

**2015
Annual Site
Environmental Report
for
Sandia National Laboratories**

**Tonopah Test Range,
Nevada
and
Kaua'i Test Facility,
Hawai'i**



Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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2015 Annual Site Environmental Report for Sandia National Laboratories, Tonopah Test Range, Nevada, and Kaua'i Test Facility, Hawai'i

Produced by

Environmental Programs
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-0730

for

Department of Energy
National Nuclear Security Administration
Sandia Field Office

Abstract

Sandia National Laboratories (SNL) is a multiprogram laboratory managed and operated by Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) under contract DE-AC04-94AL85000. The DOE/NNSA Sandia Field Office administers the contract and oversees contractor operations at the SNL, Tonopah Test Range (SNL/TTR) in Nevada and the SNL, Kaua'i Test Facility (SNL/KTF) in Hawai'i. Sandia manages and conducts operations at SNL/TTR in support of the DOE/NNSA's Weapons Ordnance Program and has operated the site since 1957. Navarro Research and Engineering subcontracts with Sandia to administer most of the environmental programs at SNL/TTR. The DOE/NNSA/Nevada Field Office retains responsibility for cleanup and management of SNL/TTR Environmental Restoration sites. Sandia operates SNL/KTF as a rocket preparation launching and tracking facility. This Annual Site Environmental Report (ASER) summarizes data and the compliance status of Sandia's sustainability, environmental protection, and monitoring programs at SNL/TTR and SNL/KTF during calendar year 2015. Major environmental programs include air quality, water quality, groundwater protection, terrestrial surveillance, waste management, pollution prevention, environmental restoration, oil and chemical spill prevention, and implementation of the National Environmental Policy Act. Sandia is responsible only for those environmental program activities related to its operations. This ASER is prepared in accordance with and as required by [DOE O 231.1B](#), [Admin Change 1](#), *Environment, Safety, and Health Reporting*.

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Prepared by

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Environmental Programs

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Project Lead/Technical Reviewer

Stacy Griffith

DOE/NNSA/SFO Project Lead/Technical Reviewer

Karen Agogino

Document Production and Technical Editing

Angela M. Salas

Nancy White

Shirley Coe

Contributing Authors

Avery, Penny

Barthel, Michael

Catechis, Christopher

Deal, Kathie

Eckstein, Joanna

Evelo, Stacie

Forston, William

Gough, Andrew

Green, Kelly

Lantow, Tiffany

Li, Jun

Martinez, Reuben

Mauser, Joseph

Nagy, Michael

Payne, Jennifer

Reiser, Anita

Ricketson, Sherry

Salinas, Stephanie

Shain, Matthew

Ulrich, Rebecca

Note to the Reader

The SNL/TTR and SNL/KTF Annual Site Environmental Report presents summary data regarding environmental performance and compliance with environmental standards and requirements. In addition, the U.S. Department of Energy views this document as a valuable tool for maintaining a dialogue with our community about the environmental health of these sites. We continually strive to improve the quality of the contents as well as to include information that is important to you. Please provide feedback, comments, questions, or requests for copies of this report and/or appendices to:

U.S. Department of Energy National Nuclear Security Administration Sandia Field Office
P.O. Box 5400
Albuquerque, NM 87185-5400
Attention: Karen Agogino

The SNL/TTR and SNL/KTF Annual Site Environmental Report can be found at the following website:
<http://www.sandia.gov/news/publications/environmental/index.html>

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Acronyms and Abbreviations

Term	Definition	Term	Definition
A		G	
AEA	Atomic Energy Act	GOES	Geostationary Operational Environmental Satellite
AP	air permit		
ASER	Annual Site Environmental Report	H	
AST	aboveground storage tank	HAP	hazardous air pollutant
B		I	
bgs	below ground surface	IOC	inorganic compound
BLM	Bureau of Land Management	ISMS	Integrated Safety Management System
C		ISO	International Organization for Standardization
CAA	Clean Air Act	K	
CAS	Corrective Action Site	KTF	Kaua'i Test Facility
CAU	Corrective Action Unit	M	
CDX	Countermeasure Demonstration Experiment	MBTA	Migratory Bird Treaty Act
CEMP	Community Environmental Monitoring Program	MCL	maximum contaminant level
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	MEI	maximally exposed individual
CFR	Code of Federal Regulations	MSDS	Material Safety Data Sheet
D		N	
DOD	U.S. Department of Defense	NAC	Nevada Administrative Code
DOE	U.S. Department of Energy	NAFB	Nellis Air Force Base
DRI	Desert Research Institute	NAFR	Nellis Air Force Range
E		Navarro	Navarro Research and Engineering
EDE	effective dose equivalent	ND	not detected
EHS	extremely hazardous substance	NDEP	Nevada Division of Environmental Protection
EMS	Environmental Management System	NEPA	National Environmental Policy Act
EO	Executive Order	NESHAP	National Emission Standards for Hazardous Air Pollutants
EPA	U.S. Environmental Protection Agency	NFO	Nevada Field Office
EPCRA	Emergency Planning and Community-Right-to-Know Act	NNSA	National Nuclear Security Administration
ER	Environmental Restoration	NNSS	National Nuclear Security Site
ESA	Endangered Species Act	NPDES	National Pollutant Discharge Elimination System
ES&H	Environment, Safety, and Health	NRS	Nevada Revised Statute
F		NTNC	Non-Transient Non-Community
FDID	Fire Department Identification	NTTR	Nevada Test and Training Range
FFACO	Federal Facility Agreement and Consent Orders	NV	Nevada
FIDLER	field instrument for detection of low energy radiation	NWHR	Nevada Wild Horse Range
FIN	facility identification number		
FTU	Flight Test Unit		

Term	Definition
O	
O&M	Operation and Maintenance
P	
PCB	polychlorinated biphenyl
Permit, the	Department of the Air Force Permit to the National Nuclear Security Administration to Use Property Located on the Nevada Test and Training Range, Nevada
pH	potential of hydrogen
PIC	pressurized ion chamber
PM ₁₀	particulate matter that has a diameter equal to or less than 10 microns
PMRF	Pacific Missile Range Facility
Pu	plutonium
PWS	public water system
R	
RCRA	Resource Conservation and Recovery Act
ROC	Range Operations Center
RPDP	Radiation Protection Dosimetry Program
S	
Sandia	Sandia Corporation
SARA	Superfund Amendments and Reauthorization Act
SD	standard deviation
SDS	Safety Data Sheet
SFO	Sandia Field Office
SHPO	State Historic Preservation Office
SNL/KTF	Sandia National Laboratories, Kaua'i Test Facility, Hawai'i
SNL/NM	Sandia National Laboratories, New Mexico
SNL/TTR	Sandia National Laboratories, Tonopah Test Range, Nevada
SOC	synthetic ¹ organic compound
SPCC	Spill Prevention, Control, and Countermeasure
STARS	Strategic Target System
SWPPP	Stormwater Pollution Prevention Plan

Term	Definition
T	
TAL	Target Analyte List
TLD	thermoluminescent dosimeter
TRI	Toxic Release Inventory
TS	Terrestrial Surveillance (Program)
TSCA	Toxic Substances and Control Act
TTR	Tonopah Test Range
U	
U.S.	United States
USAF	U.S. Air Force
UST	underground storage tank
V	
VOC	volatile organic compound
W	
WRCC	Western Regional Climate Center

Units of Measure

Unit	Definition
Bq/m ³	Becquerel per cubic meter
Ci/m ³	curies per cubic meter
°F	degrees Fahrenheit
ft	feet
gal	gallon
hp	horsepower
kg	kilogram
lb	pound
μ	micron
μCi/mL	microcuries per milliliter

Unit	Definition
μg/m ²	micrograms per square meter μg/m ²
	micrograms per cubic meter
mg/kg	milligrams per liter
mph	miles per hour
mrem/yr	millirems per year
mR/yr	milliroentgen per year
pCi/g	picocuries per gram
ppb	parts per billion
ppm	parts per million

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SNL/TTR and SNL/KTF Executive Summary



Cactus Peak, Tonopah Test Range

Sandia National Laboratories (SNL) is one of the nation's multi-program national security laboratories. SNL is a government-owned and contractor-operated (Sandia Corporation) laboratory that is part of the National Nuclear Security Administration's (NNSA) Weapons Ordnance Program. Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates the Tonopah Test Range (TTR) in Nevada and the Kaua'i Test Facility (KTF) in Hawai'i for the U.S. Department of Energy (DOE)/National Nuclear Security Administration (NNSA). The DOE/NNSA/Sandia Field Office (SFO) administers the contract and oversees contractor operations at the sites.

This Annual Site Environmental Report (ASER) was prepared in accordance with and as required by [DOE O 231.1B](#), [Admin Change 1](#), *Environment, Safety, and Health Reporting*.

This ASER summarizes data from environmental protection and monitoring programs at SNL/TTR and SNL/KTF for calendar year 2015. It also discusses Sandia's compliance with environmental statutes, regulations, and permit provisions, and it highlights significant environmental programs and efforts at SNL/TTR and SNL/KTF. This report is a key component of DOE's efforts to keep the public informed about environmental conditions throughout the DOE/NNSA complex.

Sandia National Laboratories, Tonopah Test Range

Sandia conducts operations at SNL/TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia's activities involve research and development and the testing of weapon components and delivery systems. Many of these activities require a remote testing range with a long flight corridor for air drops and rocket launches, which Tonopah Test Range can provide. There were no reportable environmental occurrences at SNL/TTR in 2015.

The following environmental programs are in place at SNL/TTR

- Air Quality Compliance Program (including the Radiological National Emission Standards for Hazardous Air Pollutants [NESHAP] Program)
- Environmental Restoration (ER) Project
- National Environmental Policy Act (NEPA) Program

- Oil Storage Program
- Terrestrial Surveillance Program
- Waste Management Program
- Water Quality Program

Air Quality Compliance Program

The Radiological NESHAP Program ensures that Sandia is in compliance with NESHAP requirements on radiological air emissions. The only radionuclide sources at SNL/TTR are the three Clean Slate sites, which are sources of diffuse radionuclide emissions as a result of the resuspension of contaminated soils. Compliance with NESHAP for these sites is currently being addressed by DOE/NNSA/SFO. The calculated dose for the maximally exposed individual was 0.024 mrem/yr, which is approximately 400 times less than the 10 mrem/yr standard set by the U.S. Environmental Protection Agency (EPA) as specified in Title 40 Code of Federal Regulations, Subpart H, “National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities.” Based on this value, it is not required that an annual dose assessment be calculated for the SNL/TTR site. See Section 3.2 for more information.

The Class II Air Quality Operating Permit for SNL/TTR requires emission reports from significant nonradionuclide sources. At SNL/TTR, these sources include a portable screen, generators, and maintenance shop activities. Maintenance shop activities at SNL/TTR includes painting, welding, and carpentry. In 2015, there were emissions from the portable screen, the generators, and activities at the maintenance shop. See Section 3.2 for more information.

Environmental Restoration Project

ER Project activities at SNL/TTR and the Nevada Test and Training Range (NTTR) are conducted through the DOE/NNSA/Nevada Field Office. ER sites that are scheduled for remediation or that have been closed at SNL/TTR include areas impacted from target tests and detonations, including nonimpacted surface debris and areas impacted by ordnance, depleted uranium, heavy metals, and fuel spills. ER activities in 2015 included characterizing and packaging approximately 75 cubic feet of low-level waste from Clean Slate I and Clean Slate II, which was generated during site investigation activities. See Section 3.3 for more information.

Other ER activities conducted on the SNL/TTR and NTTR sites in 2015 consisted of the annual post-closure inspections of closed and use-restricted industrial sites and inspections of radiological postings at the Clean Slate and Double Tracks sites. The inspections were conducted in May 2015.

