US Exhibit 2

NNSS EIS

DOE/EIS-0426
February 2013

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

Summary

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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Nye County, NV

Title: *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE/EIS-0426)

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*.

FOREWORD

This Foreword to 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)* focuses on the nature of the changes to the *Draft NNSS SWEIS* that resulted from public comments, as well as changes in environmental baseline information and the analyses of potential environmental impacts. The Foreword also discusses the role the National Environmental Policy Act (NEPA) review process and this *Final NNSS SWEIS* play in the DOE/NNSA decisionmaking process.

PUBLIC COMMENT ON THE *NNSS SWEIS*

This *Final 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. During development of an environmental impact statement (EIS), there are two required opportunities for public involvement: during public scoping and during the public comment period after the draft EIS is issued. The *NNSS SWEIS* public scoping process began on July 24, 2009, and concluded on October 16, 2009. DOE/NNSA received approximately 150 comment documents, each of which was evaluated to determine the scope of issues to be evaluated in this site-wide environmental impact statement (SWEIS).

On July 29, 2011, DOE/NNSA published a notice in the *Federal Register* (FR) announcing the availability of the *Draft NNSS SWEIS*, the duration of the comment period, the location and timing of the public hearings, and methods for submitting comments. DOE/NNSA announced a 90-day public comment period, from July 29 to October 27, 2011, to provide time for interested parties to review the *Draft NNSS SWEIS*. In response to requests for additional review time, DOE/NNSA extended the comment period by 36 days, through December 2, 2011, giving commentors a total review and comment period of 126 days. DOE/NNSA received more than 240 comment documents containing almost 800 comments.

WHAT WAS THE NATURE OF PUBLIC COMMENTS?

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 *NNSS SWEIS*. These topics included:

- ***Transportation Routing***. 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 continued to pose an unacceptable risk to human health and that the *Draft NNSS SWEIS* did not characterize this risk adequately. Commentors alleged 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 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 former 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 stated that 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*.

HOW WAS THE DRAFT *NNSS SWEIS* CHANGED?

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 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 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. Substantive changes to the text are identified through the use of margin bars on the edges of the affected pages.

WHAT HAPPENS NEXT?

DOE/NNSA will announce its decision regarding the selected alternative or alternatives in a Record of Decision (ROD) no sooner than 30 days after the U.S. Environmental Protection Agency Notice of Availability for this *Final NNSS SWEIS* is published in the *Federal Register*. 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 will be prepared following issuance of the ROD. The mitigation action plan will 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 will be made available to interested parties upon request.

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ACRONYMS AND ABBREVIATIONS

CFR	*Code of Federal Regulations*
CGTO	Consolidated Group of Tribes and Organizations
DOE	U.S. Department of Energy
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FR	*Federal Register*
NEPA	National Environmental Policy Act
NLVF	North Las Vegas Facility
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NRC	U.S. Nuclear Regulatory Commission
NTS	Nevada Test Site
NSO	Nevada Site Office
rem	roentgen equivalent man
ROD	Record of Decision
RSL	Remote Sensing Laboratory
SWEIS	site-wide environmental impact statement
TNT	2,4,6-trinitrotoluene
TTR	Tonopah Test Range
USFWS	U.S. Fish and Wildlife Service

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}

SUMMARY

S.1 Introduction and Purpose and Need

S.1.1 Introduction

The U.S. Department of Energy's (DOE's) "National Environmental Policy Act Implementing Procedures" (10 *Code of Federal Regulations* [CFR] 1021.330(c)) require preparation of a site-wide environmental impact statement (SWEIS), a broad-scope document that identifies and assesses the potential individual and cumulative impacts of ongoing and reasonably foreseeable future actions for certain large multiple-facility DOE sites, such as the Nevada National Security Site (NNSS) (formerly the Nevada Test Site). An evaluation of an existing SWEIS is required every 5 years. DOE determines whether an existing SWEIS remains adequate or whether a new SWEIS or supplement to the existing SWEIS is needed.

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 1996) and an associated Record of Decision (ROD) (61 *Federal Register* [FR] 65551). In the ROD, DOE selected the Expanded Use Alternative for most activities, but decided to manage low-level radioactive waste and mixed low-level radioactive waste at levels described under the No Action Alternative, pending decisions resulting from 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 disposal of low-level radioactive waste and mixed low-level radioactive waste. At the same time, DOE amended the *1996 NTS EIS* ROD to select the Expanded Use Alternative for waste management activities at the NNSS.

Subsequently, as required by DOE regulations (10 CFR 1021.330(d)), the National Nuclear Security Administration (NNSA), a separately organized semiautonomous agency within DOE, 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* (DOE 2002). Based on this review, DOE/NNSA concluded 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 National Environmental Policy Act (NEPA) analysis was required.

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* (DOE 2008). Based on consideration of comments received on the draft supplement analysis, potential changes to the NNSS program work scope, and changes to the environmental baseline, DOE/NNSA decided to prepare 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)* (DOE/EIS-0426). DOE/NNSA has prepared this *NNSS SWEIS* in compliance with Council on Environmental Quality regulations that implement NEPA (40 CFR Parts 1500–1508) and DOE NEPA implementing procedures (10 CFR Part 1021).

The U.S. Air Force, U.S. Bureau of Land Management, and Nye County, Nevada, are cooperating agencies in the preparation of this *NNSS SWEIS*. In addition, the Consolidated Group of Tribes and Organizations, which includes representatives from 17 tribes and organizations, participated in the preparation of this SWEIS; their assessments and recommendations appear in text boxes in this Summary and throughout this SWEIS.

Consolidated Group of Tribes and Organizations

Southern Paiute

- Kaibab Paiute Tribe, Arizona
- Paiute Indian Tribes of Utah
- Moapa Band of Paiutes, Nevada
- Las Vegas Paiute Tribe, Nevada
- Pahrump Paiute Tribe, Nevada
- Chemehuevi Paiute Tribe, California
- Colorado River Indian Tribes, Arizona

Western Shoshone

- Duckwater Shoshone Tribe, Nevada
- Ely Shoshone Tribe, Nevada
- Yomba Shoshone Tribe, Nevada
- Timbisha Shoshone Tribe, California

Owens Valley Paiute and Shoshone

- Benton Paiute Tribe, California
- Bishop Paiute Tribe, California
- Big Pine Paiute Tribe, California
- Lone Pine Paiute Tribe, California
- Fort Independence Paiute Tribe, California

Other Official Native American Indian Organizations

- Las Vegas Indian Center, Nevada

S.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 the U.S. 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 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 low-level and mixed low-level radioactive waste 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* (Public Law 109-58). Accordingly, DOE/NNSA's purpose and need is also 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.

Summary—American Indian Perspective

CGTO 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.

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 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 NNSS area and offsite locations.

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. Thus, DOE/NNSA's mission at the NNSS has evolved from one that focused on active nuclear weapons tests to one that maintain 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 to support nuclear 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 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 development of commercial-scale solar energy projects, as well as development of innovative solar and other renewable energy technologies.

S.2 Alternatives

S.2.1 Background

This *NNSS SWEIS* analyzes the potential environmental impacts of continued management and operation of the NNSS and other DOE/NNSA-managed sites in Nevada, including the Remote Sensing Laboratory (RSL), North Las Vegas Facility (NLVF), and Tonopah Test Range (TTR) (see **Figure S–1**). This *NNSS SWEIS* also analyzes the impacts of other DOE program activities, as well as those of other Federal agencies, such as the U.S. Department of Defense and U.S. Department of Homeland Security, that occur or are proposed to occur on these DOE/NNSA-managed sites.

The NNSS occupies approximately 1,360 square miles of desert and mountain terrain in southern Nevada. About 6,500 square miles of the U.S. Air Force's Nevada Test and Training Range and the Desert National Wildlife Refuge surround the NNSS on the northern, western, and eastern sides. The NNSS is a multi-disciplinary, multi-purpose facility primarily engaged in work that supports national security, homeland security initiatives, waste management, environmental restoration, and defense and nondefense research and development programs for DOE/NNSA, and other government entities.

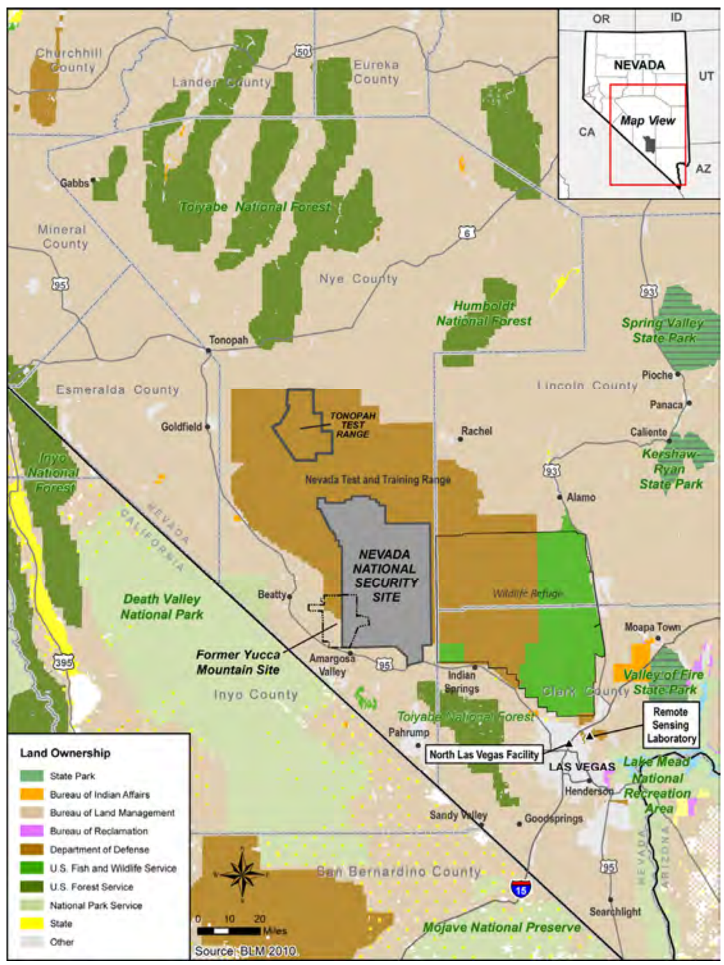

Figure S–1 Location of Nevada National Security Site and Offsite Locations in the State of Nevada

RSL is located on 35 acres at Nellis Air Force Base in North Las Vegas, Nevada, approximately 59 miles southeast of the nearest NNSS boundary. RSL is adjacent to the Nellis Air Force Base runway and has seven 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 supported at RSL.

NLVF, located on 78 acres approximately 55 miles southeast of the nearest NNSS boundary in Las Vegas, 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 Nevada Site Office (NSO) personnel offices.

The TTR, located approximately 12 miles north of the nearest NNSS boundary, is a U.S. Air Force 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 U.S. Air Force under the direction of Sandia National Laboratories and the DOE/NNSA Sandia Site Office (other DOE/NNSA sites in Nevada are under the direction of the DOE/NNSA NSO). 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 this *NNSS SWEIS*, DOE/NNSA analyzes the potential environmental impacts of three alternatives: (1) No Action, (2) Expanded Operations, and (3) Reduced Operations. Each alternative comprises current and reasonably foreseeable missions, programs, capabilities, and projects at the NNSS and the three offsite locations during a 10-year period. 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, this SWEIS includes ongoing activities, as well as activities that are more conceptual in nature. 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.

Terminology Used in 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*

Missions. This term refers to the major responsibilities assigned to the U.S. Department of Energy (DOE) and the National Nuclear Security Administration (NNSA) and comprises the National Security/Defense Mission, Environmental Management Mission, and Nondefense Mission.

Programs. DOE and NNSA are organized into program offices, each of which has primary responsibilities within the set of missions. Funding and direction for activities at DOE and 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 to implement mission assignments. Capabilities at the Nevada National Security Site and offsite locations 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).

Activities. In this site-wide environmental impact statement, activities are those physical actions used to implement missions, programs, capabilities, or projects.

Alternative descriptions are organized under three missions, each with two or more associated programs. The DOE/NNSA missions and associated programs in Nevada 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. Mission-related capabilities, projects, and activities are identified for each of the alternatives. The three alternatives include similar types of capabilities, projects, and activities, but differ primarily in their levels of operations and facility requirements. The No Action Alternative reflects the use of existing facilities and ongoing projects to maintain operations at levels consistent with those experienced since 1996. The Expanded Operations Alternative differs from the No Action Alternative in that the levels of operations would be enhanced or accelerated, and new facilities would be constructed to support increased levels of operations. In addition, under the Expanded Operations Alternative, DOE/NNSA would modify (resize) land use zones at the NNSS to better reflect the kinds of activities that would be undertaken in those zones. 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 reduced or would cease altogether. DOE/NNSA also would modify land use zones on the NNSS, and limit most activities in the northwestern portion of the NNSS.

Levels of Operations – An Example

In the 1996 Record of Decision, the U.S. Department of Energy (DOE) selected the Expanded Use Alternative. Under this alternative, DOE proposed to undertake as many as 110 annual experiments to improve its knowledge of the properties of plutonium, and assess the performance and safety of nuclear weapons. Since then, however, only about 10 such experiments have occurred annually.

The historic levels of operations form the underlying basis for the No Action Alternative in this site-wide environmental impact statement.

Sections S.2.2 through S.2.4 describe the three alternatives in greater detail. **Table S–1** (at the end of Section S.2.4) summarizes the mission-based programmatic similarities and differences among the three alternatives.

S.2.2 No Action Alternative

The No Action Alternative reflects the use of existing facilities and ongoing projects to maintain the levels of operations (activities) consistent with those experienced in recent years at the NNSS and offsite locations. For each of the three mission areas and their supporting programs, the levels of operations for associated capabilities, projects, and activities were determined by analyzing operational levels realized since 1996.

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 include 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.

Description of Alternatives—American Indian Perspective

The Consolidated Group of Tribes and Organizations (CGTO) recommends that the U.S. Department of Energy and the CGTO develop co-management strategies to avert or minimize further impacts before continuing with current or proposed activities. Strategies include:

- 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.
- 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 we can use our knowledge, prayers, and traditions to effectively restore balance to the natural and spiritual harmony of the Nevada National Security Site area and offsite locations.

Under Presidential Decision Directive 15, DOE/NNSA must be able to resume underground nuclear weapons tests within 24 to 36 months if so directed by the President. Although DOE/NNSA would maintain the capability to conduct an underground nuclear test, conducting such a test is neither included nor analyzed under this, or any, of the alternatives.

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

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

As part of the Environmental Management Mission, Waste Management Program, the NNSS would continue accepting and disposing of wastes, such as low-level radioactive waste and mixed low-level radioactive waste. The Environmental Restoration Program would continue to ensure compliance with the Federal Facility Agreement and Consent Order to characterize, monitor, and, if necessary, remediate contaminated areas, facilities, soils, and groundwater that have sustained adverse environmental impacts (NDEP 1996).

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.

Under the No Action Alternative, the Nondefense Mission would include 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, would also continue to be conducted under the Nondefense Mission. For example, DOE/NNSA would continue to identify and implement energy conservation measures and renewable energy projects related to energy efficiency, renewable energy, water, and transportation/fleet management. DOE/NNSA would also support development of a 240-megawatt commercial solar power generation facility and an associated transmission line in the southwest corner of the NNSS. If a commercial solar power generation facility were proposed at the NNSS, additional project-specific NEPA review would be required.

At the NNSS, the missions, programs, capabilities, and projects under the No Action Alternative would be undertaken in one or more of seven land use zones. The land use zones, which are used to manage activities at the NNSS and prevent interference among the various projects and activities, are not considered absolute descriptors of the range of activities that may occur in a particular zone. In addition, the NNSS is divided into numbered operational areas to facilitate management; communications; and distribution, use, and control of resources. **Figure S–2** provides the locations and sizes of these zones and operational areas, as well as the locations of major facilities within these zones and areas.

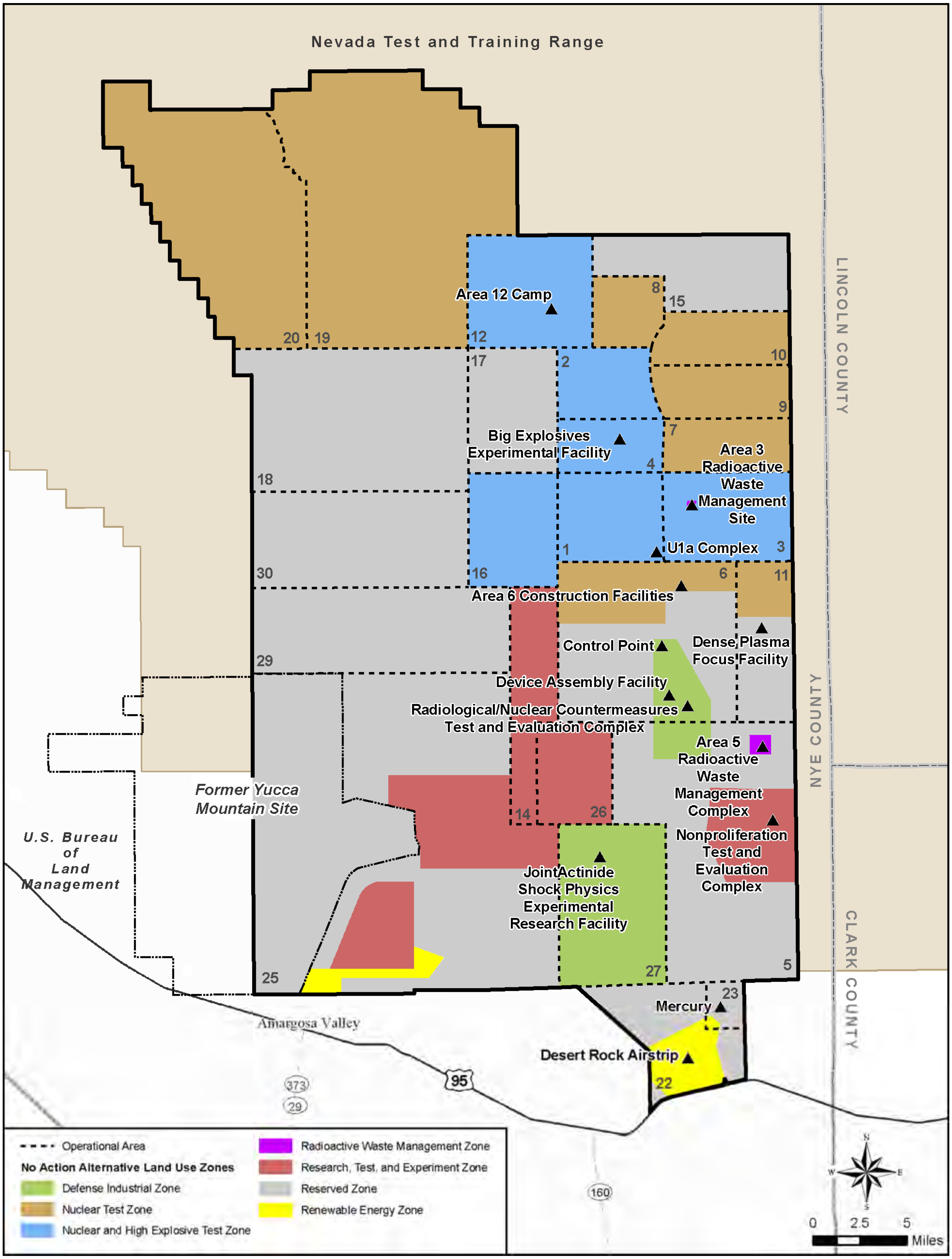

Figure S–2 No Action Alternative Land Use Zones

S.2.3 Expanded Operations Alternative

The Expanded Operations Alternative includes the levels of operations, capabilities, and projects described under the No Action Alternative, as well as additional proposed capabilities and projects. These additional capabilities and projects 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.

To illustrate, under the Expanded Operations Alternative, the annual number of stockpile stewardship tests and experiments and the yearly number of nuclear weapons that would be dispositioned would increase relative to the No Action Alternative. DOE/NNSA would construct new facilities to support enhanced training for the Office of Secure Transportation, to enhance efforts to control the spread of weapons of mass destruction, and to advance counterterrorism training, research, and development. Although the pace of environmental restoration activities would remain unchanged from that under the No Action Alternative, DOE/NNSA would accelerate the pace and amount of low-level radioactive waste that would be disposed on the NNSS.

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 (an expansion of the 4,100-acre area under the No Action Alternative). In the Renewable Energy Zone, DOE/NNSA would support development of several commercial solar power generation facilities with a maximum combined generating capacity of 1,000 megawatts in Area 25. Elsewhere, DOE/NNSA would construct a 5-megawatt photovoltaic solar power generation facility (in Area 6), and a Geothermal Demonstration Project and Geothermal Research Center (location to be determined). The locations and sizes of the land use zones and operational areas, as well as the locations of major facilities within these zones and areas, are shown in **Figure S–3**.

S.2.4 Reduced Operations Alternative

The Reduced Operations Alternative includes all of the types of activities conducted at the NNSS and offsite locations since 1996. The activity level under the Reduced Operations Alternative would vary across programs; however, the levels of operations for many programs would be reduced (relative to the No Action Alternative). Furthermore, under the Reduced Operations Alternative, activities would cease in the northwestern portion of the NNSS (Areas 18, 19, 20, 29, and 30), with the exception of environmental restoration and monitoring, site security operations, military training and exercises, and maintenance of Well 8 and critical communications and electrical transmission systems. Maintenance of roads on Pahute Mesa, Stockade Wash, and Buckboard Mesa would also be reduced to provide access only for maintaining necessary infrastructure and conducting environmental restoration activities. Operation of the Pahute Mesa Airstrip would be limited to those operations necessary to provide access for activities that would continue in these areas. In addition, the electrical transmission and distribution system beyond the Echo Peak Substation in Areas 19 and 20 would be de-energized.

The pace of environmental restoration activities and most waste generation and disposal rates would remain unchanged from that under the No Action Alternative. However, the amount of transuranic waste generated, as well as the amount of sanitary waste generated and disposed of on site, would be reduced.

Under the Reduced Operations Alternative, activities related to supply and conservation of energy, including renewable energy and other research and development projects, would continue to be conducted. For example, DOE/NNSA would support development of a 100-megawatt commercial solar power generation facility in Area 25.

At the NNSS, the Area 18, 19, 20, 29, and 30 land use designations would change to a Limited Use Zone. **Figure S–4** provides the locations and sizes of these zones and operational areas, as well as the locations of major facilities within these zones and areas.

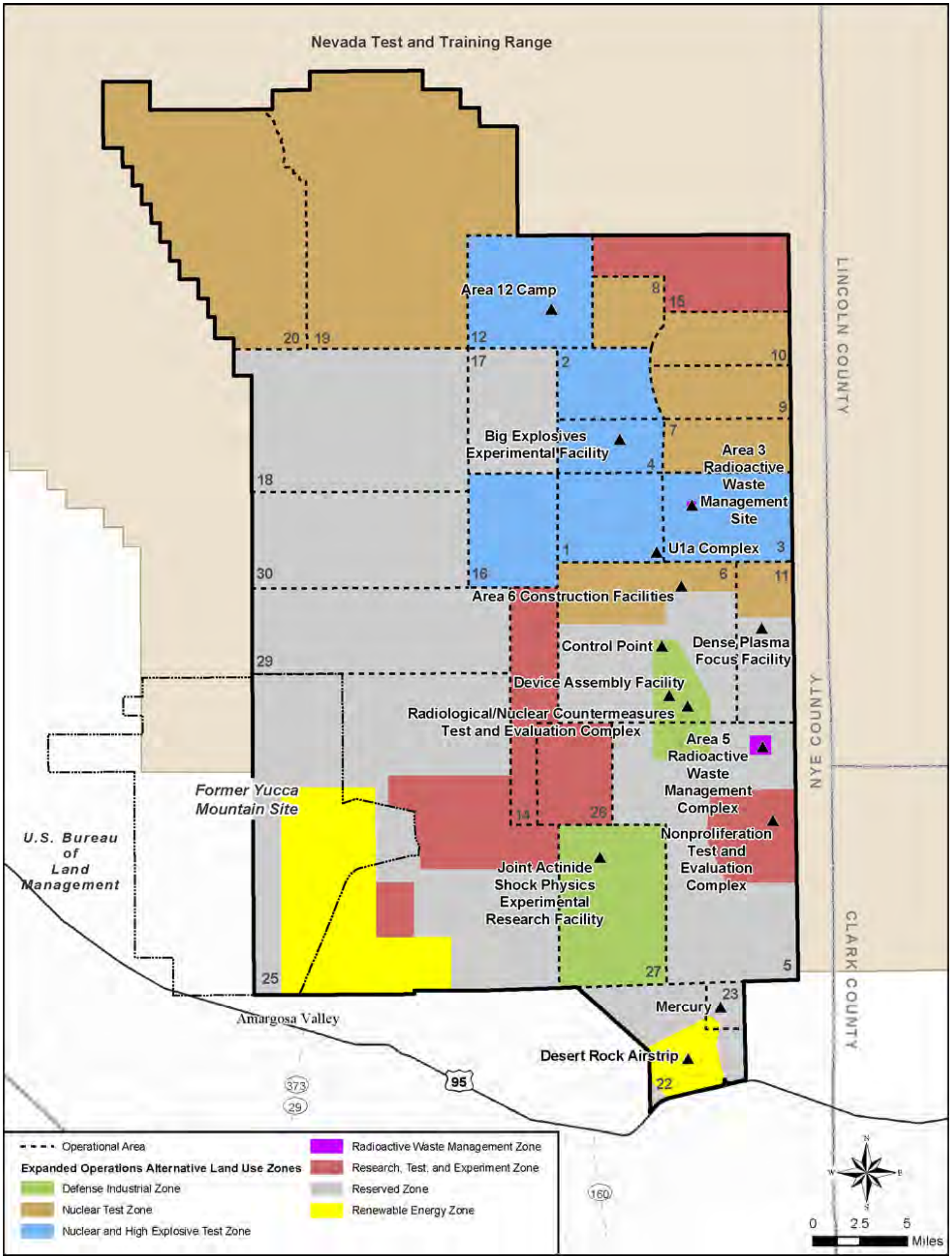

Figure S–3 Expanded Operations Alternative Land Use Zones

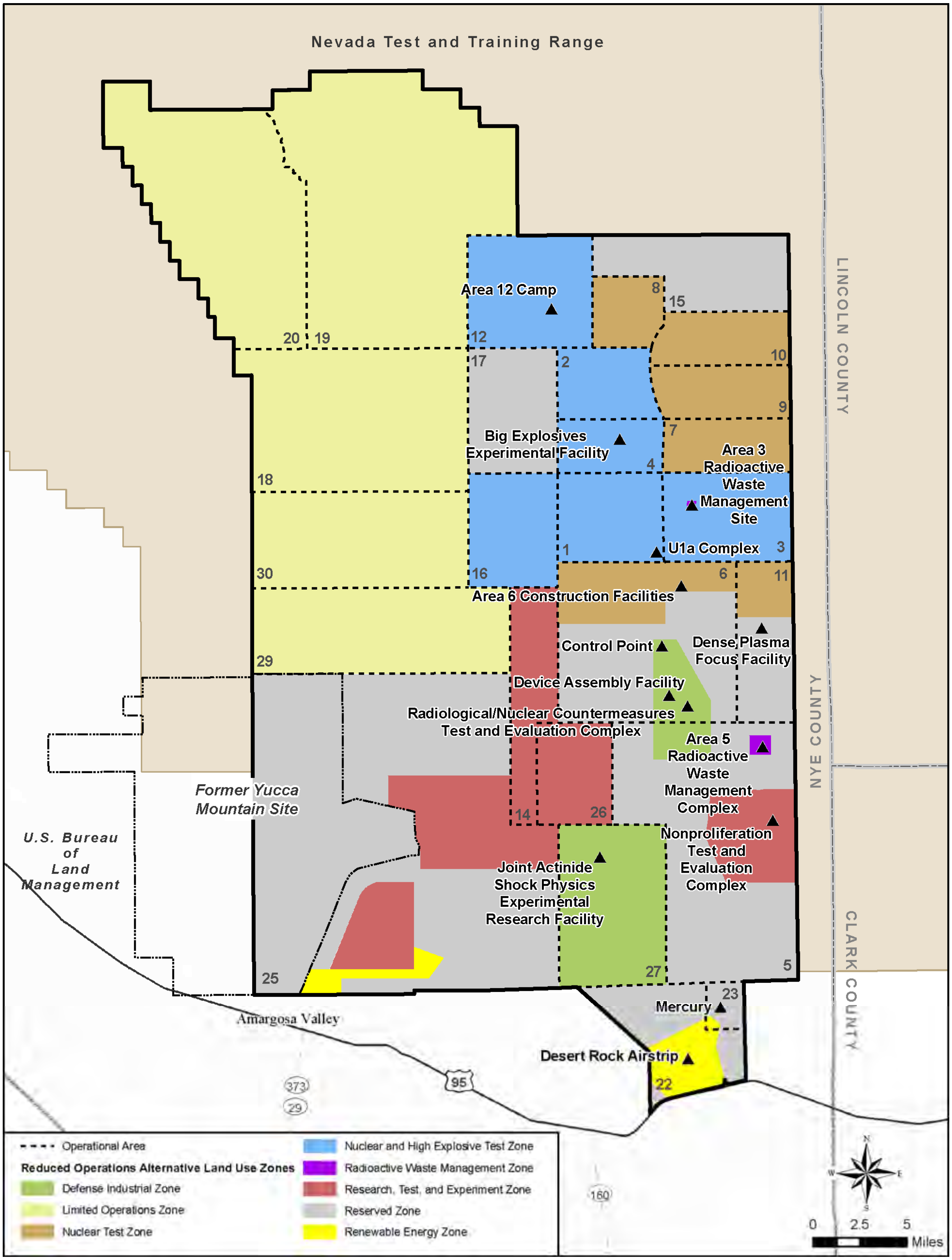

Figure S–4 Reduced Operations Alternative Land Use Zones

Table S–1 Comparison of Mission-Based Program Activities Under the Proposed Alternatives and Identification of the Preferred Alternative (blue shading)

NO ACTION ALTERNATIVE	*EXPANDED OPERATIONS ALTERNATIVE*	*REDUCED OPERATIONS ALTERNATIVE*
National Security/Defense Mission		
Stockpile Stewardship and Management Program		
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 the Big Explosives Experimental Facility 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 explosives 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 explosives charges (50 of these would be at the Big Explosives Experimental Facility 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 Big Explosives Experimental Facility. • Establish up to three areas at the NNSS for conducting explosives experiments with depleted uranium and conduct up to 20 experiments per year.	Conduct up to 10 conventional explosives experiments per year at the Big Explosives Experimental Facility using up to 70,000 pounds TNT-equivalent of explosives 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 the Joint Actinide Shock Physics Experimental Research Facility 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 the Joint Actinide Shock Physics Experimental Research Facility 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 the Joint Actinide Shock Physics Experimental Research Facility 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, training, and other operations per year at the National Criticality Experiments Research Center at the Device Assembly Facility 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 an approximate 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:	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 per year 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 locations in 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 turned over 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.
Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs		
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 provided by 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.
Conduct weapon of mass destruction emergency responder training at various DOE/NNSA NSO locations.	Same as under the No Action Alternative.	Same as under the No Action Alternative.

NO ACTION ALTERNATIVE	***EXPANDED OPERATIONS ALTERNATIVE***	***REDUCED OPERATIONS ALTERNATIVE***
Support DOE Emergency Communications Network.	Same as under the No Action Alternative.	Same as under the No Action Alternative.
Disposition improvised nuclear dispersion devices and deploy the DOE/NNSA Disposition Program and Federal Bureau of Investigation Disposition and Disposition Forensics Program to the NNSS for training and exercises or for an actual event, as needed.	Same as under the No Action Alternative, plus: • Disposition radiological dispersion devices, as needed	Same as under the No Action Alternative.
Integrate existing activities and primarily NNSS facilities to support United States efforts to control the spread of weapons of mass destruction, particularly nuclear weapons of mass destruction, 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		
Work for Others Program activities would continue to be conducted 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 of 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 within parameters established for conducting conventional high-explosives experiments.		• Discontinue Work for Others Program conventional weapons effects and other high-explosives experiments.
• Support development of capabilities to hold at-risk and 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 explosives).		• Discontinue development of capabilities to hold at-risk and defeat military assets in deeply buried hardened targets. • 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, research, and development activities.	Same as under the No Action Alternative.
Conduct criticality experiments to support National Aeronautics and Space Administration 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: • Conduct experiments using existing boreholes at the NNSS to sequester emissions such as radionuclides.	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		
Dispose up to 15 million cubic feet of low-level radioactive waste and 900,000 cubic feet of mixed low-level radioactive waste in the Area 5 Radioactive Waste Management Complex.	Dispose up to 48 million cubic feet of low-level radioactive waste and 4 million cubic feet of mixed low-level radioactive waste at the Area 5 Radioactive Waste Management Complex and Area 3 Radioactive Waste Management Site.[b]	Same as under the No Action Alternative.
Maintain the Area 3 Radioactive Waste Management Site on standby.	Open the Area 3 Radioactive Waste Management Site for disposal of authorized and/or permitted waste.	Same as under the No Action Alternative.
Treat onsite-generated mixed low-level radioactive waste.	Same as under the No Action Alternative, plus: • At the Area 5 Radioactive Waste Management Complex, store mixed low-level radioactive waste 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 disposal.	Same as under the No Action Alternative.
Store onsite-generated transuranic 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 of transuranic waste (up to 19,000 cubic feet over the next 10 years) would be generated by increased activities at NNSS facilities, such as the Joint Actinide Shock Physics Experimental Research Facility.	Same as under the No Action Alternative, except a smaller volume of transuranic waste (up to 7,100 cubic feet over the next 10 years) would be generated by increased activities at NNSS facilities, such as the Joint Actinide Shock Physics Experimental Research Facility.
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, except 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 smaller 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		
Underground Test Area Project – Comply with the Federal Facility Agreement and Consent Order; 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 Federal Facility Agreement and Consent Order.	Same as under the No Action Alternative, except: • If stricter cleanup standards were 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 Federal Facility Agreement and Consent Order 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 Federal Facility Agreement and Consent Order, 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		
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 Repository 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.

NO ACTION ALTERNATIVE	*EXPANDED OPERATIONS ALTERNATIVE*	*REDUCED OPERATIONS ALTERNATIVE*
Conservation and Renewable Energy Program		
Continue to identify and implement energy conservation measures and renewable energy projects in compliance with applicable Executive Orders and DOE Orders. • Reduce energy intensity by 3 percent annually and a total of 30 percent by the end of fiscal year 2015. • 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. • Support development of a 240-megawatt commercial solar power generation facility in NNSS Area 25. [a] • 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.	Same as under the No Action Alternative, plus: • Support development of 1,000 megawatts of commercial solar power generation facilities in NNSS Area 25. [a] • Modify NNSS land use zones to establish a 39,600-acre Renewable Energy Zone in Area 25. • Construct a 5-megawatt photovoltaic solar power generation facility near the Area 6 Construction Facilities. • Support a Geothermal Energy Demonstration Project and Geothermal Research Center at the NNSS. [a]	Same as under the No Action Alternative, except: • Support development of a 100-megawatt commercial solar power generation facility in NNSS Area 25. [a]
Other Research and Development Programs		
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.	Same as under the No Action Alternative, except: Activities would be conducted in all areas of the NNSS, except Areas 18, 19, 20, 29, and 30.

NLVF = North Las Vegas Facility; NSO = Nevada Site Office; RSL = Remote Sensing Laboratory; TNT = 2,4,6-trinitrotoluene; TTR = Tonopah Test Range.

[a] These potential projects have not reached a point of development that allows full analysis in this *NNSS SWEIS*, and would be subject to additional NEPA review before DOE/NNSA would make any decision regarding implementation. At this point, DOE/NNSA has not received or solicited proposals for any commercial solar power generation projects.

[b] Reopening of the Area 3 Radioactive Waste Management Site would only occur based upon mission need and as stated in Chapter 4, Section 4.1.11.1.1.1, of the *NNSS SWEIS*, including detailed consultation with the state of Nevada.

S.2.5 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 the blue-shaded cells in Table S–1).

In identifying its Preferred Alternative, 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 2011), as well as anticipated funding levels for DOE/NNSA and other users of the NNSS and offsite locations, such as the Department of Homeland Security. 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. Moreover, NNSA analyzed and considered the potential environmental impacts that could accrue from the implementation of any alternative.

Based on these considerations, DOE/NNSA identified a Preferred Alternative for continued operation of the NNSS and offsite locations in the state of Nevada. DOE/NNSA's Preferred Alternative is a "hybrid" alternative comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Table S–1 provides a comparison of mission-based program activities under the three alternatives and the Preferred Alternative (identified by blue-shaded cells).

Under the Stockpile Stewardship and Management Program, activities would largely reflect the No Action Alternative, but with an increased frequency of conventional explosives and shock physics experiments, and the Expanded Operations Alternative, under which certain functions at the TTR would be transferred to the U.S. Air Force. As identified under the Reduced Operations Alternative, the Atlas facility (designed for pulsed power experiments) would be decommissioned. Within the Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs, activities would also align with the No Action Alternative, except that the capability for disposition of radiological dispersion devices would be added, as well as some additional laboratory and test bed facilities. The Work for Others Program, as an emerging mission, would implement the Expanded Operations Alternative in most areas.

Under the Waste Management Program, activities would generally conform to the Expanded Operations Alternative, with the exception of hazardous waste, explosive ordnance wastes, and hydrocarbon waste management activities, which would remain at current levels. Under the Environmental Restoration Program, activities would resemble those described under the No Action Alternative, but could proceed at a faster pace and/or meet stricter cleanup standards as described under the Expanded Operations Alternative.

The preferred alternative for the General Site Support and Infrastructure Program would be Expanded Operations, which would entail developing new facilities and upgrading existing infrastructure elements (e.g., electrical and cellular communications) on much of the NNSS. Only critical infrastructure would be retained in Areas 18, 19, 20, 29, and 30 of the NNSS, as described under the Reduced Operations Alternative. For the Conservation and Renewable Energy Program, activities would closely conform to the No Action Alternative, except that a 5-megawatt photovoltaic solar power facility and a Geothermal Demonstration Project and Geothermal Research Center could be constructed at the NNSS as identified under the Expanded Operations Alternative. For the Other Research and Development Programs, activities would continue as described under the No Action Alternative.

S.2.6 Potential Decisions Resulting from this Site-Wide Environmental Impact Statement

The information, analyses, and potential environmental impacts of this *NNSS SWEIS* will provide the basis, in part, for DOE/NNSA to determine the nature of capabilities and projects, as well as their associated levels of operations, over the next 10-year period at the NNSS and offsite locations in Nevada. Accordingly, DOE/NNSA may choose to implement, either wholly or in part, any of the three alternatives, or may choose to implement a "hybrid" alternative, comprising various capabilities, projects, and activities selected from among the three alternatives. Implementation of any of the alternatives could result in changes to the names, sizes, or locations of the land use zones, or in the locations of ongoing or proposed capabilities and projects within these zones.

Although DOE/NNSA analyzed various radioactive waste shipping routes through and around metropolitan Las Vegas, Nevada, decisions on routing would not be made as part of this NEPA process. DOE/NNSA undertook this analysis to inform any highway-routing-related revisions to its waste acceptance criteria; such revisions are developed in accordance with DOE/NNSA's standard practices, which include consultation with the State of Nevada; and, when finalized, become publicly available through publication on the NNSS website. As discussed in Section S.3.1.2, DOE/NNSA determined that it would retain the highway routing restrictions for shipments of low-level radioactive waste; therefore, there would be no need to revise the waste acceptance criteria in this regard (DOE 2012).

DOE/NNSA also would not make any decisions regarding environmental restoration activities that are not consistent with the Federal Facility Agreement and Consent Order unless agreed to by the Nevada Division of Environmental Protection.

S.3 Summary of Environmental Impacts

S.3.1 Nevada National Security Site

This section summarizes the potential environmental impacts at the NNSS from continuing and proposed projects and capabilities, including their associated levels of operations (activities), under each of three alternatives analyzed in this SWEIS. The text focuses on those resource areas for which the impacts are sufficiently different to permit the reader to distinguish among the alternatives in a meaningful manner or those resource areas that may be controversial, i.e., infrastructure and energy, transportation and traffic, socioeconomics, groundwater hydrology, biological resources, air quality, visual resources, and cultural resources, waste management, human health, and cumulative impacts.

Table S–14 (at the end of Section S.3.1.10) summarizes the potential environmental impacts for all 13 resource areas for each alternative. As discussed above in Section S.2.5, DOE/NNSA's Preferred Alternative is a "hybrid" alternative comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Although the text of this Summary does not discuss the potential environmental impacts from implementing the Preferred Alternative, consistent with the approach used in Chapter 3 of the *NNSS SWEIS*, Table S–14 summarizes those impacts to enable a comparison to the three alternatives.

S.3.1.1 Energy

DOE/NNSA compared projections of utility resource requirements, such as the demand for electricity and liquid fuels, under each alternative to local and regional capabilities to supply these resources. Implementing the Expanded Operations Alternative would result in the highest energy demands of the three alternatives.

Under the Expanded Operations Alternative, continuing and newly proposed projects and capabilities would require an increase of up to 25 percent or about 1.4 million gallons per year of various fuel types, such as unleaded gasoline, ethanol-gasoline blended fuel, and biodiesel fuel. DOE/NNSA does not foresee difficulty in obtaining this amount of liquid fuels from regional suppliers. The projected annual demand for most fuel types constitutes a small proportion of current fuel use in Nevada. For example, the estimate of unleaded gasoline needed annually (534,000 gallons) would be approximately 0.05 percent of the total unleaded gasoline used in Nevada (NSOE 2009). However, the NNSS is a major consumer of biodiesel fuel in Nevada, making up approximately 60 percent of the current, annual statewide demand of 575,000 gallons (NSOE 2009); under the Expanded Operations Alternative, DOE/NNSA would increase consumption of biodiesel fuel to about 75 percent (429,000 gallons). Although not anticipated, if demand for biodiesel fuel were to exceed regional supply, the NNSS could temporarily switch to petroleum-based diesel fuel for most applications.

Implementing the Expanded Operations Alternative also would result in increased demand for electricity during construction and, later, operation of proposed projects and capabilities. DOE/NNSA estimates that the average power demand would increase up to approximately 25 percent (from 22 to 28 megawatts) over current demand, and up to approximately 35 percent (from 30 to 41 megawatts) under peak power demand. Peak demand would exceed existing system capacity (40 megawatts) (NNSA/NSO 2010a), which could result in voltage fluctuations or blackouts. However, as part of implementing the Expanded Operations Alternative, DOE/NNSA would upgrade the existing electrical distribution system to accommodate projected electrical demand, increase service reliability, and provide additional capacity to support future growth on the NNSS.

A 35 percent increase over the 2009 average electrical demand of 84,600 megawatt-hours at the NNSS (DOE 2008) would amount to approximately 105,700 megawatt-hours. During 2009, NV Energy and Valley Electric Association provided about 21,675,000 megawatt-hours collectively to their customers. Under the Expanded Operations Alternative, electricity demand would represent only about 0.49 percent of the regional electrical supply (NSOE 2009). In addition, the construction of commercial solar power generation facilities in Area 25 would increase regional electricity supplies.

S.3.1.2 Transportation and Traffic

Transportation. Radiological and nonradiological impacts on workers and the public would result from the shipments to the NNSS of radioactive waste (such as low-level radioactive waste) and radioactive materials (such as special nuclear material) from locations outside the State of Nevada, as well as from locations within Nevada, such as the TTR, to the NNSS. Radiological impacts are those associated with the effects of radiation emitted during incident-free transportation (normal operations) and from accidents resulting in a release of radioactive materials; radiological impacts are expressed as additional latent cancer fatalities. Nonradiological impacts are independent of the nature of the cargo being transported and are expressed as number of traffic accident fatalities.

Radioactive waste shipments would be by truck or by a combination of rail and truck. There is no rail line to the NNSS; therefore, rail cargo must be transferred to trucks at a transfer station. DOE/NNSA is not proposing, however, to construct or cause to be constructed any new rail-to-truck transfer facilities. Some shipments, such as radioactive materials shipments, would only be by truck. **Table S–2** provides the estimated number of shipments of radioactive waste and radioactive materials to the NNSS under each alternative.

Special Nuclear Material

Special nuclear material 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 special nuclear material, or (2) any material artificially enriched by any of these radioactive materials.

Table S–2 Estimated Number of Shipments of Radioactive Waste and Materials

Mode of Shipment to the Nevada National Security Site	*No Action Alternative*	*Expanded Operations Alternative*	*Reduced Operations Alternative*
Truck			
In-state radioactive waste shipments	2,300	15,000	2,300
Out-of-state radioactive waste shipments	25,000	80,000	25,000
Out-of-state radioactive material shipments	240	11,000	180
Rail-to-Truck			
In-state radioactive waste shipments (truck only)	2,300	15,000	2,300
Out-of-state radioactive waste shipments (rail and truck)	38,000	92,000	38,000
Out-of-state radioactive material shipments (truck only)	240	11,000	180

This *Final NNSS SWEIS* includes analyses of incident-free transportation for two cases: a Constrained Case and an Unconstrained Case. The Constrained Case retains current routing of shipments of low-level and mixed low-level radioactive waste to avoid crossing the Colorado River near Hoover Dam and the interstate system in Las Vegas, Nevada. The Unconstrained Case, in which shipments of this waste would travel over the bypass bridge near the Hoover Dam and on the interstate system through the greater metropolitan area, was analyzed to provide information relevant to consideration of potential highway routing-related revisions to NNSS's waste acceptance criteria. After consultation with the Nevada Department of Environmental Protection as part of the waste acceptance criteria revision process, DOE/NNSA determined that it would retain the highway routing restrictions for shipments of low-level radioactive waste; therefore, there will be no need to revise the waste acceptance criteria in this regard (DOE 2012). For this reason, the Summary no longer includes the results of the Unconstrained Case analysis; those results, however, may be found in Volume 2, Chapter 5, Section 5.1.3.1.2, of the *NNSS SWEIS*.

Incident-Free Transportation (Constrained Case). For incident-free truck transportation, under all three alternatives (No Action, Expanded Operations, and Reduced Operations), DOE/NNSA estimated (numerically calculated) that approximately 1 (1.3), 3 (3.3), and 1 (1.3) latent cancer fatality(ies), respectively, would occur in the population of transportation workers exposed to radiation from shipments of low-level and mixed low-level radioactive waste (see **Figure S–5**). Because many workers would be involved, the risk to an individual worker would be small. Similarly, DOE/NNSA estimated that less than 1 (0.2, 0.8, and 0.2, respectively) latent cancer fatality would occur among members of the public exposed to these same truck shipments under the three alternatives.

For incident-free rail-to-truck transportation, under all three alternatives (No Action, Expanded Operations, and Reduced Operations), DOE/NNSA estimated (numerically calculated) that less than 1 (0.5), 2 (1.5), and less than 1 (0.5) latent cancer fatality(ies), respectively, would occur in the population of transportation workers exposed to radiation from shipments of low-level and mixed low-level radioactive waste. Similarly, DOE/NNSA estimated that less than 1 (0.1 for No Action and Reduced Operations and 0.3 for Expanded Operations) latent cancer fatality would occur among members of the public exposed to these same truck and rail shipments under the three alternatives (see Figure S–5).

What is a Latent Cancer Fatality?

A latent cancer fatality is a death from cancer resulting from, and occurring sometime after, exposure to ionizing radiation or other carcinogens. This site-wide environmental impact statement focuses on latent cancer fatalities as the primary means of evaluating health risk from radiation exposure. The values reported for latent cancer fatalities are the increased risk of a fatal cancer for a maximally exposed individual or noninvolved worker, or the increased risk of a single fatal cancer occurring in an identified population.

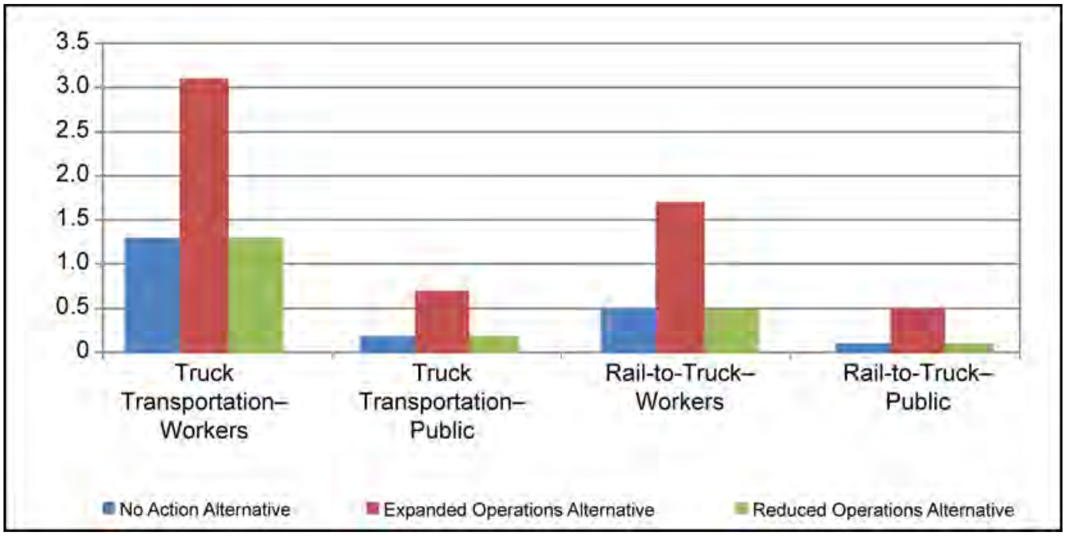

Figure S–5 Latent Cancer Fatalities from Incident-Free Transportation (Constrained Case)

Under the No Action Alternative or Reduced Operations Alternative, if an individual member of the public were exposed to every truck shipment of radioactive waste and materials, an unlikely event, this maximally exposed individual would receive an estimated dose of about 10 millirem, resulting in a risk of contracting a fatal cancer of 5×10^{-5} (1 chance in 200,000). Under the Expanded Operations Alternative, this individual would receive an estimated dose of about 20 millirem, resulting in a risk of contracting a fatal cancer of 1×10^{-5} (1 chance in 100,000). An individual exposed to every rail shipment would receive an estimated dose of about 10 millirem under the No Action and Reduced Operations Alternatives, and about 20 millirem under the Expanded Operations Alternative.

Transportation Accidents. Two types of accident analyses were performed: an assessment of consequences associated with a maximum reasonably foreseeable accident and a risk analysis that accounted for all types of accidents. The maximum reasonably foreseeable transportation truck accident involving the release of radiation was estimated to occur at an annual frequency of about 3.2×10^{-7} (about 1 chance in 3.1 million) under the No Action and Reduced Operations Alternatives and about 6.1×10^{-7} (about 1 chance in 1.6 million) under the Expanded Operations Alternative. This accident would involve the release of radiation from a truck carrying low-level radioactive waste or mixed low-level radioactive waste that is involved in a severe collision and an ensuing fire. If the accident were to occur in an urban area, DOE/NNSA estimates that the consequences for the population within 50 miles of the accident would be a collective dose of approximately 180 person-rem, which would result in less than 1 (0.1) additional fatal cancer in that population. The consequences for the maximally exposed individual, a hypothetical individual assumed to be located downwind of the event and exposed to the entire plume of radioactive release, would be an estimated dose of 34 millirem, resulting in a risk to that individual of contracting a fatal cancer of 2×10^{-5} (1 chance in 50,000). The corresponding rail accident was estimated to occur at an annual frequency of about 8.4×10^{-8}

Units of Radiation

A rem is a unit of radiation dose used to measure the biological effects of different types of radiation on humans. The dose in rem is estimated by a formula that accounts for the type of radiation, the total absorbed dose, and the tissues involved. One thousandth of a rem is a millirem. 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.

A person-rem is a unit of collective 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 specific 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 = 1.0 person-rem).

(about 1 chance in 10 million); this accident was not analyzed because the probability of the event is so remote.

For the risk analysis, under the No Action and Reduced Operations Alternatives, the total transportation accident risk for all projected accidents involving radioactive waste and radioactive materials would result in an estimated collective dose to the general population of 0.33 person-rem (truck) and 0.13 person-rem (rail-to-truck), resulting in less than 1 (0.0002) latent cancer fatality for truck transport and less than 1 (0.00008) latent cancer fatality for rail-to-truck transport. The nonradiological accident risks were estimated to be 2 and 6 traffic accident fatalities in the general population for truck transport and rail-to-truck transport, respectively. Under the Expanded Operations Alternative, the total transportation accident risk for all projected accidents would result in an estimated collective dose to the population of about 17 person-rem (truck) and 8 person-rem (rail-to-truck), resulting in less than 1 (0.01) latent cancer fatality for truck transport, and less than 1 (0.005) latent cancer fatality for rail-to-truck transport. The nonradiological accident risks were estimated to be 7 and 16 fatal traffic accident fatalities in the general population for truck transport and rail-to-truck transport, respectively.

Transportation Accident Risk

In a shipping campaign, risk is defined as the sum of the probability of each accident involving a release of radioactive material multiplied by the consequence of that event (i.e., the product of these two factors summed for all accidents).

Traffic. Traffic impacts would result from personnel (worker) trips, and trucks transporting radioactive waste and radioactive and nonradioactive materials. Traffic impacts are expressed as the relative change in the number of onsite and offsite daily vehicle trips and the degree to which traffic on nearby Federal and state highways would be affected, collectively referred to as the "level of service." The level of service provides a means to gauge the degree of congestion on transportation networks. The six levels, designated "A" through "F," represent a range of traffic conditions; the best operating conditions are characterized by free flow and little delay (level of service A) and the worst operating conditions, by poor progression and long delays (level of service F) (TRB 2000).

Level of Service C

The number of vehicles stopping is significant, although many still pass through the affected intersection without being required to stop.

Under the No Action Alternative, traffic on Mercury Highway (onsite traffic) would continue to operate at level of service A during peak traffic hours, as there would be an increase of only 16 daily vehicle trips (relative to a baseline of 1,748 trips) (see **Figure S–6**). Implementing the Expanded Operations Alternative would result in additional congestion on Mercury Highway during peak traffic hours (level of service B), as there would be an increase of about 832 daily vehicle trips. Under the Reduced Operations Alternative, traffic on Mercury Highway would continue to flow freely (level of service A), as daily vehicle trips would decrease by about 153.

Construction of one or more commercial solar power generation facilities in Area 25 would result in increased traffic on Lathrop Wells Road north of U.S. Route 95 and on site (level of service information is unavailable). Under the No Action, Expanded Operations, and Reduced Operations Alternatives, DOE/NNSA estimates that average daily vehicle trips (worker vehicles) during peak hours would increase by 250, 375, and 200, respectively. The increase in traffic from workers and construction equipment would require increased road maintenance or fundamental improvements. Although traffic during operations of solar power generation facilities would be less than traffic during construction, road maintenance or fundamental improvements would continue to be needed.

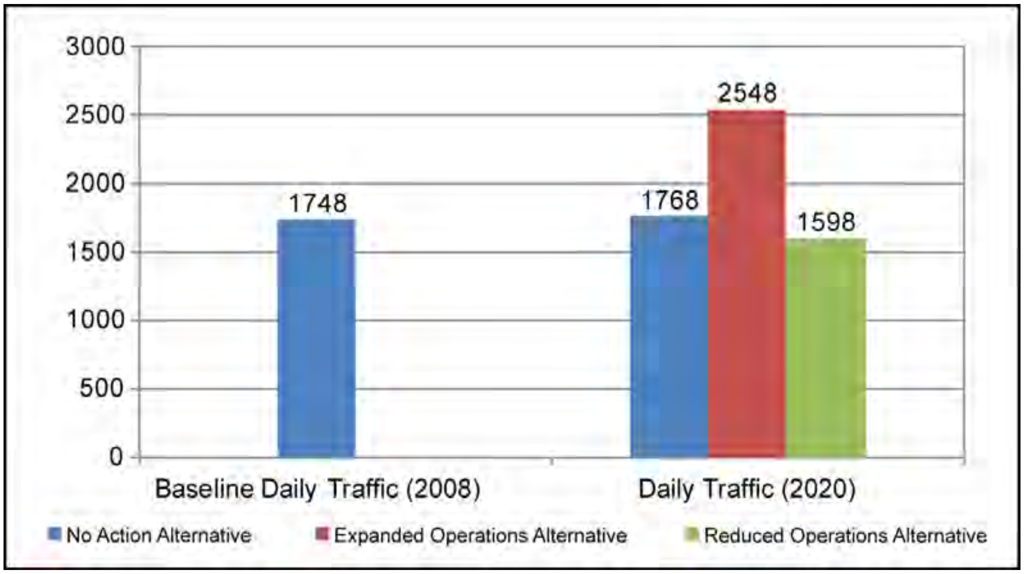

Figure S–6 Daily Vehicle Trips Between U.S. Route 95 and Mercury Highway

To estimate offsite traffic impacts after complete implementation of the alternatives, DOE/NNSA estimated baseline traffic levels and corresponding levels of service for the year 2020 for highways nearby the NNSS. The additional traffic associated with any alternative generally would not change future levels of service; for instance, the levels of service along U.S. Route 95 just west of Nevada State Route 373 in Amargosa Valley would remain at level of service C, and along Nevada State Route 373 south of U.S. Route 95 would remain at level of service A.

S.3.1.3 Socioeconomics

The continued operation and proposed projects and capabilities at the NNSS would result in changes to the current (baseline) workforce under each of the three alternatives. Accordingly, DOE/NNSA evaluated how these changes in workforce could affect economic activity; population; and the demand on housing, public finance, and public services, such as police and fire protection, in Clark and Nye Counties (the counties in which the principal direct and indirect socioeconomic impacts are likely to occur).

DOE/NNSA estimates that implementing the No Action Alternative would result in the creation of up to 1,000 temporary and 150 permanent jobs (direct employment), in addition to the current (baseline) workforce of about 1,700. Most of the additional workforce would be due to the construction and operation of a 240-megawatt commercial solar power generation facility in Area 25, as construction would require an average of approximately 500 individuals during the 35-month construction period (temporary workforce), and operation would require approximately 150 individuals (permanent workforce).

An increase in direct employment under the No Action Alternative also would result in an increase in the demand for goods (for example, fuel for personal vehicles) and services (for example, vehicle repair), which, in turn, would create additional employment opportunities (indirect jobs). DOE/NNSA used the Regional Input-Output Modeling System II (RIMS II 2010), which was developed for the U.S. Department of Commerce, to evaluate the indirect economic impact of employment. Based on this analysis, approximately 930 to 1,860 indirect temporary and approximately 394 indirect permanent jobs would be created.

The addition of 544 direct and indirect permanent jobs (150 direct and 394 indirect) was estimated to reduce unemployment by 0.3 percent in Clark County and 3.9 percent in Nye County. DOE/NNSA estimates there would be adequate housing and public services available for this additional workforce. For example, housing vacancies in Clark and Nye Counties would decrease by only 0.01 percent and 0.1 percent, respectively, and the person-to-hospital-bed ratio would remain unchanged.

Implementing the Expanded Operations Alternative would result in the creation of up to 1,500 temporary and 625 permanent jobs, in addition to the current (baseline) workforce of about 1,700. Most of the additional workforce would be a result of the construction and operation of 1,000 megawatts of commercial solar power generation facilities in Area 25, as construction would require an average of approximately 750 individuals (1,500 workers at peak) during the 42-month construction period (temporary workforce), and operation would require approximately 200 individuals (permanent workforce). DOE/NNSA estimates that this workforce would result in approximately 1,866 to 3,256 indirect temporary and approximately 920 indirect permanent jobs.

The addition of 1,545 direct and indirect permanent jobs (625 direct and 920 indirect) under the Expanded Operations Alternative would reduce unemployment in Clark and Nye Counties by 0.8 and 11.0 percent, respectively. The increased temporary and permanent workforce would not result in undue demand on housing (vacancies would decrease by only 0.02 percent in Clark County and 0.4 percent in Nye County) and most public services, although there could be a need to hire five new teachers (four in Clark County and one in Nye County) to maintain the current student-to-teacher ratio, and a need to expand the medical clinic in Mercury to maintain the person-to-hospital-bed ratio.

Implementing the Reduced Operations Alternative would result in the need for an average of 400 individuals (800 workers at peak) during the 32-month period to construct a 100-megawatt commercial solar power generation facility in Area 25. The permanent workforce needed to operate a solar power generation facility (125 individuals), however, would not offset the loss of employment due to the reduction in the levels of operation at the NNSS; the NNSS workforce would be reduced by approximately 45 individuals (from about 1,700 to 1,655 individuals). The longer-term workforce reduction also would reduce the demand for goods and services and thus indirect employment in Clark and Nye Counties. Housing vacancies would increase and demand for public services would decrease because of the reduction in the permanent workforce.

S.3.1.4 Groundwater Hydrology

Groundwater Quality. Drinking water quality is monitored to assess compliance with primary and secondary drinking water standards according to a schedule set in Federal and state laws, and requirements set by the Nevada Division of Environmental Protection. The three public water systems on site and permitted water hauling trucks meet primary and secondary drinking water standards. Implementing any of the three alternatives is not expected to result in a degradation of groundwater quality because projects and activities would be undertaken within confinement barriers, such as tests in the Joint Actinide Shock Physics Experimental Research Facility, or would be above ground, where depth to groundwater is on the order of several hundred feet. In addition, the use of operational controls and other administrative measures would remove and remediate any surface spills well before contaminants could migrate to the water table (the zone beneath the surface that is saturated with water).

There have been 828 underground nuclear tests at the NNSS. Of these, approximately one-third were detonated near, below, or within the water table. These detonations have contaminated groundwater with 43 radionuclides; tritium (a radioactive form of hydrogen) is believed to be the most mobile

Corrective Action

Corrective action unit means one or more corrective action sites grouped geographically, by technical similarity or agency responsibility, or for other appropriate reasons, for purposes of determining corrective actions.

Corrective action site refers to the sites potentially requiring corrective action.

(Bowen et al. 2001). The Federal Facility Agreement and Consent Order established five corrective action units that delineate and define areas of concern for groundwater contamination (see **Figure S–7**).

In response, and to satisfy DOE Orders and other program requirements, DOE/NNSA has monitored tritium (and other radionuclides) in wells on the NNSS and nearby offsite areas. Other organizations, such as Nye County, also monitor tritium and other radionuclides in groundwater. Tritium has been detected in two offsite wells. In 2009, DOE/NNSA detected tritium in Well ER-EC-11, which is less than half a mile off the northwestern boundary of the NNSS on the Nevada Test and Training Range and about 14 miles from the nearest public water source, a private well (see Figure S–7). The tritium concentration was 13,180 picocuries per liter, which is below the U.S. Environmental Protection Agency's (EPA's) Safe Drinking Water Act standard of 20,000 picocuries per liter. Later, in 2010, DOE/NNSA found detectable levels of tritium (48.3 picocuries per liter) in Well PM-3, which is located about 11,000 feet west of the NNSS boundary on the Nevada Test and Training Range (see Figure S–7). **Figure S–8** displays the locations of these and other wells on the NNSS and nearby offsite areas, as well as associated tritium concentrations.

In compliance with the Federal Facility Agreement and Consent Order, DOE/NNSA continues to develop groundwater flow and transport models for each of the corrective action units to identify contaminant boundaries where waters inside the boundaries exceed the radiological protection requirements of the Safe Drinking Water Act. Contaminant boundaries provide the basis for establishing use-restriction areas and identifying regulatory boundaries for protection of the health and safety of the public.

Groundwater modeling development requires 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 1997). Second, groundwater flow (boundary conditions) from this regional model was used to develop groundwater flow and transport models for each underground corrective action unit. These smaller-scale groundwater models will be used to identify contaminant boundaries based on the maximum extent of contaminant migration over a 1,000-year period.

Although groundwater flow and transport models are under development, they have been completed only for the Frenchman Flat corrective action unit (see Figure S–7) (Navarro Nevada Environmental Services 2010). **Figure S–9** shows the model-based estimation of the extent of groundwater contamination where there is a 95 percent certainty that contamination will exceed the Safe Drinking Water Act standards for radionuclides in the Frenchman Flat area over the next 1,000 years.

Groundwater Use. In this *NNSS SWEIS*, DOE/NNSA examined the extent to which each of the alternatives would have an adverse impact on the capacity of aquifers (sustainable yield) within a hydrographic basin. Potential impacts were estimated by comparing current (baseline) groundwater demand for each basin, modified by the demand from continuing and proposed projects and capabilities under each alternative, to the sustainable yield of each basin. **Figure S–10** shows the basins underlying the NNSS.

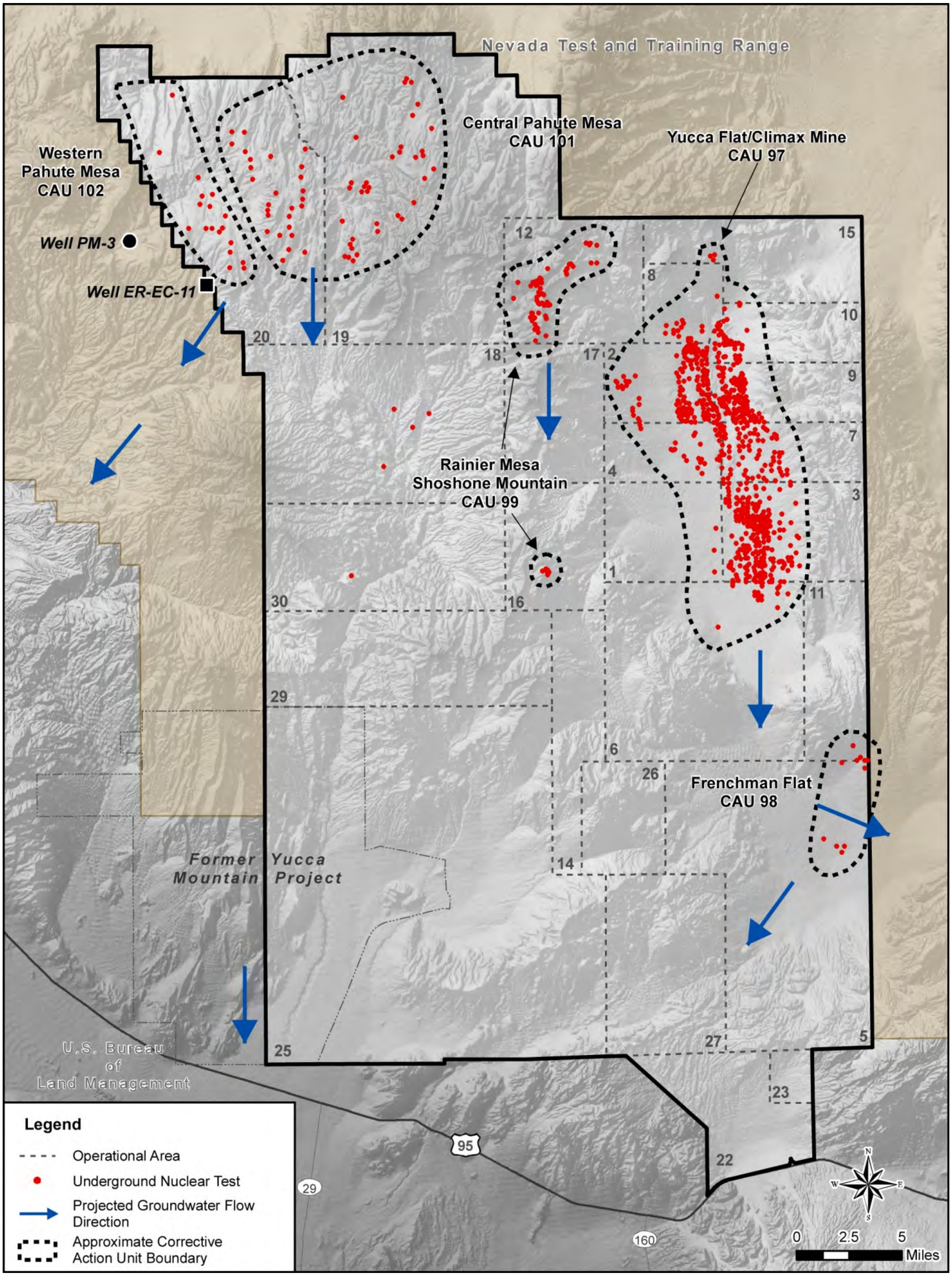

Figure S–7 Underground Test Area Corrective Action Units at the Nevada National Security Site

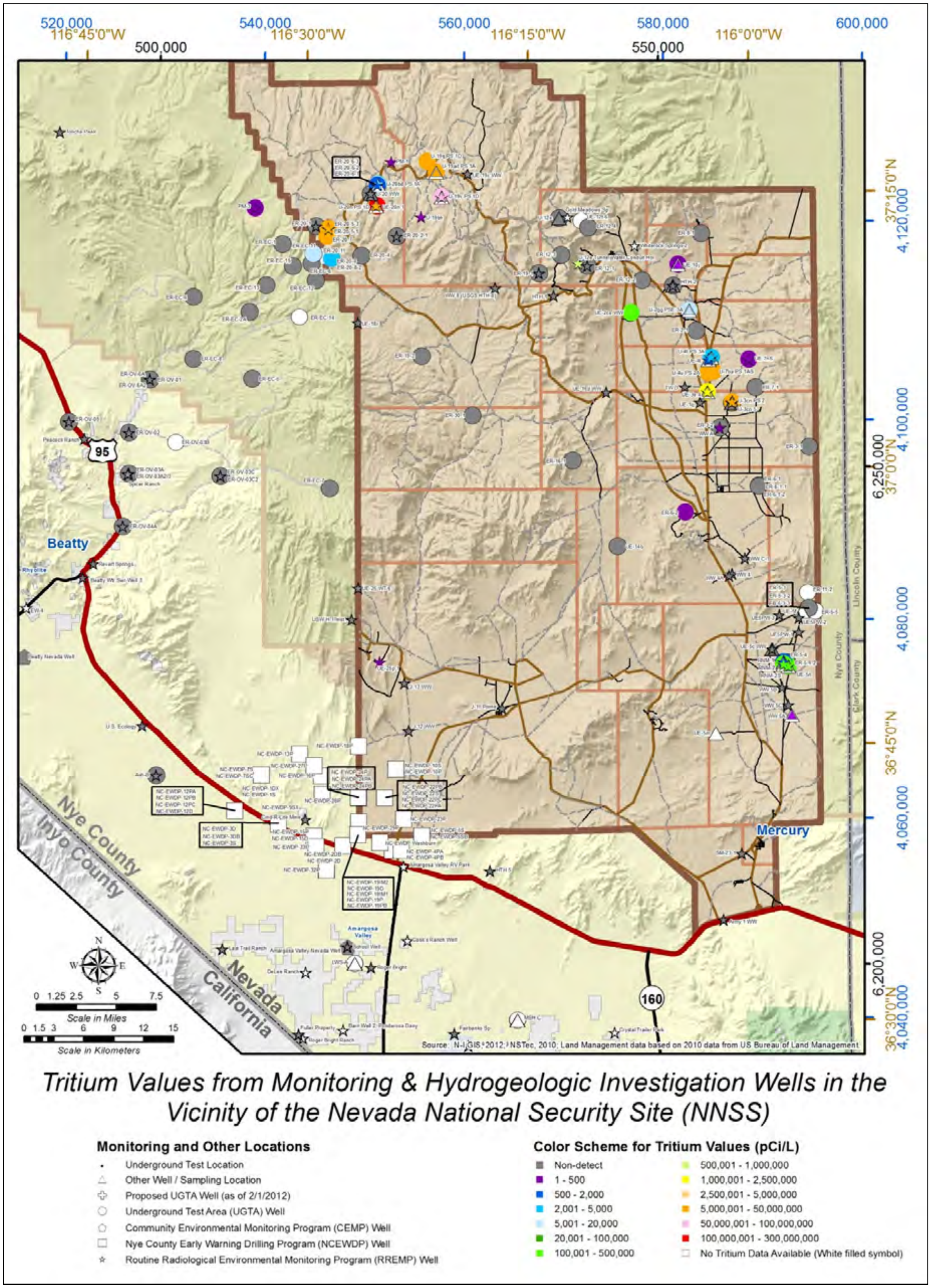

Figure S–8 Concentration of Tritium Detected in Monitoring and Hydrogeologic Investigation Wells and Springs of the Nevada National Security Site

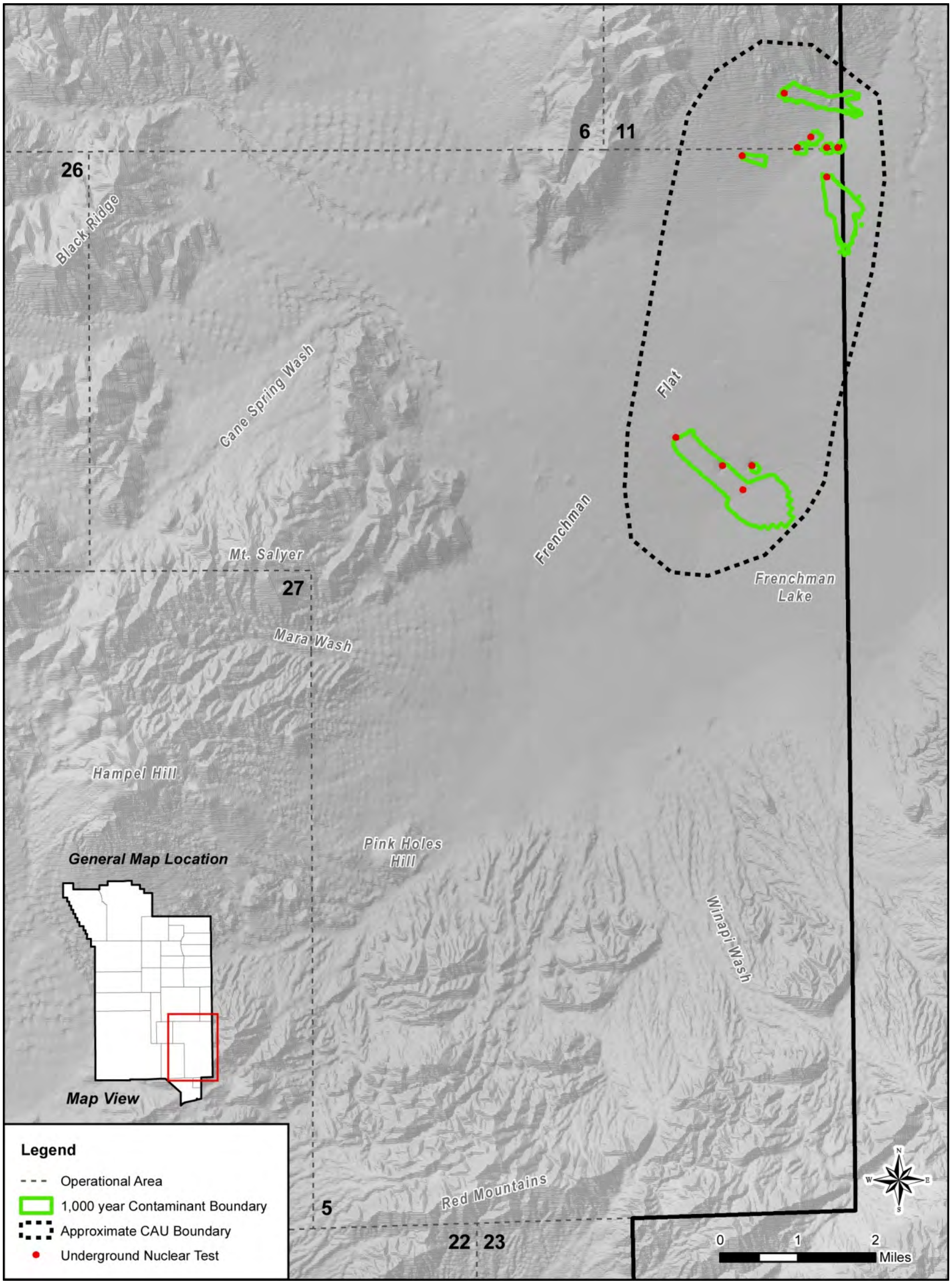

Figure S–9 Modeled Extent of the Contaminant Boundary in the Frenchman Flat Corrective Action Unit in 1,000 Years

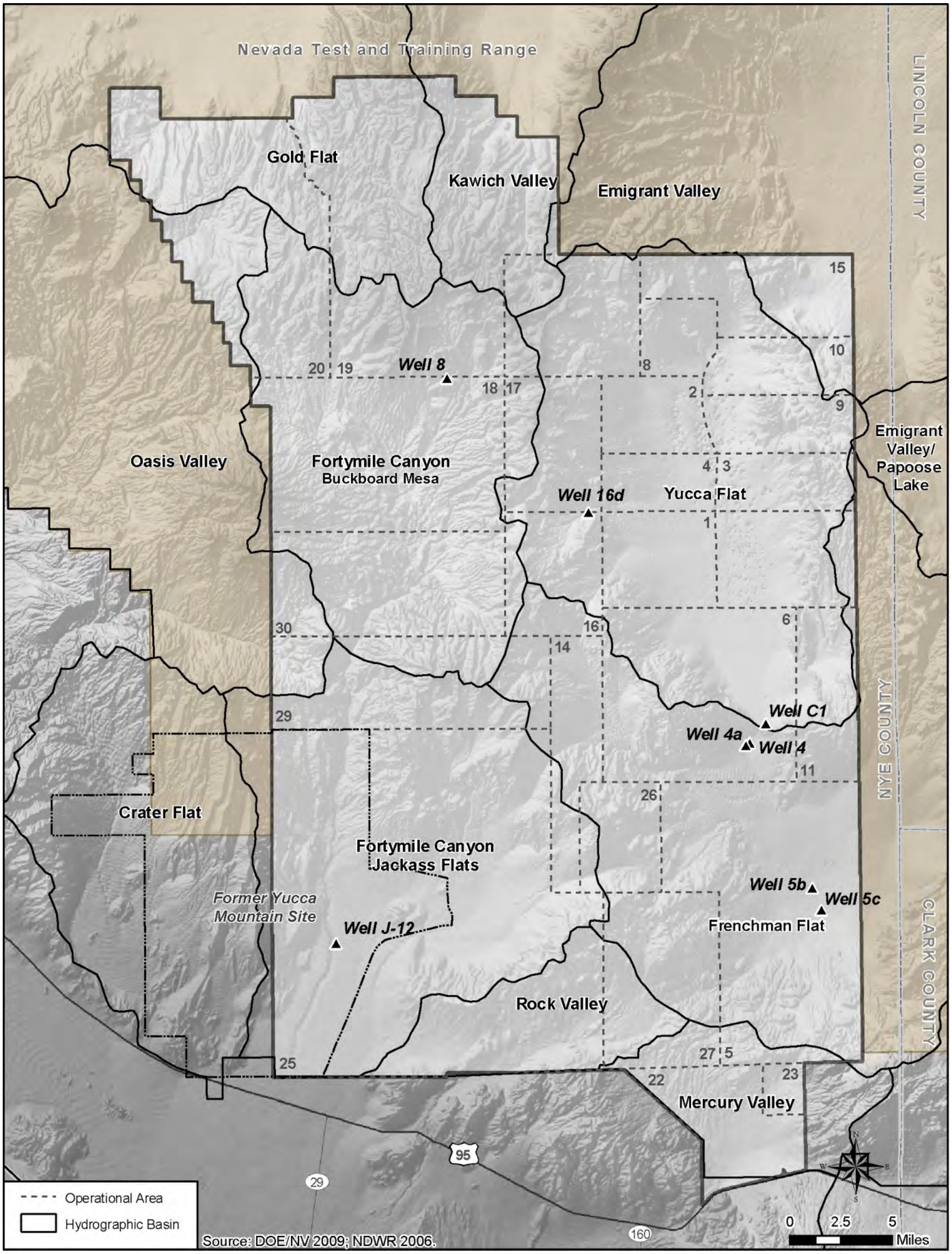

Figure S–10 Hydrographic Basins at the Nevada National Security Site

Annual water usage at the NNSS from 2005 through 2011 ranged from 530 to 691 acre-feet (NSTec 2010; Rudolph 2012). DOE/NNSA has established goals to reduce the use of potable water by 2015 by at least 16 percent from the 2007 total water use level of about 691 acre-feet per year (NSTec 2008) (potable water accounts for up to 90 percent of the current groundwater use). However, the analysis in this *NNSS SWEIS* did not account for this reduction in demand, and, instead, conservatively assumed a continued annual (baseline) water usage of 691 acre-feet.

Tables S–3 through **S–5** illustrate the estimated groundwater demand and the extent to which demand would affect sustainable yield of the affected basins (sustainable yields are from the Nevada State Engineer [NDWR 2010]). Under the three alternatives, withdrawals from each basin would be below the sustainable yield of each basin, with the exception of Frenchman Flat, where approximately 427 (Reduced Operations Alternative) to 591 percent (Expanded Operations Alternative) of the basin's sustainable yield would be withdrawn annually. The Nevada State Engineer estimates a perennial yield of 100 acre-feet per year for Frenchman Flat (NDWR 2010), which is based on assumptions that little or no groundwater recharge from precipitation occurs in the basin. Studies by DOE/NNSA and others suggest that in-basin recharge does occur and that perennial yield values are much higher than 100 acre-feet per year. Groundwater flow and transport models from underground corrective action unit activities (SNJV 2004), two U.S. Geological Survey models (Hevesi et al. 2003), and two Desert Research Institute models (Russell and Minor 2002) suggest greater estimates of precipitation-driven recharge (and thus perennial yield) to the Frenchman Flat basin. As an example, the underground corrective action unit model yields an estimate of 1,070 acre-feet per year, and the Desert Research Institute models provide perennial yield estimates of 1,920 acre-feet per year. Although DOE/NNSA appears to be overdrawing water from Frenchman Flat by a large percentage, water levels in wells have remained static and have not declined, even during peak water usage of 3,375 acre-feet in 1989. This suggests that the perennial yield of Frenchman Flat is far higher than 100 acre-feet per year and more likely in the range of yields estimated by DOE/NNSA and other models.

Groundwater Use Terms

Perennial yield is an estimate of the quantity of groundwater that can be withdrawn from a basin on an annual basis without depleting the basin (Scott et al. 1971).

Sustainable yield is the perennial yield of the basin minus any rights already committed by the Nevada State Engineer to other users.

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.

Construction and operation of one or more commercial solar power generation facilities would result in a marked increase in water consumption in Jackass Flats basin (and the single largest use of water on the NNSS), with the resulting long-term demand ranging from 5 (Reduced Operations Alternative) to 19 percent (Expanded Operations Alternative) of sustainable yield of the basin. While the Nevada State Engineer lists the perennial yield of the Fortymile Canyon, Jackass Flats Subdivision as 4,000 acre-feet per year, this value represents an aggregation of yield values for several basins adjacent to Jackass Flats (i.e., a regional yield value). Studies conducted by DOE show a range of values as low as 880 acre-feet per year (DOE 2008). These demands would be unlikely to reduce groundwater recharge to another downgradient aquifer to the degree that the aquifer's sustainable yield is reduced or current uses of that aquifer are adversely affected. Regardless, 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 as needed to avoid adversely impacting any single aquifer.

Table S–3 No Action Alternative Impacts on Groundwater Supply

Basin	***Water Demand, excluding solar power generation facility(ies) (acre-feet per year)***	***Water Demand, including construction demand from solar power generation facility(ies) (acre-feet per year)***	***Water Demand, including operational demand from solar power generation facility(ies) (acre-feet per year)***	***Nevada State Engineer 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 [a]	474 [a]
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
Total	691	1,041	941			

[a] Analysis is based on Nevada State Engineer estimates of perennial yield (100 acre-feet per year), which results in the appearance of an overutilization of the resource. To the contrary, several groundwater flow and transport models demonstrate higher estimates of precipitation-driven recharge (and thus perennial yield), and water levels in wells have not declined suggesting that perennial yield is far higher than 100 acre-feet per year.

Table S–4 Expanded Operations Alternative Impacts on Groundwater Supply

Basin	***Water Demand, excluding solar power generation facility(ies) (acre-feet per year)***	***Water Demand, including construction demand from solar power generation facility(ies) (acre-feet per year)***	***Water Demand, including operational demand from solar power generation facility(ies) (acre-feet per year)***	***Nevada State Engineer 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 [a]	591 [a]
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
Total	862	1,862	1,562			

[a] Analysis is based on Nevada State Engineer estimates of perennial yield (100 acre-feet per year), which results in the appearance of an overutilization of the resource. To the contrary, several groundwater flow and transport models demonstrate higher estimates of precipitation-driven recharge (and thus perennial yield), and water levels in wells have not declined suggesting that perennial yield is far higher than 100 acre-feet per year.

Table S–5 Reduced Operations Alternative Impacts on Groundwater Supply

Basin	***Water Demand, excluding solar power generation facility(ies) (acre-feet per year)***	***Water Demand, including construction demand from solar power generation facility(ies) (acre-feet per year)***	***Water Demand, including operational demand from solar power generation facility(ies) (acre-feet per year)***	***Nevada State Engineer 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 [a]	427 [a]
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
Total	622	822	797			

[a] Analysis is based on Nevada State Engineer estimates of perennial yield (100 acre-feet per year), which results in the appearance of an overutilization of the resource. To the contrary, several groundwater flow and transport models demonstrate higher estimates of precipitation-driven recharge (and thus perennial yield), and water levels in wells have not declined suggesting that perennial yield is far higher than 100 acre-feet per year.

S.3.1.5 Biological Resources

Implementing the alternatives would result in the permanent loss of native and nonnative vegetation of varying types, distribution and abundance, which would adversely impact wildlife that inhabit or otherwise use the NNSS. Vegetation would be lost through actions such as the drilling of new wells, grading and excavation for new facilities, detonations of high explosives, remediation of contaminated soils, and modification or construction of infrastructure such as roads and water lines.

In general, DOE/NNSA assessed the impacts on biological resources by considering the amount of land that would be disturbed under each alternative as a means to represent the permanent loss of vegetation and animal habitat. **Table S–6** provides an estimate of the amount of newly disturbed lands, and thus vegetation and habitat that would be lost, under each alternative.

Table S–6 Land Disturbance

Source of Disturbance	*No Action Alternative (acres)*	*Expanded Operations Alternative (acres)*	*Reduced Operations Alternative (acres)*
Total Land Disturbance	4,460	25,877	2,740
Commercial Solar Power Generation Facilities	2,650	10,300	1,200

The NNSS occupies approximately 870,000 acres of land, about 790,400 (91 percent) of which are undisturbed (DOE 2008). Of the undisturbed land, implementing the No Action, Expanded Operations, and Reduced Operations Alternatives would require an additional 4,460 (0.6 percent), 25,877 (3.3 percent), and 2,740 (0.4 percent) acres, respectively.

Vegetation. Under the Expanded Operations Alternative, which would result in the highest land disturbance among the alternatives, the primary vegetation alliances that would be impacted are Creosote Bush/White Bursage Shrubland, Nevada Jointfir Shrubland, Saltbush Shrubland, Blackbrush Shrubland, and Burrobush/Wolfberry Shrubland. In total, these vegetation alliances cover about 483,200 acres, or about 61 percent of the undisturbed lands on the NNSS. Because of the prevalence of these vegetation types on the NNSS as well as regionally, the amount of additional habitat loss (25,877 acres) would not reduce the viability of any of the vegetation alliances or result in substantial adverse impacts on biodiversity. However, some areas of creosote bush/white bursage vegetation in Jackass Flats and Frenchman Flat, as well as blackbrush vegetation in Yucca Flat, are considered sensitive habitat (BN 1999; DOE/NV 1998a) because soils are particularly vulnerable to wind erosion and require longer periods of time to recover if disturbed. To the extent possible, DOE/NNSA would avoid activities that would disturb soils in these areas.

Implementing the No Action and Reduced Operations Alternatives would result in lesser amounts of land disturbance (see Table S–6) in the same vegetation alliances, with the exception of Blackbrush Shrubland, which is not prevalent in the areas that would be affected by these alternatives. The additional habitat loss under either of these alternatives would not reduce the viability of any of the vegetation alliances or result in substantial adverse impacts on biodiversity because of the prevalence of these vegetation types on the NNSS and regionally. However, although less than under the Expanded Operations Alternative, activities under the No Action and Reduced Operations Alternatives would also occur in some areas of Jackass Flats and Frenchman Flat that have creosote bush/white bursage vegetation. To the extent possible, DOE/NNSA would avoid activities that would disturb soils in these areas.

Sensitive and Protected Species. The desert tortoise, a "threatened" species, is the only plant or animal species on the NNSS that has been determined by the U.S. Fish and Wildlife Service (USFWS) to be threatened or endangered. DOE/NNSA focused its analysis of direct and indirect impacts on the desert tortoise because data are available to delineate desert tortoise habitat on the NNSS, and these data allow quantitative estimates of the potential impacts on desert tortoises from ongoing and proposed activities at the NNSS.

On the NNSS, the northern extent of the desert tortoise occurs between elevations of approximately 3,900 and 4,880 feet above mean sea level, and its distribution and population densities are shown in **Figure S–11**. In its 2009 *Final Programmatic Biological Opinion for Implementation of Actions Proposed on the Nevada Test Site, Nye County, Nevada (2009 Biological Opinion*), USFWS concluded that activities 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 (USFWS 2009). The *2009 Biological Opinion* also identified terms and conditions applicable to activities on the NNSS. Under these terms and conditions, USFWS determined that up to 2,710 acres of land could be disturbed, and up to 216 tortoises could be "taken" incidentally, that is, 22 could be killed or injured, and 194 could be harassed (captured, displaced, relocated, have their behavior disrupted, or intentionally removed and relocated) without the need to reinitiate consultation.

Based on the distribution and a density range of 10 to 45 tortoises per square mile (DOE/NV 1998b), DOE/NNSA estimated the amount of desert tortoise habitat disturbed and the range of the number of tortoises that could be taken under each alternative (see **Table S–7**). Implementing any alternative would result in disturbing desert tortoise habitat; however, only the No Action and Expanded Operations Alternatives would result in disturbance in excess of that permitted by USFWS. Under the Expanded Operations Alternative, the estimated number of tortoises taken (163 to 346) could exceed that permitted by USFWS (216), whereas under the No Action and Reduced Operations Alternatives, the estimated number of tortoises taken (133 to 213 and 131 to 181, respectively) would be less than that permitted by USFWS.

DOE/NNSA anticipates that the take of desert tortoises would be due primarily to harassment, rather than injury or death, because DOE/NNSA would continue to implement its Desert Tortoise Compliance Program, which requires, in part, (1) conducting clearance surveys at project sites within 1 day of the start of project construction, (2) ensuring that environmental monitors are on site during heavy equipment operations, and (3) ensuring personnel are trained in the requirements of the *2009 Biological Opinion*. Based on the annual average of takes due to injury or death on NNSS roadways since 1992 (0.75 tortoises), only a single (1) tortoise would be expected to be taken by injury or mortality each year, and the remainder would be taken by harassment by being moved off roadways or from areas of proposed land disturbance to prevent their injury or death. Nonetheless, if either the permitted disturbance of tortoise habitat or take of tortoises were reached and anticipated to be exceeded during implementation of the alternatives, DOE/NNSA would reinitiate consultation with USFWS in accordance with the *2009 Biological Opinion*.

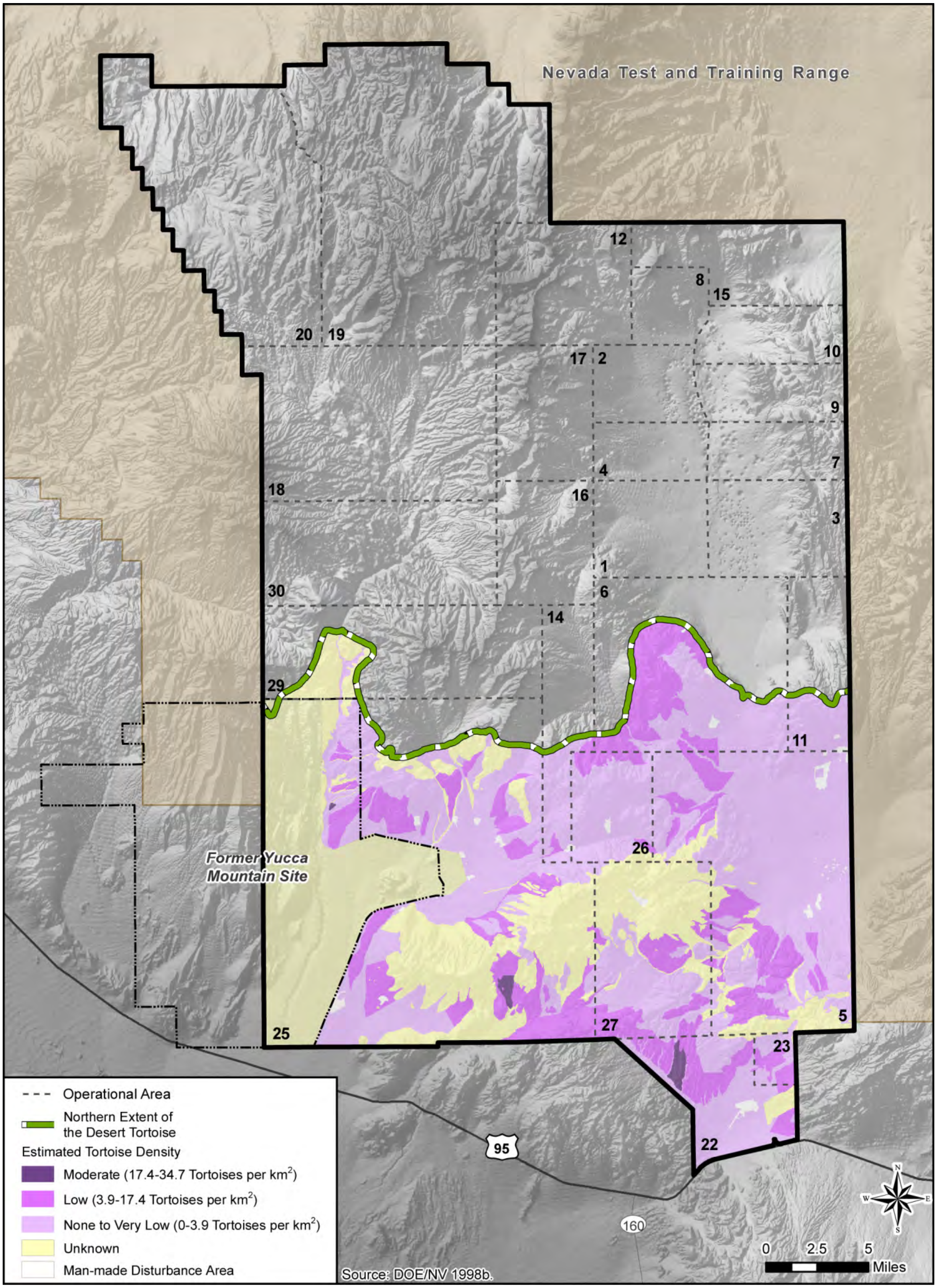

Figure S–11 Desert Tortoise Range and Abundance on the Nevada National Security Site

Table S–7 Potential Impacts on Desert Tortoises at the Nevada National Security Site

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*U.S. Fish and Wildlife Service Limit*
Area of Desert Tortoise Habitat Disturbed (acres)				
Total	**3,705**	**13,670**	**2,120**	**2,710**
Commercial Solar Power Generation Facility(ies)	2,650	10,300	1,200	
Number of Desert Tortoises Taken				
Total	**133—213**	**163–346**	**131–181**	**216**
Commercial Solar Power Generation Facility(ies)	0–41	0–161	0–19	

S.3.1.6 Air Quality

Ambient air quality in Clark and Nye Counties would be adversely impacted because of releases of air pollutants from stationary, mobile, and fugitive sources, with the magnitude of the impact variable by alternative. Greenhouse gases, also released from these sources, would contribute to global climate change.

Air quality is determined, in part, by measuring concentrations of certain pollutants (referred to as "criteria pollutants") in the atmosphere. The 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 EPA and the State of Nevada include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, and particulate matter (two different sizes of particulates are regulated).

Air quality also is determined, in part, by estimating emissions of hazardous air pollutants; these pollutants are known or suspected to cause cancer or other serious health effects, such as birth defects. EPA, under the Clean Air Act, established emission standards (the National Emission Standards for Hazardous Air Pollutants) for 188 such pollutants, most of which originate from manmade sources. Benzene, for example, is found in gasoline. In establishing the standards, 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 extent achievable.

Greenhouse gases are emitted from a wide variety of sources, including energy production, industrial processes, waste, agriculture, and forestry. Carbon dioxide is by far the primary greenhouse gas emitted in the United States (EPA 2009); other gases include methane, nitrous oxide, and a variety of fluorinated gases. Effects of these emissions on the climate involve very complex processes, although recent advances in the state of the science regarding these processes suggest a very high likelihood that greenhouse gases produced by humans are affecting climate in detectable and quantifiable ways (IPCC 2008).

Greenhouse Gases

Greenhouse gases are gaseous constituents of the atmosphere, both natural and anthropogenic (resulting from or produced by human beings), that absorb and emit thermal infrared radiation (heat) emitted by the Earth's surface, the atmosphere itself, and clouds. Water vapor, carbon dioxide, nitrous oxide, methane, and ozone are the primary greenhouse gases in the Earth's atmosphere. Greenhouse gases trap heat between the Earth's surface and the lower part of the atmosphere; this phenomenon is called the greenhouse effect.

For each alternative, DOE/NNSA estimated the amount of nonradiological and hazardous air pollutants, and greenhouse gases (expressed as carbon dioxide-equivalents) that would be released during the construction of proposed projects and the operation of ongoing and proposed projects (see **Table S–8**).

Table S–8 Emissions of Air Pollutants and Greenhouse Gases at the Nevada National Security Site (tons per year)

		No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*
	Estimated 2008 Emissions	*Annual Average Operational Emissions in 2015*		
Particulate Matter$_{10}$	3.3	6.8	20.1	4.4
Particulate Matter$_{2.5}$	2.7	3.4	8.1	2.6
Carbon Monoxide	181.3	123.3	160.9	109.8
Nitrogen Oxides	64.2	39.7	56.6	36.3
Sulfur Dioxide	0.41	0.55	1.1	0.41
Volatile Organic Compounds	4.0	5.9	11.0	4.8
Lead	0.0024	0.030	~0.010	0.0024
Hazardous Air Pollutants	0.56	0.41	~0.53	0.40
Carbon Dioxide-equivalent	50,478	39,690	49,303	38,045
	Estimated 2008 Emissions	*Peak Year Construction Emissions* [a]		
Particulate Matter$_{10}$	3.3	20.0	129.1	8.4
Particulate Matter$_{2.5}$	2.7	6.0	35.6	2.6
Carbon Monoxide	181.3	44.8	296.5	24.4
Nitrogen Oxides	64.2	56.0	388.6	24.4
Sulfur Dioxide	0.41	0.14	0.68	0.08
Volatile Organic Compounds	4.0	6.2	41.6	2.8
Lead	0.0024	0.0000089	0.000013	0.0000071
Hazardous Air Pollutants	0.56	0.038	0.058	0.030
Carbon Dioxide-equivalent	50,478	5,686	21,158	2,774

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.
[a] Represents emissions for first year of construction, as construction activity would be linearly distributed over multiple years; however, mobile source emissions would be highest in the first construction year.

In general, emission-generating activities under any alternative would be widely dispersed over the 1,360-square-mile area of the NNSS, as well as along the U.S. Route 95 corridor between Las Vegas and the NNSS. Thus, at the boundaries of the NNSS, ambient air concentrations are expected to be below the National Ambient Air Quality Standards. Nye County would continue to be in attainment for all criteria pollutants, while in Clark County, these emissions would not cause or contribute to any new violations of the standards or increases in the frequency or severity of any violations of the standards. DOE/NNSA also estimates that emissions of hazardous air pollutants would continue to remain low under any alternative and would not require additional emission control technologies; and, therefore, such emissions would not pose an undue health risk to workers or the public. Greenhouse gas emissions, while estimated to decrease relative to baseline levels, would still contribute to global climate change.

More specifically, emissions of carbon monoxide, nitrogen oxides, and greenhouse gases attributable to the levels of operations would decrease relative to existing levels under any alternative. These reductions would be due primarily to the introduction over time of newer DOE/NNSA fleet and worker vehicles with improved fuel economy, as well as improved combustion and emissions treatment efficiencies for electric power generation sources on the NNSS.

In contrast, relative to 2008 levels, emissions of volatile organic compounds, sulfur dioxide, and particulate matter would increase under the No Action and Expanded Operations Alternatives. The higher emissions of volatile organic compounds would result from the increased use of ethanol-blended fuels in vehicles. Sulfur dioxide and particulate matter emissions would increase primarily because of new projects and an increase in the levels of operations on the NNSS. Corresponding emissions under the Reduced Operations Alternative would tend to remain similar to existing emissions levels.

S.3.1.7 Visual Resources

The evaluation of visual impacts requires an understanding and identification of the visual resources (features) of the landscape, an assessment of the character and quality of those resources relative to the overall regional visual character, and a determination of the importance to people, or sensitivity, of views of visual resources in the landscape. DOE/NNSA evaluated the impact on visual resources in consideration of scenic quality classes, which are defined as follows:

- 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.

Under the No Action Alternative, only the construction of a commercial solar power generation facility and associated transmission lines in Area 25 would affect the existing visual resources of the NNSS. However, with projected traffic volumes along U.S. Route 95 of about 3,000 average daily trips, viewer sensitivity (i.e., the importance of a particular viewshed to the public) would remain moderate. A solar power generation facility and associated transmission line, which would occupy about 2,650 acres, would introduce a source of glare, alter the visual character of a landscape that is largely undeveloped, be visible to highly sensitive viewers, and reduce the existing visual quality from Class B to Class C.

Under the Expanded Operations Alternative, new facilities would be constructed or reconfigured, an existing electric transmission line would be upgraded, and geothermal and solar energy projects would be constructed. With the projected traffic volumes along U.S. Route 95, viewer sensitivity would change from moderate to high near Mercury (approximately 5,310 average daily trips) and near Area 25 (approximately 3,030 average daily trips). For most such facilities, impacts on visual resources would not be adverse. However, the addition of approximately 200,000 square feet of facilities to the Desert Rock Airport would be visible from U.S. Route 95 and would have an adverse visual impact, as would the construction of commercial solar power generation facilities and associated transmission lines on approximately 10,350 acres in Area 25, which would reduce the visual quality from Class B to Class C. The Geothermal Demonstration Project could also alter the visual character and reduce visual quality if its facilities are visible from U.S. Route 95.

Under the Reduced Operations Alternative, only the construction of a commercial solar power generation facility in Area 25 would affect existing visual resources. A solar power generation facility, which would occupy about 1,200 acres, would reduce the existing visual quality of this area of Area 25 from Class B to Class C, even though viewer sensitivity would remain moderate (2,980 average daily trips).

S.3.1.8 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 in the National Register of Historic Places (the Register) because of their association with the 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).

National Register of Historic Places

The National Register of Historic Places is the official list of the Nation's historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966, the National Park Service's National Register of Historic Places is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources.

An area's potential for containing cultural resources sites is site specific and influenced by factors such as the presence of water, food sources, shelter (e.g., caves or rock alcoves), sources 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, the areas with the highest number of recorded cultural resources are Rainier and Pahute Mesas in the northwest, Jackass Flats in the southwest, and Yucca Flat in the east. Although it is not possible to predict with a high degree of certainty the number of cultural resources sites in a given area, 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 area.

Cultural Resources Management

As part of compliance with Section 106 of the National Historic Preservation Act, the National Nuclear Security Administration (NNSA) conducts cultural resource 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, NNSA avoids significant cultural resources impacts by adjusting the location of a proposed undertaking. When avoidance is not practicable, NNSA 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 the No Action Alternative, the disturbance of approximately 4,460 acres of land would affect an estimated 1,855 cultural resources sites, 575 of which would be eligible for inclusion in the Register. DOE/NNSA estimates that implementing the Expanded Operations Alternative would disturb approximately 25,877 acres of land and thereby directly affect about 7,688 cultural resources sites, about 2,447 of which would be eligible for inclusion in the Register. Under the Reduced Operations Alternatives, approximately 2,170 acres of land would be disturbed, directly affecting about 861 cultural resources sites; about 266 of these sites would be eligible for inclusion in the Register.

One or more commercial solar power generation facilities, including an associated transmission line, would be developed in Area 25. Solar power generation facilities would vary in size; under the No Action, Expanded Operations, and Reduced Operations Alternatives, the facilities would disturb approximately 2,650, 10,300, and 1,200 acres, respectively. **Table S–9** presents the estimated number of cultural resources sites that would be impacted by solar power generation facilities under the three alternatives, including a subset of those eligible for listing in the Register.

Table S–9 Cultural Resources Sites Impacted by Solar Power Generation Facilities

Alternative	*Cultural Resources Sites*	*National Register of Historic Places – Eligible Sites*
No Action	1,802	557
Expanded Operations	7,004	2,163
Reduced Operations	816	252

S.3.1.9 Waste Management

At the NNSS, DOE/NNSA operations, environmental restoration, and decontamination and decommissioning activities would generate low-level radioactive waste; mixed low-level radioactive waste; transuranic waste; hazardous waste; explosive waste; and nonhazardous wastes, including sanitary solid waste, hydrocarbon-contaminated soil and debris, and construction and demolition debris. DOE/NNSA also accepts waste for disposal at the NNSS, including low-level and mixed low-level radioactive waste and selected nonradioactive classified wastes, from other in-state locations such as the TTR, as well as from authorized out-of-state DOE and U.S. Department of Defense generators.

DOE/NNSA assessed waste management impacts by comparing the projected waste volumes generated or disposed under each alternative to current waste management practices and/or the availability of onsite or offsite waste management capacity. **Table S–10** summarizes the types and volumes of wastes generated and disposed at the NNSS under the three alternatives. The estimates of low-level radioactive waste and mixed low-level radioactive waste volumes to be disposed of at the NNSS under the Expanded Operations Alternative are based upon conservative estimates from waste-generating facilities, and the aggregated totals reflect this conservatism (i.e., likely overestimates quantities). Appendix A, Section A.2.2.1, Table A–6, of this SWEIS provides additional details regarding generators and their associated waste volumes; Chapter 6, Table 6–13, of this SWEIS shows historical and projected disposal volumes.

Table S–10 Waste Generated and Disposed at the Nevada National Security Site

Waste Stream	*Alternatives*		
	No Action (cubic feet)	*Expanded Operations (cubic feet)*	*Reduced Operations (cubic feet)*
Waste Volumes Generated at the Nevada National Security Site			
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	9,600	19,000	7,100
Hazardous waste	210,000	340,000	190,000
Sanitary solid waste and construction and demolition debris	3,800,000	10,000,000	3,700,000
Waste Volumes Disposed at the Nevada National Security Site			
Low-level radioactive waste	15,000,000	48,000,000	15,000,000
Mixed low-level radioactive waste	900,000	4,000,000	900,000
Sanitary solid waste and construction and demolition debris	3,500,000	9,200,000	3,400,000

Construction and operation of one or more solar power generation facilities in Area 25 at the NNSS under each of the three alternatives also would generate hazardous waste, sanitary solid waste, and construction debris. **Table S–11** describes the estimated volumes of these wastes.

Table S–11 Waste Generated by Construction and Operation of Commercial Solar Power Generation Facilities

Waste Stream	*Alternatives*		
	No Action (cubic feet)	*Expanded Operations (cubic feet)*	*Reduced Operations (cubic feet)*
Waste Volumes Generated During Construction			
Hazardous waste	6,500	27,000	2,700
Sanitary solid waste and construction debris	140,000	600,000	60,000
Waste Volumes Generated During Operations (per year)			
Hazardous waste	7,100	30,000	3,000
Sanitary solid waste and construction and demolition debris	41,000	5,400	3,400

Waste Definitions

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

Transuranic 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 – Radioactive waste not classified as high-level radioactive waste, transuranic 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 transuranic elements is less than 100 nanocuries per gram.

Greater-than-Class C Waste -- The U.S. Nuclear Regulatory Commission (NRC) classification system for the four classes of low-level radioactive waste (A, B, C, and greater-than-Class C) is established in Title 10 of the *Code of Federal Regulations*, Section 61.55, (10 CFR 61.55) and is based on the concentrations of specific short- and long-lived radionuclides given in two tables. 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 greater-than-Class C low-level radioactive waste generated by NRC and agreement state licensees. The U.S. Department of Energy is the Federal Agency responsible for disposal of greater-than-Class C low-level radioactive 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 the Resource Conservation and Recovery Act and must exhibit at least one of four characteristics described in 40 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 the Resource Conservation and Recovery Act, 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 and mixed transuranic waste.

Under the No Action and Reduced Operations Alternatives, sufficient capacity would be available at the NNSS to dispose the projected volume of low-level radioactive waste and mixed low-level radioactive waste at the Area 5 Radioactive Waste Management Complex. The Waste Isolation Pilot Plant near Carlsbad, New Mexico, maintains adequate capacity to enable the disposal of transuranic waste generated at the NNSS. In addition, adequate capacity is expected to exist in Nevada and elsewhere in the United States to recycle or treat, store, and dispose hazardous waste generated at the NNSS, including waste generated by a solar power generation facility. For instance, four treatment, storage, and disposal facilities were permitted to receive hazardous waste in Nevada as of 2009 (NDEP 2009). There is also existing capacity at the NNSS to dispose nonhazardous waste (including such waste from a solar power generation facility). As of 2008, DOE/NNSA estimated that the three NNSS landfills have the following waste capacities: the Area 6 Hydrocarbon Solid Waste Disposal Site, 2.8 million cubic feet; the Area 9 U10c Solid Waste Disposal Site, 15 million cubic feet; and the Area 23 Solid Waste Disposal Site, 13 million cubic feet.

Under the Expanded Operations Alternative, the Area 3 Radioactive Waste Management Site could be reopened to receive low-level radioactive waste generated from environmental restoration and other activities at DOE/NNSA sites in the State of Nevada. Specifically, this action could be triggered by a need for additional disposal space beyond that available in the Area 5 Radioactive Waste Management Complex for the disposal of large onsite remediation debris, or soils from cleanup activities on the Nevada Test and Training Range. There is no near-term need to use the Area 3 Radioactive Waste Management Site; however, should DOE/NNSA identify a need to reopen the Area 3 Radioactive Waste Management Site in the future, it would first undertake detailed consultation with the State of Nevada and would limit disposal to in-state-generated, nonhazardous low-level radioactive waste. The Waste Isolation Pilot Plant maintains adequate capacity to enable the disposal of transuranic waste generated at the NNSS. In addition, for the reasons described immediately above, adequate capacity is expected to exist in Nevada and elsewhere in the United States to recycle or treat, store, and dispose hazardous waste generated at the NNSS, including the waste from solar power generation facilities, and to dispose nonhazardous solid waste in NNSS or offsite landfills.

S.3.1.10 Human Health

Surface-disturbing activities, tests, and experiments (operations) at various facilities on the NNSS could result in health impacts on workers and the public from exposure to radioactive waste and materials and hazardous chemicals. Workers could also be exposed to hazardous chemicals and would be subject to industrial accidents.

Radiological impacts were estimated (numerically calculated) for three public receptors: the general population living within 50 miles of a location at which radiation is released; a maximally exposed individual, which is a hypothetical individual assumed to be at the offsite location that would receive the maximum radiological exposure; and a subsistence consumer who derives all of his or her sustenance from the land and receives the same exposures as the maximally exposed individual. General population impacts were estimated for a residential scenario whereby people are exposed to radiation emitted from operational facilities, other locations where experiments are to be performed, environmental restoration activities, or legacy weapons testing areas that emit tritium or are contaminated with particulate radioactive materials. DOE/NNSA also considered potential impacts on the public from exposure to hazardous chemicals.

Impacts on the maximally exposed individual were estimated for a scenario that included the same exposure pathways assumed for the general population, but assumed an increased amount of time spent outdoors and a higher rate of contaminated food consumption. Impacts on the subsistence consumer were estimated for a scenario in which the maximally exposed individual was assumed to live near the NNSS at a location where the soil has been contaminated with radionuclides, and a portion of the individual's diet was assumed to be derived from crops raised on this soil, with the balance of the diet coming from wildlife that also has become contaminated on the NNSS.

Potential radiological and chemical impacts also were considered for two categories of workers: (1) those directly involved in activities associated with assigned missions (involved workers) and (2) nearby, noninvolved workers. An involved worker is defined as a person who is exposed to radioactive or chemical emissions during normal operations. A noninvolved worker is defined as a person who is incidentally exposed to radioactive or chemical emissions, either during normal operations or as a result of an accident.

Radiological impacts were estimated (numerically calculated) for involved workers routinely exposed to radioactive emissions, but were not estimated for these workers under accident conditions. In the event of an accident, although involved workers could receive a radiation dose, the impacts were not estimated because it is recognized that an accident could lead to extensive physical injuries or high radiological exposures and, ultimately, to worker deaths.

Impacts also were estimated (numerically calculated) for noninvolved workers incidentally exposed to radiological emissions under accident conditions. Noninvolved workers generally were assumed to be 110 yards downwind of the emission source, except in those instances where the presence of a noninvolved worker would not be logical (for example, inside the exclusion zone of a high-explosives experiment).

In addition, DOE/NNSA estimated impacts on the entire workforce (involved and noninvolved) from industrial accidents.

Normal Operations. Under the No Action Alternative, the public and workers would be exposed to radiation primarily from widespread diffuse sources, such as residual radioactive contamination, and from releases from activities associated with the Stockpile Stewardship and Management Program at the Dense Plasma Focus Facility in Area 11 and the Environmental Restoration Program. DOE/NNSA estimates that the offsite population would receive 0.50 person-rem, resulting in an estimated risk of 0.0003 latent cancer fatalities to that population (an annual risk of 1 chance in 3,300 of a single latent cancer fatality in the population). The maximally exposed individual would receive an estimated dose of 2.8 millirem, resulting in a risk of 1 chance in 500,000 (0.000002) of contracting a fatal cancer, and the subsistence consumer would receive an estimated dose of 13 millirem, resulting in a risk of 1 chance in 130,000 (0.000008) of contracting a fatal cancer. The involved worker population would receive an estimated collective dose of 5.2 person-rem, resulting in a risk of 0.003 latent cancer fatalities to that population (an annual risk of 1 chance in 330 of a single latent cancer fatality in the population). The estimated latent cancer fatalities to the public and worker populations under the Reduced Operations Alternative would be the same as or less than those under the No Action Alternative.

Under the Expanded Operations Alternative, the public and workers would be exposed to radiation primarily from widespread diffuse sources, such as residual radioactive contamination, and from releases from activities associated with the Stockpile Stewardship and Management Program at the Dense Plasma Focus Facility in Area 11 and the Big Explosives Experimental Facility in Area 4, tracer experiments under the Work for Others Program, and the Environmental Restoration Program activities. DOE/NNSA estimates that the offsite population would receive a dose of 0.89 person-rem, resulting in a risk of 0.0005 latent cancer fatalities to that population (an annual risk of 1 chance in 2,000 of a single latent cancer fatality in the population). The maximally exposed individual would receive an estimated dose of 4.8 millirem, resulting in an annual risk of 1 chance in 330,000 (0.000003) of contracting a fatal cancer, and the subsistence consumer would receive an estimated dose of 15 millirem, resulting in a risk of 1 chance in 110,000 (0.000009) of contracting a fatal cancer. The involved worker population would receive an estimated collective dose of 6.6 person-rem, resulting in a risk of 0.004 latent cancer fatalities to that population (an annual risk of 1 chance in 250 of a single latent cancer fatality in the population).

Radiological and Chemical Accidents. DOE/NNSA considered a range of potential accidents, including the maximum reasonably foreseeable accident, associated with ongoing and proposed projects and activities at various facilities on the NNSS. The same types of operations involving radioactive waste and materials, and hazardous chemicals would occur at the facilities under each of the alternatives, but the levels of operations would vary by alternative. Nonetheless, the accident scenarios and consequences analyzed were the same for each alternative because the differences in accident frequencies (probabilities of occurrence) due to the levels of operations were within the uncertainty range of the accident frequencies.

Maximum reasonably foreseeable accidents involving a release of radioactivity would involve a beyond-design basis earthquake at the Device Assembly Facility in Area 6 followed by the release of 5 kilograms of plutonium, or an explosion followed by the release of 1 kilogram of plutonium to the atmosphere. The estimated probabilities of these events occurring are 1×10^{-6} and 8×10^{-4} per year of operation, respectively (1 chance in 1,000,000 and 1 chance in 1,250).

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 severe earthquake accident would result in the highest consequences for the public and workers. If it were to occur, the maximally exposed individual would receive an estimated dose of 860 millirem, corresponding to a latent cancer fatality risk of 0.0005 (1 chance in 2,000). The offsite population within 50 miles would receive a collective dose estimated to be 113 person-rem; the calculated number of latent cancer fatalities associated with this dose is 0.07, implying that the most likely outcome would be no additional latent cancer fatalities in the exposed population. An involved worker within the Device Assembly Facility could be fatally injured in the explosion, and a noninvolved worker (located 110 yards downwind of the release) would receive an estimated dose of 2,800 rem, resulting in a lethal dose.

The above consequences would be reduced by a factor of 1 million if the probability of the accident occurring were taken into account. Because the probability of this accident is 1 chance in 1 million, the Device Assembly Facility accident involving an explosion followed by release of plutonium presents a higher risk (consequence times probability) to the public. The explosion followed by a plutonium release accident represents an estimated latent cancer fatality risk to the maximally exposed individual of 9×10^{-8} (1 chance in 11 million), the risk of a single latent cancer fatality in the population of 1×10^{-5} (1 chance in 100,000), and a latent cancer fatality risk to a noninvolved worker of 3×10^{-6} (1 chance in 300,000).

The maximum reasonably foreseeable accident involving a chemical release would involve an accidental chlorine gas release from a railcar at the Nonproliferation Test and Evaluation Complex. This hypothetical accident is expected to be in the "extremely unlikely" to "beyond extremely unlikely" frequency category, in other words, in the 10^{-4} (1 chance in 10,000) to 10^{-6} (1 chance in 1,000,000) per year or lower frequency range.

DOE/NNSA estimates that fatal concentrations of chlorine would extend downwind a few miles under typical daytime conditions and for 5 to 6 miles, or greater under more-stable (reduced windspeeds and limited vertical mixing) nighttime conditions. Chlorine concentrations that could lead to irreversible and long-lasting health effects would extend further downwind. DOE/NNSA considers these health impacts to be conservative in that the analysis was based on a 1-hour chlorine release; during actual accidents, however, releases occurred over many hours, which resulted in lower concentrations than estimated here.

Members of the public likely would not be affected by a chlorine release because the remote location of the Nonproliferation Test and Evaluation Complex 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.

Industrial Accidents. DOE/NNSA estimated the injuries and fatalities that could arise in the workforce from industrial accidents based upon accident rates from DOE and the U.S. Department of Labor (DOE 2010; DOL 2010a, 2010b). Total recordable cases, as well as those cases that result in lost workdays, restricted duty, or require a transfer, were estimated for construction activities and facility operations (see **Table S–12**). Industrial accidents that could result in fatalities are more likely to occur during construction activities than during facility operations and include, for example, electrocution and equipment mishaps. DOE/NNSA estimates that less than one fatality would occur during construction activities at the NNSS (see **Table S–13**).

Table S–12 Estimated Incidence of Nonfatal Accidents at the Nevada National Security Site

	No Action Alternative		*Expanded Operations Alternative*		*Reduced Operations Alternative*	
Location/Activity	*Total Recordable Cases*	*Lost Workdays, Restrictions, Transfer*	*Total Recordable Cases*	*Lost Workdays, Restrictions, Transfer*	*Total Recordable Cases*	*Lost Workdays, Restrictions, Transfer*
All Operations (annual total)	32	14	44	20	28	13
Commercial Solar Power Generation Facilities – Operations (annual)	6.2	3.2	8.3	4.2	5.2	2.7
Commercial Solar Power Generation Facilities – Construction	60	31	110	56	44	23

Table S–13 Estimated Incidence of Fatal Construction Accidents at the Nevada National Security Site

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*
All Operations Annually (includes commercial solar power generation facilities)	0.019	0.031	0.015
Commercial Solar Power Generation Facilities Construction (during construction)	0.019	0.029	0.015

Table S–14 Summary of Potential Direct and Indirect Impacts at the Nevada National Security Site

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use				
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 Operations, 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 levels 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 under 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 under 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				
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 low-level radioactive waste cells would be developed to accommodate disposal of those waste types. Up to 50 new wells would be developed by the Underground Test Area Project. 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 expected to affect the NNSS solid waste or wastewater infrastructure.	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 low-level and mixed low-level radioactive waste cells would be developed to accommodate disposal of increased volumes of those waste types and new sanitary and construction, decontamination and decommissioning 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. 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 generation 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 wastewater infrastructure.	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. A commercial 100-megawatt solar power generation facility 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 wastewater infrastructure.	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 low-level and mixed low-level radioactive waste cells would be developed to accommodate disposal of increased volumes of those waste types and new sanitary and construction, decontamination, and decommissioning 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 expected to affect the NNSS solid waste or wastewater infrastructure.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
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 fuel – 65,000 gallons Biodiesel fuel – 343,000 gallons DOE/NNSA would maintain and repair energy infrastructure.	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 fuel – 81,000 Biodiesel fuel – 429,000 gallons DOE/NNSA would maintain and repair energy infrastructure.	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 fuel – 59,000 gallons Biodiesel fuel – 309,000 gallons DOE/NNSA would maintain and repair energy infrastructure.	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.
Transportation [a] and Traffic				
Transportation				
Out-of-State Low-Level Radioactive and Mixed Low-Level Radioactive Waste				
Truck transport				
Worker risk (latent cancer fatality)	1 (1.3)	3 (3.1)	1 (1.3)	3 (3.1)
Population risk (latent cancer fatality)	0 (0.2)	1 (0.7)	0 (0.2)	1 (0.7)
Radiological accident (latent cancer fatality)	0 (0.0002)	0 (0.01)	0 (0.0002)	0 (0.01)
Traffic fatality	2	6	2	6
Rail transport only				
Worker risk (latent cancer fatality)	0 (0.3)	1 (1.1)	0 (0.3)	1 (1.1)
Population risk (latent cancer fatality)	0 (0.1)	0 (0.3)	0 (0.1)	0 (0.3)
Radiological accident (latent cancer fatality)	0 (0.00006)	0 (0.005)	0 (0.00006)	0 (0.005)
Traffic fatality	6	15	6	15
Combined rail-truck transport				
Worker risk (latent cancer fatality)	0 (0.5)	2 (1.5)	0 (0.5)	2 (1.7)
Population risk (latent cancer fatality)	0 (0.1)	0 (0.3)	0 (0.1)	1 (0.5)
Radiological accident (latent cancer fatality)	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				
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 250 (average over the period of construction) and 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.
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 volumes attributable to construction and operation 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 or similar to those described under the No Action Alternative; volume-to-capacity ratios and levels of service would not change.	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 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.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Socioeconomics				
	Operation of a 240-megawatt commercial solar power generation facility would increase employment by 150 full-time equivalents, of which about 15 solar power generation 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 full-time equivalents; 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 full-time equivalents, 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 full-time equivalents; about 60 employees would relocate from outside of the region. Sufficient housing exists in the area to support the increased population. 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 full-time equivalents over 35 months, with a peak of 1,000 full-time equivalents, would need to be hired for construction of the solar power generation facility.	Approximately 750 full-time equivalents over 42 months, with a peak of 1,500 full-time equivalents, would need to be hired for construction of the solar power generation facilities. Other construction projects at the NNSS would require approximately 250 full-time equivalents over the 10-year period.	Approximately 400 full-time equivalents over 32 months, with a peak of 800 full-time equivalents, would need to be hired for construction of the solar power generation facility.	Approximately 500 full-time equivalents over 35 months, with a peak of 1,000 full-time equivalents, would need to be hired for construction of the solar power generation facility. Other construction projects at the NNSS would require approximately 250 full-time equivalents 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.	Direct construction jobs and indirect jobs would reduce the unemployment rate in the region and would have a beneficial impact on the economy in the region. 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 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 solar power generation facilities and other facilities on site and increased 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 a modest increase in demand for onsite security and fire and rescue services.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Geology and Soils				
National Security/ Defense Mission	About 700 acres of soil would be disturbed by dynamic experiments in boreholes, explosives experiments, drillback operations, Office of Secure Transportation 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 Office of Secure Transportation 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 fewer Office of Secure Transportation training and exercises.	About 3,455 acres of soil would be disturbed by activities including dynamic experiments, explosives experiments, drillback operations, Office of Secure Transportation 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 Radioactive Waste Management Complex. 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 Underground Test Area Project monitoring wells.	About 600 acres of soil would be disturbed for construction of new waste cells at the Area 5 Radioactive Waste Management Complex. About 35 acres of soil would be disturbed for new sanitary, decontamination, decommissioning, and 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 Radioactive Waste Management Complex. About 35 acres of soil would be disturbed for new sanitary, decontamination, decommissioning, and 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 Underground Test Area 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 disturb, temporarily, about 467 acres of soil. Construction of a DOE 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 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				
Surface Water Resources				
National Security/ Defense Mission	Disturbance of about 700 acres of land by dynamic experiments in boreholes, explosives experiments, drillback operations, Office of Secure Transportation 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 activities similar to those as under the No Action Alternative, plus: • Up to 10,000 acres of disturbance for Office of Secure Transportation 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 Office of Secure Transportation 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. This includes dynamic experiments in boreholes, explosives experiments, drillback operations, depleted uranium experiment sites, Office of Secure Transportation training exercises, new test beds and training facilities, and additions to existing aviation facilities at the NNSS.
Environmental Management Mission	Disturbance of up to 190 acres of soil to construct, use, cover, and close disposal units within the existing Area 5 Radioactive Waste Management Complex 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 Underground Test Area Project could cause localized erosion, as could decontamination and decommissioning 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 and soils would reduce the potential for contamination of ephemeral waters.	Disturbance of up to 600 acres of soil to construct, use, cover, and close disposal units within the existing Area 5 Radioactive Waste Management Complex, plus up to 35 acres of disturbance for new sanitary, decontamination, decommissioning, and construction waste landfills would result in impacts on ephemeral waters due to alteration of natural drainage pathways, increased erosion, and subsequent sedimentation. Environmental Restoration Program impacts would be the same as under the No Action Alternative.	Same as under the No Action Alternative for both Waste Management and Environmental Restoration Programs.	Disturbance of up to 600 acres of soil to construct, use, cover, and close disposal units within the existing Area 5 Radioactive Waste Management Complex, plus up to 35 acres of disturbance for new sanitary, decontamination, decommissioning, and 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 Underground Test Area Project could cause localized erosion, as could decontamination and decommissioning 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 and soils would reduce the potential for contamination of ephemeral waters.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Nondefense Mission	No new land disturbances would occur during infrastructure-related activities under the No Action Alternative. 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 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 power generation facility. These disturbances would result in alterations of natural drainage pathways and increased sedimentation of ephemeral waterways. 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 and chemical contamination in 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.	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.	Up to 517 acres of land would be disturbed by rebuilding the existing 138-kilovolt transmission line on the NNSS and construction of 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.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Groundwater Resources				
Total water use (excluding solar power generation facility[ies])	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 to 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 to 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 to 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 to water supply may not occur.
National Security/ Defense Mission	No new or additional impacts on groundwater resources.	The following would be impacts on groundwater resources, in addition to impacts under the No Action Alternative: • 5.5 acre-feet per year of potable water for construction workers. • Water use for 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 is 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 Underground Test Area Project. Less than 7 acre-feet of total water use for dust suppression during decontamination and decommissioning 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 would be required for the drilling of new wells under the Underground Test Area Project. Less than 7 acre-feet of total water use for dust suppression during decontamination and decommissioning 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.	The positive impact of reducing potable water production 16 percent by 2015 would be partially offset by: • A 5-megawatt photovoltaic solar power system near Area 6, which would use 0.5 acre-feet per year of nonpotable water. • A one-time nonpotable water demand of 20 acre-feet, which would be required 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 Facility(ies)				
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 would be 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 would be 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 would be 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				
National Security/ Defense Mission	Approximately 295 acres of currently undisturbed desert tortoise habitat would be affected by activities in Frenchman Flat, Yucca Flat, and Jackass Flats; Mercury Valley; and Fortymile Canyon. The estimated number of desert tortoises affected ranges from 4 to 21, all by harassment. Total new disturbed area (about 700 acres) would be 0.09 percent of undisturbed land on the NNSS.	Approximately 1,930 acres of currently undisturbed desert tortoise habitat would be affected in the same areas as under the No Action Alternative. The estimated number of desert tortoises affected ranges from 30 to 136, all by harassment. Total new disturbed area (about 13,455 acres) would be 1.70 percent of undisturbed land on the NNSS.	Approximately 160 acres of currently undisturbed desert tortoise habitat would be affected in the same areas as under the No Action Alternative. The estimated number of desert tortoises affected ranges from 2 to 11, all by harassment. Total new disturbed area (about 430 acres) would be 0.05 percent of undisturbed land on the NNSS.	Approximately 1,910 acres of currently undisturbed desert tortoise habitat would be affected in the same areas as under the No Action Alternative. The estimated number of desert tortoises affected ranges from 30 to 136; all by harassment. 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, Yucca, and Jackass Flats, and Mercury Valley. The estimated number of desert tortoises affected ranges from 4 to 26, all by harassment. Total new disturbed area (about 1,110 acres) would be 0.14 percent of undisturbed land on the NNSS.	Approximately 1,205 acres of currently undisturbed desert tortoise habitat would be affected in the same areas as under the No Action Alternative because of additional waste management activities. The estimated number of desert tortoises affected ranges from 4 to 33, all by harassment. Total new disturbed area (about 1,555 acres) would be 0.2 percent of undisturbed land on the NNSS.	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. The estimated number of desert tortoises affected ranges from 4 to 33; all by harassment. 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. Approximately 2,650 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury Valley, and Frenchman Flat would be affected by DOE/NNSA activities, including a 240-megawatt commercial solar power	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 10,535 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury Valley, and Frenchman Flat would be affected by DOE/NNSA activities, including 1,000 megawatts of commercial solar power	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 1,200 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury Valley, and Frenchman Flat would be affected by DOE/NNSA activities, including a 100-megawatt commercial solar power	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 2,885 acres of currently undisturbed desert tortoise habitat in Jackass Flats, Mercury Valley, and Frenchman Flat would be affected by DOE/NNSA activities, including 240 megawatts of commercial solar power

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
	generation facility and associated transmission lines in Jackass Flats. The estimated number of desert tortoises affected ranges from 0 to 41, all by harassment. Total new disturbed area (about 2,650 acres) would be 0.34 percent of undisturbed land on the NNSS.	generation facilities and associated transmission lines in Jackass Flats. The estimated number of desert tortoises affected ranges from 4 to 178, all by harassment. Total new disturbed area (about 10,867 acres) would be 1.37 percent of undisturbed land on the NNSS.	generation facility in Jackass Flats. The estimated number of desert tortoises affected ranges from 0 to 19, all by harassment. Total new disturbed area (about 1,200 acres) would be 0.15 percent of undisturbed land on the NNSS.	generation facilities and associated transmission lines in Jackass Flats. The estimated number of desert tortoises affected ranges from 4 to 62; all by harassment. Total new disturbed area (about 3,167 acres) would be 0.40 percent of undisturbed land on the NNSS.
Air Quality				
Annual Average Operational Emissions in 2015 (tons per year)				
Particulate Matter$_{10}$	6.8	20.1	4.4	7.9
Particulate Matter$_{2.5}$	3.4	8.1	2.6	4.4
Carbon Monoxide	123.3	160.9	109.8	155.6
Nitrogen Oxides	39.7	56.6	36.3	54.8
Sulfur Dioxide	0.73	1.1	0.43	0.80
Volatile Organic Compounds	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
Carbon Dioxide-equivalent	39,690	49,303	38,045	49,298
Peak Year Construction Emissions (tons per year)				
Particulate Matter$_{10}$	20.0	129.1	8.4	65.7
Particulate Matter$_{2.5}$	6.0	35.6	2.6	16.8
Carbon Monoxide	44.8	296.5	24.4	193.6
Nitrogen Oxides	56.0	388.6	24.4	218.9
Sulfur Dioxide	0.14	0.68	0.08	0.29
Volatile Organic Compounds	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
Carbon Dioxide-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				
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 over about 2,400 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.	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 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 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, which would have an adverse effect on visual resources visible from U.S. Route 95. A Geothermal Power Project could alter the visual character and reduce visual quality if facilities are built along U.S. Route 95.
Cultural Resources				
National Security/ Defense Mission	Approximately 700 acres of undisturbed land would be affected by activities in Frenchman Flat, Yucca Flat, and Jackass Flats; Mercury Valley; and Fortymile Canyon. An estimated 24 cultural resources sites would be involved, of which an estimated 10 may be eligible for the National Register of Historic Places.	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 eligible for the National Register of Historic Places.	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 eligible for the National Register of Historic Places.	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 eligible for the National Register of Historic Places.
Environmental Management Mission	Approximately 1,110 acres of undisturbed land would be affected, primarily by environmental restoration activities in Frenchman Flat, Yucca Flat, and Jackass Flats; Emigrant and Mercury Valleys; and Fortymile Canyon. An estimated 29 cultural resource sites would be involved, of which an estimated 7 may be eligible for the National Register of Historic Places.	Approximately 1,555 acres of undisturbed land would be affected in the same areas as under the No Action Alternative because of additional waste management activities. An estimated 43 cultural resources sites would be involved, of which an estimated 12 may be eligible for the National Register of Historic Places.	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 eligible for the National Register of Historic Places.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Nondefense Mission	No impacts on cultural resources from 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 resource sites may be involved, of which an estimated 6 would be eligible for the National Register of Historic Places.	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 resource sites may be involved, of which an estimated 6 would be eligible for the National Register of Historic Places.
	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 eligible for the National Register of Historic Places.	Approximately 10,300 acres of undisturbed land in the Jackass Flats area would be affected by development of commercial solar power generation facilities and associated transmission lines. An estimated 7,004 cultural resources sites would be involved, of which an estimated 2,163 would be eligible for the National Register of Historic Places. 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 eligible for the National Register of Historic Places.	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 eligible for the National Register of Historic Places.	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 eligible for the National Register of Historic Places.
Waste Management (10-year volumes)				
Low-level radioactive waste	15,000,000 cubic feet of low-level radioactive waste is within the disposal capacity of the Area 5 Radioactive Waste Management Complex.	48,000,000 cubic feet of low-level radioactive waste is within the disposal capacity of the Area 3 Radioactive Waste Management Site and the Area 5 Radioactive Waste Management Complex.[b]	Same as under the No Action Alternative.	48,000,000 cubic feet of low-level radioactive waste is within the disposal capacity of the Area 3 Radioactive Waste Management Site and the Area 5 Radioactive Waste Management Complex.
Mixed low-level radioactive waste	900,000 cubic feet of mixed low-level radioactive waste is within the permitted disposal capacity of Cell 18 in the Area 5 Radioactive Waste Management Complex.	Disposal of 4,000,000 cubic feet of mixed low-level radioactive waste would require additional permitted mixed low-level radioactive waste disposal capacity at the Area 5 Radioactive Waste Management Complex.	Same as under the No Action Alternative.	Disposal of 4,000,000 cubic feet of mixed low-level radioactive waste would require additional permitted mixed low-level radioactive waste disposal capacity at the Area 5 Radioactive Waste Management Complex.
Transuranic waste	9,600 cubic feet would be generated by DOE/NNSA activities in Nevada. All transuranic waste would be disposed within available capacity at the Waste Isolation Pilot Plant.	19,000 cubic feet would be generated by DOE/NNSA activities in Nevada. All transuranic waste would be disposed within available capacity at the Waste Isolation Pilot Plant.	7,100 cubic feet would be generated by DOE/NNSA activities in Nevada. All transuranic waste would be disposed within available capacity at the Waste Isolation Pilot Plant.	19,000 cubic feet would be generated by DOE/NNSA activities in Nevada. All transuranic waste disposed within available capacity at the Waste Isolation Pilot Plant.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Hazardous waste	Total of 210,000 cubic feet would be generated, 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 would be generated, 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 would be generated, 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 would be generated, including 42,000 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.
Solid waste	Total of 3,800,000 cubic feet would be generated, including 3,700,000 cubic feet generated by DOE/NNSA activities in Nevada and 160,000 cubic feet generated by construction and 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 for recycling within available offsite capacity.	Total of 10,000,000 cubic feet would be generated, including 9,400,000 cubic feet generated by DOE/NNSA activities in Nevada and 630,000 cubic feet generated by construction and 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.	Total of 3,700,000 cubic feet would be generated, including 3,600,000 cubic feet generated by DOE/NNSA activities in Nevada and 77,000 cubic feet generated by construction and 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.	Total of 9,560,000 cubic feet would be generated, including 9,400,000 cubic feet generated by DOE/NNSA activities in Nevada and 160,000 cubic feet generated by operation of 240 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.	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.	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.	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				
Annual Radiological Impacts of Normal Operations				
Offsite Population				
Collective Dose (person-rem)	0.50	0.89	0.48	0.89
Latent Cancer Fatality Risk	3×10^{-4}	5×10^{-4}	3×10^{-4}	5×10^{-4}
Maximally Exposed Individual				
Dose (millirem)	2.8	4.8	2.7	4.8
Latent Cancer Fatality 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
Latent Cancer Fatality Risk	3×10^{-3}	4×10^{-3}	3×10^{-3}	4×10^{-3}
Subsistence Consumer				
Dose (millirem)	13	15	13	15
Latent Cancer Fatality Risk	8×10^{-6}	9×10^{-6}	8×10^{-6}	9×10^{-6}
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 a larger workforce and increased daily truck trips.	Similar to under the No Action Alternative, but slightly reduced due to a smaller workforce.	Same as under the No Action Alternative, but there would be some increased traffic noise due to a larger workforce and increased daily truck trips.
Facility Accident – Dose Consequence and Annual Risk [c]				
Highest Risk Facility Accident – Device Assembly Facility explosion involving 55 pounds of high explosive and 1 kilogram of plutonium (assumed frequency of 1 chance in 1,250 years)				
Offsite Population				
Collective Dose (person-rem)	23	Same as under the No Action Alternative.	Same as under the No Action Alternative.	23
Latent Cancer Fatality Risk	1×10^{-5}	Same as under the No Action Alternative.	Same as under the No Action Alternative.	1×10^{-5}
Maximally Exposed Individual				
Dose (rem)	0.18	Same as under the No Action Alternative.	Same as under the No Action Alternative.	0.18
Latent Cancer Fatality Risk	9×10^{-8}	Same as under the No Action Alternative.	Same as under the No Action Alternative.	9×10^{-8}
Noninvolved Workers				
Dose (rem)	6.5	Same as under the No Action Alternative.	Same as under the No Action Alternative.	6.5
Latent Cancer Fatality Risk	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				
	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 and 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 and 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.

NNSA = National Nuclear Security Administration; NNSS = Nevada National Security Site; 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.

[a] The reported radiological risks are the projected number of latent cancer fatalities in the population and are, therefore, presented as whole numbers. The calculated value is shown in parentheses. Both radiological impacts and nonradiological traffic impacts are based upon shipment of the entire inventory of low-level radioactive waste over a 10-year period.

[b] Reopening of the Area 3 Radioactive Waste Management Site 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.

[c] The risk is the annual increased likelihood of a latent cancer fatality in the maximally exposed individual or the noninvolved worker, or the increased likelihood of a single latent cancer fatality occurring in the offsite population, accounting for the estimated probability (frequency) of the accident occurring.

S.3.1.11 Cumulative Impacts

Council on Environmental Quality regulations 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." 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 which entity is acting.

Most of the land in the vicinity of the NNSS is managed by Federal agencies, including the U.S. Bureau of Land Management, U.S. Air Force, USFWS, U.S. Forest Service, and U.S. National Park Service. In addition, there are lands and facilities under the jurisdiction of agencies of the State of Nevada; Nye, Clark, Esmeralda, and Lincoln Counties in Nevada; the State of California; Inyo County, 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 these 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.

For DOE/NNSA contributions to cumulative impacts, the analysis primarily used the Expanded Operations Alternative, as it tends to result in the highest estimates of potential cumulative impacts associated with alternatives analyzed in this *NNSS SWEIS*. To provide a comparison of the cumulative impacts associated with each of the three alternatives considered in this *NNSS SWEIS*, **Table S–15** summarizes cumulative impacts by alternative.

S.3.2 Remote Sensing Laboratory

No new project or capabilities or changes in the levels of operations (activities) are proposed at RSL. For this reason, among the 13 resource areas, either there would be no impacts or the impacts associated with ongoing operations would continue unchanged from baseline conditions. **Table S–16** summarizes the potential environmental impacts for all 13 resource areas under each alternative. As discussed above in Section S.2.5, DOE/NNSA's Preferred Alternative is a "hybrid" alternative comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Although the text of this Summary does not discuss the potential environmental impacts from implementing the Preferred Alternative, consistent with the approach used in Chapter 3 of the *NNSS SWEIS*, Table S–16 summarizes those impacts to enable a comparison to the three alternatives.

S.3.3 North Las Vegas Facility

This section summarizes the potential environmental impacts at NLVF from continuing and proposed projects and capabilities, including their associated levels of operations (activities), under each of three alternatives. The text focuses on those resource areas for which the impacts would be sufficiently different to permit distinguishing among the alternatives in a meaningful manner or would tend to be controversial, i.e., energy, traffic, socioeconomics, air quality, waste management, and human health.

Table S–19 (at the end of Section S.3.3.6) summarizes the potential environmental impacts for all 13 resource areas. As discussed above in Section S.2.5, DOE/NNSA's Preferred Alternative is a "hybrid" alternative comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Although the text of this Summary does not discuss the potential environmental impacts from implementing the Preferred Alternative, consistent with the approach used in Chapter 3 of the *NNSS SWEIS*, Table S–19 summarizes those impacts to enable a comparison to the three alternatives.

Table S–15 Potential 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	<u>Infrastructure</u> 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.	<u>Infrastructure</u> 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.	<u>Infrastructure</u> 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.
	<u>Energy</u> 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.	<u>Energy</u> 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.	<u>Energy</u> 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	Traffic 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.	Traffic 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.	Traffic 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.
	Radiological Transportation **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.	Radiological Transportation 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.	Radiological Transportation **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	Surface Water 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.	Surface Water 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.	Surface Water 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)*	Nonradioactive Waste 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.	Nonradioactive Waste 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.	Nonradioactive Waste 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	Radiological 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	Radiological 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.	Radiological 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.

Note: Chapter 6, Section 6.2, of the *NNSS SWEIS* provides additional qualitative discussions of other potentially cumulative actions (including the proposed Greater-Than-Class C Low-Level Waste Disposal Facility and the formerly proposed Yucca Mountain Repository Projects) located within the region of influence.

Table S–16 Summary of Potential Direct and Indirect Impacts at the Remote Sensing Laboratory

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use				
	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 foreseeable actions because activities under this alternative would continue to be compatible with existing land use designations on Nellis Air Force Base.
Infrastructure and Energy				
	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 is available directly through Nellis Air Force Base.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Transportation and Traffic				
Transportation	No radioactive materials would be 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 would be transported. Nonradioactive material transports are included in Nevada National Security Site impacts.
Traffic	The number of personnel at the Remote Sensing Laboratory is expected to remain the same, and no construction or other projects are 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 the Remote Sensing Laboratory is expected to remain the same, and no construction or other projects are proposed that would result in increased traffic. There would be no additional impacts on onsite or regional traffic conditions.
Socioeconomics				
	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				
	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				
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				
	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				
Annual Average Operational Emission in 2015 (tons per year)				
Particulate Matter$_{10}$ *Particulate Matter$_{2.5}$* *Carbon Monoxide* *Nitrogen Oxides* *Sulfur Dioxide* *Volatile Organic Compounds* *Lead* *Hazardous Air Pollutants* *Carbon Dioxide-equivalent*	0.084 0.067 4.1 1.6 0.034 0.3 ~0.01 0.19 3,147	Same as under the No Action Alternative.	Same as under the No Action Alternative.	0.084 0.067 4.1 1.6 0.034 0.3 *~0.01* 0.19 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				
	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				
	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				
Hazardous waste	Annually, about 680 cubic feet of hazardous waste would be 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 of solid waste would be 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				
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.
Noise	Noise from Remote Sensing Laboratory 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 Remote Sensing Laboratory 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				
	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 and 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 and low-income populations are expected.

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.

S.3.3.1 Energy

DOE/NNSA assessed potential impacts on energy resources by comparing projections of utility resource requirements, such as the demand for electricity, natural gas, and liquid fuels at NLVF, to local and regional capabilities to supply these resources. The baseline or current energy demand is the same as that under the No Action Alternative. For instance, recent peak electrical demand was about 3.2 megawatts, and approximately 48,000 therms of natural gas (equivalent to about 495,000 cubic feet) were used for heating and in boilers (NNSA/NSO 2010b). Under the Expanded Operations Alternative, continuing and newly proposed projects and capabilities would require an increase of up to 10 percent in the use of electricity, natural gas, and liquid fuels such as gasoline and diesel fuel. Energy demand under the Reduced Operations Alternative would be no more than that under the No Action Alternative. DOE/NNSA does not foresee difficulty in obtaining electricity and fuels from regional suppliers under any alternative.

What is a Therm?

A therm equals 100,000 British thermal units. A British thermal unit is the heat required to raise the temperature of one pound of water by one degree Fahrenheit.

On average, 1,000 cubic feet of natural gas equals 10.31 therms.

S.3.3.2 Traffic

Traffic impacts would result primarily from changes in the workforce. DOE/NNSA estimates that the current workforce would not change under the No Action Alternative, would increase by approximately 25 percent (from 1,442 to 1,803) under the Expanded Operations Alternative, and would decrease by about 10 percent (from 1,442 to 1,298) under the Reduced Operations Alternative.

Traffic conditions of roadways near NLVF are represented by Losee Road. Under the No Action and Reduced Operations Alternatives, minimal changes in daily traffic volumes would affect Losee Road as a result of NNSS personnel. DOE/NNSA estimates that implementing the Expanded Operations Alternative would result in an approximately 3 percent increase in traffic volumes during the peak hour; the level of service, however, would remain at a level of service C.

Level of Service C

The number of vehicles stopping is significant, although many still pass through the affected intersection without being required to stop.

S.3.3.3 Socioeconomics

The continued operation and proposed activities at NLVF would result in changes to the current (baseline) workforce only under the Expanded Operations and Reduced Operations Alternatives. Accordingly, DOE/NNSA evaluated how these workforce changes could affect economic activity; population; housing; public finance; and public services, such as police and fire protection, in Clark and Nye Counties.

Under the Expanded Operations Alternative, the workforce would increase by 361 (from about 1,442 to 1,803). DOE/NNSA estimates that approximately 10 percent, or 36 individuals, would relocate to Clark and Nye Counties (the remaining 325 individuals would already live in Clark and Nye Counties). Of the total employment increase, DOE/NNSA estimates that 99 percent of the workers would live in Clark County and 1 percent in Nye County.

Under the Expanded Operations Alternative, in Clark County, a total of 322 direct jobs could be added, which would decrease the unemployment rate by about 0.23 percent. In Nye County, up to 3 jobs would be added, decreasing unemployment by about 0.10 percent.

An increase in direct employment also would result in an increase in the demand for goods (for example, fuel for personal vehicles) and services (for example, vehicle repair), which in turn would create additional employment opportunities (indirect jobs). The combined effect of direct (361) and indirect (699) jobs would result in a decrease in the unemployment rate in Clark County by about 0.5 percent and in Nye County by about 0.22 percent.

The increased workforce due to relocating workers (36 individuals) is not expected to result in undue demand on housing (vacancies would decrease by about 0.2 percent) and most public services. There could be a need, however, to hire three new teachers in Clark County to maintain the current student-to-teacher ratio.

Under the Reduced Operations Alternative, the workforce would decrease by about 144; the unemployment rate in Clark County would, in turn, increase by about 0.10 percent and the rate in Nye County would increase by about 0.03 percent. There would be no impact on housing or public services in either county.

S.3.3.4 Air Quality

For each alternative, DOE/NNSA estimated the amount of nonradiological and hazardous air pollutants and greenhouse gases that would be released from activities at NLVF (see **Table S–17**).

Table S–17 Emissions of Air Pollutants and Greenhouse Gases at the North Las Vegas Facility (tons per year)

		No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*
	Estimated 2008 Emissions	*Annual Average Operational Emissions in 2015*		
Particulate Matter$_{10}$	0.48	0.36	0.44	0.33
Particulate Matter$_{2.5}$	0.34	0.24	0.28	0.21
Carbon Monoxide	26.6	24.4	30.5	22.0
Nitrogen Oxides	8.8	5.9	7.2	5.4
Sulfur Dioxide	0.090	0.079	0.095	0.072
Volatile Organic Compounds	0.80	0.77	0.96	0.70
Lead	~0.060	Less than 0.01	Less than 0.01	Less than 0.01
Hazardous Air Pollutants	0.076	0.062	0.078	0.056
Carbon Dioxide-equivalent	13,355	8,379	9,031	8,118

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.

Under the No Action and Reduced Operations Alternatives, the NLVF contribution to Clark County emissions of nonradiological (criteria) pollutants would continue to be small and would decrease relative to 2008 emission levels. Most of the emission reductions at NLVF would be associated with the phasing in of newer worker vehicles with emission reduction technology. Thus, neither alternative would contribute to or cause additional violations of the criteria pollutant standards.

Implementing the Expanded Operations Alternative would result in increases (relative to the 2008 baseline) in emissions of carbon monoxide, sulfur dioxide, and volatile organic compounds, principally from mobile sources. Because the increases in emissions would be small and would come from mobile sources dispersed throughout the Las Vegas Valley, the additional pollutant burden would not produce additional violations of pollutant standards.

DOE/NNSA estimates that emissions of hazardous air pollutants would continue to remain low under any alternative and would not require additional emission control technologies; and, therefore, such emissions would not pose an undue health risk to workers or the public. Greenhouse gas emissions, although estimated to decrease relative to baseline levels under all alternatives, would continue to contribute to global climate change.

S.3.3.5 Waste Management

At NLVF, DOE/NNSA operations would generate low-level radioactive waste, hazardous waste, sanitary solid waste, and demolition debris. Under all alternatives, about 150 cubic feet of low-level radioactive waste and small amounts of water containing tritium would be generated. The low-level radioactive waste would be shipped to the NNSS for disposal where adequate capacity exists; water containing tritium either would be evaporated by introducing it to evaporative coolers at NLVF or by shipping it to the NNSS for evaporation.

About 1,100 cubic feet of hazardous waste would be generated over 10 years under all alternatives. This waste would be transferred off site to permitted facilities to be recycled or treated, stored, and disposed. Adequate capacity is expected to exist in Nevada and elsewhere in the United States to recycle or treat, store, and dispose hazardous waste generated at NLVF. For instance, four treatment, storage, and disposal facilities were permitted to receive hazardous waste in Nevada as of 2009 (NDEP 2009).

About 390,000, 490,000, and 350,000 cubic feet of sanitary solid waste would be generated under the No Action, Expanded Operations, and Reduced Operations Alternatives over 10 years, respectively. DOE/NNSA anticipates that the local municipal waste service would have sufficient capacity to accommodate disposal of this waste.

Decommissioning and demolition of certain structures at NLVF were estimated to generate up to about 110,000 cubic feet of demolition debris under each alternative. Sufficient capacity is expected to exist at landfills in Clark County to accommodate disposal of these amounts of demolition debris (otherwise, this waste would be disposed at landfills on the NNSS, which have adequate disposal capacity).

S.3.3.6 Human Health

Tritium is the only radionuclide that could result in an exposure to a noninvolved worker or a member of the public. In 1995, an accident resulted in the release of more than 1 curie of tritium in the basement of Building A-1. The tritium release was cleaned up, but residual tritium continues to emanate from the basement floor. The small amount of tritium released was estimated (numerically calculated) to result in a dose of about 0.00035 millirem per year to the maximally exposed individual member of the public located at the facility boundary or to a noninvolved worker. This dose represents an annual risk of a latent cancer fatality of about 1 chance in 5 billion. Applying this dose to the entire population of approximately 2,390,000 persons within 50 miles of NLVF results in an estimated collective dose of 4.1×10^{-5} person-rem per year, with a corresponding estimate of 2×10^{-8} latent cancer fatalities, resulting in an annual risk of 1 in 50 million of a single latent cancer fatality in the exposed population. The amount of tritium released, and thus the dose and latent cancer fatalities, would be the same among all alternatives.

DOE/NNSA estimated the injuries that could arise in the workforce from industrial accidents based upon accident rates from DOE and the U.S. Department of Labor (DOE 2010; DOL 2010a, 2010b). Total recordable cases, and those cases that result in lost workdays, restricted duty, or require a transfer are shown in **Table S–18**.

Table S–18 Annual Estimated Incidence of Nonfatal Accidents at the North Las Vegas Facility

	No Action Alternative		*Expanded Operations Alternative*		*Reduced Operations Alternative*	
Activity	***Total Recordable Cases***	***Lost Workdays, Restrictions, Transfer***	***Total Recordable Cases***	***Lost Workdays, Restrictions, Transfer***	***Total Recordable Cases***	***Lost Workdays, Restrictions, Transfer***
Facility Operations	22	9.5	27	12	20	8.6

Table S–19 Summary of Potential Direct and Indirect Impacts at the North Las Vegas Facility

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use				
	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				
	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 to a total of 16,500 megawatt-hours per year. 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 to a total of 16,500 megawatt-hours per year. 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.
Transportation and Traffic				
Transportation	No radioactive materials were analyzed. Nonradioactive material transports are included in the NNSS impacts.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No radioactive materials were 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 3 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 a 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 would occur during peak hours on local roads, when compared to the projected baseline; levels of service would remain the same.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Socioeconomics				
	There would be no change in employment; therefore, there would be no change in socioeconomic impacts.	Employment would increase by 361 full-time equivalents; 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 full-time equivalents, 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 full-time equivalents; 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.
Geology and Soils				
	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				
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				
	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.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Air Quality				
Annual Average Operational Emission in 2015 (tons per year)				
Particulate $Matter_{10}$	0.36	0.44	0.33	0.44
Particulate $Matter_{2.5}$	0.24	0.28	0.21	0.28
Carbon Monoxide	24.4	30.5	22.0	30.5
Nitrogen Oxides	5.9	7.2	5.4	7.2
Sulfur Dioxide	0.079	0.095	0.072	0.095
Volatile Organic Compounds	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
Carbon Dioxide-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.
Visual Resources				
	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				
	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				
Low-level radioactive waste [a]	150 cubic feet would be generated over the next 10 years and disposed within available capacity at the NNSS in the Area 5 Radioactive Waste Management Complex.	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 Radioactive Waste Management Complex.
Hazardous waste	1,100 cubic feet would be 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 would be generated over the next 10 years and shipped off site to be recycled or disposed within available capacity.	590,000 cubic feet would be generated over the next 10 years and shipped off site to be recycled or disposed within available capacity.	460,000 cubic feet would be 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				
Offsite Population *Collective Dose (person-rem)* *Latent Cancer Fatality Risk*	 4.1×10^{-5} 2×10^{-8}	Same as under the No Action Alternative.	Same as under the No Action Alternative.	 4.1×10^{-5} 2×10^{-8}
Maximally Exposed Individual or Noninvolved Worker *Dose (millirem)* *Latent Cancer Fatality Risk*	 3.5×10^{-4} 2×10^{-10}			 3.5×10^{-4} 2×10^{-10}
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				
	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 and 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 and low-income populations are expected.

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.

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

S.3.4 Tonopah Test Range

This section summarizes the potential environmental impacts at the TTR from continuing and proposed projects and capabilities, including their associated levels of operations (activities), under each of three alternatives. The text focuses on those resource areas for which the impacts would be sufficiently different to permit distinguishing among the alternatives in a meaningful manner or would tend to be controversial, i.e., transportation, socioeconomics, air quality, waste management, and human health.

Table S–22 (at the end of Section S.3.4.5) summarizes the potential environmental impacts for all 13 resource areas. As discussed above in Section S.2.5, DOE/NNSA's Preferred Alternative is a "hybrid" alternative comprising various programs, capabilities, projects, and activities selected from among the three alternatives. Although the text of this Summary does not discuss the potential environmental impacts from implementing the Preferred Alternative, consistent with the approach used in Chapter 3 of the *NNSS SWEIS*, Table S–22 summarizes those impacts to enable a comparison to the three alternatives.

S.3.4.1 Transportation

Radiological impacts on workers and the public would result from the shipment of low-level radioactive waste from the Nevada Test and Training Range, including the TTR, to the NNSS. This waste would be generated from environmental restoration activities. DOE/NNSA estimates there would be approximately 230 truck shipments to the NNSS under the No Action and Reduced Operations Alternatives, and about 13,100 truck shipments under the Expanded Operations Alternative.

For incident-free truck transportation, DOE/NNSA estimated that less than 1 latent cancer fatality would occur in the population of transportation workers exposed to radiation from shipments of low-level radioactive waste under the No Action Alternative (9×10^{-6}), Expanded Operations Alternative (0.0005), and Reduced Operations Alternative (9×10^{-6}). Because many workers would be involved, the risk to an individual worker would be small. Similarly, DOE/NNSA estimated that less than 1 (1×10^{-6}, 0.0002, and 1×10^{-6}, respectively) latent cancer fatality would occur among members of the public exposed to these same truck shipments under the three alternatives.

S.3.4.2 Socioeconomics

Continued operations and proposed activities at the TTR would result in changes to the current (baseline) workforce only under the Expanded Operations and Reduced Operations Alternatives. Accordingly, DOE/NNSA evaluated how this change in workforce would affect economic activity, population, housing, public finance, and public services, such as police and fire protection, in Clark and Nye Counties.

Under the Expanded Operations Alternative, the workforce would decrease from about 106 to 43 (a decrease of 63 employees); the unemployment rate in Clark County would, in turn, increase by about 0.01 percent and the rate in Nye County would increase by about 1.34 percent. There would be no impact on housing or public services in either county.

Implementing the Reduced Operations Alternative would have essentially the same impacts as those under the Expanded Operations Alternative, as the workforce would decrease by 67 employees.

S.3.4.3 Air Quality

For each alternative, DOE/NNSA estimated the amount of nonradiological and hazardous air pollutants and greenhouse gases that would be released from ongoing and proposed activities at the TTR (see **Table S–20**). In general, emission-generating activities under any alternative would be widely dispersed over the 280-square-mile area of the TTR, and mobile sources of emissions would occur mostly outside of the TTR.

Table S–20 Emissions of Air Pollutants and Greenhouse Gases at the Tonopah Test Range (tons per year)

		No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*
	Estimated 2008 Emissions	*Annual Average Operational Emissions in 2015*		
Particulate Matter$_{10}$	Less than 4.5	Less than 4.0	Less than 3.8	Less than 3.8
Particulate Matter$_{2.5}$	Less than 4.4	Less than 4.0	Less than 3.8	Less than 3.8
Carbon Monoxide	Less than 14.3	Less than 10.8	Less than 6.1	Less than 5.8
Nitrogen Oxides	Less than 21.4	Less than 17.1	Less than 14.8	Less than 14.7
Sulfur Dioxide	Less than 0.94	Less than 0.93	Less than 0.92	Less than 0.92
Volatile Organic Compounds	Less than 2.0	Less than 1.4	Less than 1.1	Less than 1.1
Lead	Less than 0.05	Less than 0.010	Less than 0.01	Less than 0.01
Hazardous Air Pollutants	Less than 1.2	Less than 1.1	Less than 1.1	Less than 1.1
Carbon Dioxide-Equivalent	4,166	3,653	1,791	1,671

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.

Under all alternatives, emissions of criteria pollutants (hazardous air pollutants) would decrease relative to baseline (2008) levels, and, therefore, would not contribute to or cause additional violations of the criteria pollutant standards. Nye County would continue to be in attainment for all criteria pollutants, while in Clark County, these emissions would not cause or contribute to any new violations of the standards or increases in the frequency or severity of any existing violation of any standard.

DOE/NNSA estimates that emissions of hazardous air pollutants would continue to remain low under any alternative and would not require additional emission control technologies; therefore, such emissions would not pose an undue health risk to workers or the public. Greenhouse gas emissions, although also estimated to decrease relative to baseline levels under all alternatives, would continue to contribute to global climate change.

S.3.4.4 Waste Management

At the TTR, DOE/NNSA actions would generate low-level radioactive waste, hazardous waste, solid waste, and construction debris. Environmental restoration activities at the Nevada Test and Training Range, including the TTR, also would generate low-level radioactive waste and possibly some transuranic waste.

Under the No Action and Reduced Operations Alternatives, about 2.9 million cubic feet of low-level radioactive waste would be generated over 10 years; this waste would be shipped by truck to the NNSS for disposal at the Area 5 Radioactive Waste Management Complex. Under the Expanded Operations Alternative, environmental restoration would generate about 11 million cubic feet of low-level radioactive waste. Although this waste would be shipped to the NNSS for disposal at the Area 5 Radioactive Waste Management Complex, because of the volume of low-level radioactive waste from the TTR and from other in-state and out-of-state sources (see Section S.3.1.10), DOE/NNSA also would need to reactivate the Area 3 Radioactive Waste Management Site to accommodate the disposal of this waste.

About 8 tons of hazardous waste would be generated annually under all alternatives. This waste would be shipped from the TTR to permitted facilities to be recycled or treated, stored, and disposed. Adequate capacity is expected to exist in Nevada and elsewhere in the United States to recycle or treat, store, and dispose hazardous waste generated at the TTR. For instance, four treatment, storage, and disposal facilities were permitted to receive hazardous waste in Nevada as of 2009 (NDEP 2009).

TTR site operations also would generate solid waste, including sanitary waste and construction debris. Under the No Action, Expanded Operations, and Reduced Operations Alternatives, about 9,400; 7,700; and 6,600 cubic feet, respectively, of solid waste would be generated annually. The volume of solid waste would be lower under the Expanded Operations Alternative because the projection for sanitary solid waste was based on the estimated number of employees and there would be a decrease of about 63 employees at the TTR. Sufficient capacity exists for DOE/NNSA to dispose this waste in solid waste landfills on the TTR, the solid waste landfills on the NNSS, or in local municipal landfills.

S.3.4.5 Human Health

Normal Operations. Environmental restoration activities on the TTR would result in the resuspension of legacy radioactive materials that are transported in the air. DOE/NNSA numerically estimated, for the alternatives, that the annual dose to a maximally exposed individual and the population within 50 miles of the TTR would be 0.024 millirem and much less than 1 person-rem, respectively. The maximally exposed individual would incur an increased risk of contracting a latent cancer fatality of 1×10^{-8} (1 chance in 100 million). The estimated number of latent cancer fatalities associated with the annual population dose of 1 person-rem is 0.0006, which results in an annual risk of a single latent cancer fatality in the population of much less than 1 in 1,700.

Workers also would be exposed to legacy radioactive materials. Under the No Action Alternative, the estimated collective worker dose would be 1.3 person-rem per year (workforce of 106 workers), resulting in an estimated annual latent cancer fatality risk of 0.0008. The workforces under the Expanded Operations and Reduced Operations Alternatives would decrease to 43 and 39 workers, respectively; and, therefore, the collective dose and risk of contracting a latent cancer fatality would be less than estimated for the No Action Alternative.

Accidents. The maximum reasonably foreseeable accident (a beyond-design-basis event), which is the same for all alternatives, would involve an aircraft crash and ensuing fire involving multiple low-level radioactive waste containers. The estimated probability of this event occurring was estimated to be 1.7×10^{-6} per year of operation (1 chance in 590,000).

If the accident were to occur, the maximally exposed individual would receive a dose of 0.34 millirem, corresponding to a latent cancer fatality risk of 2×10^{-7} (1 chance in 5,000,000). The offsite population within 50 miles would receive a collective dose estimated to be 0.012 person-rem; the calculated number of latent cancer fatalities associated with this dose is 7×10^{-6}, implying that the most likely outcome would be no additional latent cancer fatalities in the exposed population. A noninvolved worker outside the immediate area of the crash would receive an estimated dose of 1.5 rem, with an associated risk of contracting a fatal cancer of 9×10^{-4} (1 chance in 1,100). When the frequency of this accident was considered, the annual risk of a latent cancer fatality was estimated to be 3×10^{-13} for the maximally exposed individual, 1×10^{-11} for the population, and 2×10^{-9} for the noninvolved worker.

DOE/NNSA estimated the injuries that could arise in the workforce from industrial accidents based upon accident rates from DOE and the U.S. Department of Labor (DOE 2010; DOL 2010a, 2010b). Total recordable cases and those cases that could result in lost workdays, restricted duty, or a transfer are shown in **Table S–21**.

Table S–21 Annual Estimated Incidence of Nonfatal Accidents at the Tonopah Test Range

	No Action Alternative		*Expanded Operations Alternative*		*Reduced Operations Alternative*	
Activity	***Total Recordable Cases***	***Lost Workdays, Restrictions, Transfer***	***Total Recordable Cases***	***Lost Workdays, Restrictions, Transfer***	***Total Recordable Cases***	***Lost Workdays, Restrictions, Transfer***
Tonopah Test Range Industrial – Site Operations	1.6	0.7	0.7	0.3	0.6	0.3

Source: DOE 2010.

Table S–22 Summary of Potential Direct and Indirect Impacts at the Tonopah Test Range

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Land Use				
	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 levels of air traffic, navigational aid services, and airspace structure, and would continue to be 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, and airspace structure and would be coordinated and scheduled by the Nellis Air Traffic Control Facility.
Infrastructure and Energy				
	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				
Low-Level and Mixed Low-Level Radioactive Waste				
Incident-free truck transport				
Worker risk (latent cancer fatality)	0 (9×10^{-6})	0 (0.0005)	0 (9×10^{-6})	0 (0.0005)
Population risk (latent cancer fatality)	0 (1×10^{-6})	0 (0.0002)	0 (1×10^{-6})	0 (0.0002)
Transport accidents				
Radiological risk (latent cancer fatality)	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 Nevada National Security Site impacts.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	Nonradioactive material transports included in Nevada National Security Site impacts.
Traffic	Up to 4 additional truck trips per day from Environmental Restoration Program radioactive waste transport; minimal impacts on onsite and regional traffic conditions.	Up to 14 additional truck trips per day from Environmental Restoration Program 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				
	There would be no change in employment; therefore, there would be no change in socioeconomic impacts.	Employment would decrease by 63 full-time equivalents, 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 full-time equivalents, 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 full-time equivalents, 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				
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 Program – 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 Program – 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 the 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.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Hydrology				
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.
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				
	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.

	No Action Alternative	***Expanded Operations Alternative***	***Reduced Operations Alternative***	***Preferred Alternative***
Air Quality and Climate				
Annual Average Operational Emission in 2015 (tons per year) [b]				
Particulate Matter$_{10}$	<4.0	<3.8	<3.8	<3.8
Particulate Matter$_{2.5}$	<4.0	<3.8	<3.8	<3.8
Carbon Monoxide	<10.8	<6.1	<5.8	<6.1
Nitrogen Oxides	<17.1	<14.8	<14.7	<14.8
Sulfur Dioxide	<0.93	<0.92	<0.92	<0.92
Volatile Organic Compounds	<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
Carbon dioxide-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				
	No impacts on visual resources.	Same as under the No Action Alternative.	Same as under the No Action Alternative.	No impacts on visual resources.
Cultural Resources				
	All work would occur in previously disturbed areas. DOE/NNSA would consult with the State Historic Preservation Officer prior to environmental restoration of Clean Slate sites 1, 2, and 3 because they are considered to be 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 Clean Slate sites 1, 2, and 3 because they are considered to be historically significant.

	No Action Alternative	*Expanded Operations Alternative*	*Reduced Operations Alternative*	*Preferred Alternative*
Waste Management				
Low-Level Radioactive Waste	200,000 cubic feet would be generated by environmental restoration activities would be disposed within available capacity at the NNSS Area 5 Radioactive Waste Management Complex.	11,000,000 cubic feet would be generated by environmental restoration activities would be disposed within available capacity at the NNSS Area 5 Radioactive Waste Management Complex and Area 3 Radioactive Waste Management Site.	Same as under the No Action Alternative.	11,000,000 cubic feet would be generated by environmental restoration activities and disposed within available capacity at the NNSS Area 5 Radioactive Waste Management Complex and Area 3 Radioactive Waste Management Site.
Hazardous waste	About 4,600 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 would be disposed at onsite landfills within available capacity. An additional 61,000 cubic feet would be 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				
Annual Radiological Impacts of Normal Operations due to Legacy Soil Contamination				
Offsite Population		Same as under the No Action Alternative.	Same as under the No Action Alternative.	
Collective Dose (person-rem)	<1			<1
Latent cancer fatality risk	$<6 \times 10^{-4}$			$<6 \times 10^{-4}$
Maximally Exposed Individual				
Dose (millirem)	0.024			0.024
Latent cancer fatality risk	1.4×10^{-8}			1.4×10^{-8}
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		Same as under the No Action Alternative.	Same as under the No Action Alternative.	
Collective Dose (person-rem)	0.012			0.012
Latent cancer fatality risk per year)	1×10^{-11}			1×10^{-11}
Maximally Exposed Individual				
Dose (rem)	0.00034			0.00034
Latent cancer fatality risk per year)	3×10^{-13}			3×10^{-13}
Noninvolved Worker				
Dose (rem)	1.5			1.5
Latent cancer fatality risk per year)	2×10^{-9}			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 and 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 and low-income populations are expected.

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; TTR = Tonopah Test Range.

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

[b] The emissions under the Expanded Operations Alternative would be less than the levels projected under the No Action Alternative, as the Record of Decision for the *Complex Transformation Supplemental Programmatic Environmental Impact Statement* would occur under the Expanded Operations 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 a latent cancer fatality in the maximally exposed individual or the noninvolved worker or the increased likelihood of a single latent cancer fatality occurring in the offsite population, accounting for the estimated probability (frequency) of the accident occurring.

S.4 Conclusions

S.4.1 Major Conclusions

DOE/NNSA evaluated the potential direct, indirect, and cumulative impacts on 13 environmental resource areas that include features of the natural environment and matters of social, cultural, and economic concern. Each resource area is evaluated under each of three alternatives and the Preferred Alternative, and the potential environmental consequences are summarized in Section S.3.

In general, the potential environmental impacts would be greatest under the Expanded Operations Alternative, and lowest under the Reduced Operations Alternative. For most resource areas, the potential environmental impacts of the Preferred Alternative would be the same as those under the Expanded Operations Alternative. However, for a few resource areas at the NNSS, such as biological and cultural resources and air quality, the potential impacts under the Preferred Alternative would be less than those under the Expanded Operations Alternative, but greater than those under the No Action Alternative.

The continuation and enhancement of current levels of operations, specifically the rate of radioactive waste disposal, quantities of radioactive material used in tests and experiments, and transportation of radioactive wastes and materials at the NNSS, as well as the pace of environmental restoration at the Nevada Test and Training Range, including the TTR, are the primary factors that would contribute to the radiological dose and estimated health impacts on the public and workers. The vast majority of the public dose would be due to transportation of radioactive materials and waste. If all of the transportation activities evaluated under this alternative were to occur, the public would receive a collective dose of 1,400 person-rem, resulting in an estimated 1 (0.8) latent cancer fatality in that population.

Under each alternative, construction and operation of one or more solar power generation facilities at the NNSS would result in the following: an increase in employment relative to the current workforce, loss of desert tortoise habitat and the taking of tortoises, direct impacts on cultural resources, and increases in demand for groundwater. At present, DOE/NNSA has neither sought nor received proposals for specific solar facilities. Prior to authorizing the development of such facilities, DOE/NNSA would conduct a project-specific NEPA review, and undertake actions necessary to demonstrate compliance with applicable regulations.

At RSL, DOE/NNSA would maintain the current levels of operations, as no new projects or enhanced capabilities are proposed. Among the 13 resource areas, either there would be no impacts or the impacts associated with ongoing operations would remain small and continue unchanged from baseline conditions. Although the levels of operations could increase and proposed projects could be implemented at NLVF and the TTR, DOE/NNSA concluded that environmental impacts on all resource areas would remain small.

S.4.2 Areas of Controversy

American Indian tribes and organizations believe that activities at the NNSS and offsite locations, regardless of the magnitude of potential environmental impacts under any of the alternatives, would result in an adverse and unacceptable disturbance of the natural and cultural environment. In recognition of Federal laws and policies, DOE/NNSA maintains an ongoing consultation program with the Consolidated Group of Tribes and Organizations to address American Indian concerns about the environment, and, in particular, archaeological sites, plant and animal resources, traditional cultural properties, and sacred sites of cultural value.

The public in general, and Nye County residents in particular, remain concerned about the quality of groundwater from the NNSS, which flows into southern Nye County along multiple flow paths.

Groundwater contaminated by past underground nuclear weapons testing has the potential to affect the quality of water available to communities, residents, and commercial enterprises in the future. In 2009, tritium was detected in a well located on the Nevada Test and Training Range adjacent to the Western Pahute Mesa region of the NNSS. This well is about 14 miles from the nearest public water source, a private well. In 2010, tritium also was detected in a second well on the Nevada Test and Training Range. The tritium concentrations were well below the Safe Drinking Water Act standards established by the EPA. Based on early computer model predictions, DOE/NNSA does not expect contamination to reach the private well for at least 100 years; and furthermore, contamination may never reach the well.

Summary of the Consolidated Group of Tribes and Organizations' Areas of Interest

- Increased access to the Nevada National Security Site (NNSS) and Off-Site Locations to conduct traditional ceremonies and activities to promote balance and sustainability to the land.
- Expanded ethnographic studies focusing on traditional and religious use areas culminating in a Traditional Cultural Property nomination on the NNSS.
- Identify and establish co-management strategies with the National Nuclear Security Administration Nevada Site Office (NNSA/NSO) for protection of American Indian cultural resources on the NNSS and Off-Site Locations.
- Expanded studies of impacts derived from the transportation of radioactive waste and materials through ancestral lands and to the overall Indian culture.

Water use and water rights will continue to be a major concern, regardless of the water demands associated with the NNSS. Growth in water demand in Nevada, particularly in Nye County, has been rapid, and water use and Federal water rights at the NNSS remain a controversial issue when considered against the backdrop of regional water transfer plans.

The State of Nevada continues to believe that disparities exist between the original NNSS land withdrawals and DOE/NNSA activities.

The public remains concerned about possible health effects that could occur from the resuspension of radioactively contaminated soils on the NNSS. DOE/NNSA continues to monitor the releases of radionuclides to the environment from all sources, such as soils and air, and used these data to estimate the dose to a maximally exposed individual. Since 2004, this dose is estimated to have ranged from 2.0 to 2.9 millirem per year, a small fraction of the average annual dose of about 310 millirem that a member of the public receives from natural background sources of radiation.

Maximally Exposed Individual

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).

The State of Nevada and others continue to promote the current DOE/NNSA commitment of avoiding shipments of low-level and mixed low-level radioactive waste through Las Vegas, Nevada. This commitment, as expressed in the waste acceptance criteria for the NNSS, avoided Hoover Dam and Las Vegas. DOE/NNSA committed to avoid these areas at a time when major highways, specifically Interstate 15 and U.S. Route 95, were

Routing of Low-Level Radioactive Waste Shipments

While the U.S. Department of Energy/National Nuclear Security Administration's (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 low-level radioactive waste through greater metropolitan Las Vegas (constrained case). In consideration of the environmental analyses and stakeholder comments, and after consultation with the Nevada Department of Environmental Protection as part of the waste acceptance criteria revision process, DOE/NNSA determined that it would retain the highway routing restrictions for shipments of low-level radioactive waste and therefore there would be no need to revise the waste acceptance criteria in this regard (DOE 2012).

unable to accommodate the growing traffic volume. Since then, these highways have been widened and otherwise improved, the Bruce Woodward Beltway (Interstate 215 and Clark County Route 215) around Las Vegas has been expanded, and the bypass bridge has been constructed near Hoover Dam. DOE/NNSA, in this *NNSS SWEIS*, has analyzed two transportation cases; a Constrained Case and an Unconstrained Case. The Constrained Case retains current routing of shipments of low-level and mixed low-level radioactive waste and avoids crossing the Colorado River near Hoover Dam, as well as the interstate system in Las Vegas. The Unconstrained Case analyzes shipments on highways through the greater metropolitan area. This analysis was undertaken to develop a greater understanding of the potential environmental consequences of shipping such waste through and around metropolitan Las Vegas, as well as to inform any potential highway routing-related revisions to DOE/NNSA's waste acceptance criteria. Such revisions are developed in accordance with DOE/NNSA's standard practices, which include consultation with the State of Nevada; when finalized, they will be made publicly available through publication on the NNSS website. DOE/NNSA determined that it would retain the highway routing restrictions for shipments of low-level radioactive waste; therefore, there would be no need to revise the waste acceptance criteria in this regard (DOE 2012). As discussed above in Section S.3.1.2, the Summary no longer includes the results of the Unconstrained Case analysis; they may be found in Volume 1, Chapter 5, Section 5.1.3.1.2.

S.4.3 Issues to be Resolved

Implementing any of the alternatives may trigger other regulatory actions that DOE/NNSA would need to undertake prior to proceeding, such as reinitiating consultation under Section 7 of the Endangered Species Act with USFWS regarding the desert tortoise, consultations with the Nevada State Historic Preservation Officer under Section 106 of the National Historic Preservation Act, or consultations with the State of Nevada regarding reactivation of the Area 3 Radioactive Waste Management Site. DOE/NNSA has in the past undertaken such consultations, and continues to do so. As an example, DOE/NNSA, in consultation with USFWS, submitted a biological assessment of projects and activities anticipated to occur on the NNSS, and in 2009, USFWS issued its *2009 Biological Opinion* (USFWS 2009). This SWEIS addresses a range of reasonably foreseeable projects and activities that would be developed or undertaken over the next 10 years, although several such projects and activities are in the early phases of development. For these proposals, conservative assumptions regarding the location and scale of these projects and activities were made to provide a basis for programmatic analysis. Accordingly, when the planning processes for future projects and activities are refined and more-detailed information becomes available, and subsequent to any decisions in a Record of Decision, DOE/NNSA would identify regulatory requirements applicable to newly proposed projects and to changes in ongoing operations (activities), and then initiate actions leading to compliance with those requirements.

Groundwater contaminated from past weapons testing continues to migrate, and tritium has been found in a well outside the NNSS, but within the secure boundaries of the Nevada Test and Training Range. Developing an improved understanding of where radiological contamination exists in the groundwater, predicting where the contamination is moving, and defining how far it will migrate will require DOE/NNSA to continue the development of a regional three-dimensional groundwater computer model. This model also formed the basis for individualized models for each major area where underground testing was conducted. Individualized models continue to evolve as additional data are collected, and further analysis and model calibration are conducted.

DOE/NNSA could not proceed with the development of utility-scale solar power generation facilities in Area 25 of the NNSS in the absence of a commercial developer. If a developer were to propose such a facility, additional NEPA review would be required to identify and analyze potential project-specific environmental impacts. In addition, DOE/NNSA would need to identify and resolve any conflicts between the proposed facility and ongoing operations at the NNSS before the facility could be constructed.

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DOE/EIS-0426
February 2013

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)

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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Title: *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE/EIS-0426)

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}

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.

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 (Sarícks 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).

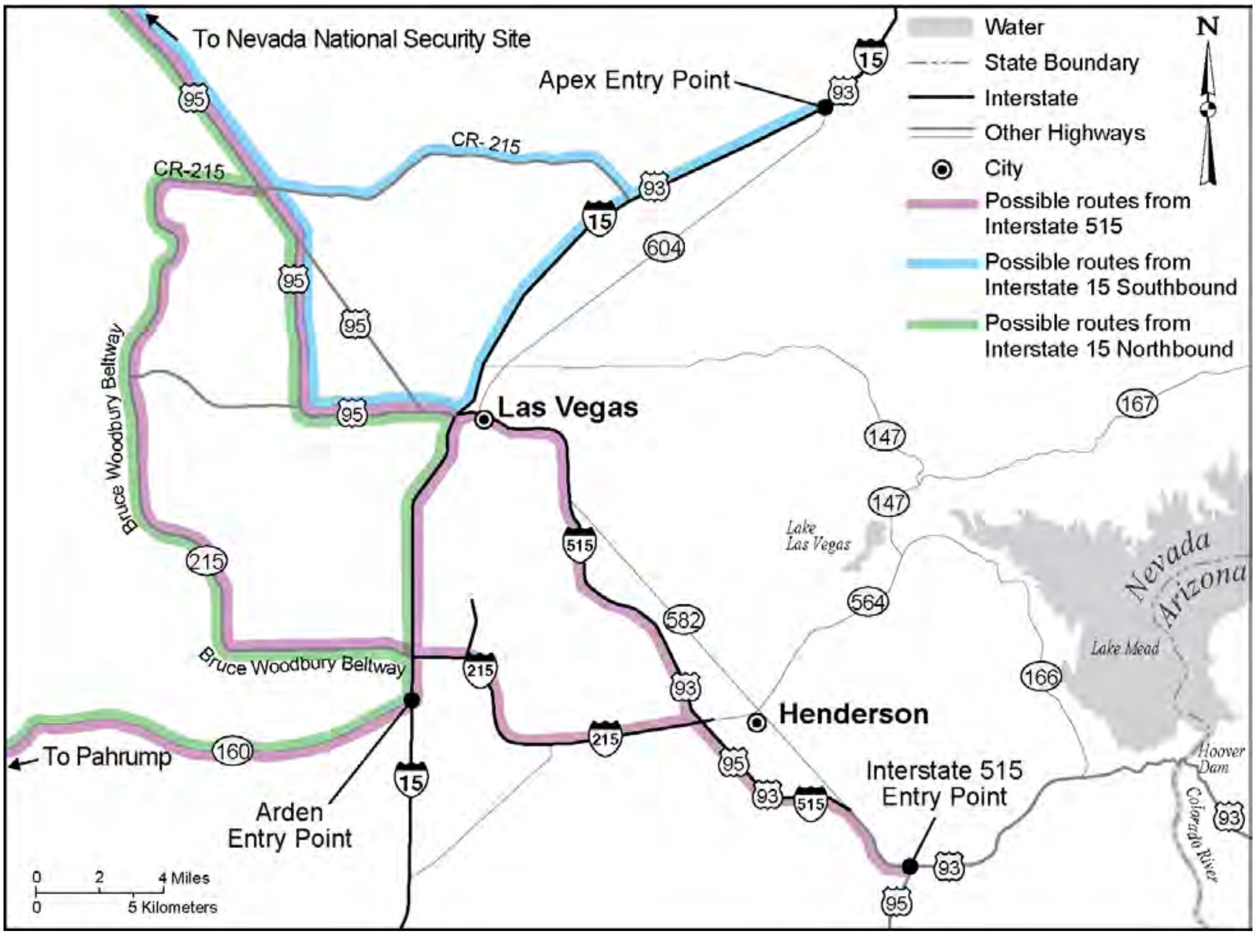

Figure 5–4 Transportation Routes Analyzed in Las Vegas for the Transport of Low-Level and Mixed Low-Level Radioactive Waste for the Unconstrained Case

- 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.

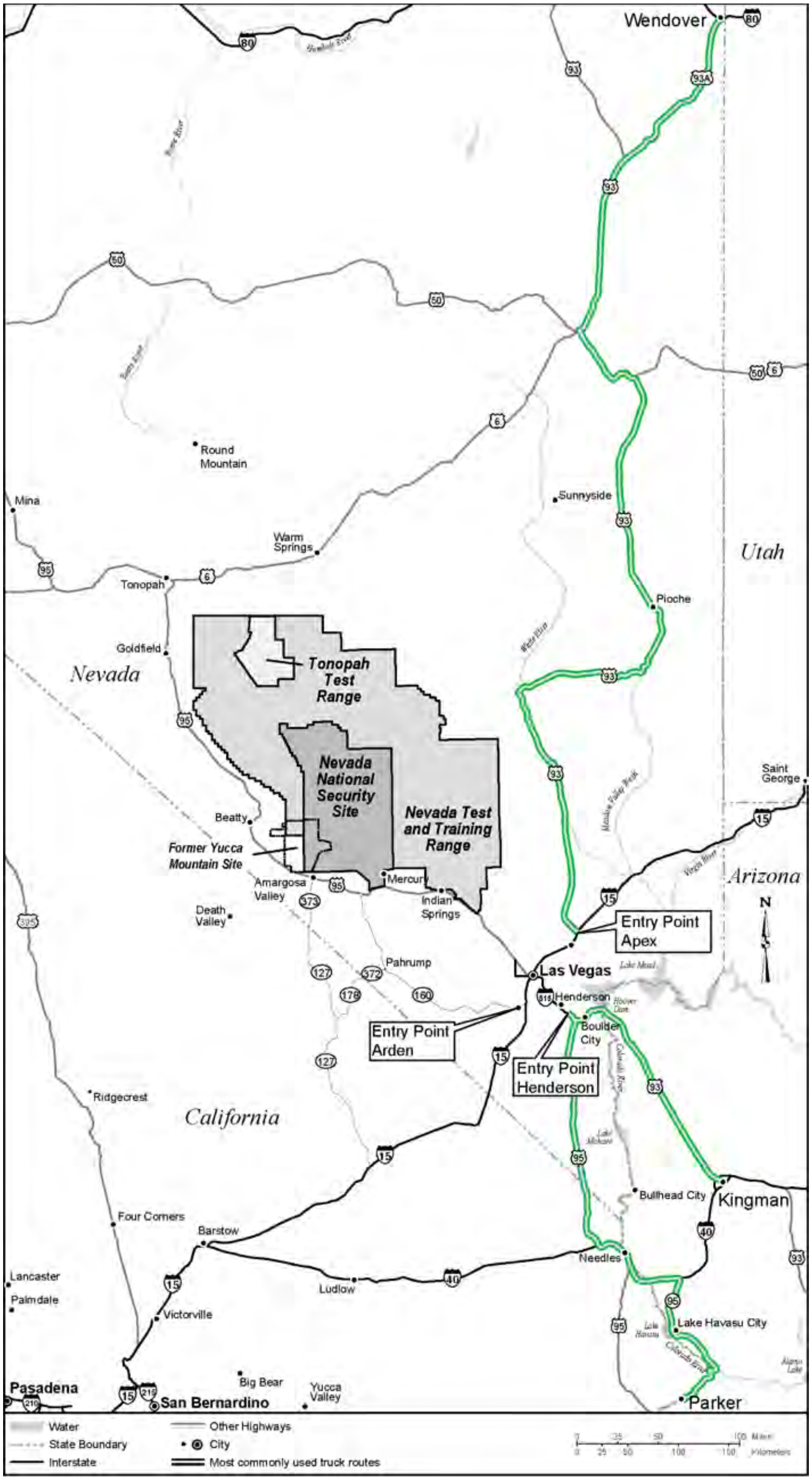

Figure 5–5 Transfer Station Locations and Analyzed Routes from These Locations to Las Vegas for the Unconstrained Case

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

				Incident-Free Conditions				*Accident Conditions*	
				Crew		*Population*			
Material	*Number of Shipments*	*One-Way Kilometers Traveled (million)*	*One-Way Miles Traveled (million)*	*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]

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
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

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	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]

		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	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 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.

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February 2013

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 2
(Appendices A through I)

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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Title: *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE/EIS-0426)

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

AEGL	Acute Exposure Guideline Level
ALOHA	Areal Locations of Hazardous Atmospheres
ARF	airborne release fraction
BEEF	Big Explosives Experimental Facility
BEIR	Biological Effects of Ionizing Radiation
CAS	corrective action site
CAU	corrective action unit
CEMP	Community Environmental Monitoring Program
CFR	*Code of Federal Regulations*
CH	contact-handled
D&D	decontamination and decommissioning
DAF	Device Assembly Facility
DAQEM	Department of Air Quality and Environmental Management
DART	days away from work, restricted duty, or transferred
DHS	U.S. Department of Homeland Security
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPFF	Dense Plasma Focus Facility
DR	damage ratio
DUF_6	depleted uranium hexafluoride
EDE	effective dose equivalent
EDMS	Emissions and dispersion Modeling System
EIS	environmental impact statement
EMAD	Engine Maintenance Assembly and Disassembly Facility
EODU	Explosives Ordnance Disposal Unit
EPA	U.S. Environmental Protection Agency
ERPGs	Emergency Response Planning Guidelines
FFACO	Federal Facility Agreement and Consent Order
FR	*Federal Register*
FRMAC	Federal Radiological Monitoring and Assessment Center
FY	fiscal year
GENII	Hanford Environmental Radiation Dosimetry Software System
GIS	geographic information system
HAP	hazardous air pollutant
HEST	High Explosive Simulation Technique
HEU	highly enriched uranium
HTF	heat transfer fluid
ICRP	International Commission on Radiological Protection
IDLH	Immediately Dangerous to Life or Health
INL	Idaho National Laboratory
ISCORS	Interagency Steering Committee on Radiation Standards

ISO	International Organization for Standardization
JASPER	Joint Actinide Shock Physics Experimental Research
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LCF	latent cancer fatality
LLW	low-level radioactive waste
LPF	leak path factor
MACCS2	MELCOR Accident Consequences Code System
MAR	material at risk
MEI	maximally exposed individual
MLLW	mixed low-level radioactive waste
MOBILE6	Mobile Source Emission Factor Model
MOVES2010	Motor Vehicle Emission Simulator 2010
NAAQS	National Ambient Air Quality Standards
NAC	Nevada Administrative Code
NASA	U.S. 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
NIOSH	National Institute of Occupational Safety and Health
NLVF	North Las Vegas Facility
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NPTEC	Nonproliferation Test and Evaluation Complex
NRC	U.S. Nuclear Regulatory Commission
NSO	Nevada Site Office
NTTR	Nevada Test and Training Range
NTS	Nevada Test Site
NNSS SWEIS	*Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada Test Site and Off-Site Locations in the State of Nevada*
OBODM	Open Burn/Open Detonation Model
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PM	particulate matter
rad	radiation absorbed dose
RADTRAN	Radioactive Material Transportation
RCRA	Resource Conservation and Recovery Act
rem	roentgen equivalent man
RF	respirable fraction
RH	remote-handled
RISKIND	Risks and Consequences of Radiological Material Transport
RNCTEC	Radiological/Nuclear Countermeasures Test and Evaluation Complex

ROD	Record of Decision
RSL	Remote Sensing Laboratory
RTG	radioisotope thermoelectric generator
RWMC	Radioactive Waste Management Complex
RWMS	Radioactive Waste Management Site
SGTs	safeguards transporters
SNM	special nuclear material
STEL	Short-Term Exposure Limit
SWEIS	Site-Wide Environmental Impact Statement
TEELs	Temporary Emergency Exposure Limits
TLV	Threshold Limit Value
TNT	2,4,6-trinitrotoluene
TRAGIS	Transportation Routing Analysis Geographic Information System
TRC	total recordable cases
TRU	transuranic waste
TRUPACT	transuranic waste package transporter
TTR	Tonopah Test Range
TWA	Time-Weighted Average
UCVS	ultrafast closure valve system
UGTA	Underground Test Area
USAF	U.S. Air Force
VMT	vehicle miles traveled
VOC	volatile organic compound
WAC	waste acceptance criteria
WRAP	Western Regional Air Partnership
Y-12	Y-12 National Security Complex
ZPPR	zero power plutonium reactor
ºC	degrees Centigrade
ºF	degrees Fahrenheit

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}

considerable data regarding threshold values for various chemical constituents of vehicle exhaust has made linear extrapolation to estimate the risks from vehicle/rail emissions untenable (Neuhauser et al. 2000). This calculation has been dropped from RADTRAN in its recent revision (SNL 2009); therefore, no risk factors have been assigned to the vehicle emissions in this SWEIS.

E.5.3 Maximally Exposed Individual Exposure Scenarios

The maximum individual doses for routine offsite transportation were estimated for transportation workers, as well as for members of the general population. For truck shipments, three hypothetical scenarios were evaluated to determine the MEI in the general population. These scenarios are as follows (DOE 2002a):

- A person caught in traffic and located 3.3 feet from the surface of the shipping container for 30 minutes
- A resident living 98 feet from the highway used to transport the shipping container
- A service station worker at a distance of 52 feet from the shipping container for 50 minutes

The hypothetical MEI doses were accumulated over a single year for all transportation shipments. However, for the scenario involving an individual caught in traffic next to a shipping container, the radiological exposures were calculated for only one event because it was considered unlikely that the same individual would be caught in traffic next to all containers for all shipments. For truck shipments, the maximally exposed transportation worker is the driver, who was assumed to have been trained as a radiation worker and to drive shipments for up to 2,000 hours per year, accumulating an exposure of 2 rem per year. For a member of the truck crew who is not trained as a radiation worker, the maximum annual dose rate would be 100 millirem (10 CFR 20.1301).

The following three hypothetical scenarios were also evaluated for railcar shipments:

- A rail yard worker working at a distance of 33 feet from the shipping container for 2 hours
- A resident living 98 feet from the rail line where the shipping container is being transported
- A resident living 656 feet from a rail stop during classification and inspection for 20 hours

The maximally exposed transportation worker (excluding drivers) for both truck and rail shipments is an individual inspecting the cargo at a distance of 3.3 feet from the shipping container for 1 hour.

E.6 Transportation Accident Risks

E.6.1 Methodology

The offsite transportation accident analysis considers the impact of accidents during the transportation of waste by truck or rail. Under accident conditions, human health and environmental impacts could result from the release and dispersal of radioactive material. Transportation accident impacts were assessed using an accident analysis methodology developed by NRC. This section provides an overview of the methodologies; detailed descriptions of various methodologies are found in NUREG-0170, *Radioactive Material Transportation Study*; NUREG/CR-4829, *Modal Study*; and NUREG/CR-6672, *Reexamination Study* (NRC 1977, 1987, 2000). Accidents that could potentially breach the shipping container are represented by a spectrum of accident severities and radioactive release conditions. Historically, most transportation accidents involving radioactive materials have resulted in little or no release of radioactive material from the shipping container. Consequently, the analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents of low severity to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. The accident analysis calculates the probabilities and consequences from this spectrum of accidents.

To provide DOE and the public with a reasonable assessment of radioactive waste transportation accident impacts, two types of analysis were performed. First, an accident risk assessment was performed that takes into account the probabilities and consequences of a spectrum of potential accident severities using a methodology developed by NRC (NRC 1977, 1987, 2000). For the spectrum of accidents considered in the analysis, accident consequences in terms of collective "dose risk" to the population within 50 miles were determined using the RADTRAN 6 computer program (SNL 2009). The RADTRAN code sums the product of consequences and probability over all accident severity categories to obtain a probability-weighted risk value referred to in this appendix as "dose risk," which is expressed in units of person-rem. Second, to represent the maximum reasonably foreseeable impacts on individuals and populations should an accident occur, maximum radiological consequences were calculated in an urban or suburban population zone for an accidental release with a likelihood of occurrence greater than 1 in 10 million per year using the RISKIND computer program (Yuan et al. 1995).

For accidents in which a waste container or the cask shielding is not damaged, population and individual radiation exposures from the waste package were evaluated for the duration of time needed to recover and resume shipment. The collective dose over all segments of transportation routes was evaluated for an affected population up to a distance of 0.5 miles from the accident location. This dose would be an external dose and would be approximately inversely proportional to the square of the distance of the affected population from the accident. Any additional dose to those residing beyond 0.5 miles from the accident would be negligible. The dose to an individual (first responder) was calculated assuming that the individual would be located at 6.6 to 33 feet from the package. For the accidents leading to loss of cask shielding, a method similar to that provided in NUREG/CR-6672, *Reexamination Study* (NRC 2000) and adapted 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)* was used (DOE 2002a).

E.6.2 Accident Rates

Whenever material is shipped, the possibility exists that a traffic accident could result in vehicular damage, injury, or death. Even when drivers are trained in defensive driving and taking great care, there is a risk of a traffic accident. To date, DOE and its predecessor agencies have a successful 50-year history in transporting radioactive materials. In the years 2004 to 2008, no fatalities related to DOE's transportation of hazardous or radioactive material cargo for the Office of Environmental Management occurred (DOE 2009). DOE Manual 460.2-1A, *Radioactive Material Transportation Practices Manual for Use with DOE Order 460.2A*, contains stipulations that DOE and its shipping contractors follow regarding conditions under which shipments should be made (DOE 2008b).

To calculate the accident risks, vehicle accident and fatality rates were taken from data provided in *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Accident rates are generically defined as the number of accident involvements (or fatalities) in a given year per unit of travel in that same year. Therefore, the rate is a fractional value, with accident involvement count as the numerator of the fraction and vehicular activity (total travel distance in truck miles) as its denominator. Accident rates were generally determined for a multi-year period. For assessment purposes, the total number of expected accidents or fatalities was calculated by multiplying the total shipment distance for a specific case by the appropriate accident or fatality rate. No reduction in accident or fatality rates was assumed even though radioactive material carrier drivers are better trained and have better-maintained equipment.

For truck transportation, the rates presented are specifically for heavy-haul combination trucks involved in interstate commerce (Saricks and Tompkins 1999). Heavy-haul combination trucks are rigs composed of a separable tractor unit containing the engine and one to three freight trailers connected to each other. Heavy-haul combination trucks are typically used for radioactive material shipments. Truck accident rates were computed for each state based on statistics compiled by the Federal Highway Administration, Office of Motor Carriers, from 1994 to 1996. A fatality caused by an accident is the death of a member of the public who is killed instantly or dies within 30 days due to injuries sustained in the accident. The accident and fatality rates are per truck-mile or railcar-mile.

For offsite transportation, the accident and fatality rates for this SWEIS were based on state-level data provided in the Saricks and Tompkins report (Saricks and Tompkins 1999). The rates in the Saricks and Tompkins report are given in terms of accident and fatality per car-kilometer and railcar-kilometer traveled. Accident and fatality rates for trucks are provided by population zone. This information is used to determine the accident and fatality rate specific to each truck and rail route. For in-state truck transport, Nevada accident and fatality rates were used (Saricks and Tompkins 1999).

A recent review of the truck accidents and fatalities reports by the Federal Carrier Safety Administration indicated that state-level accidents and fatalities were underreported. For the years 1994 through 1996, which were the basis for the analysis in the Saricks and Tompkins report, the review found that accidents were underreported by about 39 percent and fatalities were underreported by about 36 percent (UMTRI 2003). Therefore, truck accident and fatality rates were increased by factors of 1.64 and 1.57, respectively, in this SWEIS to account for the underreporting.

For each rail shipment, it was assumed that each train would consist of at least three cars: a locomotive, a crew car, and a railcar carrying waste.

For DOE SGTs, the DOE operational experience between 1984 and 1999 was used. The mean probability of an accident requiring towing of a disabled SGT was about 6 per 100 million kilometers (DOE 2000). The number of SGT trailer accidents is too small to support allocating this overall rate among the various types of routes (interstate, primary, others) used in the accident analysis. Therefore, data for the relative rate of accidents on these route types, or influence factor, provided in *Determination of Influence Factor and Accident Rates for Armored Tractor/Safe Secure Trailer* (Phillips, Clauss, and Blower 1994), were used to estimate accident frequencies for rural, urban, and suburban transports. Accident fatalities for SGTs were estimated using the commercial truck transport fatality per accident ratios within each zone.

E.6.3 Accident Severity Categories and Conditional Probabilities

Accident severity categories for potential radioactive waste transportation accidents are described in NUREG-0170, *Radioactive Material Transportation Study* (NRC 1977) (for radioactive waste in general); in NUREG/CR-4829, *Modal Study* (NRC 1987); and in NUREG/CR-6672, *Reexamination Study* (NRC 2000) (for spent nuclear fuel). The methods described in the *Modal Study* and the *Reexamination Study* are applicable to transportation of radioactive materials in a Type B spent fuel cask. The accident severity categories presented in the *Radioactive Material Transportation Study* would be applicable to all other waste transported off site.

The *Radioactive Material Transportation Study* (NRC 1977) originally was used to estimate conditional probabilities associated with accidents involving transportation of radioactive materials. The *Modal Study* and the *Reexamination Study* (NRC 1987, 2000) are initiatives taken by NRC to refine more precisely the analysis presented in the *Radioactive Material Transportation Study* for spent nuclear fuel shipping casks.

Whereas the *Radioactive Material Transportation Study* (NRC 1977) analysis was primarily performed using best engineering judgments and presumptions concerning cask response, the later studies relied on sophisticated structural and thermal engineering analysis and a probabilistic assessment of the conditions that could be experienced in severe transportation accidents. The latter results are based on representative spent nuclear fuel casks assumed to have been designed, manufactured, operated, and maintained according to national codes and standards. Design parameters of the representative casks were chosen to meet the minimum test criteria specified in 10 CFR Part 71. The study is believed to provide realistic, yet conservative, results for radiological releases during transport accident conditions.

In both the *Modal Study* and the *Reexamination Study*, potential accident damage to a cask is categorized according to the magnitude of the mechanical forces (impact) and thermal forces (fire) to which a cask may be subjected during an accident. Because all accidents can be described in these terms, severity is independent of the specific accident sequence. In other words, any sequence of events that results in an accident in which a cask is subjected to forces within a certain range of values is assigned to the accident severity region associated with that range. The accident severity scheme is designed to take into account all potential foreseeable transportation accidents, including accidents with low probability but high consequences and those with high probability but low consequences.

As discussed earlier, the accident consequence assessment considers the potential impacts of severe transportation accidents. In terms of risk, the severity of an accident must be viewed in terms of potential radiological consequences, which are directly proportional to the fraction of the radioactive material within a cask that is released to the environment during the accident. Although accident severity regions span the entire range of mechanical and thermal accident loads, they are grouped into accident categories that can be characterized by a single set of release fractions and are, therefore, considered together in the accident consequence assessment. The accident category severity fraction is the sum of all conditional probabilities in that accident category.

For the accident risk assessment, accident "dose risk" was generically defined as the product of the consequences of an accident and the probability of occurrence of that accident, an approach consistent with the methodology used by the RADTRAN computer code. The RADTRAN code sums the product of consequences and probability over all accident categories to obtain a probability-weighted risk value referred to in this appendix as "dose risk," which is expressed in units of person-rem.

E.6.4 Atmospheric Conditions

Because it is impossible to predict the specific location of an offsite transportation accident, generic atmospheric conditions were selected for the risk and consequence assessments. On the basis of observations from National Weather Service surface meteorological stations at more than 177 locations in the United States, on an annual average, neutral conditions (Pasquill Stability Classes C and D) occur 58.5 percent of the time, and stable (Pasquill Stability Classes E, F, and G) and unstable (Pasquill Stability Classes A and B) conditions occur 33.5 percent and 8 percent of the time, respectively (DOE 2002a). The neutral weather conditions dominate in each season, but most frequently in the winter (nearly 60 percent of the observations).

Neutral weather conditions (Pasquill Stability Class D) are the most frequently occurring atmospheric stability condition in the United States and are thus most likely to be present in the event of an accident involving a radioactive waste shipment. Neutral weather conditions are typified by moderate windspeeds, vertical mixing within the atmosphere, and good dispersion of atmospheric contaminants. Stable weather conditions are typified by low windspeeds, very little vertical mixing within the atmosphere, and poor dispersion of atmospheric contaminants. The atmospheric condition used in RADTRAN is an average weather condition that corresponds to a stability class spread between Class D (for near distance) and Class E (for farther distance).

The accident consequences for the maximum reasonably foreseeable accident (an accident with a likelihood of occurrence greater than 1 in 10 million per year) were assessed under both stable (Class F with a windspeed of 3.3 feet per second) and neutral (Class D with a windspeed of 13 feet per second) atmospheric conditions. The population dose was evaluated under neutral atmospheric conditions and the MEI dose, under stable atmospheric conditions. The population dose would represent an accident during average weather conditions, while the MEI dose would represent an accident during weather conditions that would yield the greatest impacts (stable conditions, with minimum diffusion and dilution).

E.6.5 Radioactive Release Characteristics

Radiological consequences were calculated by assigning radionuclide release fractions on the basis of the type of waste, the type of shipping container, and the accident severity category. The release fraction is defined as the fraction of the radioactivity in the container that could be released to the atmosphere in a given severity of accident. Release fractions vary according to waste type and the physical or chemical properties of the radioisotopes. Most solid radionuclides are nonvolatile and are, therefore, relatively nondispersible.

Representative release fractions were developed for each waste and container type on the basis of DOE and NRC reports (DOE 1994, 2002b, 2003a; NRC 1977, 2000). The severity categories and corresponding release fractions provided in these documents cover a range of accidents from no impact (zero speed) to impacts with speeds in excess of 120 miles per hour onto an unyielding surface. Traffic accidents that could occur at the site would result in minor impacts due to lower local speed, with no release potential.

For radioactive wastes transported in a Type B cask, the particulate release fractions were developed consistent with the models in NUREG/CR-6672, *Reexamination Study* (NRC 2000). For wastes transported in Type A containers (e.g., 55-gallon drums and boxes), the fractions of radioactive material released from the shipping container were based on recommended values from the *Radioactive Material Transportation Study* (NRC 1977) and the *DOE Handbook on Airborne Release and Respirable Fractions* (DOE 1994). For contact-handled and remote-handled TRU waste, the release fractions corresponding to the *Radioactive Material Transportation Study* severity categories, as adapted in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement (WIPP SEIS-II)*, were used (DOE 1997). For wastes transported in high-integrity containers and lift liners in 20-foot International Organization for Standardization (ISO) containers, release fractions were calculated using a method similar to that used in the *WIPP SEIS-II*. For soft-liners in 20-foot ISO containers, release fractions were determined using the method described in the DOE *West Valley Demonstration Project Waste Management EIS* (DOE 2003b). While the conservatism of the conditional probabilities and release fractions for each accident severity category can be argued, these studies, as well as the others mentioned in this section, are still considered the only reliable sources for this information.

For accidents in which the waste container or cask shielding is not damaged and no radioactive material is released, it was assumed that it would take 12 hours to recover from the accident and resume shipment. During this period, no individual would remain close to the cask. A first responder could stay at a location 6.6 to 33 feet from the package, at a position where the dose rate would be the highest, for 30 minutes in a loss-of-shielding accident and 1 hour for other accidents with no release (DOE 2002b).

E.6.6 Acts of Sabotage or Terrorism

In the aftermath of the tragic events of September 11, 2001, DOE is continuing to assess measures to minimize the risk or potential consequences of radiological sabotage. While it is not possible to determine terrorists' motives and targets with certainty, DOE considers the threat of terrorist attacks to be real and makes all efforts to reduce any vulnerability to this threat. DOE considers, evaluates, and plans for potential terrorist attacks during transportation and storage of special nuclear materials such as plutonium and enriched uranium. These materials would be transported using DOE's safe and secure transport equipment and would be escorted by protective force personnel. DOE has a proven record of protecting these assets; no diversion of any DOE nuclear material has occurred. The details of any postulated terrorist attack, as well as DOE's plans for the security of its facilities and terrorist countermeasures, are classified. A classified appendix has been prepared for this SWEIS that includes impact analyses for intentional acts of destruction related to transportation.

Additionally, DOE has evaluated the impacts of acts of sabotage and terrorism on transportation of spent nuclear fuel and high-level radioactive waste shipments (DOE 1996, 2002a). The spectrum of accidents considered ranges from a direct attack on a cask from afar to hijacking and exploding a shipping cask in an urban area. Both of these actions would result in damaging the cask and its contents and releasing radioactive materials. The fraction of the materials released is dependent on the nature of the attack (type of explosive or weapon used). The sabotage event evaluated in the *Yucca Mountain EIS* (DOE 2002a) was considered as the enveloping analysis for this SWEIS. The event was assumed to involve either a truck-sized or a rail-sized cask containing light-water reactor spent nuclear fuel. The consequences of such an act were calculated to result in an MEI dose (at 460 feet) of 40 to 110 rem for events involving a rail-sized or truck-sized cask, respectively. These events would lead to an increase in the risk of fatal cancer to the MEI by 2 to 7 percent, or 2 chances in 100 to 7 chances in 100 (DOE 2002a). The quantity of radioactive materials transported under all alternatives considered here would be less than that considered in the analysis in the *Yucca Mountain EIS*. Therefore, estimates of risk in the *Yucca Mountain EIS* envelop the risks from an act of sabotage or terrorism involving the radioactive material transported under all alternatives considered in this SWEIS.

E.6.7 Other Parameters

An accident involving a transport carrying radioactive material or waste can incur impacts that are not directly associated with a human health impact (i.e., traffic fatality or LCF). Such impacts can include the following:

- Financial and social costs related to cleanup activities associated with removal of dispersed radioactive materials and contaminated environmental resources
- Socioeconomic losses that could result because people avoid the area regardless of the environmental impact (impact on tourism), as well as general negative public perceptions and stigma regarding the risk associated with transporting radioactive materials and wastes

Cleanup actions would include removal and repackaging of any cargo that was released, cleanup or removal of environmental media, and restoration of local activities to previous conditions. The U.S. Environmental Protection Agency (EPA) has concluded that soil concentration levels (i.e., deposition) on the order of 0.1 to 1 microcuries per square meter represent a proper level for concern and require initiation of protective actions and temporary access restrictions. A realistic assessment would be expected to lead to less restrictive conclusions (Burley 1990). Actions and restrictions may take the form of interdiction of agricultural products and limitations on commercial and residential activities, which could in turn affect employment. Cleanup of contaminated areas or property use restrictions may involve substantial monetary cost and loss of beneficial use of property for commercial, residential, agricultural, recreational, institutional, or other purposes. Impacts on water, biological, ecological, and cultural resources are also possible in areas with contamination in excess of the EPA level of 0.1 microcuries per square meter.

Economic impacts of an accident include direct costs associated with radiation surveys, cleanup, and continued monitoring, as well as indirect costs associated with temporary or longer-term relocation of residents, temporary or longer-term loss of employment, destruction or quarantine of agricultural products, land use restrictions, and public health and medical care. The magnitude of these impacts would, in general, be proportional to the amount of radioactive material released and to the direct human health impacts. Estimates of land area that might be contaminated are highly dependent on specific accident source terms and meteorological modeling assumptions. This is because the amount of radioactive material that may accumulate on the ground is highly dependent on the size of the particles that are released from the transportation package to the environment (which determines how fast they settle back to the ground), specific accident conditions (for example, presence of a fire), and meteorological conditions. In general, unless there is a fire that can effectively loft the radiological materials into the air, most of the particles would return to the ground within less than a hundred meters of the accident site. Costs associated with radiation surveys, cleanup, and continued monitoring could vary widely depending on the characteristics of the contaminated area. In addition to the potential direct costs, there are other secondary societal costs associated with mitigation of such high-consequence accidents, including those associated with temporary or longer-term relocation of residents, temporary or longer-term loss of employment, destruction or quarantine of agricultural products, land use restrictions, and public health and medical care. Because of the myriad of factors associated with a specific accident, a full quantitative, site-specific, accident analysis that incorporates emergency response and cleanup activities was not performed for this *NNSS SWEIS*.

Specific sites along a route were not addressed in the analysis in this *NNSS SWEIS*. DOE performs transportation analyses to determine comparative risks among alternatives using risks calculated for entire routes. The risk over the entire transportation route is generally not dominated by one specific local area; therefore, analysis of specific local hazards on many possible routes was neither practical nor necessary for the purposes of this *NNSS SWEIS*. Transportation of LLW/MLLW and other radioactive materials would use existing highways and railroads and, as such, would represent a small fraction of the existing national and local (Nevada) highway and railway traffic. Because no new land acquisition and construction would be required to accommodate these shipments, this SWEIS focuses on potential impacts to human health and safety and the potential for accidents along shipment routes. In addition transport of radioactive materials and wastes occurs daily on the Nation's highways as a result of commercial and government activities; therefore, the transportation activities analyzed in this *NNSS SWEIS* would not present a new or unique hazard that would require specific locations along a route to be analyzed. This approach is consistent with the Council on Environmental Quality's guidance to agencies that environmental impact statements (EISs) "focus on significant environmental issues and alternatives" (40 CFR 1502.1) and discuss impacts "in proportion to their significance" (40 CFR 1502.2(b)).

In the 2002 *Yucca Mountain EIS* and its 2008 *Final Supplemental Environmental Impact Statement for a Geological Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (Yucca Mountain SEIS)* (DOE 2002a, 2008c), DOE evaluated the "perceived risk" and "stigma" associated with the transportation of spent nuclear fuel and high-level radioactive waste. In those EISs, DOE concluded that there is no valid method to translate public perceptions regarding waste transportation into quantifiable economic impacts. DOE has not been presented with any new information since the 2008 *Yucca Mountain SEIS* that changes this conclusion. While stigmatization can be envisioned under some scenarios, it is not inevitable or numerically predictable. As a consequence, DOE/NNSA did not attempt to quantify any potential for impacts from risk perceptions or stigma in this SWEIS.

E.7 Risk Analysis Results

Per-shipment risk factors have been calculated for the collective populations of exposed persons and for the crew for all anticipated routes and shipment configurations. Radiological risks are presented in doses per shipment for each unique route, material, and container combination. Radiological risk factors per shipment for incident-free transportation and accident conditions for the Constrained Case are presented in **Table E–10**. For incident-free transportation, both dose and LCF risk factors are provided for the crew and the exposed general population. The radiological risks would result from potential exposure of people to external radiation emanating from the packaged waste. The exposed population includes the off-link public (i.e., people living along the route), the on-link public (i.e., pedestrian and car occupants along the route), and the public at rest and fuel stops.

Table E–10 Risk Factors per Shipment of Radioactive Waste and Materials

Region/ Destination/ Origin	*Waste or Materials*	*Container*	*Incident-Free Conditions*				*Accident Conditions*	
			Crew Dose (person-rem)	*Crew Risk (LCF)*	*Population Dose (person-rem)*	*Population Risk (LCF)*	*Radiological Risk (LCF)*	*Roundtrip Nonradiological Risk (traffic fatalities)*
Truck Shipments								
Northeast	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.058	0.000035	0.027	0.000016	1.8×10^{-8}	0.00016
		B-25 box	0.048	0.000029	0.016	9.5×10^{-6}	1.5×10^{-8}	0.00016
		B-12 box	0.042	0.000025	0.016	9.5×10^{-6}	7.8×10^{-9}	0.00016
		20-foot ISO	0.083	0.00005	0.023	0.000014	2.8×10^{-8}	0.00016
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.42	0.00025	0.056	0.000033	2.1×10^{-9}	0.00016
Southeast	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.047	0.000028	0.021	0.000013	1.2×10^{-8}	0.00013
		B-25 box	0.039	0.000023	0.013	7.5×10^{-6}	1.0×10^{-8}	0.00013
		B-12 box	0.034	0.00002	0.013	7.5×10^{-6}	5.3×10^{-9}	0.00013
		20-foot ISO	0.067	0.00004	0.017	1.0×10^{-5}	1.9×10^{-8}	0.00013
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.34	0.0002	0.044	0.000026	1.4×10^{-9}	0.00013
South	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.042	0.000025	0.019	0.000011	8.2×10^{-9}	0.00011
		B-25 box	0.035	0.000021	0.011	6.6×10^{-6}	7.1×10^{-9}	0.00011
		B-12 box	0.03	0.000018	0.011	6.6×10^{-6}	3.6×10^{-9}	0.00011
		20-foot ISO	0.060	0.000036	0.014	8.2×10^{-6}	1.3×10^{-8}	0.00011
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.3	0.00018	0.038	0.000023	1.0×10^{-9}	0.00011
Southwest	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.021	0.000012	0.0090	5.4×10^{-6}	2.9×10^{-9}	0.000052
		B-25 box	0.017	0.00001	0.0053	3.2×10^{-6}	2.5×10^{-9}	0.000052
		B-12 box	0.015	8.9×10^{-6}	0.0053	3.2×10^{-6}	1.3×10^{-9}	0.000052
		20-foot ISO	0.03	0.000018	0.0059	3.5×10^{-6}	4.6×10^{-9}	0.000052
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.15	0.00009	0.019	0.000011	3.3×10^{-10}	0.000052
West	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.014	8.3×10^{-6}	0.0065	3.9×10^{-6}	3.8×10^{-9}	0.000037
		B-25 box	0.011	6.9×10^{-6}	0.0038	2.3×10^{-6}	3.3×10^{-9}	0.000037
		B-12 box	0.0099	5.9×10^{-6}	0.0038	2.3×10^{-6}	1.7×10^{-9}	0.000037
		20-foot ISO	0.02	0.000012	0.0046	2.8×10^{-6}	6.1×10^{-9}	0.000037
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.1	0.00006	0.013	8.0×10^{-6}	3.0×10^{-10}	0.000037

Region/ Destination/ Origin	Waste or Materials	Container	Incident-Free Conditions				Accident Conditions	
			Crew Dose (person-rem)	Crew Risk (LCF)	Population Dose (person-rem)	Population Risk (LCF)	Radiological Risk (LCF)	Roundtrip Nonradiological Risk (traffic fatalities)
Northwest	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.03	0.000018	0.015	8.8×10^{-6}	1.3×10^{-8}	0.000087
		B-25 box	0.025	0.000015	0.0086	5.2×10^{-6}	1.1×10^{-8}	0.000087
		B-12 box	0.021	0.000013	0.0086	5.2×10^{-6}	5.6×10^{-9}	0.000087
		20-foot ISO	0.042	0.000025	0.013	7.9×10^{-6}	2.0×10^{-8}	0.000087
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.22	0.00013	0.030	0.000018	1.8×10^{-9}	0.000087
Mountain West	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.015	9.3×10^{-6}	0.0067	4.0×10^{-6}	2.2×10^{-9}	0.000039
		B-25 box	0.013	7.7×10^{-6}	0.0040	2.4×10^{-6}	1.9×10^{-9}	0.000039
		B-12 box	0.011	6.6×10^{-6}	0.0040	2.4×10^{-6}	9.7×10^{-10}	0.000039
		20-foot ISO	0.022	0.000013	0.0045	2.7×10^{-6}	3.5×10^{-9}	0.000039
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.11	0.000067	0.014	8.3×10^{-6}	2.5×10^{-10}	0.000039
Upper Midwest	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.040	0.000024	0.018	0.000011	7.9×10^{-9}	0.00011
		B-25 box	0.034	0.00002	0.011	6.3×10^{-6}	6.9×10^{-9}	0.00011
		B-12 box	0.029	0.000017	0.011	6.3×10^{-6}	3.5×10^{-9}	0.00011
		20-foot ISO	0.058	0.000035	0.013	8.1×10^{-6}	1.3×10^{-8}	0.00011
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.29	0.00018	0.037	0.000022	1.0×10^{-9}	0.00011
INL	TRU waste [c, g]	55-gallon drum	0.049	0.000029	0.016	9.8×10^{-6}	2.1×10^{-9}	0.000039
Parker	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.0065	3.9×10^{-6}	0.0028	1.7×10^{-6}	8.0×10^{-10}	0.000016
		B-25 box	0.0054	3.2×10^{-6}	0.0016	9.9×10^{-7}	7.1×10^{-10}	0.000016
		B-12 box	0.0046	2.8×10^{-6}	0.0016	9.9×10^{-7}	3.6×10^{-10}	0.000016
		20-foot ISO	0.0092	5.5×10^{-6}	0.0019	1.2×10^{-6}	1.3×10^{-9}	0.000016
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.047	0.000028	0.0057	3.4×10^{-6}	5.2×10^{-11}	0.000016
West Wendover	CH-LLW/MLLW [a]	55-gallon drum (CH)	0.0088	5.3×10^{-6}	0.0037	2.2×10^{-6}	2.6×10^{-10}	0.000021
		B-25 box	0.0073	4.4×10^{-6}	0.0022	1.3×10^{-6}	2.2×10^{-10}	0.000021
		B-12 box	0.0063	3.8×10^{-6}	0.0022	1.3×10^{-6}	1.1×10^{-10}	0.000021
		20-foot ISO	0.013	7.5×10^{-6}	0.0020	1.2×10^{-6}	4.1×10^{-10}	0.000021
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.064	0.000038	0.0076	4.6×10^{-6}	1.5×10^{-11}	0.000021
Transport in Nevada – via southern route (Routes 95 - 160)	CH-LLW/MLLW [a, h]	55-gallon drum (CH)	0.0036	2.2×10^{-6}	0.0016	9.3×10^{-7}	3.9×10^{-10}	8.5×10^{-6}
		B-25 box	0.0030	1.8×10^{-6}	0.00092	5.5×10^{-7}	3.4×10^{-10}	8.5×10^{-6}
		B-12 box	0.0026	1.6×10^{-6}	0.00092	5.5×10^{-7}	1.7×10^{-10}	8.5×10^{-6}
		20-foot ISO	0.0052	3.1×10^{-6}	0.0010	6.0×10^{-7}	6.2×10^{-10}	8.5×10^{-6}
	RH-LLW/MLLW [b]	55-gallon drum (RH)	0.026	0.000016	0.0032	1.9×10^{-6}	5.4×10^{-10}	8.5×10^{-6}