demand that would occur as a result of decommissioning facilities.

DOE/NNSA may enter into an agreement with a commercial entity to construct one or more solar power generation facilities within Area 25. Under the Expanded Operations Alternative, the generating capacity of the commercial solar power generation facilities would increase to 1,000 megawatts. While numerous hazardous materials (e.g., fuel, lubricants, heat transfer fluid) would be stored and used during both construction and operation of the commercial solar power generation facilities, any releases are not expected to adversely impact groundwater quality. These materials would be handled and stored in accordance with established spill prevention and response procedures, and any releases would be promptly contained, and contaminated soil managed appropriately. The notional design for this solar power generation facility includes a bioremediation cell for the segregation and remediation of contaminated soil.

Additionally, DOE/NNSA proposes to construct a 5-megawatt photovoltaic solar power generation facility near the Area 6 Construction Facilities. It was estimated that annual nonpotable water use would total approximately 165,000 gallons (0.5 acre-feet) per year, which is only a small fraction of the total water use on the NNSS.

DOE/NNSA would additionally explore the NNSS for geothermal energy to evaluate the feasibility of developing a Geothermal Demonstration Project. There are seven locations on the NNSS that have enhanced geothermal potential, as depicted in Appendix A, Figure A–3. Several boreholes may be drilled up to 20,000 feet in depth, and the development of a reservoir would be necessary to store water during drilling. Minor quantities of drilling fluids may be introduced to groundwater during drilling operations, but are not expected to result in violation of any water quality standards or otherwise threaten potable water sources. The nonpotable water demand to prime the system initially (which includes the boreholes and reservoir) would be approximately 20 acre-feet on a one-time basis, or about 2 percent of the NNSS's water use in any year. Once a geothermal power plant is continuously operating, it was estimated that 50 acre-feet of water would be required annually (about 6 percent of the NNSS average annual water use). The seven locations on the NNSS to be possibly explored for enhanced geothermal potential are located within six separate hydrographic basins. Of the six basins, Yucca Flat, with 350 acre-feet available for withdrawal, has the lowest remaining yield for groundwater withdrawals (see Chapter 4, Table 4–24). An annual operational use of 50 acre-feet per year would represent 14 percent of this basin's available yield, resulting in a minor impact. Impacts on the remaining five hydrographic basins would be lower as the remaining yield for withdrawals are greater. Therefore, construction, initial priming, and operational water demands from this project would not significantly affect groundwater supply in any of the six basins to be possibly explored.

5.1.6.2.3 Reduced Operations Alternative

This section describes the proposed changes to activities under the Reduced Operations Alternative and their associated impacts on groundwater resources. Under the Reduced Operations Alternative, the frequency and scope of most ongoing activities at the NNSS would be reduced, and no new activities and facilities (even if selected in a previous NEPA decision) would be implemented. Several activities would be more geographically restricted than under the other alternatives in this SWEIS, and a 10 percent reduction in workforce from the No Action Alternative is expected.

As potable water uses would likely continue to represent the majority of total water demand (see Chapter 4, Section 4.1.6.2), it was estimated that total water use (excluding construction and operation of a solar power generation facility) would also decrease by 10 percent from that projected for the No Action Alternative, to approximately 622 acre-feet per year. However, the implementation of water conservation efforts in support of the NNSS Energy Executable Plan would likely result in more efficient potable and nonpotable water uses, making this a conservative estimate.

Under the Reduced Operations Alternative, the size of the commercial solar power generation facility would decrease to 100 megawatts in generating capacity. This facility would add an additional demand of approximately 175 acre-feet per year. During construction of the solar power generation facility, there would be a temporary demand of approximately 200 acre-feet per year for 32 months to support dust suppression, soil compaction, and other facility construction needs.

Table 5–26 summarizes the demand on each basin associated with a withdrawal of 622 acre-feet per year, as well as additional demands associated with a commercial solar power generation facility (discussed in subsequent paragraphs), and compares these demands to the sustainable yield of each basin.

As illustrated in Table 5–26, annual withdrawals from each basin under the Reduced Operations Alternative would be well below the sustainable yield of each basin, with the exception of Frenchman Flat. The greatest demand would be placed on Frenchman Flat, with approximately 427 percent of the basin's sustainable yield consumed on an annual basis. As discussed in Sections 5.1.6.2.1 and 5.1.6.2.2, the Frenchman Flat basin appears to be overdrawn, however, there is no evidence of a downward trend of water drawdown in the basin, and the perennial yield is believed to be much higher when groundwater recharge into the basin is considered. The UGTA Project has the most conservative estimate of perennial yield for Basin 160 (1,070 acre feet per year) compared to those of the USGS and the Desert Research Institute models (1,830 and 1,920 acre-feet per year, respectively). While construction and operation of a commercial solar power generation facility would result in a marked increase in water consumption in Basin 227a (construction demand would likely be the single largest use of water on the NNSS), the resulting demand would be 6 percent of the sustainable yield of Basin 227a.

Table 5–26 Impacts on Groundwater Supply Under the Reduced Operations Alternative

Basin	*Water Demand, Excluding Solar Power Generation Facility (acre-feet per year)*	*Water Demand, Including Construction Demand from Solar Power Generation Facility (acre-feet per year)*	*Water Demand, Including Operational Demand from Solar Power Generation Facility (acre-feet per year)*	*Sustainable Yield of Basin (acre-feet per year)*	*Maximum Percentage of Sustainable Yield Consumed During Construction*	*Maximum Percentage of Sustainable Yield Consumed During Operation*
Frenchman Flat (160)	427	427	427	100	427%	427%
Fortymile Canyon, Buckboard Mesa subdivision (227b)	38	38	38	3,600	1%	1%
Fortymile Canyon, Jackass Flats subdivision (227a)	42	242	217	4,000	6%	5%
Yucca Flat (159)	115	115	115	350	33%	33%

Source: Derived from Chapter 4, Tables 4–24, 4–27, and 4–30.

These demands on each basin would be unlikely to reduce groundwater recharge to another downgradient aquifer to the degree that it would reduce that aquifer's sustainable yield or adversely affect current uses of that aquifer. However, DOE/NNSA would continue to monitor groundwater levels and flow patterns across the NNSS, employ site-specific modeling to estimate specific impacts of future projects, and modify the points of diversion and pumping rates if needed to avoid adversely impacting any single aquifer. Therefore, no adverse effects on groundwater supply are expected under the Reduced Operations Alternative.

No proposed activities under the Reduced Operations Alternative are expected to result in violations of water quality standards, water level drawdowns precluding other uses of an aquifer, or alterations of groundwater recharge adversely affecting downgradient aquifers. Aspects of specific projects and activities under the NNSS missions, particularly water quality effects, are discussed in the remainder of Section 5.1.6.2.3.

5.1.6.2.3.1 National Security/Defense Mission

Under the Reduced Operations Alternative, DOE/NNSA would reduce the frequency and scope of experiments and activities and place additional geographic restrictions on ongoing activities. Specifically, Areas 12, 18, 19, and 20 would not support most activities within the National Security/Defense Mission.

This would effectively curtail most activities (other than environmental restoration) in the northwest portion of the NNSS. DOE/NNSA does not anticipate any adverse impacts on groundwater quality from National Security/Defense Mission activities under the Reduced Operations Alternative.

5.1.6.2.3.2 Environmental Management Mission

Under the Reduced Operations Alternative, LLW and MLLW waste disposal would remain the same as under the No Action Alternative. Onsite generation of hazardous, nonhazardous, and TRU waste would decrease relative to the No Action Alternative. DOE/NNSA does not anticipate any adverse impacts on groundwater quality from waste management activities under the Reduced Operations Alternative.

No change in Environmental Restoration Program activities is proposed under this alternative. Although most defense-related activities would cease in the northwest portion of the NNSS, environmental restoration and environmental monitoring activities would continue as described under the No Action Alternative. Therefore, impacts would remain the same as those under the No Action Alternative.

5.1.6.2.3.3 Nondefense Mission

Under the Reduced Operations Alternative, the only new infrastructure considered would be a solar power generation facility, whose net generating capacity would be reduced to 100 megawatts. The additional water demand associated with this project is presented in the previous introductory subsection for this alternative and is not expected to result in adverse impacts related to groundwater supply. While numerous hazardous materials (e.g., fuel, lubricants, heat transfer fluid) would be stored and used during both construction and operation of the commercial solar power generation facility, any releases are not expected to adversely impact groundwater quality. These materials would be handled and stored in accordance with established spill prevention and response procedures; any releases would be promptly contained, and contaminated soil would be managed appropriately. The notional design for this solar power generation facility includes a bioremediation cell for the segregation and remediation of contaminated soil.

Hydrology—American Indian Perspective

CGTO The Consolidated Group of Tribes and Organizations (CGTO) knows we are in a drought because humans have disrespected the earth. It is affecting the balance of our earth's climate. One inevitable implication of the current 100-year drought is that the surface water[1] on the Nevada National Security Site (NNSS) and immediate areas have diminished and become more sporadic. The modification and availability of surface water has the ability to affect all trophic levels on the NNSS.

Other tribal elders noted, *"Water has been disrespected and therefore it is disappearing. It is a medicine—used to heal and used for healing. It is used for ceremonial purposes in prayer. It is alive and must be awakened. It is spiritual--an essential component to begin religious ceremonies, and part of sweat ceremonies. Historically, water was pure and available to those who respected it. Bathing was a ritual. Now we do not trust the purity of the water because it has been disrespected. Hot springs have been affected and are no longer at the temperatures they used to be."*

When humans respect water, it sustains them and life-forms on the surface, but when water is not treated well, it withdraws its life-giving support and returns to the underworld. The CGTO knows that the springs on Pahute and Rainier mesas and near Buckboard Mesa have dried up. Water has returned to the underworld because it has not been treated correctly by the U.S. Department of Energy (DOE) activities. There are places on the NNSS where the rain falls but does not nurture the plants and animals. The CGTO wants to be involved in DOE hydrology studies because if the water continues to be treated in inappropriate ways, it will totally remove itself from the NNSS.

See Appendix C for more details.

[1] *Surface water is defined here as water available for shallow rooted plants during rainfall, water available during post-rain ponding, runoff, and absorption, and water recharged into near-surface aquifers.*

5.1.7 Biological Resources

Biological resources addressed in this impact analysis include native and nonnative vegetation and wildlife that inhabit or otherwise use DOE/NNSA sites in Nevada. Nonnative invasive or introduced species are generally considered deleterious. Both RSL and NLVF are located within developed urban settings that are devoid of natural habitat and are maintained with ornamental plant species. For this reason, detailed analysis of impacts on biological resources is limited to the NNSS and the TTR in this *NNSS SWEIS*.

Adverse impacts on wildlife include damage to or loss of habitat, direct mortality, and disturbance. Adverse impacts on vegetation include direct removal and reduction in suitable growing area. Loss of habitat and reduction in growing area are directly related to acres of land disturbed. Adverse impacts on soils, wells, and springs would also result in adverse impacts on vegetation and wildlife. DOE/NNSA is subject to, and complies with, existing laws, regulations, and policies regarding protection of sensitive and otherwise regulated plant and animal species and has established practices to minimize or avoid potential adverse effects on biological resources.

The following criteria are used in this analysis of potential impacts on biological resources resulting from activities of DOE/NNSA in Nevada:

- Area of land disturbance, i.e., habitat loss, particularly important habitats, and potential damage to biologically important habitat features, such as wells, springs, wetlands, and other resources that support biological resources. Impacts on habitats by land disturbance could affect both wildlife and native vegetation.
- The potential of proposed activities to cause damage to any species protected by applicable statutes, including exceeding the terms and conditions in the *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada* (*2009 Biological Opinion*) (USFWS 2009a). It is important to note that the analyses of potential impacts on biological resources in this SWEIS are conservative and are not intended to represent a biological assessment within the meaning of the U.S. Fish and Wildlife Service (USFWS) in its regulations implementing the Endangered Species Act. For this reason, where the take of desert tortoises may appear to exceed the tems and conditions of the *2009 Biological Opinion*, this is only for purposes of comparing the relative impacts of the alternatives addressed in this SWEIS.

Table 5–27 shows the potential area of land that would be disturbed for each mission and program area under each of the three alternatives. Potential land disturbance related to UGTA and Soils Projects activities on the Nevada Test and Training Range (except the TTR) are included in the analysis of potential impacts on biological resources at the NNSS. In 2008, the DOE/NNSA NSO estimated that about 790,400 acres, or about 91 percent of the total area of the NNSS, were considered undisturbed land based on implementation of the Expanded Use Alternative from the *1996 NTS EIS* (DOE 2008f). Although some projects envisioned in 1996 were not implemented, such as construction of a large defense industrial complex or a commercial solar power generation facility, there have been other land-disturbing projects, such as the RNCTEC and various security improvements in the areas around some facilities. For purposes of this analysis, it was assumed that about 790,400 acres of the NNSS would remain undisturbed and that all undisturbed land would continue to provide habitat for wildlife.

Table 5–27 Habitat Disturbance from Proposed Projects and Activities at the Nevada National Security Site

Mission or Program	*No Action Alternative*		*Expanded Operations Alternative*		*Reduced Operations Alternative*	
	Disturbed Area (acres)	*Percentage of Undisturbed Area on the NNSS* [a]	*Disturbed Area (acres)*	*Percentage of Undisturbed Area on the NNSS* [a]	*Disturbed Area (acres)*	*Percentage of Undisturbed Area on the NNSS* [a]
Stockpile Stewardship and Management Program	685	0.09	12,805	1.62	415	0.05
NERNC Program	15	0.002	215	0.03	15	0.002
Work for Others Program	0	0	435	0.06	0	0
National Security/Defense Mission	**700**	**0.09**	**13,455**	**1.70**	**430**	**0.05**
Waste Management Program	190	0.02	635	0.08	190	0.02
Environmental Restoration Program [b]	920	0.12	920	0.12	920	0.12
Environmental Management Mission	**1,110**	**0.14**	**1,555**	**0.2**	**1,110**	**0.14**
General Site Support and Infrastructure Program	0	0	467	0.06	0	0
Conservation and Renewable Energy Program	0	0	50	0.01	0	0
Other Research and Development Programs	0	0	0	0	0	0
Nondefense Mission	**0**	**0**	**517**	**0.07**	**0**	**0**
Total for Alternative for DOE/NNSA	**1,810**	**0.23**	**15,527**	**2.00**	**1,540**	**0.2**
Commercial Solar Power Generation Facility(ies)	2,650	0.34	10,300	1.30	1,200	0.15
Geothermal Demonstration Project	0	0	50	0.006	0	0
Total Commercial/ Demonstration Projects	**2,650**	**0.34**	**10,350**	**1.31**	**1,200**	**0.15**
Total DOE/NNSA and Commercial/ Demonstration Projects	**4,460**	**0.56**	**25,877**	**3.27**	**2,740**	**0.35**

NERNC = Nuclear Emergency Response, Nonproliferation, and Counterterrorism; NNSS = Nevada National Security Site.

[a] Percentages may not sum due to rounding.

[b] Land disturbance for Environmental Restoration activities includes 500 acres for new Underground Test Area Project groundwater characterization and monitoring wells and 420 acres for Soils Project sites. About one-half (250 acres) of the disturbance for new characterization and monitoring wells was assumed to occur on land owned or managed by others adjacent to the NNSS on the Nevada Test and Training Range, Bureau of Land Management (BLM) land, and privately owned land. Almost all of the 420 acres of land disturbance for the Soils Projects sites would occur on the Nevada Test and Training Range. For purposes of analysis and because of the close proximity of the portions of the Nevada Test and Training Range, BLM land, and privately owned land that would be disturbed, all land disturbances associated with these Environmental Restoration Program activities are included with NNSS land disturbances.

Disturbance impacts on vegetation are considered permanent when there is no evidence to indicate that predisturbance levels of biomass, cover, density, soils, and plant community structure could be achieved within approximately 5 years of the disturbance or of conducting reclamation efforts. Based on this, all vegetation disturbances under each of the alternatives would be considered permanent because reclamation is not required for all land disturbances at the NNSS; therefore, reclamation was not assumed for any land disturbances.

Under all alternatives, disturbance of native vegetation either by direct removal or by mechanical damage from off-road vehicular or pedestrian traffic could promote the proliferation of nonnative invasive weeds, such as Russian thistle. This species is currently not listed on the Nevada noxious weed list, but is considered aggressive and opportunistic, and often portrays weed-like trends. Other weed species that could invade the disturbed areas over the long term include puncture vine (*Tribulus terrestris*), perennial pepperweed (*Lepidium latifolium*), gumweed (*Grindelia* spp.), yellow star thistle (*Centaurea solstitialis*), and Russian knapweed (*Acroptilon repens*). Other impacts on vegetation include soil compaction, spread of weeds already present in the disturbance footprint to areas not currently infested, and accidental introduction of new weed species from contaminated equipment brought in from other regions. DOE/NNSA takes positive steps to prevent the introduction and/or spread of noxious weeds at the NNSS, as described in Chapter 7, Section 7.7.

Endangered Species Act Definitions

Endangered Species – Any species that is in danger of extinction throughout all or a significant portion of its range.

Threatened Species – Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Take – To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Harm – Includes any act that actually kills or injures fish or wildlife; such acts may include habitat modification or degradation that significantly impairs essential behavioral patterns of fish or wildlife.

Harass – To intentionally or negligently, through act or omission, create the likelihood of injury to wildlife by annoying it to such an extent that normal behavior patterns such as breeding, feeding, and sheltering are significantly disrupted.

Critical Habitat – Specific geographic areas, whether occupied by a listed species or not, that are essential for its conservation and have been formally designated by a rule published in the *Federal Register*.

Habitat – The place or environment where a plant or animal naturally lives and grows (a group of particular environmental conditions).

Biological Assessment – A document prepared by a Federal agency to determine whether a proposed major construction activity under its authority is likely to adversely affect listed species, proposed species, or designated critical habitat.

Biological Opinion – A document stating the opinion of the U.S. Fish and Wildlife Service as to whether a Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

In 1998, DOE/NNSA evaluated biotic and abiotic data collected from ecological landform units to identify areas of the NNSS that may warrant active protection from land-disturbing activities (DOE/NV 1998d). Four habitat types on the NNSS were identified as "important habitats": (1) pristine habitat includes areas that have few manmade disturbances; (2) unique habitats contain uncommon biological resources, such as a natural wetland; (3) sensitive habitat includes areas where vegetation recovers very slowly from direct disturbance (i.e., areas with high susceptibility to wind erosion); and (4) diverse habitats have high plant species diversity (DOE/NV 1998d). Important habitats are shown in Chapter 4, Figure 4–23. DOE/NNSA believes that the long-term protection of these important habitats is one method by which overall cumulative impacts on biological resources may be minimized. During siting for new projects, these important habitats (pristine, sensitive, and diverse) are avoided whenever possible. Unique habitats, such as wetlands and springs, are particularly sensitive to disturbance and are avoided for all activities. Important habitats on the NNSS are not based on regulatory requirements, but were developed as management tools.

Sensitive species are defined as species that are at risk of extinction or serious decline or whose long-term viability has been identified as a concern. Protected/regulated species are those that are protected or regulated by Federal or state law, such as the Endangered Species Act (16 *United States Code* [U.S.C.] 1531 et seq.), Migratory Bird Treaty Act (16 U.S.C. 703 et seq.), Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.), and Wild Free-Roaming Horses and Burros Act (16 U.S.C. 1331 et seq.). Resources important to sensitive species include cover sites, nest or burrow sites, roost sites, or water sources. There are 88 sensitive and protected/regulated species known to occur on or adjacent to the NNSS (NSTec 2010j): 1 moss, 18 flowering plants (excluding 3 species of yucca, one of agave, 18 of cacti, single-leaf pinyon pine [*Pinus monophylla*], and juniper [*Juniperus osteosperma*]), 1 mollusk, 2 reptiles (including the desert tortoise), 15 birds (all bird species on the NNSS are protected by the Migratory Bird Treaty Act, except chukar [*Alectois chukkar*], Gambel's quail [*Callipepla gambelii*], English house sparrow [*Passer domesticus*], rock dove [*Columba livia*], and European starling [*Sturnus vulgaris*]), and 27 mammals. Two bird species, chukar and Gambel's quail, and seven mammals are regulated as game species (pronghorn antelope [*Antilocarpra Americana*], Rocky Mountain elk [*Cervus elaphus*], desert bighorn sheep [*Ovis canadensis nelsoni*], mule deer [*Odocoileus hemionus*], mountain lion [*Puma concolor*], Audubon's cottontail [*Sylvilagus audubonii*], and Nuttall's cottontail [*Sylvilagus nuttallii*]). Three species of mammals are regulated as furbearers: bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), and kit fox (*Vulpes velox macrotis*). Protected and sensitive species of plants and animals are listed in Appendix F, Table F–1.

The desert tortoise (*Gopherus agassizii*), a threatened species, is the only federally listed species that occurs on the NNSS. The southern approximately one-third of the NNSS, including all or parts of Areas 5, 6, 11, 14, 22, 23, 25, 26, 27, and 29, is within the range of the desert tortoise, an area of about 328,400 acres. Approximately 7,350 acres, or 2 percent of NNSS land within desert tortoise range, has been disturbed in the past by construction of facilities and infrastructure and other activities. The net area of desert tortoise habitat at the NNSS is about 321,050 acres (about 42 percent of the undisturbed land on the NNSS). The population density of desert tortoises on the NNSS is unknown, but is considered "very low" (USFWS 2009a).

In July 2008, the DOE/NNSA NSO provided USFWS with a biological assessment of activities anticipated to occur on the NNSS over the following 10 years and entered into formal consultation, pursuant to Section 7 of the Endangered Species Act (16 U.S.C. 1531 et seq.), to update the *1996 Biological Opinion* (USFWS 1996) and obtain a new Biological Opinion. In February 2009, USFWS issued the *2009 Biological Opinion* (USFWS 2009a) to the DOE/NNSA NSO, which authorized the incidental "take" (accidental killing, injury, harassment, etc.) of desert tortoises that may occur during NNSS activities. Before implementing any new activity in desert tortoise habitat, DOE/NNSA provides specified information and consults with USFWS to determine whether the anticipated incidental take for each action, at the project level, complies with the programmatic *2009 Biological Opinion*. Both the *1996 Biological Opinion* and *2009 Biological Opinion* concluded that activities anticipated to occur on the NNSS would not jeopardize the continued existence of the Mojave population of desert tortoises and that no critical habitat would be destroyed or adversely modified. NNSS activities occurring within the range of the desert tortoise must comply with the terms and conditions outlined in the *2009 Biological Opinion*, as shown in **Table 5–28**. The *2009 Biological Opinion* also states that, if either the level of incidental take or the permitted amount of habitat disturbance is reached and anticipated to be exceeded during the course of actions, such an incidental take or habitat disturbance would represent new information requiring reinitiation of consultation and review of the reasonable and prudent measures. If a proposed activity or group of activities would result in an exceedance of the *2009 Biological Opinion*, DOE/NNSA would consult with USFWS, in accordance with Section 7 of the Endangered Species Act.

Table 5–28 Parameters and Threshold Values for Desert Tortoise Take on the Nevada National Security Site

Mission or Program	Maximum Allowable Land Disturbance (acres)	Maximum Number of Tortoises Anticipated to be Incidentally Taken	
		Killed/Injured	Other
Stockpile Stewardship and Management Program	500	1	10
Work for Others Program	500	1	10
National Security/Defense Mission Total	1,000	2	20
Waste Management Program	100	1	2
Environmental Restoration Program	10	1	2
Environmental Management Mission Total	110	2	4
Other Research and Development Programs	1,500	2	35
General Site Support and Infrastructure Program	100	1	10
Nondefense Mission Total	1,600	3	45
Nonprogrammatic Take on Existing Roads [b]	0	15 [c]	125
Overall Totals	2,710	22	194

[a] "Other Research and Development" was designated as "Nondefense Research and Development" in the *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada* (*2009 Biological Opinion*) (USFWS 2009a).
[b] Refers to tortoises that may be taken by vehicular traffic on existing roads, as opposed to those that may be taken through ground-disturbing activities.
[c] No more than 4 desert tortoises may be killed or injured by nonprogrammatic take on existing NNSS roads during any calendar year, and no more than 15 during the term of the *2009 Biological Opinion*.
Source: Modified from Table 3 in USFWS 2009a.

The DOE/NNSA NSO Desert Tortoise Compliance Program was developed in 1992, with the issuance by USFWS of the first Biological Opinion for the NNSS. The Desert Tortoise Compliance Program serves to implement the terms and conditions of the most current version of the Biological Opinion for the NNSS, to document compliance actions taken, and to assist the DOE/NNSA NSO with USFWS consultations. Some of the activities of the Desert Tortoise Compliance Program include (1) reviewing proposed activities at the NNSS to determine whether they may be located in tortoise habitat and whether clearance surveys and/or monitoring are required; (2) conducting clearance surveys at project sites within 1 day of the start of project construction; (3) ensuring that environmental monitors are on site during heavy equipment operations; (4) developing training modules and ensuring that all personnel working on the NNSS are trained in the requirements of the *2009 Biological Opinion* (USFWS 2009a); and (5) preparing annual compliance reports for submittal to USFWS. By implementing the Desert Tortoise Compliance Program, the DOE/NNSA NSO will ensure that most if not all impacts on desert tortoises addressed in this analysis would involve harassment rather than injury or mortality. For purposes of analysis in this *NNSS SWEIS*, the definition of "harass" or "harassment" includes the intentional removal and relocation of desert tortoises by qualified biologists, which would significantly reduce the "likelihood of injury" to desert tortoises contained in the definition of "harass" in the text box on page 5-112.

Tables 5–30 (Section 5.1.7.1.3), 5–31 (Section 5.1.7.2.3), and 5–32 (Section 5.1.7.3.3.1) display the estimated impacts on desert tortoises in terms of acres of habitat removed and numbers of tortoises taken by DOE/NNSA activities at the NNSS under each of the three alternatives, respectively. The acres of tortoise habitat that could be taken under the three alternatives were determined by summing the potential areas of disturbance for all of the activities that may occur within tortoise habitat on the NNSS, as depicted in Chapter 4, Figure 4–24, Northern Boundary of the Desert Tortoise Range on the Nevada National Security Site, under each alternative. Then, based upon the "Estimated Tortoise Density" ranges in Figure 4–24, a range of numbers of desert tortoises that could be impacted was calculated for each program and mission. Included within each of the three tables are the "allowable takes" of both tortoises and habitat from the *2009 Biological Opinion* (USFWS 2009a), for ready comparison. In each of the three tables, the row that lists "Nonprogrammatic Takes on NNSS Roads" (i.e., 125 over the next 10 years) is derived directly from the *2009 Biological Opinion*. As noted above, based on actual operations at the NNSS since 1992 and ongoing implementation of DOE/NNSA's Desert Tortoise Compliance Program, the calculated estimated programmatic take of desert tortoises shown in the three tables and discussed in the text would result from harassment. Of the 125 tortoises that may be "taken" under the *2009 Biological Opinion*, only 1 to 2 tortoises are expected to be taken by injury or mortality each year; the remainder would be taken by harassment by being moved by qualified biologists off of roadways or from areas of proposed land disturbance to prevent their injury or death. This estimated number of tortoises taken by injury or death on NNSS roadways over the next 10 years is based on the annual average of actual recorded takes of desert tortoises on NNSS roadways since 1992, as shown in **Table 5–29**.

Table 5–29 Number of Desert Tortoises Injured or Killed on Nevada National Security Site Roadways, 1992 through 2011

Year	*Numbers of Desert Tortoises*	*Year*	*Numbers of Desert Tortoises*
2011	1	2001	1
2010	2	2000	0
2009	1	1999	0
2008	0	1998	1
2007	1	1997	0
2006	1	1996	0
2005	1	1995	0
2004	3	1994	0
2003	0	1993	0
2002	0	1992	3
Total Number of Desert Tortoises Injured or Killed			**15**
Average Number of Desert Tortoises Injured or Killed per year			**0.75**

Sources: NSTec 2008c, 2009a, 2010j, 2011b; Ostler 2011.

In addition to the Desert Tortoise Compliance Program, the DOE/NNSA NSO conducts comprehensive program activities to monitor and protect sensitive plant and animal species and other biological resources on the NNSS, including the following:

- Biological surveys are performed at project sites where land-disturbing activities are proposed. The goal is to minimize the adverse effects of land disturbance on sensitive and protected/regulated plant and animal species, their associated habitat, and other important biological resources. Survey reports document species and resources found and provide mitigation recommendations. During these surveys, ecologists note any noxious/invasive plants that are growing in the survey area and, as appropriate, notify NNSS Maintenance, which may take steps to eradicate the plants from that area.
- Beginning in 2004, the DOE/NNSA NSO began annual surveys each spring to assess wildland fire hazards on the NNSS. NNSS ecologists conduct these wildland fire surveys in coordination with NNSS Fire and Rescue. As with biological surveys, ecologists conducting wildland fire hazards surveys identify noxious/invasive plants and, as appropriate, notify NNSS Maintenance.
- Under the NNSS Sensitive Plant Monitoring Program, the status or ranking of sensitive plant species known to occur on the NNSS is evaluated annually to ensure such plants are afforded the appropriate protection under Federal and state laws. Sensitive plant species populations on the NNSS are routinely monitored to assess plant density and plant vigor or identify any threats or

impacts on the species. Currently, there are 19 species of sensitive plants that are monitored on the NNSS. A full list of sensitive plant species on the NNSS may be found in Appendix F, Table F–1. As with biological surveys, ecologists monitoring sensitive plant species identify noxious/invasive plants and, as appropriate, notify NNSS Maintenance.

- The DOE/NNSA NSO currently monitors 18 animal species on the NNSS as part of the Sensitive and Protected/Regulated Animal Monitoring Program to ensure such animal species are afforded the appropriate protection under Federal and state laws. These monitored species include 13 species of bats, wild horses (*Equus caballus*), mule deer, mountain lion, dark kangaroo mouse (*Microdipodops meacephalus*), and pale kangaroo mouse (*Microdipodops pallidus*). In addition, the DOE/NNSA NSO monitors raptorial bird species, including the western burrowing owl (*Athene cunicularia hypugaea*). The western red-tailed skink, a potentially sensitive species of reptile, has been under evaluation since 2006 to determine its abundance and distribution on the NNSS and whether it should be added to the list of actively monitored animal species. A list of all sensitive and protected/regulated animal species known to occur on the NNSS may be found in Appendix F, Table F–1. As with biological surveys, ecologists monitoring sensitive and protected/regulated animal species identify noxious/invasive plants and, as appropriate, notify NNSS Maintenance.
- Additional monitoring of such things as natural wetlands is conducted to characterize seasonal baselines and trends in physical and biological parameters; help the Southern Nevada Health District ascertain the presence and/or prevalence of the West Nile virus in the NNSS mosquito population; and assess the use of constructed water sources by wildlife and develop and implement mitigation measures to prevent significant harm to wildlife.
- The Habitat Restoration Program involves the revegetation of disturbed land and evaluation of previous revegetation efforts. These activities are conducted at both the NNSS and the TTR. Revegetation of disturbed areas helps promote reestablishment of native plant species and reduce the opportunities for noxious/invasive plant species to colonize those areas.
- An Ecological Monitoring and Compliance Program Report is published each year to document the previous year's activities and accomplishments in all of the above-noted areas.

These activities are all elements of the DOE/NNSA NSO's program to ensure compliance with DOE Order 436.1, *Departmental Sustainability*, and all applicable statutes and regulations.

Most activities described in Chapter 3 for the three alternatives have the potential to adversely affect biological resources at the NNSS. Direct impacts on biological resources would occur as a result of ground-disturbing activities, such as drilling new monitoring/characterization wells; grading; excavation; detonations of explosives; remediation of contaminated soils sites; construction of fencing, buildings, roads, firebreaks, and utilities; building modifications; and decontamination or demolition of buildings. Vehicular access to areas containing biological resources would increase the potential for direct mortality for wildlife and disturbance of native vegetation. NNSS activities at existing facilities are expected to have no new direct impacts on biological resources, although impacts such as startled reactions and flight due to detonation of explosives or operation of machinery would continue to occur.

The discussion of potential impacts on biological resources resulting from activities addressed in this SWEIS evaluates those impacts at the alternative level and by mission and program under each of the three alternatives. In this analysis, the overall area of land disturbance for each alternative may differ from the area of desert tortoise habitat that may be disturbed. Any potentially disturbed land area that clearly would not be located within desert tortoise habitat was excluded from the desert tortoise analyses, including the Project 57 site (about 100 acres) located on the Nevada Test and Training Range, dynamic experiments conducted in boreholes, one-half of open-air explosives experiments, drillback operations, depleted uranium experiment sites, a 5-megawatt photovoltaic power generation facility, about one-half of proposed UGTA Project characterization and monitoring wells, about one-half of the Office of Secure

Transportation training and exercises, and the proposed 10,000-acre Office of Secure Transportation training facility in Area 17. Because of implementation of the NNSS Desert Tortoise Compliance Program and based on NNSS operating experience, this analysis assumes that all of the impacts on tortoises from project/activity-related actions under all three alternatives would be takes by harassment; however, takes resulting from collisions with motor vehicles would not be considered harassment and, for reasons discussed below, are not included with the analysis of missions, programs and activities. It is acknowledged that some tortoises could be taken by injury or mortality; however, based on experience at the NNSS from 1992 to 2010, for DOE/NNSA programs, projects, and activities, there would be no tortoises taken by injury or mortality by project activities and less than one per year taken due to non-project-related impacts by vehicles on NNSS roads. Vehicular traffic associated with a commercial solar power generation facility located in Area 25 of the NNSS could result in additional desert tortoise take, but would be addressed under a separate project-specific Biological Opinion that would need to be obtained by the proponent of such a project.

For all proposed activities that could result in habitat disturbance under each alternative, disturbances occurring during the nesting season for birds could affect the eggs or young in nests located within the project area. Most birds that nest within the NNSS are protected under the Migratory Bird Treaty Act and other statutes, such as the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c). A migratory bird is any species or family of birds that lives, reproduces, or migrates within or across international borders at some point during their annual life cycle. The Migratory Bird Treaty Act prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests except as authorized under a valid permit (50 CFR 21.11). Originally passed in 1940, the Bald and Golden Eagle Protection Act provides for the protection of the bald and golden eagle by prohibiting the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 U.S.C. 668(a); 50 CFR Part 22). “Take” includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb (16 U.S.C. 668c; 50 CFR 22.3).

The following sections describe potential impacts on biological resources from DOE/NNSA activities under the alternatives that have not already been addressed.

5.1.7.1 No Action Alternative

5.1.7.1.1 Impacts on Vegetation

DOE/NNSA proposed activities at the NNSS would impact native vegetation directly by clearing areas or by crushing or breaking due to vehicular or pedestrian traffic. Table 5–1 displays estimated areas of land disturbance under each alternative, mission, and program for continuing and proposed DOE/NNSA activities and commercial and demonstration projects at the NNSS. DOE/NNSA activities would disturb a small portion of undisturbed habitat on the NNSS, regardless of alternative. However, some of the areas where activities could occur may be considered important habitats and are addressed under each alternative, mission, and program, as appropriate. The impacts of habitat disturbance on wildlife and sensitive and protected species under the No Action Alternative are addressed in Sections 5.1.7.1.2 and 5.1.7.1.3, respectively.

Overall, under the No Action Alternative, less than 1 percent (4,460 acres) of undisturbed habitat on the NNSS would be affected. Over one-half of land disturbances under the No Action Alternative would be due to potential development of a commercial solar power generation facility (2,650 acres) and are addressed under the Conservation and Renewable Energy Program. For DOE/NNSA activities, most vegetation disturbance (1,810 acres) would occur in areas generally along Mercury Highway in Yucca Flat and Frenchman Flat, although some activities, such as releases of chemicals and biological simulants and Office of Secure Transportation training and exercises, may occur in almost any area of the NNSS.

Under the No Action Alternative, over one-half of the 1,810 acres of land disturbance attributed to DOE/NNSA activities would be caused by short-term activities that would occur in small increments across a broad geographical area. The primary vegetation alliances that would be impacted are creosote bush/white bursage (*Larrea tridentata*/*Ambrosia dumosa*) shrubland, Nevada jointfir (*Ephedra nevadensis*) shrubland, saltbush (*Atriplex* spp.) shrubland, and burrobush/wolfberry (*Lycium andersonii*/*Hymenoclea salsola*) shrubland. These vegetation alliances cover about 150,800 acres, 106,000 acres, 25,900 acres, and 20,250 acres, respectively, or a total of about 36 percent of the NNSS (Ostler et al. 2000). Because of the prevalence of the potentially affected vegetation types on the NNSS, as well as regionally, and the geographical distribution of impacts, this level of habitat disturbance would not reduce the viability of any of the potentially affected vegetation alliances or have substantial negative impacts on biodiversity.

Some areas of the creosote bush/white bursage vegetation alliance in Frenchman Flat are considered sensitive habitat because the soils are particularly vulnerable to wind erosion and require long periods to recover from disturbance. DOE/NNSA would avoid siting new facilities or activities in this sensitive habitat to the extent reasonably possible; however, as noted below, ongoing development of the Area 5 RWMC would affect up to 190 acres of this sensitive habitat.

5.1.7.1.1.1 National Security/Defense Mission

Disturbances to up to 700 acres of habitat resulting from National Security/Defense Mission activities under the No Action Alternative would include removal of vegetation to clear areas or crushing plants by vehicular and pedestrian traffic. Crushed plants may recover if they are not too severely damaged and the cause of crushing does not damage their roots. Where vegetation must be removed to accomplish the activity, even though the activity would last only a relatively short period, recovery of the site would likely take many years. In addition, removal or weakening of native vegetation would increase the opportunity for invasive and weedy species to invade the disturbed areas, which could prolong or even preclude the ability of native vegetation to recolonize the area. As previously mentioned, some National Security/Defense Mission activities that occur in Frenchman Flat could impact sensitive habitat, but those habitat areas would be avoided if reasonably possible.

Stockpile Stewardship and Management Program. With the exception of a potential underground nuclear test (if so directed by the President), some explosives experiments, drillback operations, and Office of Secure Transportation training and exercises, all Stockpile Stewardship and Management Program activities would occur at existing facilities and would not cause any new or additional direct impacts on biological resources. Stockpile Stewardship and Management Program activities that would occur outside of existing facilities would likely affect vegetation directly due to disturbance of up to about 685 acres of land (less than 0.10 percent of undisturbed NNSS land). In many cases, vegetation would not need to be removed, but would be damaged by vehicular traffic and the setting up of equipment associated with the activities.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. The NNSS would provide research, development, and training in support of the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs, including arms control and improvised nuclear device dispositioning and forensics activities. Most of these activities would occur at existing facilities. Under the No Action Alternative, the only new land disturbance expected to occur in this program area would be associated with releases of chemicals and biological simulants, which would temporarily disturb up to 15 acres of previously undisturbed land at the NNSS.

Arms control and counterterrorism activities would include training exercises in large, remote areas that involve the use of explosives and live fire. Areas where these exercises would be conducted would be accessible to pedestrians and on- and off-road vehicles; however, areas used for these activities have been used for similar activities for many years, and no new land areas would be affected.

Work for Others Program. Under the No Action Alternative, DOE/NNSA would continue to host the projects of other Federal agencies such as DoD and DHS, as well as other Federal, state, and local government agencies and nongovernmental organizations. Projects such as treaty verification activities, nonproliferation projects, counterproliferation research and development, and counterterrorism projects would include localized on-the-ground operations, including explosives detonations, military hardware field testing, chemical and biological simulant releases, and personnel field training. These operations would occur in various locations at the NNSS, many in remote, high-desert environments, and could potentially disturb native vegetation; however, the areas used for these activities have been used for similar activities for many years, and no additional land areas would be affected.

5.1.7.1.1.2 Environmental Management Mission

Under the No Action Alternative, up to 1,110 acres of land (0.14 percent of undisturbed land on the NNSS) would be disturbed by Environmental Management Program activities, including the Project 57 (located on the Nevada Test and Training Range to the north of NNSS Area 15) and Small Boy (located on the eastern edge of Frenchman Flat in Area 5 of the NNSS and extending onto the Nevada Test and Training Range) sites and new groundwater characterization and monitoring wells. A significant portion of the areas that would be disturbed under the Environmental Restoration Program is located on the Nevada Test and Training Range. Specific impacts related to habitat disturbance are discussed for each Environmental Management Mission program.

Waste Management Program. Under the No Action Alternative, waste management facilities would continue to operate in Areas 5, 6, 9, 11, and 23. The Area 5 RWMC would continue to operate within the approximately 740-acre area set aside for radioactive waste management, and approximately 190 acres of that area would be permanently disturbed by construction of new disposal cells. When closing these waste disposal cells, DOE/NNSA would in most if not all cases use a vegetated cap, which would, in the long term, offset most of the habitat disturbance impacts.

All of the area that would be disturbed for the Area 5 RWMC is located within the creosote bush/white bursage vegetation alliance in Frenchman Flat. As land is disturbed within the Area 5 RWMC, it would be immediately managed for waste disposal purposes, and erosion of the soil would be controlled by application of water sprays and other treatments to stabilize exposed soils. Operations within other existing waste management facilities are not anticipated to disturb additional land and would not result in any additional habitat loss.

Environmental Restoration Program. Under the No Action Alternative, the DOE/NNSA Environmental Restoration Program would continue in compliance with the most recent version of the FFACO to characterize, monitor, and remediate, as necessary, identified contaminated areas, facilities, soils, and groundwater.

Land disturbance for Environmental Restoration Program activities would include 500 acres for new UGTA Project groundwater characterization and monitoring wells and 420 acres for Soils Project sites. It was assumed that about one-half (250 acres) of the disturbance for new characterization and monitoring wells would occur on land owned or managed by others adjacent to the NNSS on the Nevada Test and Training Range, and BLM land. Almost all of the 420 acres of land disturbance for the Soils Project sites would occur on the Nevada Test and Training Range. For purposes of analysis and because of the close proximity of the portions of the Nevada Test and Training Range, and BLM land that would be disturbed, all land disturbances associated with these Environmental Restoration Program activities are included with NNSS land disturbances.

Ground-disturbing soils remediation project activities would include onsite surveys and monitoring, soil sampling, clean closure, and/or closure in place. Clean closure would entail mechanical removal and disposal of contaminated soils in an NNSS LLW waste management facility (based on approved cleanup levels). Closure in place would create very low levels of land disturbance and would consist of establishing appropriate administrative controls (land use restrictions) and/or physical barriers (fences) to control access to contaminated sites and allowing radioactive decay to gradually decrease the level of contamination. Up to approximately 420 acres of land on the NNSS and Nevada Test and Training Range (exclusive of the TTR) would be affected if clean closure were selected for remediating both the

Project 57 and Small Boy sites. Those areas have been previously disturbed, although they continue to support native vegetation and are used by wildlife. The Project 57 site consists of about 100 acres of four-wing saltbush (*Atriplex canescens*)/Anderson's wolfberry vegetation, and the Small Boy site consists of about 320 acres of shadscale saltbush/rabbit thorn or Shockley's desert thorn (*Atriplex confertifolia-Lycium pallidum* or *Lycium shockleyi*) vegetation in the eastern portions of Frenchman Flat. Both the Project 57 and Small Boy sites are in areas that would be considered sensitive habitats due to high susceptibility of their soils to wind erosion if disturbed.

Development of up to 50 groundwater characterization and monitoring wells on the NNSS and Nevada Test and Training Range would disturb up to 500 acres, approximately one-half of which are located on the Nevada Test and Training Range in blackbrush (*Coleogyne ramosissima*)/Nevada jointfir (*Ephedra nevadensis*), spiny mendora (*Menodora spinescens*)/Anderson's wolfberry, Anderson's wolfberry/spiny hopsage (*Grayia spinosa*), and four-wing saltbush/Anderson's wolfberry vegetation associations, with the balance located on the NNSS in primarily blackbrush shrubland and Nevada jointfir shrubland. These are all common vegetation alliances and associations. On the NNSS, the blackbrush and Nevada jointfir shrubland alliances are the first and fifth most prevalent vegetation alliances, respectively, accounting for a combined 286,221 acres. Because the locations of the characterization and monitoring wells are not known at this time, it is not possible to know for certain, but it is very possible that some of them could be located in habitats that would be considered pristine, sensitive, or diverse The amount of vegetation and soil that would be disturbed is not expected to reduce the viability of any of the potentially affected vegetation alliances or associations or have a substantial negative impact on biodiversity, or wetlands and springs in these areas. In the longer term, Environmental Restoration Program activities at the NNSS would have a beneficial effect on biological resources because contamination would be removed or stabilized, some buildings would be removed, and areas would be revegetated with native plant species appropriate to the sites, thus improving existing habitat conditions.

5.1.7.1.1.3 Nondefense Mission

Under the No Action Alternative, DOE/NNSA would continue maintaining and repairing existing infrastructure and taking measures to improve energy efficiency and conservation. These activities may create some minor disturbances at existing facilities, but would not disturb previously undisturbed land. Therefore, there would be no new or additional impacts on vegetation. All new land disturbances related to the Nondefense Mission (2,650 acres) would be related to potential construction of a 240-megawatt commercial solar power generation facility in Area 25. This project is discussed below under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. Under the No Action Alternative, small projects to maintain and repair NNSS facilities would occur at existing facilities in previously disturbed areas and are not anticipated to directly affect biological resources.

Conservation and Renewable Energy Program. Measures taken to increase energy efficiency, fuel efficiency, and water conservation would occur at existing facilities and are not anticipated to directly affect biological resources.

Under the No Action Alternative, DOE/NNSA would allow construction of up to 240 megawatts of commercial solar power generation that would permanently disturb about 2,650 acres of creosote bush/white bursage habitat in Area 25 and nearby off-NNSS areas (for transmission line construction). Much of the area of potential disturbance, primarily north and west of Lathrop Wells Road, is considered sensitive habitat. The entire facility would be graded and stabilized to minimize soil erosion and would be maintained in an unvegetated condition. Additionally, access roads and utilities would be constructed to support the facilities. There are approximately 150,800 acres of creosote bush/white bursage habitat on the NNSS. Disturbance of up to 2,650 acres for a commercial solar power generation facility and associated transmission lines would affect about 1.8 percent of the habitat type on the NNSS and only about 0.3 percent of overall undisturbed land. The amounts of vegetation and soil that would be disturbed are not expected to reduce the viability of creosote bush/white bursage vegetation in the region or have a substantial negative impact on biodiversity in this area. Approximately 700 acres of the area that would be disturbed by construction of a 240-megawatt commercial solar power generation facility would be within an area considered sensitive habitat because it contains vegetation associations that recover very slowly from direct disturbance and is susceptible to wind erosion. However, the area would be graded and stabilized to minimize soil erosion and would be maintained in an unvegetated condition; thus, there would be no additional impact associated with disturbance of this sensitive habitat.

Other Research and Development Programs. The Nevada National Environmental Research Park in Area 5 contains two existing facilities used to support outside scientific research on long-term environmental health. Future research programs could include activities such as habitat reclamation and remediation, which could potentially cause impacts on vegetation and soils due to ground disturbance and increased access to previously undisturbed land. No such activities are being proposed at this time.

5.1.7.1.2 Impacts on Wildlife

Under the No Action Alternative, most impacts on wildlife from DOE/NNSA activities would be temporary. Many of those temporary disturbances would occur in areas adjacent to previously disturbed areas that may possess marginal value as wildlife habitat, such as off-road vehicular traffic associated with Office of Secure Transportation training and exercises, which would occur within about 100 feet of the edge of existing roads. During periods of any human activity in an area, larger and more mobile species of wildlife would leave the area during the period of disturbance but smaller and less mobile species may be subject to direct injury and mortality. In addition to these direct effects, disturbance of vegetation, particularly in large blocks, could adversely impact wildlife populations through loss and fragmentation of cover, breeding, traveling, and foraging habitat. However, disturbance of up to 4,460 acres of habitat would represent only about 0.56 percent of undisturbed habitat on the NNSS, with the largest contiguous area of land disturbance being 2,650 acres for a commercial solar power generation facility. In addition, predation could increase because construction may attract additional predators, such as ravens or coyotes, as wildlife is displaced from protective cover to uncovered habitat.

Noise associated with DOE/NNSA activities would impact wildlife in various ways, depending on the nature and location of the noise source and the particular species of wildlife. Where noises from human activities are fairly constant, such as the Area 5 RWMC, animals become accustomed and use the habitat around the noise source in accordance with their individual comfort levels. For some species, such as coyotes, human occupation of an area may be an opportunity for foraging. Other species are less adaptable to human presence. Sudden loud noises such as explosives detonations could startle wildlife, resulting in impacts on certain species. If sudden loud noises were to occur near vital water sources, they could cause large and mobile species of wildlife to avoid them until the disturbance subsides, which could affect animal species that depend on those water sources. Most DOE/NNSA activities that would create sudden loud noises or other large disturbances that would cause wildlife to flee an area are sporadic and of such short duration that it is doubtful they would cause significant interference with wildlife activities, including foraging and visiting drinking water sources. Nesting birds may flush from their nests in response to a sudden loud noise; however, based on experience at Cape Canaveral, nesting birds respond to Space Shuttle launch noise by flying away from the nests and then returning within a few minutes (FAA 2002).

5.1.7.1.3 Impacts on Sensitive and Protected Species

Based on previous studies, data are available to delineate desert tortoise habitat on the NNSS (Rautenstrauch et al. 1994) (see Chapter 4, Figure 4–24) and to make quantitative estimates of potential impacts on desert tortoises (DOE/NV 1998b) at the alternative, mission, and program levels for proposed activities at the NNSS. Similar detailed data are not available for other sensitive and protected species that inhabit the NNSS. For those species, the impact assessment is qualitative and only at the alternative level.

Table 5–30 displays the potential impacts on the desert tortoise under the No Action Alternative. Overall, implementation of the No Action Alternative, including all DOE/NNSA activities and a 240-megawatt commercial solar power generation facility, would result in disturbance of up to 3,705 acres of desert tortoise habitat (about 1.2 percent of remaining tortoise habitat on the NNSS) and impact 133 to 213 tortoises. DOE/NNSA activities under the No Action Alternative would disturb a total of 1,055 acres of tortoise habitat; this represents about 0.3 percent of the remaining tortoise habitat on the NNSS. Disturbance of this amount of habitat and associated activities would result in a potential take of 8 to 29 tortoises due to projects and activities, as well as up to 125 on NNSS roads for a total of 133 to 172, all by harassment; however, as noted earlier in this section, based on operating experience at the NNSS since 1992, an average of no more than 1 desert tortoise is expected to be taken by injury or mortality due to vehicle collisions each year. These values do not exceed the total threshold limits (2,710 acres and 194 tortoises) of the *2009 Biological Opinion* (USFWS 2009a). Potential impacts on the desert tortoise from development of a commercial solar power generation facility under the No Action Alternative are addressed below under the Conservation and Renewable Energy Program.

In the following discussion of potential impacts on desert tortoises resulting from missions and programs under the No Action Alternative, if the level of incidental take is reached and anticipated to be exceeded during the course of actions, such an incidental take would represent new information requiring reinitiation of consultation with USFWS and review of the reasonable and prudent measures in the *2009 Biological Opinion* (USFWS 2009a).

Compared to most other special status animal species on the NNSS, the western burrowing owl (*Athene cunicularia hypugaea,*) requires greater management attention because it occupies the flat, open valley bottoms in each of the three ecoregions found on the NNSS; primarily Yucca Flat (Transition Ecoregion), Frenchman Flat, Jackass Flats (both Mojave Desert Ecoregion), and near Buckoard Mesa (Great Basin Desert Ecoregion). Except for Buckboard Mesa, these are areas on the NNSS where most ongoing activities occur and most future activities are likely to occur (Hall et al. 2003). DOE/NNSA NSO activities, such as emplacing culverts and pipes, road building, digging pits and channels, and mound building, have benefited the burrowing owl directly by increasing the number of available burrows for owls to use and indirectly by altering the natural habitat so it is more suitable for owls (Hall et al. 2003). Data developed by Hall et al. 2003 indicate that creation of a buffer area of about 60 meters around active burrowing owl burrows would preclude flushing birds by either human pedestrian or vehicular activity. Because the burrowing owl is protected under the Migratory Bird Treaty Act, DOE/NNSA enforces this buffer area around active burrows.

Other sensitive and protected bird species would be primarily impacted by disturbance during the nesting season. If active nests of sensitive and otherwise protected bird species were located during pre-project biological surveys, DOE/NNSA would avoid impacting the nests until the young birds fledge. In compliance with the Migratory Bird Treaty Act, if it were imperative to disturb an active nest of any bird species protected under the act, DOE/NNSA would consult with USFWS prior to taking any action that would affect the nest or nesting birds. For example, in 2009, three nests with chicks were protected from harm, including one Say’s phoebe nest with four chicks and two nests of unknown species, each with chicks. Activities that may have caused harm to these nests were postponed until the chicks fledged and the nests were empty (DOE/NV 2010).

Table 5–30 Potential Impacts on Desert Tortoises Under the No Action Alternative

Mission/Program	*Primary Locations of Activities*	*Area of Desert Tortoise Habitat Disturbance (acres) <allowable take>*	*Maximum Desert Tortoise Abundance (number per square mile)* [a]	*Number of Desert Tortoises Affected* [b] *<allowable take>*
Stockpile Stewardship and Management Program	Yucca Flat and Frenchman Flat	280 [c] <500>	Low (10–45)	4 to 20 <10>
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs	Frenchman Flat, Yucca Flat, and Mercury Valley	15	Low (10–45)	0 to 1
Work for Others Program	Yucca Flat, Frenchman Flat, Mercury Valley, and Fortymile Canyon	None <500>	N/A	N/A <10>
National Security/Defense Mission Total		295 <1,000>		4 to 21 <20>
Waste Management	Frenchman Flat	190 <100>	Very Low (0–10)	0 to 3 <2>
Environmental Restoration – Soils Project	Frenchman Flat, and, Nevada Test and Training Range	320 [d] <10>	Very Low (0–10)	0 to 5 <2>
Environmental Restoration – Underground Test Area Project	Yucca Flat and Frenchman Flat	250 [e]	Low (10–45)	4 to 18 [e]
Environmental Management Mission Total		760 <110>		4 to 26 <4>
General Site Support and Infrastructure	NNSS	None <100>	N/A	N/A <10>
Renewable Energy (DOE/NNSA)	NNSS	None <1,500>	N/A	N/A <35>
Nondefense Mission Total		None		N/A
Nonprogrammatic Takes on NNSS Roads	NNSS	None <None>		125 <125>
Total DOE/NNSA		1,055 <2,710>		133 to 172 <194>
Commercial Solar Power Generation Facility	Jackass Flats	2,650 [f]	Very Low (0–10)	0 to 41
Total		3,705		133 to 213

N/A = not applicable; NNSS = Nevada National Security Site.

[a] Desert tortoise abundance class from Woodward et al. 1998.

[b] Acres of Disturbance/640 × Maximum Desert Tortoise Abundance range

[c] Dynamic experiments in boreholes, drillback operations, and one-half of high-explosives experiments and Office of Secure Transportation training proposed under the No Action Alternative would be located outside of the range of the desert tortoise and are not included in this table.

[d] A total of 420 acres would be disturbed at Soils Project sites on the NNSS and Nevada Test and Training Range, but only the Small Boy site (320 acres) in the Frenchman Flat area would be within desert tortoise habitat.

[e] A total of 10 acres of tortoise habitat disturbance and 2 takes by harassment are allowable for all Environmental Restoration Program activities at the NNSS under the *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada*.

[f] 2,400 acres would be required for a commercial solar power generation facility with 240 megawatts capacity, about 250 acres would be used for transmission line right-of-way to connect the facility to the main transmission grid.

Impacts on the western red-tailed skink (*Eumeces gilberti rubricaudatus*), a potentially sensitive species of reptile, would be small because it is widespread regionally and occupies small pockets of isolated habitat in the western and northwestern portions of the NNSS (NSTec 2010j) that would not be subject to land disturbance under the No Action Alternative. The western red-tailed skink may be found in dry rocky areas, but tends to be more abundant in rocky areas near intermittent or permanent streams and springs (Stebbins 2003; NSTec 2007).

At least 13 sensitive species of bats are known to occur at the NNSS or in adjacent areas. Tunnels, abandoned mine shafts and adits, natural caves and alcoves, and buildings at the NNSS may be used by bats as maternity roosts, night roosts, day roosts, and foraging sites (NSTec 2010j). Closure of unused tunnels and abandoned mine features could impact bats by reducing habitat necessary for them to reproduce and raise young and to fulfill other functions important to their survival. Prior to closing such facilities, the DOE/NNSA NSO conducts surveys and determines the level and type of use, if any, of these sites and installs bat gates and other means to ensure adequate closure and still provide access for bats. When bats are found occupying buildings, they are captured and relocated to other areas of the NNSS. These measures reduce any impacts on bats from DOE/NNSA activities at the NNSS to very low and are largely beneficial to the various species of bats that inhabit the NNSS.

Appendix F, Figure F–1, shows the known locations of sensitive plant populations on the NNSS. DOE/NNSA routinely monitors the populations of these species to assess plant density and vigor and to identify any threats or impacts on the species. As new populations of sensitive plants are found on the NNSS, maps and databases are updated to ensure they are afforded the appropriate protection under Federal and state law. DOE/NNSA uses this information in planning projects to avoid impacting sensitive plant species. In addition to regular monitoring, biological surveys are conducted before any potential ground-disturbing activities, and if previously unknown populations of sensitive plants were discovered, DOE/NNSA would take reasonable measures to avoid those areas; however, if avoidance is not possible, there are no specified mitigation measures and the susceptible population would be lost. In this regard, it is important to note that most sensitive plant populations are located in portions of the NNSS that would be unlikely to be disturbed by any of the activities proposed under the No Action Alternative. Two sensitive species of plants occur in the valleys and would be more susceptible to being impacted: *Camissonia megalantha*, *Cymopterus ripleyi* var. *saniculoides*. Others like *Eriogonum concinnum* are growing on disturbed areas, such as road cuts and cut slopes for well pads.

5.1.7.1.3.1 National Security/Defense Mission

Land disturbance of about 295 acres for National Security/Defense Mission activities in desert tortoise habitat could result in the potential take of from 4 to 21 tortoises, all by harassment. The amount of potential land disturbance is within the threshold value given in the *2009 Biological Opinion* (USFWS 2009a) for the National Security/Defense Mission (1,000 acres). The take of tortoises could marginally exceed the threshold value (20) given in the *2009 Biological Opinion* for the National Security/Defense Mission.

Stockpile Stewardship and Management Program. Most Stockpile Stewardship and Management Program activities would occur in the Yucca Flat and Frenchman Flat areas of the NNSS and incur about 280 acres of potential land disturbance within desert tortoise habitat in these areas. The estimated number of tortoises taken by harassment would range from 4 to 20. The acres of potential disturbance would meet the threshold value in the *2009 Biological Opinion* (USFWS 2009a), but the maximum potential take of desert tortoises would exceed the threshold value (10).

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Releases of chemicals and biological simulants would occur at many locations at the NNSS, mostly within previously disturbed areas such as NPTEC, Test Cell C, and established training areas; however up to 15 such releases may occur in undisturbed desert tortoise habitat, resulting in 15 acres of disturbance, which would impact up to 1 tortoise. The *2009 Biological Opinion* (USFWS 2009a) does not include a designation for this program area; however, biological simulant and chemical releases would result primarily from Work for Others Program activities. As such, the 15 acres of potential disturbance would be within the 500 acres allotted to the Work for Others Program, and the number of tortoises potentially taken by harassment would be well within the allowable take (10) in the *2009 Biological Opinion*.

Work for Others Program. Because no new land disturbances are anticipated under the Work for Others Program, none of the parameters of the *2009 Biological Opinion* (USFWS 2009a) would likely be exceeded.

5.1.7.1.3.2 Environmental Management Mission

Under the No Action Alternative, DOE/NNSA NSO Environmental Management Program activities would disturb up to 760 acres of land within desert tortoise habitat (about 0.24 percent of remaining undisturbed habitat). Environmental Management Program activities that would disturb desert tortoise habitat on the NNSS include remediation of the 320-acre Small Boy site located on the eastern edge of the NNSS in Area 5, one-half of the proposed UGTA characterization and monitoring wells (within 250 acres assumed to be located within desert tortoise habitat for purposes of this analysis), and 190 acres from land disturbance associated with waste disposal operations at the Area 5 RWMC. However, upon completion of remediation of the Small Boy site, about 320 acres of desert tortoise habitat would be restored. The potential take of desert tortoises would range from 4 to 26, all by harassment. The area of desert tortoise habitat that would be disturbed exceeds the threshold (110 acres) of the *2009 Biological Opinion* (USFWS 2009a), and the potential take of tortoises could exceed the allowable take (four) of the *2009 Biological Opinion*.

Waste Management Program. The Area 5 RWMC is located in Frenchman Flat, and the 1,900 acres of new land disturbance would potentially affect up to three desert tortoises, all by harassment. The acres of potential disturbance and the number of potentially affected desert tortoises would exceed the allowable take (100 acres and two tortoises) in the *2009 Biological Opinion* (USFWS 2009a).

Environmental Restoration Program. The 570 acres of new land disturbance from the Soils Project (Small Boy site) and UGTA Project (new characterization and monitoring wells) would potentially affect from 4 to 23 desert tortoises, all by harassment. The acres of potential disturbance and the number of potentially affected desert tortoises would exceed the allowable take of the *2009 Biological Opinion* (i.e., 10 acres and two tortoises).

5.1.7.1.3.3 Nondefense Mission

Under the No Action Alternative, DOE/NNSA Nondefense Mission activities would not disturb previously undisturbed land; however, they could cause some temporary short-term elevated noise levels in the immediate vicinity of the facilities that would temporarily disturb wildlife in the local area. Therefore, there would be no new or additional impacts on the desert tortoise. A potential solar power generation facility considered under this alternative is discussed below under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. Under the No Action Alternative, small projects to maintain and repair NNSS facilities would occur at existing facilities in previously disturbed areas and are not anticipated to affect desert tortoises.

Conservation and Renewable Energy Program. Measures taken to increase energy efficiency, fuel efficiency, and water conservation would occur at existing facilities and are not anticipated to affect desert tortoises.

Under the No Action Alternative, DOE/NNSA would consider allowing development of a commercial solar power generation facility on about 2,400 acres in Area 25 of the NNSS. To interconnect a commercial solar power generation facility to the electrical grid would require some construction of transmission lines. Assuming that up to 10 miles of new transmission line with a right-of-way 200 feet wide would be needed for a solar power generation facility with 240 megawatts of capacity on the NNSS, an additional approximately 250 acres of land would be disturbed. Most of the transmission line impacts would occur off the NNSS on BLM and private land. The 240-megawatt facility would be located within the range of the desert tortoise and would permanently disturb its habitat. The number of desert tortoises potentially affected by this project would range from none to 41. This estimate is conservative because, within the portion of Area 25 where a solar power generation facility would be located, the soils tend to be too sandy to provide suitable tortoise burrow sites and there are very few, if any, tortoises actually inhabiting the area. The commercial solar power generation facility is not covered by the *2009 Biological Opinion* (USFWS 2009a) and would require consultation among the project proponents, USFWS, and BLM to develop a project-specific Biological Opinion.

5.1.7.1.4 Impacts on Offsite Biota

Under the No Action Alternative, activities at the NNSS would continue at about the same levels as they have since 1996. In the southern Nevada area in the vicinity of the NNSS, there are a number of sensitive locations for plants and animals. These areas include USFWS's Desert National Wildlife Range and Devils Hole National Wildlife Refuge and BLM's Ash Meadows and Amargosa Mesquite Areas of Critical Environmental Concern. The potential for DOE/NNSA activities at the NNSS to impact plants and animals in areas outside of the NNSS is negligible. The primary paths for activities at the NNSS to cause impacts at these offsite areas are surface-water runoff, groundwater withdrawals and/or contamination, wildlife migration, and air emissions.

As noted in Section 5.1.6.1, there is a negligible potential for existing onsite contamination to be transported off site via surface water, or through flood events, to affect offsite areas. This would make it unlikely that DOE/NNSA activities at the NNSS would affect plants or animals in these areas through the surface-water runoff pathway.

As discussed in Section 5.1.6.2, past underground nuclear testing introduced a substantial amount of radioactive contamination into the underground environment. A portion of that contamination is available to be transported by groundwater (i.e., the hydrologic source term). If radioactive contaminants from underground nuclear testing were to reach any of the noted offsite sensitive areas via the groundwater, it could result in a significant impact on plants and animals in that area, particularly the endangered Devils Hole pupfish (*Cyprinodon diabolis*). As described in Chapter 4, Section 4.1.6.2, DOE/NNSA has established the UGTA Project that, working with NDEP under the FFACO, is characterizing and monitoring groundwater in areas surrounding the primary underground nuclear testing areas on the NNSS, including offsite areas, as appropriate. Based on the most current studies and state-of-the-art modeling, it is unlikely that levels of radioactive contamination from the NNSS would exceed the standards established in the FFACO in areas outside of the NNSS and Nevada Test and Training Range over the next 1,000 years (see Chapter 6, Section 6.3.6.2). Therefore, it is unlikely that radioactive contamination in the groundwater would impact any of the sensitive offsite areas or seeps, springs, or other sources of water important to wildlife and vegetation over the next 1,000 years.

Groundwater withdrawals are of particular concern as they relate to maintenance of the water level at Devils Hole, which is critical to the continued survival of the Devils Hole pupfish (NPS 2010h). Under the No Action Alternative, groundwater withdrawals at the NNSS required to support DOE/NNSA activities would not likely result in excessive drawdown of the affected aquifers, and DOE/NNSA would continue to monitor groundwater levels and adjust points of diversion, as necessary, to protect the integrity of the aquifers (see Section 5.1.6.2.1). Therefore, there would not likely be any effect on water levels at Devils Hole. If a commercial solar power generation facility were proposed in Area 25 of the NNSS, a project-specific NEPA review would be performed and the project proponent would be required to obtain a groundwater appropriation from the Nevada State Engineer for any withdrawals necessary for construction and operation of the facility. As noted in Chapter 6, Section 6.3.6.2, to protect the Devils Hole pupfish, Nevada State Engineer Order 1197 states in part, "…any applications to appropriate additional underground water and any application to change the point of diversion of an existing groundwater right to a point of diversion closer to Devils Hole, described as being within a 25-mile radius from Devils Hole within the Amargosa Desert Hydrographic Basin, will be denied." For any project needing a stable water supply within the area subject to Nevada State Engineer Order 1197, the developer would need to either lease or purchase water currently being pumped under an existing certified water right. As the water user can only pump up to the authorized duty of the water right, there would be no net increase in groundwater pumping within the basin. Continued implementation of Nevada State Engineer Order 1197 will help to preclude impacts on Devils Hole and the Devils Hole pupfish due to groundwater withdrawals.

Under the No Action Alternative, all emissions to the air would be within all applicable standards and would not result in adverse impacts on plants or animals at any of the sensitive offsite locations of concern.

5.1.7.2 Expanded Operations Alternative

5.1.7.2.1 Impacts on Vegetation

Under the Expanded Operations Alternative, DOE/NNSA proposed activities at the NNSS would impact native vegetation directly by clearing areas or by crushing or breaking due to vehicular or pedestrian traffic. Crushed plants may recover if they are not too severely damaged and the cause of crushing does not damage their roots. Where vegetation must be removed to accomplish the activity, even though the activity would last only a relatively short period, recovery of the site would likely take many years. In addition, removal or weakening of native vegetation would increase the opportunity for invasive and weedy species to invade the disturbed areas, which could prolong or even preclude the ability of native vegetation to recolonize the area. Some of the areas where activities would occur may be considered important habitats and are addressed, as appropriate, in this section. Table 5–1 displays estimated areas of land disturbance by alternative, mission, and program for DOE/NNSA activities and commercial and demonstration projects at the NNSS. The impacts of habitat disturbance on wildlife and sensitive and protected species under the Expanded Operations Alternative are addressed in Sections 5.1.7.2.2 and 5.1.7.2.3, respectively.

Overall, under the Expanded Operations Alternative about 3.3 percent (25,877 acres) of undisturbed habitat on the NNSS would be disturbed. Most of this disturbance would occur in Yucca Flat, Frenchman Flat, and Jackass Flats, although some activities, such as releases of chemicals and biological simulants and Office of Secure Transportation training and exercises may occur in almost any area of the NNSS. About 10,350 acres of land disturbance under the Expanded Operations Alternative would be the result of potential development of commercial solar power generation facilities (including associated transmission lines) in the Jackass Flats in Area 25 and 50 acres the result of development of a Geothermal Demonstration Project. The remaining 15,527 acres of land disturbances would be attributed to DOE/NNSA activities.

The primary vegetation alliances that would be impacted by Expanded Operations Alternative activities are creosote bush/white bursage shrubland, Nevada jointfir shrubland, saltbush shrubland, blackbrush shrubland, and burrobush/wolfberry shrubland. These vegetation alliances cover about 150,800 acres, 106,000 acres, 25,900 acres, 180,250 acres, and 20,250 acres, respectively, or a total of about 56 percent of the NNSS (DOE/NV 2000d). Because of the prevalence of the affected vegetation types on the NNSS, as well as regionally, and the geographical distribution of impacts, this level of habitat disturbance would not reduce the viability of any of the potentially affected vegetation alliances or have substantial negative impacts on biodiversity. However, some areas of creosote bush/white bursage vegetation in Frenchman Flat and blackbrush vegetation in Yucca Flat are considered sensitive habitat because the soils are particularly vulnerable to wind erosion if disturbed and require long periods to recover. DOE/NNSA would avoid activities that would disturb soils in this sensitive habitat to the extent reasonably possible.

5.1.7.2.1.1 National Security/Defense Mission

Up to 13,455 acres of vegetation (about 1.7 percent of undisturbed land on the NNSS) would be impacted by National Security/Defense Mission projects and activities under the Expanded Operations Alternative. A number of new facilities for supporting the National Security/Defense Mission programs are proposed under the Expanded Operations Alternative. Some National Security/Defense Mission activities that occur in portions of Frenchman Flat could impact sensitive habitat, but those habitat areas would be avoided if reasonably possible.

Stockpile Stewardship and Management Program. With the exception of a potential underground nuclear test (if so directed by the President), some explosives experiments, depleted uranium experiment sites, drillback operations, and Office of Secure Transportation training and exercises, all Stockpile Stewardship and Management Program activities would occur at existing facilities and would not cause any new or additional direct impacts on biological resources. Stockpile Stewardship and Management Program activities that would occur outside of existing facilities would likely affect vegetation directly due to disturbance of up to about 12,805 acres of land, which represents about 1.6 percent of undisturbed land on the NNSS.

Development of the proposed training facility for the Office of Secure Transportation would displace 10,000 acres of blackbrush and Nevada jointfir shrublands along the western margins of Yucca Flat. These two vegetation alliances cover about 286,250 acres of the NNSS. The proposed training facility would disturb about 3.5 percent of the combined area covered by these two vegetation alliances on the NNSS. The remaining 2,805 acres of potential land disturbance attributed to the Stockpile Stewardship and Management Program under the Expanded Operations Alternative would be primarily located in the Yucca Flat and Frenchman Flat areas.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. The NNSS would provide research, development, and training in support of the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs, including arms control and improvised nuclear device dispositioning and forensics activities. To provide increased support to these activities, DOE/NNSA would develop an Arms Control Treaty Verification Test Bed and an Urban Warfare Complex at the NNSS. These new facilities would result in about 200 acres of permanent land disturbance in the Frenchman Flat and Yucca Flat areas and would most likely affect one or more of the following vegetation alliances: creosote bush/white bursage, saltbrush, Nevada jointfir, blackbrush, and burrobush/wolfberry. As under the No Action Alternative, about 15 acres of land would be temporarily disturbed for experiments involving releases of biological simulants and chemicals.

Other arms control and counterterrorism activities would include training exercises in large, remote areas that involve the use of explosives and live fire. Areas where these exercises would be conducted would be accessible to pedestrians and on- and off-road vehicles; however, areas used for these activities have been used for similar activities for many years and no additional land areas would be affected. These activities are expected to disturb native vegetation, but are not expected to reduce the viability of vegetation, including special status plant species.

Work for Others Program. Under the Expanded Operations Alternative, DOE/NNSA would continue to host the projects of other Federal agencies such as DoD and DHS, as well as other Federal, state, and local government agencies and nongovernmental organizations. Projects such as treaty verification activities, nonproliferation projects, counterproliferation research and development, and counterterrorism projects would include localized on-the-ground operations, including explosives detonations, military hardware field testing, chemical and biological simulant releases, and personnel field training. These operations would occur in various locations at the NNSS, many in remote, high-desert environments, and could potentially disturb native vegetation; however, the areas used for these activities have been used for similar activities for many years, and no additional land areas would be affected.

About 15 acres of land would be disturbed by construction of new support buildings at existing aviation facilities on the NNSS. About 20 acres of land would be disturbed in Area 15 of the NNSS for radioactive tracer experiments. In addition, as part of its Work for Others Program, DOE/NNSA would permanently disturb about 400 acres of land for various facilities, such as an Improvised Explosives Device Research and Defeat Facility and Active Interrogation Facilities. At this time, there are no specific plans or locations for these facilities, but they would most likely be located in Frenchman Flat or Yucca Flat, potentially affecting the same vegetation alliances as noted under Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs, above. Some areas of sensitive habitat may be impacted, but these areas would be avoided to the extent possible.

5.1.7.2.1.2 Environmental Management Mission

Under the Expanded Operations Alternative, up to 1,555 acres of land (about 0.2 percent of undisturbed land on the NNSS) would be disturbed, for Environmental Management activities, over the next 10 years. Specific impacts related to habitat disturbance are discussed for each Environmental Management program.

Waste Management Program. Under the Expanded Operations Alternative, waste management facilities would continue to operate in Areas 5, 6, 9, 11, and 23. The Area 5 RWMC would continue to operate within the approximately 740-acre area set aside for radioactive waste management, and approximately 600 acres of that area would be permanently disturbed by construction of new disposal cells. If necessary, DOE/NNSA would develop two new sanitary waste facilities at the NNSS. One would be located in Mercury Valley and would permanently disturb up to 15 acres of Nevada jointfir shrubland. A second sanitary waste facility would be developed in Area 25 to accept waste from Environmental Restoration demolition projects under the Industrial Sites Project. The new Area 25 sanitary waste disposal facility would permanently disturb about 20 acres of creosote bush/white bursage shrubland. Operations within other existing waste management facilities are not anticipated to disturb additional land and would not result in any additional habitat loss.

Environmental Restoration Program. Under the Expanded Operations Alternative, the DOE/NNSA Environmental Restoration Program would continue in compliance with the most recent version of the FFACO to characterize, monitor, and remediate, as necessary, identified contaminated areas, facilities, soils, and groundwater. Impacts on vegetation from these activities would be the same as under the No Action Alternative.

5.1.7.2.1.3 Nondefense Mission

Under the Expanded Operations Alternative, DOE/NNSA Nondefense Mission activities would disturb up to 517 acres of previously undisturbed land; about 467 acres for the rebuild of the 138-kilovolt electric transmission line on the NNSS and about 50 acres for a proposed 5-megawatt photovoltaic electrical generation facility in Area 6. One or more potential commercial solar power generation facilities and a potential Geothermal Demonstration Project considered under this alternative are discussed below under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. DOE/NNSA would continue to conduct small projects to maintain and repair NNSS facilities in previously disturbed areas that are not anticipated to directly affect vegetation. A proposed rebuild of the existing 138-kilovolt transmission line between Mercury Substation in the south and Valley Substation in the northern part of the NNSS would disturb an estimated 467 acres of vegetation. Most of that disturbance would be from crushing vegetation due to vehicular access, with only a small area around the base of each transmission line structure, and some new access roads resulting in the only areas that would be cleared of vegetation. Being a linear project, it would affect a large number of different vegetation alliances and associations, but would only affect an important habitat in Frenchman Flat, where it would cross sensitive creosote bush/white bursage shrubland. Applications of water sprays and other measures during construction would reduce wind erosion in this sensitive habitat.

Conservation and Renewable Energy Program. Measures taken to increase energy efficiency, fuel efficiency, and water conservation would occur at existing facilities and are not anticipated to directly affect biological resources.

DOE/NNSA proposes to construct, operate, and maintain a 5-megawatt photovoltaic solar power generation facility in Area 6, on Yucca Flat. The proposed facility would result in permanent disturbance to about 50 acres of saltbrush shrubland and would not affect any important habitats on the NNSS. There are about 25,900 acres of saltbrush shrubland on the NNSS (DOE/NV 2000d), of which the proposed photovoltaic solar power generation facility would impact about 0.2 percent.

Under the Expanded Operations Alternative, DOE/NNSA would host a Geothermal Demonstration Project. The potential location for such a facility is unknown, but would likely be located in one of the areas identified as having potential hot dry rocks in Areas 10, 12, 15, 18 or 25 (see Figure A–2 in Appendix A). Up to about 50 acres of vegetation would be disturbed for development of a Geothermal Demonstration Project, but it is not possible at this time to determine the specific impacts.

Under the Expanded Operations Alternative, DOE/NNSA would allow construction of one or more commercial solar power generation facilities with up to 1,000 megawatts of generating capacity. Development of these facilities and associated electrical transmission lines to interconnect with the main transmission grid would permanently disturb about 10,000 acres and 300 acres, respectively, of creosote bush/white bursage habitat in Area 25 and other vegetation alliances in nearby offsite areas. Much of the area of potential disturbance, primarily north and west of Lathrop Wells Road, is considered to be sensitive habitat due to susceptibility of the soils to wind erosion. However, because the entire facility would be graded and stabilized to minimize soil erosion and would be maintained in an unvegetated condition, there would be no additional impact associated with disturbance of this sensitive habitat. Disturbance of up to 10,000 acres on the NNSS (300 acres of disturbance would be off of the NNSS for transmission line construction) for commercial solar power generation facilities would affect about 1.3 percent of undisturbed land and about 6.6 percent of creosote bush/white bursage shrubland on the NNSS. The amount of vegetation and soil that would be disturbed is not expected to reduce the viability of creosote bush/white bursage vegetation in the region or have a substantial negative impact on biodiversity in this area.

Other Research and Development Programs. The Nevada National Environmental Research Park in Area 5 contains two existing facilities used to support outside scientific research on long-term environmental health. Future research programs could include activities such as habitat reclamation and remediation, which could potentially cause impacts on vegetation and soils due to ground disturbance and increased access to previously undisturbed land. No specific activities are proposed at this time.

5.1.7.2.2 Impacts on Wildlife

Under the Expanded Operations Alternative, most impacts on wildlife from DOE/NNSA activities would be sporadic and short term. Many of those disturbances would occur in areas adjacent to previously disturbed areas that may possess marginal value as wildlife habitat, such as off-road vehicular traffic associated with Office of Secure Transportation training and exercises, which would occur within about 100 feet of the edge of an existing road. During periods of any human activity in an area, larger and more mobile species of wildlife would leave the area during the period of disturbance, but smaller and less mobile species may be subject to direct injury and mortality. In addition to these direct effects, loss of large blocks of habitat, such as for commercial solar power generation facilities or the Office of Secure Transportation training area, could adversely impact wildlife populations through loss and fragmentation of cover, breeding, traveling, and foraging habitat. In addition, predation could increase because construction and other disturbances may attract predators, such as ravens and coyotes, as wildlife is displaced from protective cover to uncovered habitat.

Noise associated with DOE/NNSA activities would impact wildlife in various ways, depending on the nature and location of the noise source and the particular species of wildlife. Where noises from human activities are fairly constant, such as at the Area 5 RWMC, animals become accustomed and use the habitat around the noise source in accordance with their individual comfort levels. For some species, such a coyotes, human occupation of an area may be an opportunity for foraging on trash. Other species are less adaptable to human presence. Sudden loud noises such as explosives detonations could startle wildlife, resulting in impacts on certain species. If sudden loud noises were to occur near vital water sources, they could cause large and mobile species of wildlife to avoid them until the disturbance subsides, which could affect animal species that depend on those water sources. Most DOE/NNSA activities that would create sudden loud noises or other large disturbances that would cause wildlife to flee an area are sporadic and of such short duration that it is doubtful that they would cause significant interference with wildlife activities, including foraging and visiting drinking water sources. Nesting birds may flush from their nests in response to a sudden loud noise; however, based on experience at Cape Canaveral, nesting birds respond to Space Shuttle launch noise by flying away from the nests and then returning within a few minutes (FAA 2002).

In addition to these general impacts on wildlife, under the Expanded Operations Alternative, DOE/NNSA would conduct some activities under the Stockpile Stewardship and Management Program that could have additional impacts. Most Stockpile Stewardship and Management Program activities would continue to occur at existing facilities. At locations other than BEEF within the Nuclear and High Explosives Test Zone on the NNSS, the amount of explosives that may be used in experiments would be increased to 120,000 pounds of TNT-equivalent explosives. In addition, up to three 40-acre areas would be established in Areas 2, 4, 12, and 16 for conducting explosives experiments involving depleted uranium. Use of larger amounts of explosives at locations other than BEEF would result in a greater amount of noise and increase the area in which wildlife would be startled.

Use of depleted uranium in experiments with explosives would deposit depleted uranium particles in the soil in a localized area. Because depleted uranium is a low-activity, alpha-emitting radioactive material, it would have to be internalized by wildlife to induce radiologic effects (USAF 2006d). Because of its high density, the air transport of depleted uranium is generally limited to relatively small particles, and most of the depleted uranium dust would be deposited within a distance of 100 meters from the source (EPA 1999). In general, depleted uranium deposited by airborne transport would be present on or near the soil surface, but would show minimal uptake by plant roots. Depleted uranium is not effectively transported through the food chain because low-level organisms tend to excrete soluble uranium species quickly (Littleton 2006). For this reason, the main pathways for incorporation into an organism would be inhalation and dermal absorption. Dermal contact is considered a relatively unimportant type of exposure because little of the depleted uranium would pass across the skin into the blood. However, depleted uranium could enter systemic circulation through open wounds or from embedded fragments (WHO 2001). Inhalation is the most likely pathway for depleted uranium to be internalized in wildlife. In humans, inhaled depleted uranium particles that reside in the lungs for long periods may damage lung cells and increase the possibility of lung cancer after many years (Littleton 2006). Smaller species of mammals and reptiles and animals that live in burrows would be most susceptible to inhaling depleted uranium particles. However, development of most cancers, including lung cancer, requires a number of years, and the majority of smaller/burrowing species do not live long enough for such cancers to develop. For instance, the life span of burrowing owls is less than 10 years.

5.1.7.2.3 Impacts on Sensitive and Protected Species

Based on previous studies, data are available to delineate desert tortoise habitat on the NNSS (Rautenstrauch et al. 1994) (see Chapter 4, Figure 4–24) and to make quantitative estimates of potential impacts on desert tortoises (DOE/NV 1998b) at the alternative, mission, and program levels for proposed activities at the NNSS. Similar detailed data are not available for other sensitive and protected species that inhabit the NNSS. For those species, the impact assessment is qualitative and only at the alternative level.

Table 5–31 displays the potential impacts on the desert tortoise under the Expanded Operations Alternative. Overall, implementation of the Expanded Operations Alternative, including all DOE/NNSA activities and one or more commercial solar power generation facilities with a 1,000-megawatt combined capacity, would result in disturbance of up to 13,760 acres of desert tortoise habitat (about 4.3 percent of remaining tortoise habitat on the NNSS) and potentially affect 163 to 346 tortoises (this estimate includes up to 125 tortoises taken by harassment on NNSS roads). DOE/NNSA activities would disturb a total of 3,370 acres of desert tortoise habitat (about 1 percent of the remaining tortoise habitat on the NNSS) and result in a potential take ranging from 38 to 60 tortoises due to DOE/NNSA project-related activities, as well as up to 125 on NNSS roads, for a total of 163 to 185, all by harassment. As noted under the No Action Alternative, based on DOE/NNSA operating experience at the NNSS since 1992, all takes resulting from DOE/NNSA project activities would be by harassment, with no more than one desert tortoise per year expected to be taken by injury or mortality due to non-project/activity-related vehicle collisions. Although the area of tortoise habitat that would be affected exceeds the threshold (2,710 acres) of the *2009 Biological Opinion* (USFWS 2009a), the number of tortoises taken would not exceed the overall allowable takes (194 tortoises). Potential impacts on the desert tortoise from development of one or more commercial solar power generation facilities under the Expanded Operations Alternative are addressed below under the Conservation and Renewable Energy Program.

Under the Expanded Operations Alternative, DOE/NNSA would continue to implement protective measures for sensitive species of plants and animals, as described under the No Action Alternative. Although the level of activities would be greater than under the No Action Alternative, the protective measures would greatly reduce the potential for adversely impacting any sensitive species, such as the burrowing owl, other migratory bird species, or bats. Because there would be a greater amount of habitat disturbance in NNSS valleys under the Expanded Operations Alternative, sensitive plant species that inhabit the valley floors, such as *Camissonia megalantha*, *Cymopterus ripleyi* var. *saniculoides* would be subject to more impact if avoidance is not possible.

In the following program-level analyses under the Expanded Operations Alternative, take values that exceed the threshold limits of the *2009 Biological Opinion* are noted. If the level of incidental take is reached or anticipated to be exceeded during the course of actions, such an incidental take would represent new information requiring reinitiation of consultation with USFWS and review of the reasonable and prudent measures in the *2009 Biological Opinion*.

5.1.7.2.3.1 National Security/Defense Mission

Under the Expanded Operations Alternative, National Security/Defense Mission activities could result in disturbance of up to 1,930 acres of desert tortoise habitat and the potential take of from 30 to 136 tortoises due to projects and activities, all by harassment. This take would exceed the threshold values (1,000 acres and 20 tortoises) given in the *2009 Biological Opinion* (USFWS 2009a) for the National Security/Defense Mission.

Stockpile Stewardship and Management Program. Most Stockpile Stewardship and Management Program activities would occur in the Yucca Flat and Frenchman Flat areas of the NNSS and incur about 1,280 acres of potential land disturbance within desert tortoise habitat in these areas. The estimated number of tortoises taken by harassment would range from 20 to 90. The acres of potential disturbance and the consequent potential take of desert tortoises would exceed the allowable take (500 acres and 10 tortoises) in the *2009 Biological Opinion* (USFWS 2009a).

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Under the Expanded Operations Alternative, releases of chemicals and biological simulants that would occur outside of existing developed areas would temporarily disturb up to 15 acres of land during the next 10 years and construction of an Arms Control Verification Test Bed and a mock urban complex would permanently disturb up to 200 acres of land. The *2009 Biological Opinion* (USFWS 2009a) does not include a designation for this program area; however, the land-disturbing activities of this program are closely associated with the Work for Others Program and are included in the discussion of that program below.

Table 5–31 Potential Impacts on Desert Tortoises Under the Expanded Operations Alternative

Mission/Program	*Primary Locations of Activities*	*Area of Desert Tortoise Habitat Disturbance (acres) <allowable take>*	*Maximum Desert Tortoise Abundance (number per square mile)* [a]	*Number of Desert Tortoises Affected* [b] *<allowable take>*
Stockpile Stewardship and Management	Yucca Flat and Frenchman Flat	1,280 [c] <500>	Low (10–45)	20 to 90 <10>
Nuclear Emergency Response, Nonproliferation, and Counterterrorism	Frenchman Flat, Yucca Flat, and Mercury Valley	215	Low (10–45)	3 to 15
Work for Others	Yucca Flat, Frenchman Flat, Mercury Valley, and Fortymile Canyon	435 <500>	Low (10–45)	7 to 31 <10>
National Security/Defense Mission Total		1,930 <1,000)		30 to 136 <20>
Waste Management	Frenchman Flat, Mercury Valley, and Jackass Flats	635 <100>	Very Low (0–10)	0 to 10 <2>
Environmental Restoration – Soils Project	Frenchman Flat, and Nevada Test and Training Range	320 [d]	Very Low (0–10)	0 to 5 <2>
Environmental Restoration – Underground Test Area Project	Yucca Flat and Frenchman Flat	250 [e]	Low (10–45)	4 to 18 [e]
Environmental Management Mission Total		1,205 <110>		4 to 33<4>
General Site Support and Infrastructure	Frenchman Flat Mercury Valley Yucca Flat	235 <100>	Low (10–45)	4 to 17 <10>
Renewable Energy (DOE/NNSA)		None <1,500>	Low (10–45)	N/A <35>
Nondefense Mission Total		235 <1,600>		4 to 17 <45>
Nonprogrammatic Takes on NNSS Roads	NNSS	None <None>		125 <125>
Total DOE/NNSA		3,370 <2,710>		163 to 185 <194>
Commercial Solar Power Generation Facilities	Jackass Flats	10,300 [f]	Very Low (0–10)	0 to 161
Total		13,670		163 to 346

NNSS = Nevada National Security Site.

[a] Desert tortoise abundance class from DOE/NV 1998b.

[b] Acres of Disturbance/640 × Maximum Desert Tortoise Abundance

[c] The Office of Secure Transportation training facility, dynamic experiments in boreholes, drillback operations, and one-half of high-explosives experiments and Office of Secure Transportation training proposed under the Expanded Operations Alternative would be located outside of the range of the desert tortoise and are not included in this table.

[d] A total of 420 acres would be disturbed at Soils Project sites on the NNSS and Nevada Test and Training Range, but only the Small Boy site (320 acres) in the Frenchman Flat area would be within desert tortoise habitat.

[e] A total of 10 acres of tortoise habitat disturbance and 2 takes by harassment are allowable for all Environmental Restoration Program activities at the NNSS under the *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada*.

[f] One or more commercial solar power generation facilities with a combined capacity of 1,000 megawatts would require 10,000 acres; about 300 acres would be used for transmission line right-of-way to connect the facility to the main transmission grid.

Work for Others Program. Most Work for Others Program activities would occur in the Yucca Flat, Frenchman Flat, Mercury Valley, and Fortymile Canyon areas of the NNSS and would potentially affect desert tortoises. Proposed construction of new test beds and other facilities to support the Work for Others Program would disturb up to 435 acres of land. When the 215 acres of tortoise habitat disturbance under the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs are included, this total disturbance would be 650 acres. Assuming that all of this disturbance would occur within desert tortoise habitat, the number of affected tortoises would range from 10 to 46. This level of take could exceed the allowable take (10 tortoises) in the *2009 Biological Opinion* (USFWS 2009a), and the area of potential land disturbance would exceed the 500 acres allowed.

5.1.7.2.3.2 Environmental Management Mission

Under the Expanded Operations Alternative, DOE/NNSA Environmental Management Program activities would disturb a total of 1,205 acres of land within desert tortoise habitat (about 0.38 percent of remaining undisturbed habitat). In addition to remediation of the Small Boy site and UGTA characterization and monitoring well development, the area of desert tortoise habitat disturbance under the Expanded Operations Alternative includes 635 acres associated with waste disposal operations at the Area 5 RWMC. The potential take of desert tortoises would range from 4 to 33, all by harassment. This would exceed the allowable tortoise habitat disturbance (110 acres) and could exceed the allowable take (4) in the *2009 Biological Opinion* (USFWS 2009a).

Waste Management Program. Construction of new LLW/MLLW cells at the Area 5 RWMC in Frenchman Flat and new sanitary landfills in Areas 23 and 25 would disturb 635 acres and potentially affect up to 10 desert tortoises, all by harassment. The acres of potential disturbance and the number of potentially affected desert tortoises would exceed the allowable take (100 acres and two tortoises) in the *2009 Biological Opinion* (USFWS 2009a).

Environmental Restoration Program. The only Soils Project site located within the range of the desert tortoise is the Small Boy site (320 acres). Although some groundwater characterization and monitoring wells may be developed within desert tortoise habitat, most would be sited outside of such habitat in the northwestern NNSS and adjacent Nevada Test and Training Range. However, for purposes of this analysis, it was assumed that one-half of such well development (250 acres of land disturbance) would occur in desert tortoise habitat. The 570 acres of new land disturbance would potentially impact from 4 to 23 desert tortoises, all by harassment. The acres of potential disturbance and the number of potentially affected desert tortoises would exceed the terms and conditions of the *2009 Biological Opinion* (USFWS 2009a) (i.e., 10 acres and two tortoises).

5.1.7.2.3.3 Nondefense Mission

Under the Expanded Operations Alternative, DOE/NNSA Nondefense Mission activities would disturb about 235 acres of land in desert tortoise habitat. A proposed rebuild of the existing 138-kilovolt transmission line is the only proposed activity under the Nondefense Mission that would potentially cause a take of desert tortoises and is addressed under the General Site Support and Infrastructure Program, discussion below. One or more potential commercial solar power generation facilities considered under this alternative are discussed below under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. In addition to ongoing maintenance, repair, and replacement activities to support NNSS facilities, the DOE/NNSA NSO would construct and modify facilities as needed to support NNSS programs. Under the Expanded Operations Alternative, DOE/NNSA proposes to rebuild the main 138-kilovolt electrical transmission system between Mercury Switchyard in Area 23 and Valley Substation in Area 2. This rebuild is the only proposed infrastructure project that would potentially affect desert tortoises. It would disturb up to 235 acres of desert tortoise habitat located generally adjacent to the existing transmission line. The proposed transmission line rebuild would affect from 4 to 17 tortoises, by harassment. These potential impacts exceed the allowable acres of tortoise habitat disturbance (100 acres) and could exceed the allowable take for this program (10 tortoises) in the *2009 Biological Opinion* (USFWS 2009a).

Conservation and Renewable Energy Program. The DOE/NNSA NSO would continue current energy efficiency and water conservation measures, fleet management improvements, and sustainable building practices. Because these activities would occur at existing facilities, they are not expected to affect the desert tortoise.

In addition, under the Expanded Operations Alternative, DOE/NNSA would allow construction of one or more commercial solar power generation facilities with a combined capacity of up to 1,000 megawatts within the Renewable Energy Zone in Area 25. It was estimated that the potential permanent land disturbance associated with such a project would be 10,000 acres. To interconnect commercial solar power generation facilities to the electrical grid, construction of new transmission lines would be required. Assuming that up to 10 miles of new transmission line with a right-of-way 250 feet wide would be needed for one or more solar power generation facilities on the NNSS, an additional approximately 300 acres of land would be disturbed. Most of the transmission line impacts would occur off the NNSS on BLM and private land. The commercial solar power generation facilities and new transmission line would be located within the range of the desert tortoise and would disturb 10,300 acres of habitat. The number of desert tortoises potentially affected by this project would range from none to 161. While most of these affected desert tortoises would be taken by harassment, the permanent loss of 10,000 acres of tortoise habitat for solar power generation facilities could slightly diminish the capacity of the surrounding area to support tortoises and the overall population in the region could slightly decrease; however, as noted under the No Action Alternative, the soils in much of the potential siting area for commercial solar power generation facilities tend to be too sandy to provide suitable tortoise burrow sites, and there are very few, if any, tortoises actually inhabiting the area. The commercial solar power generation facilities are not covered by the *2009 Biological Opinion* and would require consultation among the project proponents, DOE/NNSA, USFWS, and BLM, as well as development of a project-specific Biological Opinion.

Other Research and Development Programs. The Nevada National Environmental Research Park in Area 5 contains two existing facilities used to support outside scientific research on long-term environmental health. Future research programs could include activities such as habitat reclamation and remediation, which could potentially cause disturbance in desert tortoise habitat; however, there are no proposed projects at this time and impacts on desert tortoises cannot be estimated. Any such projects proposed in the future would be subject to the then current Biological Opinion and the DOE/NNSA NSO Desert Tortoise Compliance Program.

5.1.7.2.4 Impacts on Offsite Biota

Under the Expanded Operations Alternative, activities at the NNSS would increase relative to the No Action Alternative and some new activities would be conducted as well. As noted in Section 5.1.7.1.4, in the southern Nevada area in the vicinity of the NNSS, there are a number of sensitive locations for plants and animals. Under the Expanded Operations Alternative, the potential for DOE/NNSA activities at the NNSS to impact plants and animals in areas outside of the NNSS is greater than under the No Action Alternative but still negligible. The primary paths for activities at the NNSS to cause impacts at these offsite areas are through surface-water runoff, groundwater withdrawals and/or contamination, migration of wildlife, and air emissions.

As noted in Section 5.1.6.1, there is no greater than a negligible potential for existing onsite contamination to be transported off site via surface water, or through flood events, to affect offsite areas. This would make it unlikely that DOE/NNSA activities at the NNSS would affect plants or animals in these areas through the surface-water runoff pathway.

As discussed in Section 5.1.6.2, past underground nuclear testing introduced a substantial amount of radioactive contamination into the underground environment. A portion of that contamination is available to be transported by groundwater (i.e., the hydrologic source term). If radioactive contaminants from underground nuclear testing were to reach any of the noted offsite sensitive areas via the groundwater, it could result in a significant impact on plants and animals in that area, particularly the endangered Devils Hole pupfish. As described in Chapter 4, Section 4.1.6.2, DOE/NNSA established the UGTA Project that, working with NDEP under the FFACO, is characterizing and monitoring groundwater in areas surrounding the primary underground nuclear testing areas on the NNSS, including offsite areas, as appropriate. Based on the most current studies and state-of-the-art modeling, it is unlikely that levels of radioactive contamination from the NNSS would exceed the standards established in the FFACO in areas outside of the NNSS and Nevada Test and Training Range over the next 1,000 years (see Chapter 6, Section 6.3.6.2). Therefore, it is unlikely that radioactive contamination in the groundwater would impact any of the sensitive offsite areas or seeps, springs, or other sources of water important to wildlife and vegetation over the next 1,000 years.

Groundwater withdrawals are of particular concern as they relate to the maintenance of the water level at Devils Hole, which is critical to the continued survival of the Devils Hole pupfish (NPS 2010h). Under the Expanded Operations Alternative, groundwater withdrawals at the NNSS required to support DOE/NNSA activities would not likely result in excessive drawdown of the affected aquifers, and DOE/NNSA would continue to monitor groundwater levels and adjust points of diversion, as necessary, to protect the integrity of the aquifers (see Section 5.1.6.2.1). Therefore, there would not likely be any effect on water levels at Devils Hole. If one or more commercial solar power generation facilities were to be proposed in Area 25 of the NNSS, project-specific NEPA reviews would be required and the project proponents would be required to obtain groundwater appropriations from the Nevada State Engineer for any withdrawals required for construction and operation of the facilities. As noted in Chapter 6, Section 6.3.6.2, to protect the Devils Hole pupfish, Nevada State Engineer Order 1197 states in part, "…any applications to appropriate additional underground water and any application to change the point of diversion of an existing ground-water right to a point of diversion closer to Devils Hole, described as being within a 25-mile radius from Devils Hole within the Amargosa Desert Hydrographic Basin, will be denied." For any project needing a stable water supply within the area subject to Nevada State Engineer Order 1197, the developer would need to either lease or purchase water currently being pumped under an existing certified water right. As the water user can only pump up to the authorized duty of the water right, there would be no net increase in groundwater pumping within the basin. Continued implementation of Nevada State Engineer Order 1197 will help to preclude impacts on Devils Hole and the Devils Hole pupfish due to groundwater withdrawals.

Under the Expanded Operations Alternative, all emissions to the air would be within all applicable standards and would not result in adverse impacts on plants or animals at any of the sensitive offsite locations of concern.

5.1.7.3 Reduced Operations Alternative

5.1.7.3.1 Impacts on Vegetation

DOE/NNSA-proposed activities at the NNSS would affect native vegetation directly by clearing areas or by crushing or breaking due to vehicular or pedestrian traffic. Table 5–30 displays estimated areas of land disturbance by alternative, mission, and program for DOE/NNSA activities and commercial and demonstration projects at the NNSS. DOE/NNSA activities under the Reduced Operations Alternative would disturb a small portion of undisturbed habitat on the NNSS. However, some of the areas where activities could occur may be considered important habitats. The impacts of habitat disturbance on wildlife under the Reduced Operations Alternative are addressed in Section 5.1.7.3.2; impacts on sensitive and protected/regulated species are discussed in Section 5.1.7.3.3.

Overall, under the Reduced Operations Alternative, about 2,740 acres (about 0.35 percent) of undisturbed habitat on the NNSS would be affected. Almost one-half of the land disturbances under the Reduced Operations Alternative would be due to potential development of a commercial solar power generation facility (1,200 acres) in Area 25 and are addressed under the Conservation and Renewable Energy Program. For DOE/NNSA activities, a total of 1,540 acres of land would be disturbed, mostly generally along Mercury Highway in Yucca Flat and Frenchman Flat, although some activities, such as releases of chemicals and biological simulants and Office of Secure Transportation training and exercises, may occur in almost any area of the NNSS.

Under the Reduced Operations Alternative, almost all activities with the potential to disturb vegetation would be short-term and would occur in small increments across a broad geographical area. The primary vegetation alliances that would be affected are creosote bush/white bursage shrubland, Nevada jointfir shrubland, saltbush shrubland, and burrobush/wolfberry shrubland. These vegetation alliances are among the most prevalent on the NNSS, covering a total of about 302,150 acres (Ostler et al. 2000). Because of the prevalence of the affected vegetation types on the NNSS, as well as regionally, and the geographical distribution of impacts, this level of habitat disturbance would not reduce the viability of any of the potentially affected vegetation alliances or have substantial negative impacts on biodiversity. However, some areas of creosote bush/white bursage vegetation alliance in Frenchman Flat and Jackass Flats are considered sensitive habitat because the soils are particularly vulnerable to erosion if disturbed and they require long periods to recover. DOE/NNSA would avoid siting new facilities or activities in this sensitive habitat to the extent reasonably possible. There are permanent impacts on vegetation when there is no evidence to indicate that predisturbance levels of biomass, cover, density, soils, and plant community structure could be achieved within approximately 5 years. Based on this, all vegetation disturbances under the Reduced Operations Alternative would be considered permanent because reclamation is not required for all land disturbances; therefore, reclamation was not assumed for any land disturbances. Disturbance of unique habitats, such as wetlands and springs, would be avoided for all activities.

Disturbance of native vegetation either by direct removal or by mechanical damage from off-road vehicular or pedestrian traffic could promote the proliferation of nonnative invasive weeds, such as Russian thistle. This species is currently not listed on the Nevada noxious weed list, but is considered aggressive and opportunistic and often portrays weed-like trends. Other weed species that could invade the disturbed areas over the long term include puncture vine (*Tribulus terrestris*), perennial pepperweed (*Lepidium latifolium*), gumweed (*Grindelia* spp.), yellow star thistle (*Centaurea solstitialis*), and Russian knapweed (*Acroptilon repens*). Other indirect impacts on vegetation include soil compaction, spread of weeds already present in the disturbance footprint to areas not currently infested, and accidental introduction of new weed species from contaminated equipment brought in from other regions.

5.1.7.3.1.1 National Security/Defense Mission

Disturbances to up to 430 acres of habitat resulting from National Security/Defense Mission activities under the Reduced Operations Alternative would include removal of vegetation to clear areas or crushing plants by vehicular and pedestrian traffic. Crushed plants may recover if they are not too severely damaged and the cause of crushing does not damage their roots. Where vegetation must be removed to accomplish the activity, even though the activity would last only a relatively short period, recovery of the site would likely take many years. In addition, removal or weakening of native vegetation would increase the opportunity for invasive and weedy species to invade the disturbed areas, which could prolong or even preclude the ability of native vegetation to recolonize the area. As previously mentioned, National Security/Defense Mission activities that occur in Frenchman Flat could impact sensitive habitat, but those habitat areas would be avoided if reasonably possible.

Stockpile Stewardship and Management Program. Activities that would occur outside of existing facilities would likely affect vegetation directly due to disturbance of up to about 415 acres of land. In many cases, vegetation would not need to be removed but would be damaged by vehicular traffic and the setting up of equipment associated with the activities.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Under the Reduced Operations Alternative, the only new land disturbance expected to occur in this program area would be associated with releases of chemicals and biological simulants, which would temporarily disturb up to 15 acres of previously undisturbed land at the NNSS.

Arms control and counterterrorism activities would include training exercises in large, remote areas that involve the use of explosives and live fire. Areas where these exercises would be conducted would be accessible to pedestrians and on- and off-road vehicles; however, areas used for these activities have been used for similar activities for many years and no additional land areas would be affected. These activities are expected to disturb native vegetation, but are not expected to reduce the viability of any plant species. However, by changing the land use zone designations of Areas 18, 19, 20, 29, and 30 to Limited Use and precluding most activities in these areas, potential impacts in those areas would be reduced relative to the No Action Alternative.

Work for Others Program. Under the Reduced Operations Alternative, DOE/NNSA would continue to host the projects of other Federal, state, and local government agencies and nongovernmental organizations and activities, and impacts would be similar to those under the No Action Alternative. However, by changing the land use zone designations of Areas 18, 19, 20, 29, and 30 to Limited Use and precluding most activities in these areas, potential impacts from Work for Others Program activities in those areas would be reduced relative to the No Action Alternative.

5.1.7.3.1.2 Environmental Management Mission

As under the No Action Alternative, approximately 1,110 acres of land would be disturbed by Environmental Management Program activities under the Reduced Operations Alternative. A significant portion of the areas that would be disturbed under the Environmental Restoration Program is located on the Nevada Test and Training Range.

Waste Management Program. Under the Reduced Operations Alternative, impacts on vegetation resulting from the Waste Management Program would be the same as those under the No Action Alternative.

Environmental Restoration Program. Under the Reduced Operations Alternative, the DOE/NNSA Environmental Restoration Program would continue in compliance with the most recent version of the FFACO to characterize, monitor, and remediate, as necessary, identified contaminated areas, facilities, soils, and groundwater. Impacts on vegetation resulting from Environmental Restoration Program activities would be the same as those under the No Action Alternative.

5.1.7.3.1.3 Nondefense Mission

Under the Reduced Operations Alternative, DOE/NNSA Nondefense Mission activities would not disturb previously undisturbed land. Therefore, there would be no new or additional impacts on biological resources. A potential commercial solar power generation facility considered under this alternative is discussed below under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. Under the No Action Alternative, small projects to maintain and repair NNSS facilities would occur at existing facilities in previously disturbed areas and are not anticipated to directly affect biological resources.

Conservation and Renewable Energy Program. Measures taken to increase energy efficiency, fuel efficiency, and water conservation would occur at existing facilities and are not anticipated to directly affect biological resources.

In addition, under the Reduced Operations Alternative, DOE/NNSA would allow construction of a commercial 100-megawatt solar power generation facility that would permanently disturb about 1,200 acres of creosote bush/white bursage habitat in Area 25. Much of the area of potential disturbance, primarily north and west of Lathrop Wells Road, is considered sensitive habitat. The entire facility would be graded and stabilized to minimize soil erosion and would be maintained in an unvegetated condition. Additionally, access roads and utilities would be constructed to support the facilities. There are approximately 150,800 acres of creosote bush/white bursage habitat on the NNSS. Disturbance of up to 1,200 acres for the commercial solar power generation facility would affect about 1.0 percent of the habitat type on the NNSS and only about 0.2 percent of overall undisturbed land. The amount of vegetation and soil that would be disturbed is not expected to reduce the viability of creosote bush/white bursage vegetation in the region or have a substantial negative impact on biodiversity in this area. Approximately 700 acres of the area that would be disturbed by construction of a 100-megawatt commercial solar power generation facility would likely be within an area considered sensitive habitat because it contains vegetation associations that recover very slowly from direct disturbance and is susceptible to wind erosion. However, the area would be graded and stabilized to minimize soil erosion and would be maintained in an unvegetated condition; thus, there would be no additional impact associated with disturbance of this sensitive habitat.

Other Research and Development Programs. The Nevada National Environmental Research Park in Area 5 contains two existing facilities used to support outside scientific research on long-term environmental health. Future research programs could include activities such as habitat reclamation and remediation, which could potentially cause impacts on vegetation and soils due to ground disturbance and increased access to previously undisturbed land. No such activities are being proposed at this time.

5.1.7.3.2 Impacts on Wildlife

Under the Reduced Operations Alternative, most impacts on wildlife from DOE/NNSA activities would be the result of short-term experiments and exercises. Many of those short-term disturbances would occur in areas adjacent to previously disturbed areas that may possess marginal value as wildlife habitat, such as off-road vehicular traffic associated with Office of Secure Transportation training and exercises, which would occur within about 100 feet of the edge of an existing road. During periods of any human activity in an area, larger and more mobile species of wildlife would leave the area during the period of disturbance, but smaller and less mobile species may be subject to direct injury and mortality. In addition to these direct effects, disturbance of vegetation, particularly in large blocks, could adversely impact wildlife populations through loss and fragmentation of cover, breeding, traveling, and foraging habitat. In addition, predation could increase because construction and other disturbances may attract predators, such as ravens and coyotes, as wildlife is displaced from protective cover to uncovered habitat.

Noise associated with DOE/NNSA activities would impact wildlife in various ways, depending on the nature and location of the noise source and the particular species of wildlife. Where noises from human activities are fairly constant, such as at the Area 5 RWMC, some animals become accustomed and use the habitat around the noise source in accordance with their individual comfort levels. For some species, such a coyotes, human occupation of an area may be an opportunity for foraging. Other species are less adaptable to human presence. Sudden loud noises such as explosives detonations could startle wildlife, resulting in impacts on certain species. If sudden loud noises were to occur near vital water sources, they could cause large and mobile species of wildlife to avoid them until the disturbance subsides, which could affect animal species that depend on those water sources. Most DOE/NNSA activities that would create sudden loud noises or other large disturbances that would cause wildlife to flee an area are sporadic and of such short duration that it is doubtful that they would cause significant interference with wildlife activities, including foraging and visiting drinking water sources. Nesting birds may flush from their nests in response to a sudden loud noise; however, based on experience at Cape Canaveral, nesting birds respond to Space Shuttle launch noise by flying away from the nests and then returning within a few minutes (FAA 2002).

5.1.7.3.3 Impacts on Sensitive and Protected Species

Under the Reduced Operations Alternative, DOE/NNSA would continue to implement protective measures for sensitive species of plants and animals, as described under the No Action Alternative. Impacts on these species would be somewhat less than described under the No Action Alternative due to the reduced level of activities that would occur at the NNSS. Because there would be habitat disturbance in NNSS valleys under the Reduced Operations Alternative, sensitive plant species that inhabit the valley floors, such as *Camissonia megalantha* and *Cymopterus ripleyi* var. *saniculoides*, would be subject to less impact than under the No Action Alternative. Nevertheless, DOE/NNSA would continue to avoid impacts on sensitive species resulting from its activities to the greatest reasonable extent.

Based on previous studies, data are available to delineate desert tortoise habitat on the NNSS (Rautenstrauch et al. 1994) (see Chapter 4, Figure 4–24) and to make quantitative estimates of potential impacts on desert tortoises (DOE/NV 1998b) at the alternative, mission, and program levels for proposed activities at the NNSS. Similar detailed data are not available for other sensitive and protected species that inhabit the NNSS. For those species, the impact assessment is qualitative and only at the alternative level.

Table 5–32 displays the potential impacts on the desert tortoise under the Reduced Operations Alternative. Overall, implementation of the Reduced Operations Alternative, including all DOE/NNSA activities and a commercial 100-megawatt commercial solar power generation facility, would result in disturbance of up to 2,120 acres of desert tortoise habitat (about 0.7 percent of remaining tortoise habitat on the NNSS) and potentially affect 131 to 181 tortoises (this estimate includes up to 125 tortoises taken by harassment on NNSS roads). DOE/NNSA activities would disturb a total of about 920 acres of desert tortoise habitat (representing about 0.3 percent of the 321,050 acres of remaining tortoise habitat on the NNSS) and would result in a take ranging from 6 to 37 tortoises, as well as up to 125 on NNSS roads for a total of 131 to 162 tortoises, all by harassment. Neither the area of tortoise habitat that would be impacted nor the number of tortoises taken would exceed the overall threshold limits (2,710 acres and 194 tortoises) in the *2009 Biological Opinion* (USFWS 2009a). Although all of the tortoises taken by project-related activities would be by harassment, based on DOE/NNSA experience between 1992 and 2010, fewer than one tortoise per year would be taken by injury or mortality due to non-project-related collisions by vehicles on NNSS roadways. Potential impacts on the desert tortoise from development of a commercial solar power generation facility under the Reduced Operations Alternative are addressed below under the Conservation and Renewable Energy Program.

In the following program-level analyses under the Reduced Operations Alternative, take values that exceed the threshold limits of the *2009 Biological Opinion* are noted. If the level of incidental take is reached or anticipated to be exceeded during the course of actions, such an incidental take would represent new information requiring reinitiation of consultation with USFWS and review of the reasonable and prudent measures in the *2009 Biological Opinion* (USFWS 2009a).

5.1.7.3.3.1 National Security/Defense Mission

Land disturbance of up to 160 acres for National Security/Defense Mission activities in desert tortoise habitat could result in the potential take of from 2 to 11 tortoises, all by harassment. This take would be within the threshold values (1,000 acres and 20 tortoises) in the *2009 Biological Opinion* (USFWS 2009a) for the National Security/Defense Mission.

Stockpile Stewardship and Management Program. Most Stockpile Stewardship and Management Program activities would occur in the Yucca Flat and Frenchman Flat areas of the NNSS and into about 145 acres of potential land disturbance within desert tortoise habitat in these areas. The estimated number of tortoises taken by harassment would range from 2 to 10. The acres of potential disturbance and incidental take would meet the threshold values for this program in the *2009 Biological Opinion* (500 acres and 10 tortoises) (USFWS 2009a).

Table 5–32 Potential Impacts on Desert Tortoises Under the Reduced Operations Alternative

Mission/Program	***Primary Locations of Activities***	***Area of Desert Tortoise Habitat Disturbance (acres) <allowable take>***	***Maximum Desert Tortoise Abundance (number per square mile)*** [a]	***Number of Desert Tortoises Affected*** [b] ***<allowable take>***
Stockpile Stewardship and Management Program	Yucca Flat and Frenchman Flat	145 [c] <500>	Low (10–45)	2 to 10 <10>
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs	Frenchman Flat, Yucca Flat, and Mercury Valley	15	Low (10–45)	0 to 1
Work for Others Program	Yucca Flat, Frenchman Flat, Mercury Valley, and Fortymile Canyon	None <500>	N/A	N/A <10>
National Security/Defense Mission Total		160 <1,000>		2 to 11 <20>
Waste Management Program	Frenchman Flat	190 <100>	Very Low (0–10)	0 to 4 <2>
Environmental Restoration Program – Soils Project	Frenchman Flat and Nevada Test and Training Range	320 [d] <10>	Very Low (0–10)	0 to 5 <2>
Environmental Restoration Program – Underground Test Area Project	NNSS and Nevada Test and Training Range	250 [e]	Low (10–45)	4 to 18 [e]
Environmental Management Mission Total		760 <110>		4 to 26 <4>
General Site Support and Infrastructure	NNSS	None <100>	N/A	N/A <10>
Renewable Energy (DOE/NNSA)		None <1,500>	Low (10–45)	N/A <35>
Nondefense Mission Total		None 1,600>		N/A <45>
Nonprogrammatic Takes on NNSS Roads	NNSS	None <None>		125 <125>
Total DOE/NNSA		1,685		131 to 162
Commercial Solar Power Generation Facility	Jackass Flats	1,200	Very Low (0–10)	0 to 19
Total		2,120		131 to 181

N/A = not applicable; NNSS = Nevada National Security Site.

[a] Desert tortoise abundance class from Woodward et al. 1998.

[b] Acres of Disturbance/640 × Maximum Desert Tortoise Abundance.

[c] Dynamic experiments in boreholes, drillback operations, and one-half of high-explosives experiments and Office of Secure Transportation training proposed under the Reduced Operations Alternative would be located outside of the range of the desert tortoise and are not included in this table.

[d] A total of 420 acres would be disturbed at Soils Project sites on the NNSS and Nevada Test and Training Range, but only the Small Boy site (320 acres) in the Frenchman Flat area would be within desert tortoise habitat.

[e] A total of 10 acres of tortoise habitat disturbance and 2 takes by harassment are allowable for all Environmental Restoration Program activities at the NNSS under the *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada*.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Experiments that employ releases of chemicals and biological simulants would occur at many locations at the NNSS, mostly within previously disturbed areas such as NPTEC, Test Cell C, and established training areas; however, up to 15 such experiments may occur in undisturbed desert tortoise habitat over the next 10 years, resulting in 15 acres of disturbance, which would result in an estimated take of 1 tortoise. The *2009 Biological Opinion* (USFWS 2009a) does not include a designation for this program area; however, experiments involving chemical and biological simulant releases would primarily be for Work for Others Program activities. As such, the 15 acres of potential disturbance would be within the 500 acres allotted to the Work for Others Program, and the number of tortoises potentially taken by harassment would be well within the allowable take (10) in the *2009 Biological Opinion*.

Work for Others Program. Because no new land disturbances are anticipated under the Work for Others Program, none of the parameters of the *2009 Biological Opinion* (USFWS 2009a) would likely be exceeded.

Biological Resources—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) knows the current 100-year drought has increasingly stressed the physical and spiritual nature of the plants and animals on the Nevada National Security Site (NNSS). Its environmental impacts are unprecedented in the history of the operation and management of these lands. The CGTO knows the 100-year drought has modified the abundance and distribution of all animals and plants. The quality, quantity, and distribution of indigenous plants, animals, and insects necessary to sustain a healthy environment and to maintain a productive animal habitat are clearly affected.

Water – both as free flowing springs and absorbed by plants and distributed to animals – has diminished. Certain springs have dried up making animals travel into other unfamiliar lands. Food foraging becomes difficult and land dries up. Wildlife has less body fat, which results in shorter hibernation cycles. Indian people have observed that ground squirrels are becoming cannibalistic to survive. Other animals are changing their habits as the environment continues to be impacted by this drought. For example, rabbits are now forced to eat unusual foods like Yucca. According to one tribal elder, *"The cries of some birds have changed since the drought began."*

See Appendix C for more details.

5.1.7.3.3.2 Environmental Management Mission

Under the Reduced Operations Alternative, potential impacts on desert tortoises from DOE/NNSA Environmental Management Program activities would be the same as those under the No Action Alternative.

Waste Management Program. Potential impacts on desert tortoises resulting from DOE/NNSA Waste Management activities would be the same under the Reduced Operations Alternative as those under the No Action Alternative.

Environmental Restoration Program. Under the Reduced Operations Alternative, the potential impacts on desert tortoises from Environmental Restoration Program activities would be the same as those under the No Action Alternative.

5.1.7.3.3.3 Nondefense Mission

Under the Reduced Operations Alternative, the only Nondefense Mission activities that would potentially impact desert tortoises would be associated with development of a commercial solar power generation facility, which is discussed below under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. Under the Reduced Operations Alternative, small projects to maintain and repair NNSS facilities would occur at existing facilities in previously disturbed areas and are not anticipated to affect biological resources.

Conservation and Renewable Energy Program. Measures taken to increase energy efficiency, fuel efficiency, and water conservation would occur at existing facilities and are not anticipated to affect biological resources.

A commercial 100-megawatt solar power generation facility would be located within the range of the desert tortoise in Area 25 of the NNSS and would permanently disturb its habitat. The 100-megawatt facility would permanently disturb about 1,200 acres of land. The existing electrical transmission system at the NNSS and in the region would be able to accommodate this additional generation without construction of new transmission lines. The number of desert tortoises potentially affected by this project would range from 0 to 19. The commercial solar power generation facility is not covered by the *2009 Biological Opinion* (USFWS 2009a) and would require consultation among the project proponents, USFWS, and BLM to develop a project-specific Biological Opinion.

Other Research and Development Programs. The Nevada National Environmental Research Park in Area 5 contains two existing facilities used to support outside scientific research on long-term environmental health. Future research programs could include activities such as habitat reclamation and remediation, which could potentially cause disturbance in desert tortoise habitat; however, there are no proposed projects at this time and impacts on desert tortoises cannot be estimated. Any such projects proposed in the future would be subject to the then-current Biological Opinion and the DOE/NNSA NSO Desert Tortoise Compliance Program.

5.1.7.3.4 Impacts on Offsite Biota

Under the Reduced Operations Alternative, activities at the NNSS would decrease relative to the No Action Alternative, and the offsite areas of concern identified in Section 5.1.7.1.4 would not be impacted by activities at the NNSS.

5.1.8 Air Quality and Climate

This section addresses air quality impacts from stationary, mobile, and fugitive air pollutant sources that would occur within and outside the NNSS under each of the alternatives addressed in this *NNSS SWEIS*. The ROI for each alternative in this air quality analysis encompasses Nye and Clark Counties in Nevada.

Air quality is determined, in part, by measuring concentrations of certain pollutants (referred to as "criteria pollutants") in the atmosphere. The U.S. Environmental Protection Agency (EPA) designates an area as "in attainment" for a particular pollutant if ambient air concentrations of that pollutant are below the National Ambient Air Quality Standards. Criteria pollutants regulated under these standards by both the EPA and the State of Nevada include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter with an aerodynamic diameter less than or equal to 10 micrometers and less than or equal to 2.5 micrometers.

In general, emissions-generating activities within the NNSS would be widely dispersed over the 1,360-square-mile area of the NNSS. Thus, at the boundaries of the NNSS, ambient concentrations of criteria pollutants under each alternative are expected to be below ambient air quality standards, and Nye County would continue its present attainment/nonclassified designation for all criteria pollutants. In Clark County, these emissions would not cause or contribute to any new air quality violations or increase the frequency of severity of any existing violation of any air quality standard.

Hazardous air pollutants (HAPs) are pollutants known or suspected to cause cancer or other serious health effects, such as birth defects. The EPA, under the Clean Air Act, established emission standards (the National Emission Standards for Hazardous Air Pollutants [NESHAPs]) for 188 such pollutants, most of which originate from manmade sources. Benzene, for example, is found in gasoline. In establishing the standards, the EPA identified various industries and corresponding emission limits that, if exceeded, would require the use of additional control technologies to reduce such emissions to the maximum achievable. DOE/NNSA found that, under all alternatives, HAP emissions would be well below this threshold at less than 1 ton per year for all sources and, because these emissions are also widely dispersed (similar to the criteria air pollutants), these emissions are not expected to pose an undue health risk to workers or the public.

Additional details supporting the information presented in this section can be found in Appendix D, Section D.2.1.1.

General conformity determination. EPA published the General Conformity Rule (40 CFR Part 6; 40 CFR Part 51; 40 CFR Part 93) to implement Section 176(c) of the Clean Air Act as amended in 1990. This rule requires Federal actions to conform to the appropriate State Implementation Plan. As defined in the Clean Air Act, such conformity means compliance and cooperation with the requirements of the State Implementation Plan to eliminate or reduce the severity and number of violations of the National Ambient Air Quality Standards and achieve expeditious attainment of such standards. A formal conformity determination is required for Federal actions occurring in nonattainment areas when the total direct and indirect emissions of nonattainment pollutants (or their precursors) exceed specific annual *de minimis* (threshold) values. Because ozone is a secondary pollutant, the conformity determination for ozone uses the precursor emissions of volatile organic compounds (VOCs) and nitrogen dioxide as surrogate pollutants. The *de minimis* thresholds are presented in **Table 5–33**; the total emissions in Clark County under the No Action, Expanded Operations, and Reduced Operations Alternatives would not exceed the *de minimis* levels for carbon monoxide, nitrogen oxides, VOCs, or particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) in all cases. Therefore, a general conformity analysis would not be required for any of the alternatives addressed in this *NNSS SWEIS*.

Table 5–33 *De minimis* Thresholds in Nonattainment Areas

Criteria Pollutant	*Degree of Nonattainment*	*Annual Emissions (tons per year)*
Ozone ($VOCs$ and NO_2)	Serious	50
	Severe	25
	Extreme	10
	Other ozone nonattainment areas (outside of ozone transport region)	100
VOCs	Marginal/moderate nonattainment (within ozone transport region)	50
NO_2	Marginal/moderate nonattainment (within ozone transport region	100
CO	All	100
PM_{10}	Moderate	100
	Serious	70
SO_2, NO_2	All	100
Lead	All	25

CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Greenhouse gas emissions general information. The greenhouse gas emissions are presented in carbon-dioxide-equivalent form and are partitioned by various mobile and stationary source types. These emissions levels were derived from fuel use, vehicle activity, and power consumption data. Note that carbon dioxide emissions from onsite government vehicles were calculated for 2008 using measured fuel usage data. As only vehicle-miles-traveled projections were available for the No Action Alternative, a simplified vehicle-miles-traveled approach was used for onsite government vehicles. The greenhouse gas emissions were calculated using the EPA Climate Leaders Simplified Greenhouse Gas Emissions Calculator (EPA 2010b). Because these carbon dioxide emission projections were based on the 2008 car fleet, fuel economy improvement due to the recently mandated Corporate Average Fuel Economy fuel standards (49 CFR Part 531; 49 CFR Part 533) for light-duty vehicles (passenger cars) and light-duty passenger trucks (light-duty trucks) was incorporated into the carbon dioxide emission estimate by reducing the ratio of the 2015 average fuel economy to the 2008 average fuel economy for these vehicle types.

These greenhouse gas emissions are compared with a reference amount of 25,000 metric tons (27,558 tons), the threshold level identified by the President's Council on Environmental Quality, for which a quantitative assessment may be meaningful (CEQ 2010).

Power generation (electrical energy generation) is by far the largest single source of greenhouse gas emissions related to ongoing NNSS activities. This generation includes reductions due to energy conservation measures to be implemented under the three alternatives.

Greenhouse gas emissions, while estimated to decrease relative to the 2008 baseline level, would still contribute to global climate change. More specifically, emissions of carbon monoxide, nitrogen oxides, and greenhouse gases attributable to the level of operations would decrease relative to existing levels under any alternative. These reductions are due, primarily, to the introduction over time of newer DOE/NNSA fleet and worker vehicles with improved fuel economy, and improved combustion and emissions treatment efficiencies of electric power generating sources on the NNSS.

5.1.8.1 No Action Alternative

5.1.8.1.1 Air Quality

Calculations of emissions on and near the NNSS. Table 5–34 shows the midpoint (year 2015) annual air emissions of the criteria pollutants and hazardous air pollutants associated with various NNSS activities under the No Action Alternative. Most emissions are associated with mobile source activity (e.g., vehicles and portable construction equipment). The stationary source emissions include emissions from the operation of a 240-megawatt commercial solar power generation facility that may be constructed under the No Action Alternative. Table 5–34 does not show construction-related emissions because these would be temporary (see **Table 5–35** for construction-related emissions). The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. The NNSS contribution to the mobile source emissions in Clark County would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–41), except VOC emissions from NNSS mobile sources in Clark County, which would increase relative to 2008 emission levels by 0.4 tons per year due to the widespread use of ethanol blends in southern Nevada. Only a small fraction of the sulfur dioxide, PM_{10}, and $PM_{2.5}$ emissions would come from mobile sources, so these air pollutants would show a small overall increase relative to 2008 of 0.32, 3.5, and 0.7 tons per year, respectively, due to the potential increase in activity at the NNSS under the No Action Alternative relative to 2008. These small increases are not expected to lead to any violations of the air quality standards in Nye County. Emissions of nitrogen oxides, carbon monoxide, and PM_{10} from NNSS mobile sources in Clark County would decrease relative to 2008 emission levels by 12.6, 31.5, and 0.20 tons per year, respectively. Thus, this action would not contribute to or cause additional violations of the carbon monoxide or PM_{10} air quality standards. In addition, VOC emissions are not expected to violate the ozone air quality standard because the increase would be relatively small and such mobile source emissions would be dispersed throughout the Las Vegas Valley. Appendix D, Section D.2.1.1.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization for mobile sources.

Under the No Action Alternative, LLW and MMLW would be transported to the NNSS using either a truck-only or mostly rail scenario. Table 5–35 shows the average annual air emissions for the criteria and hazardous air pollutants under these two scenarios. For all pollutants, the mostly rail scenario has much lower emissions than the truck-only scenario. This is due to the greater energy efficiency of using rail to transport the waste. Further details on the transport scenario can be found in Section 5.1.3.1.2. The majority of these emissions would occur outside of Nevada and would be widely distributed over various routes from the nine origin locations.

Construction activities emissions. Under the No Action Alternative, construction emissions from new development at the NNSS would be limited to emissions from construction of the 240-megawatt commercial solar power generation facility in Area 25. **Table 5–36** summarizes emissions from construction activities and construction workers commuting to and from the NNSS. These emissions are for the first year of construction and represent the highest emission rates as construction activity is linear over the multi-year period of construction and mobile source emission factors are highest in the first year. See Appendix D, Section D.2.1.1.1, for more information regarding how these emissions were determined and further portioning by source type and vehicle type for mobile sources. These results are shown separately from those in Table 5–35 because they span only a few years and, thus, are considered temporary.

During the period of construction, most of the $PM_{2.5}$ emissions are from the combustion of diesel construction equipment and vehicles. These diesel particulate matter emissions would be widely dispersed over the commercial solar power generation facility. Screening-level air quality modeling of these emissions found that, on an annual basis, the maximum annual average diesel particulate matter concentration on site was 0.37 micrograms per cubic meter. EPA has established an inhalation reference concentration level of 5 micrograms per cubic meter that is designed to protect against chronic noncarcinogenic health effects (EPA 2003). Thus, no adverse noncancer inhalation impacts are expected from the operation of the construction equipment and vehicles. EPA has identified that diesel particulate matter is likely to be a human carcinogen by inhalation, but has not established a carcinogenic unit risk because the exposure response data in human studies are considered too uncertain. Chapter 7, Section 7.8, identifies possible mitigation measures to reduce PM exposure.

Chemical release emissions. Chemical releases would be subject to release criteria developed in applicable NEPA analyses (DOE 2002g, 2004f) and terms and conditions in the NNSS Air Quality Operating Permit. Releases would not occur unless the meteorological conditions at the release site were appropriate for the release. Prior to an experiment, air dispersion modeling would be conducted to ensure that it would be conducted within the limitations of applicable release criteria. In compliance with the NNSS Air Quality Operating Permit, the DOE/NNSA NSO would submit a detailed test plan to the Nevada Bureau of Air Pollution Control before the planned release, monitor the release, and submit a final analysis of each chemical release test. The DOE/NNSA NSO would notify the Nevada Bureau of Air Pollution Control within 24 hours of any malfunction or upset of a test process that would result in an emission above allowable limits.

Table 5–34 No Action Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the Nevada National Security Site in 2015

	Annual Air Emissions (tons per year)															
	Stationary Sources	*Government-Owned Vehicles*	*NNSS Commuters*			*Commercial Vendors*			*Radiological Waste Trucks*			*Total*				
	Nye County	*Nye County*		*Nye County*			*Nye County*			*Nye County*			*Nye County*			
Pollutant	*On-NNSS*	*On-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Total*
PM_{10}	4.0	0.86	0.71	0.040	0.21	0.096	0.043	0.012	0.20	0.031	0.55	*1.0*	*5.0*	*0.77*	*6.8*
$PM_{2.5}$	1.4	0.68	0.39	0.027	0.12	0.078	0.036	0.010	0.17	0.027	0.49	*0.64*	*2.2*	*0.62*	*3.4*
CO	2.6	29.5	66.3	3.3	18.8	0.36	0.17	0.049	0.56	0.088	1.6	*67.2*	*35.7*	*20.4*	*123.3*
NO_x	4.0	7.5	12.4	0.69	3.5	0.96	0.43	0.12	2.5	0.40	7.2	*15.9*	*13.0*	*10.8*	*39.7*
SO_2	0.21	0.080	0.18	0.011	0.045	0.0022	0.00095	0.00027	0.0056	0.00088	0.016	*0.19*	*0.30*	*0.061*	*0.55*
VOCs	1.8	0.51	1.8	0.64	0.52	0.10	0.049	0.014	0.11	0.017	0.31	*2.0*	*3.0*	*0.84*	*5.9*
Lead	<0.03	0.000031	0.000052	0.0000033	0.000014	0.0000041	0.0000020	0.00000056	0.0000035	0.00000061	0.000011	*0.00006*	*0.030*	*0.000026*	*0.030*
Criteria Pollutant Total	*14.0*	*39.1*	*81.8*	*4.7*	*23.2*	*1.6*	*0.73*	*0.21*	*3.5*	*0.56*	*10.2*	*86.9*	*59.1*	*33.6*	*179.6*
HAPs	~0.1	0.041	0.14	0.0065	0.043	0.014	0.0064	0.0018	0.014	0.0023	0.041	*0.17*	*0.16*	*0.086*	*0.41*

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to n micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table 5–35 No Action Alternative Annual Average Emissions of Criteria Pollutants and Hazardous Air Pollutants from the Transport of Low-Level and Mixed Low-Level Radioactive Waste to the Nevada National Security Site

Pollutant	***Annual Air Emissions (tons per year)***	
	Low-Level and Mixed Low-Level Radioactive Waste Shipped via Mostly Rail	***Low-Level and Mixed Low-Level Radioactive Waste Shipped via Truck Only***
PM_{10}	4.5	21.5
$PM_{2.5}$	4.1	19.5
CO	14.1	66.4
NO_x	63.8	300.6
SO_2	0.1	0.7
VOCs	2.7	12.5
Lead	0.0001	0.000
Criteria Pollutant Total	*89.3*	*421.2*
HAPs	0.4	1.7

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table 5–36 No Action Alternative Construction Emissions of Criteria Pollutants and Hazardous Air Pollutants

	Peak Year Air Emissions from Construction Activities (tons per year)				
	Construction	***Commuting by Construction Workers***			
	Nye County		***Nye County***		
Pollutant	***On-NNSS***	***Clark County***	***On-NNSS***	***Off-NNSS***	***Total***
PM_{10}	19.9	0.11	0.0097	0.023	*20.0*
$PM_{2.5}$	5.9	0.064	0.0068	0.014	*6.0*
CO	30.0	11.2	0.96	2.6	*44.8*
NO_x	52.8	2.4	0.22	0.55	*56.0*
SO_2	0.11	0.027	0.0026	0.0052	*0.14*
VOCs	5.7	0.40	0.029	0.087	*6.2*
Lead	Not applicable	0.0000067	0.00000078	0.0000014	*0.0000089*
HAPs	Not applicable	0.029	0.0023	0.0069	*0.038*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

5.1.8.1.2 Radiological Air Quality

No activities under the No Action Alternative are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions in Chapter 4, Section 4.1.8.3.

5.1.8.1.3 Climate Change

See Chapter 4, Section 4.1.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to NNSS-related activities. Table 5–37 shows greenhouse gas emissions levels for NNSS-related activities under the No Action Alternative. The midpoint year (2015) represents the average annual emissions over the 10-year planning period. Greenhouse gas emissions would continue beyond the 10-year planning period. The color coding in Table 5–36 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by the NNSS (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–37 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Overall, NNSS-related activities under the No Action Alternative would create about 39,690 carbon-dioxide-equivalent tons of greenhouse gas emissions per year (45,376 when including temporary construction worker commuting and construction vehicles), which is about 44 percent over the threshold reporting level (65 percent when including temporary construction worker commuting and construction vehicles). This represents a net reduction over current greenhouse gas emissions (50,478 tons in 2008) of about 21 percent, but these emissions would continue to contribute to global climate change.

LLW and MLLW may be transported to the NNSS under the No Action Alternative using either a truck-only or mostly rail scenario. Under the truck-only scenario, about 8,078 carbon-dioxide-equivalent tons of greenhouse gas emissions would be created per year. For the mostly rail scenario, about 1,753 carbon-dioxide-equivalent tons of greenhouse gas emissions would be created per year. This lower rate of greenhouse gas emissions is due to the greater energy efficiency of using rail to transport the waste.

Table 5–37 No Action Alternative Greenhouse Gas Emissions by Nevada National Security Site Activity in 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year*
STATIONARY SOURCES		
Power generation	19,106	0.69
Natural gas heating	0	0
Other stationary sources, excluding air conditioning/refrigeration, natural gas heating, and sources related to the solar power generation facility	501	0.02
Stationary sources related to solar power generation facility operation	9	0.01
Sulfur hexafluoride from refrigeration/air conditioning	462	0.02
Hydrofluorocarbons from refrigeration/air conditioning	218	0.01
ALL STATIONARY SOURCES	*20,296*	*0.74*
MOBILE SOURCES		
Onsite government vehicles	5,238	0.19
Temporary construction vehicles related to the solar power generation facility (about 3 years' duration)	4,642	0.17
Commuting by regular NNSS employees	9,481	0.34
Commuting by temporary solar power generation facility construction employees (about 3 years' duration)	1,044	0.04
Hazardous material and waste transport (nongovernment)	2,922	0.11
Commercial vendors	1,753	0.06
ALL MOBILE SOURCES, excluding temporary construction vehicles and construction employee commuting	*19,394*	*0.70*
ALL MOBILE SOURCES, including temporary construction vehicles and construction employee commuting	*25,080*	*0.912*
ALL SCOPE 1 SOURCES	*6,428*	*0.23*
ALL SCOPE 2 SOURCES	*19,106*	*0.69*
ALL SCOPE 3 SOURCES	*19,842*	*0.72*
TOTAL, excluding temporary construction employee commuting and construction vehicles	***39,690***	***1.44***
TOTAL, including temporary construction employee commuting and construction vehicles	***45,376***	***1.65***

NNSS = Nevada National Security Site.

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

5.1.8.2 Expanded Operations Alternative

5.1.8.2.1 Air Quality

This section addresses air quality impacts from stationary, mobile, and fugitive criteria pollutant sources that would occur within and outside the NNSS under the Expanded Operations Alternative.

Table 5–38 shows the midpoint (year 2015) annual air emissions for the criteria pollutants and hazardous air pollutants associated with various NNSS activities under the Expanded Operations Alternative. These emissions are expected to continue beyond the 10-year planning period. Most emissions are associated with mobile source activity (e.g., vehicles and portable construction equipment). The stationary source emissions include emissions resulting from the operation of one or more commercial solar power generation facilities with a combined capacity of 1,000 megawatts that may be constructed under the Expanded Operations Alternative. Table 5–38 does not show construction-related emissions because these would be temporary. See **Table 5–39** for construction-related emissions. The midpoint year represents the average annual emissions over the next 10 years. VOC and PM_{10} emissions from NNSS mobile sources in Clark County would increase relative to 2008 emission levels by 1.0 and 0.20 tons per year, respectively; nitrogen oxide and carbon monoxide emissions from NNSS mobile sources in Clark County would decrease 7.1 and 13.9 tons per year, respectively. Only a small fraction of the sulfur dioxide, PM_{10}, and $PM_{2.5}$ emissions would come from mobile sources, so these air pollutants would show a small overall increase relative to 2008 of 0.69, 16.8, and 5.4 tons per year, respectively, due to the projected increase in activity at the NNSS under the Expanded Operations Alternative relative to 2008. These small increases are not expected to lead to any violations of the air quality standards in Nye County. The VOC increase would be due to the widespread use of ethanol blends in southern Nevada by 2015. Thus, this action would not contribute to or cause additional violations of the carbon monoxide air quality standards. The small increases in VOC and PM_{10} emissions in Clark County would be attributable to mobile sources and would be widely distributed over the Las Vegas Valley. They would not lead to any additional violations of the ozone or PM_{10} air quality standards. See Appendix D, Section D.2.1.2.1, for more detail on how these emissions were determined, as well as source-type and vehicle-type characterization data for mobile sources.

In addition, under the Expanded Operations Alternative, LLW and MLLW would be transported to the NNSS using either a truck-only or mostly rail scenario. **Table 5–40** shows the average annual air emissions for the criteria and hazardous air pollutants under these two scenarios. For all pollutants, the mostly rail scenario has much lower emissions than the truck-only scenario. This is due to the greater energy efficiency of using rail to transport the waste. Further details on the transport scenario can be found in Section 5.1.3.1.2. The majority of these emissions would occur outside of Nevada and would be widely distributed over various routes from the nine origin locations.

Table 5–38 Expanded Operations Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the Nevada National Security Site in 2015

	Annual Air Emissions (tons per year)														
	Stationary Sources	*Government-Owned Vehicles*	*NNSS Commuters*			*Commercial Vendors*			*Radiological Waste Trucks*			*Total*			
	Nye County	*Nye County*		*Nye County*			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*On-NNSS*	*On-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Total*
PM_{10}	16.2	1.1	0.89	0.05	0.26	0.12	0.054	0.015	0.37	0.055	1.0	*1.4*	*17.5*	*1.3*	***20.1***
$PM_{2.5}$	5.1	0.86	0.49	0.034	0.15	0.098	0.045	0.013	0.32	0.05	0.91	*0.91*	*6.1*	*1.1*	***8.1***
CO	7.9	37.1	83.3	4.1	23.6	0.45	0.21	0.062	1.0	0.17	3.0	*84.8*	*49.5*	*26.7*	***160.9***
NO_x	5.8	9.4	15.6	0.87	4.4	1.2	0.54	0.15	4.6	0.77	13.3	*21.4*	*17.4*	*17.9*	***56.6***
SO_2	0.68	0.10	0.22	0.014	0.057	0.0028	0.0012	0.00034	0.010	0.0017	0.030	*0.22*	*0.80*	*0.087*	***1.1***
VOCs	5.6	0.64	2.3	0.80	0.65	0.13	0.062	0.018	0.20	0.032	0.58	*2.6*	*7.1*	*1.2*	***11.0***
Lead	<0.010	0.000039	0.000065	0.0000041	0.000018	0.0000052	0.0000025	0.00000070	0.0000065	0.0000011	0.000020	*0.000077*	*~0.010*	*0.000039*	***~0.010***
Criteria Pollutant Total	*41.3*	*49.2*	*102.8*	*5.9*	*29.1*	*2.0*	*0.9*	*0.3*	*6.5*	*1.1*	*18.8*	*111.3*	*98.3*	*48.2*	***257.8***
HAPs	~0.1	0.051	0.18	0.0082	0.054	0.018	0.0080	0.0023	0.026	0.0043	0.076	*0.22*	*~0.17*	*0.13*	***~0.53***

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table 5–39 Expanded Operations Alternative Construction Emissions of Criteria Pollutants and Hazardous Air Pollutants

	Peak Year Air Emissions from Construction Activities (tons per year)						
	NNSS Construction for Work for Others	***NNSS Construction for Solar Power Generation Facilities***	***Other NNSS Construction***	***Commuting by Construction Workers***			
	Nye County				***Nye County***		
Pollutant	***On-NNSS***	***On-NNSS***	***On-NNSS***	***Clark County***	***On-NNSS***	***Off-NNSS***	***Total***
PM_{10}	11.3 (61% from vehicles)	83.2	34.4 (12% from vehicles)	0.17	0.015	0.035	*129.1*
$PM_{2.5}$	6.7	24.7	4.1	0.096	0.01	0.021	*35.6*
CO	92.2	125.6	56.6	16.8	1.4	3.9	*296.5*
NO_x	100.9	220.9	62.0	3.6	0.33	0.83	*388.6*
SO_2	0.09	0.48	0.06	0.041	0.0039	0.0078	*0.68*
VOCs	10.5 [a]	23.8 [a]	6.4 [a]	0.6	0.044	0.13	*41.6*
Lead	Not applicable	Not applicable	Not applicable	0.00001	0.0000012	0.0000021	*0.000013*
HAPs	Not applicable	Not applicable	Not applicable	0.044	0.0035	0.01	*0.058*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] VOC emissions were assumed to be equal to the hydrocarbon emissions.

Table 5–40 Expanded Operations Alternative Annual Average Emissions of Criteria Pollutants and Hazardous Air Pollutants from the Transport of Low-Level and Mixed Low-Level Radioactive Waste to the Nevada National Security Site

Pollutant	*Annual Air Emissions (tons per year)*	
	Low-Level and Mixed Low-Level Radioactive Waste Shipped via Mostly Rail	*Low-Level and Mixed Low-Level Radioactive Waste Shipped via Truck Only*
PM_{10}	16.3	56.0
$PM_{2.5}$	14.8	50.9
CO	50.6	173.1
NO_x	229.3	783.8
SO_2	0.5	1.7
VOCs	9.5	32.6
Lead	0.0003	0.001
Criteria Pollutant Total	*321.1*	*1098.1*
HAPs	1.3	4.4

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Construction activities emissions. Short-term emissions are expected during construction of new buildings at the NNSS. A full list of all construction activities under the Expanded Operations Alternative can be found in Appendix D, Section D.2.1.2.1. Construction emissions from onsite activities at the NNSS are presented in Table 5–39. These emissions are for the first year of construction and represent the highest emission rates as construction activity is linear over the multi-year period of construction and mobile source emission factors are highest in the first year. The emissions would be dispersed over numerous locations on the NNSS; however, emissions from the commercial solar power generation facilities would be more concentrated in Area 25 of the NNSS. These emissions would not increase the ambient pollutant concentrations in Nye County above the ambient air quality standards. The construction emissions shown in Table 5–39 include steps to control fugitive dust emissions using best practices, as well as compliance with the requirements for controlling fugitive dust in accordance with the State of Nevada surface disturbance permit. Additional details are presented in Appendix D, Section D.2.1.2.1.

During the period of construction, most of the $PM_{2.5}$ emissions are from combustion of diesel-fueled construction equipment and vehicles. These diesel particulate matter emissions would be widely dispersed over the commercial solar power generation facilities. Screening-level air quality modeling of these emissions found that on an annual basis, the maximum annual average diesel particulate matter concentration on site was 0.57 micrograms per cubic meter. EPA has established an inhalation reference concentration level of 5 micrograms per cubic meter that is designed to protect against chronic noncarcinogenic health effects (EPA 2003). Thus, no adverse noncancer inhalation impacts are expected from the operation of the construction equipment and vehicles. EPA has identified that diesel particulate matter is likely to be a human carcinogen by inhalation, but has not established a carcinogenic unit risk because the exposure response data in human studies are considered too uncertain. Chapter 7, Section 7.8, identifies possible mitigation measures to reduce diesel particulate matter exposure.

Chemical release emissions. Chemical release experiments would be conducted within the same parameters described under the No Action Alternative and would comply with all applicable requirements of the NNSS Air Quality Operating Permit.

5.1.8.2.2 Radiological Air Quality

Except for the depleted uranium and radiotracer experiments, no activities under the Expanded Operations Alternative are expected to produce aboveground radiation via the air pathway beyond that documented for 2008 baseline conditions in Chapter 4, Section 4.1.8.3. Before conducting any activity that is designed to include an atmospheric release of radiological materials, the DOE/NNSA NSO would model the potential releases using CAP-88 (at a minimum, additional models may be used). If the results indicate a potential dose exceeding 0.1 millirem at the nearest boundary, the DOE/NNSA NSO would submit an application to construct to the Nevada Bureau of Air Pollution Control (with a copy to EPA) in compliance with 40 CFR Part 61 Subpart H (Section 61.96). The DOE/NNSA NSO would ensure that the cumulative annual dose to the nearest offsite individual remains within the NESHAPs standard of 10 millirem per year.

Explosive testing using depleted uranium. Radiological air releases are typically assessed using the CAP-88 model; however, that model and other EPA-approved models are designed for a nonexplosive, long-term, continuous release of radioactive material and would not be appropriate for the depleted uranium/high-explosives experiments, which are not continuous and are, by definition, highly explosive. The modeling of these experiments was performed with the MACCS2 computer code, as discussed in Appendix G. The results of the modeling are presented in Appendix G and Section 5.1.12.1. The maximum annual amount of materials allowed is 4,000 pounds of depleted uranium and 12,000 TNT-equivalent pounds of explosives across 20 tests. The typical single test was estimated to use 200 pounds of depleted uranium and 600 pounds of TNT-equivalent explosives. Modeling results from the typical single test and potential health impacts analyses are discussed in Section 5.1.12.1.2.

The modeling results show that no publicly accessible area would receive a radiation dose greater than the NESHAPs effective dose equivalent limit of 10 millirem per year.

Radiotracer experiments. Radiotracer experiments conducted at the NNSS may include up to 3 underground and 12 open-air experiments a year. Up to 4 different experiments may be conducted at the NNSS, including the following scenarios:

- Explosive release of radioactive and stable gases: These releases would consist of up to 10^{15} becquerels each of radioactive noble gases (xenon-127, xenon-131m, xenon-133, krypton 85, and argon-37) and 10,000 liters of stable gases (helium-3, sulfur hexafluoride, and stable xenon). The gases would be buried underground with explosive materials. Once detonated, the gases would travel to the surface through various physical processes. Continuous monitoring and sampling of surrounding atmospheric and soil conditions would be conducted.
- Pressurized release of radioactive and stable gases: Using the same gases as the explosive experiment, this experiment would pump the gas along with large quantities of air into a pressurized underground cavity and release the gas through various physical processes. The same monitoring and sampling would be conducted as with the explosive experiment.
- Explosive release of radioactive particulates: Shallow explosions would release up to 10^{15} becquerels each of short-lived radioactive particulates (rubidium-86, zirconium-95, technetium-99m, molybdenum-99, rubidium-103, cesium-136, barium-140, cerium-141, neodymium-147, and samarium-153). Gamma-ray survey instruments would be used to measure radiation. Contamination from these experiments would be short-lived, as each particulate has a half-life of less than 1 year.
- Baseline survey of legacy contamination: No new materials would be released under this experiment. High- and medium-resolution gamma-ray spectra would be measured.

A discussion of the potential radiological dose associated with these tracer experiments can be found in Section 5.1.12.1.

The modeling results show that the no publicly accessible area would receive a cumulative (explosive testing and radiotracer experiments) radiation dose greater than the NESHAPs dose equivalent limit of 10 millirem per year. See Section 5.1.12.1 for a discussion of worker exposure levels.

5.1.8.2.3 Climate Change

See Chapter 4, Section 4.1.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to NNSS-related activities. Table 5–41 shows greenhouse gas emissions levels for NNSS-related activities under the Expanded Operations Alternative. The color coding in Table 5–41 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by the NNSS (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–41 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Table 5–41 Expanded Operations Alternative Greenhouse Gas Emissions at the Nevada National Security Site in 2015

Source Type	***Carbon-Dioxide-Equivalent Emissions (tons per year)***	***Fraction of Reference Point of 27,558 Tons Per Year***
STATIONARY SOURCES		
Power generation	22,740	0.83
Natural gas heating	0	0
Other stationary sources, excluding air conditioning/refrigeration, natural gas heating, and sources related to the solar power generation facilities	596	0.02
Stationary sources related to solar power generation facility operation	18	0.01
Sulfur hexafluoride from refrigeration/air conditioning	550	0.02
Hydrofluorocarbons from refrigeration/air conditioning	260	0.01
ALL STATIONARY SOURCES	*24,164*	*0.88*
MOBILE SOURCES		
Onsite government vehicles	6,540	0.24
Temporary construction vehicles not including solar facility vehicles (about 3 years' duration)	3	0.01
Commuting by regular NNSS employees	11,916	0.43
Temporary construction vehicles from solar facility vehicles only (about 3 years' duration)	19,438	0.71
Commuting by temporary solar power generation facility construction employees (about 3 years' duration)	1,717	0.06
Hazardous material and waste (nongovernment)	4,987	0.18
Commercial vendors	1,696	0.06
ALL MOBILE SOURCES, excluding temporary construction vehicles and non-NNSS employee commuting	*25,139*	*0.91*
ALL MOBILE SOURCES, including temporary construction vehicles and employee commuting	*46,297*	*1.68*
ALL SCOPE 1 SOURCES	*7,964*	*0.29*
ALL SCOPE 2 SOURCES	*22,740*	*0.83*
ALL SCOPE 3 SOURCES	*39,757*	*1.44*
TOTAL, excluding temporary construction employee commuting and construction vehicles	***49,303***	***1.79***
TOTAL, including temporary construction employee commuting and construction vehicles	***70,461***	***2.56***

NNSS = Nevada National Security Site.

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

Overall, NNSS-related activities under the Expand Operations Alternative would create about 49,303 carbon-dioxide-equivalent tons of greenhouse gas emissions per year (70,461 when including temporary construction worker commuting and construction vehicles), which is about 79 percent over the threshold reporting level (155 percent when including temporary construction worker commuting and construction vehicles). This represents a net decrease over current greenhouse gas emissions (50,478 tons in 2008) of about 2 percent (1,175 carbon-dioxide-equivalent tons per year) over the 10-year horizon. Early in the period, it is possible that these greenhouse gas emissions may be slightly higher than current greenhouse gas emissions. Even with this relatively small change from current emission rates, these emissions would continue to contribute to global climate change.

LLW and MLLW may be transported to the NNSS under the Expanded Operations Alternative using either a truck-only or mostly rail scenario. Under the truck-only scenario, about 36,234 carbon-dioxide-equivalent tons of greenhouse gas emissions would be created per year. For the mostly rail scenario, about 4,987 carbon-dioxide-equivalent tons of greenhouse gas emissions would be created per year. This lower rate of greenhouse gas emissions is due to the greater energy efficiency of using rail to transport the waste.

5.1.8.3 Reduced Operations Alternative

5.1.8.3.1 Air Quality

This section addresses air quality impacts from stationary, mobile, and fugitive air pollutant sources that would occur within and outside the NNSS under the Reduced Operations Alternative.

Table 5–42 shows the midpoint (2015) annual air emissions for the criteria pollutants and hazardous air pollutants associated with various NNSS activities under the Reduced Operations Alternative. Most emissions are associated with mobile source activity (e.g., vehicles and portable construction equipment). The stationary source emissions include emissions resulting from the operation of a 100-megawatt commercial solar power generation facility that may be constructed under the Reduced Operations Alternative. Table 5–42 does not show construction-related emissions because these would be temporary. The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. The NNSS contribution to the emissions in Clark County would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–41), except for VOCs, which would increase by 0.2 tons per year by 2015 due the widespread use of ethanol blends in southern Nevada. Only a small fraction of the sulfur dioxide and PM_{10} emissions are from mobile sources so these air pollutants show a small overall increase relative to 2008 of 0.02 and 1.1 tons per year, respectively. This is due to the possible increase in activity at the NNSS under the Reduced Operations Alternative relative to low activity levels in 2008. These small increases are not expected to lead to any violations of the air quality standards in Nye County. Nitrogen oxide, carbon monoxide, and PM_{10} emissions would all decrease in Clark County relative to 2008 emission levels by 14.1, 38.5, and 0.28 tons per year, respectively. The small increase in VOC emissions is from mobile sources and would be widely distributed over the Las Vegas Valley. Thus, this action would not contribute to or cause additional violations of the carbon monoxide, ozone, or PM_{10} air quality standards. Appendix D, Section D.2.1.3.1, provides more detail regarding how these emissions were determined, as well as source-type and vehicle-type characterization data for mobile sources.

Under the Reduced Operations Alternative, LLW and MMLW would be transported to the NNSS using either a truck-only or mostly rail scenario. **Table 5–43** shows the average annual air emissions for the criteria and hazardous air pollutants under these two scenarios. For all pollutants, the mostly rail scenario has much lower emissions than the truck-only scenario. This is due to the greater energy efficiency of using rail to transport the waste. Further details on the transport scenario can be found in Section 5.1.3.1.2. The majority of these emissions would occur outside of Nevada and would be widely distributed over various routes from the nine origin locations.

Table 5–42 Reduced Operations Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the Nevada National Security Site in 2015

	Annual Air Emissions (tons per year)														
	Stationary Sources	*Government-Owned Vehicles*	*NNSS Commuters*			*Commercial Vendors*			*Radiological Waste Trucks*			*Total*			
	Nye County	*Nye County*		*Nye County*			*Nye County*			*Nye County*			*Nye County*		
Pollutant	*On-NNSS*	*On-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Clark County*	*On-NNSS*	*Off-NNSS*	*Total*
PM_{10}	1.8	0.77	0.64	0.036	0.19	0.086	0.038	0.011	0.19	0.03	0.54	*0.92*	*2.7*	*0.74*	*4.4*
$PM_{2.5}$	0.70	0.61	0.35	0.024	0.11	0.07	0.032	0.0089	0.17	0.026	0.48	*0.59*	*1.4*	*0.6*	*2.6*
CO	1.6	26.3	59.3	3	16.8	0.32	0.15	0.044	0.54	0.088	1.6	*60.2*	*31.2*	*18.4*	*109.8*
NO_x	3.6	6.7	11.1	0.62	3.1	0.86	0.38	0.11	2.4	0.39	7	*14.4*	*11.7*	*10.2*	*36.3*
SO_2	0.10	0.071	0.16	0.0098	0.04	0.002	0.00085	0.00024	0.0054	0.00088	0.016	*0.17*	*0.18*	*0.056*	*0.41*
VOCs	1.1	0.45	1.6	0.57	0.47	0.089	0.044	0.013	0.11	0.017	0.3	*1.8*	*2.2*	*0.78*	*4.8*
Lead	0.0023	0.000028	0.000047	0.000003	0.000013	0.0000037	0.0000018	0.0000005	0.0000034	0.00000061	0.000011	*0.000054*	*0.0023*	*0.000025*	*0.0024*
Criteria Pollutant Total	*8.9*	*34.9*	*73.2*	*4.3*	*20.7*	*1.4*	*0.6*	*0.2*	*3.4*	*0.6*	*9.9*	*78.0*	*49.3*	*30.8*	*158.1*
HAPs	0.090	0.036	0.13	0.0058	0.038	0.013	0.0057	0.0016	0.014	0.0023	0.04	*0.16*	*0.10*	*0.08*	*0.4*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table 5–43 Reduced Operations Alternative Annual Average Emissions of Criteria Pollutants and Hazardous Air Pollutants from the Transport of Low-Level and Mixed Low-Level Radioactive Waste to the Nevada National Security Site

Pollutant	***Annual Air Emissions (tons per year)***	
	Low-Level and Mixed Low-Level Radioactive Waste Shipped via Mostly Rail	***Low-Level and Mixed Low-Level Radioactive Waste Shipped via Truck Only***
PM_{10}	4.5	21.5
$PM_{2.5}$	4.1	19.5
CO	14.1	66.4
NO_x	63.8	300.6
SO_2	0.1	0.7
VOCs	2.7	12.5
Lead	0.0001	0.000
Criteria Pollutant Total	*89.3*	*421.2*
HAPs	0.4	1.7

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Construction Activities Emissions. Short-term emissions are expected during the construction of a 100-megawatt commercial solar power generation facility in Area 25 of the NNSS. **Table 5–44** summarizes the emissions from the construction activities and from the construction workers commuting to and from the NNSS. These emissions are for the first year of construction and represent the highest emission rates as construction activity is linear over the multi-year period of construction and mobile source emission factors are highest in the first year. The construction emissions in Table 5–44 include steps to control fugitive dust emissions using best practices, as well as compliance with the requirements for controlling fugitive dust in accordance with the State of Nevada surface disturbance permit. Additional details are presented in Appendix D, Section D.2.1.3.1. These results are shown separately from those in Table 5–43 because they would last only a few years and are thus considered temporary.

Table 5–44 Reduced Operations Alternative Construction Emissions of Criteria Pollutants and Hazardous Air Pollutants

	Peak Year Air Emissions from Construction Activities (tons per year)				
	Construction	*Commuting by Construction Workers*			
	Nye County		*Nye County*		
Pollutant	***On-NNSS***	***Clark County***	***On-NNSS***	***Off-NNSS***	***Total***
PM_{10}	8.3	0.088	0.0078	0.018	*8.4*
$PM_{2.5}$	2.5	0.051	0.0054	0.011	*2.6*
CO	12.5	9.0	0.77	2.1	*24.4*
NO_x	21.9	1.9	0.18	0.44	*24.4*
SO_2	0.050	0.022	0.0021	0.0042	*0.08*
VOCs	2.4	0.32	0.023	0.070	*2.8*
Lead	Not applicable	0.0000054	0.00000062	0.0000011	*0.0000071*
HAPs	Not applicable	0.023	0.0018	0.0055	*0.03*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

5.1.8.3.2 Radiological Air Quality

No activities under the Reduced Operations Alternative are expected to produce aboveground radiation via the air pathway beyond that documented for 2008 baseline conditions in Chapter 4, Section 4.1.8.3.

5.1.8.3.3 Climate Change

See Chapter 4, Section 4.1.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to NNSS-related activities. Table 5–45 shows greenhouse gas emissions levels for NNSS-related activities under the Reduced Operations Alternative. The color coding in Table 5–45 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117); blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by the NNSS (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–45 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Table 5–45 Reduced Operations Alternative Greenhouse Gas Emissions at the Nevada National Security Site in 2015

Source Type	***Carbon-Dioxide-Equivalent Emissions (tons per year)***	***Fraction of Reference Point of 27,558 Tons Per Year***
STATIONARY SOURCES		
Power generation	19,106	0.69
Natural gas heating	0	0
Other stationary sources, excluding air conditioning/refrigeration, natural gas heating, and sources related to the solar power generation facility	501	0.02
Stationary sources related to solar power generation facility operation	4	0.01
Sulfur hexafluoride from refrigeration/air conditioning	462	0.02
Hydrofluorocarbons from refrigeration/air conditioning	218	0.01
ALL STATIONARY SOURCES	*20,291*	*0.74*
MOBILE SOURCES		
Onsite government vehicles	4,681	0.17
Temporary construction vehicles on site related to the solar power generation facility (about 3 years' duration)	1,934	0.07
Commuting by regular NNSS employees	8,483	0.31
Commuting by temporary solar power generation facility construction employees (about 3 years' duration)	840	0.03
Hazardous material and waste transport (nongovernment)	2,840	0.10
Commercial vendors	1,750	0.06
ALL MOBILE SOURCES, excluding temporary construction vehicles and construction employee commuting	*17,754*	*0.65*
ALL MOBILE SOURCES, including temporary construction vehicles and construction employee commuting	*20,528*	*0.75*
ALL SCOPE 1 SOURCES	*5,866*	*0.21*
ALL SCOPE 2 SOURCES	*19,106*	*0.69*
ALL SCOPE 3 SOURCES	*15,847*	*0.58*
TOTAL, excluding temporary construction employee commuting and construction vehicles	***38,045***	***1.38***
TOTAL, including temporary construction employee commuting and construction vehicles	***40,819***	***1.48***

NNSS = Nevada National Security Site.

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

Overall, NNSS-related activities under the Reduced Operations Alternative would create about 38,045 carbon-dioxide-equivalent tons of greenhouse gas emissions per year (40,819 when including temporary construction worker commuting and construction vehicles), which is about 38 percent over the threshold reporting level (48 percent when including temporary construction worker commuting and construction vehicles). This represents a net reduction over current greenhouse gas emissions (50,478 tons in 2008) of about 25 percent, but these emissions would continue to contribute to global climate change.

LLW and MLLW may be transported to the NNSS under the Reduced Operations Alternative using either a truck-only or mostly rail scenario. Under the truck-only scenario, about 8,078 carbon-dioxide-equivalent tons of greenhouse gas emissions would be created per year. For the mostly rail scenario, about 1,753 carbon-dioxide-equivalent tons of greenhouse gas emissions would be created per year. This lower rate of greenhouse gas emissions is due to the greater energy efficiency of using rail to transport the waste.

Air Quality and Climate—American Indian Perspective

Indian people know air can be destroyed, causing pockets of dead air. There is only so much alive air that surrounds the world. If you kill the living air, it is gone forever and cannot be restored.

Dead air lacks the spirituality and life necessary to support other life forms. Airplanes crash when they hit dead air. During a previous Consolidated Group of Tribes and Organizations (CGTO) evaluation of the area, one member of the CGTO compared this Indian view of killing air with what happens when a jet flies through the air and consumes all of the oxygen, producing a condition where another jet cannot fly through it.

As one tribal elder noted, *"The spiritual journey of the Southern Paiute Salt Songs are affected as the air quality is not the same as in the days of old. This Salt Singer wonders what is going to happen if the situation isn't corrected. Southern Paiutes need this spiritual journey to ascend their deceased to the next life."*

As people are emitting things into the air that are unnatural, such as radiation from atomic blasts or dust and debris from decontaminating and decommissioning old Nevada National Security Site (NNSS) buildings, climatic changes such as droughts are occurring because the air is being disrespected. As the air continues to be disrespected, it perpetuates and intensifies imbalance throughout the environment. This impacts many resources, including the land, soil, water, plants, and animals.

Dust devils in various forms and sizes are culturally significant to Indian people and known to bring harm. The CGTO knows the frequency and intensity of dust devils have increased within the NNSS and the surrounding area. Dust devils contain negative energy, and can disperse hazardous and radioactive contaminants from the soil at the NNSS. Their spirits can bring harm if the air is disrespected and if you watch it or allow them to come near or pass through you. If this occurs, a person will become ill and must seek cultural intervention to heal.

Some Indian people who were present during aboveground nuclear tests at the Nevada Test Site (now NNSS) believe that the sickness they have came from the radiation. To some of these people, the effects of the radiation were in addition to what happened when the air itself was killed. Some tribal elders believe that even when the plants survived the effects of radiation, the dead air killed many of them or made some lose their spiritual power to heal things.

As noted by tribal elders, *"Sheep and other animals are being born out of season, which places them at greater risk from predators and from living full lives. Consequently, their loss adversely impacts our cultural survival, as many of our stories and traditions surround these animals. Weather is out of balance. For example, when it snows, one can also hear thunder. Native people observe the changed nature of the vegetation and blame the atmospheric change on the air quality from the bomb testing on the NNSS."*

The CGTO recognizes that climatic change is occurring and will continue to impact the natural resources of the NNSS and the surrounding region. When rain gauge data are averaged over a decade they can mask the reality that plants and animals are adjusted to regular cycles of rain and snow. Isolated heavy rain events can increase the annual rainfall amounts, but are largely not useful for sustaining life. Plants and animals need the climate to return to its historic, normal annual rainfall that is more evenly dispersed by season.

The CGTO knows that ceremonies have historically helped manage the climate in the NNSS region. Unfortunately, we have not been able to perform these ceremonies since the NNSS area was used for nuclear testing and our Holy Land continues to suffer. To facilitate the healing of this area, DOE must make provisions for the CGTO to access the land and perform these rituals, which are further described below.

See Appendix C for more details.

5.1.9 Visual Resources

This section describes the potential environmental impacts on visual resources under the No Action, Expanded Operations, and Reduced Operations Alternatives. As described in Chapter 4, the threshold for determining impacts are effects on the view from public vantage points, namely local roadways in the project vicinity, factored with viewer sensitivity (see Chapter 4, Figure 4–30). Therefore, only actions that would be visible to the public are discussed. For example, Environmental Restoration Program activities and operations would continue at the NNSS under all alternatives. Restoration efforts would demolish existing structures, restore the landscape to a natural-looking appearance, and improve existing visual resources associated with environmental restoration sites, which would have a beneficial effect. However, all of these activities and operations would occur out of the public viewshed; therefore, they are not discussed below.

An action may have an adverse effect if it alters or degrades the existing visual character, introduces a new source of light or glare, negatively affects a scenic vista or view, or negatively affects a view along a designated scenic route. There are no scenic routes near the NNSS, RSL, NLVF, or TTR.

Visual Resources—American Indian Perspective

Central to the Indian experience of viewscapes is isolation and serenity in an uncompromised landscape. If construction and operation of the proposed activities proceed in a culturally-inappropriate manner, then visual resources within the Nevada National Security Site (NNSS) area will be adversely impacted, further perpetuating an unbalanced environment. To restore balance to the environment and it's visual resources, the U.S. Department of Energy (DOE) must provide access for Indian people to conduct religious and cultural ceremonies to fulfill traditional obligations. In this manner, we can restore and preserve our spiritual harmony as a whole.

The Consolidated Group of Tribes and Organizations (CGTO) knows many of the activities described in this site-wide environmental impact statement (SWEIS), such as those associated with facility construction and environmental restoration, will adversely impact visual resources. For Indian people, the adverse impact to visual resources will most certainly impact the spiritual harmony of the environment as a whole. Facility construction and operation will impede visual resources, and affect the solitude and cultural integrity of the land.

In particular, visual resources may be negatively impacted if proposed solar enterprise zones and geothermal projects are pursued. The CGTO must be part of any additional, future discussions of these projects at a minimum as these may impact visual resources and may degrade traditional and cultural ceremonies.

See Appendix C for more details.

5.1.9.1 No Action Alternative

Under the No Action Alternative, current activities and operations would continue. None of the current activities and operations would affect existing visual resources associated with the NNSS except construction of a solar power generation facility in Area 25. While viewer sensitivity would change from moderate to high (3,000 or more average annual daily traffic) near Mercury (4,980 average daily trips), views from U.S. Route 95 near Mercury would not be affected because ongoing current activities and operations would not affect existing visual resources. Portions of the study area visible from U.S. Route 95 and Amargosa Valley have a Class B scenic quality rating, as established in the *1996 NTS EIS* (DOE 1996c). As described in Chapter 4, Section 4.1.9, Visual Resources, a Class B visual quality means that, "the visual environment is made up of a combination of outstanding natural and manmade physical features and those that are common to the region."

Under this alternative, as represented by projected traffic volumes for the year 2020 (see Section 5.1.3), viewer sensitivity would remain moderate (1,000 to 2,999 average annual daily traffic) near the Area 25 Renewable Energy Zone (approximately 3,000 average daily trips). While some of this increase in traffic is associated with NNSS activities under this alternative, approximately 2,960 of the projected 3,000 average daily trips near the Renewable Energy Zone would occur without traffic related to NNSS activities and operations, and roadway viewers near Area 25 comprise mostly traffic unrelated to the NNSS.

The solar power generation facility would be composed of mirror solar fields (making up 90 percent of the facility footprint), power blocks, an office and maintenance building, parking area, laydown area, switchyard, stormwater detention basin(s), and an area designated for bioremediation of soil contaminated by heat transfer fluid, petroleum, or other process chemicals. Construction of this 240-megawatt solar power generation facility would introduce considerable infrastructure over approximately 2,400 acres of land in the Area 25 Renewable Energy Zone that would be directly visible in middleground (0.5 to 4 miles) views from U.S. Route 95 and Amargosa Valley. For purposes of this analysis, approximately 10 miles of new 230-kilovolt transmission line were assumed to be required to export power off site. The transmission line structures would likely be tall, single-poled or lattice steel structures. The transmission line would occur within the foreground and middleground of views from U.S. Route 95 or other sensitive viewing areas, resulting in an adverse visual effect because the transmission line would introduce industrial-looking features into a landscape largely absent of such views and where the existing utility lines, if present, are wooden-poled structures. The visibility of new steel poles associated with the transmission lines could be reduced by painting the structures so that they appear to recede into the surrounding environment (BLM 2008a) (refer to Chapter 7, Section 7.9, Visual Resources). Solar facilties also potentially could be seen from key observation points available from higher elevations within Death Valley National Park. Construction and operation of the commercial solar power generation facility would require a separate NEPA review (including a visual impacts analysis) if a specific design were proposed, including analysis of visual impacts on Death Valley National Park. DOE/NNSA would require a proponent for a commercial solar power generation project in Area 25 of the NNSS to work with Death Valley National Park to reduce these visual impacts.

Construction of the solar power generation facility would create temporary changes in views of Area 25. Construction activities would require vegetation removal and grading, have the potential to create dust clouds, and introduce considerable heavy equipment and associated vehicles into middleground views from U.S. Route 95 and Amargosa Valley. Dust control would be implemented during construction. The location of construction staging areas and associated facilities would also be visible in the middleground. Because construction would likely not occur over an extended period, visual changes resulting from construction are considered short-term and temporary. Viewers would not be accustomed to seeing construction in Area 25 because construction operations are not common in this portion of the study area. While construction would be temporary, visual effects would be adverse because viewers are moderately sensitive and construction is not a common visual element.

Operation of any concentrating solar power generation facility of this size would introduce a considerable source of glare from the reflective surfaces of the solar collectors, as well as use of nighttime lighting for security. It would also alter the existing visual character of the landscape, which is largely undeveloped, be visible to moderately sensitive viewers, and reduce the existing visual quality from a Class B to a Class C rating (meaning that, "the visual environment is made up of natural and manmade physical features that are common to the region") because of the intrusion of manmade elements. There is no mitigation to reduce adverse effects associated with the proposed solar array; therefore, this effect is considered adverse and unavoidable. Visual resources Mitigation Measure 1, "Apply Minimum Lighting Standards" (refer to Chapter 7, Section 7.9, Visual Resources), would reduce the potential for overlighting facilities, but the introduction of nighttime light where none presently exists would be adverse and unavoidable.

5.1.9.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, new facilities would be built or existing facilities would be reconfigured, an existing electrical transmission line would be upgraded, and geothermal and solar renewable energy projects could be implemented at the NNSS. Portions of the study area visible from U.S. Route 95 and Amargosa Valley have a Class B scenic quality rating, as established in the *1996 NTS EIS* (DOE 1996c). Under this alternative, as represented by projected traffic volumes for the year 2020 (see Section 5.1.3), viewer sensitivity would change from moderate to high near Mercury (5,310 average daily trips) and near the Area 25 Renewable Energy Zone (3,030 average daily trips). However, while some of the increase near the Area 25 Renewable Energy Zone is associated with NNSS activities under this alternative, approximately 2,960 of the projected 3,030 average daily trips would occur without traffic related to the Expanded Operations Alternative. In addition, roadway viewers near Area 25 are composed mostly of traffic unrelated to the NNSS.

A new two-story, 85,000-square-foot security facility would be constructed in Area 23, replacing existing, outdated buildings, and would be visible in the background (4+ miles) from U.S. Route 95 near Mercury. Construction activities would not be very visible given the distance and presence of other structures that would screen most construction activities. Once built, this new security building would blend with existing buildings at this location and retain the existing visual character. There would be no adverse effects.

Approximately 200,000 square feet of additional facilities would be added at Desert Rock Airport near Mercury. These changes would include lengthening the existing runway and constructing new hangars and support facilities. Construction of these facilities would require vegetation removal and grading, has the potential to create dust clouds, and would introduce considerable heavy equipment and associated vehicles into middleground views from U.S. Route 95. Dust control would be implemented during construction. The location of construction staging areas and associated facilities would also be visible in the middleground. Because construction would not likely occur over an extended period, visual changes resulting from construction are considered short-term and temporary. Viewers would not be accustomed to seeing construction at this location because construction operations are not common in this portion of the study area. While construction would be temporary, visual effects would be adverse because viewers are highly sensitive and construction is not a common visual element. Once in operation, these features would be visible in the middleground of views from U.S. Route 95, be visible to highly sensitive viewers, introduce nighttime lighting for security, have an adverse effect on visual resources because of the intrusion of manmade elements, and reduce the existing visual quality from a Class B to a Class C rating. This could introduce an adverse effect based on the presence of sensitive receptors and the distance from receptors. Visual resources Mitigation Measure 1, "Apply Minimum Lighting Standards" (refer to Chapter 7, Section 7.9, Visual Resources), would reduce the potential for overlighting facilities, but the introduction of nighttime light where none presently exists would be adverse and unavoidable. The scale and coloring of facilities would play a large part in the visual prominence of the new facilities. The BLM measure of reducing the visibility of new structures (BLM 2008a) would help reduce the visual appearance of such facilities from U.S. Route 95 by painting buildings and structures or using materials to make them appear to recede into the surrounding environment (refer to Chapter 7, Section 7.9, Visual Resources), but the effects would be adverse and unavoidable.

The existing 138-kilovolt electrical transmission line and poles would be upgraded between Mercury and Valley Substation in Area 2, paralleling the existing wooden-poled transmission line with a single steel pole structure. The upgraded transmission line would occur within the background of views from U.S. Route 95. Although a different material is being used, a visual change would not be substantial because a single pole structure similar to the existing structure would be used and the distance would make these changes imperceptible from U.S Route 95. The existing line and poles would be removed and the new line would not alter the existing visual character. Effects would not be adverse.

The existing Mercury would be reconfigured under the Expanded Operations Alternative. Demolition of specific facilities and construction of new facilities would not greatly alter the existing visual character or degrade the existing visual quality because new buildings would blend with the existing buildings at this location and would not create a new, substantial source of nighttime lighting. This would retain the existing visual character. In addition, modifications would be indiscernible due to the distance from U.S. Route 95, which is over 4 miles from the roadway. Effects would not be adverse.

Under the Expanded Operations Alternative, a small 5-megawatt photovoltaic solar power generation facility would be built on 50 acres of land in Area 6, but would not be visible from public vantage points. This small photovoltaic solar power generation facility also would not likely be seen from viewpoints in

Death Valley National Park due to the presence of mountainous terrain in the western portion of the NNSS. In addition, because this facility would use a photovoltaic system instead of mirrors, the level of reflectivity would be substantially less than that of a concentrating solar power generation facility.

Construction and operation of one or more commercial solar power generation facilities with a combined 1,000-megawatt capacity in Area 25 would have adverse visual effects because the facility(ies) would introduce considerable infrastructure over approximately 10,000 acres of land, a large portion of which would be directly visible in middleground views from U.S. Route 95 (see Chapter 3, Figure 3–2). Portions of the study area visible from U.S. Route 95 and Amargosa Valley have a Class B scenic quality rating, and viewer sensitivity is high. Construction and operation of such commercial solar power generation facility(ies) would require a separate NEPA review (including a visual impacts analysis) if a specific design were proposed, including analysis of visual impacts on Death Valley National Park. DOE/NNSA would require a proponent for a commercial solar power generation project on the NNSS to work with Death Valley National Park to reduce these visual impacts.

Construction of the solar power generation facility(ies) would create temporary changes in views of Area 25. Construction activities would require vegetation removal and grading, have the potential to create dust clouds, and introduce considerable heavy equipment and associated vehicles into middleground views from U.S. Route 95 and Amargosa Valley. Dust control would be implemented during construction. The location of construction staging areas and associated facilities would also be visible in the middleground. Because construction would not likely occur over an extended period, visual changes resulting from construction are considered short-term and temporary. Viewers would not be accustomed to seeing construction in Area 25 because construction operations are not common in this portion of the study area. While construction would be temporary, visual effects would be adverse because viewers are highly sensitive and construction is not a common visual element.

Approximately 10 miles of new 500-kilovolt transmission line were assumed to be required to export power off site from commercial solar power generation facilities. The transmission line structures would likely be tall, single-poled or lattice steel structures. The transmission line would occur within the foreground and middleground of views from U.S. Route 95 or other sensitive viewing areas, resulting in an adverse visual effect because the transmission line would introduce industrial-looking features into a landscape largely absent of such views and where the existing utility lines, if present, are wooden-poled structures. The visibility of new steel poles associated with the transmission lines could be reduced by implementing the BLM measure of painting the structures to make them appear to recede into the surrounding environment (BLM 2008a) (refer to Chapter 7, Section 7.9, Visual Resources). The solar facilties also potentially could be seen from key observation points available from higher elevations within Death Valley National Park. As described above, DOE/NNSA would require a proponent for a commercial solar power generation project in Area 25 of the NNSS to work with Death Valley National Park to reduce these visual impacts.

Operation of the concentrating solar power generation facility(ies) would introduce a considerable source of glare from the reflective surfaces of the solar collectors, as well as use of nighttime lighting for security. It would also alter the existing visual character of the landscape, which is largely undeveloped, and reduce the existing visual quality from a Class B to a Class C rating because of the intrusion of manmade elements. Visual resources Mitigation Measure 1, "Apply Minimum Lighting Standards" (refer to Chapter 7, Section 7.9, Visual Resources), would reduce the potential for overlighting facilities, but the introduction of nighttime light where none presently exists would be adverse and unavoidable. There is no mitigation to reduce adverse effects associated with the proposed solar array; therefore, this effect is considered adverse and unavoidable. No mitigation is proposed.

A Geothermal Demonstration Project would introduce facilities associated with capturing, converting, and transferring geothermal power, such as a power plant, transmission lines, and associated infrastructure, that would occur over 30 to 50 acres of land. If facilities were built along U.S. Route 95, they would be visible in the foreground or middleground from U.S. Route 95 and Amargosa Valley and potentially introduce built features and nighttime lighting into a landscape where none presently exists, altering the existing visual character and reducing visual quality. This could introduce an adverse effect based on the presence of sensitive receptors and distance from receptors. Visual resources Mitigation Measure 1, "Apply Minimum Lighting Standards" (refer to Chapter 7, Section 7.9, Visual Resources) would reduce the potential for overlighting facilities, but the introduction of nighttime light where none presently exists would be adverse and unavoidable. The BLM measure of reducing the visibility of new structures would help reduce the visual appearance of such facilities from U.S. Route 95 by painting buildings and structures or using materials to make them appear to recede into the surrounding environment (BLM 2008a) (refer to Chapter 7, Section 7.9, Visual Resources), but effects would be adverse and unavoidable.

5.1.9.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, while viewer sensitivity would change from moderate to high near Mercury (4,880 average daily trips), there would be no change to existing buildings visible at the NNSS or to the existing visual environment from activities and operations. Under this alternative, as represented by projected traffic volumes for the year 2020 (see Section 5.1.3), viewer sensitivity would remain moderate near the Area 25 Renewable Energy Zone (2,980 average daily trips). Approximately 2,960 of the projected 2,980 average daily trips would occur without traffic related to the Reduced Operations Alternative, and roadway viewers near Area 25 are mostly composed of traffic unrelated to the NNSS. Under the Reduced Operations Alternative, construction of a commercial solar power generation facility in Area 25 may occur and have adverse visual effects because the facility would introduce considerable infrastructure over approximately 1,200 acres of land for a 100-megawatt facility, a large portion of which would be directly visible in middleground views from U.S. Route 95 (see Chapter 3, Figure 3–3). Portions of the study area visible from U.S. Route 95 have a Class B scenic quality rating and viewer sensitivity is moderate. In addition, this solar facility potentially could be seen from key observation points available from higher elevations within Death Valley National Park. Construction of the commercial solar power generation facility would require a separate NEPA review (including a visual impacts analysis) if a specific design were proposed, including analysis of visual impacts on Death Valley National Park. DOE/NNSA would require a proponent for a commercial solar power generation project on the NNSS to work with Death Valley National Park to reduce these visual impacts.

Operation of any concentrating solar power generation facility of this size would introduce a considerable source of glare from the reflective surfaces of the solar collectors, as well as use of nighttime lighting for security. It would also alter the existing visual character of the landscape, which is largely undeveloped, and reduce the existing visual quality from a Class B to a Class C rating because of the intrusion of manmade elements. There is no mitigation to reduce adverse effects associated with the proposed solar array; therefore, this effect is considered adverse and unavoidable. Visual resources Mitigation Measure 1, "Apply Minimum Lighting Standards" (refer to Chapter 7, Section 7.9, Visual Resources), would reduce the potential for overlighting facilities, but the introduction of nighttime light where none presently exists would be adverse and unavoidable.

5.1.10 Cultural Resources

Cultural resources include prehistoric and historic archaeological districts, sites, buildings, structures, or objects created or modified by human activity. Cultural resources also include traditional cultural properties—properties that are eligible for inclusion on the National Register of Historic Places (NRHP) because of their association with cultural practices or beliefs of a living community that are (a) rooted in that community's history and (b) important in maintaining the continuing cultural identity of the community (Parker and King 1998). Under Federal regulations, a significant cultural resource designated a "historic property" warrants consideration with regard to potential adverse impacts resulting from proposed Federal actions (DOE 2002e). A cultural resource is a historic property if its attributes make it eligible for listing in the NRHP. Federal agencies also are required to consider the effects of their actions on sites, locations, and other resources that are of cultural or religious significance to American Indians, as established under the 1978 American Indian Religious Freedom Act. American Indian graves, associated funerary objects, and objects of cultural patrimony are protected by the 1990 Native American Graves Protection and Repatriation Act (Public Law [P.L.] 101-601).

The ROI for cultural resources is 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. Based on current knowledge of cultural resources in the region, all undisturbed areas could potentially contain cultural resources.

Cultural resources impacts in this SWEIS are assessed based on the estimated number of sites that may be affected by land-disturbing activities associated with ongoing and proposed projects at the NNSS, the TTR, and environmental restoration sites on the Nevada Test and Training Range. Estimates are based on the site densities of known cultural resources in each hydrographic basin; these density values were extrapolated to estimate the number of sites that may exist in each hydrographic basin where program facilities and activities may be located. Those impacts would affect cultural resources sites in general (both prehistoric and historic), as well as sites that would be considered eligible for inclusion on the NRHP. An area's potential for containing cultural resources sites is strongly site-specific and is influenced by factors such as presence of water, a food source, shelter (i.e., caves or rock alcoves), a source of materials for building shelters, and less tangible but equally important factors such as features that may have spiritual value to a culture. While all areas of the NNSS have the potential to possess cultural resources, areas with the highest number of recorded cultural resources are Rainier and Pahute Mesas in the northwest (largely within the Fortymile Canyon–Buckboard Mesa Hydrographic Basin), followed by Jackass Flats in the southwest (within the Fortymile Canyon–Jackass Flats Hydrographic Basin) and Yucca Flat in the east (within the Yucca Flat Hydrographic Basin) (DOE 2010a). In general, any new development on the NNSS would be located near or in similar terrain as existing facilities for which cultural resources surveys have been conducted. Although it is not possible to predict with a high degree of certainty the potential for a particular area to contain cultural resources, the record provided by cultural resources surveys conducted at the NNSS provides a means to estimate site densities and, therefore, the likelihood of encountering a cultural resources site within a given hydrographic basin. By multiplying the acres that would be disturbed within a particular hydrographic basin by the calculated site density for that basin, the number of sites that may be affected was estimated for this SWEIS. There are a number of uncertainties associated with this approach; however, it is adequate for the purpose of estimating potential cultural resources impacts at the NNSS resulting from ongoing and proposed activities addressed in this SWEIS. **Table 5–46** provides the site densities (in number of sites per acre) for each hydrographic basin on the NNSS that were used in this analysis.

Table 5–46 Approximate Nevada National Security Site Cultural Resources Site Densities by Hydrographic Basin

Hydrographic Basin	***Acres Surveyed***	***Number of Prehistoric Sites*** [a]	***Prehistoric Sites per Acre***	***Number of Historic Sites*** [a]	***Historic Sites per Acre***	***Untyped Sites*** [a]	***Untyped Sites per Acre***	***Total Sites*** [a]	***Total Sites per Acre***	***NRHP-Eligible Sites*** [a]	***NRHP Sites per Acre***
Mercury Valley	338	3	0.009	3	0.009	0	0.0	6	0.018	2	0.006
Rock Valley	445	18	0.040	1	0.002	0	0.0	19	0.043	4	0.009
Fortymile Canyon–Jackass Flats	575	367	0.640	16	0.055	9	0.031	392	0.680	120	0.210
Fortymile Canyon–Buckboard Mesa	6,138	445	0.073	3	0.001	54	0.009	502	0.082	346	0.056
Oasis Valley	3,477	125	0.036	1	0.03	2	0.001	128	0.037	49	0.014
Gold Flat	6,371	264	0.041	3	0.001	1	0.0001	268	0.042	169	0.027
Kawich Valley	2,635	72		2		8		82		58	
Emigrant Valley/ Groom Lake Valley	60	5	0.083	0	0.0	0	0.0	5	0.083	0	0.0
Yucca Flat	9,030	309	0.034	69	0.008	17	0.002	395	0.044	176	0.020
Frenchman Flat	9,047	109	0.012	45	0.005	0	0.0	154	0.017	58	0.006
Totals	**38,116**	**1,717**	**0.045**	**143**	**0.004**	**91**	**0.002**	**1,951**	**0.051**	**982**	**0.026**

NRHP = National Register of Historic Places.
[a] Source: Chapter 4, Table 4–47.

Cultural resources impacts would potentially occur as a result of activities that involve modification of buildings and ground disturbance in previously undisturbed locations. These impacts would occur through drilling; grading; excavation; fencing; training and exercises in remote areas; cleanup activities; construction of buildings, roads, firebreaks, and utilities; and building modification, decontamination, or demolition. Vehicular and pedestrian access to areas containing cultural resources would increase the potential for vandalism or unauthorized artifact collection to occur that could affect archaeological sites and archaeologically sensitive areas.

Although increased access to areas containing cultural resources could raise the potential for vandalism or unauthorized artifact collection, these are impacts that cannot be reasonably estimated; however, by not disclosing cultural resources site locations and administrative controls, the DOE/NNSA NSO would reduce these kinds of impacts to the maximum extent possible.

The precise number of cultural resources affected by the DOE/NNSA NSO activities will be unknown until cultural resource studies are completed prior to program activities described under the three alternatives. Cultural resource surveys and Section 106 consultations would be completed prior to ground-disturbing activities in previously unsurveyed areas, and impacts on sites eligible for listing in the NRHP would be avoided or mitigated through measures described in Chapter 7. Historic NNSS buildings and structures designated for modification, decommissioning, or demolition would be evaluated for historical significance, and impacts on those buildings and structures eligible for listing in the NRHP would be mitigated through measures described in Chapter 7.

The estimated cultural resources impacts do not take into account that, for many project sites, impacts would be avoided completely by identifying their locations during Section 106 surveys and relocating or redesigning project features. In addition, this analysis does not take into account mitigation measures that may reduce potential impacts on significant cultural resources to a “no adverse effect” level.

In addition to impacts from DOE/NNSA activities, the development of one or more commercial solar power generation facilities within the Fortymile Canyon–Jackass Flats Hydrographic Basin under each of the alternatives and a Geothermal Demonstration Project under the Expanded Operations Alternative would affect additional cultural resources. There is no specific schedule for constructing either solar power generation facilities or a Geothermal Demonstration Project at the NNSS. Under the No Action Alternative, up to 2,650 acres of previously undisturbed land in the Fortymile Canyon–Jackass Flats Hydrographic Basin, would be disturbed for a solar power generation facility, which would affect an estimated 3,511 cultural resources sites, 1,089 of which are eligible for inclusion on the NRHP. Under the Expanded Operations Alternative, up to 10,300 acres of previously undisturbed land would be disturbed for one or more solar power generation facilities, affecting an estimated 13,647 cultural resources sites, 4,233 of which are eligible for inclusion on the NRHP. A Geothermal Demonstration Project would disturb up to 50 acres of land and result in impacts on an estimated two cultural resources sites, one of which would be NRHP-eligible. Under the Reduced Operations Alternative, up to 1,200 acres would be disturbed for a solar power generation facility, affecting an estimated 1,590 cultural resources sites, 493 of which would be eligible for inclusion on the NRHP. This SWEIS addresses the potential impacts of such a project to enable DOE/NNSA to make a decision about whether to make land and infrastructure currently under DOE/NNSA control available for use by a commercial entity.

The following discussion of potential cultural resources impacts resulting from DOE/NNSA activities under each of the three alternatives addressed in this SWEIS evaluates the impacts by mission and program under each of the three alternatives. Most of the above discussion applies to sections of this SWEIS that address cultural resources impacts at RSL, NLVF, the TTR, and environmental restoration sites on the Nevada Test and Training Range.

5.1.10.1 No Action Alternative

Table 5–47 displays the estimated number of cultural resources sites that potentially would be affected by DOE/NNSA activities at the NNSS and environmental restoration sites on the Nevada Test and Training Range under the No Action Alternative. Overall, under the No Action Alternative, 4,460 acres of land would be disturbed, with impacts on an estimated 1,855 cultural resources sites, 575 of which would be eligible for inclusion on the NRHP. This overall total includes both DOE/NNSA activities and a potential 240-megawatt commercial solar power generation facility and associated transmission lines, as discussed below in Section 5.1.10.1.3. DOE/NNSA activities would disturb up to 1,810 acres of land and affect an estimated 53 cultural resources sites. About 18 affected cultural resources sites would be eligible for inclusion on the NRHP. Mission- and program-level impacts on cultural resources under the No Action Alternative are addressed in the following discussion.

5.1.10.1.1 National Security/Defense Mission

National Security/Defense Mission activities occur at a variety of locations on the NNSS, but primarily in the Yucca Flat and Frenchman Flat Hydrographic Basins and, to a lesser extent, in the Fortymile Canyon–Jackass Flats Basin. Under the No Action Alternative, National Security/Defense Mission activities at the NNSS would disturb up to 700 acres of previously undisturbed land. This level of land disturbance would potentially affect an estimated 24 cultural resources sites, 10 of which may be eligible for inclusion on the NRHP.

Stockpile Stewardship and Management Program. Stockpile Stewardship and Management Program activities occur primarily at existing facilities within the Yucca Flat and Frenchman Flat Hydrographic Basins. Although most Stockpile Stewardship and Management Program activities are conducted at existing facilities, some activities have the potential to disturb previously undisturbed areas and affect cultural resources. These include high-explosives experiments at locations other than BEEF, drillback operations, and Office of Secure Transportation training and exercises. These potential Stockpile Stewardship and Management Program activities would disturb up to 685 acres of previously undisturbed land and affect an estimated 21 cultural resources sites. Of those potentially affected cultural resources sites, an estimated 9 would be eligible for inclusion on the NRHP.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. The NNSS would provide research, development, and training in support of the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs, including arms control and improvised nuclear device dispositioning and forensics activities. Most of these activities would occur at existing facilities. No new facilities would be constructed, but existing buildings likely would be modified. Structural modifications would have the potential to affect potentially historic buildings. Such impacts on historic buildings would be mitigated using the measures identified in Chapter 7.

Releases of chemicals and biological simulants could occur throughout the NNSS, but would most likely occur in areas within the Yucca Flat, Frenchman Flat, and Fortymile Canyon–Jackass Flats Hydrographic Basins. Although many of these activities would be conducted at existing facilities or disturbed areas, for purposes of this analysis, it was assumed that all would occur on previously undisturbed land. These release activities would potentially disturb up to 15 acres of previously undisturbed land and affect an estimated three cultural resources sites, one of which would be eligible for inclusion on the NRHP.

Work for Others Program. Under the No Action Alternative, Work for Others Program activities would not disturb previously undisturbed land areas.

Table 5–47 No Action Alternative – Estimated Number of Potentially Affected Cultural Resources Sites on the Nevada National Security Site and Nevada Test and Training Range (except Tonopah Test Range)

Program	*Area Disturbed (acres)* [a]	*Assumed Primary Locations of Activities by Hydrographic Basin*	*Number of Sites* [b]	*Number of NRHP-Eligible Sites* [b]
Stockpile Stewardship and Management	343 343	Frenchman Flat Yucca Flat	6 15	2 7
Nuclear Emergency Response, Nonproliferation, and Counterterrorism	5 5 5	Frenchman Flat Yucca Flat Fortymile Canyon–Jackass Flats	0 [c] 0 [c] 3	0 [c] 0 [c] 1
Work for Others	None	Frenchman Flat Yucca Flat Mercury Valley Fortymile Canyon–Jackass Flats	0	0
Total National Security/Defense Mission	700		24	10
Waste Management (Area 5 RWMC) [d]	190	Frenchman Flat	0	0
Environmental Restoration Soils Project [e]	320 100	Frenchman Flat Emigrant Valley	5 8	2 0 [c]
Environmental Restoration Underground Test Area Project	167 167 167	Frenchman Flat Yucca Flat Oasis Valley [f]	3 7 6	1 3 2
Total Environmental Management Mission	1,110		29	7
General Site Support and Infrastructure	None	Frenchman Flat Mercury Valley Yucca Flat	0	0
Renewable Energy (DOE/NNSA)	None	None	0	0
Total Nondefense Mission	None		0	0
Total DOE/NNSA	**1,810**		**53**	**18**
240-MW Commercial Solar Power Generation Facility	2,650	Fortymile Canyon–Jackass Flats	1,802	557
Total Non-DOE/NNSA	**2,650**		**1,802**	**557**
Total	**4,460**		**1,855**	**575**

MW = megawatts; NRHP = National Register of Historic Places; RWMC = Radioactive Waste Management Complex.

[a] Where a program could affect multiple hydrographic basins, if the potentially disturbed area for the basin was known, it was used; if not, the total potentially disturbed acres for that program were equally apportioned among the affected basins. Area disturbed for each program may not add up to the total area disturbed for its applicable mission due to rounding.

[b] The number of sites was calculated by multiplying the number of acres potentially disturbed by the Total Sites Per Acre or NRHP Sites Per Acre columns, as appropriate, from Table 5–46. Where programs could occur in more than one hydrographic basin, the range of numbers of potentially affected cultural resources sites was used.

[c] Calculated value less than 0.5 sites per acre.

[d] The 740-acre Area 5 RWMC has been surveyed for cultural resources and no NRHP-eligible sites were found.

[e] The Small Boy and Project 57 sites are disturbed, but are considered by the DOE/NNSA Nevada Site Office to be historically significant sites.

[f] The site density for the Underground Test Area Project on the Nevada Test and Training Range was assumed to be the same as the density for the Oasis Valley Hydrographic Basin because most of the groundwater characterization and monitoring wells that would be developed on U.S. Air Force land would be adjacent to the northwestern portions of the Nevada National Security Site.

5.1.10.1.2 Environmental Management Mission

Activities under the Environmental Management Mission would potentially disturb up to 1,110 acres of previously undisturbed land. However, for reasons discussed for the separate programs, the estimated number of potentially affected cultural resources sites would be 29, lower than expected, with 9 of those sites eligible for inclusion on the NRHP.

Waste Management Program. Under the No Action Alternative, waste management facilities would be operated in Areas 5, 6, 9, 11, and 23. The Area 5 RWMC would continue to operate within the 740-acre area set aside for waste management and would be the only waste management facility that would disturb previously undisturbed land at the NNSS. Up to 190 acres of land would be disturbed for disposal of LLW and MLLW. The entire 740-acre Area 5 RWMC has been surveyed for cultural resources and no significant cultural resources were found. Therefore, Waste Management Program activities under the No Action Alternative would not affect significant cultural resources.

Environmental Restoration Program. Drilling of groundwater characterization and monitoring wells would occur on the NNSS and Nevada Test and Training Range. Development of these wells has the potential to disturb up to 500 acres of previously undisturbed land and affect an estimated 16 cultural resources sites, 6 of which would be eligible for inclusion on the NRHP. Ground-disturbing soils remediation project activities would occur at the Small Boy site in the Frenchman Flat area and at the Project 57 site on the Nevada Test and Training Range. The DOE/NNSA NSO considers both of these sites eligible for inclusion on the NRHP, although the State Historic Preservation Office has not been formally consulted. When such consultation occurs, if the State Historic Preservation Office concurs with the DOE/NNSA NSO's determination, appropriate mitigation measures would be implemented, as discussed in Chapter 7. However, based on calculated site densities in the two affected basins (Frenchman Flat and Emigrant Valley), 13 resources sites may be impacted by Soils Project activities, 2 of which may be eligible for inclusion on the NRHP. The Industrial Sites Project includes identifying and decontaminating and/or decommissioning facilities through clean closure or closure in place. Actions associated with the Industrial Sites Project have the potential to cause the alteration or neglect of a historic building, thereby affecting the character-defining features that make the building eligible for listing in the NRHP. Before performing any actions that would adversely affect these buildings, the DOE/NNSA NSO would conduct appropriate surveys and consultations pursuant to Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C. 470 et seq.) and take mitigative actions, as discussed in Chapter 7.

5.1.10.1.3 Nondefense Mission

DOE/NNSA activities under the Nondefense Mission are not expected to impact cultural resources; however, development of up to 240 megawatts of solar energy generation by commercial interests would impact cultural resources, as discussed below, under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. Under the No Action Alternative, small projects to maintain and repair NNSS facilities would occur at existing facilities in previously disturbed areas and would not affect archaeological resources. However, modification of potentially historic buildings would affect potentially historic structures that are not yet evaluated for eligibility for the NRHP.

Conservation and Renewable Energy Program. DOE/NNSA would undertake measures to increase energy efficiency, fuel efficiency, and water conservation. These actions would occur on existing facilities, some of which may be considered historic properties.

In addition to improving energy efficiency, fuel efficiency, and water conservation at existing facilities, under the No Action Alternative, DOE/NNSA would also consider allowing development of a commercial 240-megawatt solar power generation facility in Area 25 of the NNSS. Such a facility would also require an additional electrical transmission line to interconnect with the existing main transmission system to the south of the NNSS. A total of about 10 miles of new transmission line, disturbing about

250 acres of previously undisturbed land off the NNSS, was assumed in this analysis. The commercial solar power generation facility and associated transmission line would disturb a total of about 2,650 acres of land and affect an estimated 1,802 cultural resources sites, of which 557 would be considered eligible for inclusion on the NRHP.

Other Research and Development Programs. The Nevada National Environmental Research Park in Area 5 contains two existing facilities used to support outside scientific research on long-term environmental health. Future research programs could include activities, such as habitat reclamation and remediation, that have the potential to affect cultural resources because of ground disturbance and increased access to previously undisturbed land. There are no such projects proposed at this time; if there were, they would be evaluated on a case-by-case basis, and all appropriate steps would be taken pursuant to Section 106 of the NHPA.

5.1.10.2 Expanded Operations Alternative

As shown in **Table 5–48**, under the Expanded Operations Alternative, DOE/NNSA activities at the NNSS and environmental restoration sites on the Nevada Test and Training Range would disturb up to 25,877 acres of previously undisturbed land, including about 10,300 acres for one or more commercial solar power generation facilities and associated transmission lines (discussed in Section 5.1.10.2.3). This would affect an estimated 7,688 cultural resources sites, 2,447 of which would be eligible for inclusion on the NRHP. DOE/NNSA activities would potentially affect 682 cultural resources sites, 283 of which would be eligible for inclusion on the NRHP. Mission- and program-level impacts on cultural resources are addressed in the following discussion.

5.1.10.2.1 National Security/Defense Mission

National Security/Defense Mission activities occur at a variety of locations on the NNSS, but primarily in the Yucca Flat and Frenchman Flat Hydrographic Basins and, to a lesser extent, in the Fortymile Canyon–Jackass Flats Basin. Under the Expanded Operations Alternative, National Security/Defense Mission activities at the NNSS would disturb up to 13,455 acres of previously undisturbed land. This land disturbance would potentially affect an estimated 624 cultural resources sites. Of those sites, 265 would be eligible for inclusion on the NRHP.

Stockpile Stewardship and Management Program. As under the No Action Alternative, Stockpile Stewardship and Management Program activities under the Expanded Operations Alternative would occur primarily at existing facilities within the Yucca Flat and Frenchman Flat Hydrographic Basins. Although most Stockpile Stewardship and Management Program activities would be conducted at existing facilities, some activities could potentially disturb previously undisturbed areas and affect cultural resources. These include high-explosives experiments at locations other than BEEF, drillback operations, and Office of Secure Transportation training and exercises along NNSS roads. By far, the largest single land-disturbing activity would be development of a new Office of Secure Transportation training facility in Area 17, which would disturb up to 10,000 acres. Overall, these potential Stockpile Stewardship and Management Program activities would disturb up to 12,805 acres of previously undisturbed land and affect an estimated 525 cultural resources sites (440 at the proposed training facility in Area 17), of which about 236 would be eligible for inclusion on the NRHP.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Proposed activities under the Expanded Operations Alternative would disturb 15 acres for conducting releases of chemicals and biological simulants, as well as 100 acres each for an Arms Control Treaty Verification Test Bed and a Mock Urban Complex. This disturbance of 215 acres of previously undisturbed land would affect an estimated 16 cultural resources sites, of which 6 would be eligible for inclusion on the NRHP.

Table 5–48 Expanded Operations Alternative – Estimated Numbers of Potentially Affected Cultural Resources Sites on the Nevada National Security Site and Nevada Test and Training Range (except Tonopah Test Range)

Program	*Area Disturbed (acres)* [a]	*Assumed Primary Locations of Activities by Hydrographic Basin*	*Number of Sites* [b]	*Number of NRHP-Eligible Sites* [b]
Stockpile Stewardship and Management	1,403 11,403	Frenchman Flat Yucca Flat	24 501	8 228
Nuclear Emergency Response, Nonproliferation and Counterterrorism	100 100 15	Frenchman Flat Yucca Flat Fortymile Canyon–Jackass Flats	2 4 10	1 2 3
Work for Others	109 109 109 109	Frenchman Flat Yucca Flat Mercury Valley Fortymile Canyon–Jackass Flats	2 5 2 74	1 2 1 23
Total National Security/Defense Mission	13,455		624	265
Waste Management (Area 5 RWMC) [c]	600	Frenchman Flat	0	0
Waste Management Sanitary Landfill Facility (Area 23)	15	Mercury Valley	0 [d]	0 [d]
Waste Management Landfill Facility (Area 25)	20	Fortymile Canyon–Jackass Flats	14	4
Environmental Restoration Soils Project [e]	320 100	Frenchman Flat Emigrant Valley	5 8	2 0
Environmental Restoration Underground Test Area Project	167 167 167	Frenchman Flat Yucca Flat Oasis Valley	3 7 6	1 3 2
Total Environmental Management Mission	1,555		43	12
General Site Support and Infrastructure	156 156 156	Frenchman Flat Mercury Valley Yucca Flat	3 3 7	1 1 3
Renewable Energy (DOE/NNSA)	50	Yucca Flat	2	1
Total Nondefense Mission	517		15	6
Total DOE/NNSA	**15,527**		**682**	**283**
1,000 Megawatts of Commercial Solar Power Generation Facilities	10,300	Fortymile Canyon–Jackass Flats	7,004	2,163
Geothermal Demonstration Project	50	Yucca Flat	2	1
Total Non-DOE/NNSA	**10,350**		**7,006**	**2,164**
Total	**25,877**		**7,688**	**2,447**

NRHP = National Register of Historic Places; RWMC = Radioactive Waste Management Complex.

[a] Where a program could affect multiple hydrographic basins, if the potentially disturbed area for the basin was known, it was used; if not, the total potentially disturbed acres for that program were equally apportioned among the affected basins. The area disturbed for each program may not add up to the total area disturbed for its applicable mission due to rounding.

[b] The number of sites was calculated by multiplying the number of acres potentially disturbed by the Total Sites Per Acre or NRHP Sites Per Acre columns, as appropriate, from Table 5–46. Where programs could occur in more than one hydrographic basin, the range of numbers of potentially affected cultural resources sites was used.

[c] The 740-acre Area 5 RWMC has been surveyed for cultural resources and no NRHP-eligible sites were found.

[d] The calculated value is less than 0.5 sites.

[e] The Small Boy and Project 57 sites are disturbed, but are considered by the DOE/NNSA Nevada Site Office to be historically significant sites.

[f] The site density for the Underground Test Area Project on the Nevada Test and Training Range was assumed to be the same as the density for the Oasis Valley Hydrographic Basin because most of the groundwater characterization and monitoring wells that would be developed on U.S. Air Force land would be adjacent to the northwestern portions of the Nevada National Security Site.

Work for Others Program. Construction of various new test beds and additional aviation-related facilities at various locations on the NNSS, as well as establishment of an area to conduct radioactive tracer experiments, would disturb an estimated 435 acres of land. This disturbance would result in impacts on an estimated 83 cultural resources sites, of which 27 would be eligible for inclusion on the NRHP.

5.1.10.2.2 Environmental Management Mission

Activities under the Environmental Management Mission would potentially disturb up to 1,555 acres of previously undisturbed land. However, for reasons discussed for the separate programs, the number of potentially affected cultural resources sites was estimated to be 43, of which 12 would be eligible for inclusion on the NRHP.

Waste Management Program. Under the Expanded Operations Alternative, waste management facilities would be operated in Areas 5, 6, 9, 11, and 23. The Area 5 RWMC would continue to operate within the 740-acre area set aside for waste management and would use up to 600 acres of land for disposal of LLW and MLLW. The entire 740-acre Area 5 RWMC has been surveyed for cultural resources and no significant cultural resources were found. Sanitary waste disposal facilities would be developed in Areas 23 (15 acres) and 25 (20 acres). Development of these sanitary waste disposal sites would affect an estimated 14 cultural resources sites, 4 of which would be eligible for inclusion on the NRHP. All other operations would continue within their current capacities.

Environmental Restoration Program. Activities under the Environmental Restoration Program would be the same as those described under the No Action Alternative. Therefore, impacts on cultural resources would be the same as those described under the No Action Alternative.

5.1.10.2.3 Nondefense Mission

DOE/NNSA activities under the Nondefense Mission would potentially affect up to 15 cultural resources sites, 6 of which may be considered eligible for inclusion on the NHRP. Development of up to 1,000 megawatts of solar energy generation by commercial interests would impact cultural resources, as discussed below, under the Conservation and Renewable Energy Program.

General Site Support and Infrastructure Program. In addition to ongoing maintenance, repair, and replacement activities to support NNSS facilities, the DOE/NNSA NSO would modify facilities as needed to support NNSS programs. In addition, several infrastructure additions would be completed, including construction of a new security building on previously disturbed land in Area 23 (2 acres), replacement of the existing 138-kilovolt electrical transmission system, expansion of the cellular telecommunication system, and reconfiguration of Mercury in Area 23. Cultural resources impacts include damage to cultural resources resulting from construction of facilities, access roads, transmission lines, and cell towers; increased off-road vehicular and pedestrian access; expansion of facilities; and modification, relocation, or demolition of historic buildings. Historic period buildings at Mercury that are proposed for modifications, rebuilding, or demolition would be evaluated for listing in the NRHP, and eligible buildings would require mitigation. It was estimated that a total of 467 acres of previously undisturbed land would be affected by infrastructure projects under the Expanded Operations Alternative. This amount of land disturbance would affect an estimated 13 cultural resources sites, 5 of which would be NRHP-eligible. A proposed 5-megawatt photovoltaic solar power generation facility, while considered infrastructure, is addressed under the Conservation and Renewable Energy Program.

Conservation and Renewable Energy Program. The DOE/NNSA NSO would continue current energy efficiency measures, water conservation measures, fleet management improvements, and sustainable building practices. Cultural resources impacts from implementation of conservation measures would be the same as those described under the No Action Alternative.

DOE/NNSA would build a renewable energy facility consisting of a 5-megawatt photovoltaic solar power generation facility in Area 6 that would require about 50 acres of land. This would affect an estimated two cultural resources sites in the Yucca Flat Hydrographic Basin. One of those sites would be eligible for inclusion on the NRHP.

Under the Expanded Operations Alternative, DOE/NNSA would consider allowing one or more commercial solar power generation facilities with a combined capacity of up to 1,000 megawatts to be built in Area 25 in the Fortymile Canyon–Jackass Flats Hydrographic Basin. This development, including an estimated 10 miles of new transmission lines, would introduce considerable infrastructure over approximately 10,300 acres of land, affecting up to an estimated 7,004 cultural resources sites, up to 2,163 of which might be eligible for the NRHP. If DOE/NNSA allowed it, construction of commercial solar power generation facilities would require separate NEPA reviews (including cultural resources analyses). However, any solar power generation facility would require a considerable amount of clearing and grading that would directly and permanently impact all archaeological resources, built environment resources, and historic landscapes by damaging, displacing, or destroying artifacts, features, sites, and buildings in the project footprint. Proposed projects would be evaluated on a case-by-case basis and all appropriate steps would be taken pursuant to Section 106 of the NHPA.

DOE/NNSA would develop a Geothermal Demonstration Project on the NNSS under the Expanded Operations Alternative. This project would disturb an estimated 50 acres of previously undisturbed land impacting an estimated two cultural resources sites, one of which would be considered eligible for inclusion on the NRHP. Implementation of a Geothermal Demonstration Project would require a project-specific NEPA review and cultural resources analysis.

Other Research and Development Programs. Under the Expanded Operations Alternative, current programs would continue, but DOE/NNSA would actively promote and expand the National Environmental Research Park Program. Potential cultural resources impacts would be the same as those described under the No Action Alternative. No such projects are proposed at this time, but if there were, they would be evaluated on a case-by-case basis and all appropriate steps would be taken pursuant to Section 106 of the NHPA.

5.1.10.3 Reduced Operations Alternative

As shown in **Table 5–49**, under the Reduced Operations Alternative, DOE/NNSA activities at the NNSS and environmental restoration sites on the Nevada Test and Training Range would disturb up to 1,540 acres of previously undisturbed land, which would affect an estimated 45 cultural resources sites, 14 of which are eligible for listing on the NRHP. Overall, under the Reduced Operations Alternative, 2,170 acres of previously undisturbed land would be disturbed, including about 1,200 acres of disturbance for construction of a commercial solar power generation facility (discussed in Section 5.1.10.3.3). The total estimated number of cultural resources sites potentially affected is 861, 266 of which are eligible for inclusion on the NRHP. Mission- and program-level impacts on cultural resources are addressed in the following discussion.

Table 5–49 Reduced Operations Alternative – Estimated Number of Potentially Affected Cultural Resources Sites on the Nevada National Security Site and Nevada Test and Training Range

Program	Area Disturbed (acres) [a]	Assumed Primary Locations of Activities by Hydrographic Basin	Number of Sites [b]	Number of NRHP-Eligible Sites [b]
Stockpile Stewardship and Management	208 208	Frenchman Flat Yucca Flat	4 9	1 4
Nuclear Emergency Response, Nonproliferation, and Counterterrorism	5 5 5	Frenchman Flat Yucca Flat Fortymile Canyon–Jackass Flats	0 [c] 0 [c] 3	0 [c] 0 [c] 1
Work for Others	None	Frenchman Flat Yucca Flat Mercury Valley Fortymile Canyon–Jackass Flats	0	0
Total National Security/Defense Mission	430		16	6
Waste Management (Area 5 RWMC) [d]	190	Frenchman Flat	0	0
Environmental Restoration Soils Project [e]	320 100	Frenchman Flat Emigrant Valley	5 8	2 0[c]
Environmental Restoration Underground Test Area Project	167 167 167	Frenchman Flat Yucca Flat Oasis Valley [f]	3 7 6	1 3 2
Total Environmental Management Mission	1,110		29	8
General Site Support and Infrastructure	None	Frenchman Flat Mercury Valley Yucca Flat	0	0
Renewable Energy (DOE/NNSA)	None	None	0	0
Total Nondefense Mission	None		0	0
Total DOE/NNSA	**1,540**		**45**	**14**
100-MW Commercial Solar Power Generation Facility	1,200	Fortymile Canyon–Jackass Flats	816	252
Total Non-DOE/NNSA	**1,200**		**816**	**252**
Total	**2,170**		**861**	**266**

MW = megawatts; NRHP = National Register of Historic Places; RWMC = Radioactive Waste Management Complex.

[a] Where a program could affect multiple hydrographic basins, if the potentially disturbed area for the basin was known, it was used; if not, the total potentially disturbed acres for that program were equally apportioned among the affected basins.

[b] The number of sites was calculated by multiplying the number of acres potentially disturbed by the Total Sites Per Acre or NRHP Sites Per Acre columns, as appropriate, from Table 5–46. Where programs could occur in more than one hydrographic basin, the range of numbers of potentially affected cultural resources sites was used. The area disturbed for each program may not add up to the total area disturbed for its applicable mission due to rounding.

[c] The calculated value is less than 0.5 sites.

[d] The 740-acre Area 5 RWMC has been surveyed for cultural resources and no NRHP-eligible sites were found.

[e] The Small Boy and Project 57 sites are disturbed, but are considered by the DOE/NNSA Nevada Site Office to be historically significant sites.

[f] The site density for the Underground Test Area Project on the Nevada Test and Training Range was assumed to be the same as the density for the Oasis Valley Hydrographic Basin because most of the groundwater characterization and monitoring wells that would be developed on U.S. Air Force land would be adjacent to the northwestern portions of the Nevada National Security Site.

5.1.10.3.1 National Security/Defense Mission

Under the Reduced Operations Alternative, National Security/Defense Mission activities would continue to occur in the locations described under the No Action Alternative. National Security/Defense Mission activities at the NNSS would disturb up to 430 acres of previously undisturbed land. This land disturbance would potentially affect an estimated 16 cultural resources sites, of which 6 would be eligible for inclusion on the NRHP.

Stockpile Stewardship and Management Program. Under the Reduced Operations Alternative, Stockpile Stewardship and Management Program activities would be the same as under current conditions, except that some high-explosives testing would be curtailed, and the number of dynamic experiments, conventional high-explosives testing, shock physics testing, and nuclear weapons staging would be reduced relative to the No Action Alternative. A reduction in these activities would reduce the potential for ground-disturbing activities and increased access, resulting in fewer potential impacts on cultural resources. Up to 415 acres of previously undisturbed land would be disturbed by Stockpile Stewardship and Management Program activities, resulting in impacts on an estimated 13 cultural resources sites. An estimated 5 of those sites would be eligible for inclusion on the NRHP.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Under the Reduced Operations Alternative, activities under these programs would continue and cultural resources impacts would be the same as those described under the No Action Alternative.

Work for Others Program. Under the Reduced Operations Alternative, large-scale explosive tests and experiments would not be conducted. No Work for Others Program activities, except for military training and exercises, would be conducted in Areas 18, 19, 20, 29, and 30 of the NNSS. Cultural resources impacts would be the same as those under the No Action Alternative.

5.1.10.3.2 Environmental Management Mission

Activities under the Environmental Management Mission would be the same as those described under the No Action Alternative. Therefore, cultural resources impacts would be the same as those described under the No Action Alternative.

5.1.10.3.3 Nondefense Mission

General Site Support and Infrastructure Program. There would be no infrastructure projects conducted beyond maintenance of critical elements in Areas 18, 19, 20, 29, and 30. Otherwise, all other maintenance and replacement projects would be the same as those described under the No Action Alternative.

Conservation and Renewable Energy Program. The NNSS would continue current energy efficiency measures, water conservation measures, fleet management improvements, and sustainable building practices. Cultural resources impacts would be the same as those described under the No Action Alternative.

Under the Reduced Operations Alternative, DOE/NNSA would consider allowing development of a solar power generation facility with up to 100 megawatts of capacity in Area 25 in the Fortymile Canyon–Jackass Flats Hydrographic Basin. This development would introduce considerable infrastructure over approximately 1,200 acres of land, affecting up to an estimated 816 cultural resources sites, up to 252 of which might be eligible for the NRHP. If DOE/NNSA allowed it, construction of a commercial solar power generation facility would require separate NEPA review (including cultural resources analyses). However, any solar power generation facility would require a considerable amount of clearing and grading that would directly and permanently impact all archaeological resources, built environment resources, and historic landscapes by damaging, displacing, or destroying artifacts, features, sites, and buildings in the project footprint. Proposed projects would be evaluated on a case-by-case basis, and all appropriate steps would be taken pursuant to Section 106 of the NHPA.

Other Research and Development Programs. Under the Reduced Operations Alternative, current programs would continue as described under the No Action Alternative, but no programs would be conducted in Area 18, 19, 20, 29, or 30. There would be fewer cultural resources impacts relative to those described under the No Action Alternative because ground-disturbing activity would be less likely. There are no such projects proposed at this time, but if there were, they would be evaluated on a case-by-case basis, and all appropriate steps would be taken pursuant to Section 106 of the NHPA.

5.1.11 Waste Management

DOE/NNSA operations, environmental restoration, and D&D activities at the NNSS would generate LLW and MLLW; TRU waste; hazardous waste (including waste regulated under the Toxic Substances Control Act and other statutes); explosive waste; and nonhazardous wastes, including sanitary solid waste, hydrocarbon-contaminated soil and debris, and construction and demolition debris.

Nevada National Security Site (NNSS) Low-Level and Mixed Low-Level Radioactive Waste Management Programs

The NNSS low-level radioactive waste (LLW) management program addresses waste containing radioactive constituents (LLW as defined in Chapter 12, "Glossary") as well as LLW containing regulated (friable) asbestos, polychlorinated biphenyls (PCBs) in low concentrations (e.g., radioactive PCB bulk product waste containing PCBs in concentrations less than 50 parts per million), or hydrocarbon-contaminated soil and debris. The NNSS mixed low-level radioactive waste (MLLW) program addresses waste containing both radioactive and hazardous constituents (MLLW as defined in Chapter 12, "Glossary"), as well as radioactive waste containing PCBs in sufficient concentrations (e.g., radioactive PCB remediation waste containing PCBs in large capacitors or fluorescent light ballasts).

Waste management impacts are assessed by comparing the projected waste volumes generated or disposed under each SWEIS alternative to current waste management practices and/or the availability of onsite or offsite waste management capacity. Adverse impacts on waste management would occur if any of the different types of wastes lacked appropriate management capacity. For example, adverse impacts on LLW and MLLW management could occur if the projected volumes for disposal at the NNSS exceeded the available NNSS disposal capacity.

Section 5.1.12.1.4 addresses the potential long-term (over thousands of years) public and environmental impacts that could occur after closure of the NNSS LLW and MLLW disposal facilities.

Tables 5–50 and **5–51**, respectively, summarize the projected types and volumes of radioactive and nonradioactive wastes generated and disposed at the NNSS under the three SWEIS alternatives. The top portion of Table 5–50 addresses LLW, MLLW, and TRU waste projected to be generated at the NNSS, while the bottom portion addresses LLW and MLLW projected to be disposed at the NNSS from all authorized in-state and out-of-state generators.

Under all alternatives, up to 1 percent of the total projected LLW volume disposed could consist of nonradioactive, classified waste forms that require disposal at the Area 5 RWMC in a manner similar to LLW. To provide a conservative analysis of potential human health impacts, DOE/NNSA assumed that the entire volume of waste was composed of only LLW.

The top portion of Table 5–51 addresses hazardous and solid wastes projected to be generated by all DOE/NNSA Nevada facilities, as well as hazardous and solid wastes projected to be generated by a commercial solar power generation facility located at the NNSS. The bottom portion of Table 5–51 addresses solid waste projected to be disposed at the NNSS from DOE/NNSA Nevada generators, as well as from a commercial solar power generation facility located at the NNSS. NNSS landfill disposal of solid wastes from a commercial solar power generation facility would require revisions to the NNSS landfill operating permits; this waste would most likely be disposed off site.

Table 5–50 Projected 10-Year Volumes of Radioactive Wastes Generated and Disposed at the Nevada National Security Site

Waste Stream [a]	Alternatives: No Action (cubic feet)	Expanded Operations (cubic feet)	Reduced Operations (cubic feet)
Waste Volumes Generated at the NNSS			
Low-level radioactive waste	1,000,000	1,300,000	1,000,000
Mixed low-level radioactive waste	520,000	520,000	520,000
Transuranic waste [b]	9,600	19,000	7,100
Waste Volumes Disposed at the NNSS [c]			
Low-level radioactive waste	15,000,000 [d]	48,000,000 [e]	15,000,000 [d]
Mixed low-level radioactive waste [f]	900,000 [g]	4,000,000 [h]	900,000

NNSS = Nevada National Security Site.

[a] Tritiated liquids would also be generated and disposed (see text).

[b] TRU waste (including mixed TRU waste) includes TRU waste projected for storage at the Area 5 RWMC through the end of 2010, TRU waste generated by NNSS operations and in-state environmental restoration activities over the next 10 years, and two 3-foot-diameter legacy spheres containing plutonium. All TRU waste was assumed to be shipped in standard waste boxes, and the listed volumes reflect the approximate disposal (external) volumes of these boxes.

[c] Comprises all LLW and MLLW projected for NNSS disposal as received from all authorized in-state and out-of-state generators. Up to 1 percent of the total projected LLW volume could consist of nonradioactive, classified waste forms that require disposal in a manner similar to LLW.

[d] Includes approximately 1.0 million cubic feet of LLW generated by NNSS operations, environmental restoration, and facility decontamination and decommissioning (D&D). Some of the LLW from environmental restoration could be MLLW.

[e] Includes approximately 1.3 million cubic feet of LLW generated by NNSS operations, environmental restoration, and facility D&D, plus approximately 11 million cubic feet of LLW generated by environmental restoration at in-state locations outside the NNSS, for a total of approximately 12 million cubic feet of LLW from all in-state waste generators. Some of the LLW from environmental restoration could be MLLW.

[f] Includes approximately 520,000 cubic feet of MLLW generated by operations, environmental restoration, and facility D&D at the NNSS and other in-state locations.

[g] The actual permitted volume of MLLW that may be disposed in Cell 18 is 899,996 cubic feet.

[h] Expanded MLLW disposal in excess of Cell 18 capacity (899,996 cubic feet) would require new Resource Conservation and Recovery Act permit(s) from the Nevada Division of Environmental Protection prior to construction of any additional disposal cells.

Note: Totals may not equal the sum of individual values because of rounding.

There are differences between the volumes generated and disposed at the NNSS because some wastes generated at the NNSS are sent off site for disposition (e.g., all TRU and hazardous wastes), while others are dispositioned on site (e.g., all LLW). In addition, the NNSS receives for disposal LLW and MLLW from in-state generators from locations other than the NNSS (e.g., the TTR), as well as numerous authorized out-of-state generators. Some solid wastes generated at the NNSS are recycled off site, while other solid wastes, such as sanitary solid waste or construction debris, are disposed on site. DOE/NNSA also receives solid wastes at the NNSS for disposition from other authorized in-state generators, such as the RSL.

Wastes generated by ongoing operations at the NNSS (e.g., experiments at JASPER) and the other DOE/NNSA Nevada facilities would continue to be generated and disposed beyond the next 10 years. Other wastes would be generated on an episodic, project-specific basis. These episodic wastes would include those generated from specific projects such as facility construction, facility D&D, and specific environmental restoration projects that would take place over a finite period. The start and completion dates for many projects that could generate waste are uncertain (e.g., because of possible funding fluctuations or revised program needs). In addition, the timing and quantity of waste generation from environmental restoration activities are subject to future agreements or regulatory determinations. For similar reasons, the timing and quantity of wastes received from out-of-state generators are also uncertain. Due to these uncertainties, Tables 5–50 and 5–51 list total waste volumes projected over the next 10 years, rather than average or peak waste volumes that may be projected on an annual basis. After 10 years, waste generation and as-permitted or authorized waste disposal at the NNSS would continue.

Table 5–51 Projected 10-Year Volumes of Nonradioactive Wastes Generated and Disposed at the Nevada National Security Site

Waste Stream [a]	*Alternatives*		
	No Action (cubic feet)	***Expanded Operations (cubic feet)***	***Reduced Operations (cubic feet)***
Waste Volumes Generated at the NNSS			
Hazardous waste [b]			
From NNSS generators	170,000	170,000	170,000
From commercial solar power generation facility(ies)	42,000	170,000	17,000
Total hazardous waste	210,000	340,000	190,000
Solid waste [c]			
From NNSS generators	3,700,000	9,400,000	3,600,000
From commercial solar power generation facility(ies)	160,000	630,000	77,000
Total solid waste	3,800,000	10,000,000	3,700,000
Waste Volumes Disposed at the NNSS			
Solid waste [c]			
From DOE/NNSA Nevada generators [d]	3,400,000	8,500,000	3,300,000
From commercial solar power generation facility(ies) [e]	160,000	630,000	77,000
Total solid waste	3,500,000	9,200,000	3,400,000

NNSS = Nevada National Security Site.
[a] Explosive wastes would also be generated (see text).
[b] Includes wastes containing constituents regulated under the Toxic Substances Control Act or other applicable statutes. All hazardous waste would be sent to offsite recycle or treatment, storage, and disposal facilities.
[c] Includes sanitary solid waste, as well as construction and demolition debris. Offsite recycling, rather than landfill disposal, was projected for about 370,000 cubic feet of solid waste under the No Action Alternative, 970,000 cubic feet under the Expanded Operations Alternative, and 360,000 cubic feet under the Reduced Operations Alternative. It was assumed the remaining solid waste would be disposed.
[d] Includes solid waste generated at the NNSS, the North Las Vegas Facility, the Remote Sensing Laboratory, and the Tonopah Test Range.
[e] Disposal of solid waste from one or more commercial solar power generation facilities at NNSS landfills would require modifications to the landfill permits. This waste most likely would be disposed at an offsite landfill. Estimates in this table assume the commercial solar power generation facility(ies) for all alternatives would operate for 5 years during the 10-year planning period.
Note: Totals may not equal the sum of individual values because of rounding.

The following subsections address waste management consequences in detail under each alternative. The impacts of managing LLW and MLLW at the NNSS are discussed simultaneously because operational and disposal practices are similar for both types of waste.

5.1.11.1 No Action Alternative

5.1.11.1.1 DOE/NNSA Activities

Adequate disposal capacity is available at the NNSS for the volumes of LLW and MLLW projected under this alternative. Adequate TRU waste disposal capacity at WIPP is expected. Adequate recycle or treatment, storage, or disposal (TSD) capacity is expected for the hazardous and nonhazardous wastes projected under this alternative because of the large number of available offsite recycle or TSD facilities for hazardous waste, the availability of NNSS disposal capacity for nonhazardous solid waste, and the availability of extensive offsite solid waste recycle and disposal capacity.

Low-level and mixed low-level radioactive wastes. LLW and MLLW would continue to be generated at the NNSS as part of operations, environmental restoration, and D&D of excess facilities and structures. Consistent with current practice, some MLLW would be repackaged before disposal at the Area 5 RWMC (see Chapter 4, Section 4.1.11.1.2). MLLW that does not meet the EPA Resource Conservation and Recovery Act (RCRA) (P.L. 94-580) Land Disposal Restrictions would be sent to offsite TSD facilities for treatment. Treated waste would then be disposed at a permitted non-NNSS facility or returned to the NNSS for disposal. Because several permitted TSD facilities exist in the United States for MLLW (e.g., in Florida, Tennessee, Texas, Washington, and Utah), and additional facilities may be used as they are available and appropriate for the waste content or characteristics, adequate offsite treatment capacity exists for the quantity of MLLW projected under this alternative.

LLW and MLLW generated at the NNSS or received from authorized in-state and out-of-state waste generators would be disposed at the Area 5 RWMC.

Up to 15,000,000 cubic feet of LLW and 900,000 cubic feet of MLLW would be accepted for disposal from all in-state and out-of-state generators, or a total over 10 years of about 15,900,000 cubic feet of combined LLW and MLLW. The combined waste volume would include approximately 1,200,000 cubic feet of LLW from all in-state operations, environmental restoration activities, and facility D&D (see Table 5–50, footnote d). It would also include approximately 520,000 cubic feet of MLLW from all NNSS operations, environmental restoration activities, and D&D (see Table 5–50, footnote f).

LLW and MLLW disposal operations would take place at the Area 5 RWMC. Waste management and disposal operations at this facility would be comparable to current annual levels based on the projected waste volumes. The average annual level of effort, however, would be lower than 2003 and 2004 levels. Disposal units, including pits and trenches, would continue to be designed and sized to reflect operational needs.

Assuming that disposal practices would be similar to past practices, the disposal units required for disposal of 15,900,000 cubic feet of LLW and MLLW would commit about 190 acres of the Area 5 RWMC, in addition to the approximately 160 acres thus far committed to waste disposal. The total quantity of land dedicated to waste disposal at the Area 5 RWMC since it opened would amount to about 350 acres, or about 50 percent of the Area 5 RWMC disposal capacity.

At the Area 5 RWMC, DOE/NNSA would continue to conduct MLLW management support activities such as real-time radiography, operation of a permitted MLLW storage area, and repackaging before disposal of some in-state-generated MLLW.

Transuranic waste. TRU and mixed TRU wastes generated by NNSS operations or environmental restoration activities would continue to be stored at the Area 5 RWMC. Storage would be temporary pending shipment off site, either directly to WIPP for disposal or to INL for additional characterization and preparation before its eventual shipment to WIPP for disposal.

Assuming storage of 20 standard waste boxes[2] through the end of 2010, annual generation of approximately 12 standard waste boxes from JASPER, projected generation of about 2,000 cubic feet of waste from environmental restoration activities, and storage of two 3-foot-diameter legacy spheres, the total volume of stored and newly generated TRU waste over the next 10 years would be about 9,600 cubic feet. It was further assumed that this waste would be shipped off site to INL and/or WIPP (see Section 5.1.3.1).

[2] *A standard waste box is a steel box, with a capacity of about 63 cubic feet, that can be placed in TRUPACT-II or HalfPACT transport packages.*

The TRU waste volume projected under this alternative would account for only about 0.2 percent of the 6.3 million cubic feet of authorized waste disposal capacity at WIPP under the WIPP Land Withdrawal Act (P.L. 102-579). The WIPP disposal capacity is sufficient for disposal of all NNSS TRU waste generated under this alternative.

Tritiated liquids. Tritiated liquids would continue to be treated on site by evaporation into the air from ponds, open tanks, and sewage lagoons (see Chapter 4, Section 4.1.11.1.4). Existing procedures would not be changed, and treatment capacity would be adequate. The potential impacts of the release of tritium to the atmosphere through evaporation are addressed in Sections 5.1.8 and 5.1.12.

Hazardous waste. Hazardous waste and wastes regulated under the Toxic Substances Control Act (P.L. 94-469) or other statutes would be collected and temporarily stored at the source of generation as needed in compliance with applicable regulations or, if packaged, at the Area 5 Hazardous Waste Storage Unit before being sent off site for disposition. Bulk hazardous waste generated by activities such as environmental restoration would generally be shipped directly from the source of generation to an offsite location for disposition. Disposition options would depend on waste characteristics. To the extent reasonably achievable, materials such as used oil, batteries, computer equipment, fluorescent light bulbs, scrap lead materials, or unused hazardous chemicals would be sold or sent to permitted offsite recycle facilities. These activities would be conducted in accordance with DOE's ongoing Pollution Prevention and Waste Minimization Program. Some materials could be directed to new onsite users. Otherwise, hazardous waste would be shipped to offsite TSD facilities. (This does not include solid wastes containing PCBs in concentrations less than 50 parts per million, which generally may be disposed in permitted solid waste facilities at the NNSS or elsewhere.)

Over the next 10 years, approximately 170,000 cubic feet of hazardous waste would be generated by NNSS generators. Additionally, about 42,000 cubic feet would be generated from construction and operation of a commercial solar power generation facility (see Section 5.1.11.1.2). Most of this waste would be dispositioned by offsite recycling or reuse rather than offsite disposal. Adequate offsite capacity exists for this waste because of the large number of permitted hazardous waste recycle or TSD facilities that exist in Nevada and neighboring states. As of 2009, for example, 10 facilities were permitted in Nevada for recycle of used oil, antifreeze, and photographic solutions (NDEP 2009b); as of 2010, several dozen facilities in Nevada were permitted for recycle of batteries, electronic equipment, fluorescent lamps, and other materials (NDEP 2010a). In California, as of 2007, 26 facilities were permitted for recycle of batteries, 24 for fluorescent lighting, 20 for solvent recovery, and 37 for used oil and antifreeze (DTSC 2007). As of 2009, 4 hazardous waste TSD facilities were permitted in Nevada (NDEP 2009c). Additional facilities in neighboring states include 3 permitted landfills in California as of 2007 (DTSC 2007), 13 permitted TSD facilities in Utah as of 2005 (UTDEQ 2006), and 10 permitted TSD facilities in New Mexico as of 2008 (NMED 2008). As of March 2010, EPA identified 39 permitted companies in the United States that are capable of performing treatment or disposal of PCBs using chemical dechlorination, incineration, physical separation or decontamination, landfill, and other technologies (EPA 2010d).

Explosive waste. Nonradioactive explosive waste generated by tunnel operations, the NNSS Security Firing Range, resident national laboratories, or other DOE/NNSA activities would continue to be treated by open detonation at the Area 11 Explosives Ordnance Disposal Unit in accordance with the following permit conditions: no more than 100 pounds of approved explosive waste would be detonated at one time; there would be no more than one detonation event per hour; and the maximum quantity treated each year would be 4,100 pounds. There would be no lack of capacity at the NNSS for explosive waste.

Nonhazardous waste. To the extent reasonably achievable, nonhazardous solid waste generated at the NNSS would be recycled under the NNSS Pollution Prevention and Waste Minimization Program. Materials recycled under this program include scrap metals, mixed paper and cardboard, shipping materials, spent toner cartridges, cafeteria food wastes, and aluminum cans.[3] Surplus chemicals, equipment, and supplies would be preferentially directed to appropriate new users rather than being disposed as waste. These recycling operations would not consume waste disposal capacity and would only result in temporary staging activities at the NNSS, pending shipment to recycling facilities capable of accepting the materials.

It was projected that approximately 3,700,000 cubic feet of nonhazardous solid waste would be generated by authorized NNSS generators over the next 10 years. About 370,000 cubic feet of nonhazardous solid waste would be recycled (see Table 5–51, footnote c). Adequate offsite recycle capacity exists due to the large number of available recycle facilities. In Nevada, several dozen recycle facilities existed as of 2010 for nonhazardous material, including aluminum, glass bottles and jars, paper, cardboard, food waste, scrap metal, and wood (NDEP 2010a). Additional nonhazardous material recycle facilities exist in neighboring states (e.g., see DTSC 2007).

Wastes that are not reused or recycled would be disposed in permitted NNSS or offsite landfills. Solid wastes disposed at the NNSS would be received from NNSS generators and, as needed, from authorized in-state generators such as the TTR, RSL, or NLVF. Sanitary solid waste generated by these sites is usually managed by means other than shipment to the NNSS. Nonetheless, for security reasons, there may be an occasional need to ship some solid wastes from these facilities to the NNSS for landfill disposal. In addition, construction and demolition debris generated by DOE/NNSA at the TTR, RSL, or NLVF could be sent to NNSS landfills or permitted commercial landfills.[4]

About 3,500,000 cubic feet of sanitary solid waste and construction and demolition debris from DOE/NNSA Nevada facilities was projected for disposal at the NNSS over the next 10 years. As of 2008, the estimated remaining waste capacities for the three NNSS landfills were as follows: 2,800,000 cubic feet at Area 6, hydrocarbon landfill; 15,000,000 cubic feet at Area 9, U10c landfill; and 13,000,000 cubic feet at Area 23 landfill (see Chapter 4, Section 4.1.11.2.3). The projected waste volumes under the No Action Alternative are significantly smaller than the remaining landfill capacity; thus, available solid waste disposal capacity at the NNSS would not be exceeded. Adequate waste disposal capacity would also be available in the event that solid waste from a commercial solar power generation facility is disposed at permitted NNSS landfills (see Section 5.1.11.1.2).

5.1.11.1.2 Commercial Solar Power Generation Facility

Hazardous and nonhazardous solid wastes would be generated by construction and operation of a commercially operated solar power generation facility at Area 25. Waste quantities would vary depending on the electrical power capacity of the power plant, which differs under each SWEIS alternative. Construction of a 240-megawatt power plant under the No Action Alternative was projected to generate approximately 6,500 cubic feet of hazardous waste and 140,000 cubic feet of construction debris and sanitary solid waste. Operation of this same plant was projected to annually generate approximately 7,100 cubic feet of hazardous waste and 4,100 cubic feet of sanitary solid waste. Operational waste would be generated throughout the life of the facility (likely 30 years or more).

[3] Recyclable material such as scrap metal would continue to be shipped from DOE/NNSA Nevada facilities (e.g., RSL, NLVF) to the NNSS for consolidation pending offsite shipment (e.g., to be sold or recycled).

[4] NNSS solid waste disposal facilities are permitted to receive waste only from sources specified in the facility permits (e.g., FFACO sites), and other waste as approved on a case-by-case basis by the Nevada Division of Environmental Protection.

Construction of a 240-megawatt commercial solar power generation facility would take approximately 35 months.[5] The commercial solar power generation facility would begin operations after construction and was assumed to operate for 5 years during the 10-year planning period. Under these assumptions, about 42,000 cubic feet of hazardous waste and 160,000 cubic feet of sanitary solid waste and construction debris would be generated during the 10-year planning period.

There is no specific schedule for constructing a commercial solar power generation facility at the NNSS; the waste projections are included in this SWEIS to assist DOE/NNSA in determining whether to make land and infrastructure now under DOE/NNSA control available for another, future use by a commercial entity. Any hazardous or nonhazardous waste generated by construction or operation of the solar power generation facility would be managed by the commercial operator of the facility, who would be required to comply with applicable laws and regulations related to recycling, treatment, and/or disposal of wastes. Because numerous hazardous waste recycle or TSD facilities exist in Nevada and nearby states, as well as numerous landfills for industrial and sanitary solid waste, offsite disposal capacity would be adequate for the waste projected from a commercial solar power generation facility (see Section 5.1.11.1.1).

If permitted by NDEP, the projected solid waste may be disposed in NNSS landfills. Assuming an additional 160,000 cubic feet of solid waste from the commercial solar power generation facility, the total volume of solid waste to be disposed at NNSS landfills over the next 10 years would increase to 3,500,000 cubic feet. Because this volume would still be significantly smaller than the projected remaining NNSS disposal capacity (see Section 5.1.11.1.1), adequate solid waste management capacity at the NNSS would be available. Solid waste from a commercial solar generation facility most likely would be disposed off site.

5.1.11.2 Expanded Operations Alternative

5.1.11.2.1 DOE/NNSA Activities

Adequate disposal capacity exists at the NNSS for the volumes of LLW and MLLW conservatively projected under this alternative, provided the Area 3 RWMS is reopened for in-state-generated waste. Adequate disposal capacity also exists if the Area 5 RWMC is expanded or operational disposal practices at the Area 5 RWMC are modified to allow more-efficient use of available disposal space (e.g., construction of larger and/or deeper disposal units). Adequate TRU waste disposal capacity at WIPP is available. Adequate recycle or TSD capacity exists for the hazardous and nonhazardous wastes projected under this alternative because of the large number of available offsite recycle or TSD facilities for hazardous waste, the availability of NNSS disposal capacity for nonhazardous solid waste, and the availability of extensive offsite solid waste recycle and disposal capacity.

Low-level and mixed low-level radioactive wastes. LLW and MLLW would continue to be generated at the NNSS as part of operations, environmental restoration, and D&D of excess facilities and structures. MLLW treatment capability would be developed at the Area 5 RWMC to enable permitted treatment of MLLW received from all authorized generators. In-state-generated MLLW that does not meet the EPA RCRA Land Disposal Restrictions would be sent to offsite TSD facilities for treatment, then be disposed off site or returned to the NNSS for disposal. As under the No Action Alternative (see Section 5.1.11.1.1), adequate offsite TSD capacity is available for the NNSS-generated MLLW projected under this alternative.

LLW generated at the NNSS or received from authorized in-state and out-of-state waste generators would be disposed at the Area 5 RWMC or the Area 3 RWMS if the latter disposal facility is reopened. As the large volume of LLW considered for disposal under the Expanded Operations Alternative is a conservative estimate, it is more likely that the Area 5 RWMC would provide sufficient disposal capacity for the next 10 years. However, should DOE/NNSA need to activate the Area 3 RWMS, it would first

[5] *Under all alternatives it was assumed that one or more commercial solar power generation facilities would operate over 5 of the next 10 years.*

undergo detailed consultation with the State of Nevada, and would limit disposal at the Area 3 RWMS to in-state generated LLW. MLLW generated at the NNSS or received for disposal from authorized in-state and out-of-state waste generators would be disposed at the Area 5 RWMC. All waste disposed at the Area 5 RWMC or the Area 3 RWMS would meet the NNSS waste acceptance criteria.

Up to about 48,000,000 cubic feet of LLW and 4,000,000 cubic feet of MLLW would be accepted for disposal from all in-state and out-of-state generators over the next 10 years, or a total of approximately 52,000,000 cubic feet of combined LLW and MLLW. The combined volume of LLW and MLLW from in-state generators alone would include approximately 12,000,000 cubic feet of LLW (see Table 5–50, footnote e) and 520,000 cubic feet of MLLW. The combined total volumes of LLW and MLLW that would be disposed at the NNSS under the Expanded Operations Alternative would be about three times as much as those disposed at the NNSS under the No Action Alternative. Disposal units, including pits and trenches, would be designed and sized to reflect operational needs.

Assuming that disposal practices would be similar to past practices, the disposal units required for disposal of approximately 52,000,000 cubic feet of LLW and MLLW would require about 600 acres of the Area 5 RWMC. Therefore, the land area used for LLW/MLLW disposal at the Area 5 RWMC would exceed by about 20 acres the Area 5 RWMC acreage available for waste disposal. To accept the projected volumes of LLW and MLLW, DOE/NNSA would need to modify disposal operations to allow construction of larger and/or deeper disposal units.

To preclude the need to expand the Area 5 RWMC or modify operations, the Area 3 RWMS could be opened to receive in-state-generated LLW from DOE/NNSA site environmental restoration and other activities. The currently developed capacity of the Area 3 RWMS is about 1.9 million cubic feet. Two currently undeveloped disposal cells (U-3az and/or U-3bg) would be opened, leading to a total of approximately 9,100,000 cubic feet of disposal capacity at the Area 3 RWMS.

The commitment of disposal capacity at the Area 5 RWMC may also be affected by decisions made as part of the Environmental Restoration Program under the FFACO, primarily for sites managed by the Soils Project. The projected 11,000,000 cubic feet of LLW generated from in-state environmental restoration at locations outside of the NNSS (see Table 5–50, footnote e) would consist of low-activity soil and debris (a portion may be MLLW). Rather than removing this environmental restoration waste and transporting it to the NNSS for disposal, NDEP, DOE/NNSA, and the USAF (on the TTR and Nevada Test and Training Range sites only) may determine that the safest and most effective management strategy for some sites would be to close the contamination in place or open dedicated disposal facilities that are proximal to the contamination sources. Either option would reduce the amount of disposal space at the Area 5 RWMC that is committed to this environmental restoration waste, thereby extending the availability of the Area 5 RWMC for waste disposal, reducing the need to reopen the Area 3 RWMS, and reducing the costs and impacts associated with transporting the waste to the NNSS for disposal. Impacts from transporting this waste to the NNSS are addressed in Section 5.1.3.1.

In addition, the projections of LLW and MLLW volumes from NNSS and out-of-state generators are considered upper-bound estimates, and their generation would depend on programmatic and regulatory decisions, funding, and other considerations. Although for purposes of analysis it was assumed that the projected waste volumes would be disposed at the NNSS, there may be other cost-effective options for disposing the wastes, such as use of commercial disposal capacity.

The DOE/NNSA NSO would continue to conduct MLLW support activities, including real-time radiography, operation of a permitted MLLW storage area, and repackaging activities. MLLW treatment capacity at the Area 5 RWMC would be developed. This treatment capability would allow acceptance of MLLW from across the DOE complex for treatment, pursuant to EPA's land disposal restriction requirements, before disposal at the Area 5 RWMC. It is expected that treatment methods would include technologies such as macroencapsulation, microencapsulation, sorting and segregation, repackaging, neutralization, and amalgamation. DOE/NNSA would obtain the appropriate RCRA permit from NDEP before developing or implementing any MLLW treatment capability.

MLLW treatment and storage capacity would be housed in appropriately modified and permitted existing buildings at the Area 5 RWMC (e.g., the Visual Reexamination and Repackaging Building or TRU Pad Cover Building) to the extent feasible. A modular panel containment/confinement system structure with HEPA (high-efficiency particulate air) exhaust filtration could be constructed as needed within the TRU Pad Cover Building. If existing buildings are not adequate to house the MLLW treatment and storage capacity, DOE/NNSA would construct new facilities within the Area 5 RWMC.

Transuranic waste. The 10-year volume of TRU (including mixed TRU) waste projected under the Expanded Operations Alternative is about twice as large as that under the No Action Alternative because of the increased number of annual tests projected at JASPER. Annual generation of TRU waste would increase from 12 to 24 standard waste boxes, and the total quantity of TRU waste would increase to about 19,000 cubic feet. Similar to the No Action Alternative, it was assumed that this waste would be shipped off site to INL and/or WIPP (see Section 5.1.3).

Similar to the No Action Alternative (see Section 5.1.11.1.1), the projected volume of TRU waste under the Expanded Operations Alternative is modest. The projected volume would account for only about 0.3 percent of the 6.3 million cubic feet of waste authorized for disposal at WIPP under the WIPP Land Withdrawal Act. The WIPP disposal capacity would be sufficient for disposal of all TRU waste generated under this alternative.

Tritiated liquids. Under the Expanded Operations Alternative, the impacts of treating liquid tritium waste by evaporation would be the same as those described under the No Action Alternative (see Section 5.1.11.1.1).

Hazardous waste. Hazardous waste generation and management activities would be similar to those under the No Action Alternative (see Section 5.1.11.1.1). Under the Expanded Operations Alternative, approximately 170,000 cubic feet of hazardous waste would be generated by NNSS generators over the next 10 years. Additionally, about 170,000 cubic feet would be generated from construction and operation of one or more commercial solar power generation facilities (see Section 5.1.11.2.2). Most of this waste would be dispositioned by offsite recycling or reuse rather than offsite disposal. Because numerous permitted hazardous waste recycle or TSD facilities are in operation in Nevada or neighboring states, adequate offsite waste management capacity is expected for the hazardous waste projected under this alternative.

Explosive waste. The impacts of disposing nonradioactive explosive waste by detonation would be the same under the Expanded Operations Alternative as those under the No Action Alternative (see Section 5.1.11.1.1).

Nonhazardous waste. The volumes of nonhazardous solid wastes from NNSS generators would be larger than those under the No Action Alternative, principally because of additional personnel requirements and the generation of debris from new construction activities at the NNSS. As under the No Action Alternative, it was projected that about 930,000 cubic feet of this waste would be recycled. Because dozens of solid waste recycle facilities are in operation in Nevada and neighboring states (see Section 5.1.11.1.1), the projected level of nonhazardous waste generation under this alternative would not strain waste management capacity at these facilities.

About 8,500,000 cubic feet of sanitary solid waste and construction and demolition debris was projected for disposal from all DOE/NNSA Nevada generators over the next 10 years. The projected volume of solid waste would not exceed the available disposal capacity at the NNSS; however, assuming all construction and demolition debris would be disposed at the U10C Landfill in Area 9, about 53 percent of the capacity of that disposal facility would be used. Adequate waste disposal capacity would also be available in the event that solid waste from one or more commercial solar power generation facilities is disposed at permitted NNSS landfills (see Section 5.1.11.2.2).

Packaging, staging, and maintenance support. DOE/NNSA proposes to establish staging and maintenance support capacity at the Area 5 RWMC for radioactive material shipping packages. DOE/NNSA would temporarily stage, inspect, and perform maintenance on DOE/NNSA-certified (and possibly commercial) and U.S.DOT-authorized transport packagings for transport of radioactive material. The transport packages would be emptied of radioactive material before inspection, maintenance, or staging. This proposed capability would allow consolidation of specialty packagings at a centralized location that is convenient to DOE sites in the western United States. The proposed capability would be located in a fenced area within the Area 5 RWMC on approximately 1 acre of previously disturbed land. The area would be graded and covered with a gravel or asphalt pad. No more than 15 transport packagings would be staged within the area at any time. Operation of the area would use a small amount of electrical power and require only two to three workers on an as-needed basis to perform radiation surveys, container maintenance, or pre-use inspections. Minimal waste generation is expected.

New construction. New construction may occur at the NNSS under the Expanded Operations Alternative to enable expanded MLLW storage and treatment capacity, as well as packaging, staging, and maintenance support activities at the Area 5 RWMC. Construction would principally occur within existing structures, with minimal generation of construction waste. In addition, a waste offloading and staging area would be constructed as needed within a previously disturbed area at the Area 5 RWMC.

New or expanded solid waste landfills would be constructed as needed at the NNSS. An expansion of the Area 23 landfill would affect approximately 15 acres of land. In addition, a new landfill for construction and demolition debris may be constructed in Area 25, which would disturb up to 25 acres. Development of these landfills would reduce the risk and expense of transporting construction and demolition debris from Area 25 (or other areas) to the U10C Landfill, as well as extend the operational lifetimes of both the U10C and Area 23 Landfills. The DOE/NNSA NSO would seek appropriate permits from NDEP for the new or expanded landfills.

5.1.11.2.2 Commercial Solar Power Generation Facility

Construction of commercial solar power generation facilities with up to 1,000 megawatts of generating capacity under this alternative would take about 42 months and was projected to generate approximately 27,000 cubic feet of hazardous waste and 600,000 cubic feet of construction debris and sanitary solid waste. Operation of these facilities was projected to generate approximately 30,000 cubic feet of hazardous waste and 5,400 cubic feet of sanitary solid waste each year throughout the lives of the facilities (likely 30 years or more).

The commercial solar power generation facilities would begin operations after construction, and were assumed to operate for 5 years during the 10-year planning period. Under these assumptions, about 170,000 cubic feet of hazardous waste and 630,000 cubic feet of sanitary solid waste and construction debris would be generated during the 10-year planning period.

As under the No Action Alternative (see Section 5.1.11.1.2), these waste projections are included in this SWEIS to assist DOE/NNSA in determining whether to make land and infrastructure now under DOE/NNSA control available for another use by a commercial entity. Any waste generated by construction and operation of commercial solar power generation facilities would be managed by the operator(s) of the facility. Because numerous hazardous waste recycle or TSD facilities exist in Nevada and nearby states, as well as numerous landfills for industrial and sanitary solid waste, it is expected that offsite disposal capacity would be adequate for the waste projected from the commercial solar power generation facilities (see Section 5.1.11.1.1).

If permitted by NDEP, another option may be to dispose of the projected sanitary solid waste and construction debris in NNSS landfills. The total volume of sanitary solid waste and construction and demolition debris, including waste from DOE/NNSA activities and commercial solar power generation facilities, would increase to 9,200,000 cubic feet over the next 10 years. The projected volume of sanitary waste would not exceed the projected remaining NNSS disposal capacity at the Area 23 landfill (see Section 5.1.11.1.1); thus, it is expected that adequate sanitary solid waste management capacity would be available. The projected volume of construction and demolition debris would not exceed the projected available capacity at the U10C Landfill in Area 9, although approximately 57 percent of the capacity of that disposal facility would be used. As noted in Section 5.1.11.2.1, development of a new landfill for construction and demolition debris in Area 25, as well as the expanded sanitary waste landfill proposed for Area 23, would reduce the risk and expense of transporting construction and demolition debris to the existing U10C Landfill and extend the operational lifetimes of both the U10C and Area 23 Landfills. The DOE/NNSA NSO would seek appropriate permits from NDEP for the new or expanded landfills. Most likely solid waste from commercial solar generation facilities would be disposed off site.

5.1.11.3 Reduced Operations Alternative

5.1.11.3.1 DOE/NNSA Activities

Under this alternative, DOE/NNSA would manage the same quantities of LLW and MLLW as those described under the No Action Alternative and would treat the same quantities of tritiated liquids by evaporation and explosive waste by detonation. Impacts resulting from management of these waste types would be the same as those under the No Action Alternative (see Section 5.1.11.1.1).

TRU (and mixed TRU) waste volumes generated under this alternative are expected to be about 26 percent smaller than those under the No Action Alternative because of the reduced number of annual experiments projected at JASPER. Annual generation of TRU waste would decrease to six standard waste boxes, and the total 10-year volume of TRU waste under this alternative would decrease to about 7,100 cubic feet. Similar to the No Action Alternative, it was assumed that this waste would be shipped off site to INL and/or WIPP (see Section 5.1.3).

The volume of TRU waste projected under this alternative would account for only about 0.1 percent of the 6,300,000 cubic feet of waste authorized for disposal at WIPP under the WIPP Land Withdrawal Act. The WIPP disposal capacity would be sufficient for disposal of all TRU waste generated under this alternative.

Hazardous waste generation and management activities are expected to be similar to those under the No Action Alternative (see Section 5.1.11.1.1). Under the Reduced Operations Alternative, approximately 170,000 cubic feet of hazardous waste would be generated by NNSS generators over the next 10 years. Additionally, about 17,000 cubic feet would be generated from construction and operation of a commercial solar power generation facility (see Section 5.1.11.3.2). Most of this waste would be dispositioned by offsite recycling or reuse rather than offsite disposal. Because numerous permitted hazardous waste recycle or TSD facilities are in operation in Nevada or neighboring states, adequate offsite waste management capacity is expected for the hazardous waste projected under this alternative.

Compared to the No Action Alternative, a smaller quantity of sanitary solid waste would be generated because of reduced personnel requirements, as well as a smaller quantity of construction and demolition debris. About 3,600,000 cubic feet of sanitary solid waste and construction and demolition debris would be generated by authorized NNSS generators over the next 10 years. About 360,000 cubic feet of nonhazardous waste would be recycled. Because dozens of solid waste recycle facilities are in operation in Nevada and neighboring states (see Section 5.1.11.1.1), the projected level of nonhazardous waste generation under this alternative would not strain waste management capacity at these facilities.

About 3,300,000 cubic feet of combined sanitary solid waste and construction and demolition debris from DOE/NNSA Nevada generators would be disposed at NNSS landfills over the next 10 years. These projected waste volumes would not exceed the solid waste disposal capacity at the NNSS. Adequate waste disposal capacity would also be available in the event that solid waste from a commercial solar power generation facility is disposed at permitted NNSS landfills (see Section 5.1.11.3.2).

5.1.11.3.2 Commercial Solar Power Generation Facility

Construction of a 100-megawatt commercial solar power generation facility under the Reduced Operations Alternative was projected to generate approximately 2,700 cubic feet of hazardous waste and 60,000 cubic feet of construction debris and sanitary solid waste. Operation of this plant was projected to generate approximately 3,000 cubic feet of hazardous waste and 3,400 cubic feet of sanitary solid waste each year. Operational waste would be generated throughout the life of the facility (likely 30 years or more).

Construction of a 100-megawatt commercial solar power generation facility would take approximately 32 months. The commercial solar power generation facility would begin operations after construction, and was assumed to operate for 5 years during the 10-year planning period. Under these assumptions, about 17,000 cubic feet of hazardous waste and 77,000 cubic feet of sanitary solid waste and construction debris would be generated during the 10-year planning period.

As under the No Action Alternative (see Section 5.1.11.1.2), these waste projections are included in this SWEIS to assist DOE/NNSA in determining whether to make land and infrastructure currently under DOE/NNSA control available for another use by a commercial entity. Any waste generated by construction and operation of the power plant would be managed by the commercial operator of the facility. Because numerous hazardous waste recycle or TSD facilities exist in Nevada and nearby states, as well as numerous landfills for industrial and sanitary solid waste, it is expected that offsite disposal capacity would be adequate for the waste projected from the solar power generation facility (see Section 5.1.11.1.1).

If permitted by NDEP, another option may be to dispose the projected sanitary solid waste and construction debris in NNSS landfills. The total volume of sanitary solid waste and construction and demolition debris, including waste from a commercial solar power generation facility, would increase to 3,400,000 cubic feet over the next 10 years. Because this volume would be significantly smaller than the projected remaining NNSS disposal capacity (see Section 5.1.11.1.1), adequate solid waste management capacity at the NNSS would be available. Most likely solid waste from a commercial solar generation facility would be disposed off site.

Waste Management—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) continues to strongly oppose the transportation, storage and disposal of radioactive waste at the Nevada National Security Site (NNSS); however, Indian people must continue to fulfill our birth-rite obligation to care for our Holy Land and do what we can to try to restore balance to Area 5 and other contaminated locations.

The CGTO knows the NNSS is used to dispose of low-level radioactive waste and low-level mixed radioactive waste (i.e., containing certain hazardous wastes) in Area 5, and non-hazardous waste and debris. Indian people hold traditional and scientific views of radioactive materials and waste. As an example, the former builds on the view that all resources–including the rocks–are alive. Radioactive rocks are powerful, but they can become "angry rocks" if they are removed without proper ceremony, used in a culturally inappropriate way, disposed of without ceremony, or placed where they do not want to be. The practice of dealing with "bad medicine" or neutralizing negative forces is a part of our traditional culture. Indian knowledge and use of radioactive rocks, or minerals, in the western United States goes back for thousands of years. Areas with high concentrations of these minerals are called dead zones. Such areas contain places of power or energy and can only be visited or certain minerals used under the supervision of specially-trained Indian people, who are sometimes referred to in the English language as a shaman or medicine man. Therefore, the U.S. Department of Energy (DOE) would benefit from this knowledge if applied correctly.

A head Salt Song singer and religious leader for the Chemehuevi Paiutes once explained the impacts of radiation as follows:

"Our spirits will paint their faces and become angry because they are disturbed by the presence of angry rocks. When we are out there now, it is still and peaceful; it is like being in a church chamber. Radiation will disturb the harmony… It will no longer be the same. It will be violated. All the previous songs stories that have been shared in the area will be disturbed. Once a song is sung it continues to be there. When you sing a song you are on the trail – your spirit is making that trip. You are describing where you are at and what is happening. You tell in the song where you are and what you are doing. When people go to these areas today a person can get a song. Previous songs live in the mountains in the canyons. If you were a gifted person that was meant to be an owner of the song you can actually hear it… There are still areas today where you can go and hear the song. Some people hear the songs and it scares them because they do not know what it is. Young people need to be told what it is they are hearing. The places need to be protected from damage so the songs continue to be there for future generations. It is like a delayed echo that never goes away and can come again and again to new people."

We are very concerned about the tritiated liquids disposed at the NNSS and treated by evaporation into the air from ponds, open tanks, and sewage lagoons. The CGTO is concerned about the ponds drying up and the airborne residue adversely impacting the environment.

According to tribal elders, *"Evaporating tritium like this is not a natural process. The natural environment is altered. The wildlife could drink this contaminated water, birds could land on the ponds, insects and vegetation can become contaminated. This contamination would then adversely impact the food chain. We are concerned the animals will become contaminated or sick if they ingest other contaminated species in the food chain. How can they clean themselves to survive? How can DOE contain this contamination? "*

We are also concerned about adverse impacts to the land, animals, plants, water, air, and insects from the waste and noise generated during explosive waste detonation at the Area 11 Explosives Ordnance Disposal Unit. Indian people have witnessed the destructive force of explosive detonations and the resulting destruction to the environment. For example, animals relocate to unfamiliar habitats, which adversely impact their survival rate. Air is adversely impacted, increasing the occurrence of dead air [1]. Noise and vibration from the detonations impact the insects, and disrupt vegetation growth.

Indian people know if the earth and environment are being disrespected, such as in Areas 5 and 11, the spirits that protect and watch over these can become upset and respond negatively. This can result in the characteristics of the environment changing, causing animals to leave their natural habitats, reducing the native vegetation [2], further reducing water resources, and increasing occurrences of perceived mishaps.

[1] *For additional information on dead air, see Appendix C.2.8.*

[2] *Reducing the natural vegetation may result in the introduction of noxious weeds.*

Waste Management—American Indian Perspective (cont'd)

The CGTO is also concerned about transporting hazardous and radioactive waste through American Indian homelands and adversely impacting their health and environment. Many of the Indian land within the region of influence are located in remote areas with limited access by standard and substandard roads. Should an emergency situation resulting from NNSS related activities including the transportation of hazardous and radioactive waste occur, it could result in the closure of a major reservation road. If a major (only) road into a reservation is closed, numerous adverse social and economic impacts could occur. For example, Indian students who have to travel an unusually high number of miles to or from school could realize delays. Delays also could occur for regular deliveries of necessary supplies for inventories needed by tribal enterprises and personal use. Purchases by patrons of tribal enterprises and emergency medical services in route to or from the reservation could be dramatically impeded. Potential investors interested in expanding tribal enterprises and on-going considerations by tribal governments for future tribal developments may significantly diminish because of the perceived risks associated with NNSS related activities including the transportation of radioactive waste.

Finally, the CGTO struggles with the ethics of relocating radioactive waste from other American Indian lands so those people can live without fear of radioactivity. We are greatly concerned about the adverse spiritual, environmental, and health impacts associated with relocating these angry rocks from their current locations to our Holy Land. We believe transporting these to our land perpetuates animosity and discord among tribal governments. We strongly encourage DOE to host a break out session among the culturally affiliated tribes associated with the NNSS and the multi-state waste generator facilities during the 2011 NNSS Generator Workshops to facilitate further discussion and understanding, and each, annual generator workshop thereafter.

See Appendix C for more details.

5.1.12 Human Health

Continued operations at the NNSS present potential health impacts associated with radioactive materials, hazardous chemicals, industrial accidents, and noise. This section presents an assessment of the potential radiological, chemical, industrial accident, and noise impacts on workers and the general public associated with normal operations and hypothetical accident conditions. Specific details of the methodologies employed for determining radiological, chemical, and industrial impacts are presented in Appendix G.

Radiological impacts are presented for two public receptors: the general population living within 50 miles of a radioactive materials release location and an MEI. The MEI was assumed to be at the offsite location that would result in the maximum radiological impact. General population impacts were evaluated for a residential scenario whereby people are exposed to radioactive materials emitted from operational facilities, as well as other locations where experiments are to be performed or legacy testing areas that emit tritium or are contaminated with particulate radioactive materials. Radiation exposure can occur through inhalation, direct exposure to a radioactive plume or radioactive material deposited on the ground, or ingestion of contaminated food products from animals raised locally and fruits and vegetables grown in a family garden. Impacts on the MEI were evaluated for a scenario that includes the same exposure pathways assumed for the general population, but assumes an increased amount of time spent outdoors and a higher rate of contaminated food consumption.

Potential impacts are also presented for two categories of workers: workers directly involved in activities associated with assigned missions and nearby noninvolved workers.

In the event of an accident, involved workers could receive a radiation dose or be exposed to hazardous chemicals. Potential impacts on workers at a facility at which an accident was assumed to occur could range from minor to lethal. The impacts on these workers would depend on a number of factors, including the nature of the accident-initiating event, their proximity to the accident, and conditions in the vicinity of the accident (e.g., meteorological conditions or localized airflow). In this SWEIS, LCFs were not calculated for involved workers as a result of a fatal accident.

Maximally Exposed Individual (MEI) – A hypothetical individual whose location and habits result in the highest total radiological exposure (and thus dose) from a particular source for all relevant exposure routes (e.g., inhalation, ingestion, direct exposure).

Rem – A unit of radiation dose used to measure the biological effects of different types of radiation on humans. The dose in rem was estimated using 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. The average dose to an individual in the United States primarily from natural background sources of radiation is about 310 millirem per year; the national average including medical sources is about 620 millirem per year.

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. This site-wide environmental impact statement focuses on LCFs as the primary means of evaluating health risk from radiation exposure. The values reported for LCFs are the increased risk of a fatal cancer for an MEI or noninvolved worker or the increased risk of a single fatal cancer occurring in an identified population.

A noninvolved worker is a person working at the site who is incidentally exposed to radiological or chemical emissions, either during normal operations or as a result of an accident. The location of a noninvolved worker could be a facility or nearby locale that is expected to be staffed on a daily basis. Because the various areas at which activities occur are widely separated, it is unlikely that there would be a noninvolved worker nearby. Additionally, because the sources of normal operations emissions are widely separated, no single noninvolved worker would receive significant exposures from multiple locations. For purposes of accident analyses, the noninvolved worker was generally assumed to be 110 yards downwind of the emission point, except for those instances where the presence of a noninvolved worker is not logical (e.g., inside the exclusion zone of a high-explosives experiment).

Potential radiological impacts are presented in terms of dose and increased risk of an LCF.

For normal operations, the following criteria were used to evaluate the radiological impacts on an MEI:

- NESHAPs annual dose limit of 10 millirem per year for air emissions from a DOE site (40 CFR Part 61 Subpart H)
- Increased risk of an LCF

For a radiation worker, under normal operations, the following criteria were used to evaluate the radiological impacts:

- DOE's radiation worker protection requirement of 5 rem per year
- DOE guidance for maintaining doses below 2 rem per year
- The DOE/NNSA NSO guidance for maintaining doses below 0.5 rem per year
- Increased risk of an LCF

For the public, the MEI, and a noninvolved worker, there are no established standards for doses associated with an accident; however, DOE uses an offsite individual dose of 25 rem in its safety analysis as an evaluation guideline as to whether safety class or safety significant controls are required. In this SWEIS, the following criteria were used to evaluate the impacts of a facility accident:

- Dose and increased risk of an LCF if the accident were to occur and
- Overall risk of an LCF when the probability of the accident is considered

For all workers, including construction workers, the following criteria were used to evaluate the impacts from industrial accidents:

- Number of total recordable cases and the cases resulting in days away, restricted, or transferred (DART)
- Number of fatal accidents from construction across the worker population

For chemicals, measures were derived from comparisons with standards or guidelines for chemical exposure, such as the American Industrial Hygiene Association's Emergency Response Planning Guidelines.

Noise from most activities at the NNSS or any offsite location would not propagate beyond the site's boundaries at discernible levels. In general, noise levels associated with activities for each of the alternatives would have the greatest impacts on onsite workers. Activities that would generate the greatest onsite noise levels would include construction, military training, and high-explosives experiments. Activities evaluated for potential noise impacts on onsite workers included high-explosives experiments under the Stockpile Stewardship and Management and Work for Others Programs and the use of aircraft under the Work for Others Program.

Principal noise sources with the largest potential to create an impact in long-term baseline noise conditions to offsite receptors include vehicles transporting workers and materials to the sites. Thus, potential noise impacts on offsite receptors were assessed by estimating the number of employees using privately owned vehicles and the number of shipments to and from the site (primarily under the Waste Management Program).

5.1.12.1 Normal Operations

Under all alternatives, existing sources of radiation exposure would continue to result in a potential radiation dose to the public. These existing sources include tritium from evaporation or evapotranspiration of water and resuspension of radioactive particulates in surface soils; both of these sources are from past nuclear weapons testing performed at the NNSS. Potential radiation doses from these activities are discussed in Chapter 4, Section 4.1.12. For this SWEIS analysis, these sources were estimated to result in a dose of about 0.47 person-rem per year to the population of about 43,000 and a dose of 2.6 millirem per year (5-year average) to the MEI. Incremental doses from operational activities performed under each of the alternatives could add to these baseline doses.

5.1.12.1.1 No Action Alternative

Under the No Action Alternative, radioactive materials would be released as a result of some of the proposed activities. National Security/Defense Mission experiments would be performed with radioactive materials at JASPER and the U1a Complex, but the design of the facilities and experiments would not allow releases to the environment. Similarly, activities performed in the Device Assembly Facility (DAF) would not release radioactive materials that could affect receptors outside of the facility. Activities that could result in additional radioactive emissions include experiments at the Dense Plasma Focus Facility. Waste management activities performed as part of the Environmental Management Mission would not result in radioactive air emissions that would be distinguishable from the tritium and particulate emissions from legacy contamination in the vicinities of the Area 3 RWMS and the Area 5 RWMC. Activities related to D&D and environmental restoration could result in additional radioactive air emissions from the resuspension of radioactive materials previously deposited on building surfaces or the ground. Nondefense Mission activities are not expected to result in radioactive emission.

Table 5–52 presents the estimated annual doses to an MEI and to the population within 50 miles of projected emissions, and the associated annual risks of an LCF. As shown in Table 5–52, the incremental doses to the public from proposed activities at the site would be small compared to doses from baseline sources. The annual risk of an LCF to the MEI from the total dose of 2.8 millirem would be 2×10^{-6} (1 chance in 500,000 of an LCF). The calculated risk of 0.0003 LCFs to the surrounding population of approximately 54,000[6] means that the most likely outcome would be no additional LCFs in that population resulting from the estimated annual total population dose of 0.5 person-rem. Based on the premise that there is some risk associated with any radiation dose, the population risk of 0.0003 implies that there would be an annual risk of 1 in 3,300 of a single LCF in the population.

Table 5–52 Nevada National Security Site Annual Radiological Impacts of Normal Operations – No Action Alternative

Release Location	*MEI*		*Offsite Population within 50 Miles*	
	Dose (millirem)	*LCF Risk*	*Dose (person-rem)* [a]	*LCF Risk*
Baseline from diffuse sources [b]	2.6	2×10^{-6}	0.47	3×10^{-4}
National Security/Defense Mission				
Dense Plasma Focus Facility (Area 11)	0.14	8×10^{-8}	0.027	2×10^{-5}
Environmental Management Mission				
Environmental restoration/D&D [c]	< 0.01	$< 6 \times 10^{-9}$	< 0.002	$< 1 \times 10^{-6}$
Total Offsite Impact	**2.8**	$\mathbf{2 \times 10^{-6}}$	**0.5**	$\mathbf{3 \times 10^{-4}}$

< = less than; D&D = decontamination and decommissioning; LCF = latent cancer fatality; MEI = maximally exposed individual; rem = roentgen equivalent man.

[a] The approximate population within 50 miles of the Dense Plasma Focus Facility is 54,000.

[b] The baseline for the MEI is based on the dose reported in annual site environmental reports; the population dose is based on an historical calculation from a National Emission Standards for Hazardous Air Pollutants report (DOE/NV 2005a, 2005f, 2006a, 2007d, 2008a, 2009d).

[c] Estimates based on projections for D&D of the Reactor Maintenance, Assembly, and Disassembly (R-MAD); the Engine Maintenance, Assembly, and Disassembly (E-MAD); the Pluto Facility, Building 26-2106; and environmental restoration of corrective action units 300 and 543. The annual doses to the MEI associated with any of these activities were less than 0.01 millirem. The population dose is based on the population-to-MEI dose ratio for the baseline for diffuse sources, which was assumed to have similar resuspension and dispersion/deposition characteristics.

A portion of the workers at the NNSS would receive a radiation dose in the course of performing their jobs. Under the No Action Alternative, activities would continue at approximately the same level as they have over the last few years. Therefore, it is expected that the number of workers receiving a measurable radiation dose and the average annual dose would continue at about the same level. About 75 workers are expected to receive a measurable dose, with a collective worker dose of about 5.2 person-rem. The average annual dose would be about 70 millirem per worker.

The potential for occupational injury and illness was estimated for DOE/NNSA activities at the NNSS using rates based on DOE experience (DOE 2010e) and for activities associated with the construction and operation of a commercial solar power facility using general industrial experience (DOL 2010b, 2010c) (see Appendix G for details). The number of total recordable cases (TRCs) and DART cases were projected based on the number of FTEs estimated for this alternative. Under this alternative, a total of 32 TRCs and 14 DART cases were projected annually for all activities being performed at the NNSS. DOE/NNSA operations at the NNSS were estimated to result in 26 TRCs and 11 DART cases annually. Under this alternative, a commercial solar power generation facility could be constructed. Solar power facility operations would result in 6.2 TRCs and 3.2 DART cases annually. Construction of the solar

[6] *Differences in exposed populations are because different locations are used as the center of the 50-mile population, depending on the source of the emission.*

power facility by 500 FTEs over a 35-month period was projected to result in 60 TRCs and 31 DART cases. The estimated annual risk of a fatality during the construction period is 0.019.

Subsistence Consumer. A special receptor analysis was performed to evaluate the potential radiological impacts on an individual who derives all of his or her sustenance from the land. The assumption that all of the subsistence consumer's food comes from the land is conservative because even those who rely on game animals, local crops, or both for a portion of their diet generally get some of their food from commercial sources that would not be affected by the NNSS. This hypothetical individual was assumed to live near the NNSS at a location where there is soil contamination as a result of radioactive releases from past NNSS operations. A portion of the individual's diet was assumed to be derived from crops raised on a farm. The balance of the receptor's diet was assumed to come from wildlife that has become contaminated on the NNSS and was harvested through hunting at an offsite location. The estimated dose to a person living a subsistence lifestyle is about 10 millirem per year; the increased risk of an LCF from this dose is about 6×10^{-6} or 1 chance in 170,000. A more detailed description of the scenario and the results of the analysis are provided in Appendix G, Section G.2.4. Because this receptor's dose would be dominated by existing radioactive materials in the soil or in wildlife, it would be nominally the same for all of the alternatives. If this receptor also received the same dose from airborne releases as the MEI, his or her total dose would be 13 millirem per year; the incremental LCF risk from this dose would be 8×10^{-6} or 1 chance in 130,000.

Noise Impacts. Under the No Action Alternative, construction of a new solar power generation facility would involve movement of workers and equipment and would result in localized, intermittent, and temporary increases in noise levels near the construction site. DOE/NNSA would implement appropriate hearing protection programs to minimize noise impacts on workers during construction, including the use of administrative controls to ensure adherence to appropriate Occupational Safety and Health Act standards (29 CFR 1926.52), engineering controls, and personal hearing protective equipment.

High-explosives experiments under the Stockpile Stewardship and Management and Work for Others Programs would be conducted at BEEF and other locations in the Nuclear and High Explosives Test Zone (Areas 1, 2, 3, 4, 12, and 16). To protect onsite workers and visitors, an exclusion zone would be established around an experiment based on the size of the explosion and the predicted noise levels. During preparations, only authorized personnel would be allowed in the vicinity of the experiment and would be required to wear personal protective equipment. All personnel would be prevented from entering the exclusion zone during the performance of the experiment. Under the No Action Alternative, up to 30 conventional high-explosives experiments (using up to 70,000 pounds of TNT-equivalent explosives) per year would occur at BEEF or other locations within the Nuclear and High Explosives Test Zone at the NNSS. These detonations would be conducted both underground and in the open air. It was estimated that a detonation of a 70,000-pound TNT-equivalent explosive could result in noise levels of 160 decibels (dB) at 1 mile from a blast site (DTRA 1981). At this noise level, a human without hearing protection could experience tinnitus (or "ringing" of the ears); however, it is expected that this level would decrease substantially to barely audible levels at distances beyond the NNSS boundary. Potential noise impacts on residents in areas adjacent to the NNSS would be minimal because the NNSS is in a remote area and is buffered by the Nevada Test and Training Range to the north and east and partially on the west. The distances from the closest location of high-explosives experiments (within the Nuclear and High Explosives Test Zone) to the NNSS site boundary (not buffered by the Nevada Test and Training Range) and to the nearest community (Amargosa Valley) are approximately 15 and 25 miles, respectively.

Periodic military training exercises at the NNSS under the Work for Others Program would include the operation of manned and unmanned aerial systems, including fixed-wing aircraft (airplanes) and helicopters, which would result in local noise levels ranging from 80 to 90 decibels A-weighted (dBA) (DOE 2001a). Flights associated with NNSS activities originate off site at various airports and military airfields and land at the Aerial Operations Facility (Area 6), Desert Rock Airport, and Yucca Lake

Airstrip. The majority of flight activities occur within the NNSS boundary. Aerial vehicles would fly at altitudes and on flight paths approved by the Federal Aviation Administration (FAA) or military controllers. Noise impacts associated with use of these aerial vehicles would generally be limited to within the NNSS boundary or may be detected on U.S. Route 95, the closest publicly available area. Increases in noise levels from these activities would be intermittent and temporary and are not expected to result in any appreciable noise level increases to offsite receptors near the NNSS boundary. Worker hearing protection for these activities would be required, as necessary.

Potential noise impacts on offsite receptors from NNSS activities under the No Action Alternative would primarily result from traffic noise generated by privately owned vehicles of commuting employees (regular operations and construction); by trucks transporting waste and materials; and by vehicles associated with the construction of the commercial solar power generation facility. As discussed in Section 5.1.3.2, regional daily traffic volumes projected under this alternative would increase by up to approximately 35 percent from future baseline conditions on roadways analyzed (not including Mercury Highway, which mainly serves the NNSS and does not include any private residential areas) (see Tables 5–18 and 5–19). The increase in daily vehicle trips by privately owned vehicles from construction workers related to a commercial solar power generation facility would increase baseline noise conditions along the main commuter routes to the NNSS; however, increases in traffic noise would generally occur during the morning and afternoon commuting hours. The increase in daily truck trips is not expected to increase baseline noise levels substantially along the primary highways leading to the NNSS because the truck transports would be distributed throughout the day.

5.1.12.1.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, the baseline dose from legacy source emissions would be the same as under the No Action Alternative. A higher level of activities would occur to support the National Security/Defense Mission, which would increase the release of radioactive materials. A larger number of experiments with high explosives would be performed at BEEF and other locations in the Nuclear and High Explosives Test Zone; some of these experiments would use a larger quantity of explosives than that used under the No Action Alternative. Additionally, 20 uncontained experiments would be conducted using depleted uranium. A larger number of experiments would also be performed at the Dense Plasma Focus Facility. Weapons maintenance, weapons disassembly, or both would be performed at DAF under the Expanded Operations Alternative; these activities, however, are not expected to result in the release of radioactivity to the environment.

Studies using radioactive tracers in the open environment would be conducted under this alternative. These studies would use short-lived noble gas and particulate radionuclides that would be released above or below ground. The largest potential for offsite radiological impacts from typical tracer experiments is associated with the underground release of radioactive gases or particulates and their transport to the surface because larger quantities of radionuclides would be used for subsurface experiments. Because these experiments are still at the conceptual stage, the actual amounts of radioactive materials that might reach the surface and be available for transport to the public are unknown. For purposes of this SWEIS, it was assumed that the tracer experiments would comply with project-specific safety and environmental goals established to prevent exceeding the overall NNSS NESHAPs airborne radiation standard of 10 millirem per year to the MEI. For this SWEIS, it was assumed that the MEI annual dose limit goal from tracer studies would be 1 millirem per year for all experiments conducted.

Table 5–53 shows the calculated offsite doses that could occur under the Expanded Operations Alternative. As shown in Table 5–53, the incremental doses to the public from proposed activities at the site would be small compared to doses from baseline sources. The annual risk of an LCF to the MEI from the total dose of 4.8 millirem would be 3×10^{-6} (1 chance in 330,000 of an LCF). The calculated risk of 0.0005 LCFs to the surrounding population of approximately 54,000 means that the most likely outcome would be no additional LCFs in that population resulting from the estimated annual total population dose of 0.89 person-rem. Based on the premise that there is some risk associated with any radiation dose, the population risk of 0.0005 implies there would be an annual risk of 1 in 2,000 of a single LCF in the population.

Under the Expanded Operations Alternative, the level of activity associated with experiments using radioactive materials would increase. There would also be new activities performed at DAF involving limited-life component exchanges in nuclear weapons or weapons disassembly that would result in worker doses. The number of workers receiving a radiation dose under this alternative was assumed to increase proportionally to the increase in the overall workforce (see Section 5.1.4). Therefore, the number of workers receiving a measurable radiation dose would increase from 75 to about 94. Use of work practices and procedures to maintain exposures as low as reasonably achievable would continue; assuming the average dose remains at recent levels, the collective dose to the worker population would be about 6.6 person-rem.

Table 5–53 Nevada National Security Site Annual Radiological Impacts of Normal Operations – Expanded Operations Alternative

	Offsite Population			
	MEI		***Population within 50 Miles***	
Release Location	***Dose (millirem)***	***LCF Risk***	***Dose (person-rem)*** [a]	***LCF Risk***
Baseline from diffuse sources [b]	2.6	2×10^{-6}	0.47	3×10^{-4}
National Security/Defense Mission				
BEEF high-explosives experiments (Area 4)	0.62	4×10^{-7}	0.067	4×10^{-5}
DPFF (Area 11)	0.6	4×10^{-7}	0.27	2×10^{-4}
Tracer experiments [c, d]	< 1.0	$< 6 \times 10^{-7}$	0.076	5×10^{-5}
Environmental Management Mission				
Environmental restoration/D&D [e]	< 0.01	$< 6 \times 10^{-9}$	< 0.002	$< 1 \times 10^{-6}$
Total Offsite Impact	**4.8** [f]	$\mathbf{3 \times 10^{-6}}$	**0.89**	$\mathbf{5 \times 10^{-4}}$

< = less than; BEEF = Big Explosives Experimental Facility; D&D = decontamination and decommissioning; DPFF = Dense Plasma Focus Facility; LCF = latent cancer fatality; MEI = maximally exposed individual; rem = roentgen equivalent man.

[a] The approximate populations within 50 miles of facilities are: BEEF – 10,500; DPFF – 54,000; and Area 5 (assumed location of tracer experiments) – 54,000.

[b] The baseline for the MEI is based on the dose reported in annual site environmental reports; the population dose is based on an historical calculation from a National Emission Standards for Hazardous Air Pollutants report (DOE/NV 2005a, 2005f, 2006a, 2007d, 2008a, 2009d).

[c] The annual MEI dose for the tracer experiments is a proposed environmental goal.

[d] Values were modeled using the MACCS2 computer code. For conservatism in modeling population dose impacts, tracer experiments were assumed to be conducted in Area 5 because it is closer to population centers. For the MEI calculation, the receptor was conservatively assumed to be at the closest BEEF site boundary location (9 miles east of BEEF).

[e] Estimates based on projections for D&D of the Reactor Maintenance, Assembly, and Disassembly (R-MAD); the Engine Maintenance, Assembly, and Disassembly (E-MAD); the Pluto Facility, Building 26-2106; and environmental restoration of corrective action units 300 and 543. The annual doses to the MEI associated with any of these activities were less than 0.01 millirem. The population dose is based upon the population-to-MEI dose ratio for the baseline for diffuse sources, which was assumed to have similar resuspension and dispersion/deposition characteristics.

[f] Note that derivation of this dose is based on highly conservative modeling assumptions and that mitigation measures and/or reductions in testing quantities, frequencies, or both, would be invoked to ensure the 10 millirem annual dose limit would not be exceeded.

The potential for occupational injury and illness was estimated for DOE/NNSA activities at the NNSS using rates based on DOE experience (DOE 2010e) and for activities associated with the construction and operation of one or more commercial solar power generation facilities using general industrial experience (DOL 2010b, 2010c) (see Appendix G for details). Under this alternative, a total of 44 TRCs and 20 DART cases were projected annually for all activities being performed at the NNSS. DOE/NNSA operations at the NNSS were estimated to result in 32 TRCs and 14 DART cases annually. In addition, DOE/NNSA construction activities involving 250 FTEs per year would result in 3.8 TRCs and 1.7 DART cases annually. Under this alternative, one or more commercial solar power facilities could be constructed. Solar power facility operations would result in 8.3 TRCs and 4.2 DART cases annually. Construction of the solar power facilities by 750 FTEs over a 42-month period was projected to result in 110 TRCs and 31 DART cases. The highest estimated annual risk of a fatality for all construction activities is 0.031. The estimated risk of a fatality from DOE/NNSA construction activities at the NNSS would be 0.0029 per year; the estimated annual risk of a fatality during construction of the commercial solar power facility is 0.029.

Subsistence Consumer. As discussed in Section 5.1.12.1.1, a special receptor analysis was performed to evaluate the potential radiological impacts on an individual who derives all of his or her sustenance from the land. The estimated dose to a person living a subsistence lifestyle is about 10 millirem per year; the increased risk of an LCF from this dose is about 6×10^{-6} or 1 chance in 170,000. If this receptor also received the same dose from airborne releases as the MEI, the total dose would be 15 millirem per year; the incremental LCF risk from this dose would be 9×10^{-6} or 1 chance in 110,000.

Noise Impacts. Under the Expanded Operations Alternative, potential onsite noise impacts would be similar to those described under the No Action Alternative; however, the frequency of increased noise levels would increase because the number of personnel and activities would be higher under this alternative. For example, as under the No Action Alternative, aerial vehicles would be used for periodic military training exercises under the Work for Others Program; however, usage rates would increase under the Expanded Operations Alternative. Under the Stockpile Stewardship and Management and Work for Others Programs, up to 100 conventional high-explosives experiments per year would occur at BEEF and other locations within the Nuclear and High Explosives Test Zone at the NNSS. Although the experiments would still be limited to 70,000 pounds TNT-equivalent explosives at BEEF, up to 120,000 pounds TNT-equivalent explosives would be the maximum limit for experiments within the Nuclear and High Explosives Test Zone (Areas 1, 2, 3, 4, 12, or 16). It was estimated that a detonation of a 120,000-pound TNT-equivalent explosive could result in a noise level of 160 dB at 1.2 miles from the blast site (DTRA 1981). Similar to the No Action Alternative, potential noise impacts on residents in areas adjacent to the NNSS would be minimal, as this noise level would substantially decrease with distance. Depending on meteorological conditions, a temporary rumbling sound, similar to distant thunder, may be detected in nearby communities (DTRA 1981).

Potential noise impacts on offsite receptors under the Expanded Operations Alternative would primarily result from traffic noise generated by privately owned vehicles of commuting employees and by trucks transporting waste and materials to and from the NNSS. As discussed in Section 5.1.3.2, regional daily traffic volumes projected for this alternative would increase by approximately 25 percent from future baseline conditions (see Tables 5–18 and 5–19). The increase in daily vehicle trips by personnel vehicles would primarily increase baseline noise conditions along the main roadways leading to these sites; however, this would be limited to the morning and afternoon commuting hours. The increase in daily truck trips would moderately increase baseline noise levels along the primary highways leading to the NNSS.

5.1.12.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, the baseline dose from existing sources at the NNSS would be the same as under the No Action Alternative. The number of experiments conducted in support of the National Security/Defense Mission at the Dense Plasma Focus Facility would be half of the number proposed under the No Action Alternative. Environmental restoration activities under the Environmental Management Mission would be performed at about the same level as those under the No Action Alternative. **Table 5–54** presents the estimated doses from normal operations for the Reduced Operations Alternative. As shown in Table 5–54, the incremental doses to the public from proposed activities at the site would be small compared to doses from baseline sources. The annual risk of an LCF to the MEI from the total dose of 2.7 millirem would be 2×10^{-6} (1 chance in 500,000 of an LCF). The calculated risk of 0.0003 LCFs to the surrounding population of approximately 54,000 means that the most likely outcome would be no additional LCFs in that population resulting from the estimated annual total population dose of 0.48 person-rem. Based on the premise that there is some risk associated with any radiation dose, the population risk of 0.0003 implies that there would be an annual risk of 1 in 3,300 of a single LCF in the population.

Table 5–54 Nevada National Security Site Annual Radiological Impacts of Normal Operations – Reduced Operations Alternative

	MEI		*Offsite Population within 50 Miles*	
Release Location	***Dose (millirem)***	***LCF Risk***	***Dose (person-rem)*** [a]	***LCF Risk***
Baseline from diffuse sources [b]	2.6	2×10^{-6}	0.47	3×10^{-4}
National Security/Defense Mission				
DPFF (Area 11)	0.07	2×10^{-8}	0.013	8×10^{-6}
Environmental Management Mission				
Environmental restoration [c]	< 0.01	$< 6 \times 10^{-11}$	< 0.002	$< 1 \times 10^{-6}$
Total Offsite Impact	**2.7**	$\mathbf{2 \times 10^{-6}}$	**0.48**	$\mathbf{3 \times 10^{-4}}$

DPFF = Dense Plasma Focus Facility; LCF = latent cancer fatality; MEI = maximally exposed individual; rem = roentgen equivalent man.

[a] The approximate population within 50 miles of DPFF is 54,000.

[b] The baseline for the MEI is based on the dose reported in annual site environmental reports; the population dose is based on an historical calculation from a National Emission Standards for Hazardous Air Pollutants report (DOE/NV 2005a, 2005f, 2006a, 2007d, 2008a, 2009d).

[c] Estimates based on projections for D&D of the Reactor Maintenance, Assembly, and Disassembly (R-MAD); the Engine Maintenance, Assembly, and Disassembly (E-MAD); the Pluto Facility, Building 26-2106; and environmental restoration of corrective action units 300 and 543. The annual doses to the MEI associated with any of these activities were less than 0.01 millirem. The population dose is based on the population-to-MEI dose ratio for the baseline for diffuse sources, which was assumed to have similar resuspension and dispersion/deposition characteristics.

Under the Reduced Operations Alternative, the level of activity associated with experiments using radioactive materials would decrease compared to the No Action Alternative. The number of workers receiving a radiation dose under this alternative was assumed to decrease slightly, proportional to the decrease in the overall workforce (see Section 5.1.4). The number of workers receiving a measurable radiation dose would decrease from 75 to about 68. Use of work practices and procedures to maintain exposures as low as reasonably achievable would continue; assuming the average dose remains at recent levels, the collective dose to the worker population would be about 4.8 person-rem.

The potential for occupational injury and illness was estimated for DOE/NNSA activities at the NNSS using rates based on DOE experience (DOE 2010e) and for activities associated with the construction and operation of a commercial solar power facility using general industrial experience (DOL 2010b, 2010c) (see Appendix G for details). Under this alternative, a total of 28 TRCs and 13 DART cases were projected annually for all activities performed at the NNSS. DOE/NNSA operations at the NNSS were estimated to result in 23 TRCs and 10 DART cases annually. Under this alternative, a commercial solar power facility could be constructed. Solar power facility operations would result in 5.2 TRCs and 2.7 DART cases annually. Construction of the solar power facility by 400 FTEs over a 32-month period was projected to result in 44 TRCs and 23 DART cases. The estimated annual risk of a fatality during the construction period is 0.015.

Subsistence Consumer. As discussed in Section 5.1.12.1.1, a special receptor analysis was performed to evaluate the potential radiological impacts on an individual who derives all of his or her sustenance from the land. The estimated dose to a person living a subsistence lifestyle is about 10 millirem per year; the increased risk of an LCF from this dose is about 6×10^{-6} or 1 chance in 170,000. If this receptor also received the same dose from airborne releases as the MEI, the total dose would be 13 millirem per year; the incremental LCF risk from this dose would be 8×10^{-6} or 1 chance in 130,000.

Noise Impacts. Under the Reduced Operations Alternative, potential noise impacts would be similar to those described under the No Action Alternative; however, the frequency of increased noise levels would decrease because the number of personnel and activities would be reduced under this alternative. Similar to the No Action Alternative, high-explosives experiments under the Stockpile Stewardship and Management and Work for Others Programs would be conducted at BEEF and other locations in the Nuclear and High Explosives Test Zone. Up to 10 conventional high-explosives experiments per year would occur at BEEF and up to 6 per year would occur at other locations at the NNSS under the Reduced Operations Alternative. The frequency of aerial vehicle usage for periodic military training exercises under the Work for Others Program would decrease compared to the No Action Alternative.

Potential noise impacts on offsite receptors under the Reduced Operations Alternative would primarily result from traffic noise generated by vehicles associated with the construction of the commercial solar power generation facility and trucks transporting waste and materials to and from the NNSS. As discussed in Section 5.1.3.2, regional daily volumes projected for this alternative would increase by up to approximately 10 percent from future baseline conditions (see Tables 5–18 and 5–19). The increase in daily vehicle trips by privately owned vehicles from construction workers related to the commercial solar power generation facility would increase baseline noise conditions along the main commuter routes to the NNSS; however, increases in traffic noise would generally occur during the morning and afternoon commuting hours. The increase in daily truck trips is not expected to increase baseline noise levels substantially along the primary highways leading to the NNSS because the truck transports would be distributed throughout the day.

5.1.12.1.4 Waste Disposal Facilities Performance Assessments

As addressed in Chapter 4, Section 4.1.11.1.1.3, radioactive waste disposal occurs at the NNSS in accordance with authorizations issued by DOE/NNSA that consider analyses of possible long-term (over thousands of years) impacts on the public and the environment after the disposal facilities are closed. For disposal of LLW (and the radioactive component of MLLW), DOE requires preparation and maintenance of site-specific performance assessments and composite analyses in compliance with DOE Order 435.1. For disposal of TRU waste, DOE requires analyses in accordance with the requirements of "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" (40 CFR Part 191).

Performance Assessment – An analysis of a radioactive waste disposal facility conducted to demonstrate that, for waste disposed of after September 26, 1988, there is a reasonable expectation that performance objectives for the long-term protection of the public and the environment will not be exceeded following closure of the facility. The performance objectives address (1) doses to representative members of the public through all pathways, (2) doses to representative members of the public through the air pathway alone, and (3) release of radon gas. The analysis must also assess possible water resources impacts, as well as possible impacts on hypothetical future inadvertent intruders into the disposal facility.

Composite Analysis – An analysis that accounts for all sources of radioactive material that may contribute to the long-term dose projected to a hypothetical member of the public from an active or planned low-level radioactive waste disposal facility. The analysis is a planning tool intended to provide a reasonable expectation that current low-level radioactive waste disposal activities will not result in the need for future corrective or remedial actions to ensure protection of the public and environment. If the combined dose from all interacting sources exceeds 30 millirem (total effective dose equivalent) per year, as evaluated for a specified period, a cost-benefit analysis must be performed to determine whether cost-effective options exist to reduce the dose further (DOE 1999b).

LLW management performance. A combined Area 3 RWMS performance assessment and composite analysis was completed in July 2000. The Area 5 RWMC performance assessment was completed in 1998, and the Area 5 RWMC composite analysis was completed in 2001. The analyses determined that, because of the great excess of evapotranspiration over precipitation and other site-specific factors, there was little to no potential for transport of disposed radionuclides to groundwater. Further, the Intergovernmental Panel on Climate Change, in its Fourth Assessment Report estimates that, although increases in precipitation extremes (such as storms associated with "El Niño" events) are possible for the Great Basin, annual-mean precipitation is projected to decrease in the southwest United States (IPCC 2007b). This would tend to make it even more unlikely that a path to groundwater would develop in the future.

The analyses also concluded that all performance objectives would be met. The results of the initial performance assessments are summarized in **Table 5–55** for the air pathway, all pathways, groundwater protection, radon gas, and intruder performance objectives. The results of the initial composite analyses were well below the 30-millirem-per-year decision criterion for both the Area 3 RWMS and Area 5 RWMC.[7]

Subsequently, the performance assessment and composite analyses have been amended and updated annually to reflect new information such as revised estimates of disposed waste inventories or modifications to waste disposal operations (see Chapter 4, Section 4.1.11.1.1.3). The updates have included enhanced probabilistic modeling techniques. Recent reviews and updates of the Area 3 and 5 performance assessments and composite analyses concluded that the results and conclusions of the performance assessments and composite analyses remained valid (NSTec 2010f, 2011a, 2012).

[7] The Area 5 composite analysis also considered the possible long-term impacts of TRU waste and other waste in the greater confinement disposal boreholes and TRU waste in the Area 5 trench.

Table 5–55 Summary of Low-Level Radioactive Waste Disposal Facility Performance Assessments Results

Scenario	Performance Objective	*Area 5 RWMC*		*Area 3 RWMS*	
		Scenario	*PA Result* [a]	*Scenario*	*PA Result* [b]
Air pathway	10 millirem in a year	Transient occupancy [c]	0.17	U-3ah/at Community with agriculture [h]	2×10^{-3}
		Resident farmer [d]	0.77		
		Open rangeland/ Cane Spring [e]	4×10^{-4}	U-3bh Community with agriculture [i]	5×10^{-3}
All pathways	25 millirem in a year	Transient occupancy [c]	0.59	U-3ah/at Community with agriculture [h]	0.03
		Resident farmer [d]	3.4		
		Open rangeland/ Cane Spring [e]	0.17	U-3bh Community with agriculture [i]	0.01
Intruder protection	100 millirem in a year	SLB intruder agriculture [f]	160 [j]	U-3ah/at Intruder agriculture [f]	0.05
		SLB postdrilling intruder [g]	0.71	U-3bh Intruder agriculture [f]	0.03
				U-3ah/at Postdrilling intruder [g]	0.03
		Pit 6 postdrilling intruder [g]	0.90	U-3bh Postdrilling intruder [g]	0.05
Radon-222 flux density	20 pCi/m^2/ second	SLB units	5.7	U-3ah/at	0.01
		Pit 6	5.7	U-3bh	6×10^{-3}
Groundwater protection	40 CFR Part 141	No groundwater pathway during compliance period.			

CFR = *Code of Federal Regulations*; PA = performance assessment; pCi/m^2/second = picocuries per square meter per second; RWMC = Radioactive Waste Management Complex; RWMS = Radioactive Waste Management Site; SLB = shallow land burial.
[a] Analysis over a 10,000-year period of compliance.
[b] Analysis over a 1,000-year period of compliance.
[c] Exposure scenario where receptors visit the closed site, but do not reside at it.
[d] Exposure scenario involving receptor consumption of products from range-fed cattle that have access to the closed site.
[e] Exposure scenario where receptors live at a ranch established at the closed site boundary.
[f] Exposure scenario where an intruder lives in a house (with garden) constructed on top of a disposal unit, assuming a temporary disruption in institutional controls following disposal site closure.
[g] Exposure scenario where an intruder lives in a house (with garden) on an area contaminated with cuttings from a well drilled through a disposal unit, assuming a temporary disruption in institutional controls following disposal site closure.
[h] Exposure scenario where receptors live, garden, and manage livestock in a small community established at the site boundary; exposure occurs from radionuclides released to the air from Pit U-3ah/at.
[i] Exposure scenario where receptors live, garden, and manage livestock in a small community established at the site boundary; exposure occurs from radionuclides released to the air from Pit U-3bh.
[j] Calculated assuming continuation of the operational disposal unit cap. Installation of a thicker cap as part of closure of the Area 5 RWMC would reduce doses to levels in compliance with the performance objective limits (Bechtel Nevada 2000a).
Source: Bechtel Nevada 2006.

Transuranic waste management performance. As discussed in Chapter 4, Section 4.1.11.1.1.3, DOE/NNSA conducted analyses of compliance with EPA's TRU waste disposal requirements in 40 CFR Part 191 for the TRU waste disposed both intentionally in greater confinement disposal (GCD) boreholes and inadvertently in an Area 5 RWMC trench.[8] The EPA regulations were first promulgated in 1985 and revised in 1993; they include assurance requirements and three sets of quantitative safety requirements: (1) a containment requirement limiting the quantities of specific radionuclides that may be released over 10,000 years, (2) an individual protection requirement limiting the annual dose to be received by a member of the public, and (3) a groundwater protection requirement.

[8] Unclassified records accompanying a shipment of about 1,100 cubic feet of classified waste indicated the shipment contained LLW. Subsequent investigation revealed the shipment contained TRU waste (NSTec 2008a).

It was determined that disposal of TRU waste in the GCD boreholes and disposal trench would meet all applicable EPA containment, individual protection, and groundwater protection requirements. For both analyses, it was determined that the projected cumulative releases would meet the probabilities specified in the EPA standard of exceeding specified quantities of radionuclides. Regarding the EPA individual protection requirement, the mean annual dose to a member of the public from all waste in the boreholes over 1,000 years would be about 0.0062 millirem to the whole body and 0.12 millirem to bone. For the TRU waste inadvertently disposed in the trench, the mean of the maximum total effective dose equivalent for a member of the public over 10,000 years would be about 5.5 millirem in a year; 97 percent of this calculated dose was from external radiation from lead-214 and bismuth-214, which are progeny of radon-222 diffusing from LLW disposed in the same trench, and assumed to be deposited in the soil covering the trench. The results of both assessments indicated compliance with applicable EPA requirements. Regarding the EPA groundwater protection requirement, it was determined that the 1983 EPA standard did not specifically apply to the boreholes; for the TRU waste inadvertently disposed in the trench site, characterization and hydrologic processes modeling supported a conclusion that no groundwater pathway would exist within 10,000 years (SNL 2001; Shott et al. 2008).[9]

5.1.12.2 Facility Accidents

This section presents the estimated impacts of potential accidents. The analysis considered a range of accidents associated with the activities performed in support of the National Security/Defense, Environmental Management, and Nondefense Missions. The accidents for which detailed analyses were performed were those with the highest potential for offsite impacts. For each accident, the offsite population includes residents living within 50 miles of the accident location; the MEI, a hypothetical individual living along the site boundary in the direction of largest impact; and the noninvolved worker, a hypothetical individual assumed to be 110 yards from the accident location. Using the site boundary of the NNSS as the location of the MEI results in a conservative estimate of impacts because, for most of the site boundary, the Nevada Test and Training Range provides a buffer area between the NNSS and areas accessible to the general public. As many accidents result in ground-level releases, a nominal distance of 100 meters (110 yards) was selected to provide a conservative indication of the dose a potential noninvolved worker might receive. In reality, any worker not directly involved in an activity or facility would likely be much further away. Operational safety practices, including emergency preparedness and training, would make it very unlikely that any worker would receive the high doses often associated with this nearby receptor location. Additional accident analysis details are included in Appendix G.

Public and worker radiological consequences and risks of hypothesized accidents at the NNSS under the No Action, Expanded Operations, and Reduced Operations Alternatives are presented in **Tables 5–56** and **5–57**. Because the same types of activities occur at the facilities under all of the alternatives, the accident scenarios and consequences would be the same across the alternatives. Differences in accident frequencies due to the level of operations would fall within the frequency ranges of the accident events. Table 5–56 presents the potential consequences of an accident—that is, the dose and corresponding LCF risk (for an individual) or number of LCFs (for the population), assuming the accident occurs. Table 5–57 combines the estimated frequency of the postulated accidents with the potential consequences to present the estimated annual risk of an LCF due to the accidents.

[9]Although the groundwater protection requirement in the 1983 EPA standard did not strictly apply to the TRU waste in the boreholes (SNL 2001), the conclusion reached in 2008 regarding the lack of a groundwater pathway for TRU waste inadvertently disposed in the trench (Shott et al. 2008) is expected to apply to the boreholes as well.

Table 5–56 Nevada National Security Site Facility Accident Radiological Consequences – No Action, Expanded Operations, and Reduced Operations Alternatives

Accident Scenario	*Offsite Population* – *Maximally Exposed Individual* – *Dose (rem)*	*Offsite Population* – *Maximally Exposed Individual* – *LCF Risk* [a]	*Offsite Population* – *Population within 50 Miles* – *Dose (person-rem)*	*Offsite Population* – *Population within 50 Miles* – *Number of LCFs* [b]	*Onsite Noninvolved Worker* – *Dose (rem)*	*Onsite Noninvolved Worker* – *LCF Risk* [a]
National Security/Defense Mission						
DAF explosion involving 55 pounds of high explosives and 1 kilogram of plutonium	0.18	1×10^{-4}	23	$0 (1 \times 10^{-2})$	6.5	4×10^{-3}
DAF design-basis earthquake	0.86	5×10^{-4}	113	$0 (7 \times 10^{-2})$	2,800	1 [c]
National Criticality Experiments Research Center Godiva – burst reactivity induced accident	0.00045	3×10^{-7}	0.059	$0 (4 \times 10^{-5})$	1.5	9×10^{-4}
National Criticality Experiments Research Center beyond-design-basis vault fire – unmitigated	0.022	1×10^{-5}	2.9	$0 (2 \times 10^{-3})$	74	9×10^{-2}
National Criticality Experiments Research Center beyond-design-basis Godiva excess reactivity insertion	0.048	3×10^{-5}	6.3	$0 (4 \times 10^{-3})$	130	2×10^{-1}
JASPER UCVS failure	2.9×10^{-7}	2×10^{-10}	9.9×10^{-5}	$0 (6 \times 10^{-8})$	0.00091	5×10^{-7}
JASPER Target Building fire	8.0×10^{-9}	5×10^{-12}	2.8×10^{-6}	$0 (2 \times 10^{-9})$	2.5×10^{-5}	2×10^{-8}
Tracer surface explosion of short-lived particulates (Expanded Operations Alternative only)	0.45	3×10^{-4}	0.81	$0 (5 \times 10^{-4})$	6.7	8×10^{-3}
Environmental Management Mission – Waste Management Program						
Area 5 – transuranic waste container – vehicle impact and fire	0.36	2×10^{-4}	0.65	$0 (4 \times 10^{-4})$	7.9	5×10^{-3}
Area 5 – classified transuranic material container - vehicle impact and fire	0.83	5×10^{-4}	1.8	$0 (1 \times 10^{-3})$	20.5	2×10^{-2}
Area 5 design-basis earthquake	0.020	1×10^{-5}	0.043	$0 (3 \times 10^{-5})$	0.49	3×10^{-4}
Area 5 TRUPACT Type A container drop, breach, and fire	1.6	1×10^{-3}	3.4	$0 (2 \times 10^{-3})$	39	5×10^{-2}
Environmental Management Mission – Environmental Restoration Program [d]						
One-container spill	4.8×10^{-7}	3×10^{-10}	8.7×10^{-7}	5×10^{-10}	1.0×10^{-5}	6×10^{-9}
Three-container fire	3.6×10^{-6}	2×10^{-9}	7.8×10^{-6}	5×10^{-9}	8.8×10^{-5}	5×10^{-8}
Aircraft crash and fire	0.047	3×10^{-5}	0.090	5×10^{-5}	1.0	6×10^{-4}

DAF = Device Assembly Facility; JASPER = Joint Actinide Shock Physics Experimental Research; LCF = latent cancer fatality; rem = roentgen equivalent man; TRUPACT = Transuranic Packaging Transporter; UCVS = ultrafast closure valve system.

[a] Increased risk of an LCF to an individual, assuming the accident occurs. The risk value is doubled for individual doses exceeding 20 rem (NCRP 1993).

[b] The reported value is the projected number of LCFs in the population, assuming the accident occurs, and is therefore presented as a whole number. The result calculated by multiplying the collective population dose by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses.

[c] Because this represents the increased likelihood of an individual developing an LCF, a value of 1 indicates that the person would likely develop a cancer if prompt death did not occur from acute exposure. The value cannot exceed 1.

[d] Environmental restoration accidents assumed to occur at the Area 5 RWMC.

Table 5–57 Nevada National Security Site Facility Accident Radiological Risks [a] – No Action, Expanded Operations, and Reduced Operations Alternatives

Accident	*Frequency* [b]	*Offsite Population*		*Onsite Noninvolved Worker*
		Maximally Exposed Individual	*Population within 50 Miles*	
National Security/Defense Mission				
DAF explosion involving 55 pounds of high explosives and 1 kilogram of plutonium	8×10^{-4}	9×10^{-8}	1×10^{-5}	3×10^{-6}
DAF design-basis earthquake	10^{-6} to 10^{-7}	5×10^{-10}	7×10^{-8}	1×10^{-6}
National Criticality Experiments Research Center Godiva – burst reactivity induced accident	10^{-2} to 10^{-4}	3×10^{-9}	4×10^{-7}	9×10^{-6}
National Criticality Experiments Research Center beyond-design-basis vault fire – unmitigated	$< 10^{-6}$	1×10^{-11}	2×10^{-9}	9×10^{-8}
National Criticality Experiments Research Center beyond-design-basis Godiva excess reactivity insertion	$< 10^{-6}$	3×10^{-11}	4×10^{-9}	2×10^{-7}
JASPER UCVS failure	10^{-1} to 10^{-2}	2×10^{-11}	6×10^{-9}	5×10^{-8}
JASPER Target Building fire	10^{-4} to 10^{-6}	5×10^{-16}	2×10^{-13}	2×10^{-12}
Tracer surface explosion of short-lived particulates (Expanded Operations Alternative only)	10^{-4} to 10^{-6} per test	3×10^{-8}	5×10^{-8}	4×10^{-7}
Environmental Management Mission – Waste Management Program				
Area 5 – transuranic waste container - vehicle impact and fire	10^{-4} to 10^{-6}	2×10^{-8}	4×10^{-8}	5×10^{-7}
Area 5 – classified transuranic material container - vehicle impact and fire	10^{-4} to 10^{-6}	5×10^{-8}	1×10^{-7}	2×10^{-6}
Area 5 design-basis earthquake	5×10^{-4}	5×10^{-9}	2×10^{-8}	2×10^{-7}
Area 5 TRUPACT Type A container drop, breach and fire	10^{-4} to 10^{-6}	1×10^{-7}	2×10^{-7}	5×10^{-6}
Environmental Management Mission – Environmental Restoration Program [c]				
One-container spill	3×10^{-2}	9×10^{-12}	2×10^{-11}	2×10^{-10}
Three-container fire	4×10^{-6}	8×10^{-15}	2×10^{-14}	2×10^{-13}
Aircraft crash and fire	1.2×10^{-6}	4×10^{-11}	6×10^{-11}	7×10^{-10}

< = less than; DAF = Device Assembly Facility; JASPER = Joint Actinide Shock Physics Experimental Research; TRUPACT = Transuranic Packaging Transporter; UCVS = ultrafast closure valve system.

[a] The risk is the annual increased likelihood of an LCF in the MEI or noninvolved worker and the increased likelihood of a single LCF occurring in the offsite population, accounting for the estimated probability (frequency) of the accident occurring.

[b] The estimated frequency is on an annual basis unless noted otherwise.

[c] Environmental restoration accidents assumed to occur at the Area 5 RWMC.

5.1.12.2.1 No Action Alternative

As part of its National Security/Defense Mission, the NNSS retains an ongoing role in stockpile stewardship and management activities. Activities that would result in the largest offsite radiological consequences and highest radiological risk include accidents at DAF that might result in the explosive dispersal of plutonium from the building. Other experimental activities, such as those at BEEF, JASPER, and the U1a Complex, involve smaller quantities of radioactive material with limited potential for accidental dispersal in quantities that would have impacts on persons other than involved workers. The accident risks for many of the activities under the Stockpile Stewardship and Management Program are small and have no reasonably foreseeable accident scenarios that would likely result in exposure to noninvolved workers or the public.

The accidents with the highest potential consequences and highest radiological risks are shown in Tables 5–56 and 5–57. The highest consequence and risk accidents are those associated with accidents at DAF. At DAF, there are both large quantities of radioactive materials and explosives in close proximity, so there is a potential mechanism to disperse the radioactive material and release it to the atmosphere. Because DAF is designed for these activities, all of the accidents that would result in release of radioactive material to the environment would require extremely unlikely failure of multiple safety systems. The maximum reasonably foreseeable accidents at DAF could result in the explosive dispersal of 1 to 5 kilograms of plutonium and have estimated probabilities in the range of 1×10^{-6} to 8×10^{-4} per year of operation. The highest consequence accident would be an earthquake-initiated accident. If the accident were to occur, the MEI would receive a dose of 0.86 rem, corresponding to an LCF risk of 0.0005 (1 chance in 2,000). The offsite population of about 42,100 within 50 miles of DAF would receive a dose of 113 person-rem; the calculated number of LCFs associated with this dose is 0.07, implying that the most likely outcome would be no additional LCFs in the exposed population. An involved worker within DAF could be fatally injured in the seismically induced explosion. A noninvolved worker outside of DAF could receive a dose of 2,800 rem, resulting in an acute fatality due to receipt of a lethal dose. When the annual probability of the accident occurring is taken into account, the increased risk of an LCF to the MEI would be 5×10^{-10} (1 chance in 2 billion); the increased risk of a single LCF in the exposed population would be 7×10^{-8} (1 chance in 14 million); and the increased risk of an LCF to a noninvolved worker would be 1×10^{-6} (1 chance in 1 million).

> **Maximum Reasonably Foreseeable Accident**
>
> A maximum reasonably foreseeable accident is an accident with the most severe consequences that can reasonably be expected to occur.

The DAF accident that presents the highest risk to the public, that is, when the probability of the accident occurring is considered in conjunction with the consequences of the accident, would be an explosion in DAF followed by the release of a kilogram of plutonium. As shown in Table 5–56, the consequences of this accident would be less than those of the earthquake accident discussed previously. However, because this accident was estimated to be more likely to occur, the overall risk to the public is higher. The explosion followed by a plutonium release accident represents an LCF risk to the MEI of 9×10^{-8} (1 chance in 11 million), the risk of a single LCF in the population of 1×10^{-5} (1 chance in 100,000), and an LCF risk to a noninvolved worker of 3×10^{-6} (1 chance in 300,000).

More-severe accidents at DAF would have much lower probabilities than the explosions that result in dispersion of plutonium. The highest potential consequence accident that has been postulated in DAF safety analyses is an inadvertent nuclear detonation. The physical conditions that would be required to get the plutonium and explosive materials in a configuration that might result in a nuclear yield are extraordinarily unlikely. It is much more likely that accidents involving both high explosives and plutonium would just result in explosive dispersal of plutonium with no nuclear yield. An inadvertent nuclear yield accident is considered in the DAF safety analyses as a beyond-design-basis accident and safety controls are in place to prevent such an accident. The safety controls that prevent the explosive dispersal of plutonium would also prevent the conditions that might result in an inadvertent detonation.

The DAF safety analyses indicate that "this event has a vanishingly small likelihood (i.e., below 10^{-6} per year)" and at least two orders of magnitude less likely than a high-explosive dispersal accident. When the mitigation controls are considered, the likelihood of an inadvertent nuclear yield occurring as a result of an accident is expected to be far below the 10^{-6} to 10^{-7} per year range and is not considered further in this SWEIS.

The Stockpile Stewardship and Management Program also includes the disposition of a damaged U.S. nuclear weapon at existing facilities. U.S. nuclear weapons are designed with multiple layers of safeguards to prevent the accidental detonation of a weapon, even a damaged weapon. These safeguards and the design knowledge that would be available to personnel handling the weapon are expected to prevent an inadvertent detonation. Therefore, the potential radiological impacts associated with managing a damaged U.S. nuclear weapon are expected to be comparable to the accident scenarios identified for DAF.

No reasonably foreseeable major accident scenarios different than those evaluated for the Stockpile Stewardship and Management Program would occur under the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. A number of activities would involve experiments using radioactive materials in the form of sealed sources or well-packaged, unopened materials, for which substantial radiological accidents are not expected.

The activities included in this program include disposition of an improvised nuclear devise. If the need arose for the disposition of one or more improvised nuclear devices, the impacts of an accident would be comparable to those resulting from intentional destructive acts, which are discussed in Section 5.1.12.3 and are analyzed in a classified appendix.

No reasonably foreseeable major accident scenarios different than those evaluated for the Stockpile Stewardship and Management Program that could result in public or noninvolved workers exposure were identified for the Work for Others Program. All activities at shared facilities, such as BEEF, NPTEC, RNCTEC, and the T-1 Training Area, present extremely low risks to the public and noninvolved workers.

Under the Environmental Management Mission, Waste Management Program, activities that have the potential for accidents that might result in offsite radiological consequences all involve impact and a subsequent fire involving containers with large quantities of radioactive material. In all cases, these containers are designed and maintained in such a configuration that vehicle impacts are very unlikely and rupture of a container and a subsequent fire are even less likely. All of the accidents that might result in a substantial release of radioactive materials from the container are classified as "extremely unlikely," with an estimated probability of occurrence of 10^{-6} to 10^{-4} (1 chance in 10,000 to 1 million) per year. Because wastes are typically stored in containers that would be appropriate for over-the-road transportation, the likelihood that an onsite impact would substantially damage one or more containers is low.

Many of the activities under the Waste Management Program have no reasonably foreseeable accident scenarios that could result in public or noninvolved workers exposure.

The accidents with the highest potential consequences, as shown in Table 5–56, are those associated with the breach of a waste container in conjunction with a fire at the Area 5 RWMC. In these cases, there are both radioactive materials and combustible materials within waste packages, so there is a potential mechanism to disperse the radioactive material and release it to the atmosphere if the waste package is breached and ignition occurs. Because the waste packages and waste handling and storage practices are designed to protect waste while in storage, all of the accidents that would result in release of radioactive material to the environment would require a failure of multiple safety systems. The maximum reasonably foreseeable accident at the Area 5 RWMC is a container rupture due to impact and a subsequent fire that results in dispersal of up to 126 grams of plutonium. The estimated probability of this type of event is in the range of 10^{-6} to 10^{-4} (1 chance in 10,000 to 1 million) per year of operation. If this accident were to occur, the MEI would receive a dose of 1.6 rem, which corresponds to an LCF risk of 0.001 (1 chance in 1,000). The offsite population of about 54,000 within 50 miles would receive a dose of 3.4 person-rem;

the calculated number of LCFs associated with this dose is 0.002, implying that the most likely outcome would be no additional LCFs in the exposed population. A noninvolved worker within Area 5 could receive a dose of 39 rem. This dose could result in radiological injury without prompt medical treatment and represents an LCF risk of 0.05 (1 chance in 20). When the annual probability of the accident occurring is taken into account, the increased risk of an LCF to the MEI would be 1×10^{-7} (1 chance in 10 million); the increased risk of a single LCF in the exposed population would be 2×10^{-7} (1 chance in 5 million); and the increased risk of an LCF to a noninvolved worker would be 5×10^{-6} (1 chance in 200,000).

For Environmental Restoration Program activities at the NNSS, the analyzed accident would involve the release of radioactive material due to a single container spill, a multiple container fire, or an aircraft crash into multiple containers. These accidents could occur any place on the NNSS where environmental remediation is performed. For purposes of analysis, these accidents were modeled as occurring at the Area 5 RWMC; because this location is toward the southern end of the site and near the site boundary, the population and MEI doses would be conservative. The preceding paragraph discusses accidents associated with the Waste Management Program at the Area 5 RWMC that have a higher estimated frequency than an airplane crash. Only small quantities of radiological materials would be involved and potentially released. The maximum reasonably foreseeable accident for the NNSS Environmental Restoration Program activities is a military aircraft crash that results in a large fire in which a large quantity of contaminated soil is involved in the fire. The estimated probability of this type of event is 1.2×10^{-6} (1 chance in 800,000) per year of operation. If this accident were to occur, the MEI would receive a dose of 0.047 rem, with a corresponding LCF risk of 3×10^{-5} (1 chance in 33,000). The offsite population of 54,000 within 50 miles would receive a dose of 0.09 person-rem; the calculated number of LCFs associated with this dose is 5×10^{-5}, implying that the most likely outcome would be no additional LCFs in the exposed population. A noninvolved worker outside the immediate area of the crash could receive a dose of 1.0 rem, with an associated LCF risk of 6×10^{-4} (1 chance in 1,700). When the probability of the accident is taken into consideration, the risk to the offsite public or a noninvolved worker would be essentially zero (7×10^{-10} [1 chance in 1 billion] or less).

No accidents specific to the Nondefense Mission were identified that would present any relevant accident scenarios other than those already addressed for other missions.

Accidents involving hazardous chemicals. The potential for accidents involving hazardous chemicals to affect noninvolved workers or the public is quite limited. The potential for hazardous chemical impacts on the public was evaluated in the *1996 NTS EIS* (DOE 1996c) and no substantial impacts were found. Consistent with current practice, inventories of hazardous chemicals would be maintained and reported annually to the State of Nevada. Those inventories imply that only small quantities of most types of hazardous chemicals are used at the NNSS and that these chemicals present accident risks primarily to workers directly handling the chemicals. DOE safety programs are in place to minimize the risks to workers from both routine operations and accidents involving these materials. The larger quantities of hazardous materials that would be unique to NNSS-type activities include large quantities of lead metal typically used for shielding, but these materials do not present an accident risk.

Regarding risks from handling toxic or hazardous chemicals, worker safety programs at the NNSS are enforced via required adherence to Federal and state laws, DOE Orders, Occupational Safety and Health Administration (OSHA) and EPA guidelines, and plans and procedures for performing work, including training, monitoring, use of personal protective equipment, and administrative controls. Although chemical inventories have varied to a limited extent over recent years, administrative controls continually ensure that quantities do not approach those levels that pose undue risk due to storage, concentration, bulk quantity, or logistical factors. Any amount(s) that potentially exceed threshold planning quantities require reporting under Federal regulations (40 CFR Part 355, 40 CFR Part 370). Over the last 4 years, no hazardous chemicals have been stored on site in quantities sufficient to exceed the threshold planning quantities for that chemical and trigger the need to implement OSHA Process Safety Management requirements to prevent or mitigate accidental releases.

Because of the NNSS's remote location and large size, there is limited risk of chemical exposure to the surrounding public population resulting from normal site operations or accidents. Nevertheless, monitoring efforts and baseline studies are regularly performed. However, certain workers at the NNSS are at risk of chemical exposure, depending on their job function and proximity to various sources.

Some experiments proposed under the alternatives would involve use of hazardous chemicals and their intentional release to the atmosphere. For purposes of this analysis, the releases of these chemicals were treated as sporadic, planned releases rather than accidental releases. For example, small quantities of beryllium and lithium may be released to the atmosphere by experiments involving nuclear explosive-like devices. These proposed experiments would have specific job safety hazards analysis, as required by DOE rules, that would minimize potential impacts.

At NPTEC, future experimental activities could include evaluating the potential impacts of releasing larger quantities of chemicals; inadvertent release of a large quantity of chlorine has been identified as the expected limiting chemical accident. Proposed experiments would undergo thorough environmental and safety reviews prior to authorization; these reviews would include determining and performing the appropriate level of NEPA review and ensuring adequate controls are in place to protect workers, the public, and the environment. In most cases, an accident involving such hazardous materials would release the materials in an unplanned and uncontrolled manner. In the event of an accident, a release would occur that was not in accordance with proper experimental procedures. Workers may not be properly sheltered and weather conditions may not be the same as those for planned experiments. As such, accidents involving the hazardous materials have the potential to affect both involved and noninvolved workers, and to release the materials at a higher rate than planned in the controlled experiment.

To evaluate the potential environmental impacts of an accident related to future experiments at the NNSS involving hazardous chemicals, a large, accidental chlorine gas release from a railcar at the Nonproliferation Test and Evaluation Complex was postulated. This hypothetical accident is expected to be in the "extremely unlikely" to "beyond extremely unlikely" frequency category, i.e., in the 10^{-4} to 10^{-6} per year or lower frequency range. Catastrophic accidents involving a full, 90-ton railcar of chlorine have resulted in fatalities, including the January 6, 2005, accident that resulted in puncture of a 90-ton chlorine railcar in Graniteville, South Carolina. In that accident, about 60 tons of chlorine escaped through a fist-sized hole in one of the railcars and nine people were killed (NTSB 2005).

Modeling results with Areal Locations of Hazardous Atmospheres (ALOHA), assuming the release occurs quickly over 1 hour, indicate that potentially fatal concentrations (exceeding Emergency Response Planning Guideline level 3 concentrations [ERPG-3]) could extend downwind a few miles under typical daytime conditions and for 5 to 6 miles or more under stable nighttime conditions. Concentrations that could lead to potentially serious impacts (exceeding ERPG-2) could extend downwind even further, as could concentrations that could lead to odor and irritation (exceeding ERPG-1). In real-world accidents, the releases have occurred over many hours and resulted in lower concentrations than predicted in the models. Because of the nature of chlorine, the complexities of trying to model such a complex accident, and the dispersion of the heavier-than-air gas, these results have a high degree of uncertainty. If such an accident were to occur at the NNSS, it would likely not affect members of the public because of the long distances to publicly accessible locations. The remote location of the facility on the NNSS and the additional buffer provided by the Nevada Test and Training Range would keep members of the public at least 8 miles away. Involved or noninvolved workers could be exposed to fatal concentrations of the gas at the outset of the accident. Once an accident condition was recognized, in accordance with procedures and training, workers would take actions to protect themselves and emergency response teams would intervene and evacuate personnel and implement measures to reduce or stop the leak.

For the Area 5 hazardous waste storage area, the maximum reasonably foreseeable accidents identified in the *1996 NTS EIS* still represent a reasonable upper range of accidents, although those quantities of hazardous materials have not typically been present and are not expected under any of the alternatives. **Table 5–58** presents the results of the chemical accident analysis for all alternatives.

Table 5–58 Nevada National Security Site Facility Accident Chemical Risks – No Action, Expanded Operations, and Reduced Operations Alternatives

Accident	Frequency	*Offsite Population* Maximally Exposed Individual	Onsite Noninvolved Worker
Environmental Management Mission – Waste Management Program			
Area 5 Chemical Area WMH2: explosion/fire in multiple hazardous waste containers.	8×10^{-5}	None	ERPG-3 [a]
Area 5 Chemical Area WMH3: airplane crash into hazardous waste storage unit.	$< 1 \times 10^{-7}$	None	ERPG-3 [a]
WMH1, Area 5	2.96×10^{-2}	None	ERPG-3 [a]
NDRDH1, Area 5	1.7×10^{-2}	None	ERPG-3 [a]
NDRDH2, Area 5	1×10^{-4}	None	ERPG-3 [a]
NDRDH3, Area 5	1.7×10^{-7}	ERPG-1	ERPG-3 [a]
Nonproliferation Test and Evaluation Complex	1×10^{-4} to 1×10^{-6}	ERPG-1	ERPG-3 [a]

ERPG = Emergency Response Planning Guideline.
[a] The concentration at the location of the onsite noninvolved worker (110 yards away) would exceed the American Industrial Hygiene Association's Emergency Response Planning Guideline level 3 (ERPG-3).

5.1.12.2.2 Expanded Operations Alternative

The potential accident impacts under the Expanded Operations Alternative at the NNSS would be similar to those under the No Action Alternative. Although some activities would expand under this alternative and some new activities would occur, the radiological and hazardous chemical accident impacts would be the same as for the accidents identified under the No Action Alternative. New activities would include assessing the performance of limited-life component exchanges on nuclear weapons, dismantling nuclear weapons removed from the stockpile, and dispositioning radiological dispersion devices, as needed, in addition to improvised nuclear devices. These activities would occur in DAF, which was designed and constructed specifically to safely perform them. The largest credible accident at DAF, an earthquake that involves the release of 5 kilograms of plutonium-equivalent material, would result in the most conservative impacts of any credible accident at DAF.

Under the Expanded Operations Alternative, the level of some activities would increase. Given the uncertainty in accident frequency estimation for accidents that are not expected to happen within the operating lifetime of a facility or activity, the overall accident frequencies would remain within the broad frequency categories, such as "extremely unlikely" (10^{-6} to 10^{-4} [1 chance in 10,000 to 1 million] per year). Because more experiments would be performed, the risk of an accident would increase slightly under the Expanded Operations Alternative.

Under the Expanded Operations Alternative, tracer experiments would be performed. These studies would use short-lived noble gas and particulate radionuclides that would be released above or below ground. Because these experiments are still at the conceptual stage, the actual amounts of radioactive materials that might be used are unknown. For purposes of this SWEIS, it was assumed that a container with the maximum quantity of each of the short-lived radioactive particulates was accidentally explosively released on the surface rather than underground. The accident consequences and risks for the Expanded Operations Alternative would be similar to those under the No Action Alternative and are presented in Tables 5–56, 5–57, and 5–58.

5.1.12.2.3 Reduced Operations Alternative

The potential accident impacts under the Reduced Operations Alternative would be similar to those under the No Action Alternative. Although some activities would be reduced and others eliminated, all of the radiological and hazardous chemical accident scenarios that exist under the No Action Alternative would still be relevant. Accidents at the NNSS that could potentially affect noninvolved workers or the public would be the same under this alternative as the accidents identified under the No Action Alternative. None of the reduced activities was found to make more than negligible changes in the radiological or chemical impacts on noninvolved workers, the public, or the environment.

With reduced activities, the frequencies of some hazardous activities that might lead to accidents could change. Even with these changes, given the uncertainty in accident frequency estimation for very rare accidents not expected to happen within the operating lifetime of a facility or activity, the overall accident frequencies would still remain within the broad frequency categories, such as "extremely unlikely" (10^{-4} to 10^{-6} per year).

The accident risks for the Reduced Operations Alternative at the NNSS would be similar to those under the No Action Alternative, which are presented in Tables 5–56, 5–57, and 5–58. No accidents were identified under the Reduced Operations Alternative that would represent a change in accident risks.

5.1.12.2.4 Wildland Fires

An average of 11.5 wildland fires per year has occurred at the NNSS between 1978 and 2010 (NSTec 2011b). These fires burned about 76,144 acres, averaging just over 200 acres each. Most wildland fires do not occur randomly across the NNSS; they occur more often in particular vegetation types that have sufficient fuels (woody and fine fuels) that are conducive to ignition and spread of the fire (Hansen and Ostler 2004). Further, as shown in **Figure 5–6**, the most large wildfires at the NNSS have occurred in the west-central portion of the site (i.e., Areas 14, 25, 29, and 30) in areas that do not contain significant radioactive contamination sites (see Chapter 4, Figure 4–11). DOE/NNSA's Ecological Compliance and Monitoring Program conducted an evaluation of the causes of 120 wildland fires that occurred on the NNSS between 1998 and 2005 and found the following fire initiators: (1) lightning – 52 percent; (2) undetermined – 30 percent; (3) ordnance (military training and exercises at NNSS shooting ranges) – 12 percent; (4) electrical – 2 percent; (5) vehicle exhaust systems – 2 percent; (6) improperly discarded cigarette butt – 1 percent; and (7) generator malfunction – 1 percent (NSTec 2009a).

Because wildland fires can threaten human life and safety, infrastructure, and wildlife habitat and because they tend to occur more often in certain vegetation types, DOE/NNSA NSO conducts annual surveys each spring to assess wildland fire hazards on the NNSS, as noted in Chapter 4, Section 4.1.7. Annual wildland fire hazards are published to provide timely information that enables managers to assess the ecological risks and perform the necessary management practices to control wildland fires on the NNSS in a cost-effective and environmentally sound manner. Wildland fire mitigation measures are discussed in Chapter 7, Section 7.7, of this *NNSS SWEIS*.

In a 2011 report regarding soil particulate emissions during a controlled burn in a predominantly pinyon-juniper plant community in the Upper Gleason Watershed near Ely, Nevada, scientists from the Desert Research Institute found that, within the limitations of the study: (1) soil-derived dust is responsible for about 10 percent of the aerosol emitted during the first 2 hours of a prescribed burn and (2) qualitative comparison of chemical profiles suggests that the contribution of soil-derived dust to measured PM_{10} diminishes significantly starting 2 hours after the beginning of the fire (Etyemezian et al. 2011). This suggests that, if radioactive soils were present in the burn area, some portion of the soil-derived dust created by the fire would include radioactive particles.

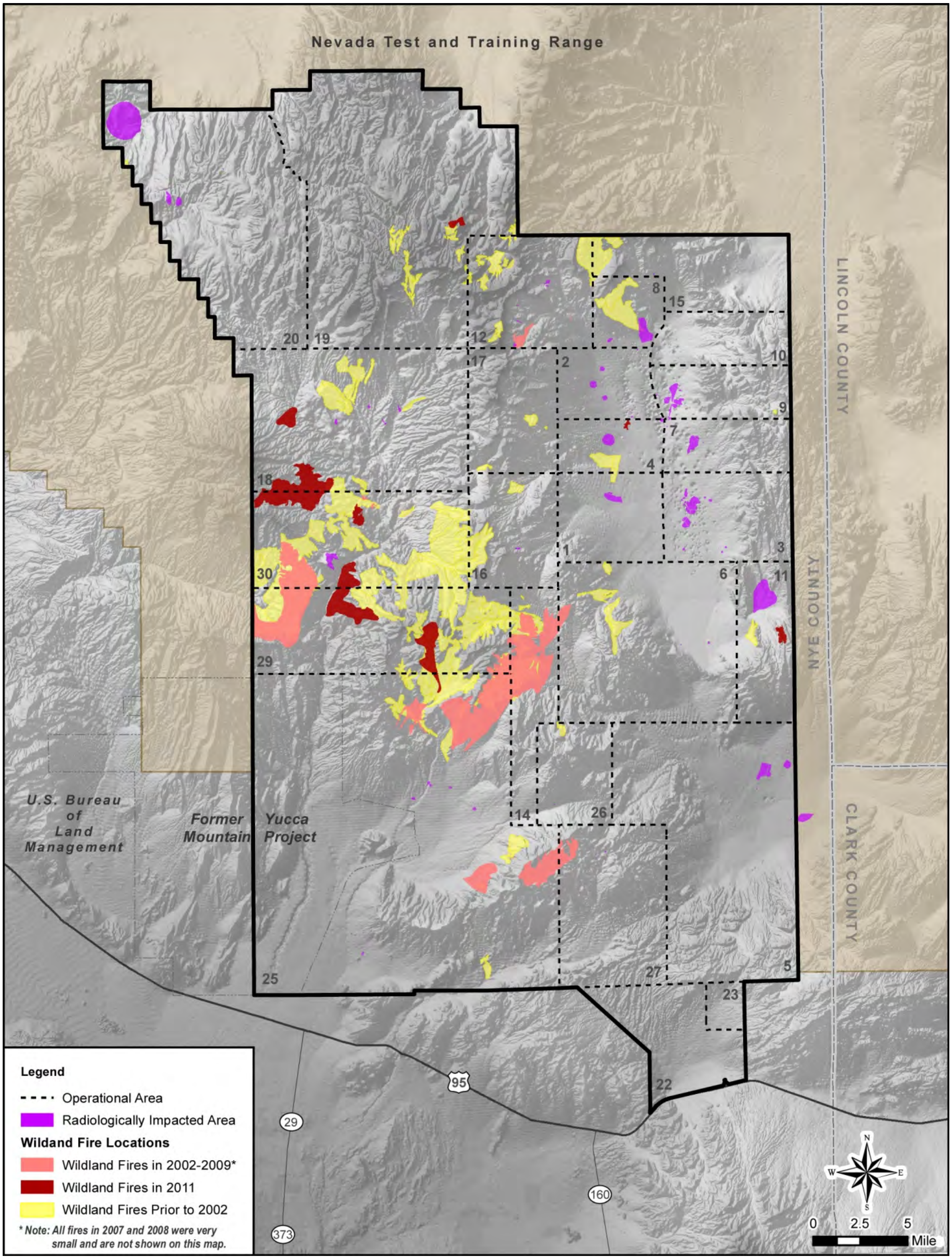


Figure 5–6 Areas Burned During Major Wildland Fires on the Nevada National Security Site from 2002 through 2011

The potential for resuspension of radionuclides has been a concern expressed by stakeholders of the NNSS for many years. For this reason, during some wildfires that occur on the NNSS, DOE/NNSA deploys high-volume air samplers to supplement data from the routine sampling network. These supplemental air samplers were deployed during fires in 2002, 2005, 2006, and 2011. It should be noted that, when used, these supplemental air samplers are located on the NNSS in relatively close proximity to the fire (albeit at a safe distance away). None of these sampling activities has indicated substantially elevated levels of manmade radionuclides as a result of the fires. For example, results of sampling during a 2002 fire indicated the presence of cesium-137, plutonium-239 and -240, and americium-241, but in concentrations that were less than 4 percent of the concentration that would result in a dose of 10 millirem per year (DOE/NV 2003a).

In 2005, there was a series of 31 lightning-caused wildfires, none of which resulted in samples with activity higher than normally observed. None of the fires occurred in areas with the highest levels of legacy radioactivity in soil, but DOE/NNSA conducted a special evaluation of the onsite and offsite radiation doses that may have occurred if a fire had spread into an area with high surface contamination, such as the SMOKY site in Area 8 of the NNSS. That evaluation found that the radiation dose 2.5 miles downwind of the SMOKY site would be 1 millirem and the highest offsite dose would be around 0.1 millirem at 24.8 miles from the SMOKY site (DOE/NV 2006a). As noted in the cited report, "[t]his finding helps confirm that radioactivity released from wild fires on the NTS would not result in hazards offsite."

The Milford Flat Fire, the largest wildland fire in the history of the state of Utah, burned over 363,046 acres in July 2007 (BLM 2011b). The southern edge of the fire was within about 2 miles of Milford, Utah, and it extended about 49 miles to the north-northeast. Delta, Utah, is located about 75 miles north and generally downwind of Milford. Filters collected from low-volume air samplers at the Milford and Delta Community Environmental Monitoring Program (CEMP) stations during the weeks ending July 2 and 9, 2007 (the weeks preceding and following the onset of the fire), were analyzed to evaluate the possibility of resuspension of contaminants from past testing at the NNSS. The Desert Research Institute conducted spectroscopic analyses of gamma activity on all of the collected filters; in addition, the filters collected from the Milford CEMP station for the week ending July 9, 2007, were sent to a commercial laboratory for analysis of gross alpha and gross beta activity using gas flow proportional counting (Hartwell et al. 2008).

The spectroscopic analysis for gamma activity did not detect cesium-137, the major long-lived gamma-emitter associated with fallout from past nuclear testing at the NNSS, or any other manmade radionuclides on any of the filters analyzed. Pre-fire samples were comparable to those collected during the fire at Milford and Delta (Hartwell et al. 2008). The analyses of alpha and beta activities on the Milford filters fell well within the normal range of measurements from the previous five quarters of sampling at the Milford CEMP station (Hartwell et al. 2008). This is in spite of the fact that the particulate loading on samples collected for the week of the fire was almost twice that of pre-fire samples as a result of deposition of particulates associated with smoke from the fire.

5.1.12.3 Intentional Destructive Acts

The impacts analysis of intentional destructive acts is described in a classified appendix to this SWEIS. The impacts of some intentional destructive acts would be similar to the accident impacts described earlier in this section, while some intentional destructive acts may have more-severe impacts. This section describes how DOE/NNSA assesses the vulnerability of its sites to terrorist threats and designs its response systems.

5.1.12.3.1 Assessment of Vulnerability to Terrorist Threats

In accordance with DOE Order 470.1B, *Graded Security Protection Policy*, and DOE Order 470.4B, *Safeguards and Security Program*, DOE/NNSA conducts vulnerability assessments and risk analyses of the facilities and sites under its management to evaluate the possible threats and the protection elements, technologies, and administrative controls used to protect against these threats. DOE Order 470.4B establishes the roles and responsibilities for the conduct of DOE's Safeguards and Security Program. DOE Order 470.3B establishes requirements designed to prevent unauthorized access, theft, diversion, or sabotage (including unauthorized detonation or destruction) of all nuclear weapons, nuclear weapons components, and SNM under DOE's control. Among other provisions, the Order (a) specifies those national security assets that require protection; (b) outlines threat considerations for safeguards and security programs to provide a basis for planning, design, and construction of new facilities or modifications to existing facilities; and (c) provides an adversary threat basis for evaluating the performance of safeguards and security systems. DOE/NNSA also protects against espionage and sabotage, as well as theft of radiological, chemical, or biological materials; classified matter; nonnuclear weapon components; and critical technologies.

DOE/NNSA's safeguards and security programs and systems employ state-of-the-art technologies to accomplish the following:

- Deny access to nuclear weapons, nuclear test devices, and completed nuclear assemblies
- Prevent theft, sabotage, or an unauthorized nuclear yield (criticality) of SNM and credible rollup quantities of SNM
- Protect the public and employees from unacceptable impacts resulting from an adversary's use of radiological, chemical, or biological materials
- Protect classified matter and designated critical facilities and activities from sabotage, espionage, and theft

DOE/NNSA's vulnerability assessments employ a rigorous methodology based on guidance from the September 2004 *DOE Vulnerability Assessment Process Guide* and the Vulnerability Assessment Certification course. Typically, a vulnerability assessment involves analyses of modeling, simulation, and performance testing results by subject matter experts to determine the effectiveness of a safeguard and security system against an adversary's objectives.

Vulnerability assessments generally include the following activities:

Characterizing the threat. Threat characterization provides a detailed description of a malevolent adversary's physical threat to a site's physical protection systems. Usually the description includes information about potential adversary types, motivations, objectives, actions, physical capabilities, and site-specific tactical considerations. Much of the information required to develop a threat characterization is described in DOE Order 470.3B and the Adversary Capabilities List. DOE also issues additional site-specific threat clarification and guidance.

Determining the target. Target determination involves identifying, describing, and prioritizing potential targets among DOE/NNSA's security interests that meet the criteria outlined in DOE Order 470.3B. Target determination results are used to help characterize potential threats and target facilities, as well as protective force and neutralization requirements.

Defining the scope. The scope of a vulnerability assessment is determined by agreement among DOE Headquarters, field staff, and contractor personnel. In addition to defining the threat and applicable targets to be assessed, the scope establishes the key assumptions and interpretations that will guide the analyses, as well as the objectives, methods, schedule, personnel responsibilities, and format for documenting the results of the assessment.

Characterizing the facility or site. This activity requires defining and documenting aspects of the facility or site, particularly existing security programs (personnel security, information security, physical security, material control and accountability, etc.), to assist in identifying strengths and weaknesses. Results are used as inputs to the pathway analyses used to develop representative case scenarios for evaluating the security system. Facility and site characterization modeling tools include Analytical System and Software for Evaluating Safeguards and Security (ASSESS), Adversary Time-Line Analysis System (ATLAS), VISA, tabletop analysis, and others.

Characterizing the protective force. To assess a facility or site's vulnerability, analysts must accurately characterize the associated protective force's capabilities against a defined threat and objective, particularly the force's ability to detect, assess, respond to, interrupt, and neutralize an adversary. Specific data used for this activity include SNM categorization; configuration, flow, as well as movement of SNM within or from a facility or site; defined threats; detection and assessment times; and adversary delay and task time. The protective force's equipment, weapons, number, and locations also are considered in the characterization. The characterization information is validated and verified via observation, alarm response assessments, limited scope performance tests, force-on-force exercises, Joint Conflict and Tactical Simulations (JCATS) software, and tabletop analyses. The JCATS software tool is used for training, analysis, planning, and mission rehearsal, as well as characterization of the protective force. It employs detailed graphics and models of buildings, natural terrain features, and roads to simulate realistic operations in urban and rural environments.

Analyzing adversary pathways. This activity identifies and analyzes base case adversary pathways based on the results of threat, target, facility, and protective force characterization, as well as ancillary analyses such as explosives analysis. ASSESS and ATLAS are two primary tools used in this analysis. Analysts also conduct insider analysis as part of this activity.

Developing base case scenarios. Base case scenarios are developed for use in performance testing and to determine the effectiveness of the security system in place against a potential adversary's capabilities and objectives. As part of this activity, data from the base case adversary pathways analyses are used to identify applicable threats, threat strategies, and objectives, and are combined with protective force strategies and capabilities to develop scenarios that include specific adversary resources, capabilities, and projected task times to complete their objectives successfully. Specialists also work with the vulnerability assessment team to develop realistic scenarios that provide a structured, intellectually honest analysis of the strengths and weaknesses of the terrorist adversary.

Determining the probability of neutralization. The probability of neutralization is a numeric value representing the probability that the protective force can prevent an adversary from achieving its objectives. The calculated number is derived from more than one source, one of which must be based on joint tactical simulation, JCATS analysis, or force-on-force exercises.

Determining system effectiveness. System effectiveness is determined by applying an equation that reflects the capabilities of a multilayered protection system. Analysis data derived from the various vulnerability assessment activities are used to calculate this equation, which reflects the security system's effectiveness against each of the scenarios developed for the vulnerability assessment. If system effectiveness is unacceptable for a scenario, the root cause of the weakness must be analyzed and security upgrades must be identified. The scenarios are reanalyzed with the upgrades, and the successful upgrades are documented in the vulnerability analysis report.

Implementation. The culmination of the vulnerability assessment is development of a report documenting the analyses and results and a plan for implementing any necessary upgrades to achieve the required security system effectiveness. DOE/NNSA verifies the results of the vulnerability assessment report and the conclusions of the implementation plan. DOE/NNSA also provides management oversight of the actual implementation of security system upgrades.

5.1.12.3.2 Terrorist Impacts Analysis

Substantive details of terrorist attack scenarios and security countermeasures are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. Depending on the nature of malevolent, terrorist, or intentional destructive acts, impacts may be similar to or could exceed the impacts of accidents analyzed for this SWEIS. A separate classified appendix to this SWEIS has been prepared that considers the underlying facility threat assumptions with regard to malevolent, terrorist, or intentional destructive acts. Based on these threat assumptions, the classified appendix evaluates the potential human health impacts using appropriate analytical models, similar to the methodology used in this SWEIS to analyze accident impacts. The analysis in this *NNSS SWEIS* evaluates potential consequences to a noninvolved worker, an MEI, and the population in terms of physical injuries, radiation doses, and LCFs. From this analysis, the following general conclusion can be drawn: the potential consequences of intentional destructive acts depend on the size and proximity of the surrounding population; the closer and denser the surrounding population, the higher the consequences. These data provide DOE/NNSA with information on which to base, in part, decisions regarding activities at the NNSS.

Facilities and locations involving sufficient radioactive material to result in potentially severe impacts are protected by numerous physical, procedural, and operations-based systems that minimize the probability of a successful intentional destructive act occurring. In the unlikely event an actual intentional destructive act occurred, physical features associated with the facilities/locations would reduce the potential impacts under most intentional destructive act scenarios; in any event, DOE/NNSA security and response teams are trained and prepared to respond to an intentional destructive act to further reduce potential impacts.

Human Health—American Indian Perspective

As discussed previously in our assessment of Section 4.7, Biological Resources, it is widely known that many tribal representatives still collect and use plants and animals found within the Nevada National Security Site (NNSS) region. Many of the plants and animals cannot be gathered or found in other places. Consumption patterns of Indian people who still use plants and animals for food, medicine, and other cultural or ceremonial purposes force the Consolidated Group of Tribes and Organizations (CGTO) to question if its member tribes are still being exposed to radiation, and possibly hazardous waste located at the NNSS.

The CGTO is aware that, typically, risk assessment models have been used and accepted as a means of mathematically calculating potential risks and assessments to human health and safety. While these models project the potential impacts based on a worst-case scenario, they do not consider the perceived risks which are considered meaningful to Indian people. The lack of knowledge of an unfamiliar concept can lead to a feeling of perceived danger. A perceived danger or hazard associated with something can be very real to Indian people. Indian people view things holistically and believe that everything is interrelated resulting in a cause-and-effect model. This is contrary to scientific models that tend to compartmentalize things from a mathematical point of view, calculating potential risks to health and safety. This viewpoint often does not consider perceived risks, which play an integral role to American Indian cultural beliefs. To address this important issue, U.S. Department of Energy (DOE) listened to the recommendations from our people and commissioned a study in 1998 to evaluate perceived risks of radiation to Indian people. (See C.2.5 for additional information regarding this study.)

Emergency Preparedness

The CGTO knows that some of our member tribes are within close proximity to the NNSS and Tonopah Test Range (TTR). These Indian people will be directly, adversely, and potentially irrevocably impacted if an emergency occurs from DOE activities.

Indian reservations within the region of influence are located in remote areas with limited access by standard and substandard roads. Should an emergency situation resulting from NNSS-related activities, including the transportation of hazardous and radioactive waste occur, it could result in the closure of the main transportation artery to that land. If a major (only) road into a reservation closes, access to hospitals and medical facilities could be impeded or cut off entirely. Delays could occur for regular deliveries of necessary supplies, such as food and medicine. Emergency medical services en route to or from the reservation could result in death.

Accordingly, the CGTO recommends DOE collaborate with potentially affected tribes to develop emergency response measures. In particular, we understand DOE has developed the NNSS Emergency Preparedness Plan and an emergency management program. Each tribal government must have a copy of this plan, and participate in the training and implementation of the emergency management program set forth by DOE and its contractors.

Noise and Vibration

Numic people sing the souls of deceased tribal members to the afterlife in a multiple day ceremony called the Cry. The songs sung are called Salt Songs, a name derived from a spiritual journey taken by two sisters. The path of the journey is punctuated by topographically special places, which are reached at the end of various songs or sets of songs. The interactions between songs and places create a songscape. The CGTO knows Salt Songs follow a spiritual trail. Salt Songs are still sung by Indian people today.

Noise can be a deterrent and a distraction. Noise upsets the spirituality of the area, negatively impacting the ability of salt songs to be heard. Because the thoughts and focus are interrupted, the balance, harmony, and well-being of the community as a whole become affected.

Increased aircraft activities proposed in the site-wide environmental impact statement (SWEIS) will increase the noise and vibration throughout the area. According to one tribal elder, *"Noise and vibrations [from the proposed increased air traffic] will cause the animals to migrate from the area. The animals are placed where they are by the Creator. Forcing them to move results in their loss of power, their life span is shortened, and their very existence is endangered. This could disrupt the entire food chain. If these are used culturally and traditionally for medicines, stories, and songs, then harmony is broken. The Creator put them in their area. If you move them outside of their home, then their spirit dies and will cause undo and irreparable stress. They are grounded in the area. If habitats and animals are disturbed, then the benefit of salt songs and stories are diminished and will harm the culture of our people. The mountain needs to hear our songs, to hear our voices, and to still know that we are here. If we are not out there performing these, then the mountain, the wind, the water, and all of the others will continue to be unbalanced. This needs to be part of the Environmental Restoration process. People don't understand harmony. This is our destiny and our responsibility. We are all woven together. The spirits are waiting for the Indian people to come back and to talk to them so that they can heal. We believe it is now time to allow the Indian people to begin the healing process. To do this, we propose balancing ceremonies."*

See Appendix C for more details.

5.1.13 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental impacts of Federal programs, policies, and activities on minority and low-income populations. Environmental justice analysis in this SWEIS is based on the geographic distribution of low-income and minority populations in Clark and Nye Counties (hereafter the region of influence or ROI), as described in Chapter 4, Section 4.1.13.

Environmental justice analysis involves two tiers of investigation. One is the determination of significant and adverse impacts as a result of the alternative. The other is an evaluation of whether a minority or low-income population is disproportionately affected by these significant and adverse impacts. If no significant and adverse impacts are expected, there would be no disproportionately high and adverse impacts on minority and low-income populations.

To determine whether human health impacts would be adverse and disproportionately high for low-income and minority populations, the following factors were considered:

- Whether the human health impacts, which may be measured in risks and rates, are significant, unacceptable, and above generally accepted norms (Adverse human health impacts may include bodily impairment, infirmity, illness, or death.)
- Whether the risk or rate of exposure of a minority or low-income population to an environmental hazard is significant and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population
- Whether human health impacts occur in a minority or low-income population affected by total or multiple adverse exposures from environmental hazards

To determine whether environmental impacts would be adverse and disproportionately high for low-income and minority communities, the following factors were considered to the extent practicable:

- Whether there is an impact on the natural or physical environment that significantly and adversely affects a minority community or low-income community
- Whether environmental effects are significant and have an adverse impact on minority or low-income populations that appreciably exceeds or is likely to appreciably exceed impacts on the general population or other appropriate comparison group
- Whether the environmental impacts occur in a minority or low-income population affected by total or multiple adverse exposures from environmental hazards

5.1.13.1 No Action Alternative

Impacts on human health would not be significant under any alternative. For example, the total number of LCFs among the general population associated with transportation of LLW, MLLW, and SNM was estimated at less than 1 for incident-free transportation and accident scenarios under each alternative. If unconstrained routing of shipments in the Las Vegas metropolitan area (see Section 5.1.3.1.2.2) occurred, shipments would pass in proximity to more densely populated areas, and could be more likely to pass near census blocks with higher minority and low-income populations. However, the analysis of unconstrained routing concluded that the transportation risk (LCFs) to the public would be the same as that seen in current constrained routing, and the population dose (expressed in person-rem) would be slightly lower than in constrained routing.

Similarly, direct and cumulative effects on environmental resources are not expected to result in significant adverse impacts on the public within the ROI.

Both human health and environmental impacts on low-income and minority populations would be the same as those on the general population within the ROI. Therefore, no disproportionately high and adverse impacts on minority and low-income populations are expected. In addition, an increase in jobs due to the construction of the solar power generation facility could provide needed jobs to unemployed individuals in the area, which would have a beneficial impact on low-income individuals in the ROI.

5.1.13.2 Expanded Operations Alternative

Impacts under the Expanded Operations Alternative would be the same as those described under the No Action Alternative in Section 5.1.13.1.

5.1.13.3 Reduced Operations Alternative

Impacts under the Reduced Operations Alternative would be the same as those described under the No Action Alternative in Section 5.1.13.1.

Environmental Justice—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) knows that federal agencies are directed by Executive Order (EO) 12898, Environmental Justice, to detect and mitigate potentially disproportionately high and adverse human health or environmental effects of its planned programs, policies, and activities to promote nondiscrimination among various populations in the United States. In the Record of Decision for the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)*, the U.S. Department of Energy (DOE) recognized the need to address environmental justice concerns of the CGTO based on disproportionately high and adverse impacts to their member tribes from DOE Nevada National Security Site (NNSS) activities. In the 2002 *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2002 NTS SA)*, DOE concluded that the selection and implementation of the Preferred Alternative would impact its member tribes at a disproportionately high and adverse level, perpetuating environmental justice concerns. The CGTO maintains that environmental justice concerns continue to exist.

Of special concern to the CGTO is the potential for Holy Land violations, cultural survival-access violations, and disproportionately high and adverse human health and environmental impacts to the Indian population. These environmental justice issues need to be addressed in the SWEIS.

There is no question that the Holy Lands of Indian people have been, continue to be, and will be impacted by activities at the NNSS. It is also well known that only Indian people have lost cultural traditions because they have been denied free access to many places on the NNSS where ceremonies need to occur, where plants need to be gathered, and where animals need to be hunted in a traditional way. Prior to undertaking or approving activities at the NNSS, the CGTO recommends that DOE comply with EO 12898 and EO 13127 by facilitating tribal access to the NNSS, sponsoring an Indian subsistence consumption study, and sponsoring a study to determine perceived health risks and environmental impacts resulting from NNSS activities to CGTO member tribes.

The CGTO has concerns that fall within the context of EO 12898, such as subsistence consumption. Subsistence consumption requires the DOE to collect, maintain, and analyze information on consumption patterns such as those of Indian populations who rely principally on fish and/or wildlife for existence. Most importantly, the EO mandates each federal agency to apply equally their environmental justice strategy to Native American programs and assume the financial costs necessary for compliance.

Environmental Justice—American Indian Perspective (cont'd)

To date, DOE has not shared its design and implementation strategy for Environmental Justice with the CGTO, nor has it identified and analyzed subsistence consumption patterns of natural resources by Indian people within the region of influence. Since the EO specifically addresses equity to Indian people and low-income populations, it is critical that the DOE immediately address the concerns of Indian tribes and communities by conducting systematic ethnographic studies and eliciting input necessary for administrative compliance and in the spirit of the DOE American Indian Policy. This policy outlines seven principles in its decision making and interaction with Federally-recognized Tribal governments. It requests that all Departmental elements ensure Tribal participation and interaction regarding pertinent decisions that may affect the environmental and cultural resources of Tribes. Of particular interest within these seven guiding principles is (1) Recognize the Department's trust responsibility. (2) Commit to a government-to-government relationship. (3) Consult with Tribes to assure rights and concerns are considered prior to taking actions, making decisions, or implementing programs. (4) Consult with Tribes about potential impacts of proposed DOE actions on cultural resources or religious concerns that will avoid unnecessary interference with traditional religious practices. (5) The Department will initiate a coordinated effort for technical assistance, economic self determination opportunities and training.

In the Record of Decision for the *1996 NTS EIS*, DOE recognized the need to address environmental justice concerns of the CGTO based on disproportionately high and adverse impacts to their member tribes from DOE Nevada Test Site activities (now NNSS). In the *2002 NTS SA*, DOE concluded that the selection and implementation of the Preferred Alternative would impact its member tribes at a disproportionately high and adverse level, perpetuating environmental justice concerns. The CGTO maintains that environmental justice concerns continue to exist and include (1) holy land violations, (2) cultural survival-access violations, and (3) disproportionately high and adverse human health and environmental impacts to the Indian population.

Holy Land Violations

American Indian people who belong to the CGTO consider the NNSS lands to be as central to their lives today as they have been since the creation of their people. The NNSS lands are part of the holy lands of Western Shoshone, Southern Paiute, and Owens Valley Paiute and Shoshone people. The CGTO perceives that the past, present, and future pollution of these holy lands constitutes both Environmental Justice and equity violations. No other people have had their holy lands impacted by NNSS-related activities. Prior to undertaking or approving new activities, the CGTO should be funded to design, conduct, and produce a systematic American Indian Environmental Justice study.

Cultural Survival-Access Violations

One of the most detrimental consequences to the survival of American Indian culture, religion, and society has been the denial of free access to their traditional lands and resources. Loss to access to traditional food sources and medicine has greatly contributed to undermining the cultural well-being of Indian people. These Indian people have experienced, and will continue to experience, breakdowns in the process of cultural transmission due to lack of free access to government-controlled lands and resources such as those in the NNSS area. No other people have experienced similar cultural survival impacts due to lack of free access to the NNSS area.

In 1996, President Clinton signed EO 13007, Indian Sacred Sites. The EO promotes accommodation of access to American Indian sacred sites by Indian religious practitioners and provides for the protection of the physical integrity of such sites located on federal lands. The CGTO recommends that open access be allowed for American Indians who must conduct their traditional ceremonies and obtain resources within the NNSS study area. Unfortunately, however, land disturbance and irreparable damage of cultural landscapes, potential Traditional Cultural Properties (TCPs), and cultural resources may render certain locations unusable.

Disproportionately High and Adverse Human Health and Environmental Impacts to the Indian Population

It is widely known that many tribal representatives still collect and use plants and animals that are found within the NNSS region. Many of the plants and animals cannot be gathered or found in other places. Consumption patterns of Indian people who still use plants and animals for food, medicine, and other cultural or ceremonial purposes force the CGTO to question if its member tribes are still being exposed to radiation, and possibly hazardous waste located at the NNSS.

See Appendix C for more details.

5.2 Remote Sensing Laboratory

The following sections describe the potential environmental consequences associated with alternatives and programs at RSL.

5.2.1 Land Use

No changes to land use were identified under any alternative for the RSL; therefore, no land use impacts, including impacts on surrounding land uses, were identified for any alternative. However, any new constructions at RSL would require close coordination with Nellis Air Force Base and would be subject to the availability of open space within or near RSL. A corresponding environmental study will be conducted as part of the new construction effort to determine any impacts on the baseline conditions.

While RSL does make use of airspace for its aircraft activities out of Nellis Air Force Base, there were no changes to airspace operations identified under the alternatives analyzed in this SWEIS. All activities involving RSL's use of airspace are under control of Nellis Air Force Base and all operations are conducted in compliance with applicable requirements, including FAA and USAF requirements. No airspace impacts were identified.

5.2.2 Infrastructure and Energy

5.2.2.1 Infrastructure

5.2.2.1.1 No Action Alternative

There would be no change to RSL under this alternative.

5.2.2.1.2 Expanded Operations Alternative

There would be no change to RSL under this alternative.

5.2.2.1.3 Reduced Operations Alternative

There would be no change to RSL under this alternative.

5.2.2.2 Energy

5.2.2.2.1 No Action Alternative

Electrical energy at RSL is provided by the USAF (Nellis Air Force Base), which in turn is supplied by three sources: 65 percent from NV Energy; 10 percent from Western Area Power Administration (hydropower); and 23 percent from Solar Star, Inc., (the Nellis Air Force Base Solar Photovoltaic Project). In FY 2009, RSL's electrical usage was 4,850 megawatt-hours (NNSA/NSO 2010b), which is a small portion of total power use (approximately 100,000 megawatt-hours) on Nellis Air Force Base. The existing electrical distribution system at RSL is capable of supporting present demands, although it is slated for minor improvements in 2014.

Natural gas at RSL is provided by the Southwest Gas Corporation through Nellis Air Force Base. In FY 2009, RSL used 33,673 therms of natural gas (NNSA/NSO 2010b). There is adequate capacity to serve current demands, and the condition of the gas lines are satisfactory (NSTec 2010i). The existing liquid fuel tanks and resupply schedules are adequate to support all heating, vehicular, and portable generator needs. RSL uses approximately 111,000 gallons of JP-8 jet fuel annually (NNSA/NSO 2010b) for aircraft operations, and an adequate supply is available directly through Nellis Air Force Base. RSL currently does not use any alternative form of fuel (e.g., E85).

As no changes in facilities, activities, or personnel staffing have been identified under this alternative, the existing electrical power and liquid fuel systems would be adequate to meet future needs.

5.2.2.2.2 Expanded Operations Alternative

As no changes in facilities, activities, or personnel staffing have been identified under this alternative, the existing electrical power and liquid fuel systems would be adequate to meet future needs.

5.2.2.2.3 Reduced Operations Alternative

As no changes in facilities, activities, or personnel staffing have been identified under this alternative, the existing electrical power and liquid fuel systems would be adequate to meet future needs.

5.2.3 Transportation and Traffic

5.2.3.1 Transportation

No radioactive waste would be generated at RSL; therefore, there would be no associated transportation impacts. Transport of any nonradioactive materials associated with RSL is encompassed by the analysis described for the NNSS in Sections 5.1.3.1 and 5.1.3.2.

5.2.3.2 Traffic

For all alternatives, the number of personnel at RSL is expected to remain the same and no construction projects are expected at RSL; therefore, no increases in vehicle traffic would occur and there would be no impacts on onsite and regional traffic associated with RSL. Traffic conditions of roadways near RSL are represented by Las Vegas Boulevard and Nellis Boulevard, as shown in Table 5–19.

5.2.4 Socioeconomics

There would be no change to the number of employees at RSL under any of the alternatives. As a result, there would be no impacts on economic activity, population, and housing; public finances; or public services.

5.2.5 Geology and Soils

5.2.5.1 No Action Alternative

RSL at Nellis Air Force Base consists of a small collection of buildings where most of its activities occur. Under the No Action Alternative, the mission of RSL would consist of remote sensing research, training, and logistical support. No construction is anticipated from continuation of the current activities. There are no prime farmland soils at RSL, so there would be no impacts on this resource under any of the alternatives.

5.2.5.1.1 National Security/Defense Mission

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Under the No Action Alternative, RSL would be used to support the Nuclear Emergency Support Team. Fixed-wing and rotary-wing aircraft stationed at RSL would be used for emergency response and aerial mapping as part of the Aerial Measuring System. RSL would also host some activities supporting U.S. nonproliferation and counterterrorism efforts at the NNSS. No additional construction would be required for implementation of these activities, so the geology and soils would not be impacted.

Work for Others Program. Under the Work for Others Program, existing facilities and resources at RSL would host other agencies for defense and homeland security applications. Should any new construction at RSL be needed, a corresponding environmental study would be conducted as a part of the new construction effort to determine any impacts on the geology or soils.

5.2.5.1.2 Environmental Management Mission

Waste Management Program. Waste produced at RSL consists primarily of office waste, nonhazardous solid waste, and small quantities of hazardous waste. There are no disposal or treatment facilities at RSL. Because oil and hazardous waste are present at the facility, there is a chance of a spill that could contaminate the soil surface. If an accidental release of hydrocarbons were to occur at the facility, the spill would be contained, and the contaminated soils would be disposed at a facility permitted to receive such waste. However, with spill prevention and mitigation measures in place, the potential for soil contamination would be reduced.

5.2.5.1.3 Nondefense Mission

General Site Support and Infrastructure Program. The activities described under the No Action Alternative would occur in existing facilities at RSL. No additional construction or demolition on the site would be required, so there would be no impacts on the geology or soils.

5.2.5.2 Expanded Operations Alternative

Should any new construction at RSL be needed, a corresponding environmental study would be conducted as a part of the new construction effort to determine any impacts on the geology or soils.

5.2.5.3 Reduced Operations Alternative

Should any new construction at RSL be needed, a corresponding environmental study would be conducted as a part of the new construction effort to determine any impacts on the geology or soils.

5.2.6 Hydrology

5.2.6.1 Surface-Water Hydrology

5.2.6.1.1 No Action Alternative

Overall, no impacts under any of the impact criteria are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.1.1 National Security/Defense Mission

No impacts are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.1.2 Environmental Management Mission

No impacts are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.1.3 Nondefense Mission

General Site Support and Infrastructure Program. RSL would continue wastewater discharges, which are expected to have no impact on surface-water resources, assuming these activities adhere to all permit limitations on discharged water quality. In 2009, all contaminant concentrations in discharged effluent were within permitted levels.

5.2.6.1.2 Expanded Operations Alternative

Overall, no impacts under any of the impact criteria are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.2.1 National Security/Defense Mission

No impacts are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.2.2 Environmental Management Mission

No impacts are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.2.3 Nondefense Mission

General Site Support and Infrastructure Program. Impacts would be the same as those described under the No Action Alternative in Section 5.2.6.1.1.3.

5.2.6.1.3 Reduced Operations Alternative

Overall, no impacts under any of the impact criteria are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.3.1 National Security/Defense Mission

No impacts are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.3.2 Environmental Management Mission

No impacts are expected at RSL because no activities are proposed that would affect surface hydrology.

5.2.6.1.3.3 Nondefense Mission

General Site Support and Infrastructure Program. Impacts would be the same as those described under the No Action Alternative in Section 5.2.6.1.1.3.

5.2.6.2 Groundwater

5.2.6.2.1 No Action Alternative

DOE/NNSA does not directly withdraw any groundwater at RSL (potable water is provided by Nellis Air Force Base) and does not directly discharge any contaminants that would threaten groundwater quality. The Nellis Air Force Base water system supplying RSL reportedly suffers from low pressure and limited supply capability. DOE/NNSA continues to work with Nellis Air Force Base officials to address these issues (DOE 2008f). While no expansion or addition of water-consuming facilities can be made at RSL until a new water source can be installed by Nellis Air Force Base, DOE/NNSA has not proposed any new facilities or activities that would exacerbate this problem or otherwise adversely impact groundwater quality or supply.

5.2.6.2.2 Expanded Operations Alternative

DOE/NNSA has not proposed any changes in activities at RSL under the No Action Alternative and has not identified any adverse impacts on groundwater quality or supply.

5.2.6.2.3 Reduced Operations Alternative

DOE/NNSA has not proposed any changes in activities at RSL under the No Action Alternative and has not identified any adverse impacts on groundwater quality or supply.

5.2.7 Biological Resources

Under all alternatives, activities at RSL in support of DOE/NNSA programs would continue in developed, previously disturbed areas characterized by an urban habitat for biological resources. No land-disturbing construction activities are proposed at RSL over the next 10 years under any of the three alternatives analyzed in this SWEIS. Therefore, DOE/NNSA activities at RSL under all missions and programs would not affect either biological resources in general or any sensitive or protected species.

5.2.8 Air Quality and Climate

5.2.8.1 No Action, Expanded Operations, and Reduced Operations Alternatives

5.2.8.1.1 Air Quality

DOE/NNSA activities at RSL would be the same under all three alternatives addressed in this *NNSS SWEIS*: No Action, Expanded Operations, and Reduced Operations. Therefore, this section addresses air quality impacts from stationary, mobile, and fugitive air pollutant sources that would occur within and outside RSL under all three of alternatives. The ROI for this air quality analysis encompasses Clark County in Nevada. Emissions from stationary and aircraft-related sources occur within RSL; emissions from other mobile sources occur mostly outside RSL, but within Clark County. Additional details supporting the information presented in this section can be found in Appendix D, Section D.2.2.1.1.

Table 5–59 shows the midpoint (year 2015) annual air emissions of the criteria pollutants and hazardous air pollutants associated with various RSL activities under the No Action Alternative. Most emissions are associated with mobile source activity. The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. The RSL contribution to the air emissions in Clark County would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–57). The VOCs, nitrogen oxides, carbon monoxide, and PM_{10} from RSL sources (both mobile and stationary) in Clark County would decrease relative to 2008 emission levels by 0.02, 0.5, 0.4, and 0.026 tons per year, respectively. Thus, this action would not contribute to or cause additional violations of the carbon monoxide, ozone, or PM_{10} ambient air quality standards. Appendix D, Section D.2.2.1.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization for mobile sources.

Table 5–59 No Action Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the Remote Sensing Laboratory in 2015

	Annual Air Emissions (tons per year)						
	Stationary Sources	*Aircraft-Related Sources*	*RSL Commuters*	*Commercial Vendors*	*Total*		
	Clark County						
Pollutant	***On-RSL***	***On-RSL***	***Off-RSL***	***Off-RSL***	***On-RSL***	***Off-RSL***	***Total***
PM_{10}	0.038	0.00040	0.03	0.016	*0.038*	*0.046*	*0.084*
$PM_{2.5}$	0.038	0.00037	0.016	0.013	*0.038*	*0.029*	*0.067*
CO	0.36	0.88	2.8	0.060	*1.2*	*2.9*	*4.1*
NO_x	0.9	0.045	0.53	0.16	*0.95*	*0.69*	*1.6*
SO_2	0.01	0.016	0.0072	0.00036	*0.026*	*0.0076*	*0.034*
VOCs	0.032	>0.17	0.079	0.017	*~0.2*	*0.096*	*~0.3*
Lead	<0.01	0.00040	0.0000020	0.00000068	*~0.01*	*0.0000027*	*~0.01*
Criteria Pollutant Total	*1.4*	*~1.1*	*3.4*	*0.25*	*~2.4*	*3.7*	*~6.1*
HAPs	0.0071	~0.17	0.006	0.0023	*~0.18*	*0.0083*	*~0.19*

< = less than; > = greater than; ~ = approximately; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; RSL = Remote Sensing Laboratory; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

General Conformity Determination. See Section 5.1.8 for a discussion of General Conformity Determinations. Based on the *de minimis* thresholds presented in **Table 5–60**, the total emissions in Clark County under the all three alternatives considered in this *NNSS SWEIS* do not exceed the *de minimis* levels for carbon monoxide, nitrogen oxides, PM_{10}, or VOCs in all cases. Therefore, a general conformity analysis would not be required under any of the alternatives.

Table 5–60 No Action Alternative Greenhouse Gas Emissions by RSL Activity in 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year*
STATIONARY SOURCES		
Power generation	1,371	0.05
Natural gas heating	136	0.01
Other stationary sources, except natural gas heating	7	0.01
ALL STATIONARY SOURCES	*1,514*	*0.05*
MOBILE SOURCES		
Aircraft and ground support equipment	1,184	0.04
Commuting	311	0.01
Commercial vendors	138	0.01
ALL MOBILE SOURCES	*1,633*	*0.06*
ALL SCOPE 1 SOURCES	*1,327*	*0.05*
ALL SCOPE 2 SOURCES	*1,371*	*0.05*
ALL SCOPE 3 SOURCES	*449*	*0.02*
TOTAL	**3,147**	**0.11**

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

5.2.8.1.2 Radiological Air Quality

No activities under the No Action Alternative are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions in Chapter 4, Section 4.2.8.3.

5.2.8.1.3 Climate Change

See Chapter 4, Section 4.2.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to RSL-related activities. Table 5–60 shows greenhouse gas emissions levels for RSL-related activities under the No Action Alternative (see Section 5.1.8 for a discussion of the methodology for this analysis). The color coding in Table 5–60 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by RSL (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–60 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Overall, RSL-related activities under all three alternatives would create about 3,147 carbon-dioxide-equivalent tons of greenhouse gas emissions per year, about 89 percent smaller than the reporting level. This represents a net reduction over current greenhouse gas emissions (4,055 tons in 2008) of about 22 percent, but these emissions would continue to contribute to global climate change.

5.2.9 Visual Resources

5.2.9.1 No Action Alternative

Under the No Action Alternative, current activities and operations would continue. These activities and operations occur indoors. No proposed changes would affect existing visual resources associated with RSL, and the scenic quality would remain Class C. No mitigation would be required.

5.2.9.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, there would be no changes at RSL from the No Action Alternative, and current activities and operations would continue. There would be no changes to the existing visual environment, and the scenic quality would remain at Class C. There would be no effect. No mitigation would be required.

5.2.9.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, there would be no changes at RSL from the No Action Alternative and current activities and operations would continue. There would be no changes to the existing visual environment, and the scenic quality would remain at Class C. There would be no effect. No mitigation would be required.

5.2.10 Cultural Resources

Under all of the alternatives addressed in this SWEIS, activities at RSL supporting all DOE/NNSA NSO programs would occur in developed, previously disturbed areas and are not expected to affect cultural resources.

5.2.11 Waste Management

Under all alternatives, RSL may generate small quantities of LLW, but is not expected to generate any MLLW, TRU waste, or mixed TRU wastes. RSL would continue to be a small-quantity generator of hazardous waste; this waste would be stored for no more than 90 days before being transferred off site to permitted facilities for recycle or treatment, storage, or disposal. Hazardous waste removal and disposition services would continue to be provided by the USAF, which would also continue to provide removal and disposition of sanitary solid wastes generated by RSL personnel. Some materials, such as scrap metals, are expected to continue to be shipped as needed to the NNSS, where they would be combined with NNSS materials and shipped off site for recycle under the NNSS Pollution Prevention and Waste Minimization Program (see Section 5.1.11.1.1).

Under all of the alternatives, about 68 cubic feet of hazardous waste would be annually generated at RSL; this waste would require offsite treatment and disposal. About 490 cubic feet of solid and hazardous wastes (e.g., scrap metal and electronic equipment) would be annually generated and would be subject to offsite reuse and recycle. In addition, based on the relatively small level of projected employment under all of the alternatives, RSL would annually generate about 4,000 cubic feet of sanitary solid waste that would require USAF removal and disposition, as discussed above.

Based on the availability of permitted facilities in Nevada and neighboring states (see Section 5.1.11.1.1), waste management activities at RSL are not expected to generate wastes that exceed available TSD or recycle capacity under any alternative.

5.2.12 Human Health

The approach to evaluating human health impacts is discussed in Section 5.1.12. The criteria for evaluating human health impacts are included in that discussion.

5.2.12.1 Normal Operations

5.2.12.1.1 No Action Alternative

No radiological or chemical impacts from normal operations activities performed for the National Security/Defense, Environmental Management, or Nondefense Missions are expected at RSL under the No Action Alternative. The potential for occupational injury and illness was estimated for RSL activities using rates based on DOE experience (DOE 2010e) (see Appendix G for details). The number of TRCs and DART cases were projected based on the number of FTEs estimated for this alternative. Under this alternative, a total of 2 TRCs and 0.9 DART cases per year were calculated.

Noise. Under the No Action Alternative, minimal noise impacts on offsite receptors are expected to result from activities at RSL because there would be no new activities on site that would generate increased noise levels. Daily volumes of privately owned vehicles and trucks would remain essentially unchanged and would not contribute to additional traffic noise.

5.2.12.1.2 Expanded Operations Alternative

As under the No Action Alternative, no radiological or chemical impacts are expected at RSL under the Expanded Operations Alternative. The number of TRCs and DART cases from industrial accidents would also be the same as the No Action Alternative.

Noise. Potential noise impacts at RSL under the Expanded Operations Alternative would be similar to those under the No Action Alternative. No new activities on site would generate increased noise levels. Daily volumes of privately owned vehicles and trucks would remain essentially unchanged and would not contribute to additional traffic noise.

5.2.12.1.3 Reduced Operations Alternative

As under the No Action Alternative, no radiological or chemical impacts are expected at RSL under the Reduced Operations Alternative. The number of TRCs and DART cases from industrial accidents would also be the same as the No Action Alternative.

Noise. Potential noise impacts at RSL under the Reduced Operations Alternative would be similar to those under the No Action Alternative. No new activities on site would generate increased noise levels. Daily volumes of privately owned vehicles and trucks would remain essentially unchanged and would not contribute to additional traffic noise.

5.2.12.2 Facility Accidents

5.2.12.2.1 No Action Alternative

No RSL accident scenarios that would cause impacts other than negligible radiological or hazardous chemical risks to the public, workers, or the environment were identified under the No Action Alternative.

5.2.12.2.2 Expanded Operations Alternative

As under the No Action Alternative, no RSL accident scenarios that would cause impacts other than negligible radiological or hazardous chemical risks to the public, workers, or the environment were identified under the Expanded Operations Alternative.

5.2.12.2.3 Reduced Operations Alternative

As under the No Action Alternative, no RSL accident scenarios that would cause impacts other than negligible radiological or hazardous chemical risks to the public, workers, or the environment were identified under the Reduced Operations Alternative.

5.2.13 Environmental Justice

5.2.13.1 No Action Alternative

Impacts on human health would not be significant under any alternative. Similarly, direct and cumulative effects on environmental resources are not expected to result in significant adverse impacts on the public within the ROI.

Impacts on low-income and minority populations under the No Action Alternative, as discussed in the other sections in this chapter, would be the same as to those of the general population. Therefore, no disproportionately high and adverse impacts on minority and low-income populations are expected.

5.2.13.2 Expanded Operations Alternative

Impacts under the Expanded Operations Alternative would be the same as those described under the No Action Alternative in Section 5.2.13.1.

5.2.13.3 Reduced Operations Alternative

Impacts under the Reduced Operations Alternative would be the same as those described under the No Action Alternative in Section 5.2.13.1.

5.3 North Las Vegas Facility

The following sections describe the potential environmental consequences associated with alternatives and programs at NLVF.

5.3.1 Land Use

No changes to NLVF land use were identified under any alternative; therefore, no land use impacts, including impacts on surrounding land uses, were identified under any alternative. No impacts on airspace were identified.

5.3.1.1 No Action Alternative

No changes to land use were identified under any alternative for NLVF.

5.3.1.2 Expanded Operations Alternative

No changes to land use were identified under any alternative for NLVF.

5.3.1.3 Reduced Operations Alternative

No changes to land use were identified under any alternative for NLVF.

5.3.2 Infrastructure and Energy

5.3.2.1 Infrastructure

5.3.2.1.1 No Action Alternative

There would be no change to NLVF under the No Action Alternative.

5.3.2.1.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, the number of employees would increase by 10 percent over the level projected under the No Action Alternative level, thereby slightly increasing demand for utilities at NLVF. Existing infrastructure and utilities are adequate to handle this increased demand (see Section 5.3.2.2 for a discussion of energy-related utilities).

5.3.2.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, the number of employees would decrease by 10 percent from the No Action Alternative level, thereby reducing demand for utilities at NLVF.

5.3.2.2 Energy

5.3.2.2.1 No Action Alternative

Under the No Action Alternative, no new facilities, changes in activity levels, or changes in personnel staffing were projected for NLVF.

In FY 2009, NLVF's electrical usage was approximately 15,000 megawatt-hours (NNSA/NSO 2010b). The peak demand recorded during 2008 and 2009 was approximately 3.2 megawatts, recorded in August 2008 during on-peak afternoon hours. DOE/NNSA estimates that these power demand levels are representative of future demand under the No Action Alternative. Given the capacity of the NLVF distribution system (approximately 8 megawatts at main switch) and the reliable supply from the utility provider (NV Energy), there is adequate electrical power supply to support all future needs under this alternative.

In FY 2009, NLVF used approximately 48,000 therms of natural gas (NNSA/NSO 2010b), primarily for heating and boilers. DOE/NNSA estimates that these demand levels are representative of future demand under the No Action Alternative. There is adequate capacity to serve current demands, and the condition of the gas lines is satisfactory. NLVF also uses small quantities of diesel and unleaded gasoline for emergency generators and miscellaneous equipment; storage capacity is less than 400 gallons of each. These existing tanks would provide sufficient capacity to support incidental needs under this alternative.

Under all alternatives, DOE/NNSA is planning to install additional building-level electrical, water, and gas meters throughout NLVF, thus improving its ability to identify future conservation opportunities.

5.3.2.2.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, staffing levels at NLVF were estimated to increase by approximately 25 percent, and plasma fusion and physics experiments would increase by approximately 66 percent. However, it is likely that this increase in workforce population and activity levels would not result in a direct one-to-one increase in average and peak power demand. DOE/NNSA would conduct facility maintenance projects to maintain all current capabilities, but no new or modified facilities are planned. Direct power increases associated with the increased workforce would be attributed to minor additions such as computer workstations and some increased demand for lighting and cooling. Increases in plasma experiments would use existing equipment, although on a more frequent basis. DOE/NNSA estimates that average and peak power demand would increase by no more than 10 percent above demand under the No Action Alternative. The capacity of the NLVF distribution system is adequate to support all future needs under this alternative. Demands for liquid fuel are not likely to increase more than 10 percent above the demand under the No Action Alternative, and current storage capacity and resupply arrangements would be sufficient to satisfy this demand.

5.3.2.2.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, staffing levels at NLVF were estimated to decrease by approximately 10 percent, and plasma fusion and physics experiments would decrease by approximately 42 percent. DOE/NNSA would conduct facility maintenance projects to maintain all current capabilities, but no new or modified facilities are planned. DOE/NNSA estimates that average and peak power demand would remain at or below the levels seen under the No Action Alternative. The capacity of the NLVF distribution system is adequate to support all future needs under this alternative. Demands for liquid fuel are also estimated to remain at or below levels under the No Action Alternative, and current storage capacity and resupply arrangements would be sufficient to satisfy this demand.

5.3.3 Transportation and Traffic

5.3.3.1 Transportation

Water containing tritium is periodically transported by tanker truck from NLVF to the NNSS. Tritium is a beta-emitter and, therefore, would not be a source of an external radiation dose. The concentration of tritium in the water being transported is, on average, 900 picocuries per liter, which is about 20 times lower than the drinking water standard of 20,000 picocuries per liter for tritium (NSTec 2010e). Therefore, any impacts associated with a transportation accident would be much lower than those of other transportation accidents analyzed. Due to these considerations, radiological impacts for these shipments were not quantified for any of the alternatives.

Transport of any nonradioactive materials associated with NLVF under the three alternatives is encompassed by the analysis described for the NNSS in Sections 5.1.3.1 and 5.1.3.2.

5.3.3.2 Traffic

Any onsite or regional traffic impacts from NLVF would primarily be associated with incremental changes in personnel. The change in workforce numbers at NLVF is expected to remain the same under the No Action Alternative, increase by 25 percent under the Expanded Operations Alternative, and decrease by 10 percent under the Reduced Operations Alternative. Increased traffic congestion within the internal roadways of NLVF and longer delays during peak commute hours at the main entrance point on Energy Way would occur under the Expanded Operations Alternative. Traffic conditions of roadways near NLVF are represented by Losee Road in Table 5–19. As the table indicates, under the No Action and Reduced Operations Alternatives, Losee Road would experience minimal, if any, increases in daily traffic volumes as a result of NNSS personnel. Under the Expanded Operations Alternative, a 3 percent increase in traffic volumes during the peak hour may occur; however, the volume-to-capacity ratio and levels of service on this roadway would remain the same as those under future baseline conditions (see Chapter 4, Table 4–11, and Table 5–19).

5.3.4 Socioeconomics

5.3.4.1 No Action Alternative

There would be no change to the number of employees at NLVF under the No Action Alternative. As a result, there would be no impacts on economic activity, population, and housing; public finances; or public services.

5.3.4.2 Expanded Operations Alternative

5.3.4.2.1 Economic Activity, Population, and Housing

Under the Expanded Operations Alternative, it was estimated that employment would increase from 1,442 to 1,803 at NLVF. This represents an increase of 361 jobs.

Approximately 10 percent, or 36 individuals, are expected to relocate. Projected rates of population growth would not be altered as a result of the Expanded Operations Alternative. The 36 new households would reduce housing vacancy rates by 0.02 percent in Clark County. Sufficient housing exists in the region to support this increase in population.

The remaining 325 individuals filling the new jobs are expected to be already living in Clark and Nye Counties. Of the 325 individuals, it was assumed that 99 percent (322) would live in Clark County and 1 percent (3) in Nye County.

The 322 direct jobs added in Clark County would decrease unemployment by about 0.23 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). In Nye County, 3 direct jobs would decrease unemployment by about 0.10 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). This would be a minor, but beneficial, impact on employment in Clark and Nye Counties.

As described under the No Action Alternative, RIMS II was used to calculate the indirect economic impact of DOE/NNSA activities on employment. An estimate of the change in the total number of jobs in a region's economy was calculated by multiplying the initial change in jobs by a direct-effect employment multiplier. By adding 361 permanent employees at the NLVF under the Expanded Operations Alternative, approximately 699 jobs would be created in the ROI. The combined effect of direct and indirect employment would result in a decrease in unemployment in Clark County of about 0.5 percent and about 0.22 percent in Nye County.

Daily spending by new employees would positively affect the immediate area of NLVF. Purchases would typically include gasoline, automobile servicing, food and beverages, laundry, and other retail items. Therefore, a minor beneficial impact on economic activity would occur under the Expanded Operations Alternative due to the increase in employment.

Public finance. Increased sales transactions for the purchase of materials and supplies for construction of the solar power generation facility(ies) would generate some additional revenues for local governments. These impacts would be minor but beneficial. Revenues for Clark County would increase due to increases in personal income and total employment, which could lead to increased spending. This would have a beneficial impact on the local economy.

5.3.4.2.2 Public Services

Public education. As described under the No Action Alternative, for the 2009 to 2010 school year, the Clark County School District student–teacher ratio was 21:1. The student–teacher ratio for the Nye County School District was 18.6:1. Under the Expanded Operations Alternative, a total of 68 children could relocate to the area based on an average of 1.89 children per family. It was assumed that all 68 children would relocate to Clark County; therefore, to maintain the 21:1 student–teacher ratio, three additional teachers would be needed in Clark County.

Police protection. Under the Expanded Operations Alternative, the number of daytime occupants at NLVF would increase by 361 employees, which could result in more calls for services. This increase could have an impact on police protection resources due to a reduced level of service.

Fire protection. No changes to building density would occur under the Expanded Operations Alternative. Therefore, it is unlikely that any additional calls for fire protection would take place. Levels of service would not be impacted.

Health care. The addition of 361 employees would have a negligible impact on area hospitals and hospital personnel, as only 36 households are expected to relocate. The activities associated with the Expanded Operations Alternative are not anticipated to increase the need for hospital care or personnel.

5.3.4.3 Reduced Operations Alternative

5.3.4.3.1 Economic Activity, Population, and Housing

Under the Reduced Operations Alternative, there would be an employment reduction of 144 individuals at NLVF, estimated at 143 employees in Clark County and 1 employee in Nye County. In Clark County, this would increase unemployment by about 0.10 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). Within Nye County, this would increase unemployment by about 0.03 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). These increases would represent a minor adverse impact on Clark County's unemployment rate and a negligible impact on Nye County's unemployment rate. As a result of this jobs reduction, daily spending in the vicinity of NLVF would decrease correspondingly, which would have a minor impact on economic activity in the area immediately adjacent to NLVF.

Public finance. Revenues for Clark County could decrease due to reductions in personal income and total employment, which could lead to reduced spending. This small decrease in spending (due to a loss of 144 jobs) would have a negligible adverse impact on the local economy.

5.3.4.3.2 Public Services

Public education. Under the Reduced Operations Alternative, no individuals are expected to relocate to work at NLVF; therefore, no new students would enroll in Clark County or Nye County schools. No new teachers would be required as a result of the Reduced Operations Alternative.

Police protection. Under the Reduced Operations Alternative, the number of daytime occupants at NLVF would decrease, which could result in fewer calls for service. Therefore, a minor beneficial impact on police protection resources is anticipated under this alternative.

Fire protection. No changes to building density would occur under the Reduced Operations Alternative. Therefore, it is unlikely that any additional calls for fire protection would take place. Levels of service would not be impacted.

Health care. As stated previously, under the Reduced Operations Alternative, a small staff reduction of 144 people is anticipated. No impact on health care in the region is anticipated. Existing levels of services would be maintained.

5.3.5 Geology and Soils

5.3.5.1 No Action Alternative

NLVF is a collection of buildings on DOE-owned property within the North Las Vegas city boundary. Under the No Action Alternative, the mission at NLVF would continue to consist of energy experiments and coordination activities. There are no prime farmland soils at NLVF, so there would be no impacts on the resource from any of the alternatives.

5.3.5.1.1 National Security/Defense Mission

Stockpile Stewardship and Management Program. Under the No Action Alternative, fusion experiments on Dense Plasma Focus machines would be conducted at NLVF. These tests would be conducted inside existing facilities and laboratories. No additional construction would be required for these tests, so there would be no impacts on the physical setting from the fusion experiments.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. NLVF would host some activities supporting U.S. nonproliferation and counterterrorism efforts on the NNSS. These activities would primarily include research and development and some training activities, most of which would occur on the NNSS. No new facilities would be constructed at NLVF to support these activities, which would primarily occur within the existing buildings. Therefore, there would be no impacts on the physical setting from implementation of the No Action Alternative.

Work for Others. Under the Work for Others Program, existing facilities and resources at NLVF would host other agencies for defense and homeland security applications. No new structures would need to be built at NLVF, so no impacts on the geology or soils would occur.

5.3.5.1.2 Environmental Management Mission

Waste Management Program. Waste produced at NLVF consists primarily of office waste, nonhazardous solid waste, and small quantities of hazardous waste. There are no disposal or treatment facilities at NLVF. Because oil and hazardous waste are present at the facility, there is a chance of an accidental spill that could contaminate the soil surface. If an accidental release of hydrocarbons were to occur at the facility, the spill would be contained, and the contaminated soils would be disposed at a facility permitted to receive such waste. Although the soils at NLVF have been previously disturbed to construct the facility, disturbance from spill cleanup would increase the potential for increased erosion from wind and precipitation runoff. However, with spill prevention and mitigation measures in place, the potential for impact on the soils from a spill would be reduced.

5.3.5.1.3 Nondefense Mission

General Site Support and Infrastructure Program. The activities described under the No Action Alternative would be completed in the existing facilities at NLVF. Neither additional construction nor demolition on site would be required, so there would be no impacts on the geology or soils at the facility.

5.3.5.2 Expanded Operations Alternative

The impacts on the geology and soils at NLVF would be very similar to the No Action Alternative. Under the Expanded Operations Alternative, fusion experiments on Dense Plasma Focus machines would be conducted at NLVF. These tests would be conducted inside existing facilities and laboratories. No additional construction would be required for these tests, so there would be no impacts on the physical setting from the fusion experiments.

5.3.5.3 Reduced Operations Alternative

There would be no changes to NLVF under the Reduced Operations Alternative, so the impacts would be the same as discussed under the No Action Alternative.

5.3.6 Hydrology

5.3.6.1 Surface-Water Hydrology

5.3.6.1.1 No Action Alternative

Overall, no impacts under any of the impact criteria are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.1.1 National Security/Defense Mission

No impacts are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.1.2 Environmental Management Mission

No impacts are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.1.3 Nondefense Mission

General Site Support and Infrastructure Program. NLVF would continue stormwater and wastewater discharges, which are expected to have no impact on surface-water resources, assuming the activities adhere to all permit limitations on discharged water quality. In 2009, all contaminant concentrations in discharged effluent were within permitted levels.

5.3.6.1.2 Expanded Operations Alternative

Overall, no impacts under any of the impact criteria are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.2.1 National Security/Defense Mission

No impacts are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.2.2 Environmental Management Mission

No impacts are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.2.3 Nondefense Mission

General Site Support and Infrastructure Program. Impacts would be the same as those described under the No Action Alternative in Section 5.3.6.1.1.3.

5.3.6.1.3 Reduced Operations Alternative

Overall, no impacts under any of the impact criteria are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.3.1 National Security/Defense Mission

No impacts are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.3.2 Environmental Management Mission

No impacts are expected at NLVF because no activities are proposed that would affect surface hydrology.

5.3.6.1.3.3 Nondefense Mission

General Site Support and Infrastructure Program. Impacts would be the same as those described under the No Action Alternative in Section 5.3.6.1.1.3.

5.3.6.2 Groundwater

5.3.6.2.1 No Action Alternative

Under the No Action Alternative, current activities and operations would continue at NLVF. The dewatering program that was established to control encroaching groundwater beneath Building A-1 would continue. This dewatering program is regulated under an NPDES permit (NV0023507), which would continue to allow the discharge of water from dewatering operations to groundwater via percolation, when used for landscape irrigation and dust suppression, and into the Las Vegas Wash via direct discharge into the City of North Las Vegas stormwater drainage system.

Water extracted from the sump well located in the basement of Building A-1 for dewatering purposes is disposed at the NNSS Area 5 sewage lagoon in the winter months and is evaporated through swamp coolers located at NLVF during the summer months. As discussed in Chapter 4, Section 4.3.6.2, the sump well was previously used in tritium remediation efforts. Although the levels of tritium are now only one-twentieth of the limit established by the Safe Drinking Water Act, DOE/NNSA continues to dispose this water separately (June 2010 report).

These discharge programs will continue to comply with all permit conditions and regulatory requirements and are not expected to result in any adverse impacts on groundwater quality or supply.

NLVF does not withdraw any groundwater for production purposes; it receives its potable water from a large municipal supplier (i.e., the Las Vegas Valley Water District).

5.3.6.2.2 Expanded Operations Alternative

While a 25 percent increase in the workforce was estimated at NLVF under the Expanded Operations Alternative, this increase is not expected to adversely affect the municipal supplier of potable water. DOE/NNSA has not proposed any activities that would require groundwater withdrawals for production purposes, and has not identified any new activities that would present a risk to groundwater quality.

5.3.6.2.3 Reduced Operations Alternative

DOE/NNSA estimates that a 10 percent workforce reduction would occur under the Reduced Operations Alternative and that a corresponding 10 percent reduction in potable water demand would occur. DOE/NNSA has not proposed any activities that would require groundwater withdrawals for production purposes and has not identified any new activities that would present a risk to groundwater quality.

5.3.7 Biological Resources

Under all alternatives, activities at NLVF in support of DOE/NNSA NSO programs would occur in developed, previously disturbed areas. No land-disturbing construction activities are proposed at NLVF over the next 10 years under any of the three alternatives analyzed in this SWEIS. Therefore, DOE/NNSA activities at NLVF under all missions and programs would not affect either biological resources in general or any sensitive or protected species.

5.3.8 Air Quality and Climate

This section addresses air quality impacts from stationary, mobile, and fugitive air pollutant sources that would occur within and outside NLVF under each of the alternatives addressed in this *NNSS SWEIS*. The ROI for each alternative in this air quality analysis encompasses Nye and Clark Counties in Nevada. Stationary sources emissions occur within NVLF, while mobile sources emissions occur mostly outside NLVF, but still within Clark County. Additional details supporting the information presented in this section can be found in Appendix D, Section D.2.3.1.1.

General conformity determination. (See Section 5.1.8 for a discussion of general conformity determinations.) Based on the *de minimis* thresholds presented in Table 5–32, the total emissions in Clark County under each of the three alternatives considered in this *NNSS SWEIS* would not exceed the *de minimis* levels for carbon monoxide, nitrogen oxides, PM_{10}, or VOCs in all cases. Therefore, a general conformity analysis would not be required for any of the alternatives.

5.3.8.1 No Action Alternative

5.3.8.1.1 Air Quality

This section addresses air quality impacts from stationary, mobile, and fugitive air pollutant sources that would occur within and outside NLVF under the No Action Alternative. The ROI for this air quality analysis includes Nye and Clark Counties in Nevada.

Table 5–61 shows the midpoint (2015) annual air emissions for the criteria pollutants and hazardous air pollutants associated with various NLVF activities under the No Action Alternative. Most emissions are associated with mobile source activity. The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. The NLVF contribution to Clark County emissions would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–63). Emissions of VOCs, nitrogen oxides, carbon monoxide, and PM_{10} from NLVF sources (both mobile and stationary) in Clark County would decrease relative to 2008 emission levels by 0.02, 2.9, 2.2, and 0.13 tons per year, respectively. Most of the emission reductions at the NLVF are associated with the phasing in of newer worker vehicles with lower emission reduction technology. Thus, this action would not contribute to or cause additional violations of the carbon monoxide, ozone, or PM_{10} air quality standards. Appendix D, Section D.2.3.1.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization for mobile sources.

Table 5–61 No Action Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the North Las Vegas Facility in 2015

	Annual Air Emissions (tons per year)											
	Stationary Sources	NLVF Commuters		Commercial Vendors	Radiological Waste Trucks			Total				
	Clark County	Clark County	Nye County	Clark County	Clark County	Nye County		Clark County		Nye County		
Pollutant	On-NLVF	Off-NLVF	Off-NNSS	Off-NLVF	Off-NLVF	On-NNSS	Off-NNSS	On-NLVF	Off-NLVF	On-NNSS	Off-NNSS	Total
PM_{10}	0.037	0.25	0.0016	0.069	0.0017	0.00010	0.00015	0.037	0.32	0.00010	0.0018	0.36
$PM_{2.5}$	0.037	0.14	0.00095	0.057	0.0014	0.000090	0.00013	0.037	0.20	0.000090	0.0011	0.24
CO	0.19	23.8	0.14	0.26	0.0046	0.00030	0.00045	0.19	24.1	0.00030	0.14	24.4
NO_x	0.73	4.4	0.027	0.70	0.021	0.0013	0.0020	0.73	5.1	0.0013	0.029	5.9
SO_2	0.017	0.060	0.00034	0.0016	0.000046	0.0000029	0.0000044	0.017	0.062	0.0000029	0.00034	0.079
VOCs	0.028	0.66	0.0041	0.076	0.00091	0.000057	0.000086	0.028	0.74	0.000057	0.0042	0.77
Lead	<0.01	0.000017	0.00000010	0.0000030	0.000000029	0.0000000020	0.0000000030	<0.01	0.000020	0.0000000020	0.00000010	<0.01
Criteria Pollutant Total	*1.0*	*29.2*	*0.17*	*1.1*	*0.028*	*0.0018*	*0.0027*	*1.0*	*30.3*	*0.0018*	*0.17*	*31.5*
HAPs	0.0026	0.049	0.00033	0.010	0.00012	0.0000076	0.000011	0.0026	0.059	0.0000076	0.00034	0.062

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

5.3.8.1.2 Radiological Air Quality

No activities under the No Action Alternative are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions in Chapter 4, Section 4.3.8.3.

5.3.8.1.3 Climate Change

See Chapter 4, Section 4.3.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to NLVF-related activities. Table 5–62 shows greenhouse gas emissions due to NLVF-related activities under the No Action Alternative (see Section 5.1.8 for a discussion of methodology for this analysis). The color coding in Table 5–62 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by NLVF (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–62 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Table 5–62 No Action Alternative Greenhouse Gas Emissions at the North Las Vegas Facility in 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year*
STATIONARY SOURCES		
Power generation	5,623	0.20
Other stationary sources	10	0.01
ALL STATIONARY SOURCES	5,633	0.20
MOBILE SOURCES		
Mobile sources – Commuting	2,601	0.09
Mobile sources – Hazardous material and waste transport (nongovernment)	7	0.01
Mobile sources – Commercial vendors	138	0.01
ALL MOBILE SOURCES	2,746	0.10
ALL SCOPE 1 SOURCES	10	0.01
ALL SCOPE 2 SOURCES	5,623	0.20
ALL SCOPE 3 SOURCES	2,746	0.10
TOTAL	**8,379**	**0.30**

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

Overall, NLVF-related activities under the No Action Alternative would create about 8,379 carbon-dioxide-equivalent tons of greenhouse gas emissions per year, about 70 percent lower than the reporting level. This represents a net reduction over current greenhouse gas emissions (13,355 tons in 2008) of about 37 percent, but these emissions would continue to contribute to global climate change.

5.3.8.2 Expanded Operations Alternative

5.3.8.2.1 Air Quality

This section addresses air quality impacts from stationary, mobile, and fugitive air pollutant sources that would occur within and outside NLVF under the Expanded Operations Alternative. The ROI for this air quality analysis includes Nye and Clark Counties in Nevada. Stationary sources emissions occur within NVLF, while mobile sources emissions occur mostly outside NLVF, but almost entirely within Clark County. Additional details supporting the information presented in this section can be found in Appendix D, Section D.2.3.1.1.

Table 5–63 shows the midpoint (2015) annual air emissions for the criteria pollutants and hazardous air pollutants associated with various NLVF activities under the Expanded Operations Alternative. Most emissions are associated with mobile source activity. The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. The NLVF contribution to Clark County air emissions would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–63). Emissions of VOCs and carbon monoxide from NNSS mobile sources in Clark County would increase relative to 2008 emission levels by 0.17 and 3.8 tons per year, respectively; however, emissions of nitrogen oxides and PM_{10} would decrease relative to 2008 emission levels by 1.6 and 0.05 tons per year, respectively. Because these emissions would be small and the increased emissions would come from mobile sources spread out over the Las Vegas Valley, the additional burden would not produce additional violations of the carbon monoxide or ozone ambient air quality standard. Appendix D, Section D.2.3.2.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization for mobile sources.

5.3.8.2.2 Radiological Air Quality

No activities under the Expanded Operations Alternative are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions in Chapter 4, Section 4.3.8.3.

5.3.8.2.3 Climate Change

See Chapter 4, Section 4.3.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to NLVF-related activities. Table 5–64 shows greenhouse gas emissions levels from NLVF-related activities under the Expanded Operations Alternative (see Section 5.1.8 for a discussion of the methodology for this analysis). The color coding in Table 5–64 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by NLVF (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–64 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Table 5–63 Expanded Operations Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the North Las Vegas Facility in 2015

Pollutant	Annual Air Emissions (tons per year)											
	Stationary Sources	NLVF Commuters		Commercial Vendors	Radiological Waste Trucks			Total				
	Clark County	Clark County	Nye County	Clark County	Clark County	Nye County		Clark County		Nye County		Total
	On-NLVF	Off-NLVF	Off-NNSS	Off-NLVF	Off-NLVF	On-NNSS	Off-NNSS	On-NLVF	Off-NLVF	On-NNSS	Off-NNSS	Total
PM_{10}	0.037	0.31	0.0020	0.086	0.0021	0.00013	0.00019	*0.037*	*0.40*	*0.00013*	*0.0022*	*0.44*
$PM_{2.5}$	0.037	0.17	0.0020	0.071	0.0018	0.00011	0.00016	*0.037*	*0.24*	*0.00011*	*0.0022*	*0.28*
CO	0.19	29.8	0.19	0.33	0.0058	0.00038	0.00056	*0.19*	*30.1*	*0.00038*	*0.19*	*30.5*
NO_x	0.73	5.5	0.033	0.88	0.026	0.0016	0.0025	*0.73*	*6.4*	*0.0016*	*0.036*	*7.2*
SO_2	0.017	0.076	0.00043	0.0020	0.000058	0.0000036	0.0000055	*0.017*	*0.078*	*0.0000036*	*0.00044*	*0.095*
VOCs	0.028	0.83	0.0051	0.095	0.0011	0.000071	0.00011	*0.028*	*0.93*	*0.000071*	*0.0052*	*0.096*
Lead	<0.01	0.000022	0.00000013	0.0000038	0.000000036	0.0000000025	0.0000000038	*<0.01*	*0.000026*	*0.0000000025*	*0.00000013*	*<0.01*
Criteria Pollutant Total	*1.0*	*36.5*	*0.23*	*1.4*	*0.035*	*0.0022*	*0.0034*	*1.0*	*37.9*	*0.0022*	*0.23*	*39.2*
HAPs	0.0026	0.062	0.00041	0.013	0.00015	0.0000095	0.000014	*0.0026*	*0.075*	*0.0000095*	*0.00042*	*0.078*

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NLVF=North Las Vegas Facility; NNSS=Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

Table 5–64 Expanded Operations Alternative Greenhouse Gas Emissions at the North Las Vegas Facility in 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 25,000 Metric Tons Per Year* [a]
STATIONARY SOURCES		
Power generation	5,623	0.20
Other stationary sources	10	0.01
ALL STATIONARY SOURCES	*5,632*	*0.20*
MOBILE SOURCES		
Mobile sources – commuting	3,252	0.12
Mobile sources – hazardous material and waste transport (nongovernment)	9	0.01
Mobile sources – commercial vendors	138	0.01
ALL MOBILE SOURCES	*3,399*	*0.12*
ALL SCOPE 1 SOURCES	*10*	*0.01*
ALL SCOPE 2 SOURCES	*5,623*	*0.20*
ALL SCOPE 3 SOURCES	*3,399*	*0.12*
TOTAL	***9,031***	***0.33***

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

Overall, NLVF-related activities under the Expanded Operations Alternative would create about 9,031 carbon-dioxide-equivalent tons of greenhouse gas emissions per year, about 67 percent smaller than the reporting level. This represents a net reduction over current greenhouse gas emissions (13,355 tons in 2008) of about 32 percent, but these emissions would continue to contribute to global climate change.

5.3.8.3 Reduced Operations Alternative

5.3.8.3.1 Air Quality

This section addresses air quality impacts from stationary, mobile, and fugitive air pollutant sources that would occur within and outside NLVF under the Reduced Operations Alternative. The ROI for this air quality analysis includes Nye and Clark Counties in Nevada. The emissions from stationary sources occur within NVLF, while the emissions from mobile sources occur mostly outside NLVF, but within Clark County. Additional details supporting the information presented in this section can be found in Appendix D, Section D.2.3.3.1.

Calculations of emissions on and near NLVF. **Table 5–65** shows the midpoint (2015) annual air emissions for the criteria pollutants and hazardous air pollutants associated with various NLVF activities under the Reduced Operations Alternative. Most emissions are associated with mobile source activity. The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. The NLVF contribution to Clark County air emissions would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–63). Emissions of VOCs, nitrogen oxides, carbon monoxide, and PM_{10} from NLVF sources (both mobile and stationary) in Clark County would decrease relative to 2008 emission levels by 0.09, 3.4, 4.7, and 0.16 tons per year, respectively. Thus, this action would not contribute to or cause additional violations of the carbon monoxide, ozone, or PM_{10} air quality standards. Appendix D, Section D.2.3.3.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization of mobile sources.

Table 5–65 Reduced Operations Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the North Las Vegas Facility in 2015

	Annual Air Emissions (tons per year)											
	Stationary Sources	NLVF Commuters		Commercial Vendors	Radiological Waste Trucks			Total				
	Clark County	Clark County	Nye County	Clark County	Clark County	Nye County		Clark County		Nye County		
Pollutant	On-NLVF	Off-NLVF	Off-NNSS	Off-NLVF	Off-NLVF	On-NNSS	Off-NNSS	On-NLVF	Off-NLVF	On-NNSS	Off-NNSS	Total
PM_{10}	0.037	0.23	0.0014	0.062	0.0015	0.00009	0.000090	*0.037*	*0.29*	*0.00009*	*0.0015*	*0.33*
$PM_{2.5}$	0.037	0.12	0.00085	0.051	0.0013	0.000081	0.000081	*0.037*	*0.17*	*0.000081*	*0.00093*	*0.21*
CO	0.19	21.4	0.13	0.23	0.0041	0.00027	0.00027	*0.19*	*21.6*	*0.00027*	*0.13*	*22*
NO_x	0.73	4.0	0.024	0.63	0.019	0.0012	0.0012	*0.73*	*4.6*	*0.0012*	*0.025*	*5.4*
SO_2	0.017	0.054	0.00031	0.0014	0.000041	0.0000026	0.0000026	*0.017*	*0.055*	*0.0000026*	*0.00031*	*0.072*
VOCs	0.028	0.60	0.0037	0.068	0.00082	0.000051	0.000051	*0.028*	*0.67*	*0.000051*	*0.0038*	*0.7*
Lead	<0.01	0.000015	0.000000094	0.0000027	0.000000026	0.0000000018	0.0000000018	*<0.01*	*0.000018*	*0.0000000018*	*0.000000096*	*<0.01*
Criteria Pollutant Total	*1.0*	*26.3*	*0.16*	0.23	0.025	0.0024	0.0016	*1.0*	*26.6*	*0.0024*	*0.16*	*27.7*
HAPs	0.0026	0.044	0.00029	0.009	0.00011	0.0000068	0.0000068	*0.0026*	*0.053*	*0.0000068*	*0.00030*	*0.056*

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

5.3.8.3.2 Radiological Air Quality

No activities under the Reduced Operations Alternative are expected to produce aboveground radiation beyond those documented for 2008 baseline conditions in Chapter 4, Section 4.3.8.3.

5.3.8.3.3 Climate Change

See Chapter 4, Section 4.3.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to NLVF-related activities. **Table 5–66** shows greenhouse gas emissions due to NLVF-related activities under the Reduced Operations Alternative (see Section 5.1.8 for a discussion of methodology for this analysis). The color coding in Table 5–66 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by NLVF (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–66 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Table 5–66 Carbon-Dioxide-Equivalent Emissions of Greenhouse Gases by Activities Related to the North Las Vegas Facility Under the Reduced Operations Alternative for 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year*
STATIONARY SOURCES		
Power generation	5,623	0.20
Other stationary sources	10	0.01
ALL STATIONARY SOURCES	*5,632*	*0.20*
MOBILE SOURCES		
Commuting	2,341	0.08
Hazardous material and waste transport (nongovernment)	6	0.01
Commercial vendors	138	0.01
ALL MOBILE SOURCES	*2,485*	*0.09*
ALL SCOPE 1 SOURCES	*10*	*0.01*
ALL SCOPE 2 SOURCES	*5,623*	*0.20*
ALL SCOPE 3 SOURCES	*2,485*	*0.09*
TOTAL	***8,118***	***0.29***

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

Overall, NLVF-related activities under the Reduced Operations Alternative would create about 8,118 carbon-dioxide-equivalent tons of greenhouse gas emissions per year, about 71 percent smaller than the reporting level. This represents a net reduction over current greenhouse gas emissions (13,355 tons in 2008) of about 39 percent.

5.3.9 Visual Resources

5.3.9.1 No Action Alternative

Under the No Action Alternative, current activities and operations would continue. These activities and operations occur indoors. No proposed changes would affect existing visual resources associated with NLVF, and the scenic quality would remain Class C. No mitigation would be required.

5.3.9.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, there would be no changes at NLVF compared with the No Action Alternative and current activities and operations would continue. There would be no changes to the existing visual environment, and the scenic quality would remain at Class C. There would be no effect. No mitigation would be required.

5.3.9.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, there would be no changes at NLVF compared with the No Action Alternative, current activities and operations would continue, and there would be no change to the existing visual environment. The scenic quality would remain at Class C. There would be no effect. No mitigation would be required.

5.3.10 Cultural Resources

Under all alternatives addressed in this SWEIS, there are no proposed activities or projects that would affect Building A-17, which the DOE/NNSA NSO considers to be historically significant due to its connection with nuclear weapons testing. In addition, activities at NLVF supporting all of the DOE/NNSA NSO programs would occur in developed, previously disturbed areas and are not expected to affect cultural resources.

5.3.11 Waste Management

Under all of the alternatives, NLVF would generate no TRU or mixed TRU wastes. However, under all of the alternatives, NLVF would generate liquids containing small quantities of tritium collected from the sump of an NLVF building (tritium concentrations in the collected water are expected to continue to be below the maximum concentration limits for tritium specified in EPA primary drinking-water standards). Disposal of the collected tritiated water would continue, either by introducing it to the NLVF evaporative coolers or by collecting it in tanker trucks and transporting it to the NNSS for evaporation (see Section 5.1.11.1.1). The potential impacts of the release of tritium to the atmosphere through evaporation are addressed in Sections 5.1.8 and 5.1.12.

Under all of the alternatives, NLVF would remain a conditionally exempt, small-quantity generator of hazardous waste; this waste would be stored on site before being transferred off site to permitted facilities for recycle or treatment, storage, or disposal. NLVF would annually generate approximately 34 cubic feet of hazardous and other regulated wastes (e.g., asbestos) for offsite treatment and disposal, 21 cubic feet of hazardous waste (including universal waste) for offsite recycle, and 55 cubic feet of used oil or antifreeze for offsite recycle.

Sanitary solid waste generation at NLVF would vary under each of the three SWEIS alternatives based on the estimated number of personnel stationed there (see Section 5.2.4). Annual generation of sanitary solid wastes would total approximately 39,000 to 49,000 cubic feet under the No Action and Expanded Operations Alternatives, respectively, and approximately 35,000 cubic feet under the Reduced Operations Alternative. It is expected that sanitary solid waste generated by NLVF personnel would continue to be removed and dispositioned by a municipal service. In addition, occasional shipments of solid waste, consisting mainly of materials containing sensitive information, would be sent to the NNSS for disposal.

D&D of certain structures at NLVF is conservatively projected to generate up to approximately 150 cubic feet of LLW and 110,000 cubic feet of (nonradioactive) demolition debris under all alternatives. The

LLW would be shipped to the NNSS for disposal in the Area 5 RWMC, while the demolition debris could be disposed at a local landfill or transported to the NNSS for disposal at an NNSS landfill. The LLW and demolition debris volumes are both included in the volumes of waste projected for disposal at the NNSS, which are presented in Table 5–47.

The quantities of LLW projected for shipment to the NNSS are small under all of the alternatives and are within available NNSS disposal capacity (see Section 5.1.11). Under all of the alternatives, the quantities of tritiated liquids projected for shipment to the NNSS would be within the NNSS's treatment capability. In addition, under all of the alternatives, recycle or TSD capacity is expected to be adequate for the nonradioactive wastes from NLVF, given the availability of large numbers of permitted recycle or TSD facilities in Nevada and neighboring states (see Section 5.1.11.1.1).

5.3.12 Human Health

The approach to evaluating human health impacts is discussed in Section 5.1.12. The criteria for evaluating human health impacts are included in that discussion.

5.3.12.1 Normal Operations

5.3.12.1.1 No Action Alternative

In support of the National Security/Defense Mission, 600 small plasma physics and fusion experiments would be conducted at NLVF, but these experiments are not expected to cause measurable releases of radioactive materials. As described in Chapter 4, Section 4.3.12, tritium from a previous spill continues to be emitted from the A-1 Building. It was estimated that the small amount of tritium expected to be released annually (an average of 0.0111 curies per year) would result in a dose of 0.00035 millirem per year to the MEI at the facility boundary or to a noninvolved worker (approximately 330 feet away). This dose represents a negligible annual risk of an LCF (about 1 chance in 5 billion). The estimated dose to the population of approximately 2,390,000 within 50 miles of NLVF is 4.1×10^{-5} person-rem per year; the calculated number of LCFs associated with this dose is 2×10^{-8}, implying that the most likely outcome would be no additional LCFs in the exposed population. Based on the premise that there is some risk associated with any radiation dose, the population risk of 2×10^{-8} implies that there would be an annual risk of 1 in 50 million of a single LCF in the population. The tritium emissions and, therefore, the potential doses and risks could vary over the years due to factors such as meteorological conditions, but would trend downward due to radioactive decay (tritium has a half-life of 12.3 years).

The potential for occupational injury and illness was estimated for NLVF activities using rates based on DOE experience (DOE 2010e) (see Appendix G for details). The number of TRCs and DART cases were projected based on the number of FTEs estimated for this alternative. Under this alternative, a total of 22 TRCs and 9.5 DART cases per year were calculated.

No radiological or chemical impacts are expected at NLVF from any activities related to the Environmental Management or Nondefense Missions.

Noise. Under the No Action Alternative, potential noise impacts on offsite receptors from activities at NLVF would primarily result from traffic noise generated by privately owned vehicles of commuting employees and would occur along the principal roadways leading to the facility. As discussed in Section 5.1.3.2, Losee Road, which is representative of the offsite traffic near NLVF, would not increase in personnel and is expected to experience a negligible increase in traffic noise along the roadways.

5.3.12.1.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, approximately 1,000 small plasma physics and fusion experiments would be performed at NLVF; however, these experiments are not expected to cause measurable releases of radioactive material. Therefore, the impacts from normal operations under the Expanded Operations Alternative would be the same as those under the No Action Alternative.

The potential for occupational injury and illness for NLVF activities would be greater under the Expanded Operations Alternative than the No Action Alternative because of the larger number of employees at this location. Based on the number of FTEs estimated for this alternative, a total of 27 TRCs and 12 DART cases per year were calculated.

Noise. Similar to under the No Action Alternative, potential noise impacts on offsite receptors from activities at NLVF would primarily result from traffic noise generated by privately owned vehicles of commuting employees and would occur along the principal roadways leading to the facility. As discussed in Section 5.3.3.2, Losee Road would experience an approximate 3 percent increase in daily traffic volumes in comparison to future baseline conditions. The increase in daily vehicle trips by personnel vehicles would primarily increase baseline noise conditions along the main roadways leading to these sites; however, this would be limited to the morning and afternoon commuting hours.

5.3.12.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, 350 plasma physics and fusion experiments would be performed at NLVF; however, because these experiments are not expected to cause measurable releases of radioactive material, the impacts from normal operations under the Reduced Operations Alternative would be the same as those under the No Action Alternative.

The potential for occupational injury and illness for NLVF activities would be slightly less under the Reduced Operations Alternative than the No Action Alternative because of the fewer number of employees at this location. Based on the number of FTEs estimated for this alternative, a total of 20 TRCs and 8.6 DART cases per year were calculated.

Noise. Under the Reduced Operations Alternative, potential noise impacts on offsite receptors from activities at NLVF would be less than those described under the No Action Alternative because the number of personnel would be reduced. As discussed in Section 5.3.3.2, Losee Road would experience a negligible decrease in daily traffic volumes in comparison to future baseline conditions. This decrease in personnel vehicles would cause a negligible decrease in baseline noise levels during morning and afternoon commuting hours along the main roadways leading to the facility.

5.3.12.2 Facility Accidents

5.3.12.2.1 No Action Alternative

No NLVF accident scenarios that would cause impacts other than extremely small radiological or hazardous chemical risks to the public, workers, or the environment were identified under the No Action Alternative. A range of potential accidents at NLVF, including accidents involving sealed sources stored and used at Building A-1, was considered. The nature of sealed sources and the manner and location in which they are stored make the probability of an accident very small and the probability of an accident that results in a substantive release even smaller. Based on the low probability of any accidents that could result in offsite doses, no NLVF accidents were analyzed in detail.

5.3.12.2.2 Expanded Operations Alternative

As under the No Action Alternative, no NLVF accident scenarios that would cause impacts other than extremely small radiological or hazardous chemical risks to the public, workers, or the environment were identified under the Expanded Operations Alternative.

5.3.12.2.3 Reduced Operations Alternative

As under the No Action Alternative, no NLVF accident scenarios that would cause impacts other than extremely small radiological or hazardous chemical risks to the public, workers, or the environment were identified under the Reduced Operations Alternative.

5.3.12.2.4 Intentional Destructive Acts Analysis

Substantive details of terrorist attack scenarios and security countermeasures are not released to the public because disclosure of this information could be exploited by terrorists to plan attacks. A separate classified appendix to this SWEIS has been prepared that considers the underlying facility threat assumptions with regard to intentionally destructive acts. Based on these threat assumptions, the classified appendix evaluates potential human health impacts using appropriate analytical models, similar to the methodology used in this SWEIS to analyze accident impacts. These data provide DOE/NNSA with information on which to base, in part, decisions regarding activities at NLVF.

5.3.13 Environmental Justice

5.3.13.1 No Action Alternative

Impacts on human health would not be significant under any alternative. Similarly, direct and cumulative effects on environmental resources are not expected to result in significant adverse impacts on the public within the ROI.

Impacts on low-income and minority populations under the No Action Alternative, as discussed in the other sections in this chapter, would be the same as those on the general population. Therefore, no disproportionately high and adverse impacts on minority and low-income populations are expected.

5.3.13.2 Expanded Operations Alternative

Impacts under the Expanded Operations Alternative would be the same as those described under the No Action Alternative in Section 5.3.13.1.

5.3.13.3 Reduced Operations Alternative

Impacts under the Reduced Operations Alternative would be the same as those described under the No Action Alternative in Section 5.3.13.1.

5.4 Tonopah Test Range

The following sections describe the potential environmental consequences associated with alternatives and programs at the TTR.

5.4.1 Land Use

This section describes the potential environmental consequences for land use and airspace associated with DOE/NNSA missions at the TTR. No land use impacts were identified for any alternative at the TTR, including impacts on surrounding land uses. The only activities that would affect airspace would be defense-related. Therefore, only the National Security/Defense Mission is discussed and evaluated for airspace impacts resulting from implementation of the alternatives.

5.4.1.1 National Security/Defense Mission

5.4.1.1.1 No Action Alternative

Airspace. Under the No Action Alternative, DOE/NNSA activities at the TTR would continue at the level of current operations; therefore, no new impacts are expected from anticipated airspace activities and requirements. DOE/NNSA would continue to coordinate the use of airspace with the controlling entity responsible for TTR airspace, the Nellis Air Traffic Control Facility. A variety of DOE/NNSA programs that require occasional flights of helicopters and fixed-wing aircraft carrying supplies and personnel would continue to occur.

5.4.1.1.2 Expanded Operations Alternative

Airspace. Impacts would be similar to those described under the No Action Alternative in Section 5.4.1.1.1.

5.4.1.1.3 Reduced Operations Alternative

Airspace. Impacts would be similar to those described under the No Action Alternative in Section 5.4.1.1.1; however, the impacts would be minimized as a result of the discontinuation of fixed rocket launch operations, cruise missile operations, and fuel-air explosives at the TTR. This would increase the restricted airspace for other military uses as coordinated and scheduled by the Nellis Air Traffic Control Facility.

5.4.2 Infrastructure and Energy

5.4.2.1 Infrastructure

5.4.2.1.1 No Action Alternative

Under the No Action Alternative, infrastructure-related activities would include small projects to maintain the present capabilities of the TTR, including repairs and replacements. There would be no increases in capabilities, facilities, or demand for utilities at the TTR.

5.4.2.1.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, the number of employees at the TTR would decrease compared with the No Action Alternative, thereby reducing demand for utilities.

5.4.2.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, the number of employees at the TTR would decrease compared with the No Action Alternative, thereby reducing demand for utilities.

5.4.2.2 Energy

5.4.2.2.1 No Action Alternative

Under the No Action Alternative, DOE/NNSA operations at the TTR would continue at current levels, and no activities have been identified that would create additional long-term demands for electrical power or liquid fuel supply.

The existing 13.8-kilovolt electrical distribution line for DOE/NNSA operations (stepped down from the 120-kilovolt USAF main line) would continue to meet all facility power demands, and no adverse effects on system capacity are expected. For any routine facility repair activities associated with the No Action Alternative, the current power resources would be adequate to handle the temporary increased demand. All remote operations would continue to be supplied with electrical power by portable generators.

DOE/NNSA operations at the TTR use propane for most heating needs, and gasoline and diesel to support emergency generators. The TTR maintains diesel-fired generators, gasoline generators, and propane-fired boilers. The TTR has onsite propane storage tanks, with a collective permitted storage capacity of 23,563 gallons (NDEP 2007). Current liquid fuel storage and resupply capacity would be sufficient to meet ongoing demands.

5.4.2.2.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, the number of employees at the TTR would decrease compared to that under the No Action Alternative level due to the transfer of certain site support functions from DOE/NNSA to the USAF, which would reduce demand for electrical power and liquid fuels. The existing electrical distribution line for DOE/NNSA operations would continue to meet all facility power demands, and no adverse effects on system capacity are expected. For any routine facility repair activities associated with the Expanded Operations Alternative, the current power resources would be adequate to handle the temporary increased demand. All remote operations would continue to be supplied with electrical power by portable generators. Current liquid fuel storage and resupply capacity would be sufficient to meet ongoing demands.

5.4.2.2.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, the number of employees at the TTR would decrease further than under the Expanded Operations Alternative, which would reduce demand for electrical power and liquid fuels. The existing electrical distribution line for DOE/NNSA operations would continue to meet all facility power demands, and no adverse effects on system capacity are expected. For any routine facility repair activities associated with the Reduced Operations Alternative, the current energy resources would be adequate to handle the temporary increased demand. All remote operations would continue to be supplied with electrical power by portable generators. Current liquid fuel storage and resupply capacity would be sufficient meet ongoing demands.

5.4.3 Transportation and Traffic

5.4.3.1 Transportation

There would be about 230 shipments of LLW due to environmental restoration activities to the NNSS for disposal under the No Action and Reduced Operations Alternatives. There would be about 13,100 shipments of radioactive waste to the NNSS for disposal under the Expanded Operations Alternative. Table 5–11 and the following subsections summarize the impacts associated with these shipments.

5.4.3.1.1 No Action Alternative

The transport of LLW and MLLW by truck to the NNSS for disposal would result in a cumulative dose of about 0.015 person-rem, resulting in less than 1 (9×10^{-6}) LCF to the crew. The cumulative dose to the general population would be about 0.0020 person-rem, resulting in less than 1 (1×10^{-6}) additional LCF. The accident risk would be very small (1×10^{-12} LCF). Nonradiological accident risks for transporting LLW and MLLW would also be less than 1 (0.002) fatality.

5.4.3.1.2 Expanded Operations Alternative

The transport of LLW and MLLW by truck to the NNSS for disposal would result in a cumulative dose of about 0.82 person-rem, resulting in less than 1 (0.0005) LCF to the crew. The cumulative dose to the general population would be about 0.28 person-rem, resulting in less than 1 (0.0002) additional LCF. The accident risk would be very small (6×10^{-11} LCF). Nonradiological accident risks for transporting LLW and MLLW would also be less than 1 (0.1) fatality.

5.4.3.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, the impacts associated with transportation of TTR environmental restoration waste to the NNSS for disposal would be the same as described in Section 5.4.3.1.1 for the No Action Alternative.

5.4.3.2 Traffic

The number of personnel at the TTR is expected to remain the same under the No Action Alternative and decrease under the Expanded Operations and Reduced Operations Alternatives. The number of shipments of radioactive waste from the TTR could result in up to 4 truck trips daily under the No Action and Reduced Operations Alternatives and up to 14 trips daily under the Expanded Operations Alternative. These additional vehicles trips are considered relatively low and are expected to result in minor impacts on regional traffic. The shipments of radioactive waste would primarily occur on U.S. Routes 6 and 95. Traffic conditions on these roadways are shown in Table 5–18.

5.4.4 Socioeconomics

5.4.4.1 No Action Alternative

Under the No Action Alternative, the number of employees and the level of operations at the TTR would continue at current levels. There would be no increases in capabilities, facilities, or services at the TTR.

Because there would be no increase or decrease in the number of employees and the level of operations would continue, no impacts on economic activity, population, and housing; public finances; or public services would occur.

5.4.4.2 Expanded Operations Alternative

5.4.4.2.1 Economic Activity, Population, and Housing

Under the Expanded Operations Alternative, there would be an employment reduction of 63 individuals at the TTR, including 14 employees in Clark County (about 22 percent of the reduction) and 42 employees in Nye County (about 67 percent of the reduction), with the balance of eliminated positions (11 percent of the reduction, 7 employees) affecting employees residing in other counties or states. In Clark County, this would increase unemployment by about 0.01 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). In Nye County, this reduction would increase unemployment by about 1.34 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). This reduction would represent a minor adverse impact on Clark County's unemployment rate and a moderate adverse impact on Nye County's unemployment rate (however, because 23 percent of the jobs added at the NNSS would be allocated to Nye County, this impact could be partially offset). As a result of the reduction in jobs, daily spending in the vicinity of the TTR would decrease, causing a minor adverse impact on economic activity in the area immediately adjacent to the TTR.

Public finance. Revenues for Clark and Nye Counties could decrease due to decreases in personal income and total employment, which could lead to reduced spending. This small decrease in spending (due to a loss of 63 jobs) would have a negligible adverse impact on local economies.

5.4.4.2.2 Public Services

Public education. Under the Expanded Operations Alternative, no individuals are expected to relocate to work at the TTR; therefore, no new students would enroll in Clark County or Nye County schools. No new teachers would be required under the Reduced Operations Alternative.

Police protection. Under the Expanded Operations Alternative, the number of daytime occupants at the TTR would decrease, which could result in fewer calls for service. Therefore, a minor beneficial impact on police protection resources is anticipated under this alternative.

Fire protection. No changes in building density at the TTR would occur under the Expanded Operations Alternative. Therefore, it is unlikely that any additional calls for fire protection would take place under the Expanded Operations Alternative. Levels of service at the volunteer fire departments in Nye County would not be impacted.

Health care. Under the Expanded Operations Alternative, a small reduction in staff of 63 people is anticipated. No impact on health care in the region is anticipated. Existing levels of service would be maintained.

5.4.4.3 Reduced Operations Alternative

5.4.4.3.1 Economic Activity, Population, and Housing

Under the Reduced Operations Alternative, there would be an employment reduction of 67 individuals at the TTR, including 15 in Clark County and 45 in Nye County, with the other 7 reductions affecting individuals residing in other counties or states. In Clark County, this reduction would increase unemployment by about 0.01 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). In Nye County, this would increase unemployment by about 1.44 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). This would represent a minor adverse impact on Clark County's unemployment rate and a moderate adverse impact on Nye County's unemployment rate (however, because 23 percent of the jobs added at the NNSS would be allocated to Nye County, this impact would be partially offset). As a result of the reduction in jobs, daily spending in the vicinity of the TTR would decrease, which would have a minor adverse impact on economic activity in the area immediately adjacent to the TTR.

Public finance. Revenues for Clark and Nye Counties could decrease due to reductions in personal income and total employment, which could lead to reduced spending. This small decrease in spending (due to a loss of 67 jobs) would have a negligible adverse impact on local economies.

5.4.4.3.2 Public Services

Public education. Under the Reduced Operations Alternative, no individuals are expected to relocate to work at the TTR; therefore, no new students would enroll in Clark County or Nye County schools. No new teachers would be required under the Reduced Operations Alternative.

Police protection. Under the Reduced Operations Alternative, the number of daytime occupants at the TTR would decrease, which could result in fewer calls for service. Therefore, a minor beneficial impact on police protection resources in calls for service is anticipated under this alternative.

Fire protection. Similar to under the Expanded Operations Alternative, no changes in building density would occur as a result of the Reduced Operations Alternative. Therefore, it is unlikely that any additional calls for fire protection would take place. Levels of service at the volunteer fire departments in Nye County would not be impacted.

Health care. Under the Reduced Operations Alternative, a small reduction in staff of 67 people is anticipated. No impact on health care in the region is anticipated. Existing levels of services would be maintained.

5.4.5 Geology and Soils

The TTR is used to test weapon systems using noncritical high-explosives experiments and aerial training. The TTR has contaminated soils sites that are managed as part of the Environmental Restoration Program.

5.4.5.1 No Action Alternative

5.4.5.1.1 National Security/Defense Mission

Stockpile Stewardship and Management Program. Several Stockpile Stewardship and Management Program activities occur at the TTR, which would impact the local geology and soils. Operations that would have a potential to impact the soils or geology would include impact tests (nonexplosive) using gravity weapons (bombs), joint test assemblies, and inert projectiles. Soils and geology would be affected by these operations because large sections of soils would be disturbed and contaminated, drainage patterns would be modified, and surface instability could be introduced into rugged areas. Although none of the tests would result in a nuclear yield, other chemicals and heavy metals could contaminate the impact surface. Many of the tests are designed to penetrate the ground surface, which results in impacts on soils from the penetration itself, as well as subsequent impacts when the ground is excavated to retrieve the test object. The operations at the TTR would be located in isolated areas that were previously used for similar tests. The passive tests using high-resonance energy, lasers, and ultrasound techniques would not affect soils because the activities would occur within existing facilities.

Work for Others. Under the Work for Others Program, and in conjunction with DoD, DOE/NNSA would use the restricted airspace at the TTR to conduct counterterrorism operations. There would be no impacts on the physical setting from performing the military operations.

Other Work for Others Program activities at the TTR would include robotics development and experiments for handling chemical materials, smart transportation-related experiments, smoke obscuration operations, infrared tests, and rocket development, testing, and deployment. These experiments would result in some localized soil disturbance, but would be unlikely to result in increased erosion or sedimentation.

5.4.5.1.2 Environmental Management Mission

Waste Management Program. At the TTR, Environmental Restoration Program activities may produce some LLW depending on negotiated cleanup levels and corrective action decisions and could produce minor quantities of TRU waste (a few drums). The wastes produced at the TTR would be disposed at the Area 5 RWMC or brought to the NNSS TRU Storage Pad, which would not generate any impacts on soils or the geology. Other wastes produced at the TTR, including small quantities of hazardous waste, used oil, asbestos, and PCB wastes, would be shipped off site for disposal and would not produce impacts at the TTR. The USAF TTR sanitary landfill that receives sanitary solid waste produced by TTR facilities would not increase its footprint under the No Action Alternative and, therefore, would not impact soils or geologic resources.

Because oil and hazardous waste are present at the TTR, there is a chance of an accidental spill that could contaminate the soil surface. If an accidental release of hydrocarbons were to occur at the TTR, the soils contaminated with hydrocarbons would be removed to be disposed in permitted and approved landfills. With spill prevention and mitigation measures in place, the potential for impact on the soils from a spill would be reduced. The removal of the contaminated soils would be a positive impact on the soils at the TTR, and the use of existing landfills would not increase surface disturbance.

Environmental Restoration. The Environmental Restoration Program at the TTR would continue to investigate and characterize contaminated soil sites as described under the NNSS No Action Alternative. The corrective action sites for soils at the TTR are primarily related to the plutonium contamination from the Clean Slate 1, 2, and 3 experiments. In total, there are 43 source units (environmental restoration sites) on the TTR, which includes underground storage tanks, landfills and lagoons, soil contamination sites, surface and near-surface radioactive sites, and unexploded ordnance sites. The corrective action sites at the TTR would be closed under the FFACO by the end of 2022.

5.4.5.1.3 Nondefense Mission

General Site Support and Infrastructure Program. The existing infrastructure at the TTR would be able to support the activities described under the No Action Alternative. Neither additional construction nor demolition on site would be required, so there would be no impacts on the geology or soils around the buildings.

5.4.5.2 Expanded Operations Alternative

5.4.5.2.1 National Security/Defense Mission

National Security/Defense Mission activities at the TTR under the Expanded Operations Alternative would be the same as the No Action Alternative. Therefore, the impacts would be the same as those described in Section 5.4.5.1.

5.4.5.2.2 Environmental Management Mission

Environmental Management Mission activities at the TTR under the Expanded Operations Alternative would be the same as those under the No Action Alternative, so the impacts on the geology and soils at the TTR would not change. No new waste facilities would be needed to accept wastes from the TTR, so impacts resulting from increased erosion or surface disturbance would not occur. The Environmental Restoration Program would also not change.

5.4.5.2.3 Nondefense Mission

Nondefense Mission program activities at the TTR under the Expanded Operations Alternative would be the same as those under the No Action Alternative, so there would be no additional impacts on the geology or soils.

5.4.5.3 Reduced Operations Alternative

5.4.5.3.1 National Security/Defense Mission

Most of the National Security/Defense Mission activities at the TTR would be the same as those under the No Action Alternative. However, under the Reduced Operations Alternative, DOE/NNSA would not conduct ground/air-launched rocket and missile operations or fuel-air explosives operations at the TTR, so impacts related to surface disturbance and alteration of drainage pathways would be less than those seen under the No Action Alternative.

5.4.5.3.2 Environmental Management Mission

Environmental Management Mission activities at the TTR would be the same as those under the No Action Alternative, so the impacts on the geology and soils at the TTR would not change. No new waste facilities would be needed to accept wastes from the TTR, so impacts resulting from increased erosion or surface disturbance would not occur. The Environmental Restoration Program would also not change.

5.4.5.3.3 Nondefense Mission

The Nondefense Mission programs at the TTR under the Reduced Operations Alternative would be the same as those under the No Action Alternative, so there would be no impacts on the geology or soils.

5.4.6 Hydrology

5.4.6.1 Surface-Water Hydrology

As described in Chapter 4, Sections 4.1.6.1 and 4.4.6.4, springs are the only perennial sources of surface water at the TTR; therefore, the only perennial surface waters occur as pools at some large springs. Springs are located outside of locations used for testing and training events and are generally upgradient; therefore, no impacts on perennial surface waters are anticipated to occur at the TTR under any of the alternatives.

The TTR land area is nearly entirely contained within the Cactus Flat Hydrographic Basin, which drains internally to Cactus Flat, roughly in the center of the TTR. Thus, in terms of transport via surface water, potential surface contamination resulting from the activities described in the following sections would be contained on site and would not affect offsite areas during rare flooding events.

5.4.6.1.1 No Action Alternative

The following sections describe impacts associated with the various activities that may potentially occur under the three missions. With respect to the aforementioned impact criteria, no activities are expected to conflict with the provisions of approved water discharge permits or cause alteration to 100- or 500-year floodplains or other flood hazard areas in a manner that would endanger lives and property.

Soils Project activities under the Environmental Restoration Program and activities under the General Site Support and Infrastructure Program are not expected to alter natural drainage pathways.

Industrial Sites Project activities under the Environmental Restoration Program and activities under the General Site Support and Infrastructure Program are not expected to contaminate surface waters with chemical and/or biological agents.

The following TTR operations and activities under the Stockpile Stewardship and Management Program and General Site Support and Infrastructure Program are not expected to deposit sediment in surface waters.

5.4.6.1.1.1 National Security/Defense Mission

Stockpile Stewardship and Management Program – Operations at the TTR. Under the No Action Alternative, operations would continue at the TTR to ensure that nuclear weapons systems meet the highest standards of safety and reliability. DOE/NNSA would conduct tests and experiments on gravity weapons, including flight tests of weapon and delivery systems, as well as impact testing to study the parameters of a weapon as it is dropped and as it penetrates the ground surface. At the TTR, following tests and experiments, recovery operations are conducted to minimize damage to the environment. All test assets and associated hardware are recovered with the use of a mobile crane and transport vehicle. When necessary, subsurface recovery excavations are performed using either an excavator or a drill rig to create an entry shaft. Surface water is controlled by building an earthen dike around the recovery area or the excavation; following recovery operations, all excavations and dikes are backfilled and/or leveled. Gravity weapon drops could cause minor alterations of natural drainage pathways and introduce chemical contamination into ephemeral waters. If these exercises would occur in areas where similar exercises occurred previously, impacts from drainage alterations would be less prominent.

Work for Others Program – Work for Others at the TTR. Under the No Action Alternative, the Work for Others Program would provide support to other agencies at the TTR. As described above under "Stockpile Stewardship and Management Program – Operations at the TTR," following tests and experiments, recovery operations are performed to minimize damage to the environment, including controlling surface water with earthen dikes, which are leveled following recovery. The operation of ground-based remote control vehicles could cause localized sedimentation to ephemeral waters. Rocket and missile testing could cause alterations of natural drainage pathways and introduce chemical contamination into the soil where weapons impacts occur. If these exercises would occur in areas where similar exercises occurred previously, impacts from drainage alteration would be less prominent.

5.4.6.1.1.2 Environmental Management Mission

Environmental Restoration Program – Soils Project. The Soils Project would continue to investigate soil sites to determine whether contamination exists and to perform corrective actions as needed. Land-disturbing activities associated with these corrective actions (e.g., vehicular and equipment movements) could cause some minor sedimentation to ephemeral waters. During corrective action activities, excavated or exposed contaminated materials could potentially be transported to downgradient land surfaces during storm events that generate runoff. Appropriate site-specific dust and drainage controls would be implemented for each corrective action (e.g., establishing temporary diversion berms), which would minimize the potential for impacts to occur; however, it is possible that moderate impacts on the water quality of ephemeral surface waters could occur if contaminants were transported to such features.

Environmental Restoration Program – Industrial Sites Project. Following the complete remediation and closure of industrial sites, the facilities would be demolished to the ground level where practical. Therefore, where facilities are demolished to ground level, natural drainage pathways would be restored, resulting in minimal beneficial impacts. Land-disturbing activities associated with demolition (e.g., vehicular and equipment movements) could cause some minor sedimentation to ephemeral waters.

5.4.6.1.1.3 Nondefense Mission

General Site Support and Infrastructure Program. At the TTR, continued wastewater discharges are expected to have no impact on surface-water resources, assuming they adhere to all permit limitations on discharged water quality. In 2009, all contaminant concentrations in discharged effluent were within permitted levels.

5.4.6.1.2 Expanded Operations Alternative

The following sections describe impacts associated with the various activities that may potentially occur under the three missions. With respect to the aforementioned impact criteria, no activities are expected to conflict with the provisions of approved water discharge permits or cause alteration to 100- or 500-year floodplains or other flood hazard areas in a manner that would endanger lives and property.

Soils Project activities under the Environmental Restoration Program and activities under the General Site Support and Infrastructure Program are not expected to alter natural drainage pathways.

Industrial Sites Project activities under the Environmental Restoration Program and activities under the General Site Support and Infrastructure Program are not expected to contaminate surface waters with chemical and/or biological agents.

TTR operations under the Stockpile Stewardship and Management Program and activities under the General Site Support and Infrastructure Program are not expected to deposit sediment in surface waters.

5.4.6.1.2.1 National Security/Defense Mission

Stockpile Stewardship and Management Program – Operations at the TTR. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.1.

Work for Others Program – Work for Others at the TTR. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.1.

5.4.6.1.2.2 Environmental Management Mission

Environmental Restoration Program – Soils Project. Impacts would be similar to those described under the No Action Alternative in Section 5.4.6.1.1.2; however, these impacts could be exacerbated because activities could occur at an accelerated rate. Therefore, compared to the No Action Alternative, an increased potential for surface contamination would occur, as well as increased sedimentation to ephemeral waters.

Environmental Restoration Program – Industrial Sites Project. Impacts would be similar to those described under the No Action Alternative in Section 5.4.6.1.1.2; however, these impacts could be exacerbated because activities could occur at an accelerated rate. Therefore, compared to the No Action Alternative, more work would be done to restore natural topographies and drainage patterns in areas where remediated facilities are demolished and increased sedimentation to ephemeral waters would occur.

5.4.6.1.2.3 Nondefense Mission

General Site Support and Infrastructure Program. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.3.

5.4.6.1.3 Reduced Operations Alternative

The following sections describe impacts associated with the various activities that may potentially occur under the three missions. With respect to the aforementioned impact criteria, no activities are expected to conflict with the provisions of approved water discharge permits or cause alteration to 100- or 500-year floodplains or other flood hazard areas in a manner that would endanger lives and property.

Soils Project activities under the Environmental Restoration Program and activities under the General Site Support and Infrastructure Program are not expected to alter natural drainage pathways. Industrial Sites Project activities under the Environmental Restoration Program and activities under the General Site Support and Infrastructure Program are not expected to contaminate surface waters with chemical and/or biological agents. TTR operations under the Stockpile Stewardship and Management Program and activities under the General Site Support and Infrastructure Program are not expected to deposit sediment in surface waters.

5.4.6.1.3.1 National Security/Defense Mission

Stockpile Stewardship and Management Program – Operations at the TTR. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.1.

Work for Others Program – Work for Others at the TTR. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.1.

5.4.6.1.3.2 Environmental Management Mission

Environmental Restoration Program – Soils Project. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.2.

Environmental Restoration Program – Industrial Sites Project. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.2.

5.4.6.1.3.3 Nondefense Mission

General Site Support and Infrastructure Program. Impacts would be the same as those described under the No Action Alternative in Section 5.4.6.1.1.3.

5.4.6.2 Groundwater

5.4.6.2.1 No Action Alternative

Under the No Action Alternative, current DOE/NNSA activities at the TTR would continue, and no new facilities or activities are proposed.

Production Well 6 supplies drinking water and fire water distribution systems at the TTR Main Compound in Area 3 and is the only well that is monitored for contaminants. Water appropriations on the TTR total 200 acre-feet per year, and their source basins are considered over-appropriated (i.e., the appropriations exceed the perennial yield in each basin). However, the estimated water demand for the entire TTR (including USAF operations) is much lower, at approximately 18 acre-feet per year (DOE 2008l). Specific water usage or demand for DOE/NNSA activities was not calculated separately. DOE/NNSA has not identified any activities or projects that would place a greater demand for groundwater withdrawals, and no adverse impacts on water supply are anticipated from DOE/NNSA activities.

5.4.6.2.1.1 National Security/Defense Mission

Flight tests for gravity weapons, including impact testing and open-air and underground detonations, would continue at the TTR under the Stockpile Stewardship and Management Program. When weapons are dropped, they strike and penetrate the ground surface. These activities could release hazardous constituents near the ground surface, which could migrate downward. Groundwater at the TTR is relatively deep (90 to 450 feet), which affords protection and makes the contamination of groundwater from these activities unlikely. As no contamination has occurred in the past, it is expected that the continuation of these activities would not negatively impact the resource.

5.4.6.2.1.2 Environmental Management Mission

The TTR is considered a small-quantity generator of hazardous waste and can accumulate hazardous waste for 180 days before transferring the waste off site for disposal. It is possible that small leaks or spills or hazardous waste could occur during accumulation or storage, although such releases would likely be discovered and contained promptly. As previously stated, the depth of the groundwater also makes groundwater contamination from waste releases unlikely.

The Industrial Sites Project would continue decommissioning facilities, which is unlikely to affect groundwater availability or quality due to the short duration of activity, the small quantity of contaminants that could be released, and the depth of the groundwater. Nonpotable water demands for dust suppression during decommissioning would be temporary and make up only a small fraction of total water demand on the TTR.

5.4.6.2.1.3 Nondefense Mission

No new activities or facilities are proposed for the TTR; thus, no adverse impacts on groundwater quality or supply would occur.

5.4.6.2.2 Expanded Operations Alternative

No new activities or facilities are proposed for the TTR; thus, no adverse impacts on groundwater quality or supply would occur.

5.4.6.2.2.1 National Security/Defense Mission

As a result of the transfer of certain site support functions from DOE/NNSA to the USAF, the number of DOE/NNSA and DOE/NNSA contractor employees at the TTR would drop from the existing 106 personnel under the No Action Alternative to approximately 43 personnel. The amount of potable water use for DOE/NNSA activities would decrease by over 50 percent compared to the amount required under the No Action Alternative and would not result in any adverse impacts on groundwater availability. No adverse impacts on groundwater quality at the TTR are expected under the Expanded Operations Alternative.

5.4.6.2.2.2 Environmental Management Mission

Impacts on groundwater quality and supply at the TTR under the Expanded Operations Alternative would be the same as those under the No Action Alternative.

5.4.6.2.2.3 Nondefense Mission

No new activities or facilities are proposed for the TTR; thus, no adverse impacts on groundwater quality or supply would occur.

5.4.6.2.3 Reduced Operations Alternative

5.4.6.2.3.1 National Security/Defense Mission

Under the Reduced Operations Alternative, activities involving fixed rocket launches, cruise missile operations, and fuel air explosives conducted under the Stockpile Stewardship and Management Program would cease. The workforce associated with DOE/NNSA activities would decrease an additional 10 percent beyond the reduction under the Expanded Operations Alternative, to approximately 39 staff. The amount of potable water use for DOE/NNSA activities would decrease by over 50 percent compared to the amount required under the No Action Alternative and would not result in any adverse impacts on groundwater availability. No adverse impacts on groundwater quality at the TTR are expected under the Reduced Operations Alternative.

5.4.6.2.3.2 Environmental Management Mission

Impacts on groundwater quality and supply at the TTR under the Reduced Operations Alternative would be the same as those under the No Action Alternative.

5.4.6.2.3.3 Nondefense Mission

No Nondefense Mission activities or facilities are proposed for the TTR; thus, no adverse impacts on groundwater quality or supply would occur.

5.4.7 Biological Resources

Impacts on biological resources would occur at the TTR due to ground-disturbing activities such as building modifications and environmental restoration (the criteria for evaluating biological impacts are listed in Section 5.1.7). These impacts would result from military equipment field testing; drilling; grading; excavation; soil disturbance due to explosives testing; environmental remediation; fencing construction; and building decontamination or demolition. Increased vehicular access would have a potential direct impact on wildlife in these areas due to the risk of road kills.

There are very minor differences among the three alternatives addressed in this SWEIS regarding the types and levels of DOE/NNSA activities at the TTR. For this reason, the following section addresses impacts at the TTR under all three alternatives.

5.4.7.1 No Action, Expanded Operations, and Reduced Operations Alternatives

5.4.7.1.1 National Security/Defense Mission

Stockpile Stewardship and Management Program. Weapons impact testing, flight test operation of gravity weapons, and passive testing would occur at the TTR. Although these activities could potentially disturb native vegetation and affect wildlife habitat, they are generally conducted in sparsely to nonvegetated playa (the flat-floored bottom of an undrained desert basin that becomes at times a shallow lake) areas and in existing facilities. For this reason, Stockpile Stewardship and Management Program activities at the TTR are not expected to reduce the viability of special status wildlife species significantly or have a negative impact on biodiversity, ecosystem functions, or springs in these areas. Explosives tests and detonations could startle wildlife, resulting in impacts on certain species. If these detonations and explosives tests were to occur near vital water sources, they could cause wildlife to avoid them, which could significantly affect species that depend on those water sources. Additionally, if detonations were to occur during the nesting season for birds, explosions could startle nesting birds, causing them to abandon their nests and resulting in a loss of eggs or young.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs. Other than providing airspace for counterterrorism activities, no nuclear emergency response, nonproliferation, and counterterrorism activities would be conducted at the TTR. Therefore, no impacts on biological resources are anticipated.

Work for Others Program. Military research and development activities, such as ground-based robotics testing, remote-controlled vehicle testing, and rocket development, would be conducted under this program in previously undisturbed areas and existing facilities and would not disturb native vegetation. Activities that create sudden loud noises, such as rocket motor tests or rocket launches, would potentially disturb nesting birds, causing them to abandon their eggs or young in nests located within the project area.

5.4.7.1.2 Environmental Management Mission

Waste Management Program. Short-term storage of hazardous waste, hydrocarbon-contaminated soil, asbestos, and PCB waste would continue at the TTR before this waste is disposed off site at a permitted facility. Disposal of sanitary solid waste would continue on site at the TTR sanitary landfill. No additional impacts on biological resources are expected to result from these ongoing activities.

Environmental Restoration Program. Soil remediation activities at the TTR may include onsite radiation surveys, soil cleanup, and fencing of contaminated areas. These activities would likely occur on previously disturbed land. However, fencing and soil excavation could potentially disturb native vegetation, although the amount of vegetation and soil that would be disturbed is not expected to reduce the viability of special status wildlife species or have a negative impact on biodiversity, ecosystem functions, or springs in these areas. However, if disturbance of native vegetation occurs during the nesting season for birds, the eggs or young in nests located within the project area could be destroyed. In the longer term, Environmental Restoration Program activities at the TTR would have a beneficial effect on biological resources because contamination would be removed or stabilized, some buildings would be removed, and areas would be revegetated with native plant species appropriate to the sites.

Regarding the Industrial Sites Project, all but 1 of the 64 corrective action sites at the TTR have been closed. Under each of the alternatives, operations involving field investigations to identify contaminated sites would continue, as would characterization and remediation of sites and D&D of facilities. No impacts on biological resources are anticipated to result from these project activities.

5.4.7.1.3 Nondefense Mission

General Site Support and Infrastructure Program. TTR facilities include 195 buildings, towers, and sheds. Under each of the alternatives, small projects to maintain and repair TTR facilities would occur in previously disturbed areas, but are not expected to affect biological resources.

The TTR area supports a number of nesting and wintering birds. Of particular note is the presence of large raptors. Due to their large size and use of utility poles as perches, raptors are most susceptible to electrocution through the potential contact with phase conductors or other electrical equipment.

Extensive research has been conducted regarding the causes of bird electrocution and collision associated with electric transmission and distribution systems, and studies are ongoing. Much if this research has been summarized by the Avian Power Line Interaction Committee (APLIC 2006). Typically, avian risk occurs where (1) poles provide perching opportunities and conductor separation/spacing, and/or proximity to other energized hardware creates electrocution potential, and (2) where overhead wires cross traditional bird use areas and create a potential for collision. The risk is greatest for large raptors. The risk may increase in weather that hinders flight maneuverability or when feathers are wet, thereby increasing conductivity.

In August 2010, the DOE/NNSA Sandia Site Office completed retrofitting four electrical transmission/distribution structures to reduce the risk of electrocution of larger birds, particularly raptors. The retrofitting included new insulator caps, the re-routing of and insulation of jumpers, and insulation of grounding wires.

In the future, new construction and refurbishments at the TTR would use a raptor-safe pole design and wire configuration to help reduce avian mortality. Regular surveys along the power lines will be conducted. Monitoring would be increased for any structures or line segments that have any avian issues. If a need for avian mortality reduction measures is identified, they will be fully developed in cooperation with state and Federal agencies.

Bird mortality incidents reported as a result of power outages or through incidental observations will be reviewed immediately. If the cause is related to an unprotected power pole or conductor issue, a mortality reduction action (i.e., retrofitting poles, installing protective coverings, or installing perch deterrents or diverters) will be implemented accordingly, consistent with standard practices recommended by the Avian Power Line Interaction Committee (APLIC 2006).

When a nest is detected in or around electrical transmission/distribution facilities, a risk assessment will be conducted to determine if nest removal or relocation is needed. If it is determined that the nest poses no risk to system function, maintenance procedures, or to the birds, the nest would be allowed to remain. If it is determined that the nest poses a potential risk, then a further assessment will be conducted to determine if the risk is imminent or not imminent. The TTR will coordinate with the USFWS to determine whether the nest would need to be removed and discarded or relocated to an alternative location.

Unless there is an immediate threat to birds or system function, nest removal or relocation (excluding eagles and state- or federally listed species) would occur only during the non-breeding season when the nest is not being used or during the breeding season if the nest is unoccupied. If removal or relocation of an eagle or state- or federally listed species nest is necessary, the TTR would coordinate with the USFWS regarding permitting and authorization pursuant to applicable regulations. Nest removal or relocation would occur when the nest is occupied only in cases where it is deemed warranted based on the risk to system function or electrocution risk of the birds. Removal or relocation of an occupied nest would require coordination and permitting/authorization with the USFWS and/or Nevada Department of Wildlife.

Conservation and Renewable Energy Program. No renewable energy projects are planned for the TTR. Energy efficiency measures, conservation measures, and best management practices would consist of small projects located in or adjacent to extant facilities. These activities could potentially disturb native vegetation, although the amount of vegetation and soil that would be disturbed is not expected to reduce the viability of special status wildlife species significantly or have a negative impact on biodiversity, ecosystem functions, or springs in these areas. However, if disturbance of native vegetation occurs during the nesting season for birds, the eggs or young in nests located within the project area could be destroyed.

5.4.8 Air Quality and Climate

This section addresses air quality impacts from stationary and mobile air pollutant sources that would occur within and outside the TTR under the No Action, Expanded Operations, and Reduced Operations Alternatives. For each of the alternatives, the ROI for air quality analysis encompasses Nye and Clark Counties in Nevada. Stationary sources emissions would occur entirely within the TTR, while mobile sources emissions would occur mostly outside the TTR boundaries. Emissions-generating activities within the TTR would be widely dispersed over the 280-square-mile area of the TTR. Under all of the alternatives, emissions levels would not increase over current levels, so Nye County would continue its present attainment/nonclassified designation for all criteria pollutants. Additional details supporting the information presented in this section can be found in Appendix D, Section D.2.4.1.1.

General conformity determination. Section 5.1.8 includes a discussion of general conformity determinations. Based on the *de minimis* thresholds presented in Table 5–32, the total emissions in Clark County under the No Action Alternative would not exceed the *de minimis* levels for carbon monoxide, nitrogen oxides, PM_{10}, or VOCs in all cases. Therefore, a general conformity analysis would not be required for any of the alternatives considered in this *NNSS SWEIS*.

5.4.8.1 No Action Alternative

5.4.8.1.1 Air Quality

Calculations of emissions on and near the TTR. Table 5–67 shows the midpoint (year 2015) annual air emissions of the criteria pollutants and hazardous air pollutants associated with various TTR activities under the No Action Alternative (from a combination of stationary and mobile sources). The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. The TTR contribution to the air emissions in Clark County would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–72). Emissions of VOCs, nitrogen oxides, carbon monoxide, and PM_{10} from TTR sources (there are no TTR stationary sources in Clark County) in Clark County would decrease relative to 2008 emission levels by 0.11, 0.70, 0.40, and 0.076 tons per year, respectively. Most of the emission reductions at the TTR are associated with the phasing in of newer worker vehicles with lower emission reduction technology. Thus, this action would not contribute to or cause additional violations of the carbon monoxide, ozone, or PM_{10} air quality standards. Appendix D, Section D.2.4.1.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization for mobile sources.

5.4.8.1.2 Radiological Air Quality

No activities under the No Action Alternative are expected to produce any aboveground radiation beyond the levels documented for 2008 baseline conditions in Chapter 4, Section 4.4.8.3.

Table 5–67 No Action Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the Tonopah Test Range in 2015

	Annual Air Emissions (tons per year)											
	Stationary Sources	*Government-Owned Vehicles*	*TTR Commuters*			*Commercial Vendors*			*Total*			
	Nye County	*Nye County*		*Nye County*			*Nye County*			*Nye County*		
Pollutant	*On-TTR*	*On-TTR*	*Clark County*	*On-TTR*	*Off-TTR/ Off-NNSS*	*Clark County*	*On-TTR*	*Off-TTR/ Off-NNSS*	*Clark County*	*On-TTR*	*Off-TTR/ Off NNSS*	*Total*
PM_{10}	<3.7	0.067	0.0099	0.0040	0.036	0.044	0.0019	0.19	0.054	<3.8	0.23	<4.0
$PM_{2.5}$	<3.7	0.051	0.0048	0.0024	0.021	0.036	0.0016	0.16	0.041	<3.8	0.18	<4.0
CO	<2.9	2.5	0.84	0.36	3.3	0.17	0.0078	0.77	1.0	<5.8	4.1	<10.8
NO_x	<13.3	0.58	0.16	0.065	0.60	0.44	0.020	1.9	0.60	<14.0	2.5	<17.1
SO_2	<0.91	0.007	0.0021	0.00084	0.0076	0.00099	0.000043	0.0042	0.0031	<0.92	0.012	<0.93
VOCs	<0.96	0.044	0.023	0.010	0.091	0.048	0.0022	0.22	0.071	<1.0	0.31	<1.4
Lead	<0.01	0.0000027	0.00000062	0.00000026	0.0000024	0.0000019	0.000000090	0.0000089	0.0000025	<0.010	0.000011	<0.010
Criteria Pollutant Total	<21.8	3.2	1.0	0.44	4.0	0.70	0.032	3.1	1.7	<25.5	7.1	<34.3
HAPs	<1.1	0.0036	0.0018	0.00082	0.0074	0.0063	0.00029	0.029	0.0081	<1.1	0.036	<1.1

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

5.4.8.1.3 Climate Change

See Chapter 4, Section 4.4.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to TTR-related activities. (See Section 5.1.8 for a discussion of methodology for this analysis.) **Table 5–68** shows greenhouse gas emissions levels for TTR-related activities under the No Action Alternative. The color coding in Table 5–68 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by the TTR (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–68 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Traffic from commercial vendors would be by far the largest single source of greenhouse gas emissions related to TTR activities. Overall, TTR-related activities under the No Action Alternative would create about 3,653 carbon-dioxide-equivalent tons of greenhouse gas emissions per year, about 87 percent smaller than the reporting level. This represents a net reduction over current greenhouse gas emissions (4,166 tons in 2008) of about 12 percent.

Table 5–68 No Action Alternative Greenhouse Gas Emissions by Tonopah Test Range Activity in 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year*
STATIONARY SOURCES		
Power generation	185	0.01
Other stationary sources	332	0.01
ALL STATIONARY SOURCES	*517*	*0.02*
MOBILE SOURCES		
Onsite government vehicles	444	0.02
Commuting	482	0.02
Commercial vendors	2,210	0.08
ALL MOBILE SOURCES	*3,136*	*0.11*
ALL SCOPE 1 SOURCES	*776*	*0.03*
ALL SCOPE 2 SOURCES	*185*	*0.01*
ALL SCOPE 3 SOURCES	*2,692*	*0.10*
TOTAL	***3,653***	***0.13***

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

5.4.8.2 Expanded Operations Alternative

5.4.8.2.1 Air Quality

This section addresses air quality impacts from stationary and mobile air pollutant sources that would occur within and outside the TTR under the Expanded Operations Alternative.

Table 5–69 shows the midpoint (year 2015) annual air emissions for the criteria pollutants and hazardous air pollutants associated with various TTR activities under the Expanded Alternative (from a combination of stationary and mobile sources). The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. These emissions would be less than the levels projected under the No Action Alternative because certain site support functions would be transferred from DOE/NNSA to the USAF under the Expanded Operations Alternative, resulting in more-efficient operations and fewer employees at the TTR.

The TTR contribution to air emissions in Clark County would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–72). Emissions of VOCs, nitrogen oxides, carbon monoxide, and PM_{10} from all TTR sources would decrease in Clark County relative to 2008 emission levels by 0.15, 1.1, 0.99, and 0.11 tons per year, respectively. Thus, this action would not contribute to or cause additional violations of the carbon monoxide, ozone, or PM_{10} air quality standards. Appendix D, Section D.2.4.2.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization for mobile sources.

5.4.8.2.2 Radiological Air Quality

Potential remediation activities may occur for the Soils Project corrective action units at the Clean Slate 2 and Clean Slate 3 sites. If this remediation activity occurs, it would likely result in increased suspended particulates and higher radiological air emissions relative to those observed in the 2008 baseline conditions, as discussed in Chapter 4, Section 4.4.8.3. However, if this remediation activity takes place at these sites, simultaneous ambient radiological air monitoring would also be performed to assess the potential for offsite impacts and the need for mitigating action.

Table 5–69 Expanded Operations Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the Tonopah Test Range in 2015

Pollutant	Annual Air Emissions (tons per year)											
	Stationary Sources	Government-Owned Vehicles	TTR Commuters			Commercial Vendors			Total			
	Nye County	Nye County		Nye County			Nye County			Nye County		
	On-TTR	On-TTR	Clark County	On-TTR	Off-TTR/ Off-NNSS	Clark County	On-TTR	Off-TTR/ Off-NNSS	Clark County	On-TTR	Off-TTR/ Off NNSS	Total
PM_{10}	<3.7	0.027	0.0040	0.0016	0.015	0.018	0.00077	0.077	0.022	<3.7	0.092	<3.8
$PM_{2.5}$	<3.7	0.021	0.0019	0.00097	0.0085	0.015	0.00065	0.065	0.017	<3.7	0.074	<3.8
CO	<2.9	1.0	0.34	0.15	1.3	0.069	0.0032	0.31	0.41	<4.1	1.6	<6.1
NO_x	<13.3	0.24	0.065	0.026	0.24	0.18	0.0081	0.77	0.25	<13.3	1.0	<14.8
SO_2	<0.91	0.0029	0.00085	0.00034	0.0031	0.00040	0.000017	0.0017	0.0013	<0.91	0.0048	<0.92
VOCs	<0.96	0.018	0.0093	0.0041	0.037	0.019	0.00089	0.089	0.028	<0.98	0.13	<1.1
Lead	<0.01	0.0000011	0.00000025	0.00000011	0.00000097	0.00000077	0.000000037	0.0000036	0.0000010	<0.010	0.0000046	<0.01
Criteria Pollutant Total	*<21.8*	*1.3*	*0.42*	*0.18*	*1.6*	*0.29*	*0.013*	*1.2*	*0.71*	*<23.3*	*2.8*	*<26.8*
HAPs	<1.1	0.0015	0.00073	0.00033	0.0030	0.0026	0.00012	0.012	0.0033	<1.1	0.015	<1.1

< = less than; CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

5.4.8.2.3 Climate Change

See Chapter 4, Section 4.4.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse gas emissions due to TTR-related activities. (See Section 5.1.8 for a discussion of methodology for this analysis.) **Table 5–70** shows greenhouse gas emissions levels for TTR-related activities under the Expanded Operations Alternative. The color coding in Table 5–70 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by the TTR (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–70 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Traffic from commercial vendors would be by far the largest single source of greenhouse gas emissions related to TTR activities. Overall, TTR-related activities under the Expanded Operations Alternative would create about 1,791 carbon-dioxide-equivalent tons of greenhouse gas emissions per year, about 94 percent lower than the threshold reporting level. This represents a net reduction over current greenhouse gas emissions (4,166 tons in 2008) of about 57 percent.

Table 5–70 Expanded Operations Alternative Greenhouse Gas Emissions at the Tonopah Test Range in 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year*
STATIONARY SOURCES		
Power generation	185	0.01
Other stationary sources	332	0.01
ALL STATIONARY SOURCES	*517*	*0.02*
MOBILE SOURCES		
Onsite government vehicles	182	0.01
Commuting	196	0.01
Commercial vendors	896	0.03
ALL MOBILE SOURCES	*1,274*	*0.05*
ALL SCOPE 1 SOURCES	*514*	*0.02*
ALL SCOPE 2 SOURCES	*185*	*0.01*
ALL SCOPE 3 SOURCES	*1,092*	*0.04*
TOTAL	***1,791***	***0.06***

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

5.4.8.3 Reduced Operations Alternative

5.4.8.3.1 Air Quality

This section addresses air quality impacts from stationary and mobile air pollutant sources that would occur within and outside the TTR under the Reduced Operations Alternative.

Table 5–71 shows the midpoint (2015) annual air emissions for the criteria pollutants and hazardous air pollutants associated with various TTR activities under the Reduced Operations Alternative (from a combination of stationary and mobile source emissions). The midpoint year represents the average annual emissions over the 10-year planning period; however, these emissions are expected to continue beyond the 10-year period. These emissions would be less than the levels projected under the No Action Alternative, as the Record of Decision for the *Complex Transformation SPEIS* (DOE 2008l) would be implemented under this Reduced Operations Alternative, resulting in smaller, more-efficient operations and fewer employees at the TTR. The TTR contribution to Clark County air emissions would continue to be small and would decrease relative to 2008 emission levels (see Chapter 4, Table 4–72).

Emissions of VOCs, nitrogen oxides, carbon monoxide, and PM_{10} from all TTR sources would decrease in Clark County relative to 2008 emission levels by 0.15, 1.1, 1.0, and 0.11 tons per year, respectively. Thus, this action would not contribute to or cause additional violations of the carbon monoxide, ozone or PM_{10} air quality standards. Appendix D, Section D.2.4.3.1, provides more detail on how these emissions were determined, as well as source-type and vehicle-type characterization for mobile sources.

5.4.8.3.2 Radiological Air Quality

No activities under the Reduced Operations Alternative are expected to produce aboveground radiation beyond the levels documented for 2008 baseline conditions in Chapter 4, Section 4.4.8.3.

5.4.8.3.3 Climate Change

See Chapter 4, Section 4.4.8.4, for general details on climate change science and greenhouse gas emissions.

Greenhouse Gas Emissions Due to TTR-related Activities. (See Section 5.1.8 for a discussion of methodology for this analysis.) **Table 5–72** shows greenhouse gas emissions levels from TTR-related activities under the Reduced Operations Alternative. The color coding in Table 5–72 corresponds to the greenhouse gas accounting requirement scopes under Executive Order 13514 (74 FR 52117) – blue shading corresponds to scope 1 direct emissions (onsite stationary and fugitive emissions, as well as onsite company-owned vehicular emissions); orange shading corresponds to scope 2 indirect emissions (purchased electricity); and green shading corresponds to scope 3 indirect emissions that are not owned or directly controlled by the TTR (commuting, product and waste transport and disposal, business travel, and product use). However, because efforts to account for scope 3 emissions are recent and accepted methods for calculating emissions are evolving, the scope 3 emissions categories reported here are for those categories for which reliable and accessible data are available for estimating emissions (commuting and commercial vendor transport activity). Specifically, Table 5–72 does not include emissions from business travel, leased assets, and outsourced assets or the greenhouse gas emissions associated with the extraction and production of purchase material and services.

Table 5–71 Reduced Operations Alternative Emissions of Criteria Pollutants and Hazardous Air Pollutants at the Tonopah Test Range in 2015

	Annual Air Emissions (tons per year)											
	Stationary Sources	***Government-Owned Vehicles***	***TTR Commuters***			***Commercial Vendors***			***Total***			
	Nye County	***Nye County***		***Nye County***			***Nye County***			***Nye County***		
Pollutant	***On-TTR***	***On-TTR***	***Clark County***	***On-TTR***	***Off-TTR/ Off-NNSS***	***Clark County***	***On-TTR***	***Off-TTR/ Off-NNSS***	***Clark County***	***On-TTR***	***Off-TTR/ Off NNSS***	***Total***
PM_{10}	<3.7	0.025	0.0036	0.0015	0.013	0.016	0.0007	0.07	*0.02*	*<3.7*	*0.083*	*<3.8*
$PM_{2.5}$	<3.7	0.019	0.0018	0.00088	0.0077	0.013	0.00059	0.059	*0.015*	*<3.7*	*0.067*	*<3.8*
CO	<2.9	0.93	0.31	0.13	1.2	0.063	0.0029	0.28	*0.37*	*<4.0*	*1.5*	*<5.8*
NO_x	<13.3	0.21	0.059	0.024	0.22	0.16	0.0074	0.7	*0.22*	*<13.5*	*0.92*	*<14.7*
SO_2	<0.91	0.0026	0.00077	0.00031	0.0028	0.00036	0.000016	0.0015	*0.0011*	*<0.91*	*0.0043*	*<0.92*
VOCs	<0.96	0.016	0.0085	0.0037	0.033	0.018	0.00081	0.081	*0.027*	*<0.98*	*0.11*	*<1.1*
Lead	<0.01	0.000001	0.00000023	0.000000096	0.00000088	0.0000007	0.000000033	0.0000033	*0.00000093*	*<0.010*	*0.0000042*	*<0.010*
Criteria Pollutant Total	*<21.8*	*1.2*	*0.38*	*0.16*	*1.5*	*0.26*	*0.012*	*1.1*	*0.64*	*<23.2*	*2.6*	*<26.4*
HAPs	<1.1	0.0013	0.00066	0.0003	0.0027	0.0023	0.00011	0.011	*0.003*	*<1.1*	*0.014*	*<1.1*

CO = carbon monoxide; HAP = hazardous air pollutant; NO_x = nitrogen oxides; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC = volatile organic compound.

Table 5–72 Reduced Operations Alternative Greenhouse Gas Emissions at the Tonopah Test Range in 2015

Source Type	*Carbon-Dioxide-Equivalent Emissions (tons per year)*	*Fraction of Reference Point of 27,558 Tons Per Year*
STATIONARY SOURCES		
Power generation	185	0.01
Other stationary sources	332	0.01
ALL STATIONARY SOURCES	*516*	*0.02*
MOBILE SOURCES		
Onsite government vehicles	164	0.01
Commuting	177	0.01
Commercial vendors	813	0.03
ALL MOBILE SOURCES	*1,155*	*0.04*
ALL SCOPE 1 SOURCES	*496*	*0.02*
ALL SCOPE 2 SOURCES	*185*	*0.01*
ALL SCOPE 3 SOURCES	*990*	*0.04*
TOTAL	***1,671***	***0.06***

Blue	Scope 1 emissions
Orange	Scope 2 emissions
Green	Scope 3 emissions

Traffic from commercial vendors would be by far the largest single source of greenhouse gas emissions related to TTR activities. Overall, TTR-related activities under the Reduced Operations Alternative would create about 1,671 carbon-dioxide-equivalent tons of greenhouse gas emissions per year, about 94 percent lower than the threshold reporting level. This represents a net reduction over current greenhouse gas emissions (4,166 tons in 2008) of about 60 percent.

5.4.9 Visual Resources

5.4.9.1 No Action Alternative

Under the No Action Alternative, current activities and operations would continue. No proposed changes would affect existing visual resources associated with the TTR, and the scenic quality would remain Class B. No mitigation would be required.

5.4.9.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, there would be no changes at the TTR under the No Action Alternative and current activities and operations would continue. There would be no changes to the existing visual environment, and the scenic quality would remain at Class B. There would be no effect. No mitigation would be required.

5.4.9.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, there would be no changes at the TTR under the No Action Alternative and current activities and operations would continue. There would be no changes to the existing visual environment, and the scenic quality would remain at Class B. There would be no effect. No mitigation would be required.

5.4.10 Cultural Resources

At the TTR, Stockpile Stewardship and Management and Work for Others Program activities would not differ significantly among any of the alternatives. All such activities would take place at existing facilities and would not, under normal operations, affect previously undisturbed land. Construction of new buildings or development of new facilities is not proposed under any of the alternatives. Therefore, Stockpile Stewardship and Management and Work for Others Program activities under all alternatives would not affect cultural resources.

DOE/NNSA would remediate the Clean Slate 1, 2, and 3 sites in accordance with the FFACO. Under the No Action and Reduced Operations Alternatives, Environmental Restoration Program activities would be the same. Under the Expanded Operations Alternative, DOE/NNSA analyzed a potential for clean closure of the Clean Slate 1, 2, and 3 sites, which would likely disturb a larger area of ground. These Soils Project sites are previously disturbed, but are themselves considered by DOE/NNSA to be historically significant. Therefore, prior to undertaking any remediation actions, DOE/NNSA, in compliance with Section 106, would consult with the State Historic Preservation Office prior to initiating such work to determine eligibility of the Clean Slate sites for inclusion on the NRHP and, if necessary, identify and implement appropriate mitigation measures.

5.4.11 Waste Management

DOE/NNSA is expected to generate wastes from site operations at the TTR and from environmental restoration at the Nevada Test and Training Range, which includes the TTR. Adequate management capacity is expected for all wastes as discussed below.

Under all SWEIS alternatives, TTR operations are not expected to generate LLW, MLLW, TRU, or mixed TRU wastes. (Environmental restoration, however, was projected to generate LLW as discussed below.) The TTR would continue to be a small-quantity generator of hazardous waste under all alternatives; this waste would be stored on site for no more than 180 days before being transferred off site to permitted recycle or TSD facilities. Under all of the alternatives, TTR operations would annually generate approximately 4 tons of hazardous waste that would be sent off site for disposal (including wastes regulated under authorities other than RCRA, such as PCBs and asbestos), as well as approximately 4 tons of waste that would be sent off site for recycling (including used oil, solid wastes, and other regulated wastes).

Under all of the alternatives, DOE/NNSA would annually generate approximately 460 cubic feet of construction debris that would be disposed at the TTR within USAF-operated landfills, as well as approximately 6,100 cubic feet of solid waste that would be annually disposed on site.[10] It is expected that this waste would be generated episodically; estimates were projected by averaging waste generation rates over 3 years of data (DOE 2009a; SNL 2007, 2008). Under all of the alternatives, the TTR would annually generate a few thousand cubic feet of sanitary solid waste per year; this small quantity is not expected to vary significantly among the alternatives because TTR personnel requirements are small and are not expected to vary among the alternatives (see Section 5.4.4). It is expected that this waste would continue to be disposed at a TTR landfill operated by the USAF.

Under the No Action and Reduced Operation Alternatives, environmental restoration at the TTR and Nevada Test and Training Range would generate approximately 2.9 million cubic feet of LLW over 10 years, a portion of which may be TRU waste.[11] The volume of this environmental restoration waste would rise to approximately 11 million cubic feet of LLW under the Expanded Operations Alternative (again, a portion of this may be TRU waste).

Under the No Action and Reduced Operations Alternatives, waste management activities from operations and environmental restoration are not expected to generate wastes that cannot be accommodated by existing recycle or TSD capacity. It is expected that LLW from environmental restoration activities

[10] *Adequate disposal capacity is expected at the NNSS and commercial landfills. NNSS landfill capacity is addressed in Section 5.1.11. Regarding commercial landfills, as of 2010, over three dozen municipal solid and industrial waste landfills were permitted in Nevada (NDEP 2010b).*

[11] *Any TRU waste generated at the TTR would be sent to the NNSS Area 5 RWMC for storage pending offsite shipment to WIPP for disposal or INL for characterization.*

would be transported to the NNSS for disposal in the Area 5 RWMC, although disposal could also occur at the Area 3 RWMS if that facility were reopened. It is not expected that the combined LLW volumes from all in-state and out-of-state generators would exceed available waste disposal capacity at the NNSS; however, additional options for managing environmental restoration waste could be considered, as discussed below and in Section 5.1.11.1.1.

Regarding nonradioactive wastes, there are several dozen facilities for disposal of hazardous waste in Nevada or nearby states, and disposal capacity for solid waste is available at the TTR and offsite locations, including the NNSS and commercial landfills. Recycle capacity for solid and hazardous materials is also available (see Section 5.1.11.1.1). Consequently, generation of nonradioactive wastes under the No Action and Reduced Operations Alternatives is not expected to strain available nonradioactive waste disposal capacity.

Under the Expanded Operations Alternative, additional LLW was projected to be generated from environmental restoration activities, as discussed above. One option for disposition of this waste is to transport it to the NNSS for disposal in the Area 5 RWMC, although disposal could also occur at the Area 3 RWMS if that facility were reopened. Under this option, waste from environmental restoration activities at the TTR and Nevada Test and Training Range could constitute approximately 21 percent of all LLW to be disposed at the NNSS under the Expanded Operations Alternative. For this reason, as well as the large number of shipments of LLW that would be required to transport the waste to the NNSS for disposal (see Section 5.4.3), additional options for managing this environmental restoration waste could be considered, including closure in place (stabilizing existing contamination in place) or construction and operation of dedicated disposal facilities for this waste that are proximal to the waste generation sources (see Section 5.1.11.1.1).

Under the Expanded Operations Alternative, the same quantities of nonradioactive wastes were projected as under the No Action and Reduced Operations Alternatives. Therefore, the same conclusions regarding adequate disposition capacity for nonradioactive wastes apply under all of the alternatives.

5.4.12 Human Health

The approach to evaluating human health impacts is discussed in Section 5.1.12. The criteria for evaluating human health impacts are included in that discussion.

5.4.12.1 Normal Operations

5.4.12.1.1 No Action Alternative

National Security/Defense, Environmental Management, and Nondefense Mission activities are not expected to cause radioactive releases that would affect the public or workers. Radiological doses from the TTR would be from legacy radioactive materials that become resuspended and transported by the wind. The annual dose to an MEI and the population within 50 miles of the TTR would be 0.024 millirem and much less than 1 person-rem, respectively, as reported in Chapter 4, Section 4.4.12.1. The increased risk of an LCF for the MEI would be 1×10^{-8} (1 chance in 100 million). The calculated number of LCFs associated with an annual population dose of 1 person-rem is 0.0006, implying that the most likely result would be no additional LCFs in the population. As noted, the annual population dose would be much less than 1 person-rem; however, assuming a dose of 1 person-rem and based on the premise that there is some risk associated with any radiation dose, the annual risk of a single LCF in the population would be much less than 1 in 1,700.

Radiological doses to workers could also come from legacy radioactive materials. Because the source would be legacy contamination, it was assumed that all workers would receive a dose approximate to the average historical dose received by radiation workers at the TTR (12 millirem per year [see Chapter 4, Section 4.4.12.2]). Based on an estimate of 106 workers under the No Action Alternative (see Section 5.1.4.1), the estimated worker dose would be 1.3 person-rem per year. The calculated annual LCF risk of 0.0008 implies that no additional LCFs are expected in the worker population.

The potential for occupational injury and illness was estimated for TTR activities using rates based on DOE experience (DOE 2010e) (see Appendix G for details). The number of TRCs and DART cases were projected based on the number of FTEs estimated for this alternative. Under this alternative, a total of 1.6 TRCs and 0.7 DART cases per year were calculated.

Noise. Fuel–air explosives experiments at the TTR under the Stockpile Stewardship and Management Program would instantaneously cause high noise levels. These increases would be intermittent and temporary and are not expected to result in any appreciable noise level increases beyond the TTR boundary. Additionally, because the TTR is located in a remote area and is essentially surrounded by the Nevada Test and Training Range to the west, east, and south, potential noise impacts on residents near the TTR would be minimal. Daily traffic volumes are expected to remain unchanged or similar to current conditions, and negligible increases in traffic noise are expected under the No Action Alternative.

5.4.12.1.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, no new activities would occur, but a larger amount of environmental restoration work would be performed. Because additional soil would be disturbed from the higher level of environmental restoration cleanup, it was assumed that the dose rate would be higher by a factor of 2. Based on an estimate of 43 workers (see Section 5.1.4.1), the estimated worker dose would be 1.0 person-rem per year. The calculated annual LCF risk of 0.0006 implies that no additional LCFs are expected in the worker population.

The potential for occupational injury and illness for TTR activities would be less under the Expanded Operations Alternative than the No Action Alternative because fewer employees would be at the site. Based on the number of FTEs estimated for this alternative, a total of 0.7 TRCs and 0.3 DART cases per year were calculated.

Noise – Under the Expanded Operations Alternative, noise impacts on offsite receptors would mainly result from the increase in daily truck traffic. Similar to the No Action Alternative, fuel–air explosives experiments at the TTR under the Stockpile Stewardship and Management Program would instantaneously cause high noise levels. The number of shipments from the TTR under the Waste Management Program would increase threefold. Up to 14 daily truck trips from the TTR could occur on any given day. This increase would contribute to small increases in baseline noise conditions along the main roadways leading to the TTR.

5.4.12.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, there would be an overall reduction in the level of activity at the TTR. Using the same basis of analysis as used for the No Action Alternative and an estimate of 39 workers (see Section 5.1.4.1), the estimated worker dose would be 0.47 person-rem per year. The calculated annual LCF risk of 0.0003 implies that no additional LCFs are expected in the worker population.

The potential for occupational injury and illness for TTR activities would be less under the Reduced Operations Alternative than the No Action Alternative because fewer employees would be at the site. Based on the number of FTEs estimated for this alternative, a total of 0.6 TRCs and 0.3 DART cases per year were calculated.

Noise. Under the Reduced Operations Alternative, fuel–air explosives experiments at the TTR would not occur; therefore, any potential noise impacts on onsite workers or offsite receptors would be eliminated. Daily vehicle trips to the TTR and, therefore, associated traffic noise, would be similar to those described under the No Action Alternative.

5.4.12.2 Facility Accidents

5.4.12.2.1 No Action Alternative

Table 5–73 presents the public and worker radiological consequences (the impacts of an accident if it were to occur) of accidents at the TTR under the No Action Alternative. **Table 5–74** combines the estimated frequency of the postulated accidents with the potential consequences to present the estimated annual risk of an increased likelihood of an LCF due to accidents at the TTR. Appendix G presents the methods used to develop the estimated consequences and risks.

Table 5–73 Tonopah Test Range Accident Radiological Consequences – No Action, Expanded Operations, and Reduced Operations Alternatives

Accident Scenario	*Offsite Population – Maximally Exposed Individual – Dose (rem)*	*Offsite Population – Maximally Exposed Individual – LCF Risk* [a]	*Offsite Population – Population within 50 Miles – Dose (person-rem)*	*Offsite Population – Population within 50 Miles – Number of LCFs* [b]	*Onsite Noninvolved Worker – Dose (rem)*	*Onsite Noninvolved Worker – LCF Risk* [a]
National Security/Defense Mission						
Joint test assembly – radiological	1.7×10^{-5}	1×10^{-8}	5.9×10^{-4}	0 (4×10^{-7})	0.075	5×10^{-5}
Sealed source aircraft impact fire	2.5×10^{-9}	2×10^{-12}	1.1×10^{-7}	0 (7×10^{-11})	1.2×10^{-5}	7×10^{-9}
Environmental Management Mission – Environmental Restoration Program						
One-container spill	3.4×10^{-9}	2×10^{-12}	1.2×10^{-7}	0 (7×10^{-11})	1.5×10^{-5}	9×10^{-9}
Three-container fire	2.5×10^{-8}	2×10^{-11}	1.1×10^{-6}	0 (7×10^{-10})	1.2×10^{-4}	7×10^{-8}
Aircraft crash and fire	3.4×10^{-4}	2×10^{-7}	0.012	0 (7×10^{-6})	1.5	9×10^{-4}

LCF = latent cancer fatality; rem = roentgen equivalent man.
[a] Increased risk of an LCF to an individual, assuming the accident occurs. The risk value is doubled for individual doses exceeding 20 rem.
[b] The reported value is the projected number of LCFs in the population, assuming the accident occurs, and is therefore presented as a whole number. The result calculated by multiplying the collective population dose by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses.

Table 5–74 Tonopah Test Range Accident Radiological Risks [a] – No Action, Expanded Operations, and Reduced Operations Alternatives

Accident	*Frequency* [b]	*Offsite Population – Maximally Exposed Individual*	*Offsite Population – Population within 50 Miles*	*Onsite Noninvolved Worker*
National Security/Defense Mission				
Joint test assembly – radiological	6×10^{-6}	6×10^{-14}	2×10^{-12}	3×10^{-10}
Sealed source aircraft impact fire	10^{-4} to 10^{-6}	2×10^{-16}	7×10^{-15}	7×10^{-13}
Environmental Management Mission – Environmental Restoration Program				
One-container spill	3×10^{-2}	6×10^{-14}	2×10^{-12}	3×10^{-10}
Three-container fire	4×10^{-6}	8×10^{-17}	3×10^{-15}	3×10^{-13}
Aircraft crash and fire	1.7×10^{-6}	3×10^{-13}	1×10^{-11}	2×10^{-9}

[a] The risk is the annual increased likelihood of an LCF in the MEI or noninvolved worker or the increased likelihood of a single LCF occurring in the offsite population, accounting for the estimated probability (frequency) of the accident occurring.
[b] The estimated frequency is on an annual basis.

Under the No Action Alternative, National Security/Defense Mission activities would include experiments with joint test assemblies, which are part of a nuclear-explosive-like assembly. The maximum reasonably foreseeable accident would involve the release of radioactive and toxic material due to a structural failure, drop, seismic event, fire, explosion, or aircraft impact involving a joint test assembly. The accident could release small quantities of uranium, lithium, and beryllium.

Since the *1996 NTS EIS* (DOE 1996c), Stockpile Stewardship and Management Program activities at the TTR have changed substantially, with the result that some of the activities evaluated in the *1996 NTS EIS* are not included under the No Action Alternative. For example, the activity that resulted in the maximum reasonably foreseeable radiological accident, the failure of an artillery-fired test assembly, is not included under any of the alternatives evaluated in this SWEIS.

Accident scenarios associated with environmental restoration activities at the TTR that are performed as part of the Environmental Management Mission were evaluated under the No Action Alternative. These accident scenarios involved the release of radioactive material due to a single container spill, a multiple container fire, and an aircraft crash into multiple containers. The maximum reasonably foreseeable accident for the TTR environmental restoration activities is an aircraft crash and fire. The estimated probability of this type of event is in the range of 1.7×10^{-6} (1 chance in 590,000) per year of operation. If this accident were to occur, the MEI would receive a dose of 0.00034 rem, with a corresponding LCF risk of 2×10^{-7} (1 chance in 5,000,000). The offsite population within 50 miles would receive a dose of 0.012 person-rem; the calculated number of LCFs associated with this dose is 7×10^{-6}, implying that the most likely outcome would be no additional LCFs in the exposed population. A noninvolved worker outside the immediate area of the crash could receive a dose of 1.5 rem, with an associated LCF risk of 9×10^{-4} (1 chance in 1,100). When the probability of the accident is taken into consideration, the risk to the offsite public or a noninvolved worker would be negligible.

No reasonably foreseeable major TTR accident scenarios that could cause exposure to noninvolved workers or the public were identified for the ongoing Nondefense Mission.

After accounting for the frequency of the postulated accidents, the estimated highest risk accident would be the aircraft crash and fire accident. Table 5–74 shows that the annual increased likelihood of an LCF from this accident for the MEI, the offsite population, or a noninvolved worker is essentially zero.

5.4.12.2.2 Expanded Operations Alternative

The accident impacts at the TTR under the Expanded Operations Alternative would be the same as those under the No Action Alternative, as presented in Tables 5–73 and 5–74. None of the new or expanded activities was determined to have potential accident impacts that would have more than negligible radiological or chemical impacts on noninvolved workers, the public, or the environment. At the expanded level of operations, the frequencies of some hazardous activities that might lead to accidents could change. However, given the uncertainty in accident frequency estimation regarding very rare accidents that are not expected to happen within the operating lifetime of a facility or activity, the overall accident frequencies would still remain within the broad frequency categories, such as "extremely unlikely" (10^{-4} to 10^{-6} per year).

5.4.12.2.3 Reduced Operations Alternative

The accident impacts at the TTR under the Reduced Operations Alternative would be the same as those under the No Action Alternative, as presented in Tables 5–73 and 5–74. Although some National Security/Defense Mission activities would be reduced or eliminated under this alternative, environmental restoration activities would continue the same as under the No Action Alternative. None of the reductions in activities was determined to result in more than negligible changes in the radiological or chemical risks to the public or workers.

5.4.13 Environmental Justice

5.4.13.1 No Action Alternative

Impacts on human health would not be significant under any alternative. Similarly, direct and cumulative effects on environmental resources are not expected to result in significant adverse impacts on the public within the ROI.

Impacts on low-income and minority populations under the No Action Alternative, as discussed in the other sections in this chapter, would be the same as those on the general population. Therefore, no disproportionately high and adverse impacts on minority and low-income populations are expected.

5.4.13.2 Expanded Operations Alternative

Impacts under the Expanded Operations Alternative would be the same as those described under the No Action Alternative in Section 5.4.13.1.

5.4.13.3 Reduced Operations Alternative

Impacts under the Reduced Operations Alternative would be the same as those described under the No Action Alternative in Section 5.4.13.1.

5.5 Aggregated Environmental Consequences

The preceding sections of this chapter present potential environmental consequences (impacts) associated with activities at specific DOE/NNSA facilities. The majority of these impacts would occur in geographically separate settings or over different periods of time and would not directly affect the same environmental resources or populations. However, DOE/NNSA has identified some instances in which impacts associated with two or more facilities could occur within the same environmental setting and time periods and can be quantitatively added to determine the total (aggregated) impact on the affected resources.

Table 5–75 presents aggregated direct impacts on socioeconomics and air quality associated with the three alternatives evaluated in this SWEIS.

Table 5–75 Aggregated Impacts from all U.S. Department of Energy/National Nuclear Security Administration Sites

Impact Category	*No Action*	*Expanded Operations*	*Reduced Operations*
Socioeconomics – Direct Employment Change in Clark County, Nevada [a]	+115	+759	–146
Socioeconomics – Direct Employment Change in Nye County, Nevada [a]	+35	+163	–110
Air Emissions – Criteria Pollutants in Clark County, Nevada (tons per year) [b]	122.8	156.11	112.44
Air Emissions – Criteria Pollutants in Nye County, Nevada (tons per year) [b]	113.97	166.23	104.16
Air Emissions – Hazardous Air Pollutants in Clark County, Nevada (tons per year) [b]	0.43	0.49	0.41
Air Emissions – Hazardous Air Pollutants in Nye County, Nevada (tons per year) [b]	1.39	1.41	1.29
Air Emissions – Greenhouse Gas Emissions (tons per year; all sites combined) [b]	54,870	63,713	50,962

[a] Excludes temporary construction-related employment and indirect economic effects, but includes permanent positions associated with one or more commercial solar power generation facilities.
[b] Includes emissions from ongoing activities and employees' commutes, calculated at the midpoint year; excludes temporary construction activities.

Note that previous discussions of traffic (see Section 5.1.3.2) and waste management (see Section 5.1.11) already present aggregated impacts in summary form, where appropriate. For example, traffic levels and level of service on local roadways are included in accounts for commuter traffic associated with multiple DOE/NNSA facilities. LLW disposed at the NNSS under each alternative includes environmental remediation wastes that may be generated at the TTR.

Chapter 6, "Cumulative Impacts," presents a discussion of cumulative effects that considers the effects of past and reasonably foreseeable future actions, as well as actions proposed under this SWEIS, and also considers a larger ROI than that analyzed in this chapter.

CHAPTER 6
CUMULATIVE IMPACTS

6.0 CUMULATIVE IMPACTS

Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) regulations (42 *United States Code* [U.S.C.] 4321 et seq.) define a cumulative impact as the "impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time" (40 *Code of Federal Regulations* [CFR] 1508.7). Thus, the cumulative impacts of an action are the total effects on a resource, ecosystem, or human community of that action and all other activities affecting that resource no matter what entity is acting. This cumulative impacts analysis is based on continued operations at U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) sites in Nevada, including the Nevada National Security Site (NNSS) (formerly the Nevada Test Site), Remote Sensing Laboratory (RSL), North Las Vegas Facility (NLVF), Tonopah Test Range (TTR), and DOE environmental restoration sites on the U.S. Air Force (USAF) Nevada Test and Training Range; reasonably foreseeable actions at these sites; and ongoing or reasonably foreseeable actions within each site's region of influence (ROI).

6.1 Methodology and Analytical Baseline

The analysis in this chapter was conducted in accordance with CEQ NEPA regulations, as outlined in the CEQ handbook, *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997), and *Guidance on the Consideration of Past Actions on Cumulative Effects Analysis* (Connaughton 2005).

Cumulative impacts assessment is based on both geographic (spatial) and time (temporal) considerations. Historical impacts at DOE/NNSA facilities in Nevada are captured in the environmental baseline conditions described in Chapter 4 of this *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* (*NNSS SWEIS*). Geographic boundaries for impact assessment vary by resource depending on the time an effect remains in the environment, the extent to which the effect can migrate, and the magnitude of the potential impact. The ROI that DOE/NNSA used for identifying potential projects for the cumulative impacts analysis includes the area within 50 miles of the boundaries of the NNSS and the TTR and within 10 miles of the boundaries of RSL and NLVF. All of these ROIs intersect, forming a single cumulative impacts ROI, as shown in **Figure 6–1**. The cumulative impacts ROI encompasses about 15,737,760 acres and includes most of Nye County and parts of Clark, Lincoln, and Esmeralda Counties in Nevada, as well as a portion of Inyo County in California. The cumulative impacts ROI was selected because, for most resource areas, there is little likelihood of any impact from activities at DOE/NNSA facilities having a cumulative effect beyond the ROIs. For some resource areas, such as transportation and air quality, cumulative impacts may occur in an area far outside of the cumulative impacts ROI just described. Where cumulative impacts may occur over a wider area, an appropriately expanded area is analyzed. For instance, the cumulative impacts analysis for transportation of radiological materials considers a nationwide ROI.

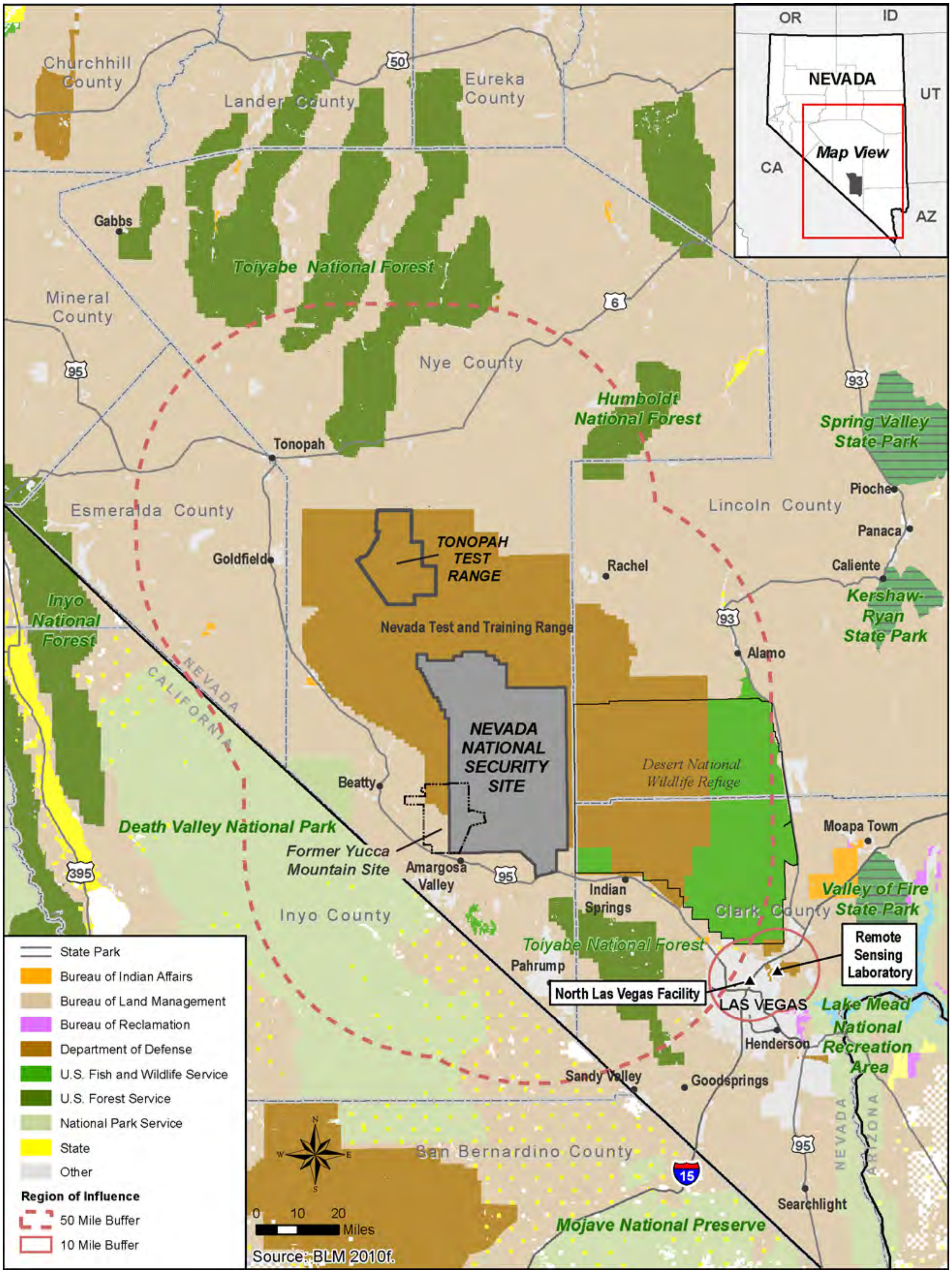


Figure 6–1 Cumulative Impacts Analysis Region of Influence

The cumulative impacts analysis for this *NNSS SWEIS* includes (1) an examination of cumulative impacts presented in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (*1996 NTS EIS*) (DOE/EIS-0243); (2) impacts from activities since the *1996 NTS EIS* was issued; and (3) a review of the environmental impacts of past, present, and reasonably foreseeable future actions of other Federal and non-Federal agencies and individuals in the ROI. For DOE/NNSA contributions to cumulative impacts, the analysis primarily uses the Expanded Operations Alternative because it tends to result in the highest estimates of potential cumulative impacts associated with the alternatives analyzed in this *NNSS SWEIS*. To compare the cumulative impacts associated with each of the three alternatives considered in this *NNSS SWEIS*, i.e., No Action, Expanded Operations, and Reduced Operations, Table 6–15 in Section 6.4 summarizes the cumulative impacts by alternative.

Plans for a number of reasonably foreseeable actions identified for this analysis have not reached a sufficient level of development for specific potential impact information to be readily available (e.g., solar power generation projects that have not met the minimum requirements of the U.S. Department of the Interior Bureau of Land Management [BLM] to begin the NEPA process). In those cases, to quantify potential cumulative impacts, a reasonable effort was made to estimate potential impacts by using known information from similar projects.

6.2 Potentially Cumulative Actions

Most of the land within the cumulative impacts ROI for this *NNSS SWEIS* is managed by Federal agencies. In addition to DOE/NNSA, other Federal agencies that manage lands within the ROI include BLM, DOE, the USAF, the U.S. Fish and Wildlife Service (USFWS), the U.S. Forest Service (USFS), and the National Park Service (NPS). In addition, there are lands and facilities under the jurisdiction of agencies of the State of Nevada and the State of California; Nye, Clark, Esmeralda, and Lincoln Counties in Nevada; Inyo County in California; various municipal governments; and private landowners. DOE/NNSA identified reasonably foreseeable future actions of others by conducting a review of publicly available documents prepared by Federal, state, tribal, and local government agencies and organizations. In addition, DOE/NNSA requested information regarding potential future actions that may not yet have been addressed in publicly available documents. The information obtained through that process formed the basis for this cumulative impacts analysis and is discussed below.

6.2.1 U.S. Department of Energy

This section addresses proposed DOE/NNSA actions that are not under the auspices of DOE/NNSA or are not environmental restoration activities. The proposed Greater-Than-Class C Low-Level Waste Disposal Facility and the formerly proposed Yucca Mountain Repository Projects are separate from the DOE/NNSA programs, projects, and activities addressed in this *NNSS SWEIS*. In addition, DOE's Office of Energy Efficiency and Renewable Energy recently proposed establishment of a Concentrating Solar Power (CSP) Validation Project in Area 25 of the NNSS. That proposed action has been indefinitely postponed and is no longer being addressed as a reasonably foreseeable action in this site-wide environmental impact statement (SWEIS).

6.2.1.1 Greater-Than-Class C Low-Level Radioactive Waste Disposal

On February 25, 2011, DOE issued a Notice of Availability for the *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (*GTCC EIS*) (76 *Federal Register* [FR] 10574) (DOE 2011a). The *Draft GTCC EIS* addresses disposal of low-level radioactive waste (LLW) that contains radionuclides in concentrations exceeding 10 CFR Part 61 Class C limits and is generated by activities licensed by the U.S. Nuclear Regulatory Commission (NRC) or an agreement state, as well as DOE-owned or generated LLW and non-defense-generated transuranic (TRU) waste with characteristics similar to GTCC LLW for which there may be no path to disposal. The NNSS is one of a number of DOE sites analyzed for disposal of GTCC and GTCC-like waste. In addition to the NNSS and other DOE sites, DOE also evaluated generic commercial disposal sites in four regions of the United States. The disposal technologies considered for the NNSS are intermediate-depth borehole disposal, enhanced near-surface trench disposal, and/or above-grade vault disposal. A combination of disposal methods and locations might be appropriate depending on the characteristics of the waste and other factors.

All of the disposal technologies would have common supporting infrastructure, such as facilities or buildings for receiving and handling waste packages or containers and space for a retention pond to collect runoff and truck washdown water. Each of the facilities, described below, would accommodate the full 12,000 cubic meters (about 420,000 cubic feet) of waste evaluated in the *Draft GTCC EIS*.

Based on the conceptual design for the intermediate-depth borehole disposal facility, about 110 acres of land would be required for 930 boreholes and supporting infrastructure. The conceptual design evaluated in the *Draft GTCC EIS* employs boreholes that are 14 feet in diameter and 130 feet deep with 100 feet between boreholes. Deeper or shallower boreholes than those evaluated in the *Draft GTCC EIS* could be used, depending on site-specific considerations (e.g., depth to groundwater).

The conceptual design for enhanced near-surface trench disposal includes 29 trenches occupying a footprint of about 50 acres. Each trench would be approximately 10 feet wide, 36 feet deep, and 330 feet long. This method of disposal would use deeper trenches than the 21-foot depth typically used for LLW at the Area 5 Radioactive Waste Management Complex (RWMC).

An above-grade vault disposal facility would consist of 12 vault units (each with 11 vault cells) and occupy a footprint of about 60 acres. Each vault would be about 36 feet wide, 310 feet long, and 26 feet tall, with 12 vault units situated in a linear array. The vault cell would be 27 feet wide, 25 feet long, and 18 feet high, with an internal volume of 12,000 cubic feet per vault cell.

U.S. Nuclear Regulatory Commission (NRC) Classification System for Low-Level Radioactive Waste (LLW)

The NRC classification system for the four classes of LLW (A, B, C, and greater-than-Class C [GTCC]) is established in 10 *Code of Federal Regulations* (CFR) 61.55 and is based on the concentrations of specific short- and long-lived radionuclides given in two tables. Classes A, B, and C LLW are generally acceptable for disposal in near-surface land disposal facilities. GTCC LLW is LLW "that is not generally acceptable for near-surface disposal," as specified in 10 CFR 61.55(a)(2)(iv). As stated in 10 CFR 61.7(b)(5), there may be some instances where waste with radionuclide concentrations greater than permitted for Class C would be acceptable for near-surface disposal with special processing or design.

Section 3(b)(1)(D) of the Low-Level Radioactive Waste Policy Amendments Act of 1985 specifies that the Federal Government is responsible for disposal of GTCC LLW generated by NRC and agreement state licensees. The U.S. Department of Energy is the Federal Agency responsible for disposal of GTCC LLW.

The GTCC reference location at the NNSS is in Area 5 of the NNSS. If the NNSS were to be selected as the site for a GTCC waste disposal facility, there would be changes to facilities and operations at the NNSS and cumulative impacts in a number of areas, including cultural and biological resources, transportation, air emissions, number of workers, health and safety, energy consumption, and groundwater use.

6.2.1.2 Yucca Mountain Repository Project

As reflected in the fiscal year 2010, 2011, and 2012 budget requests, the Administration has determined that a repository at Yucca Mountain is not a workable option and has called for elimination of all funding and activities related to development of a repository at Yucca Mountain. Regardless, DOE recognizes that it has an obligation to remediate lands disturbed by past activities associated with the formerly proposed Yucca Mountain Repository Project. Accordingly, DOE is evaluating the potential cumulative impacts of remediating the lands and closing the infrastructure and buildings at Yucca Mountain. This analysis is based on the preliminary approach to remediating and closing the former Yucca Mountain Repository site and facilities described under the No Action Alternative in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (*Yucca Mountain EIS*) (DOE/EIS-0250-F) (DOE 2002e).

As described in the *Yucca Mountain EIS* (2002), decommissioning and reclamation of the former Yucca Mountain Repository site would include dismantling and removing structures, shutting down some surface facilities, and rehabilitating land disturbed during characterization activities. The *Yucca Mountain EIS* envisioned that DOE would salvage usable equipment and materials. Drill holes would be sealed, subsurface drifts and rooms would be left in place, and the portals would be gated. The piles of excavated rock from the tunnel would be landscaped. Areas disturbed by surface studies or used as laydown yards, borrow areas, or the like would be restored. Holding ponds would be backfilled or capped. DOE would not remove foundations or infrastructure such as access roads, parking lots, and sewage systems. When funds have been appropriated by Congress for this purpose, DOE plans to prepare a detailed proposal to remediate the lands and close the infrastructure and buildings, then undertake further NEPA review, as appropriate.

6.2.2 U.S. Air Force

The USAF operates the Nevada Test and Training Range (formerly known as the Nellis Air Force Range) in south-central Nevada, a national test and training facility for military equipment and personnel that consists of approximately 3 million acres. In *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (USAF 1999), the USAF addressed potential environmental impacts of extending the land withdrawal to continue use of the Nevada Test and Training Range lands for military use. The Military Lands Withdrawal Act of 1999 (Public Law [P.L.] 106-65) renewed the land withdrawal for the Nevada Test and Training Range for a period of 25 years, beginning November 6, 2001. In addition, the act assigned to DOE lands that were formerly withdrawn for use by the USAF (portions of Areas 19 and 20 of the NNSS) and made additional adjustments to the boundary between the NNSS and Nevada Test and Training Range (see Chapter 2, Figure 2–2, of this *NNSS SWEIS*).

About 394,000 acres (BLM 2010g) of the 1,301,628-acre (BLM 2011a) BLM-administered Nevada Wild Horse Range is within the boundary of the Nevada Test and Training Range, including the TTR (see Section 6.2.5.2). More than 800,000 acres of the Nevada Test and Training Range are located within the Desert National Wildlife Range (see Section 6.2.3.1, Desert Wildlife Refuge Complex). The USAF and USFWS jointly manage this area.

Nellis Air Force Base lies within the cumulative impacts ROI for this *NNSS SWEIS* and is the host site for RSL. The main gate for the base is located approximately 8 miles northeast of downtown Las Vegas. The base covers more than 14,000 acres. Nellis Air Force Base is home to the USAF Warfare Center, an advanced air combat training mission. Nellis Air Force Base provides training for composite strike forces that include every type of aircraft in the USAF inventory. Training is conducted in conjunction with air and ground units of the U.S. Army, Navy, and Marine Corps, as well as air forces from allied nations.

In 2005, the USAF made the Indian Springs Air Force Auxiliary Airfield an air base and renamed it Creech Air Force Base. The USAF expanded its mission and infrastructure at Creech Air Force Base to play a major role in the war on terrorism. The base is home to two key military operations: the MQ-1 unmanned aerial system and the Unmanned Aerial Vehicle Battle Laboratory.

NEPA documents are periodically completed for proposed new or changing activities at Nellis and Creech Air Force Bases, the TTR, and the Nevada Test and Training Range. **Table 6–1** is a summary of USAF NEPA documents related to these facilities that have been completed since the *1996 NTS EIS* was issued. Most of these NEPA documents address activities and projects at existing facilities that are consistent with the designated missions of those facilities. A few proposed projects would affect previously undisturbed areas, but most would not.

Table 6–1 U.S. Air Force National Environmental Policy Act Documents Completed for Activities Within the Cumulative Impacts Region of Influence Since 1996

Title and Date	***Description***
Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement (USAF 1999)	The U.S. Air Force (USAF) addressed potential environmental impacts of extending the land withdrawal to continue use of the Nevada Test and Training Range lands for military use. The Military Lands Withdrawal Act of 1999 (Public Law 106-65) renewed the land withdrawal for a period of 25 years, beginning November 6, 2001.
Final Environmental Assessment for Predator Force Structure Changes at Indian Springs Air Force Auxiliary Field, Nevada (USAF 2003a)	The proposed action included changes to personnel assignments, upgrades to existing facilities, construction of new facilities, and extension of a runway by 120 meters (400 feet). The USAF issued a Finding of No Significant Impact (FONSI). The USAF completed facilities for the Predator unmanned aerial systems in 2006.
Nevada Training Initiative Environmental Assessment (USAF 2003b)	To fulfill the USAF's need to train aircrews and security forces in a modern urban and airfield environment at the Nevada Test and Training Range, the USAF proposed the Nevada Training Initiative, which would implement two separate proposed actions: (1) establish and operate a set of integrated, realistic targets and assets that simulate an urban environment for aircrews at one of two locations in the South Range of the Nevada Test and Training Range and (2) construct and operate a Military Operations in Urban Terrain complex at Range 63A that realistically simulates an airbase environment and construct facilities and infrastructure to support security forces training at one of two locations in the Indian Springs area.
Environmental Assessment Nellis Air Force Base Pipeline Project, Nevada (USAF 2005)	The proposed action would increase the refueling and fuel storage capacity of Nellis Air Force Base by installing a new 8-inch-diameter steel pipeline to the West Operational Bulk Storage Area and the East Side Operations Storage, constructing two new 420,000-gallon storage tanks, and a new 6-inch-diameter liquid fuel steel pipeline connecting the new storage tanks to the East Side Operations Storage.
Wing Infrastructure Development Outlook (WINDO) Environmental Assessment, June 2006 (USAF 2006a)	The proposed USAF action consisted of implementing over 630 Wing Infrastructure Development Outlook (WINDO) projects at Nellis Air Force Base, Creech Air Force Base, Nevada Test and Training Range, and the Tonopah Test Range (TTR). Most of the projects addressed were minor improvement, repair, and maintenance projects. Over 80 proposed projects would involve new construction, expansion, or demolition of existing facilities and infrastructure. All of the proposed WINDO projects would occur within functionally compatible areas and would likely be sited on previously used and/or disturbed land; occur within areas similarly zoned for such uses; and avoid important cultural resources, sensitive habitat, and environmental restoration sites. The USAF issued a FONSI.
Expeditionary Readiness Training (ExperRT) Course Expansion Final Environmental Assessment, June 2006 (USAF 2006b)	The USAF proposed to increase Security Forces Expeditionary Readiness Training course student capacity at the Regional Training Center at Silver Flag Alpha and Creech Air Force Base, Nevada. Training and use of facilities would continue at both Creech Air Force Base and Silver Flag Alpha. Improvements at the Silver Flag Alpha complex would include construction of a convoy combat training route, two academic facilities, a laundry/shower/ latrine facility, a leach field, and water storage tanks, as well as installation of communication, water, and power lines at the existing tent complex and Military Operations in Urban Terrain training site. All of these infrastructure improvements would occur within the already developed area of Silver Flag Alpha. The USAF issued a FONSI and began implementation of the proposed actions.
Final Environmental Assessment for Leasing Nellis Air Force Base Land for Construction & Operation of a Solar Photovoltaic System, Clark County, Nevada, August 2006 (USAF 2006c)	The USAF proposed to lease 140 acres of land for construction of a solar photovoltaic system that would provide Nellis Air Force Base with a cost-efficient renewable energy source to augment the existing energy provided by its commercial supplier. The system would generate an 18-megawatt direct current that would be transformed into a 13.5-megawatt alternating current. The USAF issued a FONSI, and the photovoltaic system was constructed and is in operation.

Title and Date	*Description*
Environmental Assessment for Increased Depleted Uranium Use on Target 63-10, Nevada Test and Training Range, September 2006 (USAF 2006d)	The proposed action authorized an increase in the annual use of depleted uranium rounds from 7,900 to 19,000 (and high-explosive incendiary rounds from 1,600 to 3,800) to provide sufficient depleted uranium rounds to accomplish essential training requirements. The USAF issued a FONSI.
Final Environmental Assessment for Sanitary Landfill Expansion on the Tonopah Test Range, Nye County, Nevada, January 2007 (USAF 2007a)	The USAF proposed to construct, operate, and maintain an expansion of its Class II landfill at the TTR to support continued operations. The landfill would be located adjacent to the existing solid waste facility. The total life expectancy of the landfill expansion would be 30 years. The USAF issued a FONSI.
Base Realignment and Closure (BRAC) Environmental Assessment for Realignment of Nellis Air Force Base, March 2007 (USAF 2007b)	The USAF proposed to implement and supplement the 2005 Base Realignment and Closure Commission's mandated realignment for Nellis Air Force Base. Realignment would add 13 F-16 aircraft and 18 F-15C aircraft to Nellis Air Force Base. The proposed action would include construction of 18 new facilities for personnel and equipment scheduled for fiscal year 2007 through fiscal year 2009. The proposed action would also encompass increases of 509 permanently based personnel and 60 part-time Reservists. The proposed action would result in an increase of 1,400 sorties, but the total number of sorties would not exceed the previously approved maximum. The USAF issued a FONSI.
Draft Environmental Assessment For the Integrated Natural Resource Management Plan Nellis Air Force Base and Nevada Test and Training Range, Nevada, May 2007 (USAF 2007c)	The proposed Integrated Natural Resource Management Plan provides guidance for the conservation of natural resources at the Nevada Test and Training Range and Nellis Air Force Base to the extent practicable. The guidelines were developed within the context of the military missions of the affected facilities. A primary goal of the plan is to sustain military readiness while maintaining ecosystem integrity and dynamics.
Range 74 Target Complexes Environmental Assessment Nevada Test and Training Range, Nevada, July 2007 (USAF 2007d)	The USAF proposed to construct mountainous terrain target complexes at three locations within Range 74: Limestone Ridge, Saucer Mesa, and Cliff Springs. The Saucer Mesa target complex comprises 9 discrete sites totaling approximately 131 acres in the hills and valleys along an existing network of two-track trails east of Saucer Mesa. The Limestone Ridge target complex includes 10 discrete sites totaling approximately 245 acres along an existing unimproved road network between Limestone Ridge and the Belted Range. The Cliff Springs target complex comprises 1 linear site situated in a 15-acre corridor along an existing road. The USAF issued a FONSI.
Draft F-35 Force Development Evaluation and Weapons School Beddown Environmental Impact Statement (May 2008) (USAF 2008a)	The USAF proposes to base 36 F-35 fighter aircraft at Nellis Air Force Base between 2012 and 2022. The aircraft would be assigned to the Force Development Evaluation Program and Weapons School at Nellis Air Force Base. Flight activities would occur at Nellis Air Force Base and the Nevada Test and Training Range. The F-35 beddown would also require construction of new facilities and alteration and demolition of existing facilities at Nellis Air Force Base.
BLM Communications Use Lease to USAF to Conduct Patriot Communications Exercises in Lincoln County, Nevada, August 2008 (USAF 2008b)	The USAF proposed to obtain from the Bureau of Land Management a 15-year Communications Use Lease for 14 sites on public land in Lincoln County, Nevada. Each site would be 500 feet by 500 feet (5.7 acres) in size, for a total of approximately 79.8 acres, and would be used for electronic air defense systems to support training with an integrated air defense system. Both the USAF and BLM issued FONSIs.
Nellis and Creech AFBs Capital Improvements Program Environmental Assessment, September 2008 (USAF 2008c)	The USAF proposed to implement updates of the Nellis and Creech Air Force Bases' general plans. The Capital Improvements Plan would include new construction, repair/replacement, installation, maintenance, demolition, and environmental projects. These projects would occur within previously developed or otherwise disturbed lands at both Nellis and Creech Air Force Bases. The USAF issued a FONSI.

Title and Date	Description
Environmental Assessment for Enhanced Use Lease of U.S. Air Force Lands to the City of North Las Vegas for Construction and Operations of a Water Reclamation Facility, Nellis Air Force Base, Nevada, April 2008 (USAF 2008d)	The USAF proposed to initiate an Enhanced Use Lease with the City of North Las Vegas for 40 acres of property that was part of the Nellis Air Force Base Sunrise Golf Course. The city of North Las Vegas would construct a water reclamation facility on the property and supply Nellis Air Force Base with reclaimed water from the facility sufficient to irrigate the golf course, as well as for other non-potable uses on the installation. Excess reclaimed water would be discharged to Sloan Channel, located approximately 500 feet east of the property. The USAF issued a FONSI.
AAFES Gas Station at Creech Air Force Base Environmental Assessment, July 2009 (USAF 2009a)	The USAF proposed to construct and operate a single-pump gasoline station on currently undeveloped land within a developed portion of Creech Air Force Base. The USAF issued a FONSI.
Final Environmental Assessment Upgrade of the Indian Springs Collection and Treatment System, December 2009 (USAF 2009b)	The USAF proposed to improve the wastewater collection and treatment system for the town of Indian Springs, Nevada. All activities associated with the project would occur in previously disturbed areas, except about 6.2 acres of land adjacent to the existing treatment ponds that would be disturbed for construction of two new percolation basins and possibly an additional 8 acres for a solar photovoltaic system for generating electrical power.
Draft Standard Army Qualification Ranges at Nellis AFB Small Arms Range Environmental Assessment, March 2010 (USAF 2010a)	The Nevada Army National Guard proposed to establish and operate new Standard Army Qualification Ranges immediately adjacent to the existing Nellis Air Force Base Small Arms Range. The proposed project would occur in three phases; Phase I and Phase II would require a total of approximately 67 acres of ground-clearing activities. The third phase of the project would be addressed as a separate action under a tiered or separate environmental assessment.
Expeditionary Readiness Course Expansion Final Supplemental Environmental Assessment, September (USAF 2010b)	In a 2006 environmental assessment, the USAF proposed to expand ground combat training facilities for the Expeditionary Readiness Training Course (USAF 2006d) and is now proposing to further expand facilities to accommodate up to 8,000 students each year. Five new buildings would be constructed at Creech Air Force Base in previously disturbed areas. A power projection platform would be installed in the northeast corner of the base on approximately 9 acres of land disturbed by previous training operations. Improvements at Range 63C would include new buildings; two mock overpasses; road improvements; placement of guardrails; and parking areas, pavilions, and sidewalks where needed around existing and new buildings. Existing roads within the TTR would be used to access the proposed convoy training route. Approximately 9.3 miles of the existing Stonewall Flat Road (east and portions of the south and north roads) would be graded and possibly paved to improve the convoy route; road widening is not expected to be necessary. A new road, approximately 1.4 miles long, would be constructed between South Stonewall Flat Road and North Stonewall Flat Road. The training area along the roads would be improved to provide realistic scenarios and handle various tactical vehicles, including low- and high-speed sections for tactical live fire. These additional improvements would be constructed over a period of 5 or more years.
Final Environmental Assessment, Outgrant for Construction and Operation of a Solar Photovoltaic System in Area 1, Nellis Air Force Base, Clark County, Nevada, March 2011 (USAF 2011)	The USAF proposes to lease 160 acres of its land to Nevada Energy for construction of a solar photovoltaic power system that would provide Nellis Air Force Base with a cost-efficient renewable energy source that would be used primarily by the USAF. The system would generate an 18-megawatt direct current that would be transformed into 10 to 15 megawatts of alternating current. This would be the second solar photovoltaic system to be located on Nellis Air Force Base. The first such system is located in the northern portion of the base (USAF 2006c).

6.2.3 U.S. Fish and Wildlife Service

6.2.3.1 Desert Wildlife Refuge Complex

USFWS manages the Desert National Wildlife Refuge Complex, which encompasses more than 1.6 million acres of land in Nye, Clark, and Lincoln Counties in southern Nevada and includes the Desert National Wildlife Range and Ash Meadows, Moapa Valley, and Pahranagat National Wildlife Refuges. Each refuge within the Desert National Wildlife Refuge Complex provides important and unique habitat for wildlife, including several endemic species (species native to the refuges and often not found anywhere else). The Ash Meadows and Moapa Valley National Wildlife Refuges were established to protect endangered and threatened species, while the Pahranagat National Wildlife Refuge was established to provide a habitat for migratory birds, and the Desert National Wildlife Range was established to protect desert bighorn sheep and other wildlife (USFWS 2009b).

All of these ranges and refuges except Moapa Valley are located within the cumulative impacts ROI for this *NNSS SWEIS* (see Figure 6–1). The closest of these to the NNSS, the Desert Wildlife Range, is located about 1 mile east of the NNSS. As noted in Section 6.2.2, over 800,000 acres of the western portion of the Desert Wildlife Range are jointly managed for shared use by the USAF and USFWS.

In August 2009, USFWS issued the *Desert National Wildlife Refuge Complex – Ash Meadows, Desert, Moapa Valley, and Pahranagat National Wildlife Refuges Final Comprehensive Conservation Plan and Environmental Impact Statement* (*DNWR Complex EIS*). Under the plan, various habitat restoration and management activities would occur and some visitor services facilities would be improved and/or constructed. There would be impacts on various resources from the proposed activities, but the net impacts of the habitat restoration and management activities would generally benefit natural plant and animal populations in the region. Construction activities would result in some localized adverse impacts on wildlife habitat and other resources, but these would be relatively minor and temporary. Because the comprehensive conservation plan is largely conceptual, specific impacts on resources were not addressed in the *DNWR Complex EIS,* but will be evaluated in subsequent NEPA processes. Therefore, although there could be some cumulative impacts associated with the proposed actions addressed in this *NNSS SWEIS*, those impacts cannot be quantified at this time but are expected to be small. For instance, USFWS is proposing to conduct restoration work at Fairbanks and Soda Springs at Ash Meadows National Wildlife Refuge (USFWS 2009c). This would result in small temporary local air quality impacts, but would not result in any other impacts that would be cumulative with the impacts of the actions analyzed in this SWEIS.

6.2.3.2 Clark County Multi-Species Habitat Conservation Plan

Federal regulations and Section 9 of the Endangered Species Act, as amended (16 U.S.C. 1531 et seq.), prohibit the ‘‘take’’ of a fish or wildlife species listed as endangered or threatened. Under the Endangered Species Act, the following activities are defined as take: “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect listed wildlife species or to attempt to engage in such conduct” (16 U.S.C. 1532). However, under Section 10(a)(1)(B) of the act, USFWS may issue permits to authorize ‘‘incidental take’’ of listed wildlife species to non-Federal entities. Incidental take is defined as take that is incidental to, but not the purpose of, carrying out an otherwise lawful activity. Regulations governing permits for endangered and threatened species are found in 50 CFR 17.22 and 17.32, respectively.

In September 2000, USFWS issued a permit to the Cities of Boulder City, Henderson, Las Vegas, Mesquite, and North Las Vegas; Clark County; and the Nevada Department of Transportation for incidental take of 78 covered species, including the federally threatened desert tortoise (*Gopherus agassizii*) by the development of up to 145,000 acres in Clark County, Nevada. The permit was based on the Clark County Multi-Species Habitat Conservation Plan (MSHCP) (USFWS 2000). The permit is effective as of February 1, 2001, and expires on January 31, 2031. Activities included in the MSHCP for the permitted projects include, but are not limited to, development of residential and commercial areas, urban parks and recreation facilities, utility and transportation facilities, and other capital improvements; operations; and flood control. As noted in the MSHCP, the permit applies to all non-Federal lands that currently exist and all non-Federal lands that result from sales or transfers from the Federal Government after the issuance of the Section 10(a) permit.

In September 2009, USFWS announced that the permitted parties intend to request a permit amendment for the incidental take of covered species on up to 215,000 additional acres in Clark County, Nevada. Activities that would be covered by the MSHCP amendment are not likely to change from the existing MSHCP (74 FR 50239). USFWS is preparing an environmental impact statement (EIS) to address the potential impacts of issuance of a modified incidental take permit.

The combined areas under the current and amended permit would total up to 360,000 acres. However, it was assumed that any amended permit resulting from this process would also apply to all non-Federal lands that currently exist and all non-Federal lands that result from sales or transfers from the Federal Government after issuance of the amendment. For this reason, in calculating potential areas of disturbance within the cumulative impacts ROI, the acres of land that would disposed by BLM (described below in Section 6.2.4.6, Las Vegas Valley Land Disposal) should be excluded to prevent double counting. Therefore, about 36,000 acres were deducted from the 360,000 acres that would be developed under the modified incidental take permit. The remaining 324,000 acres were used as part of the estimate of potential cumulative environmental impacts in this *NNSS SWEIS*.

6.2.4 Bureau of Land Management

BLM administers public lands within the cumulative impacts ROI for this *NNSS SWEIS*. BLM administers the land immediately adjacent to the southern end of the NNSS and land surrounding much of the Nevada Test and Training Range and the TTR. With the exception of almost 740 acres of the Area 5 RWMC at the NNSS, the NNSS and the Nevada Test and Training Range, including the TTR, are located on land under BLM jurisdiction that is withdrawn from public use by DOE/NNSA and the USAF, respectively.

Section 102 of the Federal Land Policy and Management Act (P.L. 94-579) states that "the national interest will be best realized if the public lands and their resources are periodically and systematically inventoried and their present and future use is projected through a land use planning process coordinated with other Federal and State planning efforts." In compliance with this policy, BLM uses a public process to prepare resource management plans that serve as the basis for all activities that occur on BLM-administered lands. The purpose of a resource management plan is to provide direction for management of renewable and nonrenewable resources found on public lands administered by BLM and to guide decisionmaking for future site-specific actions. The cumulative impacts ROI for this *NNSS SWEIS* includes parts of the Ely, Southern Nevada, and Battle Mountain Districts administered by BLM. The Ely District completed its new resource management plan in August 2008 (BLM 2008c). The Las Vegas District initiated the process to revise its resource management plan with public scoping meetings in January 2010 (BLM 2010d). The Battle Mountain District has initiated the process to update and combine the Shoshone, Eureka, and Tonopah resource management plans into a district-wide resource management plan and EIS, but has not yet begun public scoping (BLM 2010e). In 2004, BLM prepared a resource management plan for about 2.2 million acres of withdrawn public lands on the Nevada Test and Training Range (BLM 2004a). The plan guides the management of the affected natural resources through 2024. The decisions, directions, allocations, and guidelines in the plan are based on the primary use of the withdrawn area for military training and testing purposes.

6.2.4.1 Renewable Energy Projects

On May 29, 2008, DOE and BLM issued an NOI to prepare an EIS (73 FR 30908) in response to the following mandates: (1) Executive Order 13212, *Actions to Expedite Energy-Related Projects*, and (2) Title II, Section 211, of the Energy Policy Act of 2005. DOE and BLM identified utility-scale solar energy development as a potentially critical component in meeting these mandates and jointly prepared the *Final Programmatic Environmental Impact Statement for Solar Energy Development in Six Southwestern States* (*Solar Energy PEIS*) (DOE/BLM 2012) to evaluate utility-scale solar energy development in Arizona, California, Colorado, Nevada, New Mexico, and Utah. In the *Solar Energy PEIS*, BLM identified lands considered to be best-suited for large-scale production of solar energy, called solar energy zones (SEZs). Seven SEZs are located in Nevada, and three are within the cumulative impacts ROI of this *NNSS SWEIS*: Amargosa Valley (8,479 developable acres), Gold Point (4,596 developable acres), and Miller's (16,534 developable acres) (DOE/BLM 2012). No SEZs were identified in California within the cumulative impacts ROI of this *NNSS SWEIS*. The SEZs include exclusions areas where solar energy development would not be permitted. None of the SEZs in Nevada incorporate any portion of the NNSS. Under its preferred alternative, BLM would prioritize utility-scale solar energy development in SEZs; however, solar energy development may be permitted outside of SEZs in "variance areas" under a proposed variance process. BLM's preferred alternative also would establish authorization policies and procedures for utility-scale solar energy development and design features applicable to all development on BLM-administered lands. Under its preferred alternative, DOE would adopt programmatic environmental guidance, which would be used by DOE to further integrate environmental considerations into its analysis and selection of proposed solar projects. Because Area 25 of the NNSS is located on withdrawn public lands, it is reasonable to assume that any commercial solar power generation facilities that may be developed there would be required to comply with BLM's mitigation measures, as well as DOE/NNSA's. The *Solar Energy PEIS* does not provide specific analysis to support any particular project. However, information is available regarding the specific proposed renewable energy projects being considered by BLM for land use permitting within the cumulative impacts ROI analyzed in this *NNSS SWEIS*, as discussed below.

As noted in the *Final Environmental Impact Statement for the Amargosa Farm Road Solar Energy Project* (BLM 2010a), there are uncertainties in any large-scale, complex, and costly industrial project as it moves from concept toward realization. However, the level of uncertainty with some proposed renewable energy projects is high for the following reasons: (1) not all of the developers will develop the detailed information necessary to meet BLM standards; (2) following completion of BLM's NEPA process, the developers must obtain any necessary permits required by Federal, state, and local regulatory authorities; (3) the developers must secure funding to construct the project (if not already obtained), which may be affected by the status of competing renewable energy projects; and (4) proposed renewable energy projects must successfully compete for power purchase agreements with utility organizations that are working to meet their state-mandated renewable portfolio standards. Cumulative impacts analysis under NEPA requires consideration of the likelihood that the proposed projects actually will occur. To be conservative, all of the proposed solar energy projects listed in **Table 6–2** were included in the cumulative impacts analysis in this *NNSS SWEIS*.

Table 6–2 Summary of Renewable Energy Projects Within the Cumulative Impacts Region of Influence [a]

Project Name	*Estimated Facility Area (acres)*	*Proposed Plant Capacity (megawatts)*	*Estimated Operational Water Demand [b] (acre-feet per year) [c]*	*Proposed Technology*
Projects for which a Decision has been Made by BLM and a Right-of-Way Permit Issued or Pending				
Solar Millennium LLC; Amargosa Farm Road Solar Energy Project [d]	4,350	500	400	Parabolic Trough
Tonopah Solar Energy LLC; Crescent Dunes Solar Energy Project [e]	1,620	110	600 [f]	Concentrating Solar Power (power tower)
Projects that are in the Permitting Process with BLM				
Abengoa Solar, Inc.; Lathrop Wells Solar Facility [g]	5,336	250 to 520	200 to 405 [h]	Parabolic Trough plus 20 megawatts of photovoltaic
Pacific Solar, Inc.; Amargosa North Solar Project [i]	7,500	150	5 to 10	Photovoltaic
Projects for which BLM has received an Application for Right-of-Way (first-in-line projects only)				
Amargosa Flats Energy, LLC (Ausra) [j]	4,480	140	112 [i]	Linear Fresnel Reflector
Cogentrix Solar [j]	13,440	1,000	800 [h]	Solar Thermal (troughs)
Cogentrix Solar [j]	12,800	1,000	800 [h]	Solar Thermal (troughs)
Cogentrix Solar [j]	22,400	1,000	800 [h]	Solar Thermal (troughs)
Cogentrix Solar [j]	30,720	1,000	800 [h, k]	Concentrating Solar Power
EwindFarm, Inc. [j]	11,238	500	17 [k]	Photovoltaic
Nye County Solar One, LLC [j]	14,160	300	240 [h]	Parabolic Trough
Pacific Solar, Inc.; Amargosa South Solar Project [l]	4,000	500	400 [h]	Parabolic Trough
Element Power [j]	1,039	Unknown	Unknown [k]	Photovoltaic
Totals for Solar Energy Projects	**133,083**	**5,480 to 5,750**	**5,174 to 5,379**	
Sierra Geothermal Power Corp. Alum [j]	9,660	33	Unknown [m]	Geothermal
Sierra Geothermal Power Corp. Silver Peak [j]	Unknown	15	Unknown [m]	Geothermal
Totals for Geothermal Projects	**9,660**	**48**	**Unknown**	
Totals for All Renewable Energy Projects	**142,743**	**5,528 to 5,798**	**5,174 to 5,379**	

BLM = Bureau of Land Management.

[a] Values in this table are based on sources with varying degrees of certainty, from those that are derived from final EISs to those that are derived from initial plans of development. None of these values represent a built project, and all are subject to change. Some of the projects listed in this table are likely not to be built.

[b] Unless otherwise noted, water withdrawals would most likely be from the Amargosa Desert Hydrographic Basin.

[c] 1 acre-foot of water is equal to 325,851 gallons.

[d] BLM 2010a.

[e] BLM 2010f.

[f] Water would be withdrawn from groundwater within the Tonopah Flat member of the Great Smokey Valley Hydrographic Basin.

[g] 75 FR 41231.

[h] Value estimated by assuming dry-cooled technology and scaling from the *Final Environmental Impact Statement for the Amargosa Farm Road Solar Energy Project* (BLM 2010a), i.e., 0.8 acre-feet of water for each megawatt of generating capacity.

[i] 74 FR 66147.

[j] BLM Renewable Energy Table at www.blm.gov/pgdata/etc/medialib/blm/nv/energy.Par.56189.File.dat/renewable_energy_project_table_aug2010.pdf. Accessed on January 24, 2010.

[k] Located within the Pahrump Hydrographic Basin.

[l] PSI 2007.

[m] Located in northwestern Esmeralda County.

As shown in Table 6–2, within the cumulative impacts ROI, there are 13 proposed solar facilities and two proposed geothermal projects. There are no wind energy projects proposed within the cumulative impacts ROI, but two firms are evaluating potential wind energy sites west of the NNSS. Altagas Renewable Energy is evaluating a site about 5.5 miles west-southwest of Beatty in Nye County, Nevada (BLM 2010k), and Pacific Wind Development, LLC, a subsidiary of Iberdrola Renewables Inc., is evaluating a site located about 14 miles west-northwest of Lida in Esmeralda County, Nevada (BLM 2010j). As of January 2011, two of the proposed solar energy projects have completed BLM's NEPA process and may proceed: Amargosa Farm Road Solar Energy Project (BLM 2010i), located in Amargosa Valley about 5 miles southwest of the NNSS, and Crescent Dunes Solar Energy Project (BLM 2010h), located north of Tonopah, Nevada. In addition, two of the proposed projects have entered the BLM permitting process and are preparing EISs (74 FR 66147 and 75 FR 41231): Lathrop Wells Solar Facility, located in Amargosa Valley just south of the intersection of U.S. Route 95 and Nevada State Route 373 and Amargosa North Solar Project, located in Amargosa Valley between 5 and 6 miles west of the NNSS. The other seven proposed solar facilities have submitted applications for a right-of-way but have not submitted an approved plan of development to BLM to initiate the permitting process. There are also several solar power developers who have submitted applications to BLM that are "second in line," meaning that they proposed development of sites for which applications have already been submitted. The proponents have not submitted detailed project-specific information for these projects, but only basic information such as type of technology to be used, proposed size, and requested acreage. These "second-in-line" applications are not included in this cumulative impacts analysis to preclude double counting potential impacts. In addition, a potential solar project that has submitted an application to BLM that would be located on the NNSS (BLM 2010a) is not addressed in this cumulative impacts analysis because, as the holder of the withdrawal for the land proposed to be used, DOE/NNSA has not been consulted regarding this project and believes that the capacity of the facility described in the application to BLM (8,000 megawatts) is unreasonably large and cannot be supported by available resources, particularly groundwater.

6.2.4.2 National Wild Horse Range

Under the Wild Free-Roaming Horses and Burros Act, BLM manages wild horses and burros in herd areas where they were found when the act went into effect in 1971. Herd areas that can provide adequate food, water, cover, and space to sustain healthy and diverse wild horse and burro populations over the long term are designated by BLM as Herd Management Areas. There are 20 BLM Herd Management Areas (19 in Nevada and 1 in California) that lie wholly or in part within the cumulative impacts ROI for this *NNSS SWEIS* (BLM 2009d), as follows:

Amargosa Valley	Johnnie	Sand Springs West
Ash Meadows	Montezuma Peak	Saulsbury
Bullfrog	Nevada Wild Horse Range	Silver Peak
Chicago Valley	Paymaster	Stone Cabin
Goldfield	Pilot Mountain	Stonewall
Gold Mountain	Redrock	Wheeler Pass
Hot Creek	Reville	

As mentioned in Section 6.2.2, BLM administers the Nevada Wild Horse Range located within the boundary of the TTR and Nevada Test and Training Range (BLM 2010g). While the primary purpose of the TTR and Nevada Test and Training Range is weapons development and flight training, the management of wild horses is a secondary use of the lands.

6.2.4.3 Designation of Energy Corridors on Federal Land

Section 368 of the Energy Policy Act of 2005 (P.L. 109-58) directed the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior to (1) designate, under their respective authorities, corridors on Federal land in the 11 western states for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities (energy corridors); (2) perform any environmental reviews that may be required to complete the designation of such corridors; (3) incorporate the designated corridors into relevant agency land use and resource management plans; (4) ensure that additional corridors for oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities on Federal land are promptly identified and designated as necessary; and (5) expedite applications to construct or modify oil, gas, and hydrogen pipelines and electricity transmission and distribution facilities within such corridors. In partial response to that direction, DOE and BLM, as lead agencies, prepared the *Final Programmatic Environmental Impact Statement for the Designation of Energy Corridors on Federal Land in 11 Western States* (DOE/EIS-0386) (*Energy Corridors PEIS*) (DOE 2009j) to conduct a detailed programmatic environmental analysis of potential energy corridors and to integrate NEPA at the earliest possible time.

The *Energy Corridors PEIS* identified potential Section 368 corridors; evaluated effects of potential future development within designated corridors; identified mitigation measures for such effects; and developed interagency operating plans applicable to planning, construction, operation, and decommissioning of future projects within the corridors. In January 2009, BLM issued a Record of Decision (ROD) to amend relevant resource management plans and designate Section 368 energy corridors therein. Several Section 368 corridor segments identified in the *Energy Corridors PEIS* are within the cumulative impacts ROI for this *NNSS SWEIS*. Those corridor segments parallel existing transmission lines and major roadways, such as U.S. Route 95. There were no specific energy transmission projects identified for these corridor segments in the *Energy Corridors PEIS*.

6.2.4.4 Electrical Transmission Line Projects

As part of its long-term planning to support renewable energy development in the Amargosa Valley, the Valley Electric Association intends to upgrade its existing transmission lines in its service territory (BLM 2010a). The first phase would include the upgrade of an existing transmission line located south of U.S. Route 95 and west of Nevada State Route 160 from 138 to 230 kilovolts. The second phase would consist of construction of a new 230-kilovolt transmission line from the existing Valley Electric Association substation at the corner of Powerline Road and Anvil Road to the existing Valley Switching Station. The new 230-kilovolt line would then parallel Valley Electric Association's existing 138-kilovolt transmission line to the site of the proposed Johnnie substation that would be located 5 to 10 miles south of U.S. Route 95 near Nevada State Route 160. Valley Electric Association is currently performing system impact studies based on interconnection requests to determine whether other upgrades are required to accommodate future load growth. Valley Electric Association will file a right-of-way application or update to accommodate these upgrades, and BLM will prepare a separate NEPA review of Valley Electric Association's proposed action.

In January 2010, Renewable Energy Transmission Company filed an application with BLM for the proposed Solar Express Transmission Line Project (RetCo 2010). The Solar Express Transmission Line Project would consist of two 500-kilovolt, double circuit, electric transmission lines, which would run 122 miles between the existing Eldorado Valley Substation Complex, south of Boulder City, Clark County, Nevada, and a new 500-kilovolt substation, located in the Amargosa Valley in Nye County, Nevada. An additional 500-kilovolt substation is planned as a mid-terminal, at a location south of the town of Pahrump, close to the Nye and Clark County line. The proposed line would also interconnect with Valley Electric Association's 230-kilovolt system at its proposed Johnnie Substation. The Solar Express Transmission Line would be routed within Section 368 corridors 18–224, 224–225, and 225–231, as identified in the *Energy Corridors PEIS*. Renewable Energy Transmission Company filed an application in September 2010 with Western Area Power Administration for its Transmission Infrastructure Program to receive consideration for funding under Section 402 of the American Recovery and Reinvestment Act. The purpose of the proposed project is to connect new generation facilities with the Eldorado Valley Substation Complex, which is a major point of connection of the western power grid. While it is envisioned that the generation connected would be mostly solar, it is possible that wind, geothermal, or natural-gas-fired generation may also connect to the Solar Express Transmission Line Project.

The Southwest Intertie Project and the ON Line Project have both been subject to BLM NEPA processes. The Southwest Intertie Project is a proposed 520-mile, 500-kilovolt transmission line for which BLM originally granted right-of-way permits to Idaho Power Company in December 1994 (BLM 2008b). Idaho Power Company did not undertake final permitting or construction of the Southwest Intertie Project, and the rights to the southern portion were eventually transferred to Great Basin Transmission, LLC (BLM 2008b). The southern portion of the Southwest Intertie Project would extend from the proposed Thirty Mile Substation about 18 miles northwest of Ely, Nevada, south approximately 230 miles to the existing Harry Allen Substation, located about 20 miles northeast of Las Vegas, Nevada. The ON Line Project is an NV Energy-proposed 236-mile, 500-kilovolt transmission line between a new Robinson Summit Substation, located less than 1 mile southeast of the proposed Thirty Mile Substation, and the Harry Allen Substation (BLM 2010k). Both of these transmission line projects would interconnect with the existing Falcon-Gonder 345-kilovolt transmission line at their northern ends (BLM 2008b and 2010k). The alignment of the southernmost portions of both of these transmission lines would follow the Southwest Intertie Project right-of-way and would be outside of the cumulative impacts ROI for this *NNSS SWEIS*.

TransWest Express, LLC, filed an application with BLM for a right-of-way to construct and operate a 600-kilovolt overhead direct current transmission line to cross public and private lands for the TransWest Express 600-kilovolt Project (76 FR 379). The extra-high-voltage line would transmit up to 3,000 megawatts of power generated by renewable energy projects in Wyoming to the desert southwest. The project would begin in south-central Wyoming, cross northwestern Colorado and Utah, and end south of Las Vegas at the Marketplace hub in the Eldorado Valley near Boulder City, Nevada. Western Area Power Administration plans to partially fund the project under the American Recovery and Reinvestment Act of 2009. The project schedule calls for it to be in operation by 2015. Although one alternative corridor currently under consideration would cross the northern portion of the Las Vegas Valley and would be within the cumulative impacts ROI for this *NNSS SWEIS*, the proposed route would be outside of the ROI.

NV Energy is considering several potential transmission lines within the cumulative impacts ROI (NV Energy 2009). The potential projects are 500-kilovolt transmission lines and associated facilities beginning at the Harry Allen Substation, then going to the Northwest Substation, located in the northwestern area of Las Vegas Valley and then westerly and north along the western part of the state of Nevada, to NV Energy's existing Blackhawk Substation near Carson City. The potential projects could ultimately interconnect with a proposed Raven Substation in northern California. This or an equivalent electrical transmission system, such as the Solar Express Transmission Line project discussed above, would be essential to effectively market the renewable energy generation that is either proposed or considered in southern Nevada. The potential transmission system additions could include a 500-kilovolt interconnection between Amargosa Valley and Mead Substation near Boulder City, Nevada. It is reasonably likely that these 500-kilovolt transmission lines would be primarily routed within the Section 368 corridors identified in the *Energy Corridors PEIS*, as discussed in Section 6.2.4.3.

6.2.4.5 Groundwater Development Projects

The Southern Nevada Water Authority submitted an application to BLM for a groundwater development project in southern Nevada called the Clark, Lincoln, and White Pine Counties Groundwater Development Project. Based on information in the BLM Round Two Scoping Package, the Southern Nevada Water Authority Groundwater Development Project would withdraw water from the Spring Valley, Snake Valley, Cave Valley, Dry Lake Valley, Delamar Valley, and Coyote Spring Valley Hydrographic Basins (BLM 2006a). All of the affected hydrographic basins are within the Great Salt Lake or the White River Groundwater Flow Systems and are some distance from the NNSS.

6.2.4.6 Las Vegas Valley Land Disposal

To address issues associated with rapid growth and the need for developable lands and the management of public lands in southern Nevada, Congress passed the Southern Nevada Public Land Management Act in 1998 (P.L. 105-263), which was later amended by the Clark County Conservation of Public Land and Natural Resources Act (Clark County Act) (P.L. 107-282). The Southern Nevada Public Land Management Act and Clark County Act authorized BLM to dispose Federal lands in Clark County, Nevada, consistent with applicable law, population growth, and community land use plans and policies. The disposal boundary established by the two acts encompasses much of the Las Vegas Valley and totals about 46,700 acres. Public lands within the northern portion of the disposal area include the Upper Las Vegas Wash, which is within the cumulative impacts ROI for this *NNSS SWEIS*.

BLM prepared the *Las Vegas Valley Disposal Boundary Final Environmental Impact Statement* (BLM 2004b) to identify the environmental consequences that may result from the disposal and use of the remaining BLM-managed lands within the disposal boundary. The *Las Vegas Valley Disposal Boundary Final Environmental Impact Statement Record of Decision* (BLM 2004c) selected the Conservation Transfer Alternative (BLM 2004b), which allowed BLM to dispose approximately 46,700 acres of land in the Las Vegas Valley. The ROD also required additional study, collaboration, and environmental analysis of approximately 5,000 acres in the Upper Las Vegas Wash area, known collectively as the Conservation Transfer Area, that were withheld from sale because of a high concentration of sensitive resources. Although the ROD identified approximately 5,000 acres of land to be withheld from disposal, it also stipulated that the boundaries were adaptable. Based on input received during public interaction and its own review, BLM expanded the Conservation Transfer Area study area to 13,622 acres. In January 2010, BLM issued the *Draft Supplemental Environmental Impact Statement Upper Las Vegas Wash Conservation Transfer Area, Las Vegas, Nevada* (BLM/NV/EL/ES-10-06+1793) (BLM 2010b) to address the potential environmental impacts of six alternative Conservation Transfer Area configurations and sizes, ranging from about 1,448 to 12,952 acres. The BLM-preferred alternative would protect about 11,008 acres from development, leaving about 35,692 acres for BLM disposition. According to the Clark County *Regional Transportation Plan 2009–2030: A Plan for Mobility in the Las Vegas Region Over the Next 20 Years, Las Vegas, Nevada* (*Regional Transportation Plan*), the area within the Public Land Management Act boundary can accommodate nearly all the growth expected over the next 20 years (RTCSN 2008).

6.2.4.7 Amargosa River Area of Critical Environmental Concern

The BLM Barstow Field Office, located in Barstow, California, published a draft *Amargosa River Area of Critical Environmental Concern Implementation Plan* with an associated environmental assessment in October 2006 (BLM 2006b). The Amargosa River Area of Critical Environmental Concern (ACEC) encompasses 21,552 acres of land in three distinct parcels located in northeastern San Bernardino and southeastern Inyo Counties, California, near the communities of Tecopa and Death Valley Junction, California. The purpose of the draft implementation plan is to guide BLM's on-the-ground management of public lands within the ACEC over the next 20 years. The ACEC implementation plan would have generally beneficial impacts for the lower reaches of the Amargosa River but would have little or no cumulative effects with DOE/NNSA activities at the NNSS.

Certain stretches of the Amargosa River in California were designated as either wild, scenic, or recreational by the March 30, 2009, Designation of Wild and Scenic Rivers Act (P.L. 111-11, Section 1805(a)(196)(A)-(E)). One 7.9-mile stretch was designated as "wild," two stretches totaling 12.1 miles as "scenic," and two stretches totaling 6.3 miles as "recreational." These stretches begin approximately 40 miles downstream of the river's confluence with Fortymile Wash, the main Amargosa River tributary originating on the NNSS. The influx of pollutants (i.e., sedimentation and chemical contaminants) from NNSS activities to Amargosa River tributaries is expected to have little effect on water quality in the designated areas, considering the large distance between them and the mostly dry nature of these ephemeral surface waters.

6.2.5 U.S. Department of Justice

In October 2010, the U.S. Department of Justice, Office of the Federal Detention Trustee, opened a contractor-operated detention facility located on 120 acres in Pahrump, Nevada. The facility employs about 235 people.

6.2.6 Federal Aviation Administration

The Federal Aviation Administration (FAA) is proposing to develop an Air Tour Management Plan for Death Valley National Park, pursuant to the National Parks Air Tour Management Act of 2000 (P.L. 106-181) and its implementing regulations (14 CFR Part 136, Subpart B) (75 FR 2922). The objective of the plan is to develop acceptable and effective measures to mitigate or prevent the significant adverse impacts, if any, of commercial air tour operations on the natural resources, cultural resources, and visitor experiences of a national park unit and any tribal lands within or abutting the park. The Air Tour Management Plan would have no authorization over other non-air-tour operations such as military and general aviation operations; therefore, it should not affect or be affected by aviation activities at the NNSS.

6.2.7 National Park Service

The U.S. Department of Interior, NPS, operates Death Valley National Park. This is the only NPS unit located within the cumulative impacts ROI for this *NNSS SWEIS*. The NPS Planning, Environment and Public Comment website identified 10 proposed projects for Death Valley as of October 2010. The following are brief descriptions of proposed projects that are within the cumulative impacts ROI for this *NNSS SWEIS*.

Wilderness and Backcountry Management Plan – In September 2009, NPS initiated a combined Wilderness and Backcountry Stewardship Plan for Death Valley National Park (NPS 2009). The purpose of the plan is to guide NPS and to make decisions regarding the future use and protection of the park's vast wilderness and backcountry lands. As part of the planning effort, over the next 3 to 4 years, NPS will complete a NEPA environmental analysis.

Keane Wonder Mine Complex and Multi-Mine Safety Installations – NPS published two environmental assessments and Findings of No Significant Impact for the installation of safety features at the Keane Wonder Mine Complex and other abandoned mines within Death Valley National Park (NPS 2010a, 2010b, 2010c, 2010d). NPS determined to use a variety of proven techniques to prevent human and undesired wildlife intrusion while allowing adequate ingress and egress by wildlife, principally bats.

Devils Hole Site Plan – Devils Hole is a 40-acre site located within Ash Meadows Wildlife Refuge that is managed by NPS, in close cooperation with USFWS. The site contains a cave pool, formed by the collapse of the top of a stretch fault leading to a flooded cave system. The cave pool is the habitat of the only remaining population of the endangered Devils Hole pupfish (*Cyprinodon diabolis*). The Devils Hole Site Plan includes improvements to site security, installation of a ladder to improve access to Devils Hole for research and monitoring activities, installation of a webcam to improve visitor interpretation, and revegetation of disturbed areas (NPS 2010e).

Devils Hole Long-Term Ecosystem Monitoring Plan – NPS is proposing to implement a Long-Term Ecosystem Monitoring Plan for Devils Hole. This plan represents a more holistic commitment to greater scientific understanding and effective fulfillment of NPS's stewardship of Devils Hole and the resident population of Devils Hole pupfish (NPS 2010g).

Scotty's Castle Waterline Replacement – NPS proposes to replace about 1 mile of waterline that services the Death Valley Scotty Historic District and in June 2010, initiated public scoping to identify potential issues and concerns and determine the appropriate level of NEPA analysis for the project (NPS 2010f).

6.2.8 U.S. Forest Service

Portions of Humbolt–Toiyabe National Forest are located within the cumulative impacts ROI in Nye and Clark Counties. The majority of proposed actions identified for the USFS within the cumulative impacts ROI consist of activities to manage USFS lands, such as vegetation management; development and rehabilitation of trails, campgrounds, and picnic areas; mineral exploration; and livestock grazing (USFS 2007, 2009c, 2010).

On January 14, 2009, the U.S. Department of Agriculture, USFS, signed a ROD for the *Energy Corridors PEIS* (USFS 2009a) to amend relevant forest management plans and designate Section 368 energy corridors therein. There are no Section 368 energy corridor segments on USFS land within the cumulative impacts ROI.

In 2009, the USFS permitted the Las Vegas Ski and Snowboard Resort to increase the size of the snowmaking water storage pond from an existing full pond water surface area of 0.6 acres to approximately 1.2 acres of water surface area, increase the pond depth by approximately 15 feet, and increase the northeastern embankment by about 15 feet (USFS 2009b).

In a December 2009 ROD for the *Final Environmental Impact Statement Middle Kyle Complex, Spring Mountains National Recreation Area, Humboldt Toiyabe National Forest, Clark County, Nevada*, USFS decided to implement, with modifications, the Market-Supported Alternative and authorized construction of recreation and administrative facilities in the Kyle Canyon area of the Spring Mountain National Recreation Area. The ROD also provided direction to manage recreation use such as dispersed camping in the Kyle Canyon, Lee Canyon, and Deer Creek areas (USFS 2009d). Construction under the Market-Supported Alternative would permanently disturb approximately 330 acres and temporarily disturb about 580 acres. Forty-four miles of new trails and trail improvements would be constructed, including multi-use trails in previously undisturbed vegetation communities (USFS 2009c).

6.2.9 Nye County

Nye County is proposing several projects within the cumulative impacts ROI that it considers reasonably foreseeable future actions. Most of the following information was derived from input provided by Nye County, which was received in August 2010, and is reproduced in its entirety in Section 6.2.9.4.

6.2.9.1 Nye County Water District

In 2007, the State of Nevada passed a law (Chapter 542, Statutes of Nevada 2007, pp. 3396–3402) creating the Nye County Water District, with jurisdiction consisting of all the land within the boundaries of Nye County. Future actions by the Nye County Water District are likely to involve acquisition of land and water rights and other resources related to water resources management and supply. One of the major environmental and socioeconomic issues associated with residential and commercial development in southern Nye County is the demand and competition for scarce water resources. Groundwater resource limitations have the potential to affect both residential and commercial development in Nye County. Included in these concerns is the quantity and quality of groundwater from the NNSS, which naturally flows into southern Nye County along multiple flow paths, and has the potential to directly impact the quality and quantity of water available to communities, residents, and developers in the area from Beatty to Amargosa Valley (see Section 6.3.6.2, Groundwater). Nye County has been participating with DOE/NNSA, the U.S. Geological Survey, and the Desert Research Institute to study and understand groundwater availability and quality in the Amargosa Valley area and southern portions of Nye County.

6.2.9.2 U.S. Route 95 Technology Corridor

Nye County has outlined a strategy for a Technology Corridor along U.S. Route 95 (EDEN 2007). The corridor would extend from Indian Springs in Clark County in the south to Tonopah in the north, passing through the Pahrump Valley, Mercury (entrance to the NNSS), Amargosa Valley, Beatty, and Goldfield (Esmeralda County). Nye County would like to increase industrial space to accommodate new high-technology businesses by completing the Amargosa Valley Science and Technology Park at Lathrop Wells (see Section 6.2.9.3, Nye County's Amargosa Valley Land Use Concept Plan), assisting Beatty to reuse the Barrick Bullfrog site adaptively for new industry and encouraging Pahrump to facilitate a business park for the Pahrump Valley. As part of its technology corridor, a major goal of Nye County is to pursue development of renewable energy along the U.S. Route 95 corridor (EDEN 2007). There are no specific facilities or other developments proposed as part of this strategy at this time.

6.2.9.3 Nye County's Amargosa Valley Land Use Concept Plan

Nye County prepared the *Yucca Mountain Project Gateway Area Concept Plan* with proposed land use designations for an area of about 5,760 acres around the entrance to the former Yucca Mountain Repository site (Giampaoli 2007). The formerly proposed Yucca Mountain Repository Project has been determined to be "not a workable option for a nuclear waste repository" and has been discontinued; however, Nye County's *Yucca Mountain Project Gateway Area Concept Plan* presents a proposed multiphase land use plan for the area of the town of Amargosa Valley that is adjacent to the southwest corner of the NNSS. Nye County proposed this plan to ensure that land development in the area occurs in an orderly manner and to increase opportunities for industrial and commercial development consistent with NNSS-related activities and other activities along the U.S. Route 95 Technology Corridor, such as development of renewable energy projects. Nye County also plans to nominate Crater Flat lands for disposal in the BLM resource management plan amendment process.

As the host county for the NNSS and a cooperating agency in development of this *NNSS SWEIS*, Nye County requested inclusion of their input on cumulative impacts. The following section was prepared by Nye County to present its perspective regarding cumulative impacts within the county. This Nye County perspective should in no way be construed to represent the position of DOE/NNSA on any particular issue.

6.2.9.4 Nye County Input for this Site-Wide Environmental Impact Statement

Nye County Input for the 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 (NNSS SWEIS)

Nye County is proposing several projects that can be considered as reasonably foreseeable future actions and there are other activities, underway or planned, that will impact Nye County.

Water Resources and Nye County Water District

The State of Nevada, in 2007, passed a law (Chapter 542, Statutes of Nevada 2007, pages 3396-3402) creating the Nye County Water District (District), with jurisdiction consisting of all the land within the boundaries of Nye County. The law provides for the acquisition, storage, sale, and distribution of water by the District, and authorizes the District to levy and collect taxes to assist in covering operational expenses. The governing Board of the District was established by the Nye County Board of County Commissioners in 2009. The District has the power to manage water resources and to supply water to any department or agency of the U.S government, the State of Nevada, Nye County, and any town, corporation, association, or person in Nye County, for an appropriate charge. Although water supply is not a current function, future actions by the District are likely to involve acquisition of land and water rights and other resources related to water resources management and supply.

Under Cooperative Agreements with the DOE Yucca Mountain Project Office, Nye County has conducted over 15 years of geologic and hydrogeologic studies related to characterization of groundwater and groundwater resources in the area southwest (down gradient) of the NNSS. This work involved the drilling of over 40 wells. Related studies include aquifer testing, alluvial tracer testing, geochemistry, structural geology, and surface and borehole geophysical surveys. Much of this work is summarized in reports on each phase of drilling (references from the Nye County Nuclear Waste Repository Project Office [NWRPO] website below).

NWRPO, 2001 (Summary FY96-01):
http://www.nyecounty.com/RID_data/RID4527/RID4527text.pdf

NWRPO, 2003 (Phase III): http://www.nyecounty.com/RID_data/rid5579/RID5579_rpt.pdf

NWRPO, 2005 (Phase IV): http://www.nyecounty.com/RID_data/RID6801_Text.pdf

NWRPO, 2009 (Phase V): http://www.nyecounty.com/RID_data/rid7668_report.pdf

Currently, Nye County is conducting an evaluation of groundwater resources in southern Nye County under a grant from the DOE. Studies completed to date include shallow geophysical and geologic investigations of sub-surface hydrogeology at Ash Meadows. A groundwater flow model was developed by Desert Research Institute (DRI) for the Pahrump Valley, and is currently in the calibration stage. Additional major tasks planned under this grant include: drilling and construction of 15 water table piezometer wells in the Oasis, Amargosa, and Pahrump valleys; collection and analysis of water samples to establish baseline water quality at selected wells in Amargosa Desert and Pahrump Valley; evaluation of perennial yield in Basin 230, which lies just to the south of the NNSS, through a cooperative Nye County-U.S. Geological Survey (USGS) evapotranspiration study; and simulation/evaluation of the effects of pumping in key areas in Amargosa Valley and Ash Meadows through development and use of a USGS groundwater flow model.

One of the major environmental and socioeconomic issues associated with residential and commercial development in southern Nye County is the demand and competition for scarce water resources, particularly in the case of wet-cooled solar thermal designs that have been proposed. Groundwater resource limitations have the potential to affect both residential and commercial development in Nye County. Included in these concerns is the quantity and quality of groundwater from the NNSS, which naturally flows into southern Nye County along multiple flow paths, and has the potential to directly impact the quality and quantity of water available to communities, residents, and developers in the area from Beatty to Amargosa Valley. Nye County is also concerned about future County access to water resources on the NNSS and is making an effort to work with the Nevada Site Office to increase understanding of water volume, flow paths, and quality. Increased understanding would benefit not only the County, but all agencies and communities downstream from the NNSS.

Continued protest of Nye County's water rights applications by federal agencies (including the U.S. National Park Service, U.S. Fish &Wildlife Service, U.S. Air Force, and DOE) could result in cessation of development in areas on and/or near the NNSS and in Amargosa Valley, where several renewable energy projects are planned (see Section 6.2.2.x.4). The primary rationale for protesting water rights has been the restrictions on the right to access the land (Nevada State Engineer, 2008a,), and the protection of the Devils Hole Pupfish (Nevada State Engineer, 2008b). However, it has not been proven that pumping in the Amargosa Farms area affects the water level in Devils Hole. Based on scientific work by Nye County, Inyo County, and other agencies, it appears that faults in the area (particularly the Gravity fault, which lies between the Amargosa Farms area and Devils Hole) may act as barriers to groundwater flow that would protect Devils Hole from the potential effects of pumping.

Land-Use Planning

Bureau of Land Management and Other Agency Planning. Nye County participates in the updating of the Battle Mountain and Southern Nevada BLM District Resource Management Plans (RMPs). Participation includes discussion of actions and activities as well as the preparation of formal comments concerning current and planned actions that may affect BLM, Nye County, and adjacent counties; and the identification of disposal lands.

Nye County's experience has shown that the early discussion of federal- and state-agency plans and actions prior to their implementation is frequently beneficial to both the agency and Nye County. These discussions allow the informal introduction of problems and concerns, and the development of solutions to address them. These discussions have proven to be beneficial in that they reduce or eliminate what could otherwise be lengthy and acrimonious legal and political disputes. It also tends to eliminate misunderstandings and hard feelings that would otherwise delay or derail current and future actions and agreements.

Yucca Mountain Project Gateway Area Concept Plan. Nye County has completed a *Yucca Mountain Project Gateway Area Concept Plan* (Concept Plan) with proposed land use designations for the area around the entrance to the proposed Yucca Mountain repository site (Giampaoli, 2007). Whether or not the repository is developed, this land (nine sections) has been designated by the Bureau of Land Management (BLM) for disposal. The Concept Plan presents Nye County's proposed multiphase land use plan for the portion of the town of Amargosa Valley that is adjacent to and near the Yucca Mountain site entrance at the southwest corner of the NNSS. Nye County proposed this Concept Plan to ensure orderly land development associated with potential Yucca Mountain and NNSS-related activities, or with other activities along the U.S. 95 Technology Corridor, such as development of renewable energy projects. Nye County views this plan as a starting point for development of the infrastructure, institutional capacity, and facilities to offset the potential impacts associated with activities in the vicinity, while also benefiting these activities. Nye County developed the plan to use and manage existing initiatives while expanding and improving the area. The stated purposes of the Concept Plan are applicable to development in the vicinity of the NNSS and the proposed Yucca Mountain Project Gateway:

Describe key objectives and methods to manage the expected impacts of reasonably foreseeable activities, which would include growth in neighboring towns;

Review existing conditions and identify necessary planning and infrastructure improvements;

Review financial options for land and utility development; and

Present a land use concept to ensure orderly and compatible development for the area near the Yucca Mountain site entrance at the southwest corner of the NNSS.

Nye County plans to nominate Crater Flat lands for disposal (transfer of land) in the Bureau of Land Management Resource Management Plan amendment process.

U.S. Highway 95 Technology Corridor

Nye County has outlined a strategy for a Technology Corridor along U.S. Highway 95 (EDEN, Inc., 2007). The corridor extends from Indian Springs in Clark County in the south to Tonopah in the north, passing through the Pahrump Valley, Mercury (entrance to the NNSS), Amargosa Valley, Beatty, and Goldfield (Esmeralda County). Nye County would like to increase industrial space to accommodate new high-technology businesses by completing the Amargosa Valley Science and Technology Park at Lathrop Wells, assisting Beatty to adaptively reuse the Barrick Bullfrog site for new industry, and encouraging Pahrump to facilitate a business park for the Pahrump Valley. Nye County's goals for the Technology Corridor are to change economic diversity of the region's industries, transform the regional economy to one more closely associated with national trends, and increase the presence of green energy industry in the region.

As part of its Technology Corridor, a major goal of Nye County is to pursue development of renewable energy along the U.S. Highway 95 corridor (EDEN, Inc., 2007, Goal 1-7, p. C-1). Wide expanses, sunny climate, and high solar incidence offer abundant opportunity to employ solar energy options to meet energy demand and lower operating costs for households and businesses. Nevada has created an incentive for power utilities to invest in alternative energy. To increase renewable energy research and development activities, Nye County plans to work cooperatively with: 1) the DOE National Laboratory for Renewable Energy to provide contracts to regional providers; 2) private industry to attract investments to promote renewable energy projects; 3) installation providers to recruit and provide skill training through Great Basin College to local workers; and 4) utilities to develop additional transmission capacity for renewable energy projects.

Renewable Energy Developments

Nye County is signatory to the Nye County-BLM Memorandum of Understanding (MOU) for Renewable Energy. Signatories include Nye County and each of the four BLM District Offices with responsibilities within Nye County (Battle Mountain, Southern Nevada, Elko, and Carson City). Under the Nye County-BLM MOU for Renewable Energy, the County is a Cooperating

Agency and provides input to all Environmental Impact Statements (EISs) and actions that apply to or affect renewable energy within the County. This includes transmission capacity development in areas outside of Nye County that will have effects upon developments within Nye County. Nye County is also a cooperating agency on the DOE-BLM Programmatic Environmental Impact Statement to Develop and Implement Agency-Specific Programs for Solar Energy Development (74 FR 31307, June 30, 2009), which covers solar energy and transmission development in six western states, of which Nevada is one.

The BLM has received right-of-way permit applications from renewable energy developers for numerous solar, wind, and geothermal energy facilities in Nye County. The locations of the applications by developers for land within a 50-mile area around the NNSS, Nevada Test and Training Range, and Tonapah Test Range are depicted on the map located at the end of this section. The applications are in varying stages of the review process for obtaining Right-of-Way (ROW) leases from BLM. Nye County facilitates communications between the developers and federal, state, and local agencies to ensure information is fully and properly communicated, and to encourage cooperative efforts in moving renewable energy projects forward. This includes communications with transmission developers and providers, and agencies such as the DOE, the U.S. Department of Agriculture, the Public Utilities Commission of Nevada, the Federal Energy Regulatory Commission, the Western Area Power Administration, and similar California agencies that are concerned with the production and transmission of renewable energy.

Nye County coordinates with the Department of Defense regarding the applications submitted by renewable energy developers and related transmission developers and providers, and intends to continue the cooperative effort in the future. Nye County is also working to facilitate development of transmission lines to support transmission of the energy produced by the proposed renewable energy facilities to markets in Nevada, California, and other states. Nye County works closely with federal and state agencies (e.g., the DOE-Energy Efficiency and Renewable Energy Office, the U.S. Environmental Protection Agency, the Nevada State Office of Energy, etc.) to increase the use of renewable energy and increase transmission capacity within Nye County, adjacent counties, and the State of Nevada.

Water resources are of particular interest to Nye County and its communities and residents because of the arid nature of the area. Nye County provides input to and coordination with all state and federal agencies whose actions impact the quantity and quality of water within the County. Renewable energy developers are encouraged to use dry cooling whenever possible. Where dry cooling cannot be used, hybrid technology is recommended and encouraged. Particular attention is paid to blow back, cooling, and storm water diversion ponds because of concern regarding the proper handling and disposal of evaporate products, the condition of brine and ground water at renewable energy sites, and water naturally returning to or reinjected into the water table. Included in these concerns is water from the NNSS, which flows into southern Nye County to the south and west of the NNSS and has the potential to affect the quality and quantity of water available to communities, residents, and developers.

Four of the applications for ROW leases submitted to date in Nye County are drafting or completing Environmental Impact Statements: Solar Reserve, Solar Millennium, Abengoa Solar, and Pacific Solar Investments.

Solar Reserve has submitted a plan of development to BLM for a 100-megawatt (MW) concentrated solar power project (Crescent Dunes) capable of producing approximately

500 gigawatt hours (GWh) of renewable energy annually. The 653-foot power tower and its surrounding heliostats will heat liquid salt, which will be stored and used to generate electrical energy through a conventional steam turbine cycle, after which the cooled salt will be recycled through the system for reheating. The Solar Reserve site is approximately 16 miles north-northwest of the Tonopah Airport.

Solar Millennium has submitted a plan of development for two 242-MW concentrating solar trough projects on approximately 4,350 acres, located north of Amargosa Farm Road and east of Valley View Road, in Amargosa Valley, approximately 5 miles south of U.S. Highway 95 and 5 miles west of State Highway 373. The plan calls for dry cooling towers, which would be approximately 140 feet high.

Abengoa Solar has submitted a plan of development for a 250-MW net parabolic trough solar power plant with an option to expand the facility by adding a second 250-MW unit. Additionally, the Lathrop Wells Solar Facility may include up to 20-MW of photovoltaic (PV) solar power. The Lathrop Wells Solar Facility would be located on 5,336 acres south of US Highway 95 and west of State Highway 373, in Amargosa Valley, at the former Jackass Aeropark. The plan calls for dry cooling towers that would be approximately 140 feet high.

Pacific Solar Investments has submitted a plan of development for a 300-MW photovoltaic (PV) facility north of the Big Dune Area of Critical Environmental Concern (ACEC) in Amargosa Valley, south of U.S. Highway 95. A second facility is proposed to be located to the south of the Big Dune ACEC, which will be a 500-MW PV facility. Both facilities are located on the west side of the town of Amargosa Valley.

In addition, Ewind Farms has submitted a request for a right-of-way lease for a commercial solar power generation facility of 8 gigawatts on land within and adjacent to the Nevada National Security Site, south and west of the Yucca Mountain tunnel.

DOE has advised Nye County that it is considering locating two solar renewable energy sites on 25 square miles of land in Area 25, just north of the area covered by the *Yucca Mountain Project Gateway Area Concept Plan*. One site would be a solar demonstration facility comprising four to six demonstration plants ranging from 1 to 10 MW each, generating up to 30 MW of power to be used on the NNSS. A second site would be a commercial facility that could possibly generate up to 1 gigawatt of power. Development of the transmission lines being facilitated by Nye County would also be available to support renewable energy and other development on the NNSS.

Several renewable energy developers have entered into agreements with Nye County regarding the development of a PV facility at the Tonopah Airport. Nye County is working with the developers and an EPA contractor to address transmission accessibility at the airport, a former Brownfield's site.

U.S. Department of Justice Detention Facility

The U.S. Department of Justice (DOJ) Office of the Federal Detention Trustee and the U.S. Marshals Service determined that there was a need to house federal detainees at a facility near Las Vegas. In March 2008, the DOJ published the *Final Environmental Impact Statement for the Proposed Contractor Detention Facility, Las Vegas, Nevada Area* (DOJ, 2008). The preferred alternative identified in the EIS was a 120-acre site in Pahrump, about 25 miles from the NNSS. Facility operation is expected to begin in October 2010 and employ 200 to 250 people. Operation of the detention facility is anticipated to result in a number of new contractor employees who are either current residents of Nye County or who relocate to Nye County, with the remainder of the new contractor employees expected to be current residents of Clark County who would continue to reside in Clark County within commuting distance.

Coordination and Cooperation with Government Programs

Nye County has worked cooperatively with the DOE Yucca Mountain Project to provide a number of services normally provided by local government to its residents. These services have significantly benefited the Yucca Mountain Project through reduced costs and high-quality service. They have also benefited Nye County by increasing its capability to provide services to both local communities and to DOE for Yucca Mountain. Nye County believes that similar agreements with the NNSS would be equally beneficial to both parties and should be incorporated in future agreements. Those services would be provided on a government-to-government basis and could include normal Public Works, Law Enforcement, and Emergency Services, strengthening the abilities of both Nye County and the NNSS to meet both normal and anticipated emergency needs. Such agreements would also allow better implementation of the National Incident Management System (NIMS), the National Response Framework, and related programs and Presidential Directives.

References

Department of Justice, 2008. *Final Environmental Impact Statement for the Proposed Contractor Detention Facility, Las Vegas, Nevada Area.*

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NWRPO, 2001 (Summary FY96-01): http://www.nyecounty.com/RID_data/RID4527/RID4527text.pdf

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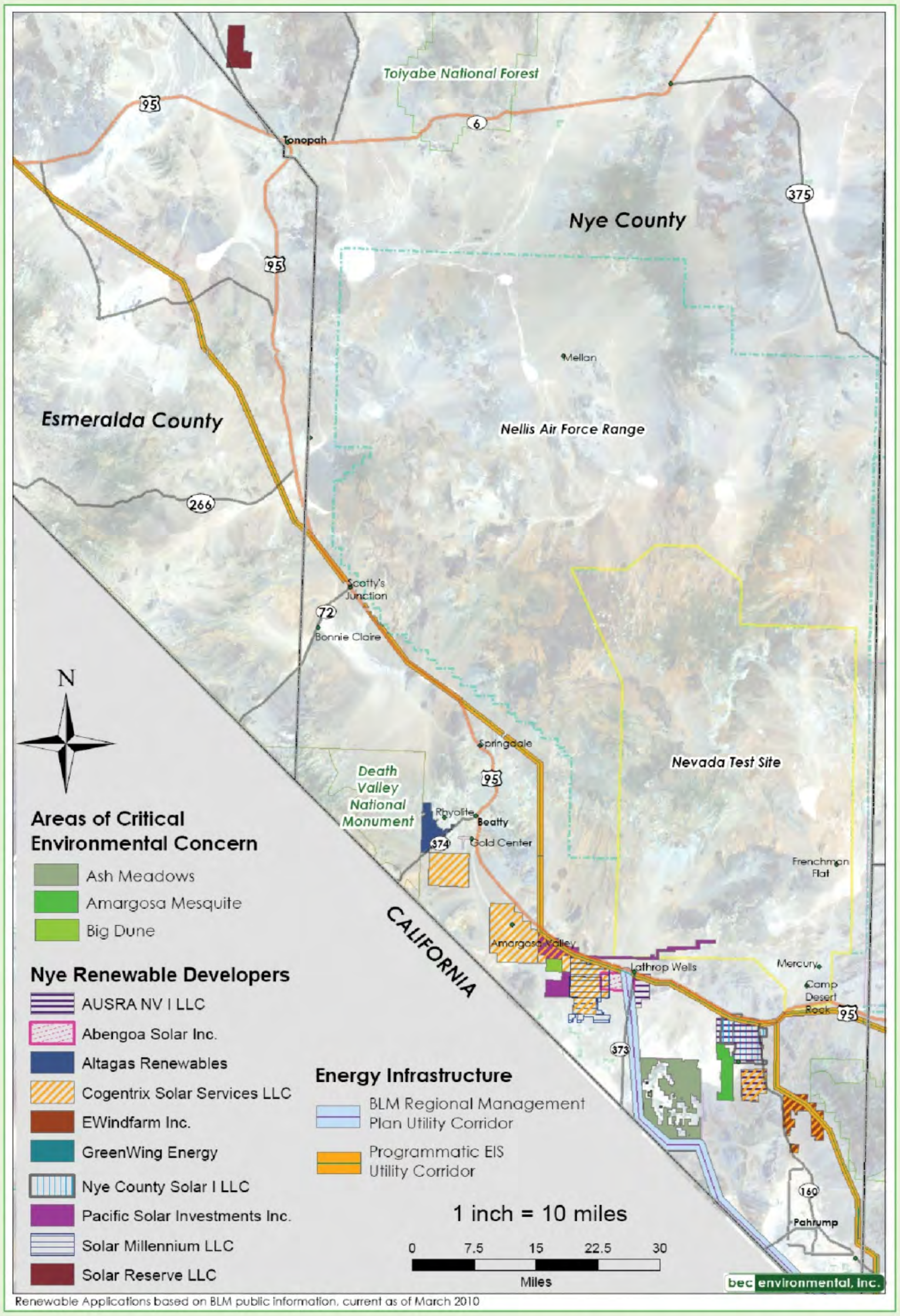
NWRPO, 2009 (Phase V): http://www.nyecounty.com/RID_data/rid7668_report.pdf



Renewable Energy Developer Permit Application Land Areas

6.2.10 Clark County and Las Vegas Area, Nevada

The *Regional Transportation Plan* for Clark County (RTCSN 2008) projected that, by 2020, the population of Clark County will increase by 1,143,071, from about 1,912,955 in 2006 to about 3,056,026 in 2020 (RTCSN 2008), an approximate 60 percent increase. A number of factors will influence this projected growth and attendant development, including water availability, air quality, the strength of the tourism industry (particularly the gaming sector), and the cost of housing. The *Regional Transportation Plan* further projected that about 63,533 acres of land will be developed within Clark County during the 2010 to 2020 time frame (RTCSN 2008). Some of that land is outside the cumulative impacts ROI for this *NNSS SWEIS*. To refine the estimate of potentially developed land, the acreage for Henderson (14,523 acres) was subtracted, resulting in a conservative estimate of 49,010 acres of land within the ROI that is projected to be developed. This area of potential development is included within the areas that may be developed under the BLM Las Vegas Valley Land Disposal and the USFWS Clark County MSHCP, but was not included in the potential land disturbance areas in this cumulative impacts assessment.

The Clark County Department of Aviation is planning a new international, commercial service airport in the Ivanpah Valley, the Southern Nevada Supplemental Airport, to ensure sufficient commercial aviation capacity in the Las Vegas metropolitan area. In the Ivanpah Valley Airport Public Lands Transfer Act of 2000 (P.L. 106-362), the U.S. Congress identified a 6,000-acre site in the Ivanpah Valley between the towns of Jean and Primm and immediately east of Interstate 15 for the purpose of developing the Southern Nevada Supplemental Airport and related infrastructure. Subsequently, in P.L. 107-272, Congress directed transfer of an additional 17,000 acres surrounding the airport site to Clark County upon final approval of the Southern Nevada Supplemental Airport. The FAA has accepted a proposed airport layout plan for the Southern Nevada Supplemental Airport, and the FAA and BLM, acting as joint lead agencies, have begun preparing an EIS for the proposed airport. Preparation of this EIS is currently suspended due to the downturn in the economy, although Clark County is continuing its planning efforts for the airport, albeit at a slower pace. The proposed Southern Nevada Supplemental Airport is a reasonably foreseeable future action, as defined by CEQ; however, it would be located about 10 miles outside of the ROI for the purpose of cumulative impact analysis in this SWEIS. Although there could be a cumulative impact with traffic traveling to and from the proposed airport and shipments to and from the NNSS along Interstate 15, no data regarding potential traffic volumes are available for the proposed airport; thus, a meaningful analysis is not possible at this time.

Within the cumulative impacts ROI, in rural Clark County and the Las Vegas metropolitan area, no specific projects were identified for analysis from reviews of the following: the *Clark County, Nevada, Comprehensive Plan* (CCCP 2010), the *Northeast Clark County Land Use Plan* (CCCP 2006), the *Northwest Clark County Land Use Plan* (CCCP 2007), planning documents from the City of Las Vegas (LVPC 2000, DFBS 2009), the *City of North Las Vegas Downtown Master Plan & Investment Strategy* (NLV 2009), and the *Coyote Springs Investment Planned Development Project Environmental Impact Statement* (USFWS 2008). Most of the proposed or ongoing projects identified during that review were urban development within already disturbed areas, such as Las Vegas and North Las Vegas, and would have little or no cumulative effect combined with DOE/NNSA activities in the state of Nevada. One large proposed project, the Coyote Springs Development, is located outside of the ROI.

6.2.11 Lincoln County, Nevada

BLM has proposed two separate but related potential projects of concern to cattlemen, ranchers, sportsmen, mining companies, and offroad vehicle enthusiasts in Lincoln County (Maxwell 2010). The first is a draft concept for a National Conservation Area consisting of 600,000 acres in Garden and Coal Valleys. The second consists of the consideration of two areas for solar development in Lincoln County: Delamar Valley (approximately 2,850 acres) and Dry Lake Valley (approximately 19,980 acres).

The National Conservation Area that is proposed would not affect existing rights (i.e., roads, rights-of-way, mining claims, or other valid existing rights). Grazing, hunting, fishing, and trapping would continue in the conservation area, in accordance with Federal and state law (Maxwell 2010). Access to and use of other private parcels within the National Conservation Area would not be affected. A management plan for the conservation area is expected to be completed by BLM within 3 years (Maxwell 2010).

A potential solar energy project on Toreson Industries property in Rachel, Nevada, off Nevada State Route 375 heading east on Smith Well Road, may be implemented. No permit applications have been submitted for this project at this time.

A possible upgrade to the Tempiute power line may occur within the next 10 years; no permits for this project have been submitted at this time.

6.2.12 Esmeralda County, Nevada

Several projects that may occur in Esmeralda County are still in a speculative phase and are not considered reasonably foreseeable. These include future storm drain projects in Goldfield and Silver Peak; a potential airport north of Goldfield; and rerouting U.S. Route 95 in the Goldfield area.

6.2.13 Inyo County, California

Almost all of the land in Inyo County, California, that falls within the cumulative impacts ROI for this *NNSS SWEI*S is Federal (BLM and NPS) or state land (Inyo County 2002). The communities of Shoshone, Tecopa, and Tecopa Springs are the main towns in the area. There were no nonfederally proposed actions identified within the portion of Inyo County that is included in the cumulative impacts ROI. Proposed Federal actions within Inyo County are addressed in Sections 6.2.4, Bureau of Land Management, and 6.2.7, National Park Service.

6.2.14 US Ecology, Inc., Beatty, Nevada

US Ecology operates a permitted solid waste treatment, storage, and disposal facility near Beatty, Nevada, located about 100 miles northwest of Las Vegas in the Amargosa Desert. Among other waste types, at its Beatty facility, US Ecology accepts Resource Conservation and Recovery Act (RCRA) hazardous wastes, polychlorinated biphenyl (PCB)-contaminated materials, and asbestos or asbestos/RCRA debris. US Ecology is currently not permitted to accept LLW or mixed low-level radioactive waste (MLLW) (US Ecology 2010); however, between September 1962 and December 1992, the site disposed about 4,862,000 cubic feet of radioactive waste containing about 709 curies of byproduct material, about 4,807,000 pounds of source material, and about 606 pounds of special nuclear material (Laney 2010). Since acceptance of radioactive waste ceased at its Beatty facility, US Ecology completed a state-approved closure plan to stabilize the site and establish proper security measures. The plan was intended to ensure that the LLW disposed during the operational phase of the facility continued to remain in a suitable, stable, and safe condition after site closure. The Nevada State Health Division continues to monitor for radioactivity in groundwater, air, soil, and vegetation (NSHD 2010). The US Ecology facility at Beatty is a RCRA-permitted facility with engineered barriers and systems and administrative controls that minimize the potential for offsite migration of hazardous constituents, and the Nevada State Health Division continues to monitor the site. In addition, the regional climate of southern Nevada is very arid, with an evapotranspiration rate that far exceeds precipitation, and the depth to groundwater is several hundred feet. For these reasons, DOE/NNSA determined that cumulative postclosure impacts from the Beatty LLW disposal facility would be very unlikely.

6.3 Cumulative Impacts Analysis

The following analysis addresses the potential cumulative impacts from past, present, and reasonably foreseeable future actions at DOE/NNSA sites and facilities in the state of Nevada and similar actions by other Federal and state agencies, local governments, and private parties. Where appropriate, impacts from the NNSS (including environmental restoration activities on the Nevada Test and Training Range), RSL, NLVF, and the TTR are considered separately; otherwise they are combined. **Table 6–3** shows the area of potential land disturbance for all applicable resources (i.e., land use, geology and soils, surface water, biological resources, and cultural resources). The land disturbance figures were derived from the information contained in Section 6.2, Potentially Cumulative Actions, and Chapter 5, Table 5–1, Potential Area of Land Disturbance at the Nevada National Security Site for Each Mission Area, Program, and Activity by Alternative, and may differ slightly from figures in those tables due to rounding.

Table 6–3 Area of Potential and Existing Ground Disturbance Used in the Cumulative Impacts Analysis

Cause of Disturbance	*Disturbed Area (acres)* [a]
Estimated Potential Land Disturbance Within the Cumulative Impacts Region of Influence	
Proposed renewable energy facilities (BLM)	143,000 [b]
Yucca Mountain Project Gateway Area (Nye County)	5,800 [c]
Targets at Nevada Test and Training Range (U.S. Air Force)	400 [d]
GTCC waste disposal (DOE)	110 [e]
Las Vegas Valley land disposal (BLM)	36,000 [f]
Las Vegas Valley estimated land disturbance under a modified Multi-Species Desert Habitat Conservation Plan	324,000 [g]
U.S. Forest Service, Middle Kyle Complex	330 [h]
Total Potential Non-DOE/NNSA-Related Land Disturbance	**509,640**
DOE/NNSA Actions at the NNSS and the TTR (based on Expanded Operations Alternative), including one or more potential commercial solar power generation facilities in Area 25 of the NNSS and Geothermal Demonstration Project	4,500 No Action 26,000 [I] Expanded Operations 2,700 Reduced Operations
Total Potential Land Disturbance	**514,140** No Action **535,640** Expanded Operations **512,340** Reduced Operations
Estimated Existing Land Disturbance Within the Cumulative Impacts Region of Influence	
Estimated Existing Disturbed Area in Clark County	215,000
Estimated Existing Disturbed Area in Nye County	51,000
Estimated Existing Disturbed Area at the NNSS	80,000
Total Estimated Existing Disturbed Land	**346,000**
Estimated Total Potential and Existing Land Disturbance Within the Cumulative Impacts Region of Influence	**860,140** No Action **881,640** Expanded Operations **858,340** Reduced Operations

BLM = Bureau of Land Management; GTCC = greater-than-Class C; NNSS = Nevada National Security Site; TTR = Tonopah Test Range.

[a] Numbers of acres of potential and existing land disturbance represent estimates of areas of disturbance and have been rounded.

[b] From Chapter 6, Table 6–2, Summary of Renewable Energy Projects Within the Cumulative Impacts Region of Influence.

[c] *Yucca Mountain Project Gateway Area Concept Plan* (Giampaoli 2007).

[d] *Range 74 Target Complexes Environmental Assessment Nevada Test and Training Range, Nevada*, July 2007 (USAF 2007d).

[e] *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (DOE/EIS-0375-D) (DOE 2011a).

[f] *Draft Supplemental Environmental Impact Statement Upper Las Vegas Wash Conservation Transfer Area, Las Vegas, Nevada* (BLM/NV/EL/ES-10-06+1793) (BLM 2010b).

[g] Clark County Multi-Species Habitat Conservation Plan (USFWS 2000) and Notice of Intent to prepare an EIS, as well as notice of public scoping meetings for a proposed Amendment of the Clark County Multi-Species Habitat Conservation Plan and Issuance of an Amended Incidental Take Permit (74 FR 50239).

[h] *Final Environmental Impact Statement Middle Kyle Complex, Spring Mountains National Recreation Area, Humboldt Toiyabe National Forest, Clark County, Nevada* (USFS 2009c).

[i] From Chapter 5, Table 5–1, Potential Area of Land Disturbance at the Nevada National Security Site for Each Mission Area, Program, and Activity by Alternative.

6.3.1 Land Use

Under both the Expanded Operations and Reduced Operations Alternatives, DOE/NNSA is proposing changes in the NNSS land use zones. Under all three alternatives, the name of the Solar Enterprise Zone would be changed to the Renewable Energy Zone. Under the Expanded Operations Alternative, the designation for Area 15 would be changed from Reserved Zone to Research, Test, and Experiment Zone, and the Renewable Energy Zone in Area 25 would expand from about 2,400 acres to 39,600 acres. Under the Reduced Operations Alternative, DOE/NNSA would change the designation of the Nuclear Test Zone for Areas 19 and 20 and the Reserved Zone for Areas 18, 29, and 30 to the Limited Use Zone.

Although land use zones under both alternatives would change, this change is not considered an adverse impact. The NNSS developed the land use zones for internal organizational and functional uses and to group similar uses and activities into specific areas based on the support needs of the NNSS mission as determined by previous and anticipated uses. Because the land use changes that would occur under the Expanded Operations or Reduced Operations Alternative would be consistent with the missions of DOE/NNSA at the NNSS and would not affect land uses outside of the NNSS boundaries, there would be no cumulative impacts on land use from any of the alternatives addressed in this *NNSS SWEIS*. Although there would be no cumulative impacts on land use from changes of use of NNSS lands, there may be cumulative impacts on other resources, such as wildlife, vegetation, cultural resources, and socioeconomics, which will be addressed under the appropriate resource areas. However, current land use for large areas of undisturbed land in Amargosa Valley would be changed by construction of reasonably foreseeable solar energy generation facilities and Nye County's Yucca Mountain Project Gateway Area development. The cumulative impacts of these land use changes would be withdrawal of approximately 148,800 acres of land in Nye County from public use and commitment of that land to use for renewable energy facilities or commercial/industrial uses. Additionally, disturbed land at the former Yucca Mountain Repository site would be restored to its approximate preconstruction condition. Land ownership and control of the site would revert to the original controlling authorities (DOE/NNSA, the USAF, and BLM) and would likely return to pre-Yucca Mountain Repository Project uses.

In Clark County, BLM would dispose up to about 36,000 acres of public land. Use of this land would be changed from its current public uses to make it available for private and/or municipal uses.

A very large percentage of the land in Nye County is owned by the Federal Government and administered by several different agencies. Much of the land managed by BLM is available for public use; however, lands managed by the U.S. Department of Defense and DOE have very strict access controls and are not available for any public use. This limits the land available in the county for development of industrial, commercial, municipal, or residential uses. There are no proposals to make large-scale reductions in the amount of land managed by Federal agencies in Nye County; likewise, there are no proposals to increase the amount of such lands. In fact, BLM land disposal actions from time to time make parcels of federally owned land available, thus marginally reducing the proportion of Federal land in the county. It is also important to note there is sufficient undeveloped non-Federal land available in Nye County that growth and development are not being hampered by lack of available land at this time.

6.3.2 Infrastructure and Energy

Impacts on infrastructure are primarily captured in other resource areas. DOE/NNSA would construct new infrastructure as needed and continue to appropriately disposition excess infrastructure. As new infrastructure is added, there would be impacts on various resources, such as soils, biology, air, and socioeconomics. Likewise, when infrastructure is dispositioned, there would be other impacts on some of the same resources. For instance, if a building or road is removed and the disturbed area is revegetated with appropriate native species, there would be a positive impact on wildlife habitat and soils, but also temporary adverse air quality impacts.

Construction of new facilities, particularly large projects, would place cumulative demands on goods and services. All of the proposed renewable energy projects in Amargosa Valley and Area 25 of the NNSS would have similar needs for large tracts of undeveloped land and water; use earth-moving/grading equipment, cranes, and other construction equipment; require similar materials, such as concrete, steel, wood, wiring, cables, etc.; and require the services of both general and specialized construction workers. The cumulative effects of these impacts are captured in the analyses for each affected resource.

Large-scale construction projects that would create cumulative impacts on traffic and roadways in the region, particularly renewable energy facilities in Amargosa Valley and Area 25 of the NNSS, are addressed in Section 6.3.3, Transportation.

In 2009, DOE/NNSA facilities in Nevada used almost 84,600 megawatt-hours of electricity. During the same year, NV Energy (southern division) and Valley Electric Association provided about 21,200,000 megawatt-hours and 470,000 megawatt-hours, respectively, of electricity to their customers (NSOE 2010), totaling almost 21,670,000 megawatt-hours. DOE/NNSA's use of electricity represents about 0.4 percent of the total electricity supplied by the two major electrical utilities in southern Nevada. The Nevada Public Utilities Commission forecasts a 1.5 percent growth rate in electricity sales through 2020 (NDEP 2008). Based on that growth rate, by 2020, total electricity sales in southern Nevada would be about 25,530,000 megawatt-hours. Based on the projected level of activities and number of employees at DOE/NNSA facilities in Nevada under the Expanded Operations Alternative, it was estimated that the cumulative demand for electrical energy at the NNSS, RSL, NLVF, and the TTR in 2020 would be about 150,000 megawatt-hours. This would represent about 0.6 percent of the total demand for electrical energy in southern Nevada by 2020, which represents a slight increase in the proportion of electrical energy consumed by DOE/NNSA-related activities in the region. This estimate did not take into account energy conservation measures that are being implemented, nor did it consider the reduction in commercial electrical service demand at the NNSS due to construction of a proposed 5-megawatt photovoltaic electrical generating facility in Area 6, from the DOE Office of Energy Efficiency and Renewable Energy-proposed CSP Validation Project, or from any commercial solar power generation facilities that would be constructed at the NNSS. Any one of these factors could result in a decrease in the proportion of DOE/NNSA's demand for electrical power in the region.

Currently, in southern Nevada, there are about 7,800 megawatts of electrical generating capacity available. Based on projected southern Nevada electrical energy demand in 2020, the available generating capacity would be adequate; however, much of that capacity is owned by or contractually obligated to electrical utilities in other regions such as Arizona and southern California. For instance, most of the electricity generated at Hoover Dam is transmitted for use outside of Nevada. However, with development of up to about 5,800 megawatts of solar power generation facilities in the Amargosa Valley area, electrical generating capacity in southern Nevada would continue to be adequate to meet projected demand, provided adequate electrical transmission line capacity is developed to transmit the power (see Section 6.2.2.4).

6.3.3 Transportation

Increased traffic on U.S. Route 95 and other local roadways, primarily in Nye County, resulting from construction and operation of renewable energy projects in Amargosa Valley (including one or more commercial solar power generation facilities in Area 25 of the NNSS); remediation activities at the former Yucca Mountain Repository site; and development of the Yucca Mountain Project Gateway Area would increase wear and tear on the roads and, consequently, maintenance requirements. During construction and site remediation, roads in Nye County could experience a 2- to 5-fold increase in daily traffic on primary roads such as U.S. Route 95 and Nevada State Route 160, which could degrade levels of service from A to D during peak commuting hours. During operations, primary roadways could experience 30 to 50 percent increases in daily traffic, and levels of service could degrade one level during peak commuting hours. The degradation in levels of service caused by increased traffic volumes on these roads could generate the need for additional travel lanes and other improvements. There would be no operational/post-remediation impacts on roadways associated with the former Yucca Mountain Repository site.

Transportation of radioactive waste and other materials to the NNSS increases the burden on local community emergency responders to establish and maintain the capabilities necessary to respond to an accident involving a radioactive waste shipment. To mitigate that increased burden, the DOE/NNSA Nevada Site Office (NSO), working jointly with the State of Nevada, established the Emergency Preparedness Working Group to provide a forum for coordination of the LLW grant program between NNSA, the State of Nevada (Division of Emergency Management), and six counties (Clark, Elko, Esmeralda, Lincoln, Nye, White Pine). In addition, the DOE/NNSA NSO placed a 50-cent-per-square-foot surcharge on radioactive waste disposed at the NNSS that, as it accumulates, is provided directly to the state for distribution to the affected counties. Since 2000, the Emergency Preparedness Working Group has distributed annual grants, funded by the surcharge, among the southern Nevada counties through which LLW and MLLW shipments travel en route to the NNSS. These grants, totaling about $10 million as of 2011, have allowed the counties to undertake emergency preparedness planning and response capability assessments and to acquire emergency response resources such as ambulances, fire trucks, and communication equipment, as well as to construct training facilities and emergency services buildings. The DOE/NNSA NSO also offers training to first responders for emergency situations involving radioactive waste and materials.

The assessment of cumulative impacts for past, present, and reasonably foreseeable future actions involving radioactive material transports concentrates on impacts from offsite transportation throughout the Nation that would result in potential radiation exposure to a greater portion of the general population than onsite and NNSS-vicinity transportation; transportation of radioactive materials could also result in fatalities from traffic accidents. 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, as described in Appendix D, Section D.5.1, of this *NNSS SWEIS*.

In addition to those impacts addressed in this *NNSS SWEIS* (see Chapter 5, Section 5.1.3), the cumulative impacts of the transportation of radioactive material consist of impacts from historical shipments of radioactive waste and spent nuclear fuel; reasonably foreseeable future 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 of the impacts was assumed to begin in 1943 and continue to some foreseeable future date. The current list of reasonably foreseeable DOE activities estimates risks up to 2042 (DOE 1999d). Projections for commercial radioactive material transport extend to 2073.

Table 6–4 provides a summary of total worker and general population collective doses from past, present, and reasonably foreseeable future transportation activities, as estimated in published NEPA documents. Impacts from these activities are not included in the analysis presented in Chapter 5 of this *NNSS SWEIS*.

Historical Shipments. The impact values provided for historical shipments to the NNSS include shipments of spent nuclear fuel from 1951 through 1993 and the impacts from radioactive waste shipments to the NNSS from 1974 through 1994 (DOE 1996c). The impact values also include historical shipments of spent nuclear fuel from the NNSS to Idaho National Laboratory, the Savannah River Site, the Hanford Site, and the Oak Ridge Reservation, as well as shipments of naval spent fuel and test specimens (DOE 1996a).

Table 6–4 Transportation-Related Radiological Collective Doses and Risks from Other U.S. Department of Energy/National Nuclear Security Administration Actions

Category	Worker		General Population	
	Collective Dose (person-rem)	Risk (LCF)	Collective Dose (person-rem)	Risk (LCF)
Historical Shipments (1943–1994) [a]				
Spent Nuclear Fuel Shipments to the NNSS	1.4	0.00	0.70	0.00
Radioactive Waste to the NNSS	82	0.05	100	0.06
Other Spent Nuclear Fuel Shipments	250	0.15	130	0.08
Subtotal	**330**	**0.20**	**230**	**0.14**
Reasonably Foreseeable Future Actions [b]				
Surplus Plutonium Disposition EIS	60	0.04	67	0.04
Naval Reactor Disposal	5.8	0.00	5.8	0.00
Treatment of Mixed Low-level Radioactive Waste EIS [c]	18	0.01	1.34	0.00
Waste Management PEIS [d]	15,000	9.0	17,700	10.6
WIPP SEIS II	790	0.47	5,900	3.54
Idaho High-Level Waste and Facilities Disposition Final EIS	520	0.31	2,900	1.74
Sandia National Laboratories SWEIS	94	0.06	590	0.35
Tritium Production in Commercial Light Water Reactor EIS	16	0.01	80	0.05
LANL SWEIS [e]	580	0.35	310	0.19
Plutonium Residues at Rocky Flat EIS	2.1	0.00	1.3	0.00
Disposition of Surplus Highly Enriched Uranium Final EIS	400	0.24	520	0.31
Molybdenum-99 Production EIS	240	0.14	520	0.31
Import of Russian Plutonium-238 EA	1.8	0.00	4.4	0.00
Pantex SWEIS	250	0.15	490	0.29
Storage and Disposition of Fissile Material	N/A	N/A	2,400 [f]	1.44
Stockpile Stewardship	N/A	N/A	38 [f]	0.02
Container System for Naval Spent Nuclear Fuel	11	0.01	15	0.01
S3G and D1G Prototype Reactor Plant Disposal EIS	2.9	0.00	2.2	0.00
S1C Prototype Reactor Plant Disposal EIS	6.7	0.00	1.9	0.00
ETTP DUF_6 Transport to Portsmouth [g]	99	0.06	3.2	0.00
Spent Nuclear Fuel PEIS	360	0.22	810	0.49
Foreign Research Reactor Spent Nuclear Fuel EIS [h]	90	0.05	222	0.13
Private Fuel Storage Facility Final EIS [i]	30	0.02	190	0.11
Mixed Oxide Fuel Fabrication at Savannah River Site [j]	530	0.32	560	0.34
Enrichment Facility in Lea County EIS [k]	1,500	0.9	450	0.27
GTCC EIS [l]	500	0.32	180	0.1
Draft TC&WM EIS [m]	2,884	1.7	425	0.3
West Valley Demonstration Project Waste Management Environmental Impact Statement	520	0.31	410	0.25
West Valley Demonstration Project Environmental Assessment for the Decontamination & Decommissioning and Removal of Certain Facilities	14	0.01	11	0.01
Draft Y-12 SWEIS [n]	Not listed	Not listed	Not listed	0.18
West Valley Decommissioning EIS [o]	1,900	1	310	0.2
Paducah DUF_6 Conversion Final EIS [p]	174	0.06	120	0.06
Portsmouth DUF_6 Conversion Final EIS [q]	93	0.04	62	0.04
Subtotal [r]	**24,800** [s]	**15**	**35,000** [s]	**21**
General Radioactive Material Transport [b, r]				
1943–1982 [s]	220,000	132	170,000	102
1983–2073 [t]	154,000	92	168,000	101
1943–2073	**374,000**	**224**	**338,000**	**203**

Category	Worker		General Population	
	Collective Dose (person-rem)	***Risk (LCF)***	***Collective Dose (person-rem)***	***Risk (LCF)***
Total Transportation Impacts Unrelated to this *NNSS SWEIS*				
Total Impacts (up to 2073)	**399,000 [r]**	**240**	**373,000 [s]**	**224**

DUF_6 = depleted uranium hexafluoride; ETTP = Eastern Tennessee Technology Park; LCF = latent cancer fatality; N/A = not available (the data are provided as a sum for workers and the public); NNSS = Nevada National Security Site; rem = roentgen equivalent man.

[a] *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE 1996c). Estimates for NNSS transportation impacts for the years 1995 to 2010 are not available.

[b] Unless it is specified otherwise, all values are taken from the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2002e) and the *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE 2008g).

[c] *Environmental Impact Statement for Treatment of Low-Level Mixed Waste*, February 1998 (JEGI 1998).

[d] The values are for the low-level and mixed low-level radioactive waste transportation impacts on the NNSS, based on the amended Record of Decision for the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*, 65 FR 10061, February 25, 2000.

[e] DOE/EIS-0380, *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico,* May 2008 (DOE 2008h).

[f] Includes worker and general population doses.

[g] DOE/EIS-0360, *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio*, Site, June 2004 (DOE 2004e).

[h] DOE/EIS-0218, *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel*, February 1996 (DOE 1996b).

[i] NUREG-1714, *Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians and the Related Transportation Facility in Tooele County, Utah*, December 2001 (NRC 2001). The impacts shown in this table reflect only those impacts associated with radioactive waste being transported to disposal sites other than the NNSS.

[j] NUREG-1767, *Environmental Impact Statement on the Construction and Operation of a Proposed Mixed Oxide Fuel Fabrication Facility at the Savannah River Site*, January 2005 (NRC 2005a).

[k] NUREG-1790, *Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico*, June 2005 (NRC 2005b). The risk values presented in this report are per year of operation. The values presented in this table are for 30 years of operation.

[l] DOE/EIS-0375D, *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (DOE 2011a).

[m] DOE/EIS-0391, *Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, October 2009 (DOE 2009g).

[n] DOE/EIS-0387, *Draft Site-Wide Environmental Impact Statement for the Y-12 National Security Complex*, October 2009 (DOE 2009o).

[o] DOE/EIS-0226, *Final Environmental Impact Statement for Decommissioning and/or Long-Term Stewardship at the West Valley Demonstration Project and Western New York Nuclear Service Center*, January 2010 (DOE 2010c). The impacts between 2011 and 2020 are included in the discussion of transportation impacts in Chapter 5, and reflect the preferred alternative with eventual clean closure. Impacts beyond 2020 are not included because no decision has been made as to the activities to be conducted beyond 2020.

[p] DOE/EIS-0359, *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site* (DOE 2004d). Includes those transportation impacts occurring beyond the next 10 years.

[q] DOE/EIS-0360, *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at Portsmouth, Ohio, Site* (DOE 2004e). Includes those transportation impacts occurring beyond the next 10 years.

[r] The summed values are rounded to three significant figures.

[s] These estimates are very conservative because few shipments were made in the 1950s and 1960s. In addition, the nonexclusive shipment dose estimates are based on a very conservative method. See the text under General Radioactive Materials Transports for dose estimates for shipments performed in 1975 and 1983. Totals are rounded.

[t] The annual dose estimates are similar to those for the period 1975–1982.

There are considerable uncertainties in these historical estimates of collective dose. For example, the population densities and transportation routes used in the dose assessment were based on the data from the 1990 U.S. census and the U.S. highway network as it existed in 1995. The U.S. population has continuously increased over the time covered in this assessment, thereby increasing the cumulative population dose. In addition, using interstate highway routes as they existed in 1995 may slightly underestimate doses for shipments that occurred in the 1950s and 1960s, because a larger portion of the transport routes would have been on noninterstate highways, where the population may have been closer to the road. By the 1970s, the structure of the interstate highway system was largely fixed, and most shipments would have been made using interstate routing.

Reasonably Foreseeable Future Actions. The values provided for reasonably foreseeable actions could lead to some double counting of impacts. For example, the LLW transportation impacts in the *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* may also be included in the individual DOE facilities' site-wide EISs. In addition, for reasonably foreseeable actions where no preferred alternative was identified or no ROD was issued, impact values were included for the alternative that has the largest transportation impacts. It was assumed that this *NNSS SWEIS* and other NEPA documents listed in **Table 6–5**, such as the *Final Sitewide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico,* and the *Sitewide Environmental Impact Statement for the Y-12 National Security Complex*, would address transportation impacts associated with the *Complex Transformation Supplemental Programmatic Environmental Impact Statement*; therefore, that NEPA document is not included in Table 6–5.

Table 6–5 Cumulative Transportation Impacts Under the Expanded Operations Alternative

	Worker		***General Population***	
	Collective Dose (person-rem)	***Risk (LCFs)***	***Collective Dose (person-rem)***	***Risk (LCFs)***
NNSS Transportation Risk (2011–2020)				
NNSS SWEIS [a]	5,600	3	1,400	0.8
Other Transportation Impacts Not Related to this *NNSS SWEIS*				
Historical Shipments to the NNSS	330	0.20	230	0.14
Reasonably Foreseeable Actions	24,800	15	35,000	21
General Radioactive Material Transport	374,000	224	338,000	203
Total	**399,000**	**240**	**373,000**	**224**
Cumulative Total [b]				
Total Impacts [c]	405,000	243	374,000	225

LCF = latent cancer fatality; NNSS = Nevada National Security Site; rem = roentgen equivalent man.
[a] The values provided are for the Expanded Operations Alternative, which has the greatest impacts.
[b] The cumulative total is the sum of the projected impacts for this *NNSS SWEIS* and the impacts from the other nonrelated transportation activities.
[c] Totals are rounded to three significant digits.

General Radioactive Materials Transports. General radioactive material transports are shipments not related to a particular action; they include shipments of radiopharmaceuticals, industrial and radiography sources, and uranium fuel cycle materials, as well as shipments of commercial LLW to commercial disposal facilities. The collective dose estimates from transportation of these types of materials were based on the following: (1) for the period 1943 through 1982, an NRC analysis documented in U.S. Nuclear Regulatory Commission Regulation (NUREG) 0170 for shipments made in 1975 (NRC 1977) and (2) for the period 1983 through 2043, an analysis of unclassified shipments in 1983, documented in the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE 1995). The NRC report estimated collective doses to the workers and population of 5,600 and 4,200 person-rem, respectively, for transports in 1975. The modes of transportation included truck, rail, and plane. The collective doses to workers and the general public for 1943 through 1982 (39 years) were estimated to be 220,000 and 170,000 person-rem, respectively (NRC 1977). The estimated collective doses to workers and populations for shipments in 1983 using a combination of truck and plane shipments were 1,690 and 1,850 person-rem, respectively (DOE 1995). These doses were calculated using more-refined models than those used in the 1977 NRC report. Even though the number of shipments was larger than those of the 1977 NRC report, the estimated doses are smaller by a factor of 2 to 3. As shown in Table 6–4, the collective doses over 91 years, from 1983 through 2073, would be 154,000 and 168,000 person-rem for workers and population, respectively.

Table 6–5 provides impacts on transport workers and the general population from future transportation activities considered in this *NNSS SWEIS* in comparison to the total worker and general population collective doses estimated in Table 6–4. The impacts from transportation in this *NNSS SWEIS* are quite small compared with the overall cumulative transportation impacts. The estimated total collective worker dose from all types of shipments (historical, reasonably foreseeable future actions, and general transportation) is about 399,000 person-rem (240 LCFs) for the period from 1943 through 2073 (131 years). The estimated total general population collective dose is about 373,000 person-rem (224 LCFs). To place these numbers in perspective, the National Center for Health Statistics indicates that the average annual number of cancer deaths in the United States from 1999 through 2004 was about 554,000, with less than a 1 percent fluctuation in the number of deaths in any given year (CDC 2007). The total number of LCFs (among the workers and general population) estimated to result from radioactive material transportation over the period between 1943 and 2073 is 468, or an average of about 4 LCFs per year. The transportation-related LCFs are about 0.0007 percent of the annual number of cancer deaths; therefore, this number is indistinguishable from the natural fluctuation in the total annual death rate from cancer. Note that the majority of the cumulative risks to workers and the general population were due to the general transportation of radioactive material unrelated to activities evaluated in this *NNSS SWEIS*.

6.3.4 Socioeconomics

Cumulative socioeconomic impacts are the impacts that result from the incremental impact of the action added to other past, present, and reasonably foreseeable future actions in Clark and Nye Counties. Because either expanding or reducing operations may have adverse impacts on different aspects of the socioeconomic environment, information from the Expanded Operations and Reduced Operations Alternatives was considered, as appropriate, in this analysis.

Under the Expanded Operations Alternative, there would be a net increase of 723 jobs to support DOE/NNSA activities over the next 10 years. In addition, operation of up to 1,000 megawatts of commercial solar power generation facilities would require an estimated 200 employees. This increase in the number of jobs would have an overall beneficial impact on economic activity in the area, as described in Chapter 5, Section 5.1.2. This increase in economic activity would have a minor contribution to overall cumulative economic impacts in Clark and Nye Counties.

Approximately 10 percent (about 92) of the individuals hired to support both DOE/NNSA activities and to operate of commercial solar power generation facilities on the NNSS under the Expanded Operations Alternative are expected to relocate to Clark and Nye Counties from other areas. Given the economic downturn, the population of Clark and Nye Counties decreased by 0.8 and 2.1 percent, respectively, in 2009 (NSBDC 2010), as noted in Chapter 2, Section 2.5.2, and Las Vegas had one of the highest home foreclosure rates in the Nation. In the short term, the increased DOE/NNSA-related workforce would likely slightly reduce the adverse impacts of the economic downturn due to new employees purchasing or renting housing and purchasing goods and services in Clark and Nye Counties. In the longer term, this increase would be so small as to be easily absorbed with almost undetectable impacts on local economies. In addition, because there would only be a small increase in population, the need for additional public services would be negligible. Therefore, this increase would not contribute to cumulative impacts on public services.

Under the Reduced Operations Alternative, a net decrease in DOE/NNSA jobs of approximately 381, relative to the No Action Alternative would occur over the next 10 years. This decrease would have an overall minor adverse economic impact in the area, as described in Chapter 5, Section 5.1.2. However, due to the high current unemployment rate, this decrease in economic activity would have a negligible contribution to overall cumulative impacts on the economy in Clark and Nye Counties. The demand for public services is expected to remain the same under the Reduced Operations Alternative. Therefore, no cumulative impacts on public services would occur.

6.3.5 Geology and Soils

Dynamic experiments using plutonium or other radioactive materials not conducted within a containment vessel would result in incremental increases in the deposition of radioactive material in the mined cavities at the U1a Complex. Dynamic experiments would not cause radiologic contamination of the land surface under normal circumstances. These types of activities are not conducted at any other locations in the United States. Therefore, the resulting cumulative impacts on geologic media would be incremental to the direct impacts and confined to the NNSS.

As shown in Table 6–3, construction of new facilities and other infrastructure by DOE/NNSA at the NNSS would result in long-term disturbance of up to 26,000 acres of previously undisturbed soils and near-surface geologic media. This disturbance, when added to previous similar disturbance at the NNSS (an estimated 80,000 acres), would amount to about 13 percent of the total area of the NNSS. Based on reviews of available documentation, potential non-DOE/NNSA land disturbance within the cumulative impacts ROI would be approximately 509,640 acres; the total area of the cumulative impacts ROI is about 15,737,760 acres. This potential disturbance includes areas specified in EISs, environmental assessments, and other planning documents and the analysis assumed that all land that would be disposed by BLM in the Las Vegas Valley would be developed. This new land surface disturbance represents about 3.2 percent of the cumulative impacts ROI. The area of existing land disturbance in the cumulative impacts ROI is about 346,000 acres, or 2.2 percent of the total area. When potential land disturbance resulting from DOE/NNSA actions (26,000 acres) is considered, the existing and potential land disturbance within the ROI would be about 881,640 acres, or 5.6 percent of the ROI. Remediation of the former Yucca Mountain Repository site would result in about 350 acres of currently disturbed lands being returned to near pre-disturbance contours and reclaimed using native species.

In addition to direct impacts on soils and geologic media resulting from DOE/NNSA and other agencies, limited access to large areas of land in Nye County would have impacts related to geological resources. Access to almost all of the NNSS and the Nevada Test and Training Range has been restricted since October 1940, when land was withdrawn for establishment of the Tonopah Bombing and Gunnery Range (Kral 1951). Since 1940, additional lands have been added to the withdrawn areas and the agencies responsible for management of various portions of the withdrawn lands have changed, resulting in the most recent configuration of the NNSS and Nevada Test and Training Range.

Based on review of existing data, the Special Nevada Report (SAIC/DRI 1991) concluded that, in areas at the NNSS that are outside of known mining districts, the following base and precious metals could occur: one small-to-medium-sized precious metal deposit, one or two tungsten skarn deposits and/or polymetallic replacement deposits, and one gold deposit. Possible deposits within known mining districts include the following: (1) a low-to-moderate potential for a precious metal or a porphyry-molybdenum deposit in the Calico Hills mining district (in the northern portion of Area 25), (2) a high potential for gold-silver resources in the Wahmonie district (generally located in Area 26) that could support a moderate-sized mining operation, (3) a high potential for skarn tungsten mineralization and porphyry molybdenum mineralization in the Oak Spring district (in the northeastern portion of the NNSS), and (4) disseminated gold deposits in the Mine Mountain district (generally located in the northwestern portion of Area 6). The Nevada Test and Training Range, including the TTR, has the following known and potential minable mineral deposits: (1) up to three small, low-to-moderate potential base-metal replacement deposits, as well as one Carlin-type gold deposit; (2) a moderate-to-high potential for discovery one or more precious metal deposits in volcanic rocks at any of the 10 established mining districts within the Nevada Test and Training Range; (3) a low-to-moderate potential for small base-metal replacement deposits; and (4) a moderate-to-high potential for small vein deposits of precious metals in parts of the Groom Mountain Range.

Certain commercial activities would not be inconsistent with DOE/NNSA activities at the NNSS. Proposed commercial activities at the NNSS would be subject to the safeguards and security protocols of DOE/NNSA, which could restrict the commercial activities from time to time. Proposals for conducting a commercial activity, such as mineral or oil and gas exploration and extraction on the NNSS, would be evaluated in accordance with DOE/NNSA NSO procedures and, if found to be compatible, could be permitted. In this way, DOE/NNSA could allow the development of commercial projects without hindering its national security activities and continue to protect the offsite public.

Continued mining restrictions on the NNSS and Nevada Test and Training Range would result in the continued exclusion of potential mineral resources from evaluation or extraction. Although the potential exists for extractable minerals and precious metals on the NNSS and Nevada Test and Training Range, extensive exploration and testing would be required to determine whether this potential is realizable and, if so, what the potential quantities of those resources would be. Since 1951, there have been no proposals by any entity to conduct mineral exploration or extraction activities at the NNSS. Therefore, it was not possible to further analyze the impact of restricted access to these potential mineral resources.

As noted in Chapter 4, Section 4.1.5.2.5, the presence of oil deposits at Railroad Valley, about 50 miles north of the NNSS, has led some researchers to hypothesize that large petroleum deposits could be present under similar conditions at the NNSS (Chamberlain 1991). However, Trexler et al. (1996) states that the likeliest formation (Chainman shale) is less extensive than previously thought and may have lost as much as 80 percent of its original hydrocarbon content from migration. Other investigations (Garside et al. 1988; SAIC/DRI 1991) also determined that large-scale hydrocarbon resources would be very unlikely because (1) there are few laterally extensive carbon-bearing formations; (2) the thermal maturity of the region is just within acceptability; and (3) the large fault complexes throughout the NNSS are likely to have fractured the confining bedrock. There are no known surface occurrences of oil, gas, coal, tar, sand, or oil shale at the NNSS, and numerous boreholes drilled at the site have not revealed any hydrocarbon shows within the likeliest formations. Further, since 1951, there have been no proposals by any entity to conduct oil and gas exploration at the NNSS. Because no exploration activities have been conducted, it is not possible to determine whether economically viable oil or gas reserves exist beneath the NNSS or to ascertain the impact of the lack of exploration and/or production.

Disposal of BLM land in Las Vegas Valley could affect access to mineral resources; however, there are no economically viable locatable or leasable minerals located within the disposal area (BLM 2004b). The use of aggregate resources on the NNSS would result in a cumulative impact on regional aggregate supply; however, aggregate resources on the NNSS are more than adequate to meet projected needs. No new sand and gravel operations would be developed within the BLM land disposal area in Las Vegas Valley (BLM 2004b). There are abundant sand and gravel resources available outside of the BLM land disposal area throughout southern Nevada.

6.3.6 Hydrology

6.3.6.1 Surface Water

Aside from seeps and springs, there are no perennial water bodies on the NNSS. Closed basins capture surface runoff for the eastern portion of the NNSS (Frenchman Flat and Yucca Flat). The western and southern portions of the NNSS are within the Amargosa River Basin. The Amargosa River (also known as the Amargosa Arroyo) is atypical of most North American rivers because it seldom flows; runoff is infrequent because much of the basin receives less than 6 inches of precipitation annually (Hardman 1965). The Amargosa River originates in the mountains surrounding Beatty, Nevada, flows through the Amargosa Desert region, and terminates at Bad Water in Death Valley National Park. Most of the river course is underground, but about 17 miles of surface flow exist in the areas of Shoshone, Tecopa, and the Amargosa Canyon in California. This perennial surface flow has created lush riparian and wetland habitats that support endemic and sensitive species such as the endangered Amargosa vole (*Microtus californicus scirpensis*). The Amargosa Canyon contains some of the lusher cottonwood–willow gallery forest in the Mojave Desert (BLM 2006b). Under some conditions, unusually heavy precipitation events can produce sufficient runoff to cause the Amargosa River to have flowing water from its headwaters to its terminus (Tanko and Glancy 2001).

The major tributaries to the northern reach of the Amargosa River are Thirsty Canyon Wash and Beatty Wash, which drain the northwestern part of the NNSS. Major tributaries to the central reach of the Amargosa River are Fortymile Wash, Topopah Wash, Rock Valley Wash, and Carson Slough. Fortymile Wash drains the southern part of Pahute Mesa, the western part of Jackass Flats, and the eastern slopes of Yucca Mountain. Topopah Wash drains the eastern part of Jackass Flats. Rock Valley Wash drains the southernmost part of the NNSS in the Rock Valley basin. Carson Slough drains the Ash Meadows area off the NNSS.

Because the only flows off the NNSS go to the Amargosa River via Fortymile Wash and Topopah Wash, this is the only contribution that is made to regional surface waters from the NNSS. In addition, ephemeral surface flows on the NNSS are infrequent, with no flow in some years, while in other years, flows may occur for only a few days. For example, measurements of stream flows in Fortymile Wash near the NNSS boundary from 2002 through 2004 showed no flow at all (USGS 2002, 2004). In 2003, a discharge of less than 0.1 cubic feet per second was measured as the yearly maximum, and the flow was not sufficient to measure a water height (USGS 2003).

In the southwestern portion of Area 25, this *NNSS SWEIS* assumed development of 100 to 1,000 megawatts of commercial solar power generation in the Renewable Energy Zone. These renewable energy activities would result in disturbance of about 1,200 to about 10,300 acres of land by construction activities in the short term and covered by solar-power-related facilities in the long term. During the construction period, land surface disturbance would likely result in some erosion of soil into Fortymile and Topopah Washes, although implementation of best management practices would minimize this impact. Once construction is complete, soil erosion and movement of any contaminants from the solar sites would be controlled by a combination of engineered features, such as berms, as well as implementation of administrative measures such as spill control plans. As part of the reclamation activities at the former Yucca Mountain Repository site, DOE would recontour the landscape to match its precharacterization conditions, ensuring natural drainage patterns. Adherence to best management practices, such as stormwater pollution prevention plans, would ensure that cleared areas and exposed earth would be seeded, graveled, or paved to control runoff and minimize soil erosion. Any sediment or contamination that reaches either Fortymile Wash or Topopah Wash from DOE/NNSA activities at the NNSS or remediation of the former Yucca Mountain Repository site potentially could be transported off the NNSS. This would have a cumulative impact on erosion from other developed areas, such as Nye County's proposed Yucca Mountain Project Gateway Area development and other renewable energy projects, that would disturb up to 94,300 acres in the drainage area of the Amargosa River in southern Nevada and increase the potential for erosion during the construction period; however, implementation of best management practices would minimize this impact.

In addition to the areas affected by the proposed actions analyzed in this SWEIS, a number of areas of the NNSS contain radioactive and/or chemical contaminants from past tests and experiments. These contaminated sites are discussed in detail in Chapter 5, Section 5.1.6.1. Because of the low potential for flooding, minimal flows from the NNSS, use of engineered flood control features, and condition of the contaminated sites on the NNSS, there is a negligible potential for existing onsite contamination to be transported off site via surface water or flood events to affect offsite areas such as the Amargosa River or Death Valley National Park.

6.3.6.2 Groundwater

Past underground nuclear testing resulted in a cumulative impact on groundwater under the NNSS. From 1951 to 1992, 828 underground nuclear tests were conducted at the NNSS. Most were conducted hundreds of feet above the groundwater table; however, about one-third of these tests were detonated in proximity of or within the water table in the saturated zone (DOE/NV 2010). These underground tests were conducted primarily on Pahute Mesa, Rainier Mesa, Frenchman Flat, and Yucca Flat (see **Figure 6–2**). Between 1965 and 1992, 82 underground nuclear tests were conducted in deep vertical boreholes on Pahute Mesa. Sixty-four of these tests were conducted on Central Pahute Mesa and 18 on Western Pahute Mesa (SNJV 2006). In the Frenchman Flat area, 10 underground tests were conducted (Navarro-Intera 2010b). In a 2001 report, scientists from Los Alamos National Laboratory and Lawrence Livermore National Laboratory calculated the underground inventory of radionuclides resulting from underground nuclear testing at the NNSS between 1951 and 1992 (Bowen et al. 2001). That report estimated the remaining underground inventory of radionuclides as of September 23, 1992 to be about 132 million curies. A general description of underground nuclear testing and its effects is provided in Appendix H.

As discussed in Chapter 4, Section 4.1.6.2, DOE/NNSA's Underground Test Area (UGTA) Project was established to assess and evaluate the effects of underground nuclear tests on local and regional groundwater through the Federal Facilities Agreement and Consent Order (FFACO). In compliance with the FFACO and in consultation with the Nevada Division of Environmental Protection (NDEP), the UGTA currently uses 89 wells to obtain characterization data (63 on the NNSS, 11 on the Nevada Test and Training Range, and 15 on public land) and will construct additional wells as needed. The purpose of these wells is to obtain data to improve understanding of groundwater flow paths, flow velocities, and transport of radioactive contamination resulting from underground nuclear testing. As new information is obtained, DOE/NNSA, in consultation with NDEP, identifies new locations for characterization and monitoring wells. The ultimate purpose of the UGTA Project is to evaluate whether there is a potential risk to the public from contaminated groundwater or radionuclide migration off the NNSS.

The UGTA has established five corrective action units (CAUs) for system characterization and preparation of groundwater flow and transport models: (1) Yucca Flat-Climax Mine (CAU 97), (2) Frenchman Flat (CAU 98), (3) Rainier Mesa-Shoshone Mountain (CAU 99), (4) Central Pahute Mesa (CAU 101), and (5) Western Pahute Mesa (CAU 102). Of these CAUs, Western Pahute Mesa is the only one at which radioactive contamination has been detected off the NNSS. In October 2009, DOE/NNSA recorded the first detectable amount of underground nuclear testing-related tritium in the newly constructed groundwater characterization well ER-EC-11, located less than one-half mile off the NNSS on lands managed by the USAF as part of the Nevada Test and Training Range (DOE/NV 2010). The results showed the level of tritium in the groundwater at that location to be about 12,000 picocuries per liter, i.e., about 60 percent of the U.S. Environmental Protection Agency (EPA) National Drinking Water Standard of 20,000 picocuries per liter. Groundwater beneath Pahute Mesa generally flows in a southwesterly direction, primarily through fractures in lava-flow and welded tuff aquifers. The ER-EC-11 characterization well is located along the interpreted groundwater flow path from western Pahute Mesa (NSTec 2010k; SNJV 2006). As shown in Figure 6–2, well ER-EC-11 is located about 14 miles from the nearest public or private water supply well along the expected primary groundwater flow path from studied testing areas on western Pahute Mesa.

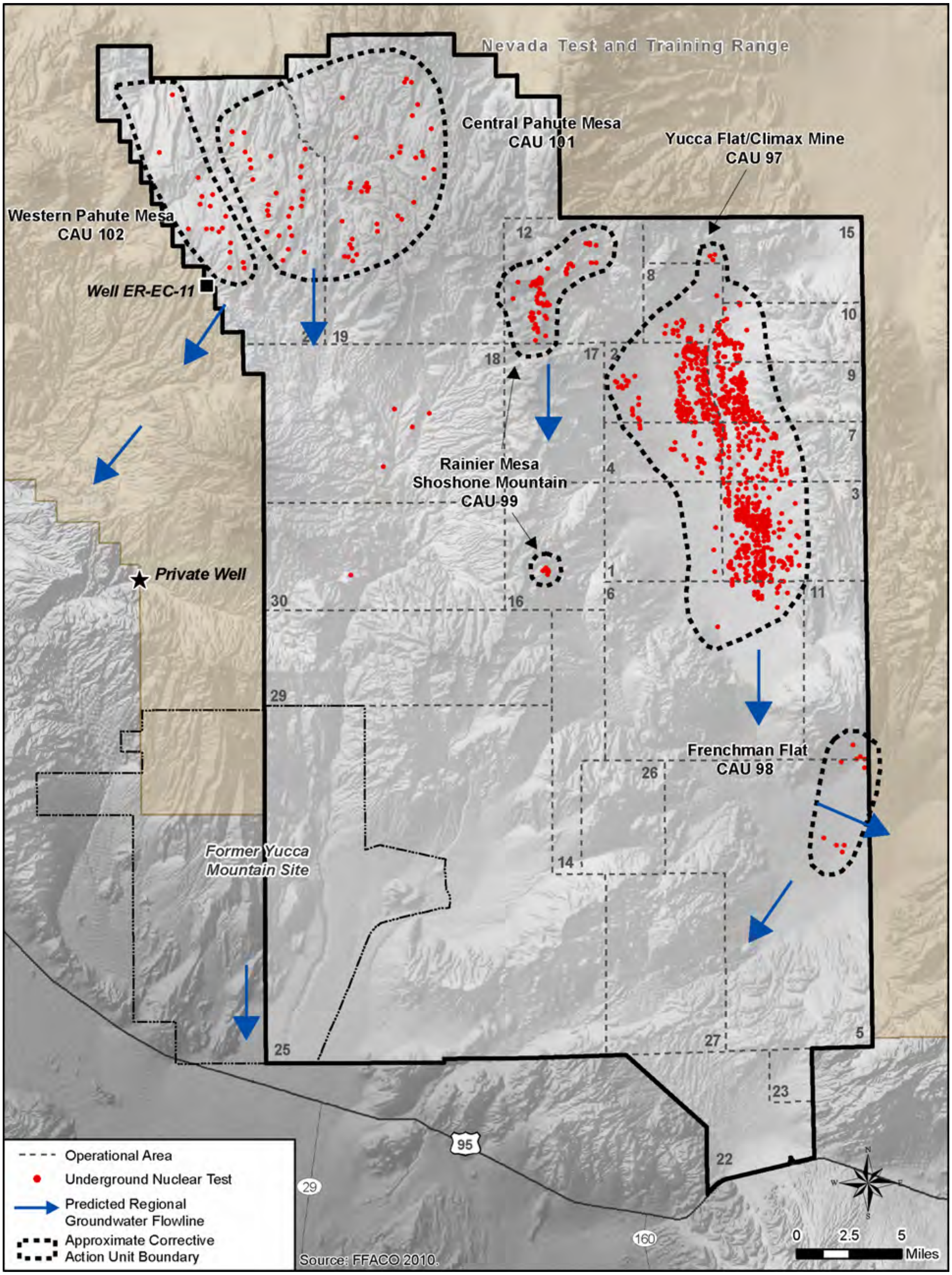


Figure 6–2 Location of Underground Test Area Corrective Action Units, Projected Groundwater Flow Directions, Characterization Well ER-EC-11, and the Nearest Private Water Well

It is difficult to reasonably estimate the volume of groundwater that may have some level of radionuclide contamination resulting from past underground nuclear testing. However, to date, the only radioactively contaminated groundwater that has been detected outside of the boundaries of the NNSS is that mentioned above, which meets EPA national drinking water standards. Because tritium is an isotope of hydrogen, it combines readily in water, is mobile in groundwater, and probably moves at the approximate velocity of groundwater flow.

A Phase I transport model has been completed for the Western and Central Pahute Mesa CAUs (SNJV 2009); however, this model still requires development prior to defining contaminant boundaries for these CAUs. The Phase I transport model needs to address a considerable amount of uncertainty regarding groundwater flow rates and direction and contaminant transport for the Pahute Mesa CAUs. Nevertheless, because tritium has been detected in an offsite characterization well, some discussion is warranted. Groundwater travel times for various flow paths between Pahute Mesa and Oasis Valley were estimated using variations in carbon and radioactive carbon isotopic values in 2002 (Rose et al. 2002). In that study, travel times for all flow paths between Pahute Mesa and Oasis Valley were estimated to range from less than 1,000 years to over 3,900 years. In the 2009 transport model study for Pahute Mesa-Oasis Valley, travel times for flow paths were estimated based on radioactive carbon data (SNJV 2009). Travel time for groundwater was calculated for one segment of a flow path (from well U-20-WW in east-central Pahute Mesa to characterization well ER-EC-6, located a short distance west of the NNSS on the Nevada Test and Training Range), yielding estimated travel times of about 3,264 years (with 95 percent confidence limits of 337 to 6,191 years). Contaminant transport in groundwater is a very complex problem; however, for the purpose of providing an example, a simple calculation may be used. The length of the flow path segment just noted is about 5.7 miles (30,096 feet). By assuming a straight-line flow path, groundwater velocity may be estimated by dividing the length of the flow path segment by the travel time, which yields about 9.2 feet per year (30,096 feet/3,264 years = 9.2 feet per year), with a range from 4.8 feet per year (6,191 year travel time) to 89 feet per year (337 year travel time). As noted, there is considerable uncertainty in this flow rate. In order to help resolve this uncertainty, DOE/NNSA, in consultation with NDEP, is developing additional characterization wells to obtain additional data to help refine Phase I model predictions for groundwater flow and transport.

DOE/NNSA completed a Phase II transport model for the Frenchman Flat CAU, and contaminant boundaries have been established. **Figure 6–3** depicts the modeled contaminant boundary in 1,000 years for the Frenchman Flat CAU. As that figure shows, groundwater contamination from underground nuclear tests conducted in the Frenchman Flat area are not expected to be transported any appreciable distance off of the NNSS and would not threaten any current water sources available to the public or used by livestock or wildlife.

Because some of the groundwater beneath the NNSS is thought to flow in a southwesterly direction and surface in the Amargosa River Valley or in Death Valley, there is a potential for impacts on springs and seeps from radioactive contamination. As discussed above, based on the most current understanding of groundwater flow rates and directions and modeling of contaminant transport, it is unlikely that any radioactive contamination from the NNSS would reach Death Valley in the reasonably foreseeable future.

Cumulative impacts on groundwater availability and quality may result from activities at DOE/NNSA facilities in Nevada. RSL and NLVF acquire water from Nellis Air Force Base and Las Vegas Valley Water District, respectively (see Chapter 4, Sections 4.2.2.2 and 4.3.2.2, respectively, for additional information). The water demand by these facilities is a very small proportion of the overall water demand in the Las Vegas region and contributes minimally to the cumulative impact on that system.

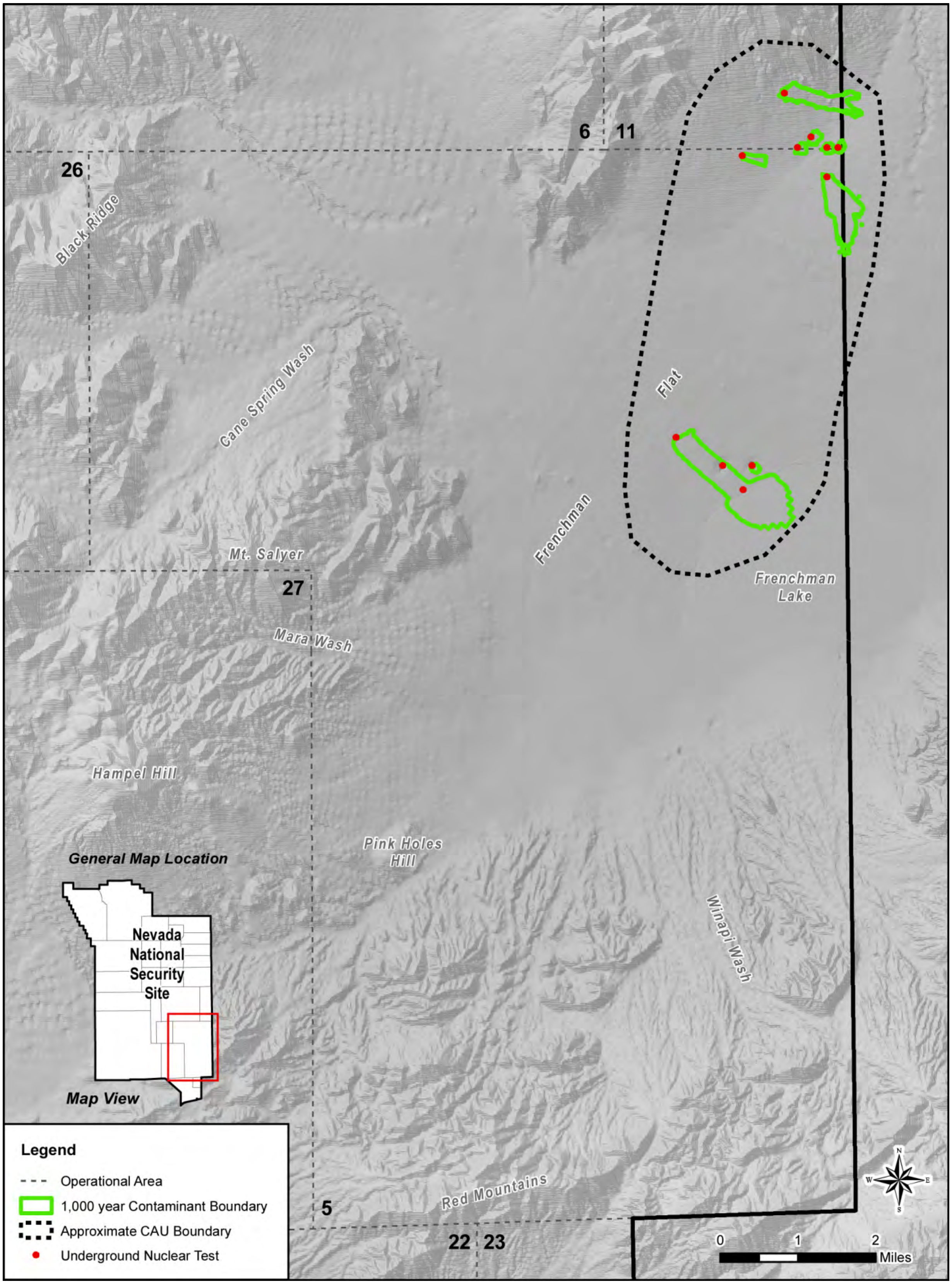


Figure 6–3 Modeled Extent of the Contaminant Boundary in the Frenchman Flat Corrective Action Unit in 1,000 Years

This cumulative impacts analysis considers groundwater contamination resulting from past underground nuclear testing but also considers potential impacts associated with the proposed actions addressed in this SWEIS. Proposed activities that would release chemicals and/or radiological materials to the soil or underground environment include disposal of LLW and MLLW, radiological tracer experiments, and chemical release experiments. These activities would all occur well above the water table, which is hundreds to thousands of feet below the ground surface at all locations on the NNSS. The NNSS is located in a very arid region with low precipitation and high rates of evapotranspiration, which result in a net upward movement of soil moisture in the upper portion of the vadose zone (NSTec 2011a). As noted in Chapter 5, Sections 5.1.6.2.1 and 5.1.6.2.2, a number of factors would preclude contamination of the groundwater beneath the NNSS from activities that release chemicals and/or radiological materials, including containment measures and/or aboveground nature of most experiments, depth to groundwater, operational controls, and groundwater monitoring programs.

As described in Chapter 4, Section 4.1.11.1.1.3, DOE/NNSA disposes of radioactive waste at the NNSS and, in accordance with DOE requirements, conducts analyses of possible long-term (over thousands of years) impacts on the public and environment after the disposal facilities are closed, i.e., performance assessments and composite analyses. Chapter 5, Section 5.1.12.1.4, notes that these analyses for radioactive waste disposal sites on the NNSS determined that, because of site-specific factors such as the predominance of evapotranspiration over precipitation, there is little or no potential for transport of disposed radionuclides to the groundwater. Further, the Intergovernmental Panel on Climate Change Fourth Assessment Report, *Climate Change 2007* (IPCC 2007a), estimates that, although increases in precipitation extremes (such as storms associated with "El Niño" events) are possible for the Great Basin, annual-mean precipitation is projected to decrease in the southwest United States (IPCC 2007b). This would tend to make it even more unlikely that a path to groundwater would develop in the future. Support for this conclusion may be found in DOE/NNSA's monitoring program for the Area 3 Radioactive Waste Management Site (RWMS) and Area 5 RWMC. Since 1993, DOE/NNSA has been conducting groundwater monitoring at pilot wells at the Area 5 RWMC (annual groundwater reports are available at the Office of Scientific and Technical Information [www.osti.gov] and the DOE/NNSA NSO website [www.doe.nv.gov]). Lysimeters have been used to monitor the vadose zone (the zone of aeration in the upper levels of the soil) since 1994 at two locations at the Area 5 RWMC; since 1999 at a few disposal cells at the Area 5 RWMC; since 2001 at the closed mixed waste cell (U3-ax/bl) at the Area 3 RWMS; and since 2004 at eight drainage lysimeters at the Area 3 RWMS. Annual summary reports since 2004 are available online at the Office of Scientific and Technical Information and DOE/NNSA NSO websites. Cumulative monitoring results of the vadose zone are summarized in annual waste management monitoring reports. Monitoring of the vadose zone at waste pits, covers, and lysimeters shows no percolation below the root zone (about 6 feet). Precipitation infiltrating into the root zone is taken by evapotranspiration, i.e., water movement in the upper few meters of alluvium occurs by root uptake, liquid advection, thermal vapor transport, and isothermal vapor transport. Upward liquid fluxes dominate at depth through the waste zone at both facilities. Of particular note in relation to the likelihood of an "El Niño" event creating a pathway to groundwater, a 25-year, 24-hour storm occurred in February 1998, and several short-duration, high-intensity storms occurred during September 2007 and December 2010. None of these precipitation events resulted in producing a pathway to groundwater.

The NNSS and TTR are located in different groundwater basins (Death Valley Basin and Central Region, respectively), and there is likely not a groundwater connection between them. Because of their geographical proximity, however, their combined use of groundwater, together with that of other ongoing and reasonably foreseeable uses, could have cumulative impacts on overall groundwater availability in southern Nevada. The cumulative analysis for groundwater availability is focused on locations either up- or down-gradient from the NNSS and the TTR. The NNSS and the TTR both acquire potable and nonpotable water from onsite water wells (see Chapter 4, Sections 4.1.2.2 and 4.4.2.2, respectively, for more information). **Table 6–6** shows potential groundwater demand at the NNSS and the TTR under the Expanded Operations Alternative.

Table 6–6 Annual Cumulative Water Demand at the Nevada National Security Site and the Tonopah Test Range Under the Expanded Operations Alternative

	NNSS	***TTR*** [a]	***Total***
Sustainable Site Capacity (acre-feet)	5,844 to 8,964	200	6,044 to 9,164
Operational Water Requirements [b] (acre-feet)	1,562	18	1,580
Percent of Sustainable Site Capacity	17.4 to 26.7	9.0	17.2 to 26.1

NNSS = Nevada National Security Site, TTR = Tonopah Test Range.
[a] TTR sustainable site capacity is based on water appropriations rather than the perennial yield of the underlying hydrographic basins. TTR water requirements include both DOE/NNSA and U.S. Air Force uses.
[b] Total water demand for the NNSS includes assumed operation of 1,000 megawatts of commercial power generation.
Note: 1 acre-foot of water is equal to 325,851 gallons.
Source: Chapter 4, Table 4–29, and Chapter 5, Table 5–21.

Proposed activities under the Expanded Operations Alternative at the NNSS and the TTR would cumulatively use up to 1,580 acre-feet of water each year, assuming operation of up to 1,000 megawatts of commercial solar power generation in Area 25 of the NNSS. While the water used by DOE/NNSA at the NNSS and the TTR would not be available for use by others, such DOE/NNSA water use would not preclude down-gradient uses of an aquifer by others because DOE/NNSA activities would only use a maximum of 17.2 to 26.1 percent of the sustainable capacity.

The town of Beatty, Nevada, is located to the west and downgradient of the northwestern portion of the NNSS. During 2006, the annual water use for Beatty was about 138,210,050 gallons (BWSD 2008), or approximately 424 acre-feet. The town of Beatty is situated in the Oasis Valley Hydrographic Basin, and most of its water is assumed to be withdrawn from that basin. DOE/NNSA does not withdraw any groundwater from the Oasis Valley Hydrographic Basin but it is assumed that groundwater flows from the Gold Flat and Fortymile Canyon–Buckboard Mesa Hydrographic Basins into that basin. Of these two basins, DOE/NNSA would withdraw about 53 acre-feet of groundwater (about 1 percent of the sustainable yield of the basin) from the Fortymile Canyon–Buckboard Mesa Hydrographic Basin.

As shown in Table 6–2, proposed renewable energy projects within the cumulative impacts ROI in southern Nevada would require almost 5,400 acre-feet per year of water for operations. However, only four of the proposed projects have either completed the BLM permitting process or are actively pursuing a land use permit. If only those four projects were considered, the total water use would be only about 2,800 acre-feet per year.

The volume of potential groundwater withdrawn for use at the NNSS and the TTR, as well as by the town of Beatty and for proposed renewable energy projects, would represent from about 4,800 acre-feet per year to over 7,300 acre-feet per year of groundwater withdrawals. These combined withdrawals could represent a significant impact on the groundwater resource. As discussed below, the total amount of groundwater rights currently approved in the Amargosa Desert Hydrographic Basin is not likely to increase due to implementation of Nevada State Engineer Order 1197.

The majority of reasonably foreseeable future actions that could have cumulative groundwater impacts associated with DOE/NNSA actions at the NNSS and TTR are solar energy developments on Federal lands in the Amargosa Desert Hydrographic Basin and are generally downgradient from the NNSS. The inferred northern boundary of the Amargosa Desert Hydrographic Basin in the vicinity of the NNSS generally follows the southern boundary of the NNSS. Nevada State Engineer Order 1197 states in part, "…any applications to appropriate additional underground water and any application to change the point of diversion of an existing ground-water right to a point of diversion closer to Devils Hole, described as being within a 25-mile radius from Devils Hole within the Amargosa Desert Hydrographic Basin, will be denied." For any project needing a stable water supply within the area subject to Nevada State Engineer Order 1197, the developer would need to either lease or purchase water currently being pumped under an existing certified water right. As the water user can only pump up to the authorized duty of the water right, there would be no net increase in groundwater pumping within the basin. Converting agricultural water rights to industrial water rights could reduce return flow (recharge) from irrigation because the water would be used primarily for cooling instead of being applied to the ground, as it would if used for irrigation of crops.

As of September 2010, only two proposed solar projects within the Amargosa Desert Hydrographic Basin, the Lathrop Wells Solar Facility and Amargosa North Solar Project, had reached the Federal permitting stage (BLM 2010a), and only the Amargosa Farm Road Solar Energy Project had been approved by BLM (BLM 2010i). Information about each project's water needs is limited. However, based on industry standards, it is anticipated that the two projects using parabolic trough concentrating solar technology, the Amargosa Farm Road Solar Energy Project and the Lathrop Wells Solar Facility, would require about 400 acre-feet and 200 to 405 acre-feet of water per year, respectively. The Amargosa North Solar Project, a multiphase photovoltaic project, would require substantially less water (5 to 10 acre-feet per year) (BLM 2010a). The water used for the three solar projects would result in a conversion of almost 1,000 acre-feet per year of existing water rights from their current permitted use to industrial use.

In addition to converting existing water rights from their current use to use in a solar energy project, the Amargosa Farm Road Solar Energy Project was required, as mitigation, to acquire no less than 236 acre-feet per year of water rights to hold in abeyance (BLM 2010i). To avoid significant impacts on water resources, both resulting from an individual project and in terms of cumulative impacts of multiple projects, it is likely that NPS, USFWS, and BLM would require other solar developers to agree to water mitigation measures like those required for the Amargosa Farm Road Solar Energy Project. This may result in additional groundwater being retired or held in abeyance until it can be proven that its use would not affect sensitive resources at Ash Meadows National Wildlife Refuge or Devils Hole. No net increase (and a possible decrease) in water usage resulting from these restrictions would avoid significant cumulative impacts on water resources and potential impacts on sensitive species. However, because water must be obtained from an existing water right holder and there are limited senior water rights within the basin, implementation of such measures would reduce the amount of water that is available for other uses, which might constrain other types of economic development in the region.

Because new water rights would not be granted to potential or proposed projects that would be located within the Amargosa Desert Hydrographic Basin, there would be no cumulative impacts from DOE/NNSA's use of groundwater at the NNSS. Further, the likely requirement that future projects acquire existing water rights in addition to their needs and hold those rights in abeyance will reduce the overall potential use of groundwater resources in the Amargosa Desert Hydrographic Basin and result in net positive cumulative impacts on those resources; however, as noted above, this requirement could constrain some types of development in the region.

As described in Chapter 4, Section 4.1.6.2, Groundwater, there are 10 hydrographic basins underlying the NNSS. The total available, or uncommitted, groundwater within these 10 basins is estimated to be in excess of 32,000 acre-feet per year. In addition, there over 1,800 acre-feet per year are committed to non-DOE/NNSA users. DOE/NNSA withdraws water for use on the NNSS from 4 of the 10 hydrographic basins: Yucca Flat, Frenchman Flat, Fortymile Canyon–Buckboard Mesa, and Fortymile Canyon–Jackass Flats). As noted in Table 6–6, there are conservatively about 5,844 acre-feet per year of groundwater available in the four hydrographic basins that currently provide the source for water on the NNSS. Under the Expanded Operations Alternative, DOE/NNSA would use up to 1,562 acre-feet per year, or less than 27 percent, of that available groundwater. Theoretically, this would leave 4,282 acre-feet per year available for other uses. Because the NNSS is a secure facility and may not be accessed by the public, non-DOE/NNSA access to available resources is precluded. Therefore, to use groundwater that flows beneath the NNSS, a potential user would need to withdraw that resource at a down-gradient point off the NNSS. DOE/NNSA, along with other Federal agencies involved in land and resource management in the region (i.e., BLM, USFS, and NPS), have for various reasons protested applications for water withdrawals by others. In DOE/NNSA's case, the protests were based on the need to protect its Federal reserve water rights where the requested withdrawals could affect those rights. To date, it has not been demonstrated that lack of access to NNSS groundwater has adversely affected development in the region. However, it is possible that the restrictions imposed on future groundwater withdrawals within the Amargosa Desert Hydrographic Basin by Nevada State Engineer Order 1197, combined with a lack of access to other sources of water, could constrain certain types of development.

6.3.7 Biological Resources

Cumulative impacts on desert tortoises would occur throughout the region, although the intensity of the impacts would vary from location to location depending on the habitat. Under the Clark County MSHCP, 145,000 acres out of an estimated 4,000,000 acres of desert tortoise habitat may be developed for other purposes, equal to approximately 3.6 percent of available desert tortoise habitat in Clark County (USFWS 2000). USFWS is evaluating a proposal by the permitted parties to amend the permit to increase the take of covered species on 215,000 additional acres (74 FR 50239) (for more information regarding the Clark County MSHCP, see Section 6.2.3.2). If approved as requested, the modified permit would be for a period of 50 years and allow for incidental take on about 360,000 acres, or about 9 percent of available desert tortoise habitat in the county. The Las Vegas Valley does not have large "islands" of habitat capable of sustaining viable desert tortoise populations; such habitat is randomly dispersed across the valley, and the tortoises are unable to move between habitat areas in most cases. As a result, this loss of habitat is not expected to jeopardize the continued existence of the Mojave population of the desert tortoise.

Within Nye County, desert tortoise habitat would be affected by a number of reasonably foreseeable future actions. The development of solar energy projects would remove up to about 131,500 acres of desert tortoise habitat (the two geothermal projects and the Crescent Dunes Solar Energy Project are located outside of the range of the desert tortoise), and development of the Nye County Yucca Mountain Project Gateway Area would remove up to 5,800 acres. Although some desert tortoises may be affected by remediation of the former Yucca Mountain Repository site, once completed, about 350 acres of tortoise habitat would again be available for use by that species.

DOE/NNSA activities at the NNSS would affect up to 3,300 acres of desert tortoise habitat. Development of up to 1,000 megawatts of solar power electric generation and associated transmission lines would affect an additional approximately 10,300 acres of tortoise habitat. Up to 507,600 acres of desert tortoise habitat in southern Nevada could be impacted by activities related to DOE/NNSA and other reasonably foreseeable future actions in Clark and Nye Counties.

Between August 1996 and February 2009, DOE/NNSA activities at the NNSS were covered under a Biological Opinion issued by USFWS (USFWS 1996). In February 2009, USFWS issued a new Biological Opinion for the NNSS (USFWS 2009a). Both of these Biological Opinions concluded that, under the terms and conditions set forth, the proposed DOE/NNSA activities would not likely jeopardize the continued existence of the Mojave population of the desert tortoise and no critical habitat would be destroyed or adversely modified (DOE/NV 2009d). DOE/NNSA established a Desert Tortoise Compliance Program to implement the terms and conditions applicable under any Biological Opinion (DOE/NV 2009d). The Desert Tortoise Compliance Program documents compliance actions taken under the Biological Opinion, conducts pre-activity surveys of potentially disturbed areas within the distribution range of the desert tortoise on the NNSS, and assists the DOE/NNSA NSO in consultations with USFWS.

Table 6–7 shows the Biological Opinion compliance measures and cumulative impacts between 1992 and 2008.

Table 6–7 Cumulative Incidental Take and Desert Tortoise Habitat Disturbance from 1992 to 2008 at the Nevada National Security Site

Compliance Measure	*Threshold Value from 1996 NNSS Biological Opinion*	*Cumulative Total* [a]
Number accidentally injured or killed due to NNSS activities	3 per year	0
Number captured and displaced from NNSS project sites	10 per year	102
Number taken by injury or mortality on paved roads on the NNSS by vehicles other than those in use during a project	Unlimited	12
Number of acres of habitat disturbed by NNSS project construction	3,015 acres	311.46 acres

NNSS = Nevada National Security Site.
[a] Cumulative totals were derived from Table 2 of USFWS 2009a.

Between 1992 and the end of 2008, a cumulative total of about 312 acres was disturbed, or about 10.3 percent of allowable disturbance of tortoise habitat and less than 0.1 percent of the 328,400 acres of desert tortoise habitat on the NNSS. Overall, about 7,350 acres, or 2 percent of NNSS land within desert tortoise range, have been disturbed in the past by construction of facilities and infrastructure and other activities. Disturbance of desert tortoise habitat by DOE/NNSA activities is mitigated in one of two ways. Between 1992 and 2004, DOE/NNSA paid a designated dollar amount into the Clark County Desert Conservation Fund for each acre, or portion thereof, of desert tortoise habitat that was disturbed on the NNSS. Since 2005, with USFWS's approval, DOE/NNSA has, as an alternative to payment into the conservation fund, reclaimed previously disturbed areas of tortoise habitat. Between 2005 and the end of 2007, 67.11 acres of desert tortoise habitat were disturbed and 14.08 acres were reclaimed under this program.

In addition to cumulative impacts on the desert tortoise through direct impacts and indirectly through conversion of habitat into solar power generation facilities, commercial/industrial uses, or other potential activities, other species of wildlife, as well as vegetation, would be subject to cumulative impacts. The development of about 535,750 acres of land in the region would cumulatively affect wildlife and wildlife habitat, although remediation of the former Yucca Mountain Repository site would provide about 350 acres of reclaimed wildlife habitat. While it is not likely that all of the projects addressed in Section 6.2 would be implemented, the loss of large areas of habitat could have a number of adverse cumulative effects. These adverse effects would include reduction of the available habitat for native wildlife; federally listed species such as the desert tortoise; and other special status species, such as Le Conte's thrasher and burrowing owl. Cumulative impacts would contribute to the loss, fragmentation, and degradation of Mojave Desert scrub habitat, which would result in impacts on habitat connectivity, the genetic integrity of wildlife populations, and wildlife movement corridors, as well as fragmentation of species populations, significant alteration of natural riparian habitat and function, and loss of occupied habitat for a variety of animals. Cumulative impacts would also encourage nonnative invasive species of plants, thereby eliminating or degrading natural plant communities on which wildlife depend. Wildlife species occupying small, isolated patches of habitat are more susceptible to disturbance than species that are more widely distributed over the landscape.

As part of the Expanded Operations Alternative in this *NNSS SWEIS*, use of depleted uranium with explosives in up to three locations and radioisotope tracer experiments could add an increment of radioactive contamination at the NNSS. The radioisotopes used in the tracer experiments would have very short half-lives and would not likely have any cumulative impact with existing radioactive contamination at the NNSS. Experiments involving detonations of explosives in combination with depleted uranium would add a small increment of added radioactive contamination in the soil at specific locations on the NNSS. As noted in Chapter 5, Section 5.1.7.2.2, inhalation is the most likely pathway for depleted uranium to be internalized in wildlife. In general, wildlife species do not have sufficiently long enough life spans to experience the adverse effects of inhaling depleted uranium (damage to lung cells and an increase in the possibility of lung cancer) therefore, there would be no additional impacts on NNSS wildlife populations.

Perhaps the longest-lived species of wildlife that inhabits the NNSS is the desert tortoise. Given its long lifespan, it is conceivable that inhaled radioactive particles could cause cancer in affected desert tortoises. Although there have been studies of impacts of radionuclides on vegetation and wildlife at the NNSS and DOE/NNSA is conducting ongoing monitoring, as noted in Chapter 4, Section 4.1.7.5 and 4.1.7.5, there is no specific data addressing the desert tortoise. However, the only area on the NNSS within desert tortoise habitat where there is radiological contamination in the soil is Frenchman Flat, which provides very poor habitat for the species. Because radioactive contamination within the range of the desert tortoise on the NNSS is in poor habitat for the species and proposed experiments using depleted uranium in combination with explosives would be conducted only in the more northerly portions of the NNSS and outside of desert tortoise habitat, there would be no cumulative impact on that threatened species.

6.3.8 Air Quality and Climate

The analysis criterion for cumulative impacts on air quality and climate is the potential for emissions of criteria or hazardous air pollutants to contribute to or create a nonattainment with applicable National Ambient Air Quality Standards (NAAQS). Based on that threshold, only DOE/NNSA-related emissions sources in Clark County received detailed analysis. Greenhouse gas emissions were also analyzed for cumulative impact.

6.3.8.1 Criteria and Hazardous Air Pollutants

Table 6–8 displays the criteria and hazardous air pollutants emissions that would be generated by DOE/NNSA activities in Nevada, including those that are unregulated, such as employee commuting, vendor transportation, and shipments of waste to or from the NNSS.

Table 6–8 Criteria and Hazardous Air Pollutants from All Sources; Total Emissions for U.S. Department of Energy/National Nuclear Security Administration Operations in Nevada Under the Expanded Operations Alternative

Pollutant	*NNSS* [a]	*RSL* [b]	*NLVF* [c]	*TTR* [d]	*Total DOE/NNSA* [e]
	(tons per year)				
PM_{10}	20.1	0.084	0.44	<3.8	24.42
$PM_{2.5}$	8.1	0.067	0.28	<3.8	12.25
Carbon monoxide	160.9	4.1	30.5	<6.1	201.60
Nitrogen oxides	56.6	1.6	7.2	<14.8	80.20
Sulfur dioxide	1.1	0.034	0.095	<0.92	2.15
Volatile organic compounds	11.0	~0.3	0.096	<1.1	12.50
Lead	~0.010	~0.01	<0.01	<0.01	0.04
Criteria Pollutant Total	**249.7**	**~6.1**	**39.2**	**<26.8**	**321.80**
Hazardous air pollutants	~0.53	~0.19	0.078	<1.1	1.90

< = less than; NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; RSL = Remote Sensing Laboratory; TTR = Tonopah Test Range.
[a] From Chapter 5, Table 5–37.
[b] From Table 5–58.
[c] From Table 5–62.
[d] From Table 5–68.
[e] Values rounded.

Cumulative diesel emissions from DOE/NNSA sources in southern Nevada in 2015 were estimated to be about 3.3 tons per year. This estimate was derived by summing PM_{10} and $PM_{2.5}$ [particulate matter with an aerodynamic diameter less than or equal to 10 and 2.5 micrometers, respectively] emissions for commercial vendors and trucks transporting radioactive waste, all of which were assumed to be powered by diesel engines, from Chapter 5, Tables 5–32, 5–50, 5–56, and 5–58.

6.3.8.1.1 Nye County

DOE/NNSA activities at the NNSS and the TTR would produce emissions of criteria and hazardous air pollutants in Nye County, as shown in **Table 6–9**. DOE/NNSA estimated potential emissions of criteria air pollutants for operations of a GTCC disposal facility at the NNSS, which is one of the alternative sites being considered for such a facility (DOE 2011a). The estimated annual emissions of air pollutants from DOE/NNSA activities at the NNSS and TTR, combined with those of a GTCC disposal facility, are shown in Table 6–9.

Table 6–9 Current and Projected Annual Emissions of Criteria and Hazardous Air Pollutants in Nye County, Nevada, from Activities Associated With the Nevada National Security Site and the Tonopah Test Range Under the Expanded Operations Alternative Compared with Current Reported Criteria Air Pollutant Emissions in Nye County

Pollutant	*NNSS 2008 Actual Emissions (tons per year)* [a]	*TTR 2008 Actual Emissions (tons per year)* [a]	*Total 2008 DOE/NNSA Air Emissions in Nye County (tons per year)*	*Total Air Emissions in Nye County in 2008 (includes DOE/NNSA Emissions) (tons per year)* [b]	*Projected Total DOE/NNSA Air Emissions in Nye County (tons per year)* [c]
PM_{10}	2	4	6	2,752	23
$PM_{2.5}$	2	4	6	471	11
CO	83	13	96	11,675	82
NO_x	36	20	56	1,247	50
SO_2	1	1	2	90	2
VOCs	3	2	5	2,016	10
Lead	0.001	0.04	0.04	0	0.2
HAPs	0.03	1	1	NR	1

CO = carbon monoxide; HAP = hazardous air pollutant; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; NR = not reported; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; TTR = Tonopah Test Range; VOC =volatile organic compound.

[a] Emissions taken from Chapter 4, Tables 4–40 and 4–71; numbers are rounded and may not match original tables.

[b] Nye County criteria air emissions source: U.S. Environmental Protection Agency "State and County Emissions Summaries" (www.epa.gov/air/emissions/where.htm).

[c] Projected emissions from Chapter 5, Tables 5–38 and 5–69; numbers for each pollutant are summed and rounded.

Cumulative diesel emissions from DOE/NNSA sources in Nye County in 2015 were estimated to be about 2.6 tons per year. This estimate was derived by summing PM_{10} and $PM_{2.5}$ emissions for commercial vendors and trucks transporting radioactive waste, all of which were assumed to be powered by diesel engines (see Chapter 5, Tables 5–32, 5–56, and 5–58).

Table 6–10 compares the total estimated annual air emissions from DOE/NNSA activities at the NNSS and TTR resulting from operation of a GTCC disposal facility and all proposed solar energy projects shown in Table 6–2 with similar emissions within Nye County in 2008, using the most recent available data on the EPA "State and County Emissions Summaries" (www.epa.gov/air/emissions/where.htm). Due to the large geographic area these projects occupy and the minimal emissions expected, these projects would have minor impacts both individually and cumulatively. Most of the cumulative impacts on air quality from the projects listed in Table 6–10 would be from renewable energy facilities, which could potentially displace electricity generation that otherwise likely would occur with higher-polluting fossil fuels. Although there would be air quality impacts associated with remediation of the former Yucca Mountain Repository site, they would be temporary, occurring over the course of about 1 year, and there would be no post-remediation man-caused air emissions associated with the site.

Nye County has been designated by EPA as an attainment/nondesignated area for purposes of compliance with NAAQS. The projected cumulative levels of air pollutant emissions shown in Table 6–10 are not considered to be sufficient to precipitate a change in Nye County's designation relative to NAAQS.

Table 6–10 Cumulative Estimated Emissions of Criteria Air Pollutants from U.S. Department of Energy/National Nuclear Security Administration Facilities and Major Reasonably Foreseeable Future Actions in Nye County, Nevada

Pollutant	*Projected Total DOE/NNSA Air Emissions in Nye County (tons)* [a]	*Projected Annual Air Emissions from GTCC Operations (tons)* [b]	*Projected Annual Air Emissions from All Solar Energy Projects Proposed in Nye County (tons)* [c]	*Cumulative Total Criteria Air Pollutant Emissions (tons)*
PM_{10}	23	2.5	576.2	601.7
$PM_{2.5}$	11	2.2	67.9	81.1
CO	82	15	40.3	137.3
NO_x	50	27	39.1	116.1
SO_2	2	3.3	8.1	13.4
VOCs	10	3.1	27.6	40.7
Lead	0.2	Not reported	Not reported	0.2

CO = carbon monoxide; GTCC = greater-than-Class C; NNSS = Nevada National Security Site; NO_x = nitrogen oxides; PM_n = particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; SO_2 = sulfur dioxide; VOC = volatile organic compound.

[a] From Table 6–9.

[b] Source of projected annual air emissions from GTCC disposal facility operations is Chapter 9, Table 9.2.1-2, of the *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste* (DOE/EIS-0375-D), February 2011. GTCC projected emissions in this table are the largest amount, regardless of type of land disposal facility.

[c] Projected annual air emissions from all solar energy projects proposed in Nye County were estimated by summing the potential onsite and offsite emissions for each criteria pollutant from the *Amargosa Farm Road Solar Energy Project Final Environmental Impact Statement* (BLM 2010c) (Chapter 4, Table 4–12, page 4–11), then dividing the totals by 500 to obtain an approximate per-megawatt rate of emission for each pollutant. The per-megawatt emission rate was then multiplied by 5,750 (i.e., the total potential generating capacity of proposed solar energy generation projects in Nye County from Table 6–2).

Although there would be increases in PM_{10} emissions of up to 22 percent and $PM_{2.5}$ emissions of up to 17 percent, as well as lesser increases in emissions of other criteria pollutants over 2008 levels, it is unlikely that cumulative air emissions from activities at the NNSS, TTR, and other reasonably foreseeable future actions in Nye County would change the county's designation relative to the NAAQS. Under some conditions, there may be a potential for air pollutants from the area to be transported to Death Valley National Park. Due to the low amounts of anticipated air pollutants and the distances from the sources of pollutants, the impacts of pollutant transport to Death Valley would be very slight.

6.3.8.1.2 Clark County

Of the air sheds within which DOE/NNSA-related activities are located, only parts of Clark County, principally the Las Vegas Valley metropolitan area, are classed as nonattainment areas for compliance with NAAQS. The Las Vegas Valley is designated as a nonattainment area for carbon monoxide and PM_{10}. A larger area, comprising about 60 percent of Clark County, is in nonattainment for ozone (RTCSN 2008). Quantities of these three pollutants generated by DOE/NNSA-related mobile sources activities in Clark County would by 2015 annually contribute about 1.87 tons of PM_{10}, 119.26 tons of carbon monoxide, and up to 31.786 tons of ozone (determined by summing ozone precursors nitrogen oxides and volatile organic compounds), as shown in **Table 6–11**. Additional quantities of these pollutants would be generated in Clark County by mobile sources associated with DOE/NNSA-related construction, but these would be short-term effects and would likely be spread over several years. Table 6–11 also shows the total quantity of construction-related emissions of PM_{10}, carbon monoxide, nitrogen oxides, and volatile organic compounds.

Table 6–11 Estimated Annual Mobile Source Emissions of Criteria Pollutants that have been in Nonattainment from U.S. Department of Energy/National Nuclear Security Administration Activities in Clark County, Nevada, Under the Expanded Operations Alternative

Pollutant	*Operations (tons per year)*					*Construction (tons per year)* [e]
	NNSS [a]	*RSL* [b]	*NLVF* [c]	*TTR* [d]	*Total*	*(10-year total)*
PM_{10}	1.4	0.046	0.403	0.022	1.87	0.17
Carbon monoxide	84.8	3.740	30.310	0.410	119.26	16.80
Nitrogen oxides	21.4	0.700	6.470	0.250	28.820	3.60
VOCs	2.6	0.270	0.068	0.028	2.966	0.60

NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; RSL = Remote Sensing Laboratory; TTR = Tonopah Test Range; VOC = volatile organic compound.

[a] From Chapter 5, Table 5–38.
[b] From Table 5–59.
[c] From Table 5–63.
[d] From Table 5–69.
[e] From Table 5–39.

State implementation plans prepared by Clark County Air Quality and Environmental Management contain modeled nonattainment pollutant emissions from mobile sources in specific horizon years. **Table 6–12** compares these modeled emissions with DOE/NNSA-related emissions of the nonattainment pollutants.

Emissions of PM_{10}, carbon monoxide, volatile organic compounds, and nitrogen oxides would contribute only a very small fraction of the total projected emissions of these pollutants by 2015.

Cumulative diesel particulate matter emissions from DOE/NNSA sources in Clark County in 2015 were estimated to be about 0.7 tons per year. This estimate was derived by summing PM_{10} and $PM_{2.5}$ emissions for commercial vendors and trucks transporting radioactive waste, all of which were assumed to be powered by diesel engines, from Chapter 5, Tables 5–32, 5–50, 5–56, and 5–58. The *Regional Transportation Plan* (RTCSN 2008), which provided the data for estimating future air emissions in Clark County, did not include an estimate of diesel particulate matter emissions.

Table 6–12 Comparison of Estimated U.S. Department of Energy/National Nuclear Security Administration-Related Mobile Source Emissions of Nonattainment Pollutants in Clark County with Emissions Projected for All Clark County Mobile Sources

Pollutant	*Regional Transportation Plan Modeled Emissions* [a, b] *(tons per year)*	*DOE/NNSA-Related Emissions* [c] *(tons per year)*	*Percentage of Regional Transportation Plan-Modeled Emissions (tons per year)*
PM_{10}	28,744	2	0.07
Carbon monoxide	140,160	119	0.09
Nitrogen oxides	11,625	29	0.26
VOCs	12,399	3	0.02

PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; VOC = volatile organic compound.

[a] RTCSN 2008, Appendix 4, page 58.
[b] RTCSN 2008 values were in tons per day. The annual emissions displayed in this column were derived by multiplying the tons per day by 365. These values are rounded to the nearest whole number.
[c] Values from Table 6–11 rounded to the nearest whole number.

6.3.8.1.3 Inyo County

Inyo County, California, is part of the Great Basin Unified Air Pollution Control District (GBUAPCD), which also includes Mono and Alpine Counties. Owens Lake, located in the west-central area of Inyo County, is the largest single source of PM_{10} in the United States. The GBUAPCD, in compliance with the Clean Air Act, developed a state implementation plan for dealing with PM_{10} at Owens Lake and has installed dust control measures to meet NAAQS (GBUAPCD 2010). Because the prevailing winds at the NNSS are generally from the southwest or north-northwest (see Chapter 4, Section 4.1.8), it is not likely that emissions of criteria or hazardous air pollutants would create a cumulative effect with similar emissions in Inyo County, leading to a violation of NAAQS.

6.3.8.2 Greenhouse Gas Emissions

Nevada's estimated total gross emissions of greenhouse gases in 2010 were 55.8 million metric tons; these emissions are expected to rise to 78.4 million metric tons by 2020 (NDEP 2008). These estimated emission levels were for the state as a whole. To estimate greenhouse gas production for the cumulative impacts ROI, the proportions of the population of the state residing in Nye, Clark, Esmeralda, and Lincoln Counties were identified. In 2009, the Nevada state demographer estimated the population of the state to be 2,711,206 and the populations of the selected counties as follows: Clark, 1,952,040; Nye, 46,360; Lincoln, 4,317; and Esmeralda, 1,187 (NSBDC 2010), for a total of 2,003,904. These four counties contain about 74 percent of the population of Nevada. By using population as a rough way to apportion greenhouse gas production for the state, approximately 41.3 and 58 million metric tons per year of greenhouse gases would be produced in the four counties in 2010 and 2020, respectively.

DOE/NNSA activities in Nevada would generate about 63,272 tons of greenhouse gases by 2015 under the Expanded Operations Alternative (see Chapter 5, Tables 5–33, 5–60, 5–64, and 5–70). Greenhouse gas emissions from operation of a GTCC disposal facility in Area 5 of the NNSS were estimated to be up to 3,300 tons of carbon dioxide per year. This would result in a total DOE/NNSA greenhouse gas emission rate of about 66,572 tons per year. To compare greenhouse gas generation from proposed DOE/NNSA activities to the amounts estimated for the four counties, the metric tons values of the state estimates were converted to short tons by multiplying by 1.10. This yielded 45.43 and 63.8 million tons of greenhouse gas emissions for the four counties in 2010 and 2020, respectively. Choosing the mid-point between the 2010 and 2020 levels for the four counties to represent the estimated emissions rate in 2015 yielded 54.6 million tons per year. DOE/NNSA greenhouse gas emissions in 2015 would account for about 0.12 percent (63,272/54,600,000 = 0.115 percent) of the combined greenhouse gas emissions for Clark, Nye, Esmeralda, and Lincoln Counties. Thus, the DOE/NNSA greenhouse gas contribution would be small compared to the four-county greenhouse gas emissions.

6.3.9 Visual Resources

As analyzed in Chapter 5, Section 5.1.9, construction and operation of one or more commercial solar power generation facilities in Area 25 would have adverse visual effects because the facilities would introduce considerable infrastructure on up to 10,000 acres of land, a large portion of which would be directly visible in middleground views from U.S. Route 95 (see Chapter 3, Figure 3–2). Under the Expanded Operations Alternative, a new 500-kilovolt electrical transmission line also would be required to interconnect commercial solar facilities with the main transmission system (under the No Action Alternative, a 230-kilovolt transmission line would be required); most of that new transmission line and attendant visual impacts would be located outside the NNSS boundaries. The transmission line may occur within the foreground and middleground of views from U.S. Route 95 or other sensitive viewing areas. Portions of the study area visible from U.S. Route 95 have a Class B scenic quality rating, and the viewer sensitivity is moderate (see Chapter 4, Section 4.1.9, Visual Resources, for a description of scenic quality and viewer sensitivity ratings). Viewer sensitivity would remain the same under the No Action and Reduced Operations Alternatives and would change from moderate to high under the Expanded Operations Alternative due to an increase in the number of average daily trips over time. CSP generation facilities covering up to 10,000 acres of land would introduce a considerable source of glare from the reflective surfaces of the solar collectors, alter the existing visual character of the landscape that is largely undeveloped, and reduce the existing visual quality to a Class C rating because of the intrusion of manmade elements. There is no mitigation to reduce adverse effects associated with a solar array of this size and, therefore, this effect would be adverse and unavoidable.

Viewsheds in Amargosa Valley are extensive given the topography, lack of vegetative screening, and dispersed nature of sensitive viewers, and much of the Amargosa Valley may be visible from key viewpoints in Death Valley National Park. According to the *Final Environmental Impact Statement for the Amargosa Farm Road Solar Energy Project* (BLM 2010a), over 106,000 acres of land could be developed for commercial solar power generation facilities in Amargosa Valley. The potential additional conversion of over 10,000 acres of land to commercial solar power generation in Area 25 would make the total potentially affected land area over 116,000 acres, primarily located along U.S. Route 95 in the Amargosa Valley. All of the potential and proposed solar power generation facilities would require new transmission lines to be constructed to integrate the power they produce into the main electrical transmission system, introducing another cumulative impact on the visual environment. In addition, Nye County is proposing to develop the Yucca Mountain Project Gateway Area in an approximately 5,800 acre area surrounding the intersection of U.S. Route 95 and Nevada State Route 373. This development would result in a large commercial/light industrial area interposed between the closest viewpoints from U.S. Route 95 of the potential commercial solar power generation facilities in Area 25 of the NNSS. Cumulatively, such projects would incrementally modify the landscape, giving it an industrial character and negatively impacting the visual quality of views from public roadways, residential areas, and recreation areas, including key observation points on mountain peaks within Death Valley National Park. As such, potential commercial solar power generation on and off the NNSS and development of the Yucca Mountain Project Gateway Area, together with past, present, and reasonably foreseeable future actions, would substantially alter the visual character of the areas within Amargosa Valley, resulting in adverse cumulative visual impacts.

Construction and operation of commercial solar power generation facilities at the NNSS would require a project-specific NEPA review (including a visual impacts analysis) if such a project were proposed. Site decommissioning and reclamation activities at the former Yucca Mountain Repository site would improve the scenic value of the site.

6.3.10 Cultural Resources

As noted in Chapter 5, Table 5–38, the overall density of cultural resources sites at the NNSS is 0.051 sites per acre, and the density of sites eligible for inclusion in the National Register of Historic Places (NRHP) is 0.026 sites per acre. However, it is important to note that the potential for an area to contain cultural resource sites is strongly site specific and is influenced by factors such as presence of water, a food source, shelter, and less tangible but equally important factors such as features that may have spiritual value to a culture. While all areas of the NNSS have the potential to possess cultural resources, areas with the highest number of recorded cultural resources are Rainier and Pahute Mesas in the northwest, followed by Jackass Flats in the southwest, and Yucca Flat in the east (DOE 2010a). Prehistoric archaeological sites make up 90 percent of recorded cultural resources on the NNSS. The remaining 10 percent are historic period archaeological sites and structures, more-recent facilities and locations associated with recent scientific research, or sites of unknown age (DOE 2010a). Numerous evaluations of nuclear testing facilities and events have been conducted since the *1996 NTS EIS* was completed, resulting in 38 sites and historic districts associated with NNSS activities becoming eligible for listing in the NRHP.

BLM estimated site density for the southern Nevada region to be about 0.024 sites per acre, and the Nevada State Historic Preservation Officer estimated that approximately 12 percent of all sites identified in Nevada are eligible for inclusion in the NRHP (DOE 1996c). For purposes of this cumulative impacts analysis, it was assumed that, for non-DOE/NNSA programs and projects, approximately 509,750 acres of previously undeveloped land are likely to be disturbed over the next decade. Using the more conservative site density value derived from the NNSS, almost 26,000 cultural resource sites may be located within the potentially disturbed area of the cumulative impacts ROI (excluding the NNSS and the TTR) for this *NNSS SWEIS*. Over 13,000 of these sites could be eligible for inclusion in the NRHP. When potentially affected cultural resources sites from DOE/NNSA activities (including commercial solar power generation facilities) (see Chapter 5, Section 5.1.10.2, Cultural Resources, Expanded Operations Alternative) are included, the overall number of sites that may be affected would be almost 34,000, of which almost 15,500 would be considered eligible for inclusion in the NRHP.

Because no additional land would be required for decommissioning and reclamation activities at the former Yucca Mountain Repository site, disturbances to cultural resources on undisturbed land in the area would be unlikely.

Cultural resources associated with Federal and state undertakings are subject to Section 106 of the National Historic Preservation Act. For these cultural resources, identification, evaluation, and data recovery, when appropriate, are likely to occur, resulting in increases of cultural resources information in the regional database. Cultural resources on about 20 percent of the potentially disturbed acreage (the estimated amount of privately held land) may be destroyed without data recovery, resulting in a serious loss of the information those resources may contain.

6.3.11 Waste Management

DOE/NNSA activities at the NNSS and other in-state locations generate and manage radioactive and nonradioactive wastes.

Radioactive waste

Table 6–13 presents the estimated quantities of radioactive and nonradioactive solid wastes that have been disposed at the NNSS, both historically and since the *1996 NTS EIS*, as well as the quantities of wastes that could be generated for disposal over the next 10 years. The waste volumes projected for disposal reflect those for the Expanded Operations Alternative (see Chapter 5, Section 5.1.11.2).

The estimates of LLW and MLLW in the table include wastes that are projected from environmental restoration activities at contaminated sites at the NNSS and offsite in-state locations. Generation of these wastes is uncertain and depends on future regulatory actions or agreements. In addition, there may be other options for management of the contaminated sites, including closure in place or development of new disposal units for this waste that are nearer the contaminated sites than the Area 5 RWMC or Area 3 RWMS.

The estimates in the table do not include waste that could result from incidents involving nuclear or radioactive materials, such as an accident involving a nuclear weapon or remediation of a site contaminated due to a possible intentional destructive act. Generation of such waste would be unplanned and episodic, but is expected to consist mostly of soil and debris. If the waste were generated, the NNSS could be considered a disposal location.

LLW and MLLW generation at the NNSS and offsite locations is expected to continue beyond the next 10 years, as is disposal of these wastes at the NNSS along with wastes received from authorized out-of-state generators, consistent with applicable disposal authorizations and permits. Assuming implementation of the Expanded Operations Alternative, up to 52 million cubic feet of combined LLW and MLLW would be received for disposal.

Table 6–13 Historical and Projected Waste Disposal at the Nevada National Security Site

Transuranic Waste (cubic feet)	***Low-Level Radioactive Waste (cubic feet)***	***Mixed Low-Level Radioactive Waste (cubic feet)*** [a]	***Solid Waste (cubic feet)*** [b]
Waste historically disposed at the NNSS through 1995			
11,300 [c]	17,600,000 [d]	283,000 [e]	No information
Waste volumes from 1996 through 2010			
0 [f]	21,700,000 [g]	395,000 [g]	8,660,000 [h]
Waste projected over the next 10 years for NNSS disposal under the Expanded Operations Alternative			
0 [f]	48,000,000 [i]	4,000,000 [i]	9,200,000 [i]
Total historical and projected NNSS waste disposal over the next 10 years [j]			
11,300	87,400,000	4,720,000	>17,800,000

NNSS = Nevada National Security Site.

[a] Includes radioactive materials regulated under the Atomic Energy Act of 1954, as amended, as well as constituents regulated under the Resource Conservation and Recovery Act and some substances regulated under the Toxic Substances Control Act.

[b] Includes sanitary solid waste and construction and demolition debris.

[c] Includes all waste disposed in the greater confinement disposal boreholes (about 10,347 cubic feet) and about 1,959 cubic feet of TRU waste inadvertently disposed at the Area 5 Radioactive Waste Management Complex.

[d] Volume as of December 31, 1995 (DOE 2008a); disposal in both the Area 5 Radioactive Waste Management Complex and the Area 3 Radioactive Waste Management Site.

[e] Source: DOE 1996c.

[f] No TRU (including mixed TRU) waste is projected for NNSS disposal.

[g] Source: Denton 2011.

[h] Estimated by adding all solid waste disposed at the NNSS for 1996 through 2008 (DOE/NV 1997b, 1998c, 1999, 2000c, 2001c, 2002b, 2003a, 2004a, 2005f, 2006a, 2007d, 2008a, 2009d) to the estimated waste quantities disposed at the NNSS in 2009 and 2010, and converting from tons to cubic feet, assuming 0.55 cubic yards per ton.

[i] From Chapter 5, Section 5.1.11.1; includes 630,000 cubic feet of solid waste that would be generated by commercial solar power generation facilities in Area 25 of the NNSS. Sanitary solid waste generated by a commercial entity could not be disposed on the NNSS under current permit conditions.

[j] Totals may not add precisely because of rounding to three significant figures.

It is expected that available disposal capacity at the Area 5 RWMC would be eventually used and disposal operations would continue at the NNSS by expanding the acreage of the Area 5 RWMC, transferring disposal operations elsewhere at the NNSS, or reopening the Area 3 RWMC. Additional disposal capacity could be developed on the NNSS or offsite locations to address disposal of wastes generated from in-state environmental restoration or decontamination and decommissioning activities. It is expected that permitted in-state treatment of MLLW would continue, as would offsite shipment of those mixed wastes generated within Nevada that lack in-state treatment capacity.

Current GTCC waste volumes and radionuclide activities projected for generation through 2083 are listed in **Table 6–14**, as are wastes owned or generated by DOE that have characteristics similar to GTCC waste and could be considered for disposal at the NNSS. Only about 24 percent of the total stored and projected waste volume and 1 percent of the total stored and projected activity in this table would be generated by DOE waste generators. Note that these projections include wastes that may never be generated depending on the outcome of decisions that are independent of this *NNSS SWEIS*. In addition, there may be other options for managing the identified wastes. For example, it is possible that, rather than being declared waste, sealed sources could be recycled or reused. (Decisions to recycle or reuse sealed sources would be made by others outside of the DOE/NNSA NSO and are not part of this *NNSS SWEIS*.) Furthermore, additional disposal options may be available for DOE wastes having characteristics similar to GTCC waste.

Table 6–14 Projected Greater-Than-Class C Waste Generation Rates through 2083

Waste Type	*In Storage*		*Projected*		*Total Stored and Projected*	
	Volume (cubic feet)	*Activity (curies)*	*Volume (cubic feet)*	*Activity (curies)*	*Volume (cubic feet)*	*Activity (curies)*
GTCC Waste						
Activated metal	2,100	1,400,000	67,000	160,000,000	71,000	160,000,000
Sealed sources	-	-	100,000	2,000,000	100,000	2,000,000
Other waste	2,600	5,100	140,000	530,000	140,000	530,000
Total GTCC Waste	*4,600*	*1,400,000*	*310,000*	*160,000,000*	*310,000*	*160,000,000*
DOE Waste						
Activated metal	220	230,000	230	4,900	460	240,000
Sealed sources	7	6	22	71	29	77
Other waste	34,000	110,000	67,000	670,000	99,000	790,000
Total DOE Waste	*34,000*	*340,000*	*67,000*	*670,000*	*99,000*	*1,000,000*
Total GTCC & DOE waste	39,000	1,700,000	390,000	160,000,000	420,000	160,000,000

GTCC = greater-than-Class C.
Note: Because all values have been rounded, totals may not equal the sum of individual components.
Source: DOE 2011a.

A commercial LLW disposal facility operated from 1962 to the end of 1992 in Beatty, Nevada, about 45 miles west of Mercury on the NNSS, and about 102 miles northwest of Las Vegas, Nevada. (A hazardous waste disposal facility still operates adjacent to the closed LLW facility.) During operation, the Beatty facility disposed about 4,862,000 cubic feet of radioactive waste containing about 709,000 curies of byproduct material, about 4,807,000 pounds of source material, and about 606 pounds of special nuclear material (Laney 2010).[1] Because of the lack of a groundwater pathway from NNSS radioactive waste management facilities and the large distances between this facility and DOE/NNSA waste management operations at the NNSS, the TTR, RSL, and NLVF, this closed disposal facility is not expected to have any projected operational or long-term cumulative impacts on members of the public with DOE/NNSA waste management activities.

Additional disposal of TRU waste at the NNSS is not expected, and there are no active TRU waste disposal facilities within Nevada. It is expected that generation of TRU (including mixed TRU) waste would continue beyond the next 10 years as a result of DOE/NNSA operations or environmental restoration or decontamination and decommissioning activities. This waste would be characterized, packaged, and prepared for disposal at the Waste Isolation Pilot Plant.

Nonradioactive waste

DOE/NNSA is expected to continue generating and managing nonradioactive hazardous and nonhazardous wastes at the NNSS and other in-state facilities. With respect to hazardous waste, after the next 10 years, DOE/NNSA would continue temporary storage of hazardous wastes in permitted storage facilities, as needed, pending shipment to offsite recycle or treatment, storage, or disposal facilities. No operating hazardous waste disposal facilities are located at the NNSS or other in-state DOE/NNSA facilities, although there are numerous hazardous waste recycle or treatment, storage, or disposal facilities in operation within Nevada and other nearby states (see Chapter 5, Section 5.1.11.1). None of these facilities would affect DOE/NNSA waste management infrastructure at the NNSS or other in-state locations, and their existence assures that adequate capacity for offsite disposition of hazardous waste would continue. If needed, permitted treatment capacity at the NNSS or offsite locations could be developed consistent with the existing DOE pollution prevention and waste minimizations programs and Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*.

[1] *As-disposed (un-decayed) activities.*

The quantities of solid waste disposed at the NNSS over the next 10 years are projected to be about 8.5 million cubic feet, as shown in Table 6–13. In addition, for purposes of analysis, about 630,000 cubic feet of solid waste would be generated by commercial solar power generation facilities in Area 25, but would not be disposed at the NNSS. Following the next 10 years, DOE/NNSA is expected to continue disposal of sanitary solid waste and construction and demolition debris within permitted landfills at the NNSS or other in-state DOE/NNSA locations, as well as recycling of solid wastes as appropriate, consistent with DOE pollution prevention and waste minimization programs and Executive Order 13514. In addition to as-needed augmentation of permitted solid waste disposal capacity at the NNSS or other DOE/NNSA in-state locations (e.g., a possible new sanitary waste facility in Area 23 and a possible construction/demolition landfill in Area 25), DOE/NNSA is expected to continue to use offsite disposal facilities as needed. As discussed in Chapter 5, Section 5.1.11.1, any hazardous or nonhazardous waste generated by construction or operation of a commercial solar power generation facility would be managed by the commercial operator of the facility, who would be required to comply with applicable laws and regulations related to waste recycling, treatment, and/or disposal. Because there are numerous permitted facilities in Nevada and nearby states for recycling hazardous materials and treatment, storage, and disposal of hazardous waste, as well as numerous landfills for industrial and sanitary solid waste, offsite disposal capacity would be adequate for the waste projected from a commercial solar power generation facility. None of these facilities would affect the DOE/NNSA waste management infrastructure at the NNSS or other in-state locations, and their existence assures that adequate capacity for offsite disposition of solid waste would continue as needed.

In its 2002 *Yucca Mountain EIS* (DOE 2002e), DOE did not estimate the volume of waste that would be generated by remediation of the former Yucca Mountain Repository site; however, the EIS did state that DOE would minimize waste generation by salvaging most of the equipment and many materials and redistributing them to other DOE sites or selling them at public auction. DOE anticipates that sanitary and industrial solid waste and demolition debris would be disposed in existing NNSS landfills.

Performance Assessment – An analysis of a radioactive waste disposal facility conducted to demonstrate that, for waste disposed after September 26, 1988, there is a reasonable expectation that performance objectives for the long-term protection of the public and the environment will not be exceeded following closure of the facility. The performance objectives address (1) doses to representative members of the public through all pathways, (2) doses to representative members of the public through the air pathway alone, and (3) release of radon gas. The analysis must also assess possible water resources impacts, as well as possible impacts on hypothetical future inadvertent intruders into the disposal facility.

Composite Analysis – An analysis that accounts for all sources of radioactive material that may contribute to the long-term dose projected to a hypothetical member of the public from an active or planned low-level radioactive waste disposal facility. The analysis is a planning tool intended to provide a reasonable expectation that current low-level radioactive waste disposal activities will not result in the need for future corrective or remedial actions to ensure protection of the public and environment. If the combined dose from all interacting sources exceeds 30 millirem (total effective dose equivalent) per year, as evaluated for a specified period, a cost-benefit analysis must be performed to determine whether cost-effective options exist to reduce the dose further (DOE 1999b).

6.3.12 Human Health

Nuclear testing began at the NNSS in 1951. There were 100 atmospheric nuclear explosions before the Limited Test Ban Treaty was implemented in August 1963. Residents who were present during the periods when nuclear weapons testing occurred (in particular, atmospheric weapons testing from 1951 to the early 1960s) would have received up to 5 rem to the thyroid gland from iodine-131 releases, equal to an effective dose of approximately 250 millirem (SNL 2007). Because of the length of time since the end of atmospheric weapons testing, this potential legacy dose would not apply to current residents that were not in the ROI at the time of the testing.

Nuclear tests were conducted underground until October 1992, when the nuclear testing moratorium was implemented. Between 1970 and 1992, 126 nuclear tests released approximately 54,000 curies of radioactivity to the atmosphere. Of this amount, 11,500 curies were accidental due to containment failure (massive releases or seeps) and late-time seeps (seeps are small releases after a test when gases diffuse through pore spaces of overlying soil and rock). The remaining 42,500 curies were operational releases. From the perspective of human health risk, if the same person stood at the boundary of the NNSS in the area of maximum concentration of radioactivity for every test since 1970, that person's total exposure would be equivalent to 32 extra minutes of normal background exposure, or the equivalent of one-thousandth of a single chest x-ray (OTA-ISC-414).

The annual radiation dose received by the offsite population within about 50 miles of the NNSS would be 0.89 person-rem per year; the annual dose received by the population with 50 miles of NLVF would be 4.1×10^{-5} person-rem. The 10-year cumulative population dose would be 8.9 person-rem. This cumulative population dose over the next 10 years are expected to result in no (actual estimated number = 0.005) LCFs. Statistically, the probability of a single LCF occurring in the population within 50 miles of the NNSS as a result of this cumulative dose would be 1 in 200. DOE estimated that remediation of the former Yucca Mountain Repository site would result in a collective dose to the public of 1.7 person-rem, which could cause 0.00085 LCFs. These totals would not represent an appreciable level of additional cumulative impact on the public.

Based on the distance between potential sources of contamination and the nearest public or private water supply wells, no impacts on the public are expected from exposure to groundwater containing radioactivity from underground nuclear testing or other NNSS sources (see Section 6.3.6.2, Groundwater).

As addressed in Chapter 4, Section 4.1.11.1.1.3, and Chapter 5, Section 5.1.12.1.4, radioactive waste disposal occurs at the NNSS in accordance with authorizations issued by DOE that consider analyses of possible long-term (over thousands of years) impacts on the public and the environment after the disposal facilities are closed.

LLW management performance. A combined Area 3 RWMS performance assessment and composite analysis was completed in July 2000. The Area 5 RWMC performance assessment was completed in 1998, and the Area 5 RWMC composite analysis was completed in 2001. These analyses are updated annually to reflect new information such as revised estimates of disposed waste inventories or modifications to waste disposal operations. The analyses determined that, because of the great excess of evapotranspiration over precipitation and other site-specific factors, there was little to no potential for transport of disposed radionuclides to groundwater. The analyses also concluded that all performance objectives would be met. As noted in Chapter 5, Section 5.1.12.1.4, the results of the initial composite analyses were well below the 30-millirem-per-year decision criterion for both the Area 3 RWMS and Area 5 RWMC. The most recent review and update of the Area 3 and 5 performance assessments and composite analyses concluded that the results and conclusions of the performance assessments and composite analyses remained valid (NSTec 2010f).

TRU waste management performance. As discussed in Chapter 4, Section 4.1.11.1.1.3 and Chapter 5, Section 5.1.12.1.4, DOE/NNSA conducted analyses of compliance with EPA's TRU waste disposal requirements in 40 CFR Part 191 for the TRU waste disposed both intentionally in greater confinement disposal (GCD) boreholes and inadvertently in an Area 5 RWMC trench. It was determined that disposal of TRU waste in the GCD boreholes and disposal trench would meet all applicable EPA containment, individual protection, and groundwater protection requirements. For both analyses, it was determined that the projected cumulative releases would meet the probabilities specified in the EPA standard of exceeding specified quantities of radionuclides. Regarding the EPA individual protection requirement, the mean annual dose to a member of the public from all waste in the boreholes over 1,000 years was about 0.0062 millirem to the whole body and 0.12 millirem to bone. For the TRU waste inadvertently disposed in the trench, the maximum total effective dose equivalent for a member of the public over 10,000 years was about 1.4 millirem in a year, predominantly from assumed inhalation of radon-222 progeny in air produced by LLW in the same trench. The results of both assessments indicated compliance with applicable EPA requirements. Regarding the EPA groundwater protection requirement, hydrologic processes modeling supported a conclusion of no groundwater pathway within 10,000 years (SNL 2001; Shott et al. 2008).

Industrial accidents. Based on occupational injury and fatality rates for industrial activities inclusive of construction (DOL 2010a, DOE 2010b), construction activities at the NNSS, including construction of one or more solar power generation facilities with a combined capacity of 1,000 megawatts, would result in less than 1 (actual calculated number = 0.08) fatality over the next 10 years. Assuming an average construction period of 36 months for all of the renewable energy projects in Amargosa Valley and a total average number of construction workers of 6,025, a single (actual calculated number = 0.69) worker fatality could be expected during the construction period. There would be a cumulative total of 1 (calculated number = 0.77) worker fatality for large-scale construction projects in the area over the 10-year period. Based on incidence rates for total recordable cases (TRCs) and days away, restricted or transferred (DART) cases as a result of accidents (DOL 2010b, DOE 2010b) across a broad range of activities, projected TRC and DART cases for 10 years of activities (operations and construction) at the NNSS, RSL, NLVF, and the TTR were estimated. The estimate includes the construction and 5 years of operation of one or more solar power generation facilities. Over a 10-year period, there would be an estimated 810 TRCs and 370 DART cases. Based on the estimated number of workers and construction duration for renewable energy projects in Amargosa Valley (see above), an additional 750 TRCs and 380 DART cases are expected, totaling 1,560 TRCs and 750 DART cases.

Noise

At the regional level, it is expected that ambient noise levels would increase, especially in those areas undergoing urban development and those that are adjacent to industrial and mineral extraction activities. Noise impacts associated with activities at the NNSS would be restricted to the geographical area contained therein and would not affect residents in adjacent areas or add measurably to regional noise levels.

6.3.13 Environmental Justice

American Indian environmental justice concerns, as identified by the Consolidated Group of Tribes and Organizations, include holy land violations, perceived risks from radiation, and cultural survival. Increased land disturbance associated with all forms of development in the ROI could result in a decrease in access to these areas for American Indians. Limiting access could reduce the traditional use of the area and affect its sacred nature. Increased development throughout the ROI has the potential for greater disturbance and vandalism of American Indian cultural resources. Such impacts would be primarily perceived by American Indian groups, the population most likely to experience disproportionate impacts of project implementation.

6.4 Summary of Cumulative Impacts

Table 6–15 contains a summary of cumulative impacts addressed in Section 6.3. As noted at the beginning of this chapter, the impacts associated with the NNSS in the preceding analyses are based on the Expanded Operations Alternative, unless otherwise noted. Table 6–15 includes summary information for all three alternatives addressed in this *NNSS SWEIS*, i.e., No Action, Expanded Operations, and Reduced Operations.

Table 6–15 Summary of Cumulative Impacts

Resource Area	*DOE/NNSA Contribution to Cumulative Impacts*	*Non-DOE/NNSA Contribution to Cumulative Impacts*	*Cumulative Impacts*
Land Use	The following land use changes would occur under the noted *NNSS SWEIS* alternatives: **No Action** • There would be no changes to NNSS Land Use Zones. • Construction of a commercial solar power generation facility would affect land use patterns outside of the NNSS due to construction of a 230-kilovolt transmission line. **Expanded Operations** • Area 15 – Change from Reserved Zone to Research, Test and Experiment Zone. • Area 25 – Designate about 39,600 acres as a Renewable Energy Zone. • Construction of commercial solar power generation facilities would affect land use patterns outside of the NNSS due to construction of a 500-kilovolt transmission line. **Reduced Operations** • Areas 19 and 20 – Change from Nuclear Test Zone to Limited Use Zone. • Areas 18, 29, and 30 – Change from Reserved Zone to Limited Use Zone. • Construction of a commercial solar power generation facility would not affect land use patterns outside of the NNSS.	In Nye County, approximately 149,000 acres of public land managed by the U.S. Bureau of Land Management would be committed to use for renewable energy facilities or commercial/industrial uses. In Clark County, the U.S. Bureau of Land Management would dispose up to about 36,000 acres of public land. Use of this land would be changed from its current public uses to private and/or municipal uses.	Regardless of the implementation of any alternative in this *NNSS SWEIS*, changes in NNSS land use zone designations or functions are not expected to affect land use patterns in areas outside of the NNSS, except for the potential construction of interconnecting transmission lines for commercial solar power generation facilities under the No Action (250 acres) and Expanded Operations (300 acres) Alternatives. Land uses at RSL, NLVF, and the TTR are expected to remain unchanged and would not affect land uses in other areas. Over 185,000 acres of public land managed by the U.S. Bureau of Land Management would be either disposed or withdrawn for non-public uses within Clark and Nye Counties.

Resource Area	***DOE/NNSA Contribution to Cumulative Impacts***	***Non-DOE/NNSA Contribution to Cumulative Impacts***	***Cumulative Impacts***
Infrastructure and Energy	Infrastructure Construction of new facilities at the NNSS, particularly one or more solar power generation facilities with a capacity of 240 megawatts under the No Action Alternative, a combined capacity of 1,000 megawatts under the Expanded Operations Alternative, and 100 megawatts under the Reduced Operations Alternative, would cause a demand for construction materials and skilled labor, in proportion to their size, similar to those of other large construction projects.	Infrastructure Construction of new facilities, particularly large projects, would place cumulative demands on goods and services. The proposed renewable energy projects in Amargosa Valley and Area 25 of the NNSS would all have similar needs for large tracts of undeveloped land and water; use earthmoving/grading equipment, cranes, and other construction equipment; require similar materials, such as concrete, steel, wood, wiring and cables, etc.; and require the services of both general and specialized construction workers.	Infrastructure Large-scale construction projects, particularly renewable energy facilities in the Jackass Flats area of the NNSS and in Amargosa Valley and construction of new high-voltage transmission lines would create an increase in demand for and cumulatively affect availability of construction materials, supplies, and labor. Because of the relative number and/or size of new facility construction considered in this *NNSS SWEIS*, the noted cumulative impact would be substantially greater for the Expanded Operations Alternative than for the No Action Alternative. The Reduced Operations Alternative would create the least demand on construction materials, supplies, and labor and would contribute the least to cumulative impacts.
	Energy The 2020 projected cumulative annual electrical energy demand for DOE/NNSA activities in Nevada under the No Action Alternative is about 113,000 megawatt-hours; under the Expanded Operations Alternative, about 127,000 megawatt-hours; and under the Reduced Operations Alternative, about 96,000 megawatt-hours. A portion of the electrical energy demand under the Expanded Operations Alternative would be offset by development of a 5-megawatt photovoltaic solar power generation facility in Area 6 of the NNSS.	Energy In 2009, NV Energy (southern division) and Valley Electric Association provided a total of about 21,670,000 megawatt-hours of electricity to their customers (NSOE 2010). The Nevada Public Utilities Commission forecasts a 1.5 percent growth rate in electricity sales through 2020 (NDEP 2008). Based on that growth rate, by 2020, total electricity sales in southern Nevada would be about 25,500,000 megawatt-hours, an increase of almost 4,000,000 megawatt-hours. There are proposals for renewable energy projects in southern Nevada that would produce a total of about 5,800 megawatts of new generating capacity.	Energy Cumulatively, the projected increase in electrical energy demand, regardless of the demand under any of the alternatives, would be offset by development of up to 5,800 megawatts of new generating capacity from proposed renewable energy facilities. In addition, construction of new high-voltage transmission lines, such as the Solar Express Transmission Line Project and the Transwest Express Transmission Project, would provide a stronger connection with other regions to support electrical demand in southern Nevada.

Resource Area	*DOE/NNSA Contribution to Cumulative Impacts*	*Non-DOE/NNSA Contribution to Cumulative Impacts*	*Cumulative Impacts*
Transportation and Traffic	<u>Traffic</u> Personnel and trucks associated with one or more commercial solar power generation facilities in Area 25 would increase daily vehicle trips on local roadways by 500 to 1,000 through the 36-month construction period under the No Action Alternative; by 750 to 1,500 through the 42-month construction period under the Expanded Operations Alternative; and by 400 to 800 under the Reduced Operations Alternative. The addition of these vehicles and associated construction trucks on a daily basis would increase the rate of pavement deterioration, degrade levels of service, and could require increased road maintenance and upgrades for roads in the project area.	<u>Traffic</u> During construction of proposed renewable energy projects in Amargosa Valley and the Yucca Mountain Project Gateway Area development, roads in Nye County could experience increases in daily traffic ranging from a two- to a fivefold increase on primary roads such as U.S. Route 95 and Nevada State Route 160, which could degrade levels of service from A to D during peak commuting hours. Personnel and trucks associated with one or more commercial solar power generation facilities in Area 25 would increase daily vehicle trips on local roadways by 500 to 1,000 through the 35-month construction period. During operations, primary roadways could experience increases in daily traffic, and levels of service could degrade one level during peak commuting hours. The degradation in levels of service caused by increased traffic volumes on these roads could generate the need for additional travel lanes and other improvements.	<u>Traffic</u> The cumulative impact of increased traffic on local roadways in southern Nye County, nearby the NNSS, associated with NNSS operations and construction and operation of one or more commercial solar power generation facilities in Area 25 would be a reduction in level of service on U.S. Route 95 from B to C, relative to the 2008 baseline, regardless of the traffic increases resulting from implementation of any of the alternatives. When combined with increased traffic from other large construction projects in Amargosa Valley, the level of service would degrade to D, causing accelerated deterioration and associated increased need for maintenance and repair. Some roadways and traffic control measures would need to be upgraded.
	<u>Radiological Transportation</u> **No Action Alternative** • Worker dose = 2,100 person-rem, equivalent to 1.3 latent cancer fatalities. • Population dose = 400 person-rem, equivalent to 0.2 latent cancer fatalities. **Expanded Operations Alternative** • Worker dose = 5,600 person-rem, equivalent to 3 latent cancer fatalities. • Population dose = 1,400 person-rem, equivalent to 1 latent cancer fatality. **Reduced Operations Alternative** • Worker dose = 2,100 person-rem, equivalent to 1.3 latent cancer fatalities. • Population dose = 400 person-rem, equivalent to 0.2 latent cancer fatalities.	<u>Radiological Transportation</u> Collective worker dose (1943 to 2073) = 399,000 person-rem, equivalent to 240 latent cancer fatalities over 130 years. Collective general population dose (1943 to 2073) = 373,000 person-rem, equivalent to 224 latent cancer fatalities over 130 years.	<u>Radiological Transportation</u> **No Action Alternative** • Worker dose = 401,000 person-rem, equivalent to 241 latent cancer fatalities over 130 years. • Population dose = 373,000 person-rem, equivalent to 224 latent cancer fatalities over 130 years. **Expanded Operations Alternative** • Worker dose = 405,000 person rem, equivalent to 243 latent cancer fatalities over 130 years. • Population dose = 374,000 person-rem, equivalent to 225 latent cancer fatalities over 130 years. **Reduced Operations Alternative** • Worker dose = 401,000 person-rem, equivalent to 241 latent cancer fatalities over 130 years. • Population dose = 373,000 person-rem, equivalent to 224 latent cancer fatalities over 130 years.

Resource Area	*DOE/NNSA Contribution to Cumulative Impacts*	*Non-DOE/NNSA Contribution to Cumulative Impacts*	*Cumulative Impacts*
Geology and Soils	An unknown but substantial amount of deep subsurface geologic media has been affected by underground nuclear tests conducted on the NNSS. Approximately 80,000 acres of land on the NNSS has been disturbed by previous DOE/NNSA activities. Overall, new disturbance of soils and near-surface geological media resulting from proposed DOE/NNSA actions at the NNSS would be as follows: **No Action**: About 1,800 acres plus an additional 2,650 acres for a commercial solar power generation facility. **Expanded Operations**: About 15,500 acres, plus an additional 10,350 acres for commercial solar power generation facilities and a Geothermal Demonstration Project. **Reduced Operations**: About 1,540 acres plus an additional 1,200 acres for a commercial solar power generation facility.	Within the cumulative impacts region of influence, about 215,000 acres of Clark County and 51,000 acres of Nye County have been disturbed by previous development. A total of about 509,750 acres of additional soil and near-surface geologic media would be affected by reasonably foreseeable land development activities in Nye and Clark Counties. This would result in a total of about 775,750 acres of soil and near-surface geologic media being disturbed.	Previous combined actions within the cumulative impacts region of influence have disturbed about 346,000 acres. Reasonably foreseeable actions would disturb additional soil and near-surface geological media within the region of influence, as follows: **No Action:** About 514,250 acres **Expanded Operations:** About 535,750 acres **Reduced Operations:** About 512,450 The total potential cumulative area of land disturbance would range from about 858,450 to 881,750 acres, which represents about 5.5 to 5.6 percent of the total area of the region of influence (15,737,760 acres).
Hydrology	<u>Surface Water</u> Within areas that drain off the NNSS, under the No Action, Expanded Operations, and Reduced Operations Alternatives, a total of 2,650, 10,300, and 1,200 acres, respectively, of land could be disturbed for construction of one or more commercial solar power generation facilities. During construction of these facilities, the potential for soil erosion affecting surface waters would be greater due to removal of vegetation and other earth-disturbing activities. If such erosion were to occur it would likely result in increased sediments being transported into Fortymile Wash and eventually into the Amargosa River. However, implementation of erosion control measures would reduce the likelihood of such erosion.	<u>Surface Water</u> Disturbing about 94,300 acres in Amargosa Valley for constructing one or more solar power generation facilities and developing the Yucca Mountain Project Gateway Area could result in erosion and slightly increase sedimentation in the Amargosa River during the construction period. However, U.S. Bureau of Land Management-prescribed and enforced erosion control measures would reduce the likelihood of such an impact.	<u>Surface Water</u> Although the potential for increased sedimentation in the Amargosa River drainage is a potential cumulative impact regardless of alternative considered in this *NNSS SWEIS*, implementation of recognized measures to prevent erosion would reduce the likelihood of such impacts occurring.

Resource Area	*DOE/NNSA Contribution to Cumulative Impacts*	*Non-DOE/NNSA Contribution to Cumulative Impacts*	*Cumulative Impacts*
Hydrology (cont'd)	Groundwater Past underground nuclear testing has contaminated an unknown volume of groundwater beneath the NNSS. That contamination is not expected to impact publicly available water supplies within the next 100 years, based on estimated groundwater travel times between the NNSS and Oasis Valley that range from 337 to over 6,191 years (95 percent confidence limits) (Rose et al. 2002). DOE/NNSA proposed activities under this *NNSS SWEIS* would not cause new or additional groundwater contamination. DOE/NNSA activities at the NNSS and the TTR, as well as operation of one or more solar power generation facilities in Area 25 of the NNSS, under all three alternatives addressed in this *NNSS SWEIS*, would require withdrawal of groundwater, as follows: **No Action:** 959 acre-feet **Expanded Operations:** 1,580 acre-feet **Reduced Operations:** 815 acre-feet This volume of groundwater represents about 16 percent, 27 percent, and 14 percent, respectively, of the cumulative sustainable yield for all of the affected hydrographic basins. DOE/NNSA would not withdraw groundwater from the Oasis Valley, Crater Flats, or Amargosa Valley Hydrographic Basins.	Groundwater The town of Beatty, Nevada, uses just under 500 acre-feet of water per year obtained from the Oasis Valley Hydrographic Basin. Operational water requirements for one or more solar power generation facilities proposed in Amargosa Valley would require almost 6,000 acre-feet of groundwater each year, primarily from the Amargosa Desert, Oasis Valley, and Crater Flats Hydrographic Basins. Nevada State Engineer Order 1197 requires that water for new uses in the Amargosa Desert Hydrographic Basin be obtained by acquisition of existing water rights.	Groundwater Regardless of alternative considered in this *NNSS SWEIS*, groundwater monitoring programs conducted by DOE/NNSA and other organizations, such as the U.S. Geological Survey and Desert Research Institute, would ensure that there would be sufficient lead-time for DOE/NNSA to identify and implement appropriate protective and mitigative measures if contamination associated with underground nuclear testing were to affect any water supply located off Federal land. Due to the implementation of Nevada State Engineer Order 1197, there would be no new cumulative impacts associated with groundwater availability resulting from DOE/NNSA proposed actions and reasonably foreseeable projects in the Amargosa Desert Hydrographic Basin.

Resource Area	***DOE/NNSA Contribution to Cumulative Impacts***	***Non-DOE/NNSA Contribution to Cumulative Impacts***	***Cumulative Impacts***
Biological Resources	Currently, approximately 80,000 acres of the NNSS are considered disturbed. Overall, new wildlife habitat disturbed by DOE/NNSA actions would be as follows: **No Action**: About 1,810 acres, plus an additional 2,650 acres for a commercial solar power generation facility. **Expanded Operations**: About 15,500 acres, plus an additional 10,350 acres for commercial solar power generation facilities and a Geothermal Demonstration Project. **Reduced Operations**: About 1,540 acres, plus an additional 1,200 acres for a commercial solar power generation facility. Impacts on the threatened desert tortoise under all alternatives would be the result of harassment. **No Action**: DOE/NNSA activities at the NNSS would affect about 1,055 acres of desert tortoise habitat and impact up to 47 tortoises; a commercial solar power generation facility would affect an additional 2,650 acres of tortoise habitat and up to 41 tortoises. **Expanded Operations**: DOE/NNSA activities at the NNSS would affect about 3,370 acres of desert tortoise habitat and impact up to 60 tortoises; commercial solar power generation facilities would disturb about 10,300 acres of tortoise habitat and up to 161 desert tortoises. **Reduced Operations**: DOE/NNSA activities at the NNSS would disturb about 920 acres of desert tortoise habitat and impact up to 37 tortoises; a commercial solar power generation facility would affect an additional 1,200 acres of tortoise habitat and up to 19 tortoises. An additional 125 tortoises may experience impacts due to harassment on NNSS roads under all three alternatives. Overall, wildlife habitat disturbed by DOE/NNSA actions would total about 26,000 acres.	Reasonably foreseeable actions by the U.S. Fish and Wildlife Service would result in a total of about 360,000 acres of desert tortoise habitat in Clark County, Nevada, being permitted under the Endangered Species Act for incidental take of desert tortoises (USFWS 2000; 74 FR 50239). This represents about 9 percent of the estimated 4,000,000 acres of tortoise habitat in Clark County. Within Nye County, desert tortoise habitat would be affected by a number of reasonably foreseeable actions. The development of solar energy projects in Nye County would remove up to about 131,500 acres of desert tortoise habitat; development of the Nye County Yucca Mountain Project Gateway Area would remove up to 5,800 acres. The development of over 509,000 acres of open land in the region would cumulatively affect wildlife and wildlife habitat. The loss of large areas of habitat would reduce the available habitat for native wildlife, including federally listed species and other special status species. Development of undisturbed land would contribute to loss, fragmentation, and degradation of habitat and encourage nonnative invasive species, thereby eliminating or degrading natural plant communities on which wildlife depend.	The development of from about 512,000 (Reduced Operations Alternative) to 535,750 acres (Expanded Operations Alternative) of currently open land in the region would cumulatively affect wildlife and wildlife habitat. The loss of large areas of habitat would reduce the available habitat for native wildlife, including federally listed species and other special status species. Development of undisturbed land would contribute to loss, fragmentation, and degradation of habitat and encourage nonnative invasive species, thereby eliminating or degrading natural plant communities on which wildlife depend. DOE/NNSA proposed actions and reasonably foreseeable actions by others within the cumulative impacts region of influence would result in the loss of over 522,000 acres of tortoise habitat under the Expanded Operations Alternative or about 508,000 acres under the No Action and Reduced Operations Alternatives. However, because a large portion of that habitat loss would be permitted by USFWS under the Endangered Species Act, pursuant to Section 10(a)(1)(B) for non-Federal entities and Section 7 for Federal agencies, this habitat loss would not threaten the continued existence of the desert tortoise.

Resource Area	*DOE/NNSA Contribution to Cumulative Impacts*	*Non-DOE/NNSA Contribution to Cumulative Impacts*	*Cumulative Impacts*
Air Quality and Climate	Nye County Annual DOE/NNSA air emissions in Nye County from all sources in 2015: **No Action Alternative:** Particulate $Matter_{10}$ = 9.8 tons Particulate $Matter_{2.5}$ = 6.8 tons Carbon Monoxide = 66 tons Nitrogen Oxides = 40 tons Sulfur Dioxide = 1.3 tons Volatile Organic Compounds = 5.2 tons Lead = 0.04 tons Hazardous Air Pollutants = 1.4 tons **Expanded Operations Alternative:** Particulate $Matter_{10}$ = 22.6 tons Particulate $Matter_{2.5}$ = 11 tons Carbon Monoxide = 82 tons Nitrogen Oxides = 50 tons Sulfur Dioxide = 2 tons Volatile Organic Compounds = 10 tons Lead = 0.2 tons Hazardous Air Pollutants = 1.4 tons **Reduced Operations Alternative:** Particulate $Matter_{10}$ = 7.2 tons Particulate $Matter_{2.5}$ = 5.8 tons Carbon Monoxide = 55 tons Nitrogen Oxides = 36 tons Sulfur Dioxides = 1.2 tons Volatile Organic Compounds = 4.1 tons Lead = 0.01 tons Hazardous Air Pollutants = 1.3 tons	Nye County Because Nye County is considered an attainment/nondesignated area for purposes of compliance with National Ambient Air Quality Standards, no countywide air monitoring data are available.	Nye County Cumulatively, the annual air emissions from Federal and non-Federal activities in Nye County from all sources in 2015, regardless of the level of projected emissions under any of the alternatives considered in this *NNSS SWEIS*, are not expected to cause a nonattainment condition with respect to National Ambient Air Quality Standards.

Resource Area	***DOE/NNSA Contribution to Cumulative Impacts***	***Non-DOE/NNSA Contribution to Cumulative Impacts***	***Cumulative Impacts***
Air Quality and Climate (cont'd)	Clark County Estimated annual mobile source emissions related to DOE/NNSA activities in Clark County, including worker commuting, for the criteria pollutants that are in nonattainment in the Las Vegas Valley are: **No Action Alternative:** Particulate $Matter_{10}$ = 1.5 tons Carbon Monoxide = 97 tons Nitrogen Oxides = 24 tons Volatile Organic Compounds = 3.1 tons **Expanded Operations Alternative:** Particulate $Matter_{10}$ = 2 tons Carbon Monoxide = 119 tons Nitrogen Oxides = 29 tons Volatile Organic Compounds = 3.9 tons **Reduced Operations Alternative:** Particulate $Matter_{10}$ = 2 tons Carbon Monoxide = 86 tons Nitrogen Oxides = 22 tons Volatile Organic Compounds = 3 tons	Clark County Clark County, principally the Las Vegas Valley, is classed as a nonattainment area for some air pollutants, i.e., not in compliance with National Ambient Air Quality Standards. Criteria pollutants for which the Las Vegas Valley have been out of attainment and the projected (2013) annual mobile source emissions are: Particulate $Matter_{10}$ = 28,744 tons Carbon Monoxide = 140,160 tons Nitrogen Oxides = 11,625 tons Volatile Organic Compounds = 12,399	Clark County The estimated 2015 cumulative total of annual mobile source emissions of criteria pollutants that are currently in nonattainment in the Las Vegas Valley are: **No Action Alternative:** Particulate $Matter_{10}$ = 28,746 tons Carbon Monoxide = 140,257 tons Nitrogen Oxides = 11,649 tons Volatile Organic Compounds = 12,402 tons **Expanded Operations Alternative:** Particulate $Matter_{10}$ = 28,746 tons Carbon Monoxide = 140,279 tons Nitrogen Oxides = 11,654 tons Volatile Organic Compounds = 12,403 tons **Reduced Operations Alternative:** Particulate $Matter_{10}$ = 28,746 tons Carbon Monoxide = 140,246 tons Nitrogen Oxides = 11,647 tons Volatile Organic Compounds = 12,402 tons
	Greenhouse Gas Emissions DOE/NNSA activities in Nye and Clark County were estimated to annually generate the following estimated amounts of greenhouse gas emissions in 2015: **No Action Alternative:** 60,555 tons **Expanded Operations Alternative:** 88,679 tons **Reduced Operations Alternative:** 53,755 tons	Greenhouse Gas Emissions Annual greenhouse gas emissions in Nye, Clark, Lincoln, and Esmeralda Counties in 2015 were estimated to be about 54.6 million tons.	Greenhouse Gas Emissions Annual cumulative greenhouse gas emissions in Nye, Clark, Lincoln, and Esmeralda Counties are projected to be as follows: **No Action:** 54,661,000 tons **Expanded Operations:** 54,689,000 tons **Reduced Operations:** 54,654,000 tons
Visual Resources	Under all three alternatives addressed in this *NNSS SWEIS*, the development of one or more solar power generation facilities with generating capacities ranging from 100 to 1,000 megawatts in Area 25 of the NNSS would reduce the visual quality rating of that viewshed from Class B to Class C due to intrusion of manmade elements. Under the Expanded Operations Alternative, construction of additional facilities at Desert Rock Airport would adversely impact the viewshed along U.S. Route 95 in Mercury Valley.	In Nye County, in the vicinity of the NNSS, development of one or more solar power generation facilities would substantially alter the visual character along U.S. Route 95 in Amargosa Valley.	Regardless of the alternative considered in this *NNSS SWEIS*, development of one or more solar power generation facilities, the Yucca Mountain Gateway Project, and new facilities at Desert Rock Airport (only under the Expanded Operations Alternative) would substantially alter the visual character along U.S. Route 95 in Amargosa and Mercury Valleys, reducing the visual quality rating from Class B to Class C.

Resource Area	***DOE/NNSA Contribution to Cumulative Impacts***	***Non-DOE/NNSA Contribution to Cumulative Impacts***	***Cumulative Impacts***
Cultural Resources	The estimated number of cultural resources sites potentially affected by DOE/NNSA activities and development of one or more commercial solar power generation facilities under each alternative are as follows: **No Action Alternative:** DOE/NNSA activities would potentially affect up to 53 sites; 18 could be considered eligible for inclusion in the National Register of Historic Places. Development of a 100-megawatt commercial solar power generation facility would potentially affect up to 802 sites; 557 could be considered eligible for inclusion in the National Register of Historic Places. **Expanded Operations Alternative:** DOE/NNSA activities would potentially affect up to 682 sites; 283 could be considered eligible for inclusion in the National Register of Historic Places. Development of up to 1,000 megawatts of commercial solar power generation facilities and a Geothermal Demonstration Project would potentially affect up to 7,006 sites; 2,163 could be considered eligible for inclusion in the National Register of Historic Places. **Reduced Operations Alternative:** DOE/NNSA activities would potentially affect up to 45 sites; 14 could be considered eligible for inclusion in the National Register of Historic Places. Development of a 100-megawatt commercial solar power generation facility would potentially affect up to 816 sites; 252 could be eligible for inclusion in the National Register of Historic Places.	An estimated 26,000 cultural resources sites would be affected by land-disturbing activities within the cumulative impacts region of influence, with about 13,000 of those sites being considered eligible for inclusion in the National Register of Historic Places.	The estimated cumulative total of potentially affected cultural resources sites, including both proposed and reasonably foreseeable future actions under each alternative, are as follows: **No Action Alternative:** Total sites—26,855 National Register of Historic Places-eligible sites—13,565 **Expanded Operations Alternative:** Total sites—33,688 National Register of Historic Places-eligible sites—15,446 **Reduced Operations Alternative:** Total sites—26,861 National Register of Historic Places-eligible sites—13,266

Resource Area	*DOE/NNSA Contribution to Cumulative Impacts*	*Non-DOE/NNSA Contribution to Cumulative Impacts*	*Cumulative Impacts*
Waste Management	<u>Radioactive Waste</u> Historic disposal of low-level and mixed low-level radioactive waste, and some transuranic waste at the NNSS totaled about 40,000,000 cubic feet through 2010. During the next 10 years, the following estimated volumes of radioactive waste would potentially be disposed at the NNSS: **No Action and Reduced Operations Alternatives:** • Low-level radioactive waste = 15,000,000 cubic feet • Mixed low-level radioactive waste = 900,000 cubic feet **Expanded Operations Alternative:** • Low-level radioactive waste = 48,000,000 cubic feet • Mixed low-level radioactive waste = 4,000,000 cubic feet	<u>Radioactive Waste</u> The NNSS is the only active disposal facility for low-level radioactive waste and mixed low-level radioactive waste in Nevada. It accepts for disposal only low-level radioactive waste and mixed low-level radioactive waste that meet the NNSS waste acceptance criteria. A commercial low-level radioactive waste disposal facility operated from 1962 to the end of 1992 in Beatty, Nevada, about 45 miles west of Mercury on the NNSS. Because of a lack of a groundwater pathway from NNSS radioactive waste management facilities, the large distances between this facility and DOE/NNSA waste management operations, depth to groundwater, the high evaporation rate in the region, and monitoring by the Nevada Division of Environmental Protection to ensure continued proper function of closure/containment measures, this closed disposal facility is not expected to have any cumulative impacts with DOE/NNSA waste management activities.	<u>Radioactive Waste</u> Because the NNSS operates the only low-level radioactive waste/mixed low-level radioactive waste disposal facilities in Nevada, there would be no cumulative impacts from management of such wastes outside of the NNSS.

Resource Area	***DOE/NNSA Contribution to Cumulative Impacts***	***Non-DOE/NNSA Contribution to Cumulative Impacts***	***Cumulative Impacts***
Waste Management (cont'd)	<u>Nonradioactive Waste</u> The following estimated volumes of hazardous waste would be generated by DOE/NNSA activities and one or more commercial solar power generation facilities over the next 10 years: **No Action Alternative:** • DOE/NNSA activities—170,000 cubic feet • Commercial solar power generation facility—42,000 cubic feet **Expanded Operations Alternative:** • DOE/NNSA activities—170,000 cubic feet • Commercial solar power generation facilities—170,000 cubic feet **Reduced Operations Alternative**: • DOE/NNSA activities—170,000 cubic feet • Commercial solar power generation facility—17,000 cubic feet All hazardous waste generated by DOE/NNSA activities would be transported to commercial treatment, storage, and disposal facilities for treatment and/or disposal. Hazardous waste generated by one or more commercial solar power generation facilities would be managed by the operator in accordance with applicable statutes and regulations.	<u>Nonradioactive Waste</u> There are a number of hazardous waste treatment, storage, and disposal facilities in Nevada and neighboring states that treat and dispose such wastes from many generators.	<u>Nonradioactive Waste</u> The volume of hazardous waste that DOE/NNSA and one or more commercial solar power generation facilities would dispose at commercial treatment, storage, and disposal facilities would not exceed the capacity of such facilities and would represent a very small portion of the overall volume of such waste disposal, regardless of the alternative considered.

Resource Area	*DOE/NNSA Contribution to Cumulative Impacts*	*Non-DOE/NNSA Contribution to Cumulative Impacts*	*Cumulative Impacts*
Human Health	<u>Radiological</u> The dose to the offsite population resulting from DOE/NNSA activities in southern Nevada under each alternative addressed in this *NNSS SWEIS* would be: **No Action Alternative:** • Dose = 5.0 person-rem over 10 years • Consequences = No (0.003) latent cancer fatality **Expanded Operations Alternative:** • Dose = 8.9 person-rem over 10 years • Consequences = No (0.005) latent cancer fatality **Reduced Operations Alternative:** • Dose = 4.8 person-rem over 10 years • Consequences = No (0.003) latent cancer fatality	<u>Radiological</u> There are no other non-background sources of potential radiological exposure for an offsite member of the public within the cumulative impacts region of influence.	<u>Radiological</u> Because there is no other source for above-background level of exposure to radioactivity in the cumulative impacts region of influence, DOE/NNSA is the sole contributor to the cumulative dose analyzed in this *NNSS SWEIS*. Cumulatively, the impacts would then be as follows: **No Action Alternative:** • Dose = 5.0 person-rem over 10 years • Consequences = No (0.003) latent cancer fatality **Expanded Operations Alternative:** • Dose = 8.9 person-rem over 10 years • Consequences = No (0.005) latent cancer fatality **Reduced Operations Alternative:** • Dose = 4.8 person-rem over 10 years • Consequences = No (0.003) latent cancer fatality

Resource Area	DOE/NNSA Contribution to Cumulative Impacts	Non-DOE/NNSA Contribution to Cumulative Impacts	Cumulative Impacts
Human Health (cont'd)	Nonradiological The following estimated nonradiological consequences would occur over a 10-year period from DOE/NNSA activities at the NNSS, RSL, NLVF, and the TTR and construction of one or more commercial solar power generation facilities at the NNSS under each alternative addressed in this *NNSS SWEIS*: **No Action Alternative:** Operations Total recordable cases = 578 Days away, restricted, or transferred = 253 Construction Total recordable cases = 60 Days away, restricted, or transferred = 31 TOTAL for Alternative Total recordable cases = 638 Days away, restricted, or transferred = 314 **Expanded Operations Alternative:** Operations Total recordable cases = 700 Days away, restricted, or transferred = 314 Construction Total recordable cases = 148 Days away, restricted, or transferred = 48 TOTAL for Alternative Total recordable cases = 848 Days away, restricted, or transferred = 362 **Reduced Operations Alternative:** Operations Total recordable cases = 508 Days away, restricted, or transferred = 225 Construction Total recordable cases = 44 Days away, restricted, or transferred = 23 TOTAL for Alternative Total recordable cases = 552 Days away, restricted, or transferred = 248	Nonradiological During construction of proposed renewable energy projects in Amargosa Valley, industrial accidents could result in an estimated fatality to one worker in 750 total recordable cases and 380 days away, restricted, or transferred.	Nonradiological Industrial accidents from all activities at DOE/NNSA sites over a 10-year period, and construction of renewable energy projects in Amargosa Valley could result in the following total recordable cases and days away, restricted or transferred for each alternative: **No Action Alternative:** Total recordable cases = 1,328 Days away, restricted, or transferred = 633 **Expanded Operations Alternative:** Total recordable cases = 1,598 Days away, restricted, or transferred = 742 **Reduced Operations Alternative:** Total recordable cases = 1,302 Days away, restricted, or transferred = 628

Resource Area	***DOE/NNSA Contribution to Cumulative Impacts***	***Non-DOE/NNSA Contribution to Cumulative Impacts***	***Cumulative Impacts***
Environmental Justice	Potential new land disturbances on the NNSS for both DOE/NNSA activities and development of one or more commercial solar power generation facilities would result in new land disturbance on up to about 4,500 acres, 26,000 acres, and 2,700 acres, respectively under the No Action, Expanded Operations, and Reduced Operations Alternatives. Previously undisturbed lands may be important to American Indians. Land disturbances on the NNSS could affect traditional cultural properties of concern for various American Indian tribes with a cultural affiliation with the NNSS.	Non-DOE/NNSA actions would account for approximately 509,750 acres of new land disturbances within the cumulative impacts region of influence. Land disturbance of this magnitude would likely have adverse impacts on American Indian traditional cultural properties by destroying places important to the continuation of those cultures.	The potential disturbance of up to 514,250 acres (No Action Alternative), 535,750 acres (Expanded Operations Alternative), or 512,450 acres (Reduced Operations Alternative) of currently undisturbed land within the cumulative impacts region of influence would likely have adverse impacts on American Indian traditional cultural properties by affecting places important to the continuation of those cultures.

NLVF = North Las Vegas Facility; Particulate $Matter_{10}$ = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; Particulate $Matter_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers; rem = roentgen equivalent man; RSL = Remote Sensing Laboratory; TTR = Tonopah Test Range.

CHAPTER 7
MITIGATION MEASURES

7.0 MITIGATION MEASURES

Chapter 7 presents the proposed mitigation measures that would be implemented by the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) to avoid, minimize, rectify, reduce, eliminate, or compensate for potential adverse impacts on the environment (in accordance with 40 *Code of Federal Regulations* [CFR] 1508.20) resulting from any of the three alternatives analyzed in this site-wide environmental impact statement (SWEIS). These proposed mitigation measures are listed by resource category and address specific adverse environmental impacts identified in Chapter 5. Where the potential impacts and mitigation measures vary across the three alternatives, measures specific to each alternative are described. Some of these descriptions of mitigation measures for resource areas include American Indian perspectives prepared by the American Indian Writers Subgroup (AIWS); the AIWS input is provided in text boxes identified with a Consolidated Group of Tribes and Organizations (CGTO) feather icon.

DOE/NNSA considers planning and implementation of mitigation measures throughout the environmental analysis process. This SWEIS represents the latest phase of DOE/NNSA's environmental analysis of activities occurring at the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) and other Nevada sites managed by DOE/NNSA. As such, these mitigation measures build on those developed through prior environmental analyses covering the history of the NNSS and DOE/NNSA-managed sites in Nevada.

In accordance with DOE regulations (10 CFR 1021.331), DOE/NNSA will prepare a mitigation action plan for those mitigation commitments made in a future Record of Decision associated with the continued management and operation of the NNSS and other DOE/NNSA-managed sites in Nevada. This mitigation action plan will identify specific mitigation measures associated with the alternative selected in the Record of Decision and describe plans for implementing the mitigation measures, monitoring their implementation and effectiveness, and reporting the results of mitigation efforts to DOE/NNSA management and applicable Federal, state, local, and tribal entities and the public. DOE/NNSA may revise the mitigation action plan as more-specific and -detailed information regarding the various missions, programs, capabilities, and projects at the NNSS and other offsite locations in Nevada becomes available.

Mitigation Measures—American Indian Perspective

CGTO

Indian people bring a unique perspective based on our traditional ecological knowledge which guides us on how and where to interact with the earth and its resources. As a means of minimizing impacts to these precious resources, we continuously strive to maintain a delicate balance and sustain its spiritual integrity. According to tribal elders, *"Indian people have the conviction that the ecology of the natural environment is inter-connected. We have been blessed from the beginning of creation as having a unique understanding of being a good steward, and a clear path to care for the land and its resources. The songs, stories, traditions and customs provide the foundation for this conviction. It is like the world is a huge stage and there are many cast members--using their roles to make possible for a successful event."*

With this in mind, the Consolidated Group of Tribes and Organizations (CGTO) is providing the U.S. Department of Energy (DOE) recommendations in Section 7.0 in an effort to avert or minimize impacts. We must emphasize recommendations made by the CGTO do not imply we support the proposed action or alternatives. These are merely our attempt to restore harmony and balance to the resources impacted or potentially impacted by DOE activities using the National Environmental Policy Act (NEPA) process.

In 1996 and 2000, the DOE invited the CGTO to participate in the development of the Nevada Test Site (NTS)/DOE Resource Management Plan (RMP) in an effort to mitigate impacts to resources. The CGTO provided culturally-appropriate resource management strategies for the NTS based on traditional Indian perspectives. The CGTO's long-term objective is to see our existing government-to-government relationship evolve and expand into co-management of the Nevada National Security Site (NNSS) (formally NTS) land and its resources. Therefore, the CGTO believes the continued collaborative development of the RMP is essential to blending elements of two world views. In turn, this promotes implementation of culturally-sensitive strategies for the land, which is mutually beneficial to the DOE and the culturally affiliated tribes. The CGTO understands the RMP is a dynamic, living document that requires periodic evaluation and updates. Accordingly, the CGTO recommends the DOE continue to hold annual tribal update meetings, which should include current and proposed activities at the NNSS, and discussions regarding the RMP, mitigation measures, and their potential implications.

See Appendix C for more details.

7.1 Land Use

No adverse impacts on land use that would require mitigation have been identified at the NNSS or at offsite locations under the No Action, Expanded Operations, or Reduced Operations Alternatives. In addition, no adverse airspace impacts that would require mitigation at any project location have been identified under any of the alternatives.

Additional projects that are conceptual in nature but are anticipated to be located on the NNSS, such as the development of a commercial solar power generation facility, would be subject to additional National Environmental Policy Act (NEPA) review. These future reviews would require identification of environmental impacts, including land use impacts, as well as formulation of measures to mitigate these impacts to the extent practicable.

DOE/NNSA will continue working with CGTO to provide access for tribal members to the NNSS for the purpose of visiting culturally significant sites for studies and ceremonial activities.

Land Use—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) is concerned with the U.S. Department of Energy's (DOE's) plans to continue to restrict access and potentially close areas within the Nevada National Security Site (NNSS). As discussed in earlier environmental impact statement (EIS) sections, the NNSS area is part of the traditional Holy Lands for the Western Shoshone, Southern Paiute and Owens Valley Paiute and Shoshone people. These lands are central in the lives of our people and mutually shared for religious ceremony, resource use, and social events.

Since the early 1990's, DOE has funded representatives of the CGTO to visit portions of the NNSS (formerly NTS). This involvement has allowed tribal representatives to identify places, spiritual trails, and cultural landscapes of traditional and contemporary cultural significance. CGTO remains committed in our assertion that portions of the NNSS must be set aside for traditional and contemporary ceremonial use.

In order to fulfill the Holy Land use expectations, the CGTO also recommends continuing to identify special places, spiritual trails, and landscapes, and setting aside these places for unique and innovative co-stewardship activities and ceremonial access. For example, studies have begun regarding the identification of places, spiritual trails and cultural landscapes in the Timber Mountain Caldera. We strongly encourage DOE to pursue these studies, which, when completed, will add an American Indian cultural component that will broaden the understanding and importance of this National Natural Landmark. The CGTO recommends the Gold Meadows area continue to be set aside for exclusive Indian use because of significant cultural resources. Similarly, the CGTO recommends DOE set aside Water Bottle Canyon, Scrugham Peak, Prow Pass, Timber Mountain, select areas within the Calico Hills and portions of Shoshone Mountain for exclusive Indian use. As such, areas should be made to forego any additional land disturbances within these areas and provide reasonable access for Indian people. The CGTO also recommends tribal visits to areas designated for repatriation such as Pahute Mesa, and periodic assessments conducted to compliance with the Native American Graves Protection and Repatriation Act (NAGPRA).

See Appendix C for more details.

7.2 Infrastructure and Energy

The NNSS will continue utilizing measures for energy and water conservation, including the following:

- Implementing strategies and policies to support energy-efficient commuting and travel.
- Identifying, promoting, and implementing water reuse strategies that reduce potable water consumption (Water efficiency practices could include water management planning; system audits; repairs of water leaks; water-efficient landscaping and irrigation; and installation of water-efficient [WaterSense™] products, including toilets and urinals, faucets and showerheads, boiler systems, and other water-using equipment.)

- Increasing diversion of compostable and organic material from waste streams to reduce energy used in disposal
- Managing existing building systems to reduce consumption of energy, water, and materials
- Identifying opportunities to consolidate and dispose existing assets to optimize real property portfolios

7.3 Transportation

Radiological and nonradiological risks to the public would result from overland transport of radioactive and nonradioactive wastes. These risks would be reduced by choosing (to the extent practicable) waste transportation routes that minimize impacts from potential exposure to radiation during incident-free transport, as well as impacts from postulated accidents and the potential for traffic accidents. Other measures to mitigate impacts could include (to the extent practicable) scheduling transports of wastes during periods of lighter traffic volume and training local emergency response personnel. To mitigate potential impacts on American Indian reservations and tribal enterprises, DOE/NNSA would collaborate with potentially affected tribes to develop appropriate emergency response measures.

7.4 Socioeconomics

No adverse impacts are expected over the course of the next 10 years. Therefore, no mitigation measures are proposed. DOE/NNSA will continue, using CGTO as a conduit, where appropriate, to identify employment opportunities for American Indian people and American Indian–owned businesses at the NNSS.

Socioeconomics—American Indian Perspective

CGTO Although the U.S. Department of Energy (DOE) continues to make strides to diversify their workforce, the Consolidated Group of Tribes and Organizations (CGTO) strongly encourages DOE to enhance efforts to hire more Indian people and promote the hiring of Indian-owned businesses to mitigate socioeconomic impacts to our people. To facilitate this effort, the CGTO could serve as a point of contact to assist DOE and its contractors in identifying and promoting employment opportunities for American Indians at the Nevada Site Office and the Nevada National Security Site (NNSS).

See Appendix C for more details.

7.5 Geology and Soils

Impacts related to surface disturbance would be mitigated on a site-specific basis, depending on factors such as the size of the area of disturbance, future use of the site, soil characteristics, annual precipitation, and site slope. Where possible, DOE/NNSA would use areas disturbed by past activities for staging, parking, and equipment storage during construction to minimize erosion.

Following removal of soils and vegetation, disturbed sites would be stabilized using water or commercially available soil stabilizers, such as polymers. Potential mitigation measures could include restoring slope stability by shoring, bolting, and grouting; planting natural vegetation; gravel re-armoring; chemical stabilization; and seeding. Where intensive revegetation techniques are necessary, subsoils could be amended and irrigation may be used to encourage germination and plant establishment. DOE/NNSA would make provisions for American Indian people to participate in stabilization and revegetation efforts on the NNSS, including identifying culturally appropriate stabilization efforts and revegetation techniques based on traditional ecological knowledge.

Geology and Soils—American Indian Perspective

During the evaluation of the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)*, the Consolidated Group of Tribes and Organizations (CGTO) noted severe disturbances to the geology and soils, or minerals, in large portions of the Nevada National Security Site (NNSS) (formerly the Nevada Test Site [NTS]) stemming from previous testing activities. This seemingly irreparable damage has made certain areas unfit for human use and inaccessible to American Indians who have relied on the earth, soil and minerals for medicine and religious purposes.

In general, the mitigation measures proposed by the U.S. Department of Energy (DOE) for geology and soils include erosion control through stabilization and re-vegetation. The CGTO is concerned about the unnatural erosion control methods proposed by DOE. In particular, the CGTO struggles with activities that require relocating rocks and soil away from where they were originally placed by the Creator and using them contrary to the Creator's intention. Indian people know relocating the soil in a culturally-unacceptable manner can cause adverse impacts to the environment, such as the increased potential for noxious weed growth. This could potentially threaten nearby native vegetation and harm people and wildlife that rely on it for survival.

Therefore, the CGTO recommends DOE implement culturally-appropriate stabilization efforts and re-vegetation techniques based on traditional ecological knowledge. Indian people stabilize our land by offering prayers to explain to the soil why it is being removed, how we intend to use it, and thanking it for its use. We then remove and protect the top soil for future use. We replace the soil with dirt and gravel from nearby land only after once again offering prayers, and re-contour the land out of respect to the visual landscape and unseen song and storyscapes. Indian people re-vegetate our land by determining suitable locations, offering prayers to bless the seeds and plants so they can grow strong. We take great care in placing the seedlings in the direction of the morning sun and give thanks for the opportunity to plant them, and for the water that is used to provide nourishment. Plants must be compatible with their new homes, neighboring plants, animal habitats, and soil composition. We believe a holistic approach helps to sustain balance and protects and restores our ancestral lands.

In the *1996 NTS EIS* and in the 2002 *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (2002 NTS SA)*, the CGTO continued to express concerns about the removal of contaminated soils and the need for religious leaders to conduct balancing ceremonies and healing prayers at these disturbed locations. In particular, the CGTO recommended tribal representatives provide information useful in the re-vegetation of a portion of the Double Tracks site located on the Tonopah Test Range (TTR). The CGTO maintains our involvement is still necessary for the Double Tracks site as well as the Clean Slates site also located on TTR; however, we are awaiting DOE's approval to proceed so we may begin to heal these lands and its resources.

See Appendix C for more details.

7.6 Hydrology

During development projects, DOE/NNSA would use site planning, design, construction, and maintenance strategies to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow. Such strategies could include use of biological systems and engineered systems such as, but not necessarily limited to, the following:

- Rain gardens, bioretention, and infiltration planters
- Porous pavements
- Vegetated swales and bioswales
- Trees and tree boxes
- Pocket wetlands
- Reforestation/revegetation using native plants
- Protection and enhancement of riparian buffers and floodplains

- Rainwater harvesting for use (e.g., irrigation; heating, ventilation, and air-conditioning; nonpotable indoor uses)
- Avoiding placing support structures in washes or desert dry wash woodlands, where feasible
- Use of existing natural drainage channels and natural features, such as earthen berms or channels, rather than concrete-lined channels, where feasible
- Road crossings over washes (where needed) that provide adequate flow-through during storm events
- Fencing that does not impede flows and sediment transport through drainages

Surface-water resources could be affected by disposal unit construction or environmental restoration activities that could alter drainage patterns, leading to possible erosion and deposition of sediments and inundation of areas or ponding of water. Impacts of sediment generation could be minimized by limiting exposed surfaces and intercepting runoff from exposed surfaces prior to discharge. Erosion and sediment controls would include use of runoff interceptor trenches or swales, filter or silt berms or fences, sediment barriers or basins, rock-lined ditches or swales, or stormwater drainage structures, as well as timely revegetation of exposed surfaces. Where practicable, DOE/NNSA would use areas disturbed by past activities for staging, parking, and equipment storage during construction to minimize erosion.

Hydrology—American Indian Perspective

When water is respected, it sustains all life forms. Conversely, when water is mistreated, it withdraws life-giving support and returns to the underworld. The Consolidated Group of Tribes and Organizations (CGTO) knows the hydrological systems throughout the Nevada National Security Site (NNSS) have been impacted from drought. Drainage patterns have been unnaturally altered from U.S. Department of Energy (DOE) activities and will continue to be impacted if these proceed. There are places on the NNSS where the rain falls but does not nurture the plants and animals. Therefore, the CGTO must be involved with DOE in mitigating impacts to hydrological resources because if the water is mistreated, it will remove itself from the NNSS.

To minimize some adverse impacts to hydrological resources, the CGTO recommends the DOE allow Indian people access to clean the natural tanks and pohs (natural catchment basins) to bring and gather water from the rain and to nourish the plants and animals that rely on it. The water within these features is central to our ceremonies in restoring balance. By supporting the CGTO in this proposed project, DOE will help reduce drought conditions. In turn, this project will provide spiritual, cultural and ecological benefits to the land and the environment, thereby facilitating our obligation to sustain the spiritual and ecological balance. Implementation will require cultural experts to identify sites, inventory and evaluate site resources and conditions, and to implement culturally-appropriate mitigation measures.

See Appendix C for more details.

DOE/NNSA would delineate a Wellhead Protection Area using site-specific modeling or a standard 1,000-foot radius around all drinking water source wells to protect against the introduction of contaminants. No experiments, construction, placement of facilities, parking, or hazardous material storage would occur in this area. DOE/NNSA would also continue to perform detailed hydrographic studies of its water supply system to ensure that new withdrawals of groundwater would allow sufficient groundwater aquifer recharge for future uses.

DOE/NNSA would utilize water conservation measures to the maximum extent practicable (for example, efficient landscaping and recycling of wastewater).

When scheduling experiments, DOE/NNSA would consider weather and ground conditions to minimize certain potential impacts that may be exacerbated by sheet flow during storm events, such as erosion and the spread of contaminants.

DOE/NNSA would consider requests by CGTO for American Indian people to access the “pohs” and natural tanks found throughout the NNSS for ceremonial purposes.

7.7 Biological Resources

In February 2009, the U.S. Fish and Wildlife Service (USFWS) issued the *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada* (*2009 Biological Opinion*) (USFWS 2009a) to the DOE/NNSA Nevada Site Office (NSO) that authorized the incidental "take" (accidental killing, injury, harassment, etc.) of desert tortoises that may occur during NNSS activities. Before implementing any new activity in desert tortoise habitat, DOE/NNSA provides specified information and consults with USFWS to determine whether the anticipated incidental take for each action, at the project level, complies with the *2009 Biological Opinion*. The *2009 Biological Opinion* concluded that activities anticipated to occur on the NNSS would not jeopardize the continued existence of the Mojave population of desert tortoises and that no critical habitat would be destroyed or adversely modified. NNSS activities occurring within the range of the desert tortoise must comply with the terms and conditions outlined in the *2009 Biological Opinion*, as shown in Chapter 5, Table 5–27. The *2009 Biological Opinion* also states that, if the level of incidental take is reached and anticipated to be exceeded during the course of actions, such an incidental take would represent new information requiring reinitiation of consultation and review of the reasonable and prudent measures in the *2009 Biological Opinion*. If a proposed activity or group of activities would result in an exceedance of the parameters of the *2009 Biological Opinion*, DOE/NNSA would consult with USFWS, in accordance with Section 7 of the Endangered Species Act. Should DOE/NNSA and the U.S. Bureau of Land Management (BLM) decide to go forward with a commercial solar power generation facility, specific measures to minimize and mitigate habitat loss would be incorporated into any future project-specific NEPA review. DOE/NNSA would incorporate mitigation measures provided in the BLM-DOE *Solar Energy Development Programmatic Environmental Impact Statement* (announced at 76 *Federal Register* [FR] 66958), as applicable.

The DOE/NNSA NSO Desert Tortoise Compliance Program was developed in 1992, with the issuance by USFWS of the first Biological Opinion for the NNSS. The Desert Tortoise Compliance Program serves to implement the terms and conditions of the most current version of the Biological Opinion for the NNSS, to document compliance actions taken, and to assist the DOE/NNSA NSO with USFWS consultations. Some of the activities of the Desert Tortoise Compliance Program include (1) reviewing proposed activities at the NNSS to determine whether they may be located in tortoise habitat and whether clearance surveys and/or monitoring are required, (2) conducting clearance surveys at project sites within 1 day of the start of project construction, (3) ensuring that environmental monitors are on site during heavy equipment operations, (4) developing training modules and ensuring that all personnel working on the NNSS are trained in the requirements of the Biological Opinion, and (5) preparing annual compliance reports for submittal to USFWS. By implementing the Desert Tortoise Compliance Program, the DOE/NNSA NSO would ensure that most, if not all, of the impacts on desert tortoises addressed in this analysis would involve harassment, rather than injury or mortality.

In addition to the Desert Tortoise Compliance Program, the DOE/NNSA NSO conducts a comprehensive program to monitor and protect sensitive plant and animal species and other biological resources on the NNSS, including the following:

- Biological surveys are performed at project sites where land-disturbing activities are proposed. The goal is to minimize adverse effects of land disturbance on sensitive and protected/regulated plant and animal species, their associated habitat, and other important biological resources. Survey reports document the species and resources found and provide mitigation recommendations.
- Beginning in 2004, the DOE/NNSA NSO began annual surveys each spring to assess wildland fire hazards on the NNSS. NNSS ecologists conduct these wildland fire surveys in coordination with NNSS Fire and Rescue.

- Under the NNSS Sensitive Plant Monitoring Program, the status or ranking of sensitive plant species known to occur on the NNSS is evaluated annually to ensure such plants are afforded the appropriate protection under Federal and state laws. Sensitive plant species populations on the NNSS are routinely monitored to assess plant density, plant vigor, or identify any threats to or impacts on the species.
- As part of the Sensitive and Protected/Regulated Animal Monitoring Program, to ensure such animal species are afforded the appropriate protection under Federal and state laws, the DOE/NNSA NSO currently monitors 18 animal species on the NNSS. Federal and state lists of sensitive and protected/regulated animal species are reviewed annually to update the list of animal species monitored through this program.
- Additional monitoring is conducted for such things as natural wetlands to characterize seasonal baselines and trends in physical and biological parameters; West Nile virus to help the Southern Nevada Health District ascertain the presence and/or prevalence of the virus in the NNSS mosquito population; and constructed water sources to assess their use by wildlife for the purpose of developing and implementing mitigation measures to prevent them from causing significant harm to wildlife.
- The Habitat Restoration Program involves the revegetation of disturbed land and evaluation of previous revegetation efforts. These activities are conducted at both the NNSS and the Tonopah Test Range (TTR).
- An Ecological Monitoring and Compliance Program Report is published each year to document the previous year's activities and accomplishments in all of the above-noted areas.

These activities are all elements of the DOE/NNSA NSO's program to ensure compliance with DOE Order 436.1, *Departmental Sustainability*, and all applicable statutes and regulations.

The last nuclear weapon test at the NNSS was conducted in September 1992. Since that time, most activities at the NNSS have not affected offsite areas and, as discussed in Chapter 4, Section 4.1.7.6, ongoing monitoring of plants and animals on the NNSS has consistently demonstrated that, while plants and animals that inhabit radiological sites or radioactive waste containment covers may have elevated concentrations of radionuclides in their bodies, the concentrations are below levels considered harmful to their health. To date, there has been no indication that plants or animals located in offsite areas near the NNSS have been adversely affected by radioactive contamination remaining in the soil. DOE/NNSA will continue to monitor biota on the NNSS and will conduct characterization activities in radioactively contaminated areas on the Nevada Test and Training Range, as well as in an area that may extend to the east onto the Desert National Wildlife Range, to determine the levels of radioactivity present and the areal extent of the contaminated soils. If such contamination is found and determined to be of sufficient magnitude as to potentially impact wildlife, DOE/NNSA will work with the U.S. Air Force and, as applicable, USFWS to develop specific mitigation measures.

Chapter 5, Sections 5.1.7.1.3, 5.1.7.2.3, and 5.1.7.3.3, describe potential impacts on sensitive and protected species, including migratory birds. DOE/NNSA's staff of qualified plant and animal ecologists conduct pre-activity and other surveys related to biological resources on the NNSS, monitor various species that live on the NNSS, and maintain a constant surveillance of the NNSS biota. Because golden eagle nesting is rare on the NNSS (only two nests have been documented since 1968), these ecologists take special note when they do occur. As stated in Chapter 4, Section 4.1.7.4, as well as the above-noted sections of Chapter 5, if an active nest of a sensitive or otherwise protected or regulated bird species may be impacted by a proposed activity, DOE/NNSA would first seek to avoid the impact by postponing the activity until after the young birds fledge. If avoidance were not possible, DOE/NNSA would consult with USFWS before taking any action that would affect the nest or nesting birds.

Under Executive Order 13112, *Invasive Species,* subject to the availability of appropriations and within Administration budgetary limits, Federal agencies are to use relevant programs and authorities to: (1) prevent the introduction of invasive species; (2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (3) monitor invasive species populations accurately and reliably; and (4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded.

The DOE/NNSA Habitat Restoration Program involves the revegetation of disturbances and the evaluation of previous revegetation efforts. Sites that have been revegetated are periodically sampled, and the information obtained is used to develop site-specific revegetation plans for future restoration efforts on the NNSS. DOE/NNSA has conducted revegetation for projects that damage desert tortoise habitat, water pipeline installations/replacements, wildfire sites, and abandoned industrial or nuclear test support sites characterized and remediated under the Environmental Restoration Program. Revegetation supports the intent of Executive Order 13112 to prevent the introduction and spread of non-native species and restore native species and habitat conditions in ecosystems that have been invaded. In addition, as noted in Chapter 4, Section 4.1.7, and Chapter 5, Section 5.1.7, DOE/NNSA annually conducts surveys of the NNSS to assess the hazards of wildland fires, as well as conducts pre-activity surveys and other plant and wildlife monitoring/surveillance activities throughout the year. Those surveys and monitoring/surveillance activities are conducted by qualified ecologists who additionally survey for noxious or invasive plant species populations. These survey, surveillance, and monitoring activities support the intent of Executive Order 13112 to monitor invasive species populations accurately and reliably and detect and respond rapidly to and control populations of invasive species in a cost-effective and reliable manner. In Section 5.1.7, invasion of disturbed areas by invasive species is acknowledged. When invasion of disturbed areas by noxious weeds is identified during the survey, NNSS Maintenance is notified and may undertake appropriate steps (i.e., application of herbicides or mechanical removal) to selectively eradicate the target plants.

At the TTR, DOE/NNSA's Sandia Site Office (SSO) has an Ecology Program that serves to conserve flora and fauna (NNSA/SSO 2010). The primary objectives of the Ecology Program include the following:

- Collect ecological resource inventory data to support site activities, while preserving ecological resources and maintaining regulatory compliance
- Collect information on plant and animal species present to further the understanding of ecological resources on site
- Collect biota contaminant data on an as-needed basis in support of site projects and regulatory compliance
- Assist Sandia National Laboratory organizations in complying with regulations and laws
- Provide information to employees regarding ecological resource conservation
- Support Sandia National Laboratory line organizations by conducting biological surveys in support of site activities

Enhancement measures that have been utilized in the past include installing artificial nest platforms, boxes, and perches.

In 2010, an Avian Protection Plan was adopted and implemented at the TTR (Lacy 2011). The Avian Protection Plan was developed to describe procedures that would be taken by DOE/NNSA at the TTR to address potential impacts from its associated transmission and distribution lines to avian species that are known to occur in the area (NNSA/SSO 2010).

In August 2010, the DOE/NNSA SSO completed retrofitting four electrical transmission/distribution structures to reduce the risk of electrocution of larger birds, particularly raptors. The retrofitting included new insulator caps, rerouting of and insulation of jumpers, and insulation of grounding wires.

In the future, new construction and refurbishments at the TTR will use a raptor-safe pole design and wire configuration to help reduce avian mortality. Regular surveys along the power lines will be conducted. Monitoring will be increased for any structures or lines segments that have any avian issues. If a need for mortality reduction measures is identified, these measures will be fully developed in cooperation with Federal and state agencies.

Bird mortality incidents reported as a result of power outages or through incidental observations will be reviewed immediately. If the cause is related to an unprotected power pole or conductor issue, a mortality reduction action (i.e., retrofitting poles, installing protective coverings or perch deterrents diverters) will be implemented accordingly, consistent with standard practices recommended by the Avian Power Line Interaction Committee (APLIC 2006).

If a nest is detected in or around electrical transmission/distribution facilities, a risk assessment will be conducted to determine whether nest removal or relocation is needed. If it is determined that the nest location poses no risk to system function, maintenance procedures, or the birds, the nest will be allowed to remain. If it is determined that the nest poses a potential risk, a further assessment will be conducted to determine whether the risk is imminent. The TTR will coordinate with USFWS to determine whether the nest needs to be removed and discarded or relocated to an alternative location.

Unless there is an immediate threat to birds or system function, nest removal or relocation (excluding eagles and federally or state-listed species) will occur only during the non-breeding season when the nest is not being used or during the breeding season if the nest is unoccupied. If removal or relocation of an eagle’s or federally or state-listed species’ nest is necessary, the TTR will coordinate with USFWS regarding permitting and authorization pursuant to applicable regulations. Nest removal or relocation will occur when the nest is occupied only in cases where it is deemed warranted based on the risk to system function or to the birds (electrocution). Removal or relocation of an occupied nest will require coordination and permitting/authorization with USFWS and/or the Nevada Department of Wildlife.

DOE will continue its collaboration with CGTO to manage biological resources, including pine nut tree care and the relocation and reintroduction of the big horn sheep and desert tortoise. American Indian people consider the relocation and reintroduction of animals to be highly sensitive religious acts, and DOE will include the participation of American Indian people in these activities.

Biological Resources—American Indian Perspective

The mitigation measures presented by the U.S. Department of Energy (DOE) in Section 7.7 focus on avoidance of biological resources, relocation of animals species and monitoring plants, animals, and their habitats. The Consolidated Group of Tribes and Organizations (CGTO) recommends DOE mitigate adverse impacts to biological resources through avoidance, culturally-appropriate re-vegetation efforts, reintroduction of native animals, and traditional plant and animal management methods. Indian people have extensive traditional ecological knowledge and deep concern for the biological resources of the area and should participate directly with DOE to mitigate impacts and protect their resources.

According to tribal elders, *"Prior to re-vegetation efforts, we talk to the land to let it know what we plan to do and ask the Creator for help. We choose our seeds from the sweetest and best plants and store them for the winter to dry. When the winter is over, we place the seeds in a moist towel or sock until they are ready to transplant into the ground. This is a long and delicate process, requiring patience, skill and knowledge passed down from our ancestors. If the plants are struggling to grow, we tag them and move them to face the same direction of the sun."*

The DOE would benefit from this knowledge to enhance their re-vegetation efforts. The CGTO knows DOE struggles with success rates regarding the density and diversity of native plants during re-vegetation efforts. A co-stewardship approach with us would enable DOE to enhance their re-vegetation efforts, thus saving time, money and resources.

Part of the mitigation measures presented by DOE in this section includes notifying the U.S. Fish and Wildlife Service (FWS) of incidental taking of desert tortoises. The desert tortoise is culturally significant to Indian people because of its healing powers, longevity and wisdom. It is integral to our traditional winter stories, well-being and perpetuation of our native culture. Incidental taking of this traditionally-important animal is particularly disturbing to native people. Accordingly, the CGTO must be notified concurrently with the FWS to prepare our people and the environment of this loss.

Over the past 14 years, various initiatives have been undertaken to restore animal habitats and reintroduce certain animals such as the desert big horn sheep near the southern portions of the Nevada National Security Site (NNSS) without participation from the CGTO. Modification of habitat or the restocking of animals is considered a highly sensitive religious act and requires participation from Indian people. For these activities to be successful, it is essential to have tribal representatives involved throughout this process.

See Appendix C for more details.

7.8 Air Quality and Climate

To reduce emissions from mobile sources, DOE/NNSA would provide further incentives for the NNSS commuter program to encourage more employees to travel by bus to the NNSS, rather than using privately owned vehicles.

DOE/NNSA would extend the Conservation and Renewable Energy Program to activities beyond 2015 and continue improving energy efficiency measures in new and existing buildings through at least 2020. To reduce dependence on energy generated from fossil fuels, DOE/NNSA would pursue using at least a portion of the electricity generated from the solar power projects proposed under all of the alternatives.

Waste management, facility decommissioning, and environmental restoration activities have the potential to release radioactive constituents and nonradioactive pollutants from suspension of particulates from soil, operation of heavy equipment, evaporation of tritium, and treatment of explosive waste. The release of these pollutants would be controlled by compliance with DOE and external regulatory requirements, and pursuing site closure in place when appropriate.

Emissions from construction equipment would be minimized through activities such as properly maintaining the equipment, applying diesel engine refit technology as practicable (e.g., catalytic particulate filters), and limiting unnecessary equipment idling times. To reduce diesel particulate matter, DOE/NNSA would require the use of U.S. Environmental Protection Agency (EPA) Tier 4 certified diesel engine construction equipment. During a transition period to EPA Tier 4 equipment, DOE/NNSA would require that equipment meets the EPA Tier 3 standards. Other measures to reduce diesel particulate emissions would include using construction equipment that runs on compressed natural gas as well as some smaller construction equipment with electric engines.

DOE/NNSA would seek to minimize emissions during construction and maintenance activities through development and implementation of a Construction Emissions Mitigation Plan and/or Fugitive Dust Control Plan. Details of these plans will be described more fully in the mitigation action plan that DOE/NNSA will prepare after issuance of a Record of Decision. The Construction Emissions Mitigation Plan and/or Fugitive Dust Control Plan will describe measures to reduce the release of dust and particulates using standard best management practices, including the following:

- Stabilizing unpaved construction roads with a nontoxic soil stabilizer or soil-weighting agent
- Watering disturbed areas of construction sites to control visible dust plumes
- Limiting vehicle speeds on stabilized unpaved roads to 25 miles per hour as long as such speeds do not create a visible dust plume
- Limiting vehicle speeds on unstabilized unpaved roads and within construction areas to 10 miles per hour or less
- Stabilizing disturbed soils after construction activities are completed and revegetating exposed areas
- Minimizing construction activities under windy conditions and using wind erosion controls (such as windbreaks, water, or chemical dust suppressants) where soils are disturbed in construction and materials storage areas
- Phasing construction activities, where possible and practicable, to avoid disturbing the entire construction area at once
- Monitoring for fugitive dust emissions and initiating increased control measures to abate any visible dust plumes

CGTO has expressed concerns that climatic change (including irregular cycles of rain and snow) is occurring and will adversely impact the natural resources of the NNSS and the surrounding region. DOE/NNSA will work with CGTO to identify opportunities for American Indian people to conduct traditional ceremonies at the NNSS aimed at mitigating climate-based impacts, including Rain Calling, Snow Making, and Balancing ceremonies.

7.9 Visual Resources

Recent studies have shown that painting structures one to two shades darker than the color of the general surrounding area reduces the visual impact of the structure compared with painting it a matching or lighter hue (BLM 2008a). Therefore, new structures would be painted accordingly. In addition, shotcrete[1] structures would implement integral color, in the same nature, to reduce visibility. Colors would be chosen from the BLM Standard Environmental Colors Chart CC-001: June 2008. Because color selection would vary by location, color panels would be evaluated from key observation points during common lighting conditions (front and back lighting) to aid in the appropriate color selection. Panels would be a minimum of 3 feet by 2 feet in dimension and would be evaluated from various distances to ensure the best possible color selection.

All paints used for the color panels and structures would be color-matched directly from the physical color chart, not digital or color-reproduced versions of the color chart. Paints would have a dull, flat, or

[1] *Shotcrete is concrete projected through a hose at high speeds onto a surface.*

satin finish only. Appropriate paint types would be selected for the finished structures to ensure long-term durability of the painted surfaces. The paint color would be maintained over time.

Mitigation Measure 1: Apply Minimum Lighting Standards. Lights would be installed at the lowest practicable height, and the lowest practicable wattage would be used. Lights would be screened and directed downward, away from the night sky, to the highest degree possible. The number of nighttime lights would be minimized to the highest degree possible.

Visual Resources—American Indian Perspective

All landforms within the Nevada National Security Site (NNSS) have high sensitivity levels for American Indians. The ability for us to see the land without the distraction of buildings, towers, cables, roads and other objects is critical to establishing the spiritual connection between Indian people and our traditional lands. We rely on unobstructed views, as we share our songs and stores. These activities help us reaffirm the importance of the land and the tie to American Indian ceremonialism that is necessary for our cultural survival.

The Consolidated Group of Tribes and Organizations (CGTO) knows that many of the activities described under the proposed action and alternatives, such as those associated with facility construction and environmental restoration, will adversely impact visual resources. For Indian people, the adverse impact to visual resources will most certainly impact the spiritual harmony of the environment as a whole. Facility construction and operation will impede visual resources and affect the solitude and cultural integrity of the land.

Although the U.S. Department of Energy (DOE) proposes to mitigate visual resource impacts by painting structures to reduce visibility, the CGTO knows additional mitigation measures are necessary. The CGTO recommends that landscape modifications, including those associated with environmental restoration activities, be done in consultation with tribal representatives. Specifically, DOE should make provisions for Indian people to participate in annual monitoring of land disturbing activities through the duration of the project. The CGTO should also participate in restoring the land, and concealing infrastructure using traditional Indian re-vegetation methods (See American Indian Perspective for Section 7.7, Biological Resources). Finally, the CGTO recommends that DOE make provisions for Indian people to conduct ceremonies and offer prayers and songs in an effort to re-balance this adversely impacted resource.

See Appendix C for more details.

7.10 Cultural Resources

The DOE/NNSA NSO is committed to ensuring that the NNSS Cultural Resources Management Program meets the requirements of Federal mandates, addresses the concerns of external groups, minimizes adverse impacts on cultural resources, and integrates historic preservation into routine management and project-specific compliance activities. At all times, the NNSS Cultural Resources Management Program attempts to combine preservation and mitigation strategies to meet the needs of the DOE/NNSA NSO mission. As part of this commitment and in compliance with Section 106 of the National Historic Preservation Act, the DOE/NNSA NSO conducts cultural resources surveys and identifies cultural resources within the area of potential effect for all proposed projects and activities (undertakings) that may affect cultural resources. If possible, the DOE/NNSA NSO avoids significant cultural resources impacts by adjusting the location of a proposed undertaking. When avoidance is not practicable, the DOE/NNSA NSO consults with the Nevada State Historic Preservation Officer, and possibly the Advisory Council on Historic Preservation, to identify measures to mitigate adverse impacts on those resources.

Under all of the alternatives, projects and activities would have the potential for adverse impacts on cultural resources. Several strategies for mitigating adverse impacts on cultural resources could be employed. For archaeological resources, these strategies would consist of avoidance, evaluation and data recovery, and monitoring. For structure-related (also known as built environment) resources, strategies would consist of avoidance, evaluation and archival documentation, and monitoring. The *Cultural Resources Management Plan for the Nevada Test Site* (DOE 2010a) provides cultural resources compliance guidance to the DOE/NNSA NSO, its contractors, and other users of the NNSS. Under

Federal regulations, a significant cultural resource designated as a "historic property" warrants consideration with regard to potential adverse impacts resulting from proposed Federal actions (DOE 2002e). The descriptions of the mitigation measures below summarize those actions described in the Cultural Resources Management Plan.

Mitigation Measure 1: Avoidance of Significant Cultural Resources. When specific project information becomes available, it may be possible to avoid impacts on cultural resources through project design. For archaeological resources, prior to determining whether avoidance is feasible, it may be necessary to conduct test excavations to determine the vertical and horizontal extent of the resource. Once avoidance can be assured, resource location information would be delineated on project plans or sensitive areas would be fenced off prior to project implementation as areas to be avoided and periodically monitored. During the project, if avoidance were determined to be infeasible, the processes outlined in Mitigation Measure 2 (for archaeological resources) and Mitigation Measure 3 (for built environment resources, i.e., buildings, structures, engineered features, etc.) would be followed, as applicable.

Mitigation Measure 2: Evaluation and Data Recovery of Significant Archaeological Resources. It is presumed that it would not be possible to avoid all cultural resources within the various areas of program implementation. Resources that cannot be avoided would be subject to test excavations to determine their significance and, if determined to be significant, would be subject to data recovery. The process that would be followed to determine resource significance and conduct data recovery would be developed in a historic properties treatment plan. All archaeological work on properties eligible for listing in the National Register of Historic Places would be conducted in accordance with *Treatment of Archaeological Properties: A Handbook* (ACHP 1980), the Advisory Council on Historic Preservation's *Archaeology Guidance* (ACHP 2009), and *Archaeology and Historic Preservation: the Secretary of the Interior's Standards and Guidelines* (*Standards and Guidelines*) (NPS 1983). Investigations would be performed under the supervision of professionals whose education and experience meet or exceed the Secretary of the Interior's professional qualifications standards, as described in the *Standards and Guidelines* (NPS 1983).

Mitigation Measure 3: Archival Documentation of Significant Built Environment Resources. If project implementation requires removal of a built environment resource (e.g., buildings, structures, and engineered features), Historic American Building Survey/Historic American Engineering Record (HABS/HAER) documentation would be completed. DOE/NNSA would contact the Nevada State Historic Preservation Officer to determine the level and kind of HABS/HAER documentation that would be required for the resource. DOE/NNSA would ensure that the required documentation is completed and accepted by HABS/HAER before the resource is deconstructed.

Mitigation Measure 4: Monitoring of Significant Archaeological Resources. Portions of the area of potential effects have been determined to have the potential for buried archaeological resources. During project implementation, archaeological monitoring would be conducted within these areas. Any unanticipated resources identified during monitoring would be evaluated and treated in accordance with Mitigation Measures 1 and 2. If human remains were discovered during monitoring, the regulatory requirements described in Mitigation Measure 6 would be followed.

Mitigation Measure 5: Monitoring of Significant Built Environment Resources. Significant built environment resources would be periodically monitored to ensure protection of the resources. If unexpected effects on significant built environment resources were identified, provisions for protection, stabilization, or mitigation would be made in consultation with the Nevada State Historic Preservation Officer.

Mitigation Measure 6: Discovery of Human Remains. Should human remains be discovered during project implementation and be determined to be American Indian, DOE/NNSA would follow the requirements of the Native American Graves Protection and Repatriation Act (NAGPRA) and other applicable Federal laws.

DOE/NNSA has supported several cultural resources studies at the NNSS that have incorporated previous recommendations made by CGTO. These cultural resources studies have identified several areas on the NNSS that are culturally and spiritually important to American Indian people. DOE/NNSA would collaboratively work with CGTO to arrange for tribal visits to monitor the state of cultural sites located within the NNSS and to offer blessings. DOE/NNSA would also arrange for tribal visits to areas that have been designated for repatriation, such as the Timber Mountain area, and for periodic assessments by American Indian people of efforts conducted by DOE/NNSA to comply with NAGPRA.

Cultural Resources—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) understands the mitigation measures proposed by the U.S. Department of Energy (DOE) in this site-wide environmental impact statement (SWEIS) include avoidance, evaluation and data recovery, and monitoring, as described further under Mitigation Measures 1 through 6 of the Nevada Test Site (NTS) Cultural Resource Management Plan. Accordingly, the CGTO must be an integral part of these mitigation measures so impacts on American Indian cultural resources can be minimized or averted. American Indian people know the Nevada National Security Site (NNSS) landscape in great depth and can help DOE identify and protect traditional-use plants, animals, geography, archaeological sites, and traditional cultural properties that have been or may be adversely impacted by NNSS programs and activities.

The CGTO recommends DOE make provisions for Indian people to continue to identify culturally significant locations so potentially impacted resources can be identified, alternative solutions discussed, and adverse impacts averted. These studies will address and guide DOE in developing culturally-appropriate Best Management Practices to protect cultural resources and more effectively implement Mitigations Measures 1 through 6. To accomplish this, Indian people must be involved with the following actions:

- Assess and determine culturally-appropriate measures to protect geological formations important to the spiritual landscape.
- Implement culturally-appropriate environmental restoration techniques that require minimal ground disturbance.
- Restore impacted plant and animal species essential to the spiritual and cultural landscape.
- Provide American Indian people access to CGTO designated areas so we can conduct purification and balancing ceremonies in an attempt to restore the natural and spiritual harmony of the NNSS landscape.
- Complete Traditional Cultural Property (TCP) Nomination process previously recommended by the CGTO in 2009 for Shoshone Mountain and initiated for Water Bottle Canyon.
- Complete the Indian History Project report prepared collaboratively with DOE, the U.S. Department of Defense (DOD) and CGTO in 2001.
- Develop and implement systematic American Indian ethnographic studies to better understand the interconnectedness of the cultural landscape, and implement culturally-appropriate methods to protect the landscape and sustain spiritual and cultural balance.
- Complete the re-vegetation efforts for the restoration of Clean Slates dating back to 1996.

In addition, the CGTO recommends Gold Meadows continue to be set aside for exclusive Indian use because of significant cultural resources. Similarly, the CGTO recommends DOE set aside Water Bottle Canyon, Scrugham Peak, Prow Pass, Timber Mountain, and select areas within Calico Hills and Shoshone Mountain for exclusive Indian use. Efforts should be made to forego any additional land disturbances within these areas and provide access to Indian people.

The CGTO agrees with the mitigation measures proposed by DOE in this SWEIS regarding site monitoring, and recommends Indian people serve as site monitors. As a minimum, the CGTO recommends annual tribal visits to monitor the condition of cultural sites located within the NNSS and off-site locations to offer appropriate. The CGTO further recommends visits to areas designated or potentially designated for repatriation such as Pahute Mesa. Finally, we recommend Indian people conduct periodic assessments in accordance with the Native American Graves Protection and Repatriation Act (NAGPRA) and other federal mandates.

See Appendix C for more details.

7.11 Waste Management

Waste management activities at the NNSS would result in the permanent commitment of land for disposal of radioactive and nonradioactive waste. This land commitment would be reduced through continuation of the DOE Waste Minimization and Pollution Prevention Program, which reduces the quantity of waste generated each year and enhances the recycle or reuse of waste or excess materials, resulting in less waste that requires disposal each year. Land commitment would also be reduced by restricting waste disposal to approved, designated areas.

Waste Management—American Indian Perspective

We continue to strongly oppose the transportation, storage and disposal of radioactive waste at the Nevada National Security Site (NNSS); however, Indian people must continue to fulfill our birth-rite obligation to care for our Holy Land and do what we can to try to restore balance to Area 5 and other contaminated locations. The Consolidated Group of Tribes and Organizations (CGTO) recommends U.S. Department of Energy (DOE) allocate funds and resources for Indian people to conduct systematic ethnographic studies of these waste management programs. If DOE selects the expanded use alternative, the CGTO must conduct a cultural assessment of the Area 3 Radioactive Waste Management Site (RWMS) prior to new use to mitigate potential impacts.

The CGTO supports DOE's intention to minimize waste within the NNSS area. We encourage the DOE to partner with us to develop and participate in DOE's waste minimization and pollution prevention programs. In particular, the waste minimization efforts described in the SWEIS regarding land commitments must include members of the CGTO to ensure that cultural implications of these decisions are considered prior to implementation.

Finally, the CGTO struggles with the ethics of transporting and relocating radioactive waste from other American Indian lands so those people can live without fear of unnatural radioactivity. We are greatly concerned about the adverse spiritual, environmental, and health impacts associated with relocating these angry rocks from their current locations to our Holy Land. We believe transporting these to our land perpetuates animosity and discord among tribal governments and disproportionately impacts the natural balance of the area. Because these decisions adversely impact our land and our relationships with other tribal governments, the CGTO recommends DOE host a break-out session for culturally-affiliated tribes associated with the NNSS and the multi-state waste generator facilities during DOE's Annual Waste Generator Conference. These efforts will facilitate further discussion, understanding, and develop culturally-appropriate mitigation measures.

See Appendix C for more details.

7.12 Human Health

Impacts on the health and safety of workers would be minimized by continued implementation of formal radiation protection and chemical hazards management programs in compliance with DOE radiation protection and occupational safety and health requirements. Among other measures, DOE has implemented an Integrated Safety Management System that integrates environment, safety, and health management programs at DOE sites. The use of an Integrated Safety Management System helps ensure that (1) all levels of program organizations are accountable for environmental protection; (2) all projects are planned with environment, safety, and health concerns in mind; and (3) continuous improvements in program implementation occur.

Radiation protection mitigation measures would include formal analysis of proposed work in a radiological environment by workers, supervisors, and radiation protection personnel and identification of methods to reduce worker exposures to levels as low as reasonably achievable (e.g., use of personal protection equipment, shielding, time management in radiation areas, and training), as well as distribution of the workload across a larger number of workers.

Mitigation measures to protect workers from physical hazards would involve safety reviews of planned activities and implementation of safety measures, including bracing and stabilizing buildings and excavations, wearing personal protective equipment, and conducting safety monitoring and inspections.

Mitigation measures to protect workers from hazardous or toxic materials include training, monitoring, use of personal protective equipment, administrative controls, and compliance with the NNSS Hazardous Materials Control and Management Program. Among other things, this program subjects the purchase of chemicals to a review process to ensure that toxic chemicals and products are not purchased when less-hazardous substitutes are available. The Chronic Beryllium Disease Prevention Program established at the NNSS and other DOE sites reduces the number of workers potentially exposed to beryllium while at work, minimizes the levels of and potential for exposure to beryllium, and maintains a medical surveillance program for early detection of disease.

Very small impacts on members of the public could result from release of radioactive materials to air, particularly from environmental restoration activities, or from release of other airborne pollutants from activities such as heavy equipment operation. These impacts would be minimized by continued compliance with applicable DOE, other Federal, and state requirements (e.g., requirements implemented under the Atomic Energy and Clean Air Acts). Impacts on the public from releases of radioactive and nonradioactive pollutants to air would be reduced via control measures such as using water or surfactants to reduce suspension of contaminated particulates and continuing environmental monitoring programs that track releases, impacts, and trends and publish their results.

DOE/NNSA will collaborate with potentially affected tribes to develop appropriate emergency response measures. DOE will also provide affected tribal governments with current versions of the NNSS Emergency Preparedness Plan and allow tribal governments to participate in the training and implementation of the Emergency Management Program set forth by DOE/NNSA and its contractors.

7.13 Environmental Justice

Although no environmental justice impacts have been identified in this SWEIS, DOE/NNSA will continue the following activities to avoid disproportionate impacts on low-income and minority populations:

- Expand opportunities for low-income and minority communities to provide input within the public involvement process by seeking the constructive involvement of affected stakeholders

- Encourage CGTO participation in DOE/NNSA-sponsored cultural resources investigations, including those associated with ground-disturbing activities such as environmental restoration

- Encourage CGTO participation in development of educational programs to ensure students and researchers receive proper guidance regarding how to interact with the physical environment and cultural landscape

- CGTO maintains that environmental justice concerns from DOE/NNSA NSO activities continue to exist. Of special concern to CGTO is the potential for holy land violations, cultural survival access violations, and disproportionately high and adverse human health and environmental impacts on the American Indian population. While DOE/NNSA did not reach these same conclusions in its environmental justice analysis in this SWEIS, DOE/NNSA will continue its collaboration with CGTO to address the concerns of American Indian people. While the funding and operational constraints of activities must be considered on a case-by-case basis, DOE/NNSA will continue allowing American Indian people access to sites on the NNSS to conduct traditional ceremonies, protecting identified cultural resources, and including American Indian perspectives in its environmental protection programs. DOE/NNSA also will continue its sponsorship of periodic meetings with CGTO to discuss current and proposed actions in greater depth, to deliberate potential impacts, and to consider and develop mutually acceptable mitigation measures.

7.14 Environmental Management Systems

The DOE/NNSA NSO conducts activities at its facilities in Nevada in a manner that ensures protection of the environment, the worker, and the public. This is accomplished through the implementation of the DOE/NNSA NSO Environmental Management System. An Environmental Management System is a business management practice that incorporates concern for environmental performance throughout an organization, with the ultimate goal to continually reduce the organization's impact on the environment. An Environmental Management System ensures that environmental issues are systematically identified, controlled, and monitored. It also provides mechanisms for responding to changing environmental conditions and requirements, reporting on environmental performance, and reinforcing continual improvement. The DOE/NNSA NSO Environmental Management System incorporates environmental stewardship goals that are identified in the Federal Environmental Management System directives applicable to all DOE/NNSA sites.

Based on independent evaluation of the DOE/NNSA NSO Environmental Management System, certification was maintained for 2009 and 2010. The environmental policy underlying the DOE/NNSA NSO Environmental Management System contains the following key goals and commitments:

- Protect environmental quality and human welfare by implementing Environmental Management System practices
- Identify and comply with all applicable DOE orders and Federal, state, and local environmental laws and regulations
- Identify and mitigate environmental aspects early in project planning
- Establish environmental objectives, targets, and performance measures
- Collaborate with employees, customers, subcontractors, and key suppliers on sustainable development and pollution prevention efforts
- Communicate and instill an organizational commitment to environmental excellence through processes of continual improvement

DOE/NNSA NSO operations are evaluated to determine whether they have an environmental aspect and to implement the DOE/NNSA NSO Environmental Management System to minimize or eliminate any potential impacts. Operations are evaluated by performing hazard assessments, preparing health and safety plans and execution plans, and preparing and reviewing NEPA documents. All of these documents require identification of mitigation actions to minimize the risk of adverse impacts.

DOE/NNSA NSO operations are reviewed annually to determine which Environmental Management System objectives and targets will be implemented to address specific environmental aspects. In addition, As stated in the previous section, DOE/NNSA incorporates American Indian perspectives into its planning processes by continuing to sponsor periodic meetings with CGTO to discuss current and proposed actions in greater depth, to deliberate potential impacts, and to consider and develop mutually acceptable mitigation measures.

CHAPTER 8
RESOURCE COMMITMENTS

8.0 RESOURCE COMMITMENTS

In accordance with the National Environmental Policy Act (NEPA), Section 102 (42 *United States Code* [U.S.C.] 4332), and the Council on Environmental Quality's NEPA implementing regulations (40 *Code of Federal Regulations* [CFR] 1502.16), Chapter 8 addresses the following:

- Any unavoidable adverse effects associated with implementation of the alternatives presented in Chapter 3, "Description of Alternatives"
- The relationship between short-term uses of the environment and maintenance and enhancement of long-term productivity
- Any irreversible and irretrievable commitments of resources associated with implementation of the alternatives

8.1 Nevada National Security Site

8.1.1 Unavoidable Adverse Effects

The potential environmental consequences of implementing the alternatives are discussed in Chapter 5 of this site-wide environmental impact statement (SWEIS). During implementation of any of the alternatives, the U.S. Department of Energy National Nuclear Security Administration (DOE/NNSA) would take all reasonable measures to avoid or minimize potential environmental impacts. These measures would include best management practices, as well as the mitigation measures presented in Chapter 7 of this SWEIS. Following a Record of Decision, DOE/NNSA would also commit to development and implementation of a mitigation action plan in accordance with 10 CFR 1021.331, if mitigation commitments are made in the Record of Decision. However, there could be unavoidable adverse impacts associated with implementation of the alternatives. This section provides a summary of those unavoidable adverse impacts.

8.1.1.1 No Action Alternative

Most air emissions at the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) would be associated with mobile source (e.g., vehicles and portable equipment) activity. The NNSS contribution to the mobile source emissions in Clark and Nye Counties would continue to be small and would decrease relative to 2008 emission levels, except volatile organic compound (VOC) emissions from NNSS mobile sources in Clark County, which would increase relative to 2008 emission levels by 0.4 tons per year due to the widespread use of ethanol blends in southern Nevada. VOC emissions are not expected to violate the ozone air quality standard because the increase would be relatively small and such mobile source emissions would be dispersed throughout the Las Vegas Valley and the U.S. Route 95 corridor. NNSS-related activities under the No Action Alternative would create about 39,360 carbon-dioxide-equivalent tons of greenhouse gas emissions per year (45,376 tons when temporary construction worker commuting is included).

8.1.1.1.1 National Security/Defense Mission

Airspace restrictions would continue to prohibit commercial and general aviation use. DOE/NNSA would continue to coordinate the use of airspace with the Nellis Air Traffic Control Facility, the controlling entity responsible for NNSS airspace.

Ground-disturbing activities that encroach on undisturbed areas are likely to have adverse impacts on vegetation and soils, including essential components of the desert tortoise's habitat. These activities could potentially disturb native vegetation, although the amount of vegetation and soil that would be affected is not expected to reduce the viability of special status wildlife significantly or have substantial negative impacts on biodiversity, ecosystem functions, or springs in these areas. If native vegetation were disturbed during the nesting season for birds, the eggs or young in nests located within the project area could be destroyed. Most birds that nest within the NNSS are protected under the Migratory Bird Treaty Act. If detonations and explosives tests were to occur near vital water sources, they could cause wildlife to avoid them, adversely affecting wildlife that depend on those water sources. If detonations were to occur during the nesting season for birds, explosions could startle nesting birds, causing them to abandon their nests and resulting in a loss of eggs or young.

8.1.1.1.2 Environmental Management Mission

The Nevada Division of Environmental Protection (NDEP) issued a Resource Conservation and Recovery Act (RCRA) Part B permit to DOE/NNSA effective December 1, 2010, for a new mixed low-level radioactive waste (MLLW) disposal unit, Cell 18, at the Area 5 Radioactive Waste Management Complex (RWMC). Construction of the new MLLW disposal unit was completed and the disposal unit began accepting MLLW for disposal in January 2011.

By the end of the 10-year period analyzed in this SWEIS, about 50 percent (370 acres) of the approximately 740-acre Area 5 RWMC would be used for low-level radioactive waste (LLW) and MLLW disposal cells as necessary. The remaining area would be subject to use for disposal cells beyond the 10-year period. Once filled, disposal cells would be operationally capped, pending final closure.

Unavoidable adverse effects from remediation of industrial sites and soil contamination sites would include temporary emissions to the air from exhausts of remediation-associated vehicles and equipment and potential resuspension of contaminants. There would also be temporary disturbance of wildlife and existing habitats and a risk of exposure of workers to the contamination, although such exposures would be monitored and controlled to be as low as reasonably achievable. For those sites that would be closed-in-place, there would be long-term impacts on land use due to administrative controls and, in some cases, engineered barriers.

The Underground Test Area Project would result in short-term unavoidable impacts during development of characterization and monitoring wells, primarily due to air emissions of drilling equipment and vehicle exhaust and particulate matter from ground-disturbing activities. There would also be short-term impacts on wildlife due to disturbance during construction activities. Well development activities may have long-term adverse effects on cultural resources sites. Long-term unavoidable effects would be associated with development and operation of characterization and monitoring wells, including loss of habitat (up to 500 acres over the next 10 years) associated with new well development and disturbance of wildlife during periods of human activities at the wells. In addition, long-term operation of the wells would require electrical energy supplied by connections to electrical power lines and/or diesel-powered generators.

8.1.1.1.3 Nondefense Mission

Land preparation activities associated with the development of a commercial solar power generation facility (240 megawatts), to be located within the Renewable Energy Zone in Area 25, plus a transmission line corridor, would disturb an area of approximately 2,650 acres. Most of the soils in Area 25 have not been modified through construction or other uses, so construction of a solar power generation facility would affect topsoil and increase the potential for erosion in Jackass Flats. Ground-disturbing activities and increased vehicular access to previously undisturbed land would adversely affect wildlife in the immediate area of the solar power generation facility by direct mortality of individuals and loss of habitat. The solar power generation facility would be located within the range of the desert tortoise and its habitat. Implementation of the measures identified in the U.S. Fish and Wildlife Service's *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada* (*2009 Biological Opinion*) (USFWS 2009a) would be required to minimize the potential for take of desert tortoises.

The solar power generation facility would introduce considerable infrastructure in Area 25 that would be directly visible in middleground views from U.S. Route 95. Portions of the study area visible from U.S. Route 95 have a Class B scenic quality rating. Viewer sensitivity would change from moderate to high near the Area 25 Renewable Energy Zone. A solar power generation facility would introduce a considerable amount of glare from the reflective surfaces of the solar collectors, alter the existing visual character of the landscape that is largely undeveloped, be visible to highly sensitive viewers, and reduce the existing visual quality to a Class C rating because of the intrusion of manmade elements. There is no mitigation to reduce adverse effects associated with the proposed solar array; therefore, this effect is considered adverse and unavoidable.

8.1.1.2 Expanded Operations Alternative

Unavoidable adverse impacts resulting from implementation of the Expanded Operations Alternative include those presented above for the No Action Alternative. The discussion in this section focuses on the differences between the unavoidable adverse impacts under the Expanded Operations and No Action Alternatives.

Most air emissions at the NNSS would be associated with mobile source (e.g., vehicles and portable combustion equipment) activity. The stationary source emissions include emissions resulting from the operation of a 1,000-megawatt commercial solar power generation facility that may be constructed under the Expanded Operations Alternative. These emissions (PM_{10} and $PM_{2.5}$)[1] would mainly occur from the cooling tower and during colder ambient temperatures, as the heat transfer fluid is heated to prevent freezing. VOC and PM_{10} emissions from NNSS mobile sources in Clark County would increase relative to 2008 emission levels by 1.0 and 0.20 tons per year, respectively. The VOC increase would be due to the widespread use of ethanol blends in southern Nevada by 2015. The small increases in VOC and PM_{10} emissions would be attributable to mobile sources and would be widely distributed over the Las Vegas Valley and through the U.S. Route 95 corridor. They would not lead to any additional violations of the ozone or PM_{10} air quality standards. NNSS-related activities under the Expand Operations Alternative would create about 49,303 carbon-dioxide-equivalent tons of greenhouse gas emissions per year (70,461 tons when temporary construction worker commuting is included).

8.1.1.2.1 National Security/Defense Mission

Under the Expanded Operations Alternative, as part of the Stockpile Stewardship and Management Program, DOE/NNSA would add additional equipment and ancillary features within the existing Big Explosives Experimental Facility (BEEF) to support activities occurring in the Nuclear and High Explosives Test Zone. Depleted uranium experiment sites would occupy 40 acres per experiment, with up to 3 experiments during the period of analysis, while high-explosives experiments would occupy 5 acres per experiment, with up to 500 experiments during the period of analysis. The areas for these experiments would be located in appropriately zoned operational areas on the NNSS; however, reserving these areas for the depleted uranium and high-explosives experiments would prevent other activities or uses from occurring within these reserved areas.

New support facilities would be constructed for Office of Secure Transportation (OST) training purposes in Area 17. About 10,000 acres of currently undisturbed land would be reserved for use as an active training area, where live-fire training areas and other training facilities and supporting infrastructure would be developed. Additionally, OST would expand facilities in either Area 12 (12 Camp), Area 6 (Control Point Complex), or Area 23 (Mercury). Temporary impacts on soils would result from construction-related surface disturbance. Some localized impacts on the surface soil structure would occur from DOE/NNSA and U.S. Department of Defense training of OST personnel in off-road locations because driving vehicles through undisturbed soils and vegetation could disturb soil structures and

[1] *PM_{10} is particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; $PM_{2.5}$ is particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers.*

increase soil erosion by wind. Construction of new OST facilities on previously undisturbed lands would result in a permanent loss of native vegetation and wildlife habitat. Construction of new roads would result in increased vehicular access to previously undisturbed land. Construction activities related to expansion of OST facilities would cause adverse impacts on wildlife through direct mortality of individuals and loss of habitat. For example, expansion of facilities in Areas 6 and 23 would occur within the range of the desert tortoise and could potentially result in an incidental taking of desert tortoises.

The proposed projects for the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs and the proposed relocation of the Federal Bureau of Investigation Disposition Forensics Program would cause environmental impacts at the NNSS. Construction of additional nonproliferation and counterterrorism facilities, which are still conceptual in nature, would result in 200 acres of surface disturbance, which would cause short- and long-term impacts on soils.

DOE/NNSA would construct additional hangars, shops, and buildings totaling approximately 200,000 square feet (4.6 acres) at Desert Rock Airport, which would result in temporary impacts on soils from surface disturbance. The additional facilities at Desert Rock Airport may include new hangars and support facilities and a lengthened existing runway. These features would be visible in the middleground (0.5 to 4 miles) of views from U.S. Route 95 and would adversely affect visual resources. The scale and coloring of facilities would play a large part in the visual prominence of the new facilities.

8.1.1.2.2 Environmental Management Mission

Waste disposal activities would increase under the Expanded Operations Alternative, which would result in reactivation of the Area 3 Radioactive Waste Management Site. Within these areas, new disposal units would be constructed, filled, and closed to accommodate the waste volumes and types.

Development of new landfills in Area 23 and Area 25 would convert a combined total of 35 acres of currently unused land into waste management facilities and preclude that land from being used for other purposes. Construction of the sanitary waste disposal facility in Area 25 could also result in loss of habitat and direct mortality of tortoises. Increased roadway traffic in Area 25 could also result in incidental takes of desert tortoise from injury or mortality.

Unavoidable adverse effects from Environmental Restoration Program activities under the Expanded Operations Alternative would be the same as those under the No Action Alternative, described in Section 8.1.1.1.2.

8.1.1.2.3 Nondefense Mission

Under the Expanded Operations Alternative, DOE/NNSA would allow development of one or more commercial solar power generation facilities to be located within a 39,600-acre Renewable Energy Zone, with a maximum combined generating capacity of 1,000 megawatts. Land preparation activities associated with the development of the commercial solar power generation facilities, plus a transmission line corridor, would disturb an area of approximately 10,300 acres. Most of the soils in Area 25 have not been modified through construction or other uses, so construction of solar power generation facilities would affect topsoil and increase the potential for erosion in Jackass Flats. Ground-disturbing activities and increased vehicular access to previously undisturbed land would adversely affect wildlife in the immediate area of the solar power generation facilities by direct mortality of individuals and loss of habitat. The solar power generation facilities would be located within the range of the desert tortoise and its habitat. Implementation of the measures identified in the U.S. Fish and Wildlife Service's *2009 Biological Opinion* (USFWS 2009a) would be required to minimize the potential for take of desert tortoises.

The solar power generation facilities would introduce considerable infrastructure in Area 25 that would be directly visible in middleground views from U.S. Route 95. Portions of the study area visible from U.S. Route 95 have a Class B scenic quality rating. Viewer sensitivity would change from moderate to high near the Area 25 Renewable Energy Zone. Solar power generation facilities would introduce a considerable amount of glare from the reflective surfaces of the solar collectors, alter the existing visual character of the landscape that is largely undeveloped, be visible to highly sensitive viewers, and reduce the existing visual quality to a Class C rating because of the intrusion of manmade elements. There is no mitigation to reduce adverse effects associated with the proposed solar array; therefore, this effect is considered adverse and unavoidable.

The Geothermal Demonstration Project has the potential to introduce facilities associated with capturing, converting, and transferring geothermal power such as a power plant, transmission lines, and associated infrastructure that would occur on 30 to 50 acres of land.

8.1.1.3 Reduced Operations Alternative

Unavoidable adverse impacts under the Reduced Operations Alternative include those presented above for the No Action Alternative. The discussion in this section focuses on the differences between the unavoidable adverse impacts under the Reduced Operations and No Action Alternatives.

Most air emissions at the NNSS would be associated with mobile source (e.g., vehicles and portable combustion equipment) activity. The NNSS contribution to the emissions in Clark County would continue to be small and would decrease relative to 2008 emission levels, except for VOCs, which could increase by 0.2 tons per year by 2015 due the widespread use of ethanol blends in southern Nevada. The small increase in VOC emissions would be from mobile sources and would be widely distributed over the Las Vegas Valley and the U.S. Route 95 corridor. NNSS-related activities under the Reduced Operations Alternative would create about 38,045 carbon-dioxide-equivalent tons of greenhouse gas emissions per year (40,819 tons including temporary construction worker commuting).

Under the Reduced Operations Alternative, employment is assumed to decrease from the current level of 1,699 to 1,654, with employment from the operation of the solar power generation facility offsetting most losses associated with a reduction in activity associated with other NNSS programs. This decrease would be equal to about 45 jobs (35 in Clark County and 10 in Nye County). In Clark County, this would increase unemployment by about 0.02 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). In Nye County, unemployment would increase by about 0.32 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). Daily spending in the immediate area of the NNSS would decrease correspondingly, which would have a minor impact on economic activity.

8.1.1.3.1 National Security/Defense Mission

No unavoidable adverse impacts have been identified for this mission.

8.1.1.3.2 Environmental Management Mission

Unavoidable adverse effects from Environmental Restoration Program activities under the Reduced Operations Alternative would be the same as those under the No Action Alternative, described in Section 8.1.1.1.2.

8.1.1.3.3 Nondefense Mission

DOE/NNSA would continue to support the development of a commercial solar power generation facility in Area 25 that would be sited on 1,200 acres of land; the net generating capacity under the Reduced Operations Alternative would be 100 megawatts. Most of the soils in Area 25 have not been modified through construction or other uses, so construction of a solar power generation facility would affect topsoil and increase the potential for erosion in Jackass Flats. Ground-disturbing activities and increased vehicular access to previously undisturbed land would adversely affect wildlife in the immediate area of the solar power generation facility by direct mortality of individuals and loss of habitat. The solar power generation facility would be located within the range of the desert tortoise and its habitat. Implementation of the measures identified in the U.S. Fish and Wildlife Service's *2009 Biological Opinion* (USFWS 2009a) would be required to minimize the potential for take of desert tortoises.

The solar power generation facility would introduce considerable infrastructure in Area 25 that would be directly visible in middleground views from U.S. Route 95. Portions of the study area visible from U.S. Route 95 have a Class B scenic quality rating. Viewer sensitivity would change from moderate to high near the Area 25 Renewable Energy Zone. A solar power generation facility would introduce a considerable amount of glare from the reflective surfaces of the solar collectors, alter the existing visual character of the landscape that is largely undeveloped, be visible to highly sensitive viewers, and reduce the existing visual quality to a Class C rating because of the intrusion of manmade elements. There is no mitigation to reduce adverse effects associated with the proposed solar array; therefore, this effect is considered adverse and unavoidable.

8.1.2 Relationship of Short-Term Uses and Long-Term Productivity

Council on Environmental Quality regulations implementing the procedural requirements of NEPA (40 CFR 1502.16) require consideration of the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity. This includes using:

> *"… all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans" (NEPA, Section 101, 42 U.S.C. 4331).*

Short-term uses are defined as those that would take place during the 10-year timeframe analyzed within this SWEIS. While this section discusses the short-term use of the environment and the maintenance of its long-term productivity, Chapter 5 provides a more detailed discussion of the impacts and resource utilization associated with each of the alternatives. The majority of effects on long-term productivity would result from the continuation of present land use and from future land uses associated with the three alternatives. Under each alternative, lands previously withdrawn from public use would continue to be unavailable for alternate uses by the public. Establishment of new developed areas at the NNSS would occur under all alternatives in this SWEIS.

Underground subcritical experiments would result in the long-term unavailability of the mined cavity, but the land surface would be unaffected and unrestricted.

The Area 3 and Area 5 Waste Management Program sites would have disturbed areas that would be restricted from subsurface access for the long term, and the surface would be restricted from most uses. Rehabilitation of the surface following closure of a disposal site would restore ecological productivity unless rock armor (rocks used to protect against erosion) were used in closure. Although not expected to be used, rock armor or other solid surface coatings would result in a sterile surface for the long term. The area in the buffer zones would have some restrictions on surface uses that would be designed to prevent intrusion into the buried waste. Because it would likely remain undisturbed, the buffer zones' ecological productivity would remain unimpaired for the long term.

Environmental Restoration Program activities at the NNSS under all three alternatives would contribute to long-term productivity through the remediation of surface and subsurface contamination and their return to other productive uses. The rate of return to ecological productivity would vary at individual sites, depending upon the revegetation measures employed and local soil conditions. In the short term, productivity would be reduced at some sites if contaminated soil were removed for disposal.

8.1.2.1 No Action Alternative

Developed areas of the NNSS, as well as offsite locations within Nevada (including facility footprints and buffer areas), would continue to be unproductive ecologically, but would continue their long-term contributions to the DOE/NNSA mission through their support of research and development and training.

Under the No Action Alternative, construction of a commercial solar power generation facility in Area 25 of the NNSS would result in the conversion of approximately 2,650 acres of land to support energy infrastructure.

8.1.2.2 Expanded Operations Alternative

Under the Expanded Operations Alternative, construction of one or more commercial solar power generation facilities in Area 25 of the NNSS would result in the conversion of approximately 10,300 acres of land to support energy infrastructure.

Under the Expanded Operations Alternative, there would be an additional irreversible and irretrievable commitment of land resources associated with the development of facilities in Area 17, including offices, classrooms, a live-fire shoot house, a live-fire training area, and a simulated town to support training for OST. This complex in Area 17 would be approximately 10,000 acres in size (including buffer zones), and could result in up to 3,500 acres of surface disturbance. DOE/NNSA would also upgrade or construct new facilities in Areas 6, 12, or 23 to provide approximately 50,000 square feet of building space.

8.1.2.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, construction of a commercial solar power generation facility in Area 25 of the NNSS would result in the conversion of approximately 1,200 acres of land to support energy infrastructure.

While some facilities would be considered for closure and demolition under the Reduced Operations Alternative, restoration of these areas to preconstruction conditions may not be practicable over the next 10 years, and these sites may also be considered for alternate uses in support of NNSS mission activities.

8.1.3 Irreversible and Irretrievable Commitment of Resources

NEPA Section 102 (42 U.S.C. 4332) and Council on Environmental Quality regulations implementing the procedural requirements of NEPA (40 CFR 1502.16) require environmental analyses to include identification of "… any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible commitment of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, as well as those factors that are renewable only over long time spans, such as soil productivity. An irretrievable commitment of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the past utilization opportunities are irretrievable.

Implementation of any of the alternatives would result in a permanent commitment of certain air, groundwater, soil, biota, mineral, surface, and subsurface resources. There would be an irreversible and irretrievable commitment of these natural resources.

Under each alternative, developed areas on the NNSS would remain in urban or industrial land uses. This long-term land use commitment would preclude other uses of the land and prohibit natural habitat productivity. Even with any removal of structures and infrastructure, completely natural conditions would be difficult to achieve.

Use of the radioactive waste management facilities for waste disposal would result in an irreversible and irretrievable commitment of land resources. Land uses and access to the subsurface would be severely restricted at the sites and in surrounding buffer areas. Some areas would be rehabilitated on closure and would provide natural habitat. Although not expected, if closures were designed using rock armor, this would inhibit vegetation or burrowing animals and thereby severely limit their use as natural habitat. Sanitary and construction landfills would represent an irreversible and irretrievable commitment of the subsurface and would limit surface uses.

Underground subcritical experiments would result in an irreversible and irretrievable commitment of the mined cavity. Following subcritical experiments, the land surface would be unaffected and unrestricted.

Decontamination and decommissioning activities would produce mixed results depending on the remedy selected. Most decontamination and decommissioning activities would result in either decontamination, resulting in the consequent availability of the facility for other use, or demolition of the facility and disposal. In-place disposal of basements would result in an irretrievable and irreversible commitment of the subsurface for most land use. Reuse would entail the facility remaining in an industrial mode, which would represent a long-term commitment to that type of land use. Demolition of the facility could result in the land's availability for other development or for site rehabilitation and use as natural habitat.

Closure in place would result in an irreversible and irretrievable commitment for those RCRA industrial sites that are so treated. Land use on these sites and in a surrounding buffer zone would be severely constrained. Rehabilitation by revegetation would permit their functioning as natural habitat, but closure would likely be designed using rock armor to inhibit vegetation or burrowing animals.

Continued airspace restriction would represent an irreversible and irretrievable commitment because access would be limited to government use only. Airspace access would be prohibited for general aviation and commercial users.

Energy and materials utilized in the construction, operation, maintenance, decontamination, demolition, and closure of the facilities would be irreversibly and irretrievably committed. Groundwater would be withdrawn to support all NNSS programs under each alternative. This water use would represent an irreversible and irretrievable commitment of this resource.

Continued restriction of harvesting products like game, pine nuts, or grass, as well as maintenance of areas in development that precludes their natural productivity, would represent an irretrievable commitment of resources.

Removal of soils for Environmental Restoration Program projects would result in their irreversible and irretrievable loss because they would be landfilled and any associated natural resource services that they provide would be lost as well. Environmental Restoration Program activities would mostly involve land that has been previously disturbed. The amount that would be redisturbed during remediation depends, first, upon the levels of contamination that would be determined during characterization and, second, upon the agreements reached with the State of Nevada regarding cleanup levels.

8.1.3.1 No Action Alternative

Construction of a commercial solar power generation facility in Area 25 of the NNSS and associated transmission lines would result in an irreversible and irretrievable commitment of land resources of approximately 2,650 acres under the No Action Alternative.

8.1.3.2 Expanded Operations Alternative

Construction of one or more commercial solar power generation facilities in Area 25 of the NNSS and associated transmission lines would result in an irreversible and irretrievable commitment of land resources of approximately 10,300 acres under the Expanded Operations Alternative.

As stated previously, under the Expanded Operations Alternative, there would be an additional irreversible and irretrievable commitment of land resources associated with the development of facilities in Area 17, including offices, classrooms, a live-fire shoot house, a live-fire training area, and a simulated town to support training for OST, as well as the proposed upgrade or construction of new facilities in Areas 6, 12, or 23. Designation and development of a 39,600-acre Renewable Energy Zone in Area 25 under the Expanded Operations Alternative would constitute an additional irreversible, but not necessarily irretrievable, commitment of land resources.

8.1.3.3 Reduced Operations Alternative

Construction of a commercial solar power generation facility in Area 25 of the NNSS and associated transmission lines would result in an irreversible and irretrievable commitment of land resources of approximately 1,200 acres the Reduced Operations Alternative.

8.2 Remote Sensing Laboratory

8.2.1 Unavoidable Adverse Effects

No unavoidable adverse impacts have been identified for the Remote Sensing Laboratory (RSL) under any of the three alternatives.

8.2.2 Relationship of Short-Term Uses and Long-Term Productivity

No new facility development is proposed for RSL under any of the three alternatives.

8.2.3 Irreversible and Irretrievable Commitment of Resources

See Section 8.1.3 for a discussion of irreversible and irretrievable commitment of resources under the alternatives.

8.3 North Las Vegas Facility

8.3.1 Unavoidable Adverse Effects

8.3.1.1 No Action Alternative

No unavoidable adverse impacts have been identified for the North Las Vegas Facility (NLVF).

8.3.1.2 Expanded Operations Alternative

No unavoidable adverse impacts have been identified for NLVF.

8.3.1.3 Reduced Operations Alternative

Under the Reduced Operations Alternative, there would be a small reduction in employment of 144 individuals at NLVF, including 143 employees in Clark County and 1 employee in Nye County. In Clark County, this would increase unemployment by about 0.10 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). Within Nye County, this would increase unemployment by about 0.03 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). As a result of this jobs reduction, daily spending in the vicinity of NLVF would decrease correspondingly.

8.3.2 Relationship of Short-Term Uses and Long-Term Productivity

No new facility development is proposed for NLVF under any of the three alternatives.

8.3.3 Irreversible and Irretrievable Commitment of Resources

See Section 8.1.3 for a discussion of irreversible and irretrievable commitment of resources under the alternatives.

8.4 Tonopah Test Range

8.4.1 Unavoidable Adverse Effects

8.4.1.1 No Action Alternative

Airspace restrictions would continue to prohibit commercial and general aviation use. DOE/NNSA would continue to coordinate the use of airspace with the controlling entity responsible for the Tonopah Test Range (TTR) airspace, the Nellis Air Traffic Control Facility.

Weapons impact testing, flight test operation of gravity weapons, and passive testing would occur during TTR operations using gravity weapons; passive testing would occur on the TTR. These activities could potentially disturb native vegetation. If disturbance of native vegetation occurs during the nesting season for birds, the eggs or young in nests located within the project area could be destroyed. Explosives tests and detonations could startle wildlife, resulting in adverse impacts. If these detonations and explosives tests were to occur near vital water sources, they could cause wildlife to avoid them, which could adversely affect wildlife that depend on those water sources. Additionally, if detonations were to occur during the nesting season for birds, explosions could startle nesting birds, causing them to abandon their nests and resulting in a loss of eggs or young.

Environmental Restoration Program activities at the TTR would include industrial and soils sites remediation. The unavoidable effects from these activities would be the same as those described in Section 8.1.1.1.2.

8.4.1.2 Expanded Operations Alternative

Unavoidable adverse effects from Environmental Restoration Program activities under the Expanded Operations Alternative would be the same as those under the No Action Alternative, described in Section 8.4.1.1.

8.4.1.3 Reduced Operations Alternative

Airspace impacts would be similar to those described for the No Action Alternative in Section 8.4.1.1; however, impacts would be reduced as a result of the discontinuation of fixed rocket launch operations, cruise missile operations, and fuel-air explosives at the TTR. This would increase the restricted airspace availability for other military uses as coordinated and scheduled by the Nellis Air Traffic Control Facility.

Under the Reduced Operations Alternative, there would be a reduction in employment of 67 individuals at the TTR, including 15 in Clark County and 45 in Nye County. In Clark County, this reduction would increase unemployment by about 0.01 percent (a total of 142,137 Clark County residents were unemployed as of August 2010). In Nye County, this would increase unemployment by about 1.44 percent (a total of 3,133 Nye County residents were unemployed as of August 2010). As a result of the reduction in jobs, daily spending in the vicinity of the TTR would decrease.

8.4.2 Relationship of Short-Term Uses and Long-Term Productivity

No new facility development is proposed for the TTR under any of the three alternatives.

Environmental Restoration Program activities at the TTR under all three alternatives would contribute to long-term productivity through the remediation of surface and subsurface contamination and their return to other productive uses. The rate of return to ecological productivity would vary at individual sites, depending upon the revegetation measures employed and local soil conditions. In the short term, productivity would be reduced at some sites if contaminated soil were removed for disposal.

8.4.3 Irreversible and Irretrievable Commitment of Resources

See Section 8.1.3 for a discussion of irreversible and irretrievable commitment of resources under the alternatives.

CHAPTER 9
LAWS, REGULATIONS, AND PERMITS

9.0 LAWS, REGULATIONS, AND PERMITS

Chapter 9 presents the environmental, safety, and health laws, regulations, and permits that potentially apply to the alternatives in this *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 (NNSS SWEIS)*. Federal, State of Nevada, Executive Orders, and U.S. Department of Energy (DOE) environmental, safety, and health requirements are summarized in Section 9.1. Applicable permits that may be required to implement the alternatives are identified in Section 9.2.

9.1 Introduction

The major Federal and State of Nevada laws and regulations, Executive Orders, DOE Orders, and other requirements that may apply to the various alternatives analyzed in this site-wide environmental impact statement (SWEIS) are identified in **Table 9–1**. These compliance requirements are summarized in Sections 9.1.1 through 9.1.14. Executive Orders and DOE Orders that are new or that have been revised since the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* are easily identified in this chapter with their date of issuance and change date(s) transpiring after 1996.

Table 9–1 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
"U.S. Air Force Environmental Impact Analysis Process"	32 CFR Part 989 (July 15, 1999)
National Environmental Policy Act Implementing Procedures	10 CFR Part 1021
Protection and Enhancement of Environmental Quality, as amended by Executive Order 11991	Executive Order 11514 (March 5, 1970), amended by Executive Order 11991 (May 24, 1977)
Departmental Sustainability	DOE Order 436.1 (May 2, 2011)
Environment, Safety, and Health Reporting	DOE Order 231.1B (June 27, 2011)
Agreement in Principle Between the National Nuclear Security Administration and the State of Nevada 2011–2016	DE-GM08-99NV13571; 42 U.S.C. 7101 et seq., and NRS 41, 117, 118, 278, 414, 439, 444, 445, 459, 461, 486, and 590 (July 1, 2011)
Land Use	
Federal Land Policy and Management Act of 1976	43 U.S.C. 1701–1784, enacted by P.L. 94-579, as amended
Military Lands Withdrawal Act of 1999	P.L. 106-65
Real Property Asset Management	DOE Order 430.1B (September 24, 2003; Change 2, April 25, 2011)
Infrastructure and Energy	
Energy Policy Act of 2005	42 U.S.C. 15801 et seq.
Strengthening Federal Environmental, Energy, and Transportation Management	Executive Order 13423 (January 24, 2007)
Federal Leadership in Environmental, Energy, and Economic Performance	Executive Order 13514 (October 5, 2009)
Departmental Sustainability	DOE Order 436.1 (May 2, 2011)

Law, Regulation, Order, or Other Requirement	***Citation/Date***
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
Packaging and Transportation for Offsite Shipment of Materials of National Security Interest	DOE Order 461.1B (December 16, 2010)
Departmental Materials Transportation and Packaging Management	DOE Order 460.2A (December 22, 2004)
Packaging and Transportation Safety	DOE Order 460.1C (May 14, 2010)
Geology and Soils	
Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction	Executive Order 12699 (December 22, 2005)
Facility Safety	DOE Order 420.1B (December 22, 2005)
Guide for the Mitigation of Natural Phenomena Hazards for DOE Nuclear Facilities and Nonnuclear Facilities	DOE Guide 420.1-2 (March 28, 2000)
Natural Phenomena Hazards Assessment Criteria	DOE Standard 1023-95 (April 2002)
Hydrology	
Clean Water Act of 1972, as amended	33 U.S.C. 1251 et seq.
Safe Drinking Water Act of 1974, as amended	42 U.S.C. 300(f) et seq.
National Wellhead Protection Program	Established by the 1986 Amendments to the Safe Drinking Water Act
"National Primary Drinking Water Regulations"	40 CFR Part 141 (July 1, 2003)
"National Primary Drinking Water Regulations Implementation"	40 CFR Part 142 (July 1, 2003)
"National Secondary Drinking Water Regulations"	40 CFR Part 143 (July 1, 2003)
"Compliance with Floodplain and Wetland Environmental Review Requirements"	10 CFR Part 1022
Floodplain Management	Executive Order 11988 (May 24, 1977)
"Underground Water and Wells"	NRS 534
"Water Controls" (Public Water Systems)	NAC 445A (445A.450–445A.6731)
"Water Controls" and "Sanitation"	NAC 445A and 444
"Underground Injection Control Program"	NAC 445A.810–445A.925
Fluid Management Plan for the Underground Test Area Project	DOE/NV-370-Rev. 5 (August 2009)
Biological 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.
National Wildlife Refuge System Administrative Act of 1966, as amended	16 U.S.C. 668dd-668ee
Wild Horses and Burros Act of 1971	16 U.S.C. 1331–1340
Protection of Wetlands	Executive Order 11990 (May 24, l977)
Invasive Species	Executive Order 13112 (February 3, 1999)
Responsibilities of Federal Agencies to Protect Migratory Birds	Executive Order 13186 (January 10, 2001)
Five-Party Cooperative Agreement	1977 (see also Wild Horses and Burros Act of 1971)
"Protection of Wildlife"	NAC 503.010 – 503.104
Air Quality and Climate	
Clean Air Act of 1970, as amended	42 U.S.C. 7401 et seq.
"National Ambient Air Quality Standards"	40 CFR Part 50
"National Emission Standards for Hazardous Air Pollutants"	40 CFR Part 61
"Stratospheric Ozone Protection"	40 CFR Part 82
"Mandatory Greenhouse Gas Reporting"	40 CFR Part 98
"Standards of Quality for Ambient Air"	NAC 445B.22097

Law, Regulation, Order, or Other Requirement	***Citation/Date***
"Class II Operating Permits"	NAC 445B.3455 – 445B.3477
"Air Pollution" "Alternative Fuels; Clean Burning Fuels"	NRS 445B.100 – 445B.825 and NRS 486A.010 – 486A.180
Visual Resources	
Visual Resource Management	*BLM Manual 8400*
Cultural Resources	
American Indian Religious Freedom Act of 1978	42 U.S.C. 1996
Antiquities Act of 1906, as amended	16 U.S.C. 431–433
Archaeological and Historic Preservation Act of 1960, as amended	16 U.S.C. 469–469c-2
Archaeological Resources Protection Act of 1979, as amended	16 U.S.C. 470aa et seq.
National Historic Preservation Act of 1966, as amended	16 U.S.C. 470 et seq.
Native American Graves Protection and Repatriation Act of 1990	25 U.S.C. 3001 et seq.
Protection and Enhancement of the Cultural Environment	Executive Order 11593 (May 13, 1971)
Indian Sacred Sites	Executive Order 13007 (May 24, 1996)
Consultation and Coordination with Indian Tribal Governments	Executive Order 13175 (November 6, 2000)
Preserve America	Executive Order 13287 (March 3, 2003)
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	42 U.S.C. 2011 et seq.
Resource Conservation and Recovery Act of 1976, as amended	42 U.S.C. 6901 et seq.
Federal Facility Compliance Act of 1992	P.L. 102-386
Federal Facility Agreement and Consent Order, as amended	Current version
Low-Level Radioactive Waste Policy Act of 1980, as amended	42 U.S.C. 2021 et seq.
Toxic Substances Control Act of 1976	15 U.S.C. 2601 et seq.
"Disposal of Solid Waste"	NAC 444.570 – 444.7499
"Disposal of Hazardous Waste"	NAC 444.850 – 444.8746
"Storage Tanks"	NAC 459.9921 – 459.999
"Polychlorinated Biphenyl"	NAC 444.940 – 444.9555
Radioactive Waste Management	DOE Order 435.1 (July 9, 1999; Change 1, August 28, 2001; Certified, January 9, 2007)
Mutual Consent Agreement	January 1994; modified 1995 and 1998
Settlement Agreement for Mixed Transuranic Waste	June 1992
Human Health and Safety	
Occupational Safety and Health Act of 1970	29 U.S.C. 651 et seq.
Noise Control Act of 1972, as amended	42 U.S.C. 4901 et seq.
"Procedural Rules for DOE Nuclear Facilities"	10 CFR Part 820
"Nuclear Safety Management"	10 CFR Part 830
"Occupational Radiation Protection"	10 CFR Part 835
"Worker Safety and Health Program"	10 CFR Part 851
Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction, as amended by Executive Order 13286	Executive Order 12699 (January 5, 1990)
Conduct of Operations	DOE Order 422.1 (June 29, 2010)
Radiation Protection of the Public and the Environment	DOE Order 458.1 Change 2 (June 6, 2011)
Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees	DOE Order 440.1B (May 17, 2007)
Maintenance Management Program for DOE Nuclear Facilities	DOE Order 433.1B (April 21, 2010)
Verification of Readiness to Startup or Restart Nuclear Facilities	DOE Order 425.1D (April 16, 2010)
Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities	DOE Order 426.2 (April 21, 2010)

Law, Regulation, Order, or Other Requirement	***Citation/Date***
Facility Safety	DOE Order 420.1B (December 22, 2005; Change 1, April 19, 2010)
Quality Assurance	DOE Order 414.1D (April 25, 2011)
DOE Radiological Health and Safety Policy	DOE Policy 441.1 (April 26, 1996)
Environmental Justice	
Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Executive Order 12898 (February 11, 1994)
Protection of Children from Environmental Health Risks and Safety Risks, as amended by Executive Order 13229	Executive Order 13045 (April 21, 1997)
Emergency Planning, Pollution Prevention, and Conservation	
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (also known as Superfund)	42 U.S.C. 9601 et seq.
Emergency Planning and Community Right-to-Know Act of 1986	42 U.S.C. 11001 et seq.
Pollution Prevention Act of 1990	42 U.S.C. 13101 et seq.
Homeland Security Act of 2002	6 U.S.C. 101 et seq. enacted by Public Law 107-296
Management of Domestic Incidents	Homeland Security Presidential Directive 5 (February 28, 2003)
National Preparedness	Homeland Security Presidential Directive 8 (December 17, 2003)
"Designation, Reportable Quantities, and Notification"	40 CFR 302.1 – 302.8
Federal Compliance with Pollution Control Standards, as amended by Executive Order 12580, Superfund Implementation	Executive Order 12088 (October 13, 1978)
Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements	Executive Order 12856 (August 3, 1993)
Strengthening Federal Environmental, Energy, and Transportation Management	Executive Order 13423 (January 24, 2007)
Federal Leadership in Environmental, Energy, and Economic Performance	Executive Order 13514 (October 5, 2009)
Safeguards and Security Program	DOE Order 470.4B (July 26, 2011)
Independent Oversight Program	DOE Order 227.1 (August 30, 2011)
Comprehensive Emergency Management System	DOE Order 151.1C (November 2, 2005)
Departmental Radiological Emergency Response Assets	DOE Order 153.1 (June 27, 2007)
State of Nevada Chemical Catastrophe Prevention Act and the Chemical Accident Prevention Program	Nevada Legislature Senate Bill 641 (July 1991) and NRS 459.380 – 459.3874

BLM = Bureau of Land Management; CFR = *Code of Federal Regulations*; NAC = *Nevada Administrative Code*; NRS = *Nevada Revised Statute*; P.L. = Public Law; U.S.C. = *United States Code*.

9.1.1 Environmental Quality

National Environmental Policy Act (NEPA) of 1969 (42 United States Code [U.S.C.] 4321 et seq.). The purposes of NEPA, as amended, are: (1) to declare a national policy that will encourage productive and enjoyable harmony between man and his environment; (2) to promote efforts that will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; (3) to enrich the understanding of the ecological systems and natural resources important to the Nation; and (4) to establish a Council on Environmental Quality (CEQ). NEPA establishes a national policy requiring that Federal agencies 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 of the *Code of Federal Regulations* [CFR] Part 1500 et seq.) may result in a categorical exclusion, an environmental assessment (EA) and Finding of No Significant Impact (FONSI), or an environmental impact statement (EIS). The DOE National Nuclear Security Administration (DOE/NNSA) Nevada Site

Office's NSO's) procedures for compliance with NEPA are described below. This *NNSS SWEIS* has been prepared in accordance with NEPA requirements, CEQ regulations (40 CFR Part 1500 et seq.), and DOE provisions for implementing the procedural requirements of NEPA (10 CFR Part 1021; DOE Order 451.1B, Change 1). It discusses reasonable alternatives and their potential environmental consequences.

DOE Order 451.1B, *National Environmental Policy Act Program*, establishes DOE requirements and responsibilities for implementing NEPA, CEQ regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500–1508), and DOE NEPA implementing procedures (10 CFR Part 1021). Under NEPA, Federal agencies are required to consider environmental effects and values and reasonable alternatives before making a decision to implement any major Federal action that may have a significant impact on the human environment. Before initiating any project or activity at the Nevada National Security Site (NNSS), North Las Vegas Facility (NLVF), or Remote Sensing Laboratory (RSL), it is evaluated for possible impacts on the environment. DOE/NNSA uses the following four levels of documentation to demonstrate compliance with NEPA:

- Environmental Impact Statement (EIS) – a full disclosure of the potential environmental effects of proposed actions and the reasonable alternatives to those actions

- Environmental Assessment (EA) – a concise discussion of proposed actions and alternatives and the potential environmental effects to allow a reasoned determination that an EIS is or is not required. If an EIS is not required, a FONSI is made by the Manager of the DOE/NNSA NSO. The determination to prepare an EA is made by the DOE/NNSA NSO Manager, based on a recommendation by the NEPA Compliance Officer.

- Supplement Analysis – a collection and analysis of information for a proposed action to determine whether it is adequately addressed in an existing EIS (such as this SWEIS) or EA or if a new or supplemental NEPA process is required

- Categorical Exclusion – a category of action that does not have a significant adverse environmental impact, either by itself or cumulatively, based on analyses of similar previous activities and for which neither an EA nor an EIS is required

DOE/NNSA uses a NEPA Environmental Evaluation Checklist (Checklist) as an initial screening tool for all proposed activities. The Checklist is reviewed by the DOE/NNSA site NEPA Compliance Officer to determine whether the proposed activity: (1) fits within a class of actions that is listed in 10 CFR Part 1021, Appendix A or B, and meets all other requirements to be considered categorically excluded from further NEPA reviews; (2) does not meet the requirements for categorical exclusion, but has been adequately addressed in an existing NEPA document, which determination may require preparation of a supplement analysis; (3) does not meet the requirement for categorical exclusion and has not been previously addressed in an existing NEPA document; or (4) clearly has the potential to cause significant impacts on the human environment. Each NEPA Checklist must be approved by the DOE/NNSA site NEPA Compliance Officer, and all necessary NEPA review and documentation must be completed before the proposed project or activity may proceed.

32 CFR Part 989, "U.S. Air Force (USAF) Environmental Impact Analysis Process". This regulation implements the USAF environmental impact analysis process and provides procedures for environmental impact analysis both within the United States and abroad. DOE/NNSA would comply with U.S. Department of Defense and USAF management policies and directives that are applicable to the activities discussed in this SWEIS that are conducted on USAF installations and ranges (e.g., the Nevada Test and Training Range, the Tonopah Test Range, and Nellis Air Force Base). Such USAF policies and directives standardize implementation of higher-level guidance, including laws and statutes, across the entire USAF. One example of such higher-level guidance is 32 CFR Part 989, "Environmental Impact Analysis Process," which deals with implementing NEPA on USAF real property.

Executive Order 11514, *Protection and Enhancement of Environmental Quality* (March 5, 1970), as amended by Executive Order 11991 (May 24, 1977). This Order requires Federal agencies to continuously monitor and control their activities (1) to protect and enhance the quality of the environment and (2) to develop procedures to ensure the fullest practicable provision of timely public information and understanding of Federal plans and programs that may have potential environmental impacts so that interested parties can submit their views. DOE issued regulations (10 CFR Part 1021) and DOE Order 451.1B, *National Environmental Policy Act Compliance Program*, in compliance with this Order.

DOE Order 436.1, *Departmental Sustainability* (May 2, 2011). This Order defines requirements and responsibilities for managing sustainability at DOE facilities. Under the Order, DOE facilities are to ensure that the Department carries out its missions in a sustainable manner that addresses national energy security and global environmental challenges and advances sustainable, efficient, and reliable energy for the future; institute wholesale cultural change to factor sustainability and greenhouse gas (GHG) reductions into all DOE corporate management decisions; and ensure that DOE achieves the sustainability goals established in its *Strategic Sustainability Performance Plan – Discovering Sustainable Solutions to Power and Secure America's Future* (*Strategic Sustainability Performance Plan*) (DOE 2010d). The Order also mandates that DOE develop and commit to implementing an annual Site Sustainability Plan, which identifies its respective contribution toward meeting the Department's sustainability goals. In addition, under this Order, DOE sites must use an Environmental Management System (EMS) as a platform for Site Sustainability Plan implementation and programs with objectives and measurable targets that contribute to meeting the Department's sustainability goals. Sites must maintain their EMS(s) to ensure certification or conformance with the International Organization for Standardization (ISO) 14001:2004 International Standard, in accordance with the accredited registrar provisions of the International Standard or the self-declaration instructions found in the ISO 14001:2004(E) International Standard, *Environmental Management Systems: Requirements with Guidance for Use* (www.iso.org/iso/catalogue_detail?csnumber=31807) and *Instructions for Self-Declaration of Conformance with ISO 14001:2004(E)*, Office of the Federal Environmental Executive, January 15, 2008, (www.fedcenter.gov/_kd/go.cfm?destination=ShowItem&Item_ID=8864). DOE Order 436.1 cancels DOE Order 450.1A, *Environmental Protection*, and DOE Order 430.2B, *Departmental Energy, Renewable Energy, and Transportation Management*.

DOE Order 231.1B, *Environment, Safety, and Health Reporting* (June 27, 2011). The purpose of this Order is to ensure that DOE, including the NNSA, receives timely and accurate information about events that have affected or could adversely affect the health, safety, and security of the public or workers; the environment; the operations of DOE facilities; or the credibility of the Department. This is to be accomplished through timely collection, reporting, analysis, and dissemination of data pertaining to environment, safety, and health issues as required by law, or regulations, or in support of United States political commitments to the International Atomic Energy Agency (IAEA). This Order cancelled only the provisions of DOE Order 231.1A, Change 1, *Environment, Safety, and Health Reporting*, (dated June 3, 2004) that pertain to environment, safety, and health reporting. Occurrence reporting and processing of operations information provisions from DOE Order 231.A remain in effect. Under DOE Order 231.1B, the following reports and information must be submitted: (1) Annual Site Environmental Reports (prepared and submitted annually to DOE Headquarters, regulatory agencies, and interested stakeholders); (2) Occupational Safety and Health Information; (3). Annual Submission of Fire Protection Information; (4) Ionizing Radiation Exposure Information; (5) Safety Basis Information; and (6) Radioactive Sealed Sources Information.

Agreement in Principle Between the National Nuclear Security Administration and the State of Nevada 2011–2016 (July 1, 2011). This agreement reflects the understanding and commitments between the DOE/NNSA NSO and the State of Nevada regarding NSO's provision of technical and financial support to Nevada for environmental, safety, and health oversight and associated monitoring activities for NSO operations located in Nevada. This agreement also commits the NSO to assisting in emergency management initiatives to further protect the health and safety of both NSO and contractor personnel, as well as citizens in surrounding communities and areas in Nevada. The intent of this agreement is for both parties to work cooperatively to assure citizens of Nevada that the public's health and safety, as well as the environment, are protected. Nevada officials will verify protection efforts through independent monitoring and oversight.

9.1.2 Land Use

Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C. 1701–1784, enacted by Public Law 94-579, as amended). FLPMA governs the use of Federal lands that may be overseen by several agencies and establishes the procedure for applying to the Bureau of Land Management (BLM) for land withdrawals and rights-of-way. Land use is addressed in Chapter 4, Sections 4.1.1, 4.2.1, 4.3.1, and 4.4.1.

Military Lands Withdrawal Act of 1999 (Public Law 106-65). On October 5, 1999, this Act renewed withdrawal of lands known as Pahute Mesa that are an integral part of the NNSS and include the site of nuclear weapons testing activities. Pursuant to the Act, these lands were transferred from the U.S. Department of Defense to DOE, thus aligning jurisdictional responsibilities consistent with DOE's retention of environmental, safety, and health responsibilities at the NNSS.

DOE Order 430.1B, *Real Property Asset Management* (September 24, 2003; Change 2, April 25, 2011). The objective of this Order is to establish a corporate, holistic, and performance-based approach to real property life-cycle asset management that links real property asset planning, programming, budgeting, and evaluation to program mission projections and performance outcomes. To accomplish the objective, this Order sets forth the requirements for the major real property asset management functional components of planning, real estate, acquisition, maintenance and recapitalization, disposition and long-term stewardship, value engineering, and performance goals and measures. One of the requirements is documentation of the results of real property asset site planning and performance in a Ten-Year Site Plan (TYSP) that is kept current and covers a 10-year planning horizon. The content of the TYSP must address how the site's real property assets will support DOE's strategic plan, the Secretary of Energy's 5-year planning guidance, and appropriate program guidance. It must be a comprehensive site-wide plan encompassing the needs of tenant activities. This Order applies to DOE/NNSA for operations on the NNSS, as well as at NLVF and RSL.

9.1.3 Infrastructure and Energy

Energy Policy Act of 2005 (42 U.S.C. 15801 et seq.). Signed on August 8, 2005, this Act was the first omnibus energy legislation enacted in more than a decade. Major provisions include tax incentives for domestic energy production and energy efficiency, a mandate to double the Nation's use of biofuels, repeal of restrictions on interstate utility holding companies, faster procedures for energy production on Federal lands, and authorization of numerous Federal energy research and development programs. Applicability for DOE ranges from energy management requirements, procurement of energy-efficient products, assessment of renewable energy resources, and Price-Anderson Amendments Act requirements.

Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (January 24, 2007). This Order sets goals for Federal agencies to conduct their environmental, transportation, and energy-related activities in support of their respective missions in an integrated, efficient, continuously improving, and sustainable manner that complies with the law and all regulatory requirements and is environmentally, economically, and fiscally sound.

Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (October 5, 2009). This Order focuses on improving and strengthening the overall sustainability of the Federal Government. All Federal agencies are required to inventory their GHG emissions, set targets to reduce their emissions by 2020, and develop a plan for meeting a wide range of goals for improving sustainability, such as water efficiency, waste reduction, sustainable community development planning, high-performance buildings, sustainable acquisition, electronics stewardship, and environmental management.

In accordance with Executive Order 13514, DOE published its first *Strategic Sustainability Performance Plan* (DOE 2010d) in September 2010. The *Strategic Sustainability Performance Plan* is updated annually, and progress toward its goals is reported in the annual updates. The Plan includes the following: (1) sustainability goals and targets, including GHG reduction targets; (2) integration with overall strategic planning and budgeting processes within DOE; (3) activities, policies, plans, procedures, goals, schedules, and milestones needed to implement Executive Order 13514; (4) performance metrics and evaluation of projects based on life-cycle return on investment; (5) involvement of DOE employees in achieving sustainability goals; and (6) climate change adaptation planning.

9.1.4 Transportation

Hazardous Materials Transportation Act of 1975, as amended (49 U.S.C. 5101 et seq.). The transportation of radioactive materials is regulated jointly by the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Transportation (DOT). DOT regulates shippers and carriers of hazardous materials, including radioactive material. DOT's responsibility includes vehicle safety, routing, shipping papers, and emergency response information and shipper/carrier training requirements. NRC regulates users of radioactive material in 17 states (33 states regulate material within their borders) and approves the design, fabrication, use, and maintenance of shipping containers for more-hazardous radioactive material shipments (NTA 2009). NRC requires radioactive materials to be shipped in accordance with the hazardous materials transportation safety regulations of DOT. 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.

Transportation of hazardous materials that occurs entirely on DOE property (i.e., on the NNSS), to which public access is controlled at all times through the use of gates and guards, is subject to applicable DOE directive and transportation safety requirements set forth in 10 CFR Part 830, Subpart B. DOE transport of hazardous materials (e.g., mixed low-level radioactive waste) off site for treatment, over highways to which the public has access, would be subject to applicable DOT, DOE, and U.S. Environmental Protection Agency (EPA) directives. Potential transportation impacts from implementation of the alternatives analyzed in this SWEIS are discussed in Chapter 5, Sections 5.1.3, 5.2.3, 5.3.3, and 5.4.3.

10 CFR Part 71, "Packaging and Transportation of Radioactive Material." These NRC regulations include detailed packaging design requirements and package certification testing requirements. Complete documentation of design and safety analysis and the results of the required testing are submitted to NRC to certify the package for use. This certification testing involves the following components: heat, physical drop onto an unyielding surface, water submersion, puncture by dropping the package onto a steel bar, and gas tightness.

DOE Order 461.1B, *Packaging and Transportation for Offsite Shipment of Materials of National Security Interest* (December 20, 2010). This Order establishes the requirements and responsibilities for offsite shipments of naval nuclear fuel elements, Category I and Category II special nuclear materials (SNM), nuclear explosives, nuclear components, special assemblies, and other materials of national security interest. Requirements and responsibilities for onsite transfers have been removed from this Order and are included in the new DOE Order 461.2, *Packaging and Transportation for Onsite Transfer of Materials.* This Order is applicable to primary DOE organizations, including NNSA.

DOE Order 461.2, *Onsite Packaging and Transfer of Materials of National Security Interest* (November 1, 2010). This Order establishes safety requirements and responsibilities for onsite packaging and transfers of materials of national security interest to ensure safe use of Transportation Safeguards System (TSS) and non-TSS Government- and contractor-owned and/or leased resources. This Order also establishes a process for identifying and mitigating risks associated with noncompliant transfers.

DOE Order 460.2A, *Departmental Materials Transportation and Packaging Management* (December 22, 2004). This 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 460.1B. 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. This Order applies to NNSA.

DOE Order 460.1C, *Packaging and Transportation Safety* (May 14 2010). The objective of this Order is to establish safety requirements for the proper packaging and transportation of DOE and DOE/NNSA 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.) Operations conducted under DOE Order 461.1, *Packaging and Transfer or Transportation of Materials of National Security Interest*, are excluded from this Order.

9.1.5 Geology and Soils

Executive Order 12699, *Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction* (January 5, 1990), as amended by Executive Order 13286 (February 28, 2003). This Order requires Federal agencies to: (1) reduce risks to occupants of buildings owned, leased, or purchased by the Federal Government or buildings constructed with Federal assistance and to persons who would be affected by failures of Federal buildings in earthquakes; (2) improve the capability of existing Federal buildings to function during or after an earthquake; and (3) reduce earthquake losses of public buildings, all in a cost-effective manner. Each Federal agency responsible for the design and construction of a Federal building shall ensure that the building is designed and constructed in accordance with appropriate seismic design and construction standards. This requirement pertains to all building projects for which development of detailed plans and specifications is initiated subsequent to the issuance of this Order; therefore, it applies to the proposed activities evaluated in this SWEIS. Seismic risks and potential impacts are evaluated in Chapters 4 and 5 of this SWEIS.

DOE Order 420.1B, *Facility Safety* (December 22, 2005). This Order requires that nuclear and nonnuclear facilities be designed, constructed, and operated so that the public, workers, and environment are protected from adverse impacts of natural phenomena hazards, including earthquakes. The Order stipulates natural phenomena hazards mitigation for DOE facilities and specifically provides for re-evaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. The design and construction of new facilities and major modifications to existing facilities proposed in this SWEIS must address natural phenomena mitigation design.

DOE Guide 420.1-2, *Guide for the Mitigation of Natural Phenomena Hazards for DOE Nuclear Facilities and Nonnuclear Facilities* (March 28, 2000). This document provides guidance in implementing the natural phenomena hazards mitigation requirements of DOE Order 420.1B, *Facility Safety*, Section 4.4, "Natural Phenomena Hazards Mitigation." This Guide does not establish or invoke any new requirements. Any apparent conflicts arising from the natural phenomena hazards guidance would defer to the requirements in DOE Order 420.1.

DOE Standard 1023-95, *Natural Phenomena Hazards Assessment Criteria* (April 2002). To implement the natural phenomena hazards mitigation requirements, several standards have been developed for compliance with DOE Order 420.1. DOE Standard 1023-95 provides general and detailed criteria for establishing adequate design-basis load levels.

9.1.6 Hydrology

Clean Water Act of 1972, as amended (33 U.S.C. 1251 et seq.). The Clean Water Act, which amended the Federal Water Pollution Control Act, was enacted to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." The Act prohibits the unpermitted discharge of toxic pollutants in toxic amounts to navigable waters of the United States. Section 313 of the Clean Water Act 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 of the Clean Water Act, which provides 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, is addressed in Section 9.1.7, Biological Resources.

The Act 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 program is administered by EPA, pursuant to regulations in 40 CFR Part 122 et seq., and may be delegated to states. Stormwater provisions of the NPDES program are set forth in 40 CFR 122.26, and require discharge permits for industrial and construction activities disturbing 0.4 hectares (1 acre) or more. The NNSS operations do not require any NPDES permits (DOE/NV 2009d). At NLVF, an NPDES permit regulates the discharge of pumped groundwater. At the NNSS, Clean Water Act regulations are followed through compliance with wastewater discharge permits issued by the Nevada Division of Environmental Protection (NDEP). Wastewater discharge permits held by DOE/NNSA for the NNSS and other locations are identified in this chapter in Section 9.2, "Applicable Permits."

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, which are generally defined as systems that have at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents. These standards apply to the NNSS and other locations for community and non-community water supplies. The State of Nevada implements its own safe drinking water program under authority of the Safe Drinking Water Act. Nevada has adopted standards at least as stringent as the EPA's and has a safe drinking water program in place to make sure water systems meet these standards. NDEP's Bureau of Safe Drinking Water is responsible for enforcement of these standards.

National Wellhead Protection Program (established by the 1986 amendments to the Safe Drinking Water Act). The Safe Drinking Water Act amendments require each state to develop a Comprehensive State Groundwater Protection Program and encourage local water systems to develop wellhead protection plans for their community water systems.

40 CFR Part 141, "National Primary Drinking Water Regulations." These regulations provide maximum contaminant levels, monitoring and analytical requirements, reporting and record-keeping 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, as well as other subparts to follow.

40 CFR Part 142, "National Primary Drinking Water Regulations Implementation." These regulations provide the proper measures for implementation and enforcement of the "National Primary Drinking Water Regulations" (40 CFR Part 141).

40 CFR Part 143, "National Secondary Drinking Water Regulations." This part establishes national secondary drinking water regulations pursuant to Section 1412 of the Safe Drinking Water Act, as amended (42 U.S.C. 300g-1). These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may also exist, as well as aesthetic degradation. The regulations are not federally enforceable, but are intended as guidelines for the states.

10 CFR Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements." DOE requirements for compliance with Executive Order 11988, "Floodplain Management," and Executive Order 11990, "Protection of Wetlands," are set forth in 10 CFR Part 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements." 10 CFR Part 1022 establishes policy and procedures for DOE responsibilities under both Executive Orders, including: (1) DOE policy regarding the consideration of floodplain and wetland factors in DOE planning and decisionmaking and (2) DOE procedures for identifying proposed actions located in a floodplain or wetland, providing opportunity for early public review of such proposed actions, preparing floodplain or wetland assessments, and issuing statements of findings for actions in a floodplain. DOE shall accommodate the requirements of Executive Order 11988 and Executive Order 11990, to the extent possible, through applicable DOE NEPA procedures or, when appropriate, using the environmental review process under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see Section 9.1.14 of this Chapter). Additionally, DOE must specifically to adhere to the flood design and evaluation criteria specified in DOE Standards 1020–2002, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, and 1023-95, *Natural Phenomena Hazards Assessment Criteria*. Chapter 5 of this SWEIS addresses the potential floodplain impacts associated with the activities analyzed for each of the alternatives.

Executive Order 11988, *Floodplain Management* (May 24, 1977). This Order (implemented by DOE in 10 CFR Part 1022) directs Federal agencies to evaluate the potential effects of any actions that may be taken in a floodplain. When conducting activities in a floodplain, Federal agencies are required to take actions to reduce the risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

State of Nevada, *Nevada Revised Statutes* (NRS) 534, "Underground Water and Wells." The Nevada Division of Water Resources oversees these regulations, which relate to drilling, construction, and licensing of new wells and reworking of existing wells to prevent the contamination and excess use (i.e., waste) of groundwater. DOE/NNSA complies with these regulations as a matter of comity, holding to the position that state licensing requirements do not apply to the Federal Government and its contractors as a matter of law, under the principle of Federal supremacy and associated case law. Two current operations that voluntarily comply with these regulations are the Underground Test Area (UGTA) Project, which drills new wells and reworks old wells, and the Borehole Management Program, which plugs abandoned the NNSS boreholes (DOE/NV 2009d). For information on the current status of the Borehole Management Program, see Chapter 3, Section 3.1.2.2, of this SWEIS.

State of Nevada, Nevada Administrative Code (NAC) 445A, "Water Controls (Public Water Systems, 445A.450 through 445A.6731)." These regulations enforce Safe Drinking Water Act requirements and set standards for permitting, design, construction, operation, maintenance, certification of operators, and water quality of public water systems. NDEP's Bureau of Safe Drinking Water oversees and enforces compliance with public water system permit requirements. Permits issued by the Bureau for three of the NNSS public water systems and two potable water hauler trucks are listed in Section 9.2.

NAC 445A (cited above) and 444, "Sanitation." These regulations protect the waters of the state from the discharge of pollutants. NDEP's Bureau of Water Pollution Control oversees and enforces compliance with Nevada's water pollution control laws and regulations. These regulations apply to the collection, treatment, and disposal of wastewater and sewage at the NNSS. The requirements are issued in permits to DOE/NNSA, as shown in Table 9–2. DOE/NNSA also obtains underground injection control permits from NDEP for tracer tests in UGTA Project characterization wells (DOE/NV 2009d).

NAC 445A.810–445A.925, "Underground Injection Control Program." NDEP's Bureau of Safe Drinking Water issues permits to protect the public health and safety and the general welfare of the people of Nevada. An applicant for a permit to inject fluids must satisfy the state that the underground injection will not endanger any source of drinking water (NAC 445A.865, NAC 445A.867). Construction of an injection well for which a permit is required may not begin until the permit has been issued (NAC 445A.905)**.** Plugging and abandonment requirements may be added as a condition to the permit or the requirements in the NAC must be followed. (See NRS 534 above for information on plugging abandoned boreholes on the NNSS.)

***Fluid Management Plan for the Underground Test Area Project* (DOE/NV-370-Rev. 5, August 2009) (*UGTA FMP*).** UGTA Project wells are regulated by the State of Nevada through an agreement between DOE/NNSA and NDEP, documented in the *UGTA FMP* (DOE 2009l). The *UGTA FMP* was developed in place of issuing separate water pollution control permits for each UGTA characterization well under the Clean Water Act. The *UGTA FMP* identifies the methods for disposing groundwater pumped from UGTA wells during drilling, construction, development, testing, experimentation, and/or well water sampling based on radiological contamination levels. The *UGTA FMP* is a comprehensive attachment to the *Underground Test Area Project Waste Management Plan* (*UGTA WMP*) (DOE 2009k). The *UGTA WMP* is a state-approved document that includes the *UGTA FMP* and requires the UGTA Project to draft a specific Fluid Management Strategy when conducting activities such as drilling. This activity-specific Fluid Management Strategy would also be approved by the State of Nevada and must adhere to the guidelines provided by the *UGTA FMP*.

9.1.7 Biological Resources

Bald and Golden Eagle Protection Act of 1973, as amended (16 U.S.C. 668–668d). The Bald and Golden Eagle Protection Act, as amended, 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 Interior to relocate a nest that interferes with resource development or recovery operations. Both bald and golden eagles occur on the NNSS (DOE/NV 2009d). During the project planning phase and prior to construction, biological surveys are conducted to prevent direct harm to eagles and their nests and eggs. See Chapter 5, Sections 5.1.7, 5.2.7, 5.3.7, and 5.4.7, for bald and golden eagle impact analysis.

Clean Water Act, Section 404, Jurisdictional Wetlands. The Clean Water Act 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 the Clean Water Act (EPA and Army 2007). Based on the new guidance, no wetlands at the NNSS are expected to qualify as waters of the United States; a site-specific evaluation by the U.S. Army Corps of Engineers, based on the new guidance, will be determinative.

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 having 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 or the National Marine Fisheries Service to ensure that 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 4 identifies potential endangered, threatened, or listed species in the affected environment. Chapter 5 describes the potential impacts on those species from implementation of the alternatives.

Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 et seq.). The Migratory Bird Treaty Act, as amended, is intended to protect birds that have common migration patterns between the United States and Canada, Mexico, Japan, and Russia. It regulates the harvest of migratory birds by specifying conditions such as mode of harvest, hunting seasons, and bag limits. The Act stipulates that it is unlawful, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess…any migratory bird…or any part, nest, or egg of any such bird." Of the 239 species of birds observed on the NNSS, 234 are protected under the Migratory Bird Treaty Act (DOE/NV 2009d). During the project planning phase and prior to construction, biological surveys are conducted to prevent direct harm to the birds and their nests and eggs. Potential impacts on migratory birds from implementation of the alternatives are analyzed in Chapter 5, Sections 5.1.7 and 5.4.7.

National Wildlife Refuge System Administrative Act of 1966, as amended (16 U.S.C. 668dd-668ee). This Act provides for the administration and management of the national wildlife refuge system, including wildlife refuges, areas for the protection and conservation of fish and wildlife threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Desert National Wildlife Refuge is protected under this act. Biological monitoring is conducted to verify that tests conducted at the Nonproliferation Test and Evaluation Complex in Area 5 on the NNSS do not disperse toxic chemicals that could harm Desert National Wildlife Refuge biota (DOE/NV 2009d).

Wild Horses and Burros Act of 1971 (16 U.S.C. 1331–1340). This Act requires the protection, management, and control of wild free-roaming horses and burros on public lands. Wild horses on the NNSS may wander off the site onto public lands; therefore, they are protected under this Act (DOE/NV 2009d). Potential impacts on wild horses and burros protected under this Act are analyzed in Chapter 5, Sections 5.1.7, 5.2.7, 5.3.7, and 5.4.7.

Executive Order 11990, *Protection of Wetlands* (May 24, l977). This Order, implemented by DOE through 10 CFR Part 1022, directs Federal agencies to ensure consideration of wetlands protection in decisionmaking and to evaluate the potential impacts of any new construction proposed in a wetland.

This Order directs Federal agencies to avoid the destruction or modification of wetlands and avoid direct or indirect support of new construction in wetlands if a practicable alternative exists.

Executive Order 13112, *Invasive Species* (February 3, 1999). This Order establishes the National Invasive Species Council. It requires Federal agencies to act to prevent the introduction of invasive species and provide for their control; to implement restoration with native species; and to minimize actions that could spread invasive species. This Order applies to DOE/NNSA, as land-disturbing activities on the NNSS have resulted in the spread of numerous invasive plant species (DOE/NV 2009d). Potential impacts and habitat reclamation to control invasive species are addressed in Chapter 5, Sections 5.1.7 and 5.4.7.

Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (January 10, 2001). This Order directs Federal agencies taking actions with a measurable negative effect on migratory bird populations to develop and implement a Memorandum of Understanding with the U.S. Fish and Wildlife Service that promotes the conservation of migratory bird populations, in support of the Migratory Bird Treaty Act.

Five-Party Cooperative Agreement (1977 – see also Wild Horses and Burros Act of 1971). This five-party agreement between DOE/NNSA, the U.S. Air Force, the U.S. Fish and Wildlife Service, BLM, and the Nevada State Clearinghouse seeks coordination and cooperation in conducting resource inventories and developing management plans for wild horses and burros in an effort to maintain desirable habitat on federally withdrawn lands for these animals.

NAC 503.005–503.104, "Classification and Taking of Wildlife." This regulation identifies Nevada animal species (i.e., protected and not protected), and prohibits harm to protected species without a special permit. This applies to DOE/NNSA; potential impacts are addressed in Chapter 5, Sections 5.1.7, 5.2.7, 5.3.7, and 5.4.7.

9.1.8 Air Quality and Climate

Clean Air Act of 1970, 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 that each Federal agency with jurisdiction over any property or facility engaged in any activity that might result in the discharge of air pollutants 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 under 40 CFR Parts 50–99. Potential air quality impacts from implementation of the alternatives in this SWEIS are analyzed in Chapter 5, Sections 5.1.8, 5.2.8, 5.3.8, and 5.4.8.

40 CFR Part 50, "National Ambient Air Quality Standards (NAAQS)." The Clean Air Act requires EPA to set 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. Air quality permits for the NNSS, NLVF, and RSL demonstrate compliance with NAAQS criteria pollutants as well as requirements such as applicable reporting and recordkeeping, opacity field monitoring, emission quantities of hazardous air pollutants (e.g., lead) and criteria pollutants, and summaries of significant malfunctions and repairs.

40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants (NESHAPs)." DOE facility emissions of radionuclides and other hazardous air pollutants, including a release of asbestos during demolition and renovation activities, are regulated under the NESHAPs program (40 CFR Part 61, "National Emission Standards for Hazardous Air Pollutants (NESHAPS)," and 40 CFR Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories (a.k.a. Maximum Achievable Control Technology [MACT])." The NNSS radioactive air emissions are monitored on site to determine the public dose from inhalation and to determine compliance with NESHAPs under the Clean Air Act (DOE 2009d).

40 CFR Part 82, "Stratospheric Ozone Protection." The Clean Air Act establishes limits on the production and consumption of certain ozone-depleting substances according to specified schedules. At the NNSS, ozone-depleting substances are mainly used in air conditioning units in vehicles, buildings, refrigerators, drinking water fountains, vending machines, and laboratory equipment. While there are no reporting requirements, recordkeeping to document the usage of ozone-depleting substances and technician certification is required, and EPA may conduct random inspections to determine compliance (DOE/NV 2009d).

40 CFR Part 98, "Mandatory Greenhouse Gas Reporting." On October 30, 2009, EPA issued this regulation, which requires reporting of GHG emissions from large sources and suppliers in the United States. Its purpose is to collect accurate and timely emissions data for future policy decisions. Suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year of GHG emissions are required to submit annual reports to EPA. EPA's GHG reporting system will provide a better understanding of where GHGs are coming from and guide development of sound policies and programs to reduce emissions. These comprehensive, nationwide emissions data will help in the study of climate change.

On July 20, 2010, EPA signed revisions to certain provisions of the Mandatory Greenhouse Gas Reporting Rule. These proposed amendments primarily make clarifying and technical changes to specific sections of the final rule that either were not clear or did not have the intended effect. This proposal is complementary to the proposed rulemaking, *Technical Corrections, Clarifying and Other Amendments to Certain Provisions of the Mandatory Greenhouse Gas Reporting Rule* (75 FR 114), published on June 15, 2010. Together, these two proposed rulemakings address the most significant questions raised during implementation. This proposed rule was published in the *Federal Register* on August 11, 2010.

NAC 445B.22097, "Standards of Quality for Ambient Air." This regulation identifies the minimum standards of quality for ambient air in Nevada, as required by NRS 445B.210. These standards shall be used when considering issuance of a permit for a stationary source and shall ensure that the stationary source will not cause the Nevada standards to be exceeded in areas where the general public has access. Minimum standards for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter with an aerodynamic diameter less than or equal to 10 micrometers in size (PM_{10}), lead, and hydrogen sulfide are identified. This regulation applies to DOE/NNSA; potential impacts are addressed in Chapter 5, Sections 5.1.8, 5.2.8, 5.3.8, and 5.4.8.

NAC 445B.3453 – 445B.3477, "Class II Operating Permits." These regulations specify the general requirements for obtaining a Class II air quality operating permit in Nevada for a proposed stationary source or a proposed modification to a stationary source. The application process is outlined and a list of required contents of the permit is provided. Necessary steps toward either applying for a revision or renewing an existing permit are also identified. All Class II operating permits must be renewed 5 years after their date of issuance. In accordance with NAC 445B.3477, a Class II general permit covering numerous similar stationary sources may be issued. DOE/NNSA has Class II permits for its facilities in Nevada. Impacts on air quality are addressed in Chapter 5, Sections 5.1.8, 5.2.8, 5.3.8, 5.4.8.

State of Nevada, NRS 445B.100–445B.825, "Air Pollution," and NRS 486A.010–486A.180, "Alternative Fuels; Clean Burning Fuels." The mission of NDEP's Bureau of Air Pollution Control is to achieve and maintain levels of air quality to protect human health and safety; prevent injury to plant and animal life; prevent damage to property; and preserve visibility and the scenic, esthetic, and historic values of the state (NDEP 2009a). The authority for the Bureau to implement air pollution control requirements has been established in NRS 445B.100 – 445B.825, inclusive, and NRS 486A.010 – 486A.180, inclusive. DOE works with the Bureau's Compliance and Enforcement Branch to ensure that all air quality sources operate in compliance with Federal and state laws and regulations. For example, DOE/NNSA must allow the Clark County Department of Air Quality and Environmental Management to conduct inspections of NLVF and RSL permitted equipment.

9.1.9 Visual Resources

BLM Manual 8400 – Visual Resource Management **(BLM 2009a).** This manual describes BLM's policy that it has a basic stewardship responsibility to identify and protect visual values on all BLM lands (BLM 2009b). BLM is responsible for ensuring that the scenic values of public lands are considered before allowing uses that may have negative visual impacts. This is accomplished through BLM's Visual Resource Management system described in Section 8400 of the manual, a system that involves inventorying scenic values and establishing management objectives for those values through the resource management planning process, and evaluating proposed activities to determine whether they conform to management objectives (BLM 2009c). The visual resource impacts on public lands from implementation of the proposed alternatives are presented in Chapter 5, Sections 5.1.9, 5.2.9, 5.3.9, and 5.4.9.

9.1.10 Cultural Resources

American Indian Religious Freedom Act of 1978, as amended (42 U.S.C. 1996 and 1996a). This Act reaffirms American Indian religious freedom rights under the First Amendment and establishes U.S. policy to protect and preserve the inherent and constitutional right of American Indians 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 American Indian 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 SWEIS alternatives are analyzed in Chapter 5, Sections 5.1.10, 5.2.10, 5.3.10, and 5.4.10.

Antiquities Act of 1906, as amended (16 U.S.C. 431–433). 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 (DOE/NV 2009d). Potential impacts from implementation of the SWEIS alternatives are analyzed in Chapter 5, Sections 5.1.10, 5.2.10, 5.3.10, and 5.4.10.

Archaeological and Historic Preservation Act of 1960, as amended (16 U.S.C. 469–469c-2). The purpose of this Act is to provide for the 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 SWEIS alternatives are analyzed in Chapter 5, Sections 5.1.10, 5.2.10, 5.3.10, and 5.4.10.

Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa et seq.). This Act protects cultural resources on Federal lands greater than 100 years old and prohibits looting, vandalism, and unauthorized excavation. No one may sell, buy, or trade items from a cultural resource on Federal land. Criminal and civil penalties for violations are mandated, including forfeiture of equipment and vehicles used in any violations. Permits for excavation and removal of cultural resources on Federal lands by qualified persons are obtained from the appropriate Federal agency and for the purpose of furthering archaeological knowledge for the benefit of the public. The Federal land manager must contact any American Indian tribe or organization with an interest in the cultural resource to be excavated. Recovered items remain the property of the United States and are to be preserved by a qualified institution. Federal agencies cannot reveal the location of a cultural resource if by doing so the cultural resource is at risk of being altered or destroyed. Agencies are also to develop plans for surveying lands other than those scheduled for undertakings and to record and report violations of the Act. Potential impacts from implementation of the SWEIS alternatives are analyzed in Chapter 5, Sections 5.1.10, 5.2.10, 5.3.10, and 5.4.10.

Historic Sites, Buildings, and Antiquities Act of 1935. 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 (HABS), and the Historic American Engineering Record (HAER).

National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. 470 et seq.). This Act 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 the NHPA pertaining to this SWEIS 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, including the Nevada State Historic Preservation Office and the Advisory Council on Historic Preservation, 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, stressing 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 alternatives are analyzed in Chapter 5, Sections 5.1.10, 5.2.10, 5.3.10, and 5.4.10. In addition, DOE has started consultations under Section 106 with the State Historic Preservation Officer, Advisory Council on Historic Preservation, and American Indian tribes on the possible adverse impacts of the proposed actions and alternatives being evaluated in this SWEIS. For further information on consultations with American Indians, see Chapter 10 of this SWEIS.

Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 U.S.C. 3001 et seq.). This Act requires Federal agencies to consult with American Indian tribes regarding human remains and materials in their collections. The Act acknowledges tribal rights to American Indian 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 American Indian human remains or objects covered by this Act. In the case of unexpected discoveries of American Indian graves or grave goods during activities on Federal lands, the tribes or organizations are to be notified and procedures are agreed upon to establish affiliation and for 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 to DOE/NNSA during implementation of the activities analyzed in this SWEIS. Impacts of proposed DOE/NNSA activities on cultural resources important to American Indians are addressed in Chapter 5, Sections 5.1.10, 5.2.10, 5.3.10, and 5.4.10.

Executive Order 11593, *Protection and Enhancement of the Cultural Environment* (May 13, 1971). This 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 Order directs Federal agencies to accommodate the access and ceremonial use of American Indian sacred sites on their lands by American Indian 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 Order supplements the Executive Memorandum (dated April 29, 1994) entitled "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. This Order also 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 Order reemphasizes 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 the 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 Order communicates responsibilities for interacting with American Indian governments and transmits the DOE American Indian and Alaska Native Tribal Government Policy (i.e., "Indian Policy"), including its guiding principles. This policy outlines the requirements to be followed by DOE in its interactions with federally recognized American Indian 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 Indian 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 Indian nations into the decisionmaking processes.

9.1.11 Waste Management

Atomic Energy Act (AEA), as amended in 1954 (42 USC 2011 et seq.). The AEA provides fundamental jurisdictional authority to DOE and NRC over governmental and commercial use of nuclear materials. The 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. DOE regulations are found in 10 CFR. The DOE regulations that are the most relevant to radioactive waste and materials management include the following:

- "Nuclear Safety Management" (10 CFR Part 830)
- "Occupational Radiation Protection" (10 CFR Part 835)
- "Byproduct Material" (10 CFR Part 962)

The AEA also gives EPA the authority to develop generally applicable standards for protection of the general environment from radioactive materials. EPA has promulgated several regulations under this authority. The EPA regulation that is the most relevant to radioactive waste and materials management activities addressed by this SWEIS (e.g., transuranic waste at the NNSS) is 40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes." Transuranic waste (including mixed transuranic waste) generated as part of NNSS operations or from in-state environmental restoration programs is sent to the Area 5 Radioactive Waste Management Complex for temporary storage before shipment off site for further characterization and/or final disposition. See Chapter 4, Section 4.1.11.1.3, for a summary of transuranic waste management at the NNSS.

Resource Conservation and Recovery Act (RCRA) of 1976, as amended (42 U.S.C. 6901 et seq.). RCRA has four main goals: (1) to protect human health and the environment from hazards posed by waste disposal; (2) to conserve energy and natural resources through waste recycling and recovery; (3) to reduce or eliminate the generation of waste, including hazardous waste; and (4) to ensure that wastes are managed in an environmentally safe manner. RCRA focuses only on active and planned facilities. *(Note: Hazardous waste cleanup operations at the NNSS [i.e., nonhistoric waste management activities, including satellite accumulation and the RCRA Part B Permit for the hazardous waste accumulation facility] are regulated under RCRA; they are not regulated under CERCLA. Historic contamination from the nuclear testing era is covered by the Federal Facility Agreement and Consent Order [described below in this Section]. Typically, the CERCLA regulations apply to historic cleanups such as Superfund and emergency response. The applicable emergency response requirements of CERCLA, as well as an overview of CERCLA, are described in Section 9.1.14.)*

The transportation and treatment, storage, and disposal (TSD) of solid and hazardous wastes are regulated by EPA under the authority of RCRA. The 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. This Act imposed management requirements on generators and transporters of hazardous waste and upon owners and operators of TSD facilities. EPA has established a comprehensive set of regulations governing all aspects of TSD facilities, including location, design, operations, and closure. Any state that seeks to administer and enforce a hazardous waste program pursuant to RCRA may apply to EPA for authorization to administer its state program in lieu of the Federal program. EPA has authorized the State of Nevada to implement the state hazardous waste management program in lieu of the Federal RCRA program. Waste management is discussed in Chapter 4, "Affected Environment," and Chapter 5, "Environmental Consequences."

Federal Facility Compliance Act of 1992 (Public Law 102-386). The Federal Facility Compliance Act, enacted on October 6, 1992, amended RCRA Section 6961 and other sections and requires DOE to prepare plans that develop treatment capacity for mixed waste stored or generated at each facility, except for those facilities subject to a permit that establishes a schedule for treatment of such waste or an existing agreement or order governing the treatment of such waste to which the state is a party. The host state and/or EPA must approve each plan. Compliance with this Act by DOE/NNSA per the State of Nevada requires the identification of existing quantities for mixed waste, the proposal of methods and technologies of mixed treatment and management, the creation of enforceable timetables, and the tracking and completion of deadlines.

Federal Facility Agreement and Consent Order, as amended. This Consent Order, agreed to by the State of Nevada, DOE Environmental Management, and the U.S. Department of Defense, became effective in May 1996. In August 2006, as part of assuming stewardship responsibility for the Central Nevada Test Area and Project Shoal, DOE's Office of Legacy Management became a signatory to the FFACO. It addresses the environmental restoration of historically contaminated sites at the NNSS, parts of the Tonopah Test Range, parts of the Nevada Test and Training Range, the Central Nevada Test Area, and the Project SHOAL Area (DOE/NV 2009d). The Federal Facility Agreement and Consent Order incorporates RCRA and CERCLA elements that promulgate the characterization, restoration, and closure of identified sites.

Low-Level Radioactive Waste Policy Act, as amended in 1985 (42 USC 2021b et. seq.). This Act amended the AEA to specify that the Federal Government (i.e., DOE and NRC) is responsible for disposal of low-level radioactive waste (LLW). If authorized by NRC under interstate compacts, states may regulate disposal of LLW from commercial sources. DOE remains responsible for the disposition of defense LLW (i.e., from DOE and U.S. Navy origin).

Toxic Substances Control Act of 1976 (15 U.S.C. 2601 et seq.). The Toxic Substances Control Act provides EPA with the authority to require testing of chemical substances entering the environment and to regulate them as necessary. EPA is also authorized to impose strict limitations on the use and disposal of polychlorinated biphenyls (PCBs), chlorofluorocarbons, asbestos, dioxins, certain metalworking fluids, and hexavalent chromium. The EPA regulations that establish prohibitions of and requirements for PCBs and PCB items are found in 40 CFR Part 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions." Removal of any PCB transformers remaining at facilities on the NNSS and other locations would require disposition in compliance with this Act.

NAC 444.570–444.7499, "Sanitation (Solid Waste Disposal)." These regulations set standards for solid waste management systems, including the storage, collection, transportation, processing, recycling, and disposal of solid waste in Nevada. These regulations apply on the NNSS to active and inactive landfills, as described in Chapter 4, Sections 4.1.11, 4.2.11, 4.3.11, and 4.4.11.

NAC 444.850–444.8746, "Disposal of Hazardous Waste." These regulations apply to the operation of hazardous waste disposal facilities in Nevada to comply with Federal RCRA regulations. These regulations apply on the NNSS to the operation of a hazardous waste storage unit in Area 5, the Explosives Ordnance Disposal Unit in Area 11, and the disposal of mixed low-level radioactive waste from DOE offsite facilities into a mixed waste disposal unit (DOE/NV 2009d). The impacts of hazardous waste storage on the NNSS from implementation of the alternatives proposed in this SWEIS are analyzed in Chapter 5, Sections 5.1.11, 5.2.11, 5.3.11, and 5.4.11.

NAC 459.9921–459.999, "Storage Tanks." These regulations enforce Federal RCRA regulations for the maintenance and operation of storage tanks, including underground storage tanks, to prevent environmental contamination. The underground storage tanks located on the NNSS and RSL–Nellis are either: (1) fully regulated under RCRA and registered with the state, (2) regulated under RCRA and registered with the state, but deferred from leak detection requirements, or (3) excluded from Federal and state regulations. For example, at RSL, Clark County enforces these regulations under approval from NDEP and issues permits to DOE/NNSA (DOE/NV 2009d). Underground storage tanks would be used not to store waste, but to store consumable materials such as fuel oil (e.g., diesel) or gasoline.

NAC 444.940–444.9555, "Polychlorinated Biphenyl." These regulations enforce Federal requirements for the handling, storage, and disposal of PCBs and contain record-keeping requirements for PCB activities.

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 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.

Mutual Consent Agreement (January 1994; modified 1995 and 1998). This agreement between DOE and the State of Nevada covered the storage and management of mixed waste on the NNSS that was generated or identified after March 1996. The Mutual Consent Agreement authorized the storage of newly identified mixed waste at the NNSS Area 5 Radioactive Waste Management Site. State of Nevada approval of a Treatment and Disposal Plan is required for mixed waste storage greater than 9 months (DOE 2008f).

Settlement Agreement for Mixed Transuranic Waste (June 1992). The DOE NSO signed this agreement with the State of Nevada that requires operation of the NNSS Area 5 TRU Waste Storage Pad in accordance with 40 CFR Part 264, Subpart I. Transuranic waste is discussed in Chapter 4, Sections 4.1.11, 4.2.11, 4.3.11, and 4.4.11.

9.1.12 Human Health

Occupational Safety and Health Act (OSHA) of 1970 (29 U.S.C. 651 et seq.). Section 4(b)(1) of 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, *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 this Order, program requirements contained in 29 CFR Part 1960, "Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters;" applicable functional area requirements contained in Attachment 1; and other related site-specific worker protection activities. Potential impacts on human health associated with implementation of the proposed alternatives are analyzed in Chapter 5, Sections 5.1.12, 5.2.12, 5.3.12, and 5.4.12.

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 5 addresses the noise impacts associated with the activities analyzed for each of the alternatives.

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 employees involved in activities being considered in this SWEIS that could result in the occupational exposure of an individual to radiation or radioactive materials.

10 CFR Part 851, "Worker Safety and Health Program." Effective February 9, 2007, DOE established worker safety and health regulations to govern contractor activities at DOE sites. This program established the framework for a worker protection program that will reduce or prevent occupational injuries, illnesses, and accidental losses by requiring DOE contractors to provide their employees with safe and healthful workplaces. Also, the program established procedures for investigating whether a requirement has been violated, for determining the nature and extent of such violation, and for imposing an appropriate remedy.

Executive Order 12699, *Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction* (January 5, 1990). See Section 9.1.5, Geology and Soils.

DOE Order 422.1, *Conduct of Operations*, (June 29, 2010). This Order defines the requirements for establishing and implementing Conduct of Operations Programs at DOE, including NNSA, facilities and projects. A Conduct of Operations Program consists of formal documentation, practices, and actions implementing disciplined and structured operations that support mission success and promote worker, public, and environmental protection. The goal is to minimize the likelihood and consequences of human fallibility or technical and organizational system failures. Conduct of Operations is one of the safety management programs recognized in the Nuclear Safety Management Rule (10 CFR Part 830, "Nuclear Safety Management), but it also supports safety and mission success for a wide range of hazardous, complex, or mission-critical operations, and some Conduct of Operations Program attributes can enhance even routine operations. It supports the Integrated Safety Management System by providing concrete techniques and practices to implement ISM Core Functions such as "Develop and Implement Hazard Controls" and "Perform Work Within Controls." It may be implemented through facility policies, directives, plans, and safety management systems and need not be a stand-alone program. The term "operations" encompasses the work activities of any facility or organization, from building infrastructure, to print shops and computer centers, to scientific research, to maintaining and operating nuclear facilities. While many hazards can be dealt with through engineered solutions, people still have to perform operations, and they can and do make mistakes. The purpose of this Order is to ensure that management systems are designed to anticipate and mitigate the consequences of human fallibility or potential latent conditions and to provide a vital barrier to prevent injury, environmental insult, or asset damage, as well as to promote mission success. This Order cancelled DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities,* dated July 9, 1990.

DOE Order 440.1B, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees* (May 17, 2007). This 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.

Radiological Safety Oversight and Radiation Protection

10 CFR Part 820, "Procedural Rules for DOE Nuclear Facilities." DOE issued procedural rules for use in applying its substantive regulations and orders relating to nuclear safety. These procedural rules are intended to be an essential part of the framework through which DOE deals with its contractors, subcontractors, and suppliers to ensure its nuclear facilities are operated in a manner that protects public and worker safety and the environment. In particular, this part sets forth the procedures to implement the provisions of the Price-Anderson Amendments Act of 1988, which subjects DOE contractors to potential civil and criminal penalties for violations of DOE rules, regulations, and orders relating to nuclear safety (DOE Nuclear Safety Requirements). DOE also published its enforcement policy to inform contractors and other persons of the bases and anticipated processes for various enforcement actions.

10 CFR Part 830, "Nuclear Safety Management." Specific requirements in these regulations apply to DOE contractors, DOE personnel, and other persons conducting activities (including providing items and services) that affect, or may affect, the safety of DOE nuclear facilities. These regulations include quality assurance (10 CFR Part 830, Subpart A) and safety-basis (10 CFR Part 830, Subpart B) requirements. The latter require the contractor responsible for a DOE nuclear facility to analyze the facility, work to be performed and associated hazards, and to identify the conditions, safe boundaries, and hazard controls necessary to protect workers, the public, and the environment from adverse consequences. DOE relies on these analyses and hazard controls to operate facilities safely.

DOE Order 426.2, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities* (April 21, 2010). The purpose of this Order is to establish selection, training, and qualification requirements for contractor personnel who can impact the safety basis through their involvement in the operation, maintenance, and technical support of Hazard Category 1, 2, and 3 nuclear facilities. The Systematic Approach to Training, as defined in the Contractor Requirements Document of this Order, is designed to ensure that such personnel have the requisite knowledge, skills, and abilities to properly perform work in accordance with the safety basis. The Nuclear Safety Management Rule (10 CFR Part 830) requires Quality Assurance Programs and Documented Safety Analyses to address training. The training programs established to comply with this Order support those requirements. This Order updates and consolidates DOE training requirements consistent with applicable aspects of current industry standards of American National Standards Institute/American Nuclear Society (ANSI/ANS) 3.1-1993, *American National Standard, Selection, Qualification and Training of Personnel for Nuclear Power Plants*, ANSI/ANS 15.4-2007, *American National Standard, Selection and Training of Personnel for Research Reactors*, and 10 CFR Part 55, "Operators' Licenses," based on years of DOE experience. Implementation of the requirements of this Order will address 10 CFR 830.122, Criteria 2 – Management/Personnel Training and Qualification. This Order cancelled DOE Order 5480.20A.

DOE Order 458.1 Change 2, *Radiation Protection of the Public and the Environment* (June 6, 2011). This Order establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of the DOE pursuant to the AEA, as amended. 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 this 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/NNSA employees and contractors shall comply with their respective responsibilities under this Directive.

DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities* (April 21, 2010). The objective of this Order is to define the safety management program required by 10 CFR 830.204(b)(5) for maintenance and reliable performance of structures, systems, and components that are part of the safety basis required by 10 CFR 830.202 at hazard category 1, 2 and 3 DOE nuclear facilities. Radiological facilities (e.g., facilities with quantities of hazardous radioactive materials that fall below the hazard category 3 threshold per DOE Standard 1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23*, *Nuclear Safety Analysis Report*) are excluded from the provisions of this order; however, the maintenance management program requirements of DOE Order 430.1B, *Real Property Asset Management*, are applicable to radiological facilities. Radiological facilities that warrant additional controls may apply appropriate requirements of this Order until further guidance is issued. A single maintenance program may be used to address the requirements of this Order and the requirements of DOE Order 430.1B.

DOE Order 425.1D, *Verification of Readiness to Startup or Restart Nuclear Facilities* (April 16, 2010; cancels DOE Order 425.1C, March 13, 2003). This Order establishes DOE requirements for verifying readiness for startup of new hazard category 1, 2, and 3 nuclear facilities, activities, and operations, and for restart of existing hazard category 1, 2, and 3 nuclear facilities, activities, and operations that have been shut down. The requirements specify a readiness review process (e.g., operational readiness reviews or readiness assessments) that provides an independent verification of readiness to start or restart operations. DOE Standard 3006-2010, *Planning and Conducting Readiness Reviews*, provides guidance on approaches and methods approved as acceptable for implementing the requirements of this Order. In all cases, the readiness review process must demonstrate there is a reasonable assurance for adequate protection of workers, the public, and the environment from adverse consequences from the start (or restart) of a hazard category 1, 2, or 3 nuclear facility, activity, or operation. Such facilities, activities, or operations may be started (or restarted) only after readiness reviews have been conducted and the approvals specified in this Order have been received.

DOE Order 420.1B, *Facility Safety* (December 22, 2005; Change 1, April 19, 2010). This Order establishes facility safety requirements related to nuclear and explosives safety design criteria; a comprehensive fire protection program for DOE sites, facilities, and emergency service organizations; nuclear criticality safety (i.e., a criticality safety program that is applicable to DOE nuclear facilities and activities, including transportation activities, that have a potential for criticality hazards); natural phenomena hazards mitigation; and a system engineer program for hazard category 1, 2, and 3 nuclear facilities to ensure continued operational readiness of the systems within its scope. This Order requires that all DOE facilities and sites be designed, constructed, and operated so that the public, workers, and environment are protected from impacts of natural phenomena hazards (e.g., earthquake, wind, flood, and lightning). This Order applies to design and construction of new DOE hazard category 1, 2, and 3 nuclear facilities, as well as to major modifications to such nuclear facilities that could substantially change the approved facility safety analysis.

DOE Order 414.1D, *Quality Assurance* (April 25, 2011). DOE uses two requirements documents to express identical sets of quality assurance requirements for two distinct organizational groups. The first, DOE Order 414.1C, applies to practically all DOE organizations and all contractors whose contract includes the DOE Order. The second is a regulation, 10 CFR Part 830 (including Subpart A), that applies to nuclear facility contractors indemnified under the Price Anderson Amendments Act and suppliers of items and services to those nuclear facilities. Application of quality assurance basic requirements (i.e., management, performance, assessment) extends from the planning and conduct of basic and applied research, scientific investigation, and engineering design to operations, maintenance and repair of facilities, and eventual environmental restoration. These basic requirements reflect a comprehensive way of doing business throughout the life cycle of DOE programs and projects (DOE 2009h).

DOE Policy 441.1, *DOE Radiological Health and Safety Policy* (April 26, 1996). This document states that it is DOE policy to conduct its radiological operations in a manner that ensures the health and safety of all its employees, contractors, and the general public. The policy states that in achieving this objective, DOE will ensure that radiation exposures of its workers and the public and releases of radioactivity to the environment are maintained below regulatory limits, and deliberate efforts are taken to further reduce exposures and releases to as low as is reasonably achievable levels. DOE is committed to implementing a radiological control program of the highest quality that consistently reflects this policy.

9.1.13 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994). This 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 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 in the environmental justice sections of Chapter 5 of this SWEIS for each of the alternatives under consideration.

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (April 21, 1997), as amended by Executive Order 13229 (October 9, 2001). This Order requires each Federal agency to make it a high priority to identify and assess environmental health risks 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 risks or safety risks.

9.1.14 Emergency Planning, Pollution Prevention, and Conservation

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 – amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 (42 U.S.C. 9601 et seq.). CERCLA provides a statutory framework for the remediation of abandoned or historical waste sites, including Federal facilities, containing hazardous substances. Using a hazard-ranking system, Federal and private contaminated sites are ranked and may be included on the National Priorities List. CERCLA requires Federal facilities with contaminated sites to undertake investigations, remediation, and natural resource restoration, as necessary. Hazardous waste cleanup operations on the NNSS are not regulated under CERCLA.

CERCLA, as amended by SARA, also provides an emergency response program for releases or threatened releases of hazardous substances, pollutants, and contaminants that may endanger public health or the environment. Releases of hazardous substances exceeding reportable quantities must be reported on a timely basis to the National Response Center. The emergency response program requirements of

CERCLA are applicable on the NNSS and other locations. This is addressed in Chapter 4, Section 4.1.12.6.

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 U.S.C. 11001 et seq.). This Act 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. For DOE/NNSA compliance, see the Executive Order 12856 summary below.

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. Current waste management and pollution prevention practices are discussed in Chapter 4, Sections 4.1.11, 4.2.11, 4.3.11, and 4.4.11.

Homeland Security Act of 2002 (6 U.S.C. 101 et seq., enacted by Public Law 107-296). This Act established the U.S. Department of Homeland Security, integrating the functions of organizations related to national security. The Act authorizes the U.S. Department of Homeland Security to enter into work agreements, joint sponsorships, contracts, and any other agreement with DOE regarding the use of the national laboratories or sites and support of the science and technology base at those facilities.

Homeland Security Presidential Directive 5, *Management of Domestic Incidents* (February 28, 2003). The purpose of this Directive is to enhance the ability of the United States to manage domestic incidents by establishing a single, comprehensive national incident management system. The system provides a consistent, integrated nationwide approach for Federal, state, local and tribal governments to work effectively and efficiently together to prepare for, prevent, respond to, and recover from domestic incidents (e.g., terrorist attacks, major disasters, and other emergencies), regardless of cause, size, or complexity.

Homeland Security Presidential Directive 8, *National Preparedness* (December 17, 2003). This Directive establishes policies to strengthen the United States preparedness in order to prevent and respond to threatened or actual domestic terrorist attacks, major disasters, and other emergencies. It requires a national domestic all-hazards preparedness goal, with established mechanisms for improved delivery of Federal preparedness assistance to state and local governments. This directive is a companion to Homeland Security Presidential Directive 5, which identifies steps for improved coordination in response to incidents. This *National Preparedness* Directive describes the way Federal departments and agencies will strengthen preparation for such a response, including prevention activities during the early stages of a terrorism incident.

Executive Order 12088, *Federal Compliance with Pollution Control Standards* (October 13, 1978), as amended by Executive Order 12580, Superfund Implementation (January 23, 1987). This 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, the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act, and RCRA.

Executive Order 12856, *Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements* (August 3, 1993). This Order requires that all Federal facilities comply with the provisions of EPCRA. The DOE/NNSA NSO is required to submit reports 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).

Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (October 5, 2009). See Section 9.1.3, Infrastructure and Energy.

DOE Order 470.4B, *Safeguards and Security Program* (July 26, 2011). This Order establishes responsibilities for the DOE Safeguards and Security Program and the managerial framework for implementing DOE Policy 470.1, *Integrated Safeguards and Security Management*, dated May 8, 2001. The requirements identified in this Order and its topical manuals are based on national policy promulgated in laws, regulations, and Executive Orders to prevent unacceptable adverse impacts on national security and the health and safety of DOE and contractor employees, the public, or the environment. Assignment of roles and responsibilities in this Order include identification and definition of interfaces and necessary interactions between safeguards and security programs and other disciplines such as safety, emergency management, counterintelligence, facility operations, cyber system operations, and business/budget operations (including property management).

DOE Order DOE Order 227.1, *Independent Oversight Program* (August 30, 2011). This Order prescribes the requirements and responsibilities for the DOE Independent Oversight Program. The DOE Independent Oversight Program is implemented by the Office of Enforcement and Oversight, an independent office within DOE that has no line management or policy-making responsibilities or authorities. The Independent Oversight Program is one element of DOE's multi-faceted approach to oversight, as described in DOE Policy 226.1B, *Department of Energy Oversight Policy*, dated April 25, 2011. Effective oversight, including independent oversight, of DOE Federal and contractor operations is an integral part of the Department's responsibility as a self-regulating agency to provide assurance of its safety and security posture to its leadership, its workers, and the public. The Independent Oversight Program is designed to enhance DOE safety and security programs by providing Congress, DOE and contractor managers, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements, as well as the effectiveness of DOE and contractor line management performance in safety and security and other critical functions directed by the Secretary. This Order cancelled DOE Order 470.2B, *Independent Oversight and Performance Assurance Program*.

DOE Order 151.1C, *Comprehensive Emergency Management System* (November 2, 2005). This 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). Emergency planning must include identification of hazards and threats, hazard mitigation, development and preparation of emergency plans and procedures, and identification of personnel and resources needed for an effective response. Emergency preparedness must include acquisition and maintenance of resources, training, drills, and exercises. Emergency response must include the application of resources to mitigate consequences of an emergency to workers, the public, the environment, and national security, as well as to initiate recovery. Recovery must include planning for and actions taken following termination of the emergency to return the facility/operations to normal. Readiness assurance must include assessments and documentation to ensure that stated emergency capabilities are sufficient to implement emergency plans.

DOE Order 153.1, *Departmental Radiological Emergency Response Assets* (June 27, 2007). This Order establishes requirements and responsibilities for DOE/NNSA's national radiological emergency response assets and capabilities and Nuclear Emergency Support Team assets. The assets described in this Order consist of both the personnel and equipment needed to perform carefully defined missions related to nuclear/radiological emergency response. Other existing statutes, regulations, directives, and standards applicable to emergency response assets also apply for planning, preparedness, and response.

State of Nevada Chemical Catastrophe Prevention Act (Nevada Legislature Senate Bill 641, July 1991) and Chemical Accident Prevention Program (CAPP). In July 1991, the Nevada Legislature passed Senate Bill 641, the Chemical Catastrophe Prevention Act, primarily in response to a large chlorine release in Henderson, Nevada, in May 1991 and a large ammonium perchlorate explosion in May 1988, also in Henderson. The resulting statute, codified at NRS 459.380–459.3874, directed NDEP to develop and implement an accident prevention program, which was renamed CAPP.

CAPP requirements fall into one of three categories: accident prevention, emergency response, or public right-to-know. For accident prevention, facilities are required to evaluate and mitigate hazards, understand the design parameters of their processes and operate within the appropriate design limits, prepare comprehensive operating procedures, thoroughly train operators in those procedures, and maintain the facility equipment and instruments to prevent premature failure. For emergency response, facilities are required to develop an action plan for dealing with potential emergency situations and they are further required to coordinate emergency response activities with local responders, to ensure that the responders are prepared to deal with the emergencies appropriately. For the public right-to-know, all information disseminated by the facilities is available to the public, as are all site inspection reports generated by CAPP staff (NDEP 2009b).

9.2 Applicable Permits

Implementation of activities and alternatives proposed in this SWEIS would require compliance with existing environmental permits, modification to existing permits, or the acquisition of new permits, if applicable. A list of all required Federal and state environmental permits that are issued for NNSS, NLVF, RSL, and TTR operations is presented in **Table 9–2**.

Future environmental permits, including modifications to existing permits that may be required for implementation of the alternatives analyzed in this SWEIS, are identified below.

NNSS Drinking Water System Permits are renewed annually; modification of the applicable permits would be required to include potable water system tie-in(s) to new facilities. Coordination with NDEP’s Bureau of Safe Drinking Water is necessary.

The NNSS Water Pollution Control General Permit was renewed in August 2010, and will require renewal in 5 years. Stormwater Pollution Prevention Plans would need to be updated to include provisions for new construction activities prior their undertaking.

The NNSS Class II Air Quality Operating Permit is renewed every 5 years. This permit would require modification to include new construction and operation activities associated with implementation of the *NNSS SWEIS* preferred alternative. For example, dust control measures for proposed activities would need to be identified and incorporated into the permit. Coordination with NDEP’s Bureau of Air Pollution Control for permit modification is mandatory.

The NNSS Hazardous Waste Management Permit expires on December 1, 2015. When applying for renewal, RCRA-related activities associated with this SWEIS would need to be included.

Table 9–2 Environmental Permits Required for the Nevada National Security Site and the Nevada National Security Site Facility Operations

Permit Number	*Description*	*Location/Notes*
Air Quality		
AP9711-0549.01	NNSS Class II Air Quality Operating Permit	NNSS
08-29	NNSS Burn Variance (various locations)	NNSS
08-30	NNSS Open Burn Variance, A-23, Facility #23-T00200	NNSS Fire and Rescue Training Center
Facility 657, Mod. 3	Clark County Authority to Construct/Operating Permit for a Testing Laboratory	NLVF
Facility 348, Mod. 2	Clark County Authority to Construct/Operating Permit for a Testing Laboratory	RSL-Nellis
AP8733-0680.02	Class II Air Quality Operating Permit	TTR
Drinking Water		
NY-0360-12NTNC	Areas 6 and 23	NNSS
NY-4098-12NC	Area 25	NNSS
NY-4099-12NC	Area 12	NNSS
NY-0835-12NP	NNSS Water Hauler #84846	NNSS
NY-0836-12NP	NNSS Water Hauler #84847	NNSS
NY-3014-12NTNC	Well 6 Production Well	TTR
NY-3014-1112NTNC	Permit to Operate a Treatment Plant	TTR
NNSS Septic Systems and Pumpers		
NY-1054	Septic System, Area 3	Waste Management Offices
NY-1069	Septic System, Area 18	820th Red Horse Squadron
NY-1076	Septic System, Area 6	Airborne Response Team Hanger
NY-1077	Septic System, Area 27	Baker Compound
NY-1079	Septic System, Area 12	U12g Tunnel
NY-1080	Septic System, Area 23	Building 1103
NY-1081	Septic System, Area 6	Control Point-170
NY-1082	Septic System, Area 22	Building 22-01
NY-1083	Septic System, Area 5	Radioactive Material Management Site
NY-1084	Septic System, Area 6	Device Assembly Facility
NY-1085	Septic System, Area 25	Central Support Area
NY-1086	Septic System, Area 25	Reactor Control Point
NY-1087	Septic System, Area 27	Able Compound
NY-1089	Septic System, Area 12	Camp
NY-1090	Septic System, Area 6	Los Alamos National Laboratory Construction Camp Site
NY-1091	Septic System, Area 23	Gate 100
NY-1103	Septic System, Area 22	Desert Rock Airport
NY-1106	Septic System, Area 5	Hazmat Spill Center
NY-1110-HAA-A	Individual Sewage Disposal System	A12, Building 12-910
NY-1112	Commercial Sewage Disposal System, Area 1	U1a
NY-1113	Commercial Sewage Disposal System, Area 1	Building 121
NY-1124	Commercial Individual Sewage Disposal System, Area 6	NNSS
NY-1128	Commercial Individual Sewage Disposal System, Area 6	NNSS, Yucca Lake Project
NY-17-03313	Septic Tank Pumper E 106785	

Permit Number	***Description***	***Location/Notes***
NY-17-03315	Septic Tank Pumper E 107107	
NY-17-03317	Septic Tank Pumper E 105918	
NY-17-03318	Septic Tank Pumping Contractor	One unit
NY-17-06838	Septic Tank Pumper E 105919	
NY-17-06839	Septic Tank Pumper E 107103	
Wastewater Discharge		
GNEV93001	Water Pollution Control General Permit	NNSS sewage lagoons (both operational and inactive)
NEV96021	Water Pollution Control Permit	NNSS, E Tunnel Wastewater Disposal System and Monitoring Well ER-12-1
VEH-112	NLVF Wastewater Contribution Permit	NLVF
NV0023507	North Las Vegas National Pollutant Discharge Elimination System Permit	NLVF
CCWRD-080	Industrial Wastewater Discharge Permit	RSL–Nellis
SNL/NM-NV 10031	Backfilling Horse Pond	TTR
Hazardous Materials		
2287-5146	Hazardous Materials Permit	NNSS
2287-5147	Nonproliferation Test and Evaluation Complex	NNSS
2287-5144	Hazardous Materials Permit	NLVF
2287-5145	Hazardous Materials Permit	RSL–Nellis
212 FDID 13007	Hazardous Materials Permit	TTR
Hazardous Waste		
NEV-HW0021	NNSS Hazardous Waste Management Permit	NNSS
0510003453	Utah Generator Site Access Permit	NNSS
NNSS Waste Management		
U1576-33N-01	Waste Management Permit – Underground Storage Tank	RSL–Nellis
NNSS Disposal Sites		
SW 13 000 01	Asbestiform Low-Level Solid Waste Disposal Site, Area 5	
SW 13 097 02	Hydrocarbon Disposal Site, Area 6	
SW 13 097 03	U10c Solid Waste Disposal Site, Area 9	
SW 13 097 04	Solid Waste Disposal Site, Area 23	
Endangered Species/Wildlife/Special Use		
File No. 1-5-96-F-33	U.S. Fish and Wildlife Service – Desert Tortoise Incidental Take Authorization (Biological Opinion for Programmatic NNSS Activities)	
MB008695-0	U.S. Fish and Wildlife Service – Migratory Bird Scientific Collecting Permit	
MB037277-1	U.S. Fish and Wildlife Service – Migratory Bird Special Purpose Possession – Dead Permit	
S29157	Nevada Division of Wildlife – Scientific Collection of Wildlife Samples	

NLVF = North Las Vegas Facility; NNSS = Nevada National Security Site; RSL = Remote Sensing Laboratory; TTR = Tonopah Test Range.
Source: DOE/NV 2009d; SNL 2010b.

CHAPTER 10
CONSULTATION AND COORDINATION

10.0 CONSULTATION AND COORDINATION

Chapter 10 presents an overview of the U.S. Department of Energy/National Nuclear Security Administration's (DOE/NNSA's) consultation and coordination efforts with other Federal, state, and local government agencies and American Indian groups during the development of this *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 (NNSS SWEIS)*. Discussions regarding DOE/NNSA's public involvement efforts are presented in Chapter 1, Section 1.6, of this *NNSS SWEIS*.

10.1 Cooperating Agencies

Council on Environmental Quality regulations provided in 40 *Code of Federal Regulations* (CFR) 1501.6 and 1508.5 emphasize agency cooperation early in the National Environmental Policy Act (NEPA) process and allow a lead agency (in this case, DOE/NNSA) to request the assistance of other agencies that have either jurisdiction by law or special expertise regarding issues considered in an environmental impact statement. For this *NNSS SWEIS*, the U.S. Bureau of Land Management (BLM), the U.S. Air Force (USAF), and Nye County, Nevada, accepted roles as cooperating agencies. Their respective roles and expertise are discussed in the remainder of this section.

BLM is an agency within the U.S. Department of the Interior and is responsible for administering more than 250 million acres of public lands, mostly in 12 western states, including Alaska. BLM administers much of the land in the general vicinity of the Nevada National Security Site (NNSS) (formerly known as the Nevada Test Site) and the Tonopah Test Range (TTR), and offers special expertise regarding environmental resources on and near these sites. As the lead agency for many other NEPA studies in this region, BLM also offers special expertise regarding other Federal actions considered in the cumulative effects analysis in this *NNSS SWEIS*. BLM has also played an integral role in the establishment of land withdrawals for the NNSS.

The mission of the USAF, in conjunction with the United States' other armed services, is to preserve the peace and security and provide for the defense of the United States, its Territories, Commonwealths, and possessions, and any U.S.-occupied areas. The USAF controls much of the land and airspace in the vicinity of the NNSS and operates the Nevada Test and Training Range, which borders the NNSS on three sides, as well as the Remote Sensing Laboratory (RSL) and the TTR, on which DOE/NNSA is a tenant. The USAF offers special expertise regarding environmental resources on and near the NNSS, RSL, and the TTR, as well as areas of environmental contamination (and ongoing remediation activities) resulting from historic national-defense-related activities. The geographic proximity of USAF and DOE/NNSA facilities also require the two agencies to review their proposed actions carefully to ensure that one agency does not adversely affect the other's missions and operations.

The NNSS and the TTR are located in Nye County, Nevada. Nye County has special expertise regarding the relationship of DOE/NNSA's proposed actions to the objectives of regional and local land use plans, policies, and controls, as well as to the current and planned infrastructure in the county, including public services and traffic conditions. Nye County also possesses special expertise regarding local governmental actions considered in the cumulative effects analysis in this site-wide environmental impact statement (SWEIS).

In addition to the special expertise and roles described above, all cooperating agencies have provided the following support to DOE/NNSA during preparation of this *NNSS SWEIS*:

- Participating in technical group meetings and workshops throughout the NEPA process
- Assisting in development of action alternatives
- Providing land use plans, policy documents, and NEPA documents to assist in describing the affected environment and conducting the environmental consequences analyses
- Participating in internal reviews of preliminary draft SWEIS sections and providing comments within their respective areas of expertise
- Assisting with public involvement and preparation of responses to public comments

Table 10–1 summarizes specific meetings and workshops involving cooperating agencies.

Table 10–1 Cooperating Agency Meetings

Meeting Date	*Attending Agencies* [a]	*Scope of Discussions*
January 25, 2010	Nye County	Kickoff meeting, discussion of Nye County role and supporting personnel
February 1, 2010	USAF, BLM	Kickoff meeting, discussion of renewable energy initiatives potentially within the scope of this SWEIS
February 8, 2010	BLM	Discussion of preliminary alternatives, specific NNSS projects, and BLM role in review process
April 20, 2010	BLM, USAF, Nye County	Distribution of preliminary draft SWEIS sections (Introduction, Purpose and Need, Alternatives), discussion of options for alternatives, and requests for comments from attendees
May 19, 2010	USAF	Discussion of USAF comments regarding the preliminary draft SWEIS sections (Introduction, Purpose and Need, Alternatives)

BLM = Bureau of Land Management; NNSS = Nevada National Security Site; SWEIS = site-wide environmental impact statement; USAF = U.S. Air Force.

[a] DOE/NNSA was present at all meetings.

10.2 American Indian Groups

DOE/NNSA has been conducting government-to-government consultation with American Indian tribes since 1987. During this process, the Consolidated Group of Tribes and Organizations (CGTO) was established to facilitate consultation with the NNSS. CGTO comprises 17 tribes and organizations that represent three ethnic groups from Arizona, California, Nevada, and Utah that are culturally and historically affiliated with the NNSS and surrounding areas: the Western Shoshone, Southern Paiute, and Owens Valley Paiute (Stoffle et al. 1990). As such, CGTO has a long-standing relationship with DOE/NNSA.

During preparation of the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (1996 NTS EIS)*, a small committee of American Indian people representing the previously mentioned ethnic groups was appointed by CGTO to provide American Indian input for the *1996 NTS EIS*. This committee is called the American Indian Writers Subgroup (AIWS). AIWS input for the *1996 NTS EIS* was documented in Appendix G of that document, and specific comments made by AIWS were inserted in various chapters of the *1996 NTS EIS*.

DOE/NNSA has continued this model of consultation and cooperative writing with CGTO and AIWS in this *NNSS SWEIS*. Appendix C, "American Indian Assessment of Resources and Alternatives Presented in the SWEIS," of this *NNSS SWEIS* contains CGTO's comprehensive perspective regarding past and ongoing impacts of DOE/NNSA activities at the NNSS on those resources that are important to American Indian people. Appendix C was prepared in response to the consultation required for this *NNSS SWEIS* in accordance with DOE Order 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy*. Excerpts from Appendix C, selected by AIWS, have been inserted throughout this *NNSS SWEIS* to reinforce CGTO's perspective and recommendations regarding specific resources and DOE/NNSA activities.

Based on CGTO's and AIWS's previous involvement in the *1996 NTS EIS* and similar NEPA documents, CGTO expressed its desire for AIWS to become involved in the development of culturally appropriate text for this new *NNSS SWEIS*. This effort was achieved through convening four meetings for the purpose of reviewing draft text and formatting tribal perspectives on behalf of CGTO. Each week-long writing session provided a mechanism for AIWS to develop text that represents the tribal perspective for incorporation in this *NNSS SWEIS*.

Accordingly, AIWS members were selected because of their knowledge and past experience with the *1996 NTS EIS* and similar NEPA documents. This familiarity provided the opportunity for tribal representatives to maximize their involvement using thorough reviews of text and supporting documents, in addition to determining the areas on which to focus.

After the completion of text development, AIWS presented its results at the 2010 Annual Meeting of CGTO in Las Vegas. The presentation consisted of an overview of the NEPA process specific to this SWEIS and a description of the AIWS writing process, followed by the formal presentation of the tribal text for tribal review and approval. As is customary, tribal representatives met in executive session to deliberate on the information presented. At the conclusion of the session, the meeting was reconvened and tribal representatives accepted the AIWS text for inclusion in this *NNSS SWEIS*.

Table 10–2 summarizes specific meetings and workshops involving CGTO/AIWS.

Table 10–2 Consolidated Group of Tribes and Organizations/American Indian Writers Subgroup Meetings

Meeting Date	*Scope of Meeting*
September 1, 2009	Kickoff meeting, introduction to the SWEIS process and timeline, affirmation of previous model of consultation, and NNSS site tour.
February 21–26, 2010	Field visit to selected sites on the NNSS to establish a foundation for writing and an understanding of the topics to be discussed in this *NNSS SWEIS*. Review of the proposed SWEIS schedule, meeting expectations, and anticipated deliverables with primary focus on Chapter 1, "Introduction and Purpose and Need for Agency Action"; Chapter 2, "Site Overview and Update"; Chapter 4, "Affected Environment"; and Chapter 5, "Environmental Consequences."
April 4–9, 2010	Review of selected Chapter 5 resource areas: visual resources, land use, geology and soils, biological resources, cultural resources, socioeconomics, hydrology, air quality, climate, waste management, human health, and environmental justice.
July 18–23, 2010	Completion of review of Chapter 5 resource areas, followed by a review of Chapter 6, "Cumulative Impacts." Regular reviews of previous chapters to ensure accuracy and completeness.
August 15–20, 2010	Development of American Indian text for Chapters 7 through 10, with a focus on Chapter 7, "Mitigation Measures," and development of Appendix C. Final reviews of preceding text of all SWEIS chapters before submittal to DOE/NNSA.

NNSS = Nevada National Security Site; SWEIS = site-wide environmental impact statement.

CHAPTER 11
REFERENCES

11.0 REFERENCES

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CHAPTER 12
GLOSSARY

12.0 GLOSSARY

absorbed dose—The energy imparted by ionizing radiation per unit mass of the irradiated material (e.g., biological tissue). The units of absorbed dose are the rad and the gray (Gy). (See *gray*, *quality factor*, *rad*, *rem*, and *sievert*.)

accident—An unplanned sequence of events that usually results in undesirable consequences.

actinides—A series of heavy radioactive metallic elements of increasing atomic number (Z number) beginning with actinium (89) and continuing through lawrencium (103).

activities—In this site-wide environmental impact statement, activities are those physical actions used to implement missions, programs, capabilities, or projects.

aggregate—Hard inert materials such as sand, gravel, or slag used for mixing with a cementing material to form concrete.

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 of 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 one pollutant is 150 percent of its standard, even if levels of other pollutants are well below their respective standards).

air quality standards—The legally prescribed level of constituents in the outside air that cannot be exceeded during a specified time in a specified area.

alpha-emitter (α-emitter)—A radioactive substance that decays by releasing an alpha particle.

alpha (α) particle—A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). (See *alpha radiation*.)

alpha (α) radiation—A strongly ionizing, but weakly penetrating, form of radiation consisting of positively charged alpha particles emitted spontaneously from the nuclei of certain elements during radioactive decay. Alpha radiation is the least penetrating of the four common types of ionizing radiation (alpha, beta, gamma, and neutron). Even the most energetic alpha particle generally fails to penetrate the dead layers of cells covering the skin and can be easily stopped by a sheet of paper. Alpha radiation is most hazardous when an alpha-emitting particle is ingested or inhaled by an organism.

ambient air—The surrounding atmosphere as it exists around people, plants, and structures.

aquifer— A permeable water-bearing unit of rock or sediment that yields water in a usable quantity to a well or spring.

aquitard (or confining unit)**—**A rock or sediment unit of relatively low permeability that retards the movement of water in or out of adjacent aquifers.

artesian**—**Where water in a lower aquifer is under pressure in relation to an overlying confining unit; when intersected by a well, the water will rise up the borehole.

as low as is reasonably achievable (ALARA)—The approach to radiation protection to manage and control exposures (both individual and collective) to the workforce and to the general public to as low as is reasonable, taking into account social, technical, economic, practical, and public policy considerations. ALARA is not a dose limit; it is a process that has the objective of attaining doses as far below the applicable limits of Title 10 of the *Code of Federal Regulations* Part 835 as is reasonably achievable.

asbestiform low-level radioactive waste—Any low-level radioactive waste containing friable asbestos material; Category I nonfriable asbestos-containing material that has become friable; Category I nonfriable asbestos-containing material that will be or has been subjected to sanding, grinding, cutting, or abrading; or Category II nonfriable asbestos-containing material that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder.

background concentration—The level of chemical elements, compounds, or radionuclides in the natural environment not affected by human activities, found by taking measurements in areas unaffected by contamination.

background radiation—Radiation from: (1) cosmic sources; (2) naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material); and (3) global fallout as it exists in the environment (e.g., from the testing of nuclear explosive devices).

best management practices—Structural, nonstructural, and managerial techniques, other than effluent limitations, to prevent or reduce pollution of surface water. They are the most effective and practical means to control pollutants that are compatible with the productive use of the resource to which they are applied. Best management practices are used in both urban and agricultural areas. Best management practices can include schedules of activities; prohibitions of practices; maintenance procedures; treatment requirements; operating procedures; and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

beta-emitter (β-emitter)—A radioactive substance that decays by releasing a beta particle.

beta (β) particle—A charged particle emitted from a nucleus during radioactive decay, with a mass equal to 1/1,837 that of a proton. A negatively charged beta particle is identical to an electron. A positively charged beta particle is called a positron.

beta (β) radiation—Ionizing radiation consisting of fast-moving beta particles (negatively charged) and positrons (positively charged) emitted from the nucleus of an atom during radioactive decay. Beta radiation is more penetrating, but less energized, than alpha radiation. Beta radiation is stopped by clothing or a thin sheet of metal.

biological simulant—A biological substance, or microorganism that shares at least one physical or biological characteristic of a biological agent, that has been shown to be non-pathogenic, and can be used for biological defense testing to replace the agent under study.

biota (biotic)—The plant and animal life of a region.

borrow pit—An excavated area where material has been dug for use as fill at another location (e.g., a gravel pit).

caldera—A near-circular volcanic feature formed by the collapse of rocks overlying a magma chamber from rapid emptying of the chamber during large-volume eruptions.

capabilities—This term refers to the combination of facilities, equipment, infrastructure, and expertise necessary to undertake types or groups of activities and to implement mission assignments. Capabilities at the Nevada National Security Site have been established over time, principally through mission assignments and activities directed by program offices.

cask—A heavily shielded container used to store or ship radioactive materials.

characteristic waste—Solid waste that is classified as hazardous waste because it exhibits any of the following properties or "characteristics": ignitability, corrosivity, reactivity, or toxicity, as described in Title 40 of the *Code of Federal Regulations*, Sections 261.20 through 261.24, and Title 6 of the *New York Code of Rules and Regulations*, Subpart 371.3 (6 NYCRR 371.3). (See *hazardous waste*, *solid waste*, and *waste characterization*.)

characterization (waste)—The determination of waste composition and properties, whether by review of process knowledge, nondestructive examination or assay, or sampling and analysis, generally done for the purpose of determining appropriate storage, treatment, handling, transport, and disposal requirements.

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 site-wide environmental impact statement, collective dose is expressed in units of person-rem. Person-sieverts is another term for collective dose. (See *person-rem* and *person-sievert*.)

committed dose equivalent—The radiation dose to some specific organ or tissue in the body after the intake of radioactive material. The period examined is commonly 50 years. Committed dose equivalent is expressed in units of rem or sieverts.

committed effective dose equivalent—The radiation dose obtained by multiplying committed dose equivalents (see *committed dose equivalent*) by weighting factors (applicable to the specific organ or tissue that is irradiated) and summing the resulting products. The period examined is commonly 50 years. Committed effective dose equivalent is expressed in units of rem or sieverts.

communities (biological)—Assemblage of plants and animals (dominated by one to a few species) that live in the same environment and that are mutually sustaining and interdependent.

concentration—The quantity of a substance in a unit quantity of a sample (e.g., milligrams per liter or micrograms per kilogram).

construction and demolition debris—Discarded nonhazardous material, including solid, semisolid, or contained gaseous material resulting from construction, demolition, industrial, commercial, mining, and agricultural operations and from community activities. The category does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act (Title 42 of the *United States Code*, Section 2011 et seq. [42 U.S.C. 2011 et seq.]).

contact-handled waste—Radioactive waste or waste packages whose external dose rate is low enough to permit contact handling by humans during normal waste management activities (waste with a surface dose rate not greater than 200 millirem per hour). (See *remote-handled waste*.)

contamination—Unwanted chemical elements, compounds, or radioactive material on environmental media (e.g., soil, water, and air), structures (e.g., buildings), equipment, or personnel.

criticality (nuclear)—The condition in which a system is capable of sustaining a nuclear chain reaction.

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. Usually divided into three major categories: prehistoric and historic archaeological resources, architectural resources, and traditional cultural resources.

curie (Ci)—A unit that describes the intensity of radioactivity in a sample of material, equal to 3.7×10^{10} (i.e., 37,000,000,000) disintegrations per second. Also, a quantity of any radionuclide or mixture of radionuclides that decays at a rate of 37 billion disintegrations per second.

decommissioning—Removing facilities such as processing plants, waste tanks, and burial grounds from service and reducing or stabilizing radioactive contamination. Includes the following concepts: the 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 chemical or radioactive substances from environmental media (e.g., soil, water, and air), structures (e.g., buildings), equipment, or personnel. Radioactive decontamination may be accomplished by washing, chemical action, mechanical cleaning, or other techniques.

depleted uranium (DU)—Uranium whose content of the fissile isotope uranium-235 is less than the 0.7 percent (by weight) found in natural uranium, so that it contains more uranium-238 than natural uranium. (See *enriched uranium*.)

deterministic—Referring to events that have no random or probabilistic aspects but proceed in a fixed, predictable fashion.

disposal—As used in this site-wide environmental impact statement, emplacement of waste so as to ensure isolation from the biosphere with no intent of retrieval, and requiring deliberate action to gain access after emplacement.

disposal facility—A natural and/or manmade structure in which waste is disposed. (See *disposal*.)

DOE orders—Requirements internal to the U.S. Department of Energy (DOE) that establish DOE policy and procedures, including those for compliance with applicable laws.

dose (radiological)—The radioactive energy that is absorbed by one gram of material that has been irradiated. Dose measures include dose equivalent, effective dose equivalent, committed effective dose equivalent, or committed equivalent dose as defined elsewhere in this glossary.

***dose equivalent*—**A measure of radiological dose that correlates with biological effect on a common scale for all types of ionizing radiation. Defined as a quantity equal to the absorbed dose in tissue multiplied by a quality factor (the biological effectiveness of a given type of radiation) and all other necessary modifying factors at the location of interest. Dose equivalent is expressed in rems or sieverts.

dose rate—The radiation dose delivered per unit of time (e.g., rad per year, millirad per year).

downblending—A process in which an appropriate substance is added to a fissile material (generally) such as plutonium or enriched uranium to reduce the concentration of the fissile material in the resulting mixture. The quantity of the fissile material in the resulting mixture remains the same while the total quantity of the mixture increases.

downdraft table—A work area having a surface perforated with holes. A vacuum applied to the surface removes air containing particulates, gases, or vapors from the work area. Air thus removed is then normally treated by filtration or other processes before discharge.

drainage basin—A region or area bounded by a drainage divide and occupied by a drainage system; specifically, the tract of country that gathers water originating as precipitation and contributes to a particular stream channel or system of channels or a lake, reservoir, or other body of water.

drinking water standards—Prescriptive limits on the maximum contaminant level that may be in water for it to be considered safe for human consumption.

dynamic plutonium experiments—These are experiments designed to provide improved knowledge of plutonium material properties, including equation of state and strength, over broad ranges of relevant pressures, temperatures, and time scales. These experiments range from essentially static experiments, such as diamond anvil cell and quasi-static load frame, to increasingly dynamic experiments, such as gas-gun-driven, pulsed-power-driven, special nuclear material-mated-to-high-explosives-driven, and laser-driven experiments. None of these experiments reaches nuclear criticality or involves self-sustaining nuclear reactions.

effective dose equivalent—The dose value obtained by multiplying the dose equivalents received by specified tissues or organs of the body by the appropriate weighting factors applicable to the tissues or organs irradiated, and then summing all of the resulting products. It includes the dose from radiation sources internal and external to the body. The effective dose equivalent is expressed in units of rems or sieverts. (See *committed effective dose equivalent*.)

electron—An elementary particle with a mass of 9.107×10^{-28} grams (or 1/1,837 of a proton) and a negative charge. Electrons surround the positively charged nucleus and determine the chemical properties of the atom. (See *nucleus*.)

***endangered species*—**Any species that is in danger of extinction throughout all or a significant portion of its range from natural or manmade changes in the environment. The list of endangered species can be found in Title 50 of the *Code of Federal Regulations*, Sections 17.11 (wildlife), 17.12 (plants), and 222.23(a) (marine organisms).

***engineered barrier (controls)*—**Physical controls designed to isolate or contain wastes or hazardous materials (e.g., caps, entombment of facilities, contaminant immobilization).

enriched uranium—Uranium whose content of the fissile isotope uranium-235 is greater than the 0.7 percent (by weight) found in natural uranium. (See *depleted uranium*.)

environmental impact statement (EIS)—The detailed written statement that is 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) environmental impact statement is prepared in accordance with applicable requirements of the Council on Environmental Quality NEPA regulations in Title 40 of the *Code of Federal Regulations* (CFR) Parts 1500–1508 and 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.

environmental testing—Subjecting a test unit to specified environments such as vibration, shock, or static acceleration in a controlled environment.

ephemeral stream—A stream that flows only after a period of heavy precipitation.

erosion—Natural processes that include weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the Earth's surface.

exposure—The amount of radiation or pollutant present in a given environment that represents a potential health threat to living organisms.

fault (geologic)—Fracture in the Earth's crust accompanied by displacement of one side of the fracture with respect to the other.

fissile materials—Isotopes that readily fission after absorbing a neutron of any energy, either fast or slow. Fissile materials are uranium-235, uranium-233, plutonium-239, and plutonium-241. Uranium-235 is the only naturally occurring fissile isotope. Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning, namely, any material fissionable by thermal (slow) neutrons. The three primary fissile materials are uranium-233, uranium-235, and plutonium-239.

fission—The splitting of a nucleus into at least two other nuclei (elements) and the release of a relatively large amount of energy.

fission products—Nuclei (new elements) formed from the fission of heavy elements.

floodplain—That portion of a river valley, adjacent to the river channel, that is built of sediments during the present regimen of the stream and that is covered with water when the river overflows its banks at flood stages.

gamma-emitter (γ-emitter)—A radioactive substance that decays by releasing gamma radiation.

gamma (γ) radiation—High-energy, short-wavelength electromagnetic radiation emitted from the nucleus of an atom during radioactive decay. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma (γ) rays are very penetrating and are best stopped or shielded by dense materials, such as lead or depleted uranium. Gamma rays are similar to x-rays, but are usually more energetic than x-rays. (See *alpha radiation* and *beta radiation*.)

glove box—A large enclosure that separates workers from equipment used to process hazardous material, while allowing the workers to be in physical contact with the equipment; normally constructed of stainless steel, with large acrylic/lead glass windows. Workers have access to equipment through the use of heavy-duty, lead-impregnated rubber gloves, the cuffs of which are sealed in portholes in the glovebox windows.

gradient—The elevation change within a given distance, particularly of a stream or a land surface.

***gray (Gy)*—**The SI (International System of Units) unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule per kilogram (1 gray is equal to 100 rad). (The joule is the SI unit of energy.) (See *absorbed dose*, *gray*, *quality factor*, *rem*, and *sievert*.)

Greater-Than-Class C (GTCC)—Low-level radioactive waste that exceeds the concentration limits established for Class C waste in Title 10 of the *Code of Federal Regulations*, Section 61.55. Greater-than-Class C waste and transuranic waste can represent similar wastes. Waste containing transuranics that may be greater-than-Class C by U.S. Nuclear Regulatory Commission classification could be considered transuranic by the U.S. Department of Energy.

groundwater—Water below the ground surface in a zone of saturation. *Related definition:* Subsurface water is all water that exists in the voids found in soil, rocks, and sediment below the land surface, including soil moisture, capillary fringe water, and groundwater. That part of subsurface water in voids completely saturated with water is called groundwater. Subsurface water above the groundwater table is called vadose water.

habitat—The environment or place where a plant or animal naturally or normally grows or lives (includes soil, water, climate, other organisms, and communities.)

half-life (biological)—The time required for a biological system, such as that of a human, to eliminate, by natural processes, half of the amount of a substance (such as a radioactive material) that has entered it.

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.

hazardous chemical—Any chemical that is a physical hazard or a health hazard as defined under the Occupational Safety and Health Act and the Emergency Planning and Community Right-to-Know Act.

hazardous constituent—A constituent listed in Title 40 of the *Code of Federal Regulations* Part 261, Appendix VII or VIII, that may cause a waste to be listed as a Resource Conservation and Recovery Act hazardous waste.

hazardous waste—A category of waste regulated under the Resource Conservation and Recovery Act. To be considered hazardous, a waste must be a solid waste under RCRA and must exhibit at least one of four characteristics described in Title 40 of the *Code of Federal Regulations* (CFR), Section 261.20-24 (ignitability, corrosivity, reactivity, and toxicity), or be specifically listed by the U.S. Environmental Protection Agency in 40 CFR 261.31-33.

high-efficiency particulate air (HEPA) filter—An air filter capable of removing at least 99.97 percent of particles 0.3 micrometers (about 0.00001 inches) in diameter. These filters include a pleated fibrous medium (typically fiberglass) capable of capturing very small particles.

high-level waste or high-level radioactive waste—High-level waste is the highly radioactive waste material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that is determined, consistent with existing law, to require permanent isolation.

hydraulic conductivity—A measure of the rate at which water can move through a permeable medium (e.g., soil) at a specified pressure and temperature.

hydraulic gradient—The change in elevation of the water table over a distance, resulting in groundwater movement.

hydrodynamic experiments—Hydrodynamic experiments are driven by high-explosives to assess the performance and safety of nuclear weapons. During a nuclear weapon function test, the behavior of solid materials is similar to liquids, hence the term hydrodynamic. These experiments are conducted using test assemblies that are representative of nuclear weapons. Hydrodynamic experimentation is a central component in maintaining nuclear weapons design and assessment capability. It is coupled with high-performance computer modeling and simulation to certify, without underground nuclear testing, the safety, reliability, and performance of the nuclear physics package of weapons.

hydrodynamic test—A dynamic, integrated systems test of a mock-up nuclear package during which the high explosives are detonated and the resulting motions and reactions of materials and components are observed and measured. The explosively generated high pressures and temperatures cause some of the materials to behave hydraulically (like a fluid). Hydrodynamic tests are used to obtain diagnostic information on the behavior of a nuclear weapon's primary assembly (using simulant materials for the fissile materials in an actual weapon) and to evaluate the effects of aging on the nuclear weapons remaining in the stockpile.

hydrogeology—The study of the occurrence, distribution, and chemistry of all water, including groundwater, surface water, and rainfall.

hydrology—The study of water, including groundwater, surface water, and rainfall.

hydrophytic—A property of a plant that can grow in water or in soil too water-logged for most plants to survive.

industrial waste—As used in this site-wide environmental impact statement, nonradiological and nonhazardous solid or semisolid material generated from site cleanup activities.

in situ—In the natural or original position.

institutional controls—Measures taken by Federal or state organizations to maintain waste management facilities safely for a period of time. The measures, active or passive, may include site access control, site monitoring, facility maintenance, and erosion control.

intensity (of an earthquake)—A measure of the effects (due to ground shaking) of an earthquake at a particular location, based on observed damage to structures built by humans, changes in the Earth's surface, and reports of how people felt the earthquake. Earthquake intensity is measured in numerical units on the Modified Mercalli scale. (See *Modified Mercalli Intensity Scale*.)

***inventory, radionuclide*—**The total amount (by volume and/or activity) of radioactive material in a container, building, or disposal facility.

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).

latent cancer fatality (LCF)—A death from cancer occurring some time after, and postulated to be due to, exposure to ionizing radiation or other carcinogens.

latent cancer morbidity—A statistically based estimate of cancer incidences from, and occurring some time after, exposure to ionizing radiation or other carcinogens.

long-term stewardship—Activities necessary to ensure protection of human health and the environment following closure of a site. Long-term stewardship includes engineered and institutional controls designed to contain or to prevent exposure to residual contamination and waste such as monitoring and maintenance activities, record-keeping activities, inspections, groundwater monitoring and treatment, access control, posting signs, and periodic performance reviews.

***low-level radioactive waste (LLW)*—**Radioactive waste not classified as high-level radioactive waste, transuranic (TRU) waste, spent fuel, or byproduct material as defined by Section 11e(2) of the Atomic Energy Act of 1954, as amended. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level radioactive waste, provided the concentration of TRU elements is less than 100 nanocuries per gram.

maximally exposed individual (MEI)—A hypothetical individual whose location and habits result in the highest total radiological or chemical exposure (and thus dose) from a particular source for all exposure routes (inhalation, ingestion, external exposure).

maximum contaminant level (MCL)—Under the Safe Drinking Water Act, the maximum permissible concentration of a specific constituent in drinking water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people. The standards set as maximum contaminant levels take into account the feasibility and cost of attaining the standard.

***maximum reasonably foreseeable accident*—**A maximum reasonably foreseeable accident is an accident with the most severe consequences that can reasonably be expected to occur.

millirem—One thousandth (10^{-3}) of a rem. (See *rem*.)

***missions*—**In this site-wide environmental impact statement, the term "missions" refers to the major responsibilities assigned to the U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) (described in Chapter 1, Section 1.1). DOE/NNSA accomplishes these major responsibilities by assigning groups or types of activities to DOE/NNSA's system of security laboratories, production facilities, and other sites.

mitigation—(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 (42 U.S.C. 6901 et seq.).

mixed waste—Waste containing both radioactive and hazardous components, as defined by the Atomic Energy Act and Resource Conservation and Recovery Act, respectively. Mixed waste intended for disposal must meet the Land Disposal Restrictions as listed in Title 40 of the *Code of Federal Regulations* Part 268. Mixed waste is a generic term for specific types of mixed waste such as mixed low-level radioactive waste and mixed transuranic waste.

Modified Mercalli Intensity Scale—The Modified Mercalli Intensity Scale is a standard of relative measurement of earthquake intensity developed to fit construction conditions in most of the United States. It is a 12-step scale, with values from I (not felt except by a very few people) to XII (damage total). A Modified Mercalli Intensity is a numerical value on the Modified Mercalli Scale. (See *intensity [of an earthquake]*.)

Mojave Global Change Facility (MGCF)—MGCF was established in Area 5 of the Nevada National Security Site to examine the impact of global climate change factors other than increased carbon dioxide (i.e., increasing summer monsoon rains, increased nitrogen deposition, and disturbance or destruction of the desert soil crust) on the Mojave Desert ecosystem.

morphology—The observation of the form of lands.

nanocurie—0.000000001 (10^{-9}) of a curie. (See *curie*.)

NEPA review—The process used to comply with Section 102(2) of the National Environmental Policy Act (NEPA).

neutron—An uncharged elementary particle with a mass slightly greater than that of the proton. Neutrons are found in the nucleus of every atom heavier than hydrogen-1. (See *nucleus* and *proton*.)

neutron (n) radiation—The emission of neutrons from atomic nuclei. Neutrons are uncharged subatomic particles of nearly the same mass as protons. Interaction with atomic nuclei in matter results indirectly in ionization and thus an absorbed dose to biological material. Neutron bombardment of heavy nuclei (e.g., uranium, plutonium) can result in fission. Highly penetrating, neutrons can be stopped by thick masses of concrete, water, or paraffin.

Nevada Desert Free-Air Carbon Dioxide Enrichment (FACE) Facility—An environmental research facility located in Area 5 of the Nevada National Security Site that conducts long-term environmental research. FACE is a state-of-the-art facility designed to study responses of an undisturbed desert ecosystem to increasing levels of atmospheric carbon dioxide. This facility is in a standby condition due to lack of funding.

noncommunity water supply**—**A water system that provides water for drinking or household purposes to 25 or more persons at least 60 days per year or has 15 or more service connections. Noncommunity water systems serve either a transient or a nontransient population.

nontransient, noncommunity water system—A water system that regularly serves at least 25 of the same people more than 6 months per year. For example, a school or business with its own water supply is considered a nontransient system.

nuclear forensics—Nuclear forensics, the analysis of nuclear materials recovered from either the capture of unused materials or the radioactive debris following a nuclear explosion, can contribute significantly to the identification of the sources of the materials and the industrial processes used to obtain them. In the case of an explosion, nuclear forensics can also reconstruct key features of the nuclear device.

nuclear material—A composite term applied to: (1) special nuclear material; (2) source material such as uranium or thorium or ores containing uranium or thorium; and (3) byproduct material, which is any radioactive material that is made radioactive by exposure to the radiation incident to the process of producing or using special nuclear material.

nuclear testing—An underground nuclear weapons test of either a single underground nuclear explosion or two or more underground nuclear explosions conducted at the Nevada National Security Site within an area delineated by a circle with a diameter of 2 kilometers and conducted within a total period of 0.1 seconds. The yield of a test shall be the aggregate yield of all explosions in the test.

nuclear weapons simulator—A device that simulates some aspect of a nuclear weapon, but cannot produce an explosion resulting from the energy released by reactions involving atomic nuclei, either fission, fusion, or both.

nuclear weapon pit— The pit is the central core of a nuclear weapon containing plutonium-239 and/or highly enriched uranium that undergoes fission when compressed by high explosives. The pit and the high explosive are known as the "primary" of a nuclear weapon.

nucleus—The positively charged central portion of an atom that composes nearly all of the atomic mass and consists of protons and neutrons, except in hydrogen, in which it consists of one proton only. (See *neutron* and *proton*.)

nuclide—An atomic nucleus specified by its atomic weight, atomic number, and energy state; a radionuclide is a radioactive nuclide.

occupational dose—Whole-body radiation dose received by workers participating in a given task or over the course of employment.

perennial stream—A stream that flows throughout the year.

permeability—The rate at which liquids or gases pass through materials in a specified direction. In hydrology, it is used to describe the capacity of a rock, sediment, or soil for transmitting groundwater. Permeability depends on the size and shape of the pores between soil particles and how they are interconnected.

person-rem—A unit of collective radiation dose applied to populations or groups of individuals (see *collective dose*); that is, a unit for expressing the dose when summed across all persons in a specified population or group. One person-rem equals 0.01 person-sieverts.

person-sievert (person-Sv)—A unit of collective radiation dose applied to populations or groups of individuals (see *collective dose*); that is, a unit for expressing the dose when summed across all persons in a specified population or group. One person-sievert equals 100 person-rems.

photon—A unit of electromagnetic energy exhibiting behavior like that of a particle.

picocurie—0.000000000001 (10^{-12}) of a curie. (See *curie*.)

piezometer—An instrument used for measuring the pressure of groundwater.

pit (nuclear)—The pit is the central core of a nuclear weapon containing plutonium-239 and/or highly enriched uranium that undergoes fission when compressed by high explosives. The pit and the high explosive are known as the "primary" of a nuclear weapon.

pit (waste management)—An excavation similar to a trench within which waste is emplaced for disposal.

pollution prevention—The use of materials, processes, and practices that reduce or eliminate the generation and release of pollutants, contaminants, hazardous substances, and waste into land, water, and air. For the U.S. Department of Energy, this includes recycling activities.

polychlorinated biphenyls (PCBs)—A group of toxic, persistent chemicals regulated under the Toxic Substances Control Act used for insulating purposes in electrical transformers and capacitors and in gas pipeline systems.

population dose—See *collective dose*.

programs—The U.S. Department of Energy (DOE) and National Nuclear Security Administration (NNSA) are organized into program offices, each of which has primary responsibilities within the set of DOE/NNSA missions. Funding and direction for activities at DOE/NNSA facilities are provided through these program offices, and similarly coordinated sets of activities to meet program office responsibilities are often referred to as "programs." Programs are usually long-term efforts with broad goals or requirements.

projects—This term is used to describe activities with a clear beginning and end that are undertaken to meet a specific goal or need. Projects can vary in scale from very small (such as a project to undertake one experiment or a series of small experiments) to major (such as a project to construct and start up a new nuclear facility). Projects are usually relatively short-term efforts and can cross multiple programs and missions, although they are usually "sponsored" by a primary program office. In this site-wide environmental impact statement (SWEIS), "projects" is usually used more narrowly to describe construction activities, including facility modifications (such as a project to build a new office building or to establish and demonstrate a new capability). Construction projects considered reasonably foreseeable at the Nevada National Security Site over about a 10-year period are discussed and analyzed in this SWEIS.

proton—An elementary nuclear particle with a positive charge equal in magnitude to the negative charge of the electron; it is a constituent of all atomic nuclei. The atomic number of an element indicates the number of protons in the nucleus of each atom of that element. (See *electron* and *nucleus*.)

public—Anyone who may be impacted by, interested in, or aware of operations at the Nevada National Security Site or other U.S. Department of Energy/National Nuclear Security Administration (DOE/NNSA) facilities. With respect to normal operations or accidents analyzed in this site-wide environmental impact statement, the public includes anyone outside the boundary of the DOE/NNSA property that may be exposed to contaminants.

public water system (PWS)—A system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least 15 service connections or regularly serves at least 25 individuals.

pulse power—The technology of using electrical energy stores for producing multi-terawatt (10^{12} Watts or higher) pulses of electrical power for inertial confinement fusion, nuclear weapon effects simulation, and directed energy weapons.

quality factor—The factor by which the absorbed dose (rad or gray) is to be multiplied to obtain a quantity that expresses, on a common scale for all ionizing radiation, the biological damage (rem or sievert) to an exposed individual. It is used because some types of radiation, such as alpha particles, are more biologically damaging internally than other types. (See *absorbed dose*, *gray*, *rad*, *rem*, and *sievert*).

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 (1 rad is equal to 0.01 grays). The joule is the SI (International System of Units) unit of energy. (See *absorbed dose*, *gray*, *quality factor*, *rem*, and *sievert*.)

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, and of negligible economic value considering 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 thermoelectric generator (RTG)—An electrical generator that derives its electric power from heat produced by the decay of radioactive strontium-90, plutonium-238, or other suitable isotopes. The heat generated is directly converted into electricity, in a passive process, by an array of thermocouples.

radiological survey—The evaluation of the radiation hazard accompanying the production, use, or existence of radioactive materials under a specific set of conditions. Such evaluation customarily includes a physical survey of the disposition of land, materials, and equipment, measurements or estimates of the levels of radiation that may be involved, and a sufficient knowledge of processes affecting these materials to predict hazards resulting from unexpected or possible changes in land, materials, or equipment.

radionuclide—An unstable element that decays or disintegrates spontaneously, emitting radiation.

real-time radiography—A nondestructive test method whereby an image is produced electronically, rather than on film, so that very little lag time occurs between the item being exposed to radiation and the resulting image.

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 10 of the *Code of Federal Regulations* (CFR), Section 1021.315, and 40 CFR 1505.2). A ROD identifies the alternatives considered in reaching the decision, the decision made, 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 (ROI)—A site-specific geographic area in which the principal direct and indirect effects of actions are likely to occur.

release fraction—The portion of the total inventory of radioactivity that could be released to the atmosphere in a given accident.

rem (roentgen equivalent man)—A unit of radiation dose equivalent. The dose equivalent in rems equals the absorbed dose in rads multiplied by the appropriate quality factor (1 rem is equal to 0.01 sieverts). (See *absorbed dose*, *gray*, *quality factor*, and *sievert*.)

remote-handled waste—In general, radioactive waste that must be handled at a distance to protect workers from unnecessary exposure (waste with a dose rate of 200 millirem per hour or more at the surface of the waste package). (See *contact-handled waste*.)

Resource Conservation and Recovery Act (RCRA)—A law that gives the U.S. Environmental Protection Agency and authorized states the authority to control hazardous waste from "cradle to grave" (i.e., from the point of generation to the point of ultimate disposal), including its minimization, generation, transportation, treatment, storage, and disposal. RCRA also sets forth a framework for the management of nonhazardous solid wastes. (See *hazardous waste* and *solid waste*.)

restricted airspace—An area of airspace in which the controlling authority has determined that air traffic must be restricted, if not continually prohibited. It denotes the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles.

risk—The probability of a detrimental effect on life, health, property, and/or the environment from exposure to a hazard. 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).

roentgen—A unit of exposure to ionizing *x* or gamma radiation equal to or producing one electrostatic unit of charge per cubic centimeter of air. (See *gamma radiation* and *x-rays*.)

runoff—That portion of precipitation, snowmelt, or irrigation water that moves over the land surface as a sheet or channelized flow.

sanitary landfill—As defined in this site-wide environmental impact statement, a disposal facility that accepts nonhazardous and nonradioactive industrial waste. (See *industrial waste*.)

saturated zone—The area below the water table where all spaces (fractures and rock pores) are completely filled with water.

scientific notation—A notation adopted by the scientific community to deal with very large and very small numbers. Scientific notation uses a number times 10 and either a positive or negative exponent to show how many places to the left or right the decimal place has been moved. For example, in scientific notation, 120,000 would be written as 1.2×10^5, and 0.000012 would be written as 1.2×10^{-5}.

seep—A spot where groundwater discharges onto the land surface, often forming the source of a small stream.

seismicity—The study of the worldwide distribution of earthquakes; primarily related to location, size, and probability of occurrence.

shielding—Any material or obstruction used to absorb radiation in order to protect personnel or equipment.

sievert (Sv)—The SI (International System of Units) unit of radiation dose equivalent. The dose equivalent in sieverts equals the absorbed dose in grays multiplied by the appropriate quality factor (1 sievert is equal to 100 rem). (See *absorbed dose*, *gray*, *quality factor*, *rad*, and *rem*.)

silt—A sedimentary material consisting of fine mineral particles, intermediate in size between sand and clay. In general, soils categorized as silt show greater rates of erosion than soils categorized as sand.

solid waste—(1) In general, solid wastes are nonliquid, nonsoluble discarded materials ranging from municipal garbage to industrial wastes that contain complex and sometimes hazardous substances. Solid wastes include sewage sludge, agricultural refuse, demolition wastes, and mining residues. (2) For purposes of Resource Conservation and Recovery Act regulation, solid waste is any garbage; refuse; sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and other discarded material. Solid waste includes solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities. Solid waste does not include solid or dissolved material in domestic sewage or irrigation return flows or industrial discharges that are point sources subject to permits under Section 402 of the Clean Water Act. Finally, solid waste does not include source, special nuclear, or byproduct material as defined by the Atomic Energy Act. A more detailed regulatory definition of solid waste can be found in Title 40 of the *Code of Federal Regulations*, Section 261.2, and Title 6 of the *New York Code of Rules and Regulations*, Part 360. (See *hazardous waste* and *Resource Conservation and Recovery Act*.)

source term—The amount of a specific pollutant (e.g., chemical, radionuclide) emitted or discharged to a particular environmental medium (e.g., air, water) from a source or group of sources. It is usually expressed as a rate (i.e., amount per unit of time).

special nuclear material (SNM)—SNM is (1) plutonium, uranium-233, uranium enriched in isotopes of uranium-233 or -235, or any other material that the U.S. Nuclear Regulatory Commission determines to be SNM, or (2) any material artificially enriched by any of these radioactive materials.

special use airspace—Airspace where activities must be confined because of their nature or where limitations are imposed upon aircraft operations that are not part of those activities, or both. This airspace includes restricted airspace, military operations areas, and controlled firing areas.

spent nuclear fuel—Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated.

stabilization—Treatment of waste or a waste site to protect the biosphere from contamination.

stakeholder—Any person or organization with an interest in or affected by future activities impacting cleanup of the site. Stakeholders may include representatives from Federal and state agencies, Congress, American Indian Tribal governments, unions, educational groups, industry, environmental groups, other groups, and members of the general public.

stochastic (effects)—Effects that occur by chance. In the radiation protection context, the main stochastic health effects from exposure to high levels of radiation are cancer and genetic effects.

storage (waste)—The collection and containment of waste in a retrievable manner, requiring surveillance and institutional control, as not to constitute disposal.

storage facility (RCRA)—A building used for storing radioactive or hazardous wastes for greater than 90 days.

subcritical experiments—Subcritical experiments are performed with special nuclear material (for example, plutonium) in a manner that prevents the material from achieving a nuclear explosion. The experiments are designed to improve current knowledge of the dynamic properties of new or aged nuclear weapons parts and materials and to assess the effects of new manufacturing techniques on weapon performance. Subcritical experiments can vary any or all factors that influence criticality (mass, density, shape, volume, concentration, moderation, reflection, neutron absorption, enrichment, and interactions). Because there is no nuclear explosion, subcritical experiments are consistent with the U.S. nuclear testing moratorium.

***succession*—**Relatively orderly, predictable, and progressive replacement of one plant community (called a stage) by another until a relatively stable climax community occupies the site (e.g., abandoned farm field to mature forest).

sump—A pit or reservoir serving as a drain or receptacle for liquids.

tectonic—Relating to the deformation of the crust of the Earth.

test bed—An area that includes physical structures or designated terrain where tests and experiments are conducted.

transient, noncommunity water system—Regularly serves at least 25 individuals, but not the same individuals, for more than 60 days per year. For example, a rest area, campground or restaurant with less than 25 employees on its own water supply is considered a transient water system.

transloading—Transfer of material at an intermodal transfer facility from one packaging to another for purposes of continuing the movement of the material in commerce.

transuranic—Refers to any artificially made, radioactive element whose atomic number is higher than that of uranium (atomic number 92), including neptunium, plutonium, americium, and curium.

***transuranic (TRU) waste*—**Radioactive waste containing alpha particle-emitting radionuclides having an atomic number greater than 92 (the atomic number of uranium) and half-lives greater than 20 years, in concentrations greater than 100 nanocuries per gram.

tritium—A beta-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. The symbols for tritium are T and ^3H; the latter symbol is more frequently encountered.

vadose zone (unsaturated zone)—The zone between the land surface and the water table (saturated zone); also called the zone of aeration.

waste acceptance criteria—A document that establishes U.S. Department of Energy/National Nuclear Security Administration Nevada Site Office waste acceptance criteria. The document provides the requirements, terms, and conditions under which the Nevada National Security Site (NNSS) accepts low-level radioactive waste and mixed low-level radioactive waste for disposal. It includes requirements for the generator's waste certification program, characterization, traceability, waste form, packaging, and transfer. The criteria apply to radioactive waste received at the NNSS Area 3 Radioactive Waste Management Site and Area 5 Radioactive Waste Management Complex for storage or disposal.

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

waste generator—An individual, facility, corporation, government agency, or other institution that produces waste material for certification, treatment, storage, or disposal.

wetlands—An area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in those conditions, including swamps, marshes, bogs, and similar areas.

wind rose—A circular diagram showing, for a specific location, the percentage of the time the wind is from each compass direction. A wind rose is used in assessing consequences of airborne releases and shows the frequency of different windspeeds for each compass direction.

worker—Any worker whose day-to-day activities are controlled by process safety management programs and a common emergency response plan associated with a facility or facility area. This definition includes any individual within a facility/facility area who would participate in or support activities required for implementation of the alternatives.

x-rays—Penetrating electromagnetic radiation with a wavelength much shorter than that of visible light. X-rays are identical to gamma rays, but originate outside the nucleus, either when the inner orbital electrons of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons. (See *electron*, *gamma radiation*, and *nucleus*.)

zeolite—Any of various hydrous silicates utilized for their adsorbent and catalytic properties. Inorganic ion-exchange materials used for water purification or water softening are often zeolites.

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CHAPTER 14
DISTRIBUTION LIST

14.0 DISTRIBUTION LIST

The U.S. Department of Energy provided copies of this *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* to Federal, state, and local elected and appointed government officials and agencies; American Indian representatives; national, state, and local environmental and public interest groups; and other organizations and individuals as listed. Approximately 175 copies of the final site-wide environmental impact statement (SWEIS), 360 copies of the Summary of the final SWEIS, and 35 compact discs (CDs) of the final SWEIS were sent to interested parties.

Copies will be provided to others on request.

United States Congress

U.S. Senate

The Honorable Michael D. Crapo, Idaho
The Honorable Dean Heller, Nevada
The Honorable Orrin Hatch, Utah
The Honorable Jeff Flake, Arizona
The Honorable Mike Lee, Utah
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The Honorable Barbara Mikulski, Chairman, Committee on Appropriations
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Defense Nuclear Facilities Safety Board
Federal Aviation Administration
U.S. Department of Agriculture Forest Service
U.S. Department of Defense
    United States Air Force
U.S. Department of Health and Human Services
U.S. Department of Homeland Security
    FEMA Region IX
U.S. Department of the Interior
    Bureau of Indian Affairs
    Bureau of Land Management
    Bureau of Reclamation
    Fish and Wildlife Service
    National Park Service
    Oakland Regional Office
U.S. Department of Labor
U.S. Department of Transportation
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U.S. Environmental Protection Agency
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The Honorable Wayne Dyer, Yomba Shoshone Tribe
The Honorable Eldred Enas, Colorado River Indian Tribes
The Honorable Bill Saulque, Benton Paiute Indian Tribe
The Honorable George Gholson, Timbisha Shoshone Tribe
The Honorable Virginia Sanchez, Duckwater Shoshone Tribe
The Honorable Virgil “Dave” Moose, Big Pine Paiutes Tribe of the Owens Valley
The Honorable Manual Savala, Kaibab Band of Southern Paiutes
The Honorable William Anderson, Moapa Paiutes Tribe
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HCR 69 box 401-T
Amargosa, NV 89020

Beatty Library District
400 North Fourth Street
Beatty, NV 89003-0129

Clark County Library
1401 E. Flamingo Road
Las Vegas, NV 89119

Green Valley Library
2797 N. Green Valley Parkway
Henderson, NV 89014

Indian Springs Library
715 Gretta Lane
Indian Springs, NV 89018

Kingman Public Library
3269 North Burbank Street
Kingman, AZ 86402

Las Vegas Library
833 N. Las Vegas Blvd.
Las Vegas, NV 89101

Lincoln County Library
63 Main Street
Pioche, NV 89043

Nevada State Library and Archives
100 Stewart Street
Carson City, NV 89193

North Las Vegas Library
Main Branch
2300 Civic Center Drive
North Las Vegas, NV 89030

Pahrump Community Library
701 East Street
Pahrump, NV 89048-0578

Public Reading Room for the Nuclear Testing Archive
755C East Flamingo Road
Las Vegas, NV 89119

Rainbow Library
3150 N. Buffalo Drive
Las Vegas, NV 89128

Reno – Downtown Library
301 South Center Street
Reno, NV 89501

St. George Library
88 West 100 South
St. George, UT 84770

Summerlin Library
1771 Inner Circle Drive
Las Vegas, NV 89134

Tonopah Library
167 South Central Street
Tonopah, NV 89049-0449

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Experience/Technical Specialty:
Thirty-six years. Includes 23 years of environmental management, NEPA documentation, and analysis on projects for Federal agencies. Specialties include socioeconomics, land use, and environmental justice.

ROBIN W. GRIFFIN, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Education: M.S., Environmental Management
B.A., English

Experience/Technical Specialty:
Fourteen years. NEPA analysis, socioeconomics, environmental justice, community services, and land use.

SETH HARTLEY, ICF INTERNATIONAL
SWEIS RESPONSIBILITIES: TECHNICAL REVIEWER FOR AIR QUALITY AND AFFECTED ENVIRONMENT AND TECHNICAL SUPPORT FOR AIR QUALITY ANALYSIS

Education: M.S., Atmospheric Sciences
B.S., Physics

Experience/Technical Specialty:
Nine years. Air pollution and air quality, particularly as related to transportation; general numerical modeling; engineering; and data handling and analysis issues.

SHARON HEJAZI, NEVADA SITE OFFICE
SWEIS RESPONSIBILITIES: SITE LEGAL REVIEW (NSO FEDERAL)

Education: B.S., Psychology, University of Utah
J.D., University of Utah

Experience/Technical Specialty:
Twenty-four years. Twenty-one years as a Federal attorney providing environmental counsel.

ROY KARIMI, SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SWEIS RESPONSIBILITIES: TRANSPORTATION, RISK ASSESSMENT

Education: Sc.D., Nuclear Engineering, Massachusetts Institute of Technology
N.E., Nuclear Engineering, Massachusetts Institute of Technology
M.S., Nuclear Engineering, Massachusetts Institute of Technology
B.S., Chemical Engineering, Abadan Institute of Technology

Experience/Technical Specialty:
Thirty-one years. Nuclear power plant safety, risk and reliability analysis, design analysis, criticality analysis, accident analysis, consequence analysis, spent fuel dry storage safety analysis, and probabilistic risk assessment.

DAVID LECHEL, LECHEL, INC.
SWEIS RESPONSIBILITIES: SUMMARY PREPARATION

Education: M.S., Fisheries Biology, Michigan State University
B.S., Fisheries Biology, Michigan State University

Experience/Technical Specialty:
Thirty-eight years. Thirty-one years in management and preparation of NEPA documents (biological resources, cumulative impacts) and regulatory compliance; 6 years in ecological studies and assessment.

JOHN L. LEPPERT, U.S. DEPARTMENT OF ENERGY, NATIONAL NUCLEAR SECURITY ADMINISTRATION
SWEIS RESPONSIBILITIES: STOCKPILE STEWARDSHIP

Education: B.S., General Engineering

Experience/Technical Specialty:
Forty-one years, plus 10 years active duty U.S. Air Force Civil Engineering, including duties as Base Chief of Engineering. Vertical and Horizontal Construction, over 30 years Civil Service, including assignments with the U.S. Army Corps of Engineers, Civil Works Department.

JAMIE MARTIN-NAUGHTON, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: GEOLOGY AND SOILS

Education: B.S., Geology-Biology

Experience/Technical Specialty:
Nine years. Geology and soils, aesthetics, cultural resources, and field research for environmental and NEPA-related projects.

STEVE MIRSKY, SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SWEIS RESPONSIBILITIES: HUMAN HEALTH, INTENTIONAL DESTRUCTIVE ACTS, AND ACCIDENTS

Education: M.S., Nuclear Engineering, The Pennsylvania State University
B.S., Mechanical Engineering, Cooper Union
Registered Professional Engineer

Experience/Technical Specialty:
Thirty-five years. Safety analysis, nuclear power plant design, operations, foreign nuclear power plant system analysis, accident analysis, thermal hydraulics, shielding and dose assessment, and spent nuclear fuel dry storage safety analysis.

CYNTHIA ONG, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: TRAFFIC, ENVIRONMENTAL NOISE

Education: M.S., Environmental Sciences, Miami University
B.S., Civil Engineering, Purdue University

Experience/Technical Specialty:
Eleven years. NEPA analysis, transportation, traffic, noise, stormwater, and utilities.

DOUGLAS A. OUTLAW, SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SWEIS RESPONSIBILITIES: HUMAN HEALTH LEAD, FACILITY ACCIDENTS LEAD, TECHNICAL EXPERT

Education: Ph.D., Nuclear Physics, North Carolina State University
M.S., Nuclear Physics, North Carolina State University
B.S., Nuclear Physics, North Carolina State University

Experience/Technical Specialty:
Thirty-three years. Nuclear physics, safety analysis, and risk assessment.

KIRK OWENS, SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SWEIS RESPONSIBILITIES: TECHNICAL LEAD HUMAN ENVIRONMENT

Education: B.S., Environmental Resource Management, The Pennsylvania State University

Experience/Technical Specialty:
Thirty-three years. Radioactive waste management, regulatory analysis, environmental compliance and assessment, and radiological impacts assessment.

POLLY QUICK, ICF INTERNATIONAL
SWEIS RESPONSIBILITIES: TECHNICAL ADVISOR, VISUAL RESOURCES IMPACT ANALYSIS

Education: Ph.D., Anthropology
M.A., Anthropology
B.A., Anthropology

Experience/Technical Specialty:
Thirty-six years. NEPA analysis, aesthetics, cultural resources, and environmental justice.

BRIAN RAMOS, ICF INTERNATIONAL
SWEIS RESPONSIBILITIES: CULTURAL RESOURCES REVIEWER

Education: Ph.D., Anthropology, University of California, Davis

Experience/Technical Specialty:
Fifteen years. NEPA analysis, cultural resources, and environmental justice.

GARY ROLES, SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SWEIS RESPONSIBILITIES: WASTE MANAGEMENT

Education: M.A., Nuclear Engineering, University of Arizona
B.S., Mechanical Engineering, Arizona State University

Experience/Technical Specialty:
Thirty-two years. Radioactive waste management, regulatory and compliance analysis, and NEPA analysis.

ANNE ROTHWEILER, SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SWEIS RESPONSIBILITIES: PROJECT SUPPORT

Education: M.S., Environmental Science, University of Nevada, Las Vegas
B.S., Biology, University of Tulsa

Experience/Technical Specialty:
Ten years. Environmental Scientist. NEPA analysis, administrative record management, and cumulative impacts.

DEBBIE SHINKLE, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: GIS TEAM LEAD, RESOURCE AUTHOR FOR LAND USE

Education: B.A., Environmental Studies, University of Pittsburgh

Experience/Technical Specialty:
Ten years. NEPA analysis, land use, utilities, Geographic Information Systems (GIS) and mapping, and graphics.

STACEY SHUELER, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: GROUNDWATER RESOURCES

Education: B.S., Environmental Science, University of North Carolina at Wilmington

Experience/Technical Specialty:
Ten years. NEPA documentation, site remediation, wetlands, biological resources, water resources, and geology and soils.

MICHAEL G. SKOUGARD, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: ALTERNATIVES DEVELOPMENT, BIOLOGICAL RESOURCES IMPACTS, CUMULATIVE IMPACTS

Education: M.S., Botany, Brigham Young University
B.S., Law Enforcement, Brigham Young University

Experience/Technical Specialty:
Thirty-four years. NEPA analysis, biological resources, water resources, utilities and infrastructure, and Federal program and project management.

CARRIE STEWART, STOLLER-NAVARO
SWEIS RESPONSIBILITIES: MANAGEMENT SUPPORT

Education: M.A., Computer and Information Technologies, Webster University
M.A., Human Resources and Development, Webster University
B.S., Geology, California Polytechnic University, Pomona

Experience/Technical Specialty:
Twenty-three years. NEPA specialist and advisor.

JENNIFER LYN STOCK, ICF INTERNATIONAL
SWEIS RESPONSIBILITIES: VISUAL RESOURCES ANALYSIS

Education: B.S., Landscape Architecture, Pennsylvania State University, University Park

Experience/Technical Specialty:
Twelve years. Visual resources analyses for PEAs, EAs, Iss, EISs, and EIRs.

NEIL SULLIVAN, ICF INTERNATIONAL
SWEIS RESPONSIBILITIES: DEPUTY PROJECT MANAGER

Education: M.S., Integrated Environmental Management
B.S., Human and Physical Geography

Experience/Technical Specialty:
Fifteen years. NEPA documentation for infrastructure and energy projects, environmental program management, and technical and policy analysis.

NATE WAGNOR, ICF INTERNATIONAL
SWEIS RESPONSIBILITIES: VISUAL RESOURCES

Education: M.S., Human Dimensions of Ecosystem Science and Management
B.S., Natural Resources Integrated Policy and Planning

Experience/Technical Specialty:
Six years. Parks and recreation and visitor use characteristics.

GILBERT H. WALDMAN, SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
SWEIS RESPONSIBILITIES: HUMAN HEALTH – NORMAL OPERATIONS AND ACCIDENTS

Education: M.S., Engineering Management, Johns Hopkins University
B.S., Nuclear Engineering, University of Florida

Experience/Technical Specialty:
Nineteen years. Radiological impacts analysis, radiological dose modeling, and radiological risk assessments.

DEBRA A. WALKER, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: QUALITY ASSURANCE LEAD

Education: B.S., Biology

Experience/Technical Specialty:
Thirty-four years. NEPA analysis, biological resources, water resources, quality assurance/controls, and program and project management.

BRIAN M. WHIPPLE, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: SENIOR RESOURCE LEAD FOR HYDROLOGY, TECHNICAL GUIDANCE, METHODOLOGY, AND QA/QC REVIEWS

Education: M.S., Information Science
B.S., Environmental Engineering

Experience/Technical Specialty:
Seventeen years. NEPA analysis, environmental remediation, engineering studies, and regulatory compliance.

ANDREA WILKES, POTOMAC-HUDSON ENGINEERING, INC.
SWEIS RESPONSIBILITIES: INFRASTRUCTURE, ENERGY

Education: M.A., Science Writing, Johns Hopkins University
B.S., Civil and Environmental Engineering, University of Wisconsin-Madison
B.S., English Literature, University of Wisconsin-Madison

Experience/Technical Specialty:
Twenty-five years. Environmental engineering, science writing, and NEPA documentation and analysis.

KAREN E. WILLIAMS, U.S. DEPARTMENT OF ENERGY, NATIONAL NUCLEAR SECURITY ADMINISTRATION
SWEIS RESPONSIBILITIES: WSE-RELATED

Education: B.A., Biology

Experience/Technical Specialty:
Thirty-four years. Radiological analysis (radiochemistry lab, Area 5 RWMS – low-level, transuranic, and mixed wastes).