In addition, air samples were collected routinely throughout the year at various locations on the SNL/TTR and NTTR sites.

National Environmental Policy Act Program

At SNL/TTR, NEPA compliance is coordinated between personnel from SNL/TTR, SNL, New Mexico (SNL/NM), and the DOE/NNSA/SFO. Personnel from SNL/TTR and the SNL/NM NEPA team supported the DOE/NNSA/SFO in analyzing projects at SNL/TTR, such as the upgrade of a fiber-optic cable communications loop. This support included the continued collaboration with DOE/NNSA/SFO, SNL/TTR staff, and various Nevada regulators to assure the installation of the fiber-optic cable would be completed and available for various tests scheduled for 2016. See Section 3.4 for more information.

In addition to these activities, the SNL/NM NEPA team completed ten NEPA checklists for SNL/TTR, five of which were transmitted to the DOE/NNSA/SFO for review and determination in 2015.

Oil Storage Program

The SNL/TTR Spill Prevention Control and Countermeasures Plan (required under the Clean Water Act) describes the oil storage facilities on-site and the mitigation controls in place to prevent inadvertent discharges of oil. Additional oil storage capacity in 55 gal drums, mobile and portable containers, mobile refuelers, and oil-filled operational equipment (transformers, hydraulic elevators, etc.) occurs throughout the site on an as-needed basis. SNL/TTR currently operates seven aboveground storage tanks, two mobile refuelers (one truck and one trailer), a drum storage area, and a transformer storage area. See Section 3.5 for more information.

Terrestrial Surveillance Program

The Terrestrial Surveillance Program at SNL/TTR is designed and conducted to address the requirements of DOE O 458.1 Admin Change 3, *Radiation Protection of the Public and the Environment*, which establishes standards and requirements to protect the public and the environment from undue risk of exposure to radiation associated with radiological activities under the control of DOE. The Terrestrial Surveillance Program collects environmental media (soil) samples and analyzes these for radiological constituents, as required. As a best management practice, samples are also collected for analysis of metals. In addition to the environmental media samples, ambient external gamma radiation levels are measured using thermoluminescent dosimeters. These surveillance activities are conducted at designated locations that are on-site, off-site, and around the perimeter of SNL/TTR. See Section 3.6 for more information.

In 2015, soils were analyzed for radiological and nonradiological constituents. The results of the statistical analysis for americium-241 at location S-51 continues to be identified as Priority-1. This location, at the edge of South Plume Area, is expected to have elevated readings. This is consistent with the hot particle theory, where the presence of americium-241 and/or plutonium-239/240 in a heterogeneous sample skews the apparent average concentration, making it appear greater than it is. Sampling and trend analyses will continue at S-51.

Nonradiological monitoring of modified Target Analyte List metals for soil samples were conducted at 13 on-site locations, and one location was identified as Priority-2 for cobalt. This value is assumed to represent natural background at this location.

Waste Management Program

Waste generated during 2015 at SNL/TTR included hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA) and nonhazardous industrial and sanitary solid waste. All hazardous waste was shipped to permitted treatment, storage, and disposal facilities. Waste minimization and recycling efforts are integrated into the Waste Management Program. See Section 3.7 for more information. Sandia does not handle waste generated by ER activities. The Nevada Division of Environmental Protection (NDEP) conducted a document inspection of SNL/TTR waste management activities during March 2015; no deficiencies were noted. See Section 3.7 for more information.

Water Quality Program

The NDEP permits the Public Water System (PWS) at SNL/TTR as a non-transient non-community water system under identification number NV003014. Production Well 6 supplies potable water for the SNL/TTR Area 3 Drinking Water Distribution System and the Area 3 Fire Protection Water Distribution System. See Section 3.8 for more information.

The PWS water is routinely sampled and analyzed per the NDEP requirements to demonstrate conformance with primary drinking water standards. In 2015, all PWS sample results were below the maximum contaminant levels established for the substances monitored.

SNL/TTR also has an NDEP-permitted treatment system for arsenic removal (permit number NV-3014-TP-11-12NTNC). The arsenic removal system has performed well since the installation of a carbon dioxide (potential of hydrogen [pH] adjustment) system in June 2008. The arsenic removal media was replaced with new media in February 2013. PWS arsenic levels throughout 2015 were at or below the detection limit of 1 ppb. The arsenic removal media should last approximately five years before a media change-out is required.

Wastewater discharges at SNL/TTR did not negatively impact the U.S. Air Force-held National Pollutant Discharge Elimination System permit in 2015.

Five septic tank systems are located on-site at SNL/TTR (the newest of which is inactive); they are owned by DOE/NNSA. None of these systems required maintenance, sampling, or pumping in 2015.

Sandia National Laboratories, Kaua'i Test Facility

SNL/KTF personnel provide rocket preparation, launching, and tracking support for DOE/NNSA, and also provide support to other U.S. government agencies. SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense, Pacific Missile Range Facility (PMRF). SNL/KTF is located on the island of Kaua'i at the north end of the PMRF near Nohili Point; it has been used as an active rocket launching facility since 1962.

The EPA recommended continued reevaluation for environmental contamination at SNL/KTF due to past ordnance activity near the site. Rocket exhaust continues to be the main source of metals and other nonreportable air emission releases. The EPA's recommendation is addressed by collecting environmental soil samples for Target Analyte List metal analysis every five years. See [Chapter 5](#) for more information.

The following environmental programs are in place at SNL/KTF:

- Air Quality Compliance Program
- NEPA Program
- Oil Storage Program
- Terrestrial Surveillance Program
- Waste Management Program
- Water Quality programs

Air Quality Compliance Program

SNL/KTF was in compliance with all air quality permit conditions in 2015. The State of Hawai'i requires annual and semiannual reports to document emissions and monitoring activities. The two Semi-Annual Monitoring Report Forms and the Annual Emissions Report for 2015 were submitted to the State of Hawai'i within specified timelines. These reports document that the site is in compliance with permitted operating limits. See [Section 6.1](#) for more information.

National Environmental Policy Act Program

At SNL/KTF, NEPA compliance is coordinated between personnel from SNL/KTF, SNL/NM, and the DOE/NNSA/SFO. In 2015, the SNL/NM NEPA team continued to

provide support to several programmatic activities performed at either KTF or PMRF. See Section 6.4 for more information.

In addition to these activities, the NEPA team completed five NEPA checklists for SNL/KTF, four of which were transmitted to the DOE/NNSA/SFO for review and determination in 2015.

Oil Storage Program

SNL/KTF operates under the PMRF Spill Prevention Control and Countermeasures Plan (required under the Clean Water Act), which describes the oil storage facilities at the SNL/KTF site and the mitigation controls in place to prevent inadvertent discharges of oil. Additional oil storage capacity in 55 gal drums, mobile and portable containers, mobile refuelers, and oil-filled operational equipment (transformers, hydraulic elevators, etc.) occurs throughout the site on an as-needed basis. SNL/KTF currently operates three aboveground storage tanks (one bulk storage tank and two generator base tanks) and a single underground storage tank. See Section 5.3 for more information.

In 2015, a Field Citation was issued by the Hawai'i Department of Health to Sandia for failure to complete annual liquid tightness testing on the spill bucket of the underground storage tank used to store fuel.

Terrestrial Surveillance Program

Terrestrial surveillance is conducted every five years at SNL/KTF. Sampling was conducted in 2012, which confirmed that SNL/KTF operations made no detectable environmental impact. Sampling was not conducted in 2015. See Section 6.6 for more information.

Waste Management Program

Some hazardous waste is generated through normal operations at SNL/KTF. Sandia is classified as a conditionally exempt small-quantity generator, and follows applicable RCRA requirements. See Section 6.7 for more information.

Water Quality Program

In 2015, there were no compliance issues with respect to any state or federal water pollution regulations at SNL/KTF. See Section 6.8 for more information.

Drinking water at SNL/KTF is obtained through local facilities and suppliers. No wells provide drinking water at the site.

The limited quantity of sanitary sewage released at the facility does not impact any protected waters; no state inspections were conducted during 2015. As a best management practice, personnel periodically perform sampling. All three on-site septic tanks were inspected, sampled, and pumped in 2013. Historically, no contaminants have been identified above the reporting limits from these past sampling events. During 2015, no septic tank systems were sampled at SNL/KTF.

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PART ONE



SANDIA NATIONAL LABORATORIES, TONOPAH TEST RANGE, NEVADA

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Chapter 1. SNL/TTR Introduction



Old settlement at Tonopah Test Range

OVERVIEW ■ Sandia manages and operates the Tonopah Test Range (TTR) in Nevada for the DOE/National Nuclear Security Administration (NNSA). TTR is located on approximately 280 square miles (179,200 acres) of withdrawn land within the boundaries of the Nevada Test and Training Range. Sandia conducts operations at SNL/TTR in support of the DOE/NNSA's Weapons Ordnance Program. No nuclear devices are tested at SNL/TTR.

This Annual Site Environmental Report (ASER) is prepared in accordance with and as required by U.S. Department of Energy (DOE) Order 231.1B, *Environment, Safety, and Health Reporting* (DOE O 231.1B, Admin Change 1). Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates the Tonopah Test Range (TTR) in Nevada for the DOE/National Nuclear Security Administration (NNSA). DOE/NNSA owns TTR, and the DOE/NNSA/Sandia Field Office (SFO) in Albuquerque, New Mexico, oversees contractor operations.

Part One of this ASER summarizes the environmental protection and monitoring programs in place at Sandia National Laboratories, Tonopah Test Range (SNL/TTR) during calendar year 2015 unless otherwise noted. Sandia makes this report available to the general public in printed and electronic form.

1.1 Mission

Sandia's enduring core mission is to provide science and engineering support for the nation's nuclear weapons stockpile. The mission encompasses additional critical aspects of national security, including developing technologies and strategies for responding to emerging threats, protecting and preventing the disruption of critical infrastructures, and supporting the nonproliferation of weapons of mass destruction. Sandia also collaborates with representatives from other government agencies, the industrial sector, and universities to develop and commercialize new technologies. Information about recent technologies developed at Sandia can be found at:

<http://www.sandia.gov/news/index.html>

1.1.1 Operating Contract and DOE Directives

The Prime Contract between Sandia and the DOE (DE-AC04-94AL85000) defines the contractual obligations for managing and operating SNL/TTR. The DOE directives that pertain to environmental protection and management are as follows:

- [DOE O 231.1B, Admin Change 1, Environment, Safety, and Health Reporting](#), ensures that the DOE receives information about the events that have affected or could adversely affect the health, safety, and security of the public or workers, the environment, the operations of DOE facilities, or DOE's credibility. This ASER is prepared in accordance with this directive.
- [DOE O 435.1 Change 1, Radioactive Waste Management](#), ensures that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety and the environment. Under this directive, contractors that manage and operate DOE facilities are required to plan, document, execute, and evaluate the management of DOE radioactive waste.
- [DOE O 458.1 Admin Change 3, Radiation Protection of the Public and the Environment](#), establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities under the control of DOE pursuant to the Atomic Energy Act.
- [DOE O 232.2 Admin. Change 1, Occurrence Reporting and Processing of Operations Information](#), provides timely notification to the DOE complex of events that could adversely affect the health and safety of the public or the workers, the environment, DOE missions, or DOE's credibility.
- [DOE O 436.1, Departmental Sustainability](#), Environmental Management Systems (EMSs) and site sustainability are at the forefront of environmental excellence. At Sandia, the intent of this directive is implemented through an International Organization for Standardization (ISO) 14001-certified EMS. Although it is not part of the scope of the certification, Sandia implements EMS at SNL/TTR consistent with the ISO 14001 standard ([ISO 2004](#)). Conformance to the standard is verified through internal EMS assessments. SNL/TTR assessments were conducted in 2011 and 2014.

Environmental programs at SNL/TTR include the following:

- Air Quality Compliance Program (including the Radiological National Emission Standards for Hazardous Air Pollutants [NESHAP] Program)
- Environmental Restoration (ER) Project
- National Environmental Policy Act (NEPA) Program
- Oil Storage Program
- Terrestrial Surveillance Program

- Waste Management Program
- Water Quality Program

DOE O 231.1B, Change 1, *Environment, Safety, and Health Reporting*, specifies the requirements for environmental monitoring conducted at and around the SNL/TTR site. This ASER is an important component of DOE's efforts to keep the public informed about environmental conditions at DOE/NNSA facilities.

1.2 Location Description

SNL/TTR is located on approximately 280 square miles (179,200 acres) of withdrawn land, which is permitted from the U.S. Air Force (USAF) within the boundaries of the Nevada Test and Training Range (NTTR); it is used to support DOE/NNSA and USAF activities and missions. Navarro Research and Engineering (Navarro), performs or supports most environmental program functions at SNL/TTR on behalf of Sandia, including air monitoring, ER activities, NEPA, spill response, waste management operations, and water quality. Navarro also supports SNL/TTR during tests by operating optics equipment and radar units and recovering test objects.

1.3 SNL/TTR History and Operations

In 1940, President Franklin Delano Roosevelt withdrew approximately 5,000 square miles of federal land in Nevada to establish the Las Vegas Bombing and Gunnery Range (now referred to as NTTR), which is part of Nellis Air Force Base (NAFB).

Before establishing SNL/TTR in 1956, Sandia used three other ranges as test sites: the Los Lunas Test Site (Kirtland Air Force Base Practice Bombing Range) in New Mexico, the Salton Sea Test Site in California, and the Yucca Flat Test Site in Nevada. SNL/TTR was selected as a test range after these facilities became inadequate. The atmosphere at Salton Sea Test Base became permeated with haze, which limited visibility and hampered photography in the mid-1950s. The Yucca Flat Test Site became inadequate, since it did not offer the flat terrain and long approach corridor required for the increasing emphasis on low-altitude approaches and deliveries.

 In 1940, President Franklin Delano Roosevelt withdrew approximately 5,000 square miles of federal land in Nevada to establish what is now the Nevada Test and Training Range, which is part of Nellis Air Force Base.

The SNL/TTR site is located in the northwest corner of the (then) Las Vegas Bombing and Gunnery Range. A land-use permit was obtained from the USAF in 1956, and SNL/TTR became operational to test new weapon systems in 1957. The facilities built at SNL/TTR were designed and equipped to gather data on aircraft-delivered inert test vehicles under U.S. Atomic Energy Commission cognizance (now DOE). As technologies changed, the facilities and capabilities at SNL/TTR were expanded to accommodate tests related to DOE/NNSA's Weapons Ordnance Program.

The NAFB Complex includes several auxiliary small arms ranges and the NTTR, which is divided into the North Range and the South Range (Figure 1-1).

The Nevada National Security Site, formerly known as the Nevada Test Site, is located between the North and South ranges at NTTR. The entire NAFB Complex is comprised of

approximately 3 million acres. SNL/TTR is located 32 miles southeast of Tonopah, Nevada. In April 2002, the USAF and NNSA signed a land-use permit, "Department of the Air Force Permit to the National Nuclear Security Administration to Use Property Located on the Nevada Test and Training Range, Nevada" (the Permit) (USAF/DOE/NNSA 2002). The Permit is valid from April 26, 2002, until October 5, 2019. The Permit reduced the size of SNL/TTR from approximately 335,655 acres to approximately 179,200 acres.

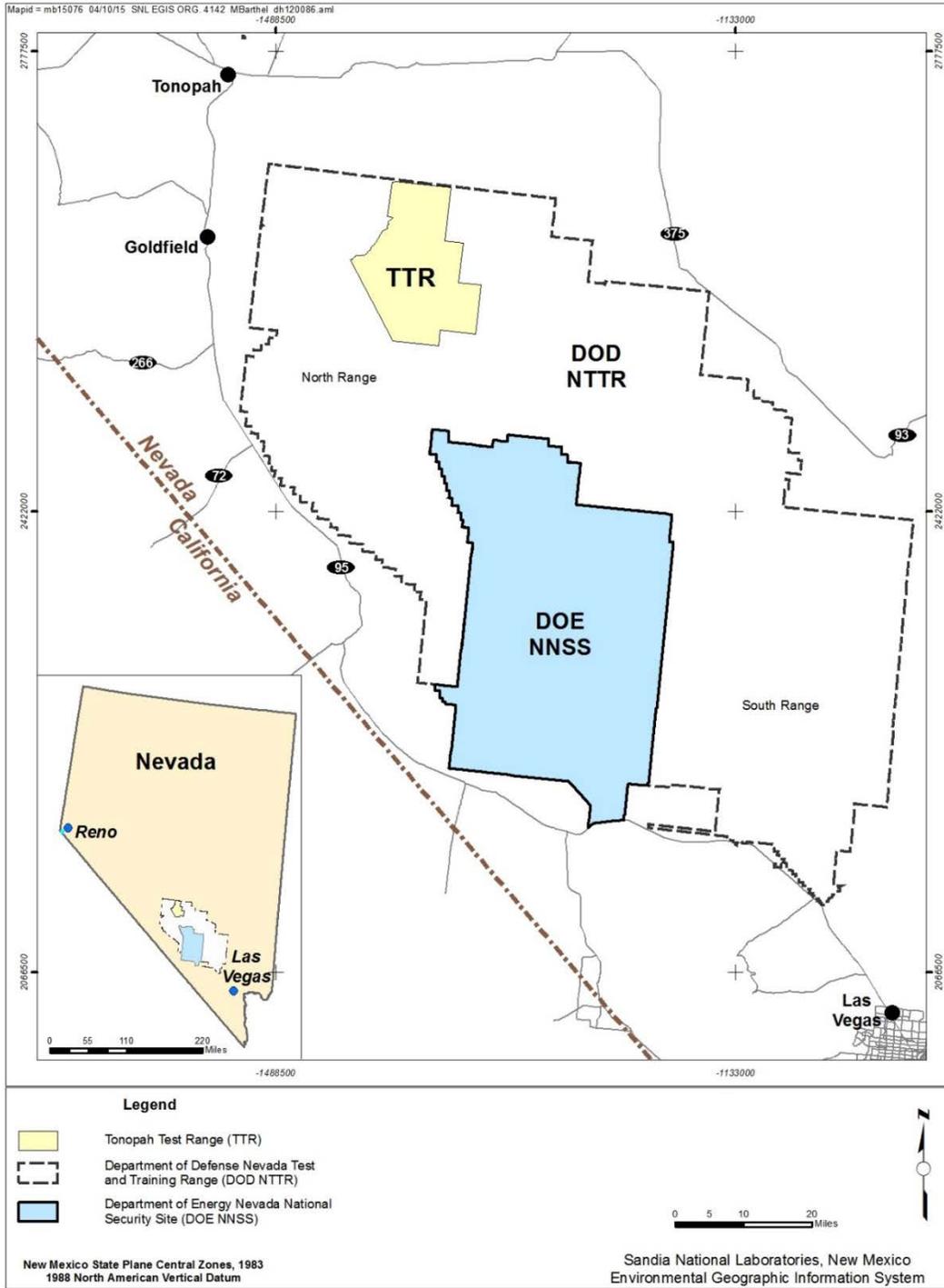


Figure 1-1. SNL/TTR location within the boundaries of NTTR

1.4 SNL/TTR Activities and Facilities

SNL/TTR provides research and development test support for the DOE's weapon programs, and it offers a unique test environment for use by other government agencies and their contractors. With capabilities such as modern electronic tracking instrumentation and data acquisition systems, SNL/TTR assures customers complete and accurate test data. SNL/TTR also provides facilities, a large land area, and the security to conduct a wide variety of tests.

SNL/TTR provides research and development test support for the DOE's weapon programs

Sandia conducts operations at SNL/TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia's activities involve research and development and the testing of weapon components and delivery systems (Figure 1-2). Many of these activities require a remote testing range with a long flight corridor for air drops and rocket launches. Other activities include explosives tests and gun firings. No nuclear devices are tested at SNL/TTR.

Current DOE/NNSA activities at SNL/TTR include:

- Air drop operations (test units dropped from aircraft)
- Explosives operations (render-safe operations, including handling, transporting, and storing explosives)
- Missile operations (ground- and air-launched missiles)

These activities require a remote range for both public safety and to maintain national security. The majority of test activities at SNL/TTR occur within Cactus Flat, a valley with almost no topographical relief flanked by mountains and hills.



Figure 1-2. SNL/TTR Antelope Lake Drilling Recovery Shaft, May 2015

1.4.1 Mission Control Center

The SNL/TTR Mission Control Center tower is a four-story structure that affords a 360-degree view of the site. It houses mission critical systems that coordinate all test activities during testing operations. The control tower houses the test director, camera control operators, Range Safety Officer, telemetry control operators, test engineer, computer operator, Test and Evaluation Command and Control System operator, telemetry personnel, and visitors during test operations. The fourth floor (Operations Center) of this facility was remodeled during 2014. Windows,

lighting, flooring, and control electronics were replaced (Figure 1-3). A project to renovate the facility's first, second, and third floors—including elevator replacement and heating, venting, and air conditioning systems—began in December 2015 and is expected to be completed no later than May of 2016.

SNL/TTR is instrumented with a wide array of signal-tracking equipment, including video, high-speed cameras, telemetry, and radar tracking devices that are used to characterize ballistics, aerodynamics, and parachute performance of test units.



Figure 1-3. SNL/TTR Operations Center

1.4.2 Environmental Restoration Project

The ER Project at SNL/TTR was initiated in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. In late 1992 and early 1993, an agreement was reached between DOE headquarters and the Albuquerque and Nevada field offices to designate responsibility for all ER sites to the DOE/Nevada Field Office (NFO). The NNSA was established in 2000, and responsibility for all ER sites in Nevada still resides with the NNSA/NFO, with the exception that NESHAP compliance and reporting for ER activities is currently being addressed by the DOE/NNSA/SFO. However, environmental program management of SNL/TTR is a joint effort between SNL/TTR and SNL/NM personnel, with oversight from DOE/NNSA/SFO.

1.5 Environmental Setting

The topography at SNL/TTR is characterized by a broad, flat valley bordered by two north- and south-trending mountain ranges: the Cactus Range to the west (occurring mostly within the boundaries of SNL/TTR) and the Kawich Range to the east. Cactus Flat is the valley floor, where the main operational area of SNL/TTR is located. An area of low hills outcrops in the south. Elevations range from 5,347 ft at the valley floor to 7,482 ft at Cactus Peak. The elevation of the town of Tonopah is 6,030 ft.

1.5.1 Site Description and Demographics

SNL/TTR is located within NTTR at its northwestern boundary (Figure 1-1). The area north of the SNL/TTR boundary is comprised of sparsely populated public lands jointly administered by the Bureau of Land Management (BLM) and the U.S. Forest Service. Cattle graze this land in winter and spring. There also is a substantial irrigated farming operation north of the range. SNL/TTR lies within a portion of the Nevada Wild Horse Range (NWHR) herd area, which is administered by the BLM.

The nearest residents are located in the towns of Goldfield, Nevada (2010 Census population 268) and Tonopah, Nevada (2010 Census population 2,478). Census data indicate a net resident loss of 550 people from the towns of Goldfield (loss of 88 residents) and Tonopah (loss of 462 residents) between the 2000 Census and the 2010 Census. Goldfield is located approximately 22 miles southwest of the site boundary, and Las Vegas, Nevada, is approximately 140 miles southeast of SNL/TTR. The total population within the 50-mile radius around SNL/TTR is approximately 6,450, which includes the potential population at SNL/TTR if all housing units at the site were occupied.

1.5.2 Geology

SNL/TTR is located in the western part of the Basin and Range geophysical province. This area is marked by horst and graben topography, a system of mountains and down-dropped fault valleys formed through regional extension. SNL/TTR is northeast of the Walker Lane lineament, a zone of transcurrent faulting and shear, and northwest of the Las Vegas Valley shear zone (Sinnock 1982).

The Cactus Range to the west of SNL/TTR is the remnant of a major volcanic center consisting of relatively young (six million years old) folded and faulted Tertiary volcanics. This range is one of at least five northwest trending, raised structural blocks that lie along the Las Vegas Valley/Walker Lane lineaments (ERDA 1975).

1.5.3 Surface Water

Drainage patterns within and near SNL/TTR are intermittent (ephemeral stream channels) and end in closed basins. Ephemeral streams occasionally carry spring runoff to the center of Cactus Flat, where there is a string of north–south trending dry lake beds; however, due to the high rate of evaporation, little is recharged to the groundwater (DRI 1991).

An *ephemeral spring* flows only briefly in the immediate locality.

There are several small springs within the Cactus and Kawich ranges. Three occur within SNL/TTR's boundaries: Cactus Springs, Antelope Springs, and Silverbow Springs. Water from these springs does not travel more than approximately 100 ft before it dissipates through evaporation and infiltration. The effect on the landscape is purely local.

1.5.4 Groundwater

SNL/TTR obtains its water from local wells. The U.S. Geological Survey has recorded groundwater depths from 21 to 454 ft bgs at the site. Approximate groundwater levels have been recorded as follows:

- Antelope Mine Well in the Cactus Range at 21 ft bgs
- EH2 Well near the Tonopah Test Range Airport at 454 ft bgs
- Area 9 Well located near the northern end of the site at 131 ft bgs
- Production Well 6 in Area 3 at 350 ft bgs.

1.5.5 Climate

The climate at SNL/TTR is typical of high desert, mid-latitude locations, with large diurnal and seasonal changes in temperature and little total rainfall. Temperature extremes at the test range vary from highs near 104°F in summer, with lows approaching –22°F in winter. July and August are the hottest months, with highs generally in the 90s°F during the day and dropping to the 50s°F at night. January conditions vary from highs of the 40s°F to lows of the teens °F.

Rainfall, which is sparse, is dependent on elevation. Annual average rainfall in the desert valley floor is 4 inches, while in nearby mountains as much as 12 inches occurs (USAF 1999).

Temperature extremes at the test range vary from highs near 104°F in summer, with lows approaching -22°F in winter.

Winds are generally from the northwest in winter and early spring, switching to southerly directions during summer. The mountain-and-valley system channels the wind such that the wind seldom blows from eastern or southwestern directions. Dust storms are common in the spring, when monthly average wind speeds reach 15 mph. During the spring and fall, there may be a diurnal wind cycle, bringing northwest winds in the early hours and shifting to southerly winds by afternoon.

1.5.6 Vegetation

SNL/TTR is part of the Central Basin and Range Level III ecoregion as classified by the U.S. Environmental Protection Agency. SNL/TTR contains three further discrete, Level IV ecoregions within its boundaries. Vegetation in each of the Level IV ecoregions on SNL/TTR is as follows:

- The Lahontan and Tonopah Playas ecoregion occurs at the lowest elevations of SNL/TTR. Little to no vegetation grows in this highly alkaline playa ecoregion. At SNL/TTR, four-wing saltbush (*Atriplex canescens*) grows along the playa edges.
- The surrounding low-lying non-playa areas that compose the majority of SNL/TTR lands are part of the Tonopah Basin ecoregion. This ecoregion on SNL/TTR is dominated by shrubs such as winterfat (*Krascheninnikovia lanata*), shadscale (*Atriplex confertifolia*), spiny hopsage (*Grayia spinosa*), and budsage (*Artemisia spinescens*). Lesser quantities of longspine horsebrush, four-wing saltbush, sagebrush (*Artemisia tridentata*), littleleaf horsebrush (*Tetradymia glabrata*), and snakeweed (*Gutierrezia sarothrae*) shrubs are also common. Indian ricegrass (*Achnatherum hymenoides*) and galleta (*Pleuraphis jamesii*) are grasses found throughout this ecoregion on SNL/TTR.
- The Tonopah Sagebrush Foothills ecoregion occurs in the higher elevation mountains on the west side of SNL/TTR. Dwarf sagebrush (*Artemisia arbuscula*) is the dominant plant species at the higher elevations of this ecoregion on SNL/TTR. Nevada jointfir (*Ephedra nevadensis*) grows along the drainages at all elevations and is a more dominant shrub at the lower elevations of this ecoregion on SNL/TTR, along with spiny greasebush (*Glossopetalon spinescens*), spiny hopsage, and budsage shrubs. Joshua tree (*Yucca brevifolia*) and juniper (*Juniperus species*) grow in the transition zone at the base of the mountains.

1.5.7 Wildlife

Wild horses are protected in Nevada, and their populations are monitored and managed. Though wild horses compete with livestock and wildlife for limited forage, their presence is tolerated because they are associated with regional national heritage. The NWHR comprises an area of 2,034 square miles (1,301,628 acres) and encompasses a significant portion of the northern NTTR, with herds common in Cactus Flat, Gold Flat, Kawich Valley, Goldfield Hills, and the Stonewall Mountains. The BLM has published Appropriate Management Levels (BLM's estimate of the maximum number of animals that are sustainable in a specific Herd Management Area) for the NWHR at 500 wild horses (BLM 2011).

Other mammals common to the area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), kit fox (*Vulpes macrotis*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), and gray

fox (*Urocyon cinereoargenteus*). To a lesser extent, bighorn sheep (*Ovis canadensis*), mountain lion (*Felis concolor*), and wild burro (*Equus asinus*) are also present (USAF 1999; DRI 1991).

Horned larks (*Eremophila alpestris*) are prevalent throughout the Tonopah Basin ecoregion on SNL/TTR. Other common breeding bird species in this ecoregion include yellow warbler (*Dendroica petechia*), brewer's sparrow (*Spizella breweri*), and black-throated sparrow (*Amphispiza bilineata*). Birds commonly found in association with water sources at SNL/TTR in this ecoregion include Bullock's oriole (*Icterus bullockii*), common yellowthroat (*Geothlypis trichas*), mourning dove (*Enaida macroura*), and Wilson's warbler (*Cardellina pusilla*). The common raven (*Corvus corax*) is a common year-round resident.

Chukar (*Alectoris chukar*), rock wren (*Salpinctes obsoletus*), and Northern mockingbird (*Mimus polyglottos*) are bird species found in association with the higher elevation Tonopah Sagebrush Foothills ecoregion.

Wild horses are protected in Nevada.

In general, the NTTR land withdrawal has had a positive effect on local plant and animal life. Since much of the withdrawal area is undisturbed by human activity, large habitat areas are protected from the effects of public use.

1.6 Double Tracks and Clean Slate Sites

In May and June 1963, Project Roller Coaster conducted a series of four nuclear weapons destruction tests that resulted in plutonium dispersal in surrounding soils. Three of these tests were conducted within the boundaries of SNL/TTR; the fourth was conducted on NTTR just west of SNL/TTR. The three Project Roller Coaster test sites at SNL/TTR are referred to as Clean Slate 1, Clean Slate 2, and Clean Slate 3. The fourth test site at NTTR is referred to as Double Tracks. In 1996 and 1997, interim corrective actions were performed at Double Tracks and Clean Slate 1. In 2015, NNSA/NFO developed SAFER (Streamline Approach for Environmental Restoration) plans for Double Tracks and Clean Slate 1, and the Nevada Division of Environmental Protection (NDEP) approved the plans. These plans provide site investigation criteria and corrective action alternatives for the two sites. In 2015, site investigations of these two sites were also conducted.

Table 1-1 summarizes test information related to the four Project Roller Coaster sites. DOE/NNSA/NFO is responsible for remediation of these and all other ER sites at SNL/TTR (refer to Chapter 3). DOE/NNSA/NFO and Sandia will continue to be responsible for all other environmental compliance at these sites.

In addition to the activities conducted in 1996 at Double Tracks and in 1997 at Clean Slate 1, the initial cleanup of each Clean Slate site was conducted shortly after each test. Test-related debris was bladed into a hole at test ground zero and backfilled. An initial fence was built around each test area where the soil contamination was set at approximately 1,000 µg/m² of plutonium. The soil survey was conducted on 61-meter grids with a handheld survey meter, a field instrument for detection of low-energy radiation (FIDLER). In 1973, additional outer fences were set at 40 pCi/g of plutonium in soil, also using the handheld-meter method. The areas are visually inspected each year to determine whether any fence repairs or sign replacement is required.

In 1977, Edgerton, Gemeshausen, and Grier, Inc. performed an aerial radiological survey for the Nevada Applied Ecology Group (EG&G 1995). The aerial radiological surveys were undertaken to supplement the FIDLER and previous soil sample measurements of transuranics. The

objective was to determine the extent of surficial distribution of plutonium and other transuranic elements dispersed during the Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241, plutonium-239, and plutonium-240 were drawn for each area. The cumulative area of the diffuse sources, as determined by the aerial radiological survey, is approximately 4,900 acres. The survey found transuranic contamination outside the fenced area in the downwind direction (EG&G 1995). Subsequent aerial surveys were conducted in 1993 and 2006. These surveys confirmed previous survey results in terms of extent of contamination.

Table 1-1. SNL/TTR Project Roller Coaster test information

Test Name	CAU Number	Date of Test	Location	Status
Double Tracks	411	May 15, 1963	NTTR, North Range (west of SNL/TTR)	Final closure is in process
Clean Slate 1	412	May 25, 1963	SNL/TTR	Final closure is in process
Clean Slate 2	413	May 31, 1963	SNL/TTR	In the investigation phase
Clean Slate 3	414	June 9, 1963	SNL/TTR	Remediation has not started

NOTES: Source: Sampling and Analysis Plan for Clean Slate 1, September 1996 (IT 1996).

CAU = Corrective Action Unit

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

NTTR = Nevada Test and Training Range

Air Monitoring at Environmental Restoration Sites

Remediation activities were conducted at Clean Slate 1 in 1997. The Desert Research Institute (DRI) collected air-monitoring data from several locations in the vicinity of Clean Slate 1 before, during, and after remediation activities. The data were presented to DOE/NNSA/NFO in the form of a draft report (DRI 1997). The report documented the as-left condition at the site, but did not require follow-up action.

During 2015, at the request of DOE/NNSA/NFO, DRI maintained three portable environmental monitoring stations (two installed in 2008 and the third installed in 2011) at SNL/TTR as part of the ER Project Soils Activity (Figure 1-4). The primary objective of the monitoring stations is to evaluate whether and under what conditions there is wind transport of radiological contaminants from any of the Soils Activity Corrective Action Units (CAUs) associated with Operation Roller Coaster on SNL/TTR.

One monitoring station (400) is located in the general vicinity of the Range Operations Center (ROC), the second station (401) is located on the north edge of Clean Slate 3, and the newest station (402) is located on the north edge of Clean Slate 1. The ROC station measures potential radionuclide concentrations associated with airborne particulates at the closest location where there are regular site workers. The station at Clean Slate 3 is located at the perimeter of the largest of the three SNL/TTR Soils Activity CAUs. The station at Clean Slate 1 is located on the north perimeter of the soil CAU. The stations at Clean Slate 3 and Clean Slate 1 both measure the radionuclide concentration associated with airborne particulates at the boundaries of the sites in one of the predominant downwind directions.

The TTR monitoring stations collect data on selected meteorological and environmental parameters (e.g., wind speed and direction and airborne particulate concentration as a function of particulate size). In addition, airborne particulate samplers are deployed at each location to collect particulate samples for radiological analyses. Data are provided to the Western Regional Climate Center (WRCC) for management and incorporation into a TTR-specific database. The stations at the ROC and Clean Slate 3 have been in continuous operation since July 2008; the station installed at Clean Slate 1 became operational in August 2011.

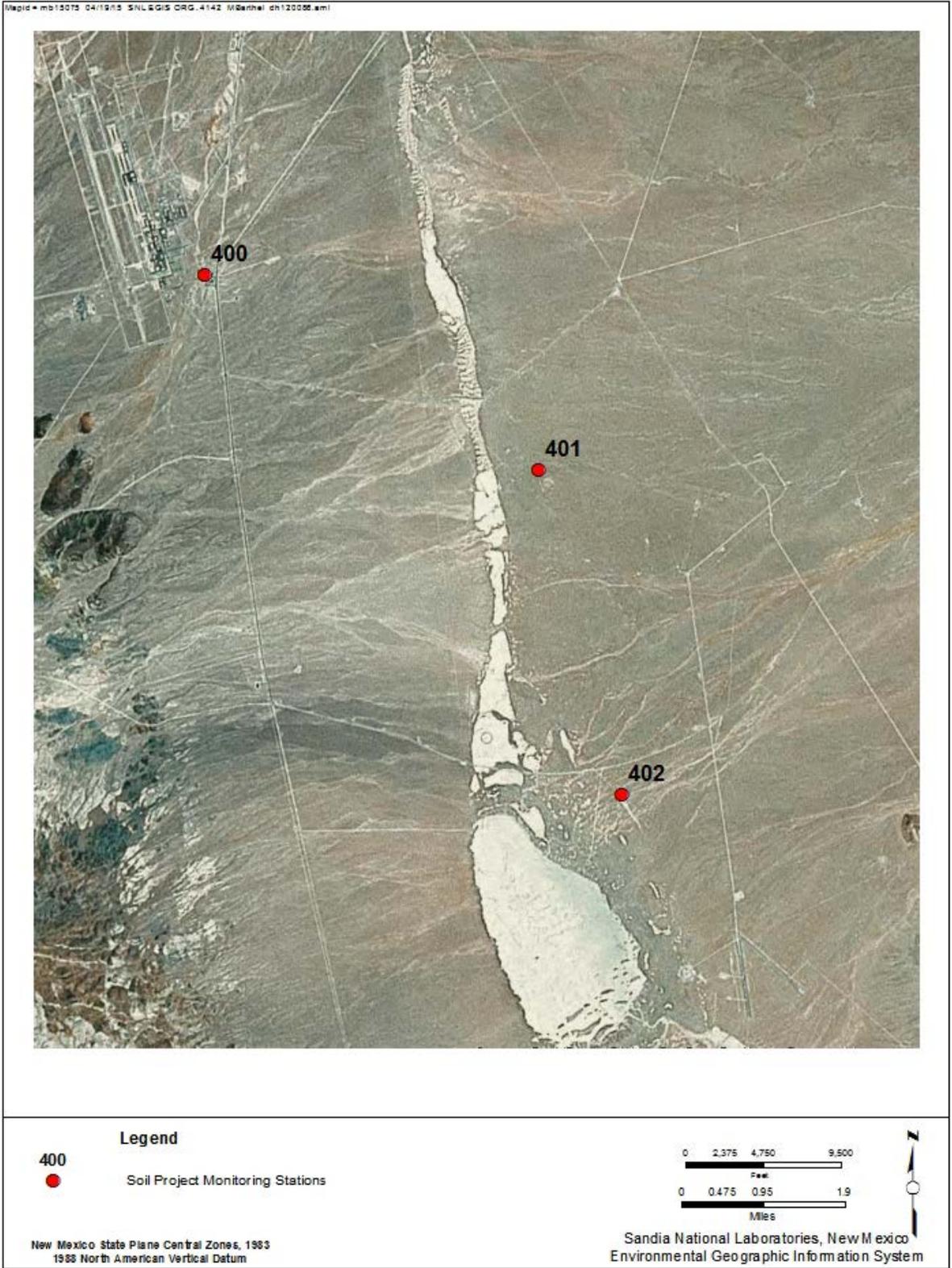


Figure 1-4. TTR soils project air-monitoring stations located at the Range Operations Center (400), Clean Slate 1 (402), and Clean Slate 3 (401)

Monitoring Station Locations and Capabilities

Station 400 (a Portable Environmental Monitoring Station) is located south of the ROC. This station was located to provide data at the ROC, which has the greatest concentration of Sandia personnel at TTR. In addition, Station 400 was located where line power was available to operate the instruments. Station 401 and Station 402 are solar-powered with battery backup power; the batteries are recharged continuously by solar panels. All three stations consist of two primary components: an air sampler and an auxiliary meteorological tower. Station 401 is located along the fenced perimeter of the north end of Clean Slate 3. Station 402 is located along the fenced perimeter of the north end of Clean Slate 1. Their locations were initially selected based on a review of wind speed and direction data collected at the Tonopah Airport (Engelbrecht et al. 2008), as well as for ease of access. Though the Tonopah Airport wind data are of limited time duration, the topographic setting is more similar to the Clean Slate sites than stations with longer periods of record located within the town of Tonopah. On-site wind direction measurements have since confirmed the appropriateness of the station locations. Figure 1-4 shows the location of the monitoring stations at SNL/TTR.

All three monitoring stations are equipped with continuous low-volume air samplers (having a flow rate of approximately 2 cubic feet per minute), and filters are routinely collected every two weeks. These filters are delivered to the Radiological Services Laboratory at the University of Nevada, in Las Vegas, Nevada, for analyses. Standard analyses include gross alpha and beta measurements and gamma spectral analysis; samples may undergo alpha spectral analysis if initial gamma spectral analyses indicate the presence of americium-241, which could indicate that plutonium particles are being transported.

Station 400: Range Operations Center

Station 400 is a portable station with all monitoring and sampling systems mounted on a 7 ft by 14 ft trailer. The station is located approximately 100 yards south–southwest of the ROC. The station configuration as currently deployed is shown in Figure 1-5. Airborne dust particles are collected continuously using a Hi-Q air sampler. Filters are recovered and new filters deployed every two weeks. Sensors include an anemometer, a wind direction vane, a pyranometer, a tipping rain bucket, a temperature and relative humidity probe, a barometer, a soil temperature probe, a pressurized ion chamber (PIC), and an ambient air particulate size profiler. Data from these sensors are collected and stored on a Campbell Scientific data logger and are then transmitted through a Geostationary Operational Environmental Satellite (GOES) transmitter to the WRCC. Regular quality assurance procedures include checking the PIC response and the air volume passing through the air sampler on a monthly basis, as well as performing data quality checks on the WRCC database. In addition to the real-time instruments and continuous air sampler, this station is equipped with a manually activated low-volume air sampler (AirMetrics MiniVol) that can collect air samples on quartz and Teflon filter media, which allows for different types of chemical and elemental analysis. This air sampler is intended to run in the event of nearby wildfire or in conditions of extreme dust storms, during which there may be value in distinguishing the relative contribution of organic and inorganic constituents. The station is also equipped with an ambient air particulate size profiler (Met-One). The Met-One measures the concentration of suspended particulates in real time. Data can be used to determine whether high wind events are always associated with higher concentrations of suspended particulates, and whether there are correlations between particulate concentrations and radionuclide concentration.



Figure 1-5. TTR Station 400 measures radiological and meteorological conditions near the ROC

Station 400: Air Sampling Results

Station 400 is equipped with a continuous air particulate sampler from which a 4-inch glass-fiber air filter sample is collected every two weeks and then delivered to the Radiological Services Laboratory at the University of Nevada, Las Vegas, on a monthly basis for batch processing. Between December 23, 2014, and December 23, 2015, 26 air particulate filter samples were collected and then analyzed by gamma spectroscopy and for gross alpha and beta activity. Only naturally occurring radionuclides were identified and measured on these samples; beryllium-7 (25 samples) and lead-210 (17 samples) were the most commonly identified radionuclides, with occasional detections of potassium-40 (two samples). No anthropogenic gamma-emitting radionuclides such as cesium-137, cobalt-60, or americium-241 have been detected. The mean annual gross alpha activity from all samples (Table 1-2) was 1.22×10^{-15} $\mu\text{Ci}/\text{mL}$, with a maximum of 2.90×10^{-15} $\mu\text{Ci}/\text{mL}$, a minimum of 0.60×10^{-15} $\mu\text{Ci}/\text{mL}$, and a standard deviation of 0.50×10^{-15} $\mu\text{Ci}/\text{mL}$. The mean annual gross beta activity from all samples (Table 1-3) was 1.72×10^{-14} $\mu\text{Ci}/\text{mL}$, with a maximum of 2.77×10^{-14} $\mu\text{Ci}/\text{mL}$, a minimum of 1.19×10^{-14} $\mu\text{Ci}/\text{mL}$, and a standard deviation of 0.38×10^{-14} $\mu\text{Ci}/\text{mL}$.

Table 1-2. TTR gross alpha results for sampling stations, 2015

Sampling Location	Number of Samples	Concentration ($\times 10^{-15}$ $\mu\text{Ci}/\text{mL}$ [3.7×10^{-5} Bq/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	26	1.22	0.50	0.60	2.90
401	26	1.08	0.51	0.35	2.31
402	25	1.30	0.45	0.51	2.19

NOTE: TTR = Tonopah Test Range

Table 1-3. TTR gross beta results for sampling stations, 2015

Sampling Location	Number of Samples	Concentration ($\times 10^{-14}$ $\mu\text{Ci}/\text{mL}$ [3.7×10^{-4} Bq/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	26	1.72	0.38	1.19	2.77
401	26	1.49	0.37	0.83	2.26
402	25	2.01	0.48	1.30	3.21

NOTE: TTR = Tonopah Test Range

Station 401: Clean Slate 3

Station 401 consists of a solar-powered air sampler (sampler and solar panels) mounted on a 7 ft by 14 ft trailer, plus a portable meteorological tower. The station is located on the north end of Clean Slate 3. Sensors include an anemometer, a temperature and relative humidity probe, a PIC, and an ambient air particulate size profiler (Met-One). The Met-One measures the concentration of suspended particulates in real time. Data from these sensors are collected and stored on a Campbell Scientific data logger and are then transmitted through a GOES transmitter to the WRCC. Regular quality assurance procedures include checking the PIC response and the air volume passing through the air sampler on a monthly basis, as well as performing data quality checks on the WRCC database. Working with Hi-Q Products Inc., DRI constructed this mobile version of a solar-powered air sampler based on a design currently being used by the USAF on NTTR. Internal airflow monitoring and self-adjustment capabilities allow the air sampler to maintain a near-constant flow rate. An internal totalizer computes the volume of air passed through the collection filter and the collector's run time. A saltation sensor was installed at Station 401 in August 2011. This instrument measures sand and particle movement by aeolian transport close to the ground surface. Saltation is a wind-driven process and is an important mechanism for transport of soil material in desert environments. DRI monitors the frequency of saltation events as a function of wind speed and wind direction at Station 401. Solar panels, with battery assist, provide power for the air sampler and the meteorological station. The configurations of the solar-powered air sampler and the portable meteorological station are shown in [Figure 1-6](#).

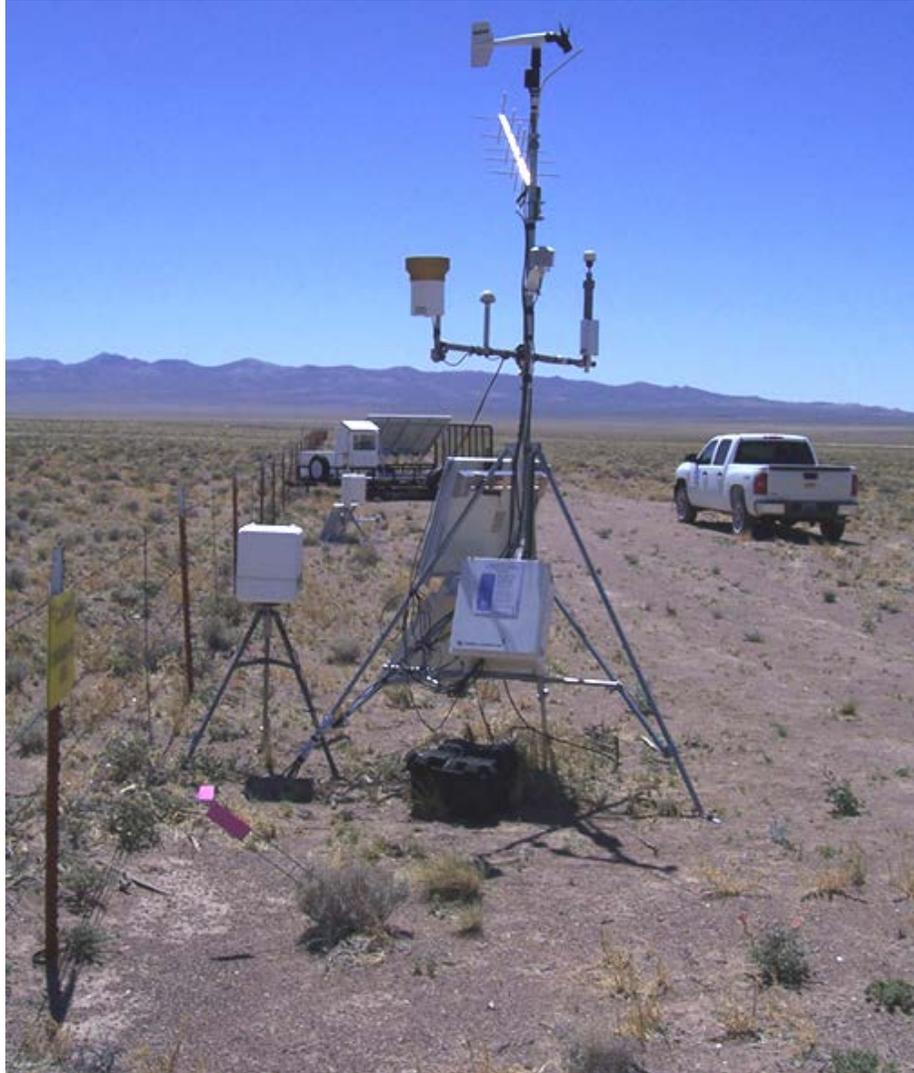


Figure 1-6. TTR solar-powered air sampler, saltation sensor, and meteorological tower (background, center, and foreground, respectively) at Station 401, located along the north fence that bounds the Clean Slate 3 contamination area

Station 401: Air Sampling Results

Station 401 is equipped with a continuous air particulate sampler from which a 4-inch glass-fiber air filter sample is collected every two weeks and then delivered to the Radiological Services Laboratory at the University of Nevada, Las Vegas, on a monthly basis for batch processing. Between December 23, 2014, and December 23, 2015, 26 air particulate filter samples were collected and then analyzed by gamma spectroscopy and for gross alpha and beta activity. Only naturally occurring radionuclides were identified and measured on these samples; beryllium-7 (24 samples) and lead-210 (13 samples) were the most commonly identified radionuclides, with minor detections of potassium-40 (one sample) and lead-212 (one sample). No anthropogenic gamma-emitting radionuclides such as cesium-137, cobalt-60, or americium-241 have been detected. The mean annual gross alpha activity (Table 1-2) from all samples was 1.08×10^{-15} $\mu\text{Ci}/\text{mL}$, with a maximum of 2.31×10^{-15} $\mu\text{Ci}/\text{mL}$, a minimum of 0.35×10^{-15} $\mu\text{Ci}/\text{mL}$, and a standard deviation of 0.51×10^{-15} $\mu\text{Ci}/\text{mL}$. The mean annual gross beta activity (Table 1-3) from all samples was 1.49×10^{-14} $\mu\text{Ci}/\text{mL}$, with a maximum of 2.26×10^{-14} $\mu\text{Ci}/\text{mL}$, a minimum of 0.83×10^{-14} $\mu\text{Ci}/\text{mL}$, and a standard deviation of 0.37×10^{-14} $\mu\text{Ci}/\text{mL}$.

Station 402: Clean Slate 1

In May 2011, DRI established Station 402 and installed a portable meteorological tower with an anemometer, a temperature and relative humidity probe, and a Met-One ambient air particulate size profiler, as well as a GOES satellite transmitter. During August 2011, DRI installed a solar-powered air sampler (sampler and solar panels) mounted on a trailer, and a PIC was installed in September 2011. Internal airflow monitoring and self-adjustment capabilities allow the air sampler to maintain a near-constant flow rate. An internal totalizer computes the volume of air passed through the collection filter and the collector's run time. Data from the sensors are collected and stored on a Campbell Scientific data logger. DRI installed a saltation monitoring station at Station 402 in August 2011. This instrument measures sand and particle movement by aeolian transport close to the ground surface. Saltation is a wind-driven process and is an important mechanism for transport of soil material in desert environments. DRI monitors for frequency of saltation events as a function of wind speed and wind direction at Station 402. Solar panels, with battery assistance, provide power for the air sampler and the meteorological station. The configurations of the solar-powered air sampler and the portable meteorological station are shown in Figure 1-7.



Figure 1-7. TTR solar-powered air sampler, saltation sensor, and meteorological tower (center right, foreground left, and center left, respectively) at Station 402, located along the north fence that bounds the Clean Slate 1 contamination area

Station 402: Air Sampling Results

Station 402 is equipped with a continuous air particulate sampler from which a 4-inch glass-fiber air filter sample is collected every two weeks and then delivered to the Radiological Services Laboratory at the University of Nevada, Las Vegas, on a monthly basis for batch processing.

Between December 23, 2014, and December 23, 2015, a total of 25 air particulate samples were collected and then analyzed by gamma spectroscopy and for gross alpha and beta activity. Only naturally occurring radionuclides were identified and measured on these samples; beryllium-7 (23 samples) and lead-210 (13 samples) were the most commonly identified radionuclides, with minor detections of potassium-40 (two samples), bismuth-214 (one sample), and protactinium-234m (one sample). No anthropogenic gamma-emitting radionuclides such as cesium-137, cobalt-60, or americium-241 have been detected. The mean gross alpha activity (Table 1-2) from all samples was 1.30×10^{-15} $\mu\text{Ci}/\text{mL}$, with a maximum of 2.19×10^{-15} $\mu\text{Ci}/\text{mL}$, a minimum of 0.51×10^{-15} $\mu\text{Ci}/\text{mL}$, and a standard deviation of 0.45×10^{-15} $\mu\text{Ci}/\text{mL}$. The mean gross beta activity (Table 1-3) from all samples was 2.01×10^{-14} $\mu\text{Ci}/\text{mL}$, with a maximum of 3.21×10^{-14} $\mu\text{Ci}/\text{mL}$, a minimum of 1.30×10^{-14} $\mu\text{Ci}/\text{mL}$, and a standard deviation of 0.48×10^{-14} $\mu\text{Ci}/\text{mL}$.

Station 400, Station 401, and Station 402: Air Particulate Migration

At Station 400 (ROC), wind speed of 15 mph or less was observed 92 percent of the time; wind speeds exceeded 30 mph for 4 hours and 20 minutes during the year, and sustained winds over 35 mph were registered for approximately 20 minutes during the year. Slightly lower wind speeds were observed at Station 401 (Clean Slate 3), where winds of 15 mph or less were observed 93 percent of the time and wind speed exceeded 30 mph for approximately 5 hours for the entire year. At Station 402 (Clean Slate 1), wind speed of 15 mph or less was observed approximately 92 percent of the time, and the wind speed exceeded 30 mph for approximately 10 hours and 20 minutes of the year. Figure 1-8 shows the average respirable particulate matter (having a diameter equal to or less than 10 μ [PM₁₀]) concentrations for 5 mph wind speed intervals at all three stations. The PM₁₀ concentrations increased approximately exponentially as wind speed increased at all stations. PM₁₀ concentrations at all three stations were less than approximately 10 $\mu\text{g}/\text{m}^3$ for wind speeds below 15 mph. At Station 400, PM₁₀ concentrations peaked at 1,300 $\mu\text{g}/\text{m}^3$ for wind speeds in the range of 30 to 35 mph. At Station 401, PM₁₀ concentrations rose to 2,191 $\mu\text{g}/\text{m}^3$ for wind speeds over 35 mph. At Station 402, PM₁₀ concentrations peaked at 2,478 $\mu\text{g}/\text{m}^3$ for wind speeds over 35 mph. Generally, the dust concentrations were significantly higher for sustained winds over 25 mph when compared to 2014.

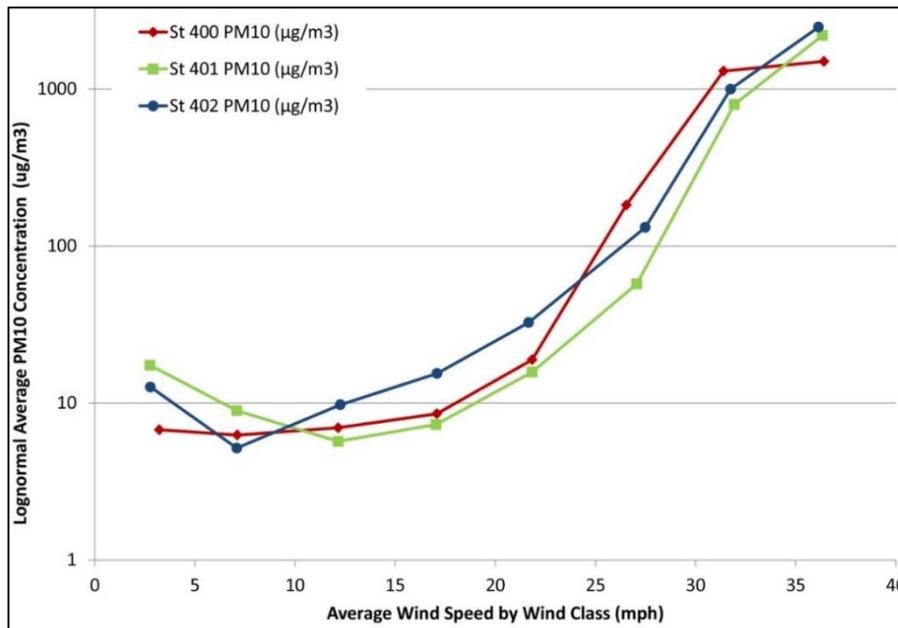


Figure 1-8. Wind speed and lognormal PM₁₀ trends for stations 400, 401, and 402, January 1–December 31, 2015

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Chapter 2. SNL/TTR Compliance Summary



Old times at Tonopah Test Range

OVERVIEW ■ SNL/TTR operations comply with all federal, state, and local environmental regulations. Releases and occurrences are reported according to numerous permit requirements. Regular audits, appraisals, and inspections identify areas for improvement as well as noteworthy practices.

Sandia Corporation (Sandia) conducts operations at Sandia National Laboratories, Tonopah Test Range (SNL/TTR) in compliance with federal, state, and local environmental requirements, including U.S. Department of Energy (DOE) directives and Presidential Executive Orders (EOs). As a part of this compliance, Sandia adheres to strict reporting and permitting requirements.

All operations and activities at SNL/TTR, including those in the environmental programs, are performed under corporate Environment, Safety, and Health (ES&H) policy (ESH100), which states:

It is the policy of Sandia National Laboratories to perform work in a safe and environmentally responsible manner by committing to: maintain a safe workplace, prevent incidents, and protect the public; protect the environment, conserve resources, and prevent pollution; maintain compliance with legal and other requirements; and strive for continual improvement. DOE's Integrated Safety Management System (ISMS) is a key element of the Sandia Management Model. ISMS provides the framework for managing ES&H activities and functions while integrating them into all SNL operations.

2.1 Compliance Status with State Regulations

The State of Nevada administers most environmental regulations applicable to SNL/TTR (Table 2-1). Specific state regulations (State of Nevada Environmental Regulations) include those governing air quality, solid and hazardous waste management, wildlife, water quality, and radiation control. The U.S. Environmental Protection Agency (EPA) administers radionuclide air emissions directly.

Table 2-1. SNL/TTR applicable State of Nevada administrative regulations

Chapter and Provisions	Applicable Sources or Activities
NAC-444, Sanitation	
NAC 444.570 to 444.980, Solid Waste Disposal	<ul style="list-style-type: none"> Disposal of construction debris Disposal of routine nonhazardous solid wastes Disposal of septic sludge
NRS 444A.010 to 444A.120, Programs for Recycling	<ul style="list-style-type: none"> Disposal of hazardous waste PCB Asbestos
Chapter 445A, Water Controls	
NAC 445A.9656 to 445A.9706, Septic Tanks	<ul style="list-style-type: none"> Septic tanks
NAC 445A.228 to 445A.272, Discharge Permits	<ul style="list-style-type: none"> Surface water runoff
NAC 445A.450 to 445A. 6731, Public Water Systems	<ul style="list-style-type: none"> Water wells Operator certification Treatment of water Distribution of water Storage structures Water conservation plan
Chapter 445B, Air Controls	
NAC 445B.001 to 445B.3477, Air Pollution	<ul style="list-style-type: none"> Open burning Hazardous air pollutants from stacks and vents Disturbance of soils during construction (particulate matter) Class II operating permit
NAC 445B.400 to 445B.774, Emissions from Engines	<ul style="list-style-type: none"> Generators Mobile sources
Chapter 459, Hazardous Materials	
NAC 459.9921 to 459.999, Storage Tanks	<ul style="list-style-type: none"> Spill reporting
Chapter 477, State Fire Marshall	
NAC 477.323, Permit to Store Hazardous Material	<ul style="list-style-type: none"> Hazardous material storage
Chapter 534, Underground Water and Wells	
NAC 534.010 to 534.500, Underground Water and Wells	<ul style="list-style-type: none"> Drilling, construction, operation, and plugging (abandonment) of wells and boreholes

NOTES: The Nevada Administrative Code is accessed through <http://www.leg.state.nv.us/nac/>.

NAC = Nevada Administrative Code

PCB = polychlorinated biphenyl

NRS = Nevada Revised Statute

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

2.2 Compliance Status with Federal Regulations

The primary federal regulations applicable to environmental compliance at TTR are presented in Table 2-2.



Western Fence Lizard (*Sceloporus occidentalis*)

Table 2-2. SNL/TTR applicable major environmental regulations and statutes

Regulation/Statute	Description
Atomic Energy Act	Directs DOE and the U.S. Nuclear Regulatory Commission in the management of nuclear materials and radioactive waste
Clean Air Act and Clean Air Act Amendments	Provides standards to protect the nation’s air quality
Clean Water Act	Provides a permitting structure and regulatory direction (i.e., National Pollutant Discharge Elimination System) for restoring and maintaining the chemical, physical, and biological integrity of U.S. waters; protecting fish, wildlife and recreation; and reducing pollutant discharges
Comprehensive Environmental Response, Compensation, and Liability Act	Provides federal funding for cleanup of inactive waste sites on the National Priorities List and mandates requirements for reportable releases of hazardous substances (also known as “Superfund”)
Cultural Resources Acts	Includes various acts that protect archeological, historical, and religious sites and resources
Emergency Planning and Community-Right-to-Know Act	Mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community (also known as the Superfund Amendments and Reauthorization Act, Title III)
Endangered Species Act	Provides special protection status for federally listed threatened or endangered species
Executive Orders	Several Executive Orders provide specific protection for wetlands, floodplains, and environmental justice in minority and low-income populations, and encourages leadership in environmental management
Federal Facility Compliance Act	Directs federal agencies regarding environmental compliance
Federal Insecticide, Fungicide, and Rodenticide Act	Controls the distribution and use of various pesticides
Migratory Bird Treaty Act of 1918	Prevents the taking, killing, possessing, transporting, and importing of migratory birds, their eggs, parts, and nests
National Emission Standards for Hazardous Air Pollutants	Specifies standards for radionuclide air emissions and other hazardous air releases under the Clean Air Act
National Environmental Policy Act	Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making
Oil Pollution Act	Sets forth requirements for the prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities
Resource Conservation and Recovery Act	Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks
Safe Drinking Water Act	Enacts specific health standards for drinking water sources
Toxic Substances Control Act	Specifies rules for the manufacture, processing, distribution, use, and disposal of specific chemical substances and mixtures, such as asbestos and polychlorinated biphenyls

NOTES: This is a partial listing of all applicable environmental regulations and statutes.

DOE = U.S. Department of Energy

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

U.S. = United States

2.2.1 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as “Superfund,” defines assessment activities and reporting requirements for inactive waste sites at federal facilities. As required by CERCLA, a Preliminary Assessment was submitted in 1988 for all facilities listed on the federal agency hazardous waste compliance docket. Sites with significant contamination were put on the National Priorities List for cleanup (EPA 2013). There are no National Priorities List, or “Superfund,” sites located at SNL/TTR. The Superfund Amendments and Reauthorization Act (SARA) Title III amended CERCLA requirements for reportable quantity releases and chemical inventory reporting.

2.2.2 Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act [EPCRA]), also known as SARA Title III, requires the submittal of a Toxic Release Inventory report for chemical releases over a given threshold quantity. [Table 2-3](#) lists SARA Title III reporting requirements.

Table 2-3. SNL/TTR applicable EPCRA reporting requirements, 2015

Section	EPCRA Section Title	Requires Reporting?		Description
		Yes	No	
302-303	Emergency Planning	✓		Sandia personnel prepare an annual report that lists chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 (Appendix B), including the location of the chemicals and emergency contacts. The DOE/NNSA/SFO distributes the report to the required entities.
304	Emergency Notification		✓	No reportable quantity releases of an EHS, as defined by CERCLA, were reported in 2015.
311-312	Hazardous Chemical Storage Reporting Requirements	✓		There are two "Community Right-to-Know" reporting requirements: (1) Sandia personnel complete the EPA Tier II forms for all hazardous chemicals present at the SNL/TTR facility at any one time in amounts equal to or greater than 10,000 lb and for all EHSs present at the facility in an amount greater than or equal to 500 lb or the Threshold Planning Quantity, whichever is lower, and provide the report to DOE/NNSA/SFO for distribution to the required entities; and (2) Sandia personnel provide Safety Data Sheets for each chemical entry on a Tier II form and provide the report to DOE/NNSA/SFO prior to distribution to the required entities.
313	Toxic Chemical Release Forms		✓	Facilities that release toxic chemicals listed in SARA Title III over a threshold value must submit a TRI report. In 2015 no releases resulting from SNL/TTR operations were reported above the threshold requiring a TRI report.

NOTES: CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
 CFR = Code of Federal Regulations
 DOE = U.S. Department of Energy
 EHS = extremely hazardous substance
 EPA = U.S. Environmental Protection Agency
 EPCRA = Emergency Planning and Community Right-to-Know Act
 NNSA = National Nuclear Security Administration
 Sandia = Sandia Corporation
 SARA = Superfund Amendments and Reauthorization Act
 SFO = Sandia Field Office
 SNL/TTR = Sandia National Laboratories, Tonopah Test Range
 TRI = Toxic Release Inventory

2.2.3 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) and the Nevada Revised Statutes regulate the generation, transportation, treatment, storage, and disposal of hazardous chemical waste and nonhazardous solid wastes. Applicable regulations are listed in [References](#) (Federal Acts and Statutes).

SNL/TTR usually generates a small quantity of hazardous waste through normal operations each month, which classifies the site for small-quantity generator status requirements. (See [Chapter 3](#) for a summary of hazardous waste management activities during 2015.)

Under this designation, hazardous waste can only be stored on-site for 180 days before it must be shipped off-site for treatment and disposal at an EPA-permitted facility. SNL/TTR hazardous waste shipments are scheduled to occur at least two to three times a year (as needed).

Sanitary solid waste, which is also regulated under RCRA, is disposed of at the SNL/TTR Class II sanitary landfill operated by the U.S. Air Force (USAF) operations and maintenance contractor. The landfill is used cooperatively by all organizations at SNL/TTR. SNL/TTR had

one recycling contract in 2015, for tires. In January 2014, Sandia contracted with Lunas Recycling in Las Vegas, Nevada, to recycle tires generated at SNL/TTR. Lunas Recycling accepts all tire sizes that SNL/TTR is currently using (including loader tires).

2.2.4 Oil Pollution Prevention

Aboveground storage tanks (ASTs) are subject to EPA regulations 40 Code of Federal Regulations (CFR) 112, *Oil Pollution Prevention*, and 40 CFR 110, *Discharge of Oil*. There are no ASTs at SNL/TTR regulated by the State of Nevada. SNL/TTR personnel completed replacement of all AST systems in 2014. The last of the underground storage tanks at SNL/TTR were removed in 1995. There were seven ASTs in operation at SNL/TTR in 2015.

2.2.5 Federal Facility Compliance Act

The Federal Facility Compliance Act requires federal facilities to comply with all federal, state, and local requirements for hazardous and solid waste, including full compliance with the restrictions and prohibitions on extended storage of wastes that do not meet the applicable hazardous waste treatment standards. Extended storage at DOE facilities is typically associated with mixed wastes (wastes that have hazardous and radioactive components) that have been generated on-site. Since SNL/TTR operations do not generate mixed waste and there is currently no mixed waste stored on-site, these requirements are not applicable to operations at SNL/TTR.

2.2.6 Clean Air Act and Clean Air Act Amendments of 1990

The Clean Air Act (CAA) and CAA Amendments of 1990 requirements are regulated by State of Nevada air quality regulations. Air emissions from nonradionuclide sources, such as a portable screen or maintenance shop activities, are permitted under a Class II Air Quality Permit. Emissions are tracked, and Sandia pays a standard \$500 permit fee to the State of Nevada annually. SNL/TTR met all air quality permit conditions in 2015.

National Emission Standards for Hazardous Air Pollutants Compliance

The EPA retains compliance authority for all radionuclide air releases, which are regulated by National Emission Standards for Hazardous Air Pollutants (NESHAP) and implemented under 40 CFR 61, Subpart H. The Clean Slate sites, as discussed in [Chapter 1](#), have been the only source of radionuclide air emissions at SNL/TTR. Continuous air monitoring was conducted from February 22, 1996, to February 25, 1997 ([SNL/NM 1997a](#)). It was determined that the SNL/TTR airport was the location of the maximally exposed individual. The result of 0.024 mrem/yr was below the threshold of 0.1 mrem/yr, for which continuous air monitoring would be required, and approximately 400 times less than the EPA standard of 10 mrem/yr. The *NESHAP Annual Report for CY 2015 Sandia National Laboratories, Tonopah Test Range* ([SNL/NM 2016](#)) and [Chapter 3](#) of this report discuss these monitoring results.

2.2.7 Wastewater

SNL/TTR wastewater discharges are controlled by the Nevada Division of Environmental Protection (NDEP), which administers regulations relevant to water pollution and sanitary waste systems. Wastewater that enters the sanitary sewer system is treated in the SNL/TTR sewage lagoons. The USAF operates these lagoons under a National Pollution Discharge Elimination System (NPDES) permit issued by NDEP. Sandia also maintains five septic tank systems (the newest of which is inactive) in remote areas at SNL/TTR, which are used for domestic sanitary sewage collection only. Additional information can be found in [Chapter 3](#).

Stormwater

The issuance of an NPDES stormwater permit is generally based on whether or not stormwater runoff is discharged to “waters of the U.S.” The SNL/TTR site is primarily a closed basin, with runoff evaporating or infiltrating to the ground. The State of Nevada has determined that there are no industrial activities at SNL/TTR that require permitting. New construction activities that exceed one acre of soil disturbance require permitting under the Construction General Permit. On October 9, 2014, SNL/TTR personnel submitted a Notice of Intent to operate under the Nevada Stormwater Construction Permit NVR100000 for a project titled “Tonopah Test Range Fiber Optic Cable Installation.” A Stormwater Pollution Prevention Plan for Construction Activities was developed for this project and will be maintained until a Notice of Termination is submitted to NDEP. On March 24, 2015, SNL/TTR personnel submitted a Notice of Intent to operate under the Nevada Stormwater Construction Permit NVR100000 for a project titled “Tonopah Test Range (TTR) Test Unit Recovery Operations.” A similar Stormwater Pollution Prevention Plan for Construction Activities was developed for this project and will be maintained until a Notice of Termination is submitted to NDEP.



Bighorn sheep (*Ovis canadensis*)

2.2.8 Safe Drinking Water Act

Sandia meets standards for drinking water as defined in the Safe Drinking Water Act and NDEP public water supply and public water system regulations. Production Well 6 normally provides all drinking water for the Area 3 compound. SNL/TTR operates under permits issued by NDEP (one for the public water system and one for the arsenic treatment system). The USAF public water system and the Sandia public water system are designed such that they can, on an as-needed basis, provide backup drinking water to each other. [Chapter 3](#) discusses monitoring activities. The NDEP Bureau of Safe Drinking Water characterizes this public water system as a Non-Transient Non-Community system.

2.2.9 Toxic Substances Control Act

Compliance with the Toxic Substances Control Act (TSCA) at SNL/TTR primarily concerns management of asbestos and polychlorinated biphenyls (PCBs). As defined by TSCA, any material containing PCB with a concentration greater than or equal to 500 ppm is considered a PCB; materials with greater than or equal to 50 ppm but less than 500 ppm are considered PCB contaminated.

In 1993, sampling was performed on SNL/TTR transformers to determine whether PCBs were present (IT 1993). All samples contained less than 50 ppm of PCBs. During 2015, the USAF assumed all responsibility for maintaining the Tonopah Test Range High Voltage Power Transmission Facilities. In December 2015, all high voltage transformers in the SNL/TTR transformer storage yard inventory were transferred to the USAF and moved to their facilities.

Asbestos-containing materials at SNL/TTR were identified in a comprehensive 1993 Asbestos Site Survey, which is available on the SNL/TTR server. The survey is updated periodically when new information (such as sample results or abatement activities) is available.

Asbestos abatement was conducted in Building 03-57 in December 2015 prior to beginning renovation activities there. All asbestos-related activities are conducted in accordance with applicable regulatory requirements.

2.2.10 Federal Insecticide, Fungicide, and Rodenticide Act

Chemical pesticides used at SNL/TTR include herbicides, rodenticides, and insecticides, as needed. All chemicals used are EPA approved and are applied in accordance with applicable label guidelines and regulations. Sandia retains records of the quantities and types of pesticides that are used as well as Safety Data Sheets for each pesticide. There were no violations of the Federal Insecticide, Fungicide, and Rodenticide Act in 2015.

2.2.11 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies (and other organizations that perform federally sponsored projects) to consider environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues, and include this information in early project planning and decision making. Proposed actions that would not significantly impact the human environment are categorically excludable from additional NEPA documentation (as identified in DOE 10 CFR Part 1021, *National Environmental Policy Act Implementing Procedures*). Other proposed actions may fit within a class of actions that have environmentally significant impacts associated with them. For this class of proposed actions, the agency must prepare an environmental assessment or an environmental impact statement before making an irrevocable commitment of resources or funding. Although a major NEPA objective is to preserve the environment for future generations, the law does not require an agency to choose a course of action with the least environmental impacts. The DOE/National Nuclear Security Administration (NNSA)/Sandia Field Office (SFO) coordinates NEPA compliance at SNL/TTR with personnel from SNL, New Mexico (SNL/NM). NEPA activities are discussed in [Chapter 3](#).

2.2.12 Endangered Species Act

The Endangered Species Act applies to both private individuals and federal agencies. Federal agencies must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. At SNL/TTR, the Endangered Species Act is addressed under the NEPA Program and the Ecology Program. If potentially significant impacts to sensitive species or habitats are found as a result of a proposed action, an environmental assessment or an environmental impact statement must be prepared.

[Table 2-4](#) lists all federal- and state-protected species occurring within Nye County, Nevada, and having the potential to occur at SNL/TTR.

Table 2-4. SNL/TTR protected species potentially occurring in Nye County, Nevada

Common Name	Scientific Name	Federal Status	State of Nevada Protected Status
Plants			
Sodaville milkvetch	<i>Astragalus lentiginosus</i> var. <i>sesquimetralis</i>	—	Endangered
Ash Meadows milkvetch	<i>Astragalus phoenix</i>	Threatened	Endangered
Spring-loving centaury	<i>Centaureium namophilum</i>	Threatened	Endangered
Ash Meadows sunray	<i>Enceliopsis nudicaulis</i> var. <i>corrugata</i>	Threatened	Endangered
Ash Meadows gumplant	<i>Grindelia fraxinopratenensis</i>	Threatened	Endangered
Ash Meadows ivesia	<i>Ivesia kingii</i> var. <i>eremica</i>	Threatened	Endangered
Ash Meadows blazingstar	<i>Mentzelia leucophylla</i>	Threatened	Endangered
Amargosa niterwort	<i>Nitrophila mohavensis</i>	Endangered	Endangered
Williams combleaf	<i>Polycytenium williamsiae</i>	—	Endangered
Animals			
Invertebrates			
Ash Meadows naucorid	<i>Ambrysus amargosus</i>	Threatened	—
Fishes			
Railroad Valley springfish	<i>Crenichthys nevadae</i>	Threatened	Threatened
Devils Hole pupfish	<i>Cyprinodon diabolis</i>	Endangered	Endangered
Ash Meadows Amargosa pupfish	<i>Cyprinodon nevadensis mionectes</i>	Endangered	Threatened
Warm Springs Amargosa pupfish	<i>Cyprinodon nevadensis pectoralis</i>	Endangered	Endangered
Pahrump poolfish	<i>Empetrichthys latos latos</i>	—	Endangered
White River spinedace	<i>Lepidomeda albivallis</i>	Endangered	Endangered
Moapa dace	<i>Moapa coriacea</i>	Endangered	Endangered
Lahontan cutthroat trout	<i>Oncorhynchus clarkii henshawi</i>	Threatened	Threatened
Ash Meadows speckled dace	<i>Rhinichthys osculus nevadensis</i>	Endangered	Endangered
Reptiles			
Desert Tortoise	<i>Gopherus agassizii</i>	Threatened	Threatened
Mammals			
Spotted bat	<i>Euderma maculatum</i>	—	Threatened
Birds			
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	Threatened	Sensitive
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Endangered	Endangered
Yuma Clapper Rail	<i>Rallus longirostris yumanensis</i>	Endangered	Endangered

NOTES: — = not available
 SNL/TTR = Sandia National Laboratories, Tonopah Test Range

2.2.13 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) of 1918 implemented the 1916 Convention for the Protection of Migratory Birds. The original statute implemented the agreement between the U.S. and Great Britain (for Canada), and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia. The MBTA prevents taking, killing, possessing, transporting, and importing migratory birds, their eggs, parts, or nests.

Federal institutions are not exempt from the MBTA. At SNL/TTR, the MBTA is coordinated through NEPA reviews and the Ecology Program.

2.2.14 Federal Facility Agreement and Consent Order Compliance for Environmental Restoration Activities

The Federal Facility Agreement and Consent Order (FFACO) is an ongoing action with the State of Nevada that started in 1996. This agreement was implemented in May 1996 between the State of Nevada, DOE, and the U.S. Department of Defense (DOD) ([DOD, DOE, and State of Nevada 1996](#)). All DOE cleanup activities at certain specified facilities in the State of Nevada must be conducted in conformance with the requirements of this agreement. The FFACO is an enforceable agreement with stipulated penalties for violations. The Environmental Restoration (ER) sites subject to the FFACO for which DOE has assumed responsibility are:

- Nevada National Security Site
- Areas within SNL/TTR
- Areas within the Nevada Test and Training Range
- Central Nevada Test Area
- Project Shoal Area (east of Carson City in Churchill County)

A summary of DOE/NNSA's ER sites in Nevada can be found in the FFACO document ([DOD, DOE, and State of Nevada 1996](#)). The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAUs), which are listed by Corrective Action Site (CAS) numbers. Each CAU and CAS is listed in the FFACO in the following appendices:

- Appendix II, "Corrective Action Sites/Units" (this section includes inactive CAUs and CASs)
- Appendix III, "Corrective Action Investigations/Corrective Actions" (this section includes active CAUs and CASs)
- Appendix IV, "Closed Corrective Action Units" (this section lists CAUs and CASs where corrective actions are complete)

The FFACO is updated every six months. A discussion of ER sites located at TTR is provided in [Chapter 3](#).

2.2.15 Cultural Resources Acts

Federal cultural resources management responsibilities are applicable to activities at SNL/TTR. These include, but are not limited to, compliance with the following laws and their associated regulations:

- National Historic Preservation Act
- Archaeological Resources Protection Act
- American Indian Religious Freedom Act

The DOE/NNSA/SFO is responsible for determining the level of applicability of cultural resources requirements. In 2015, Sandia's operations generated no impact on cultural resources at SNL/TTR.

Historic Building Assessment

In 2011, DOE/NNSA/SFO completed consultation with the Nevada State Historic Preservation Office (SHPO), reaching an agreement on the proposed SNL/TTR Historic District. In 2012, DOE/NNSA/SFO provided samples of the documentation created to mitigate the effect of future demolition of properties within the SNL/TTR Historic District. The Nevada SHPO reviewed the sample documentation and agreed with its suitability. Negotiation is ongoing between the DOE/NNSA/SFO and the Nevada SHPO regarding a memorandum of agreement covering the historic district and future mitigative efforts at the site.

Once the memorandum of agreement is signed, the Historic American Buildings Survey/ Historic American Engineering Record Western Region office will provide instructions on the format for the final report on the SNL/TTR Historic District. Sandia will then produce the report.

Archaeological Survey

In 2014, preparatory to the proposed installation of a fiber-optic cable line to improve communications at the site, an archaeological survey of the affected area was undertaken. In 2015, DOE/NNSA/SFO engaged in consultation with the Nevada SHPO regarding the results of the survey and any necessary actions to avoid or mitigate the impact on archaeological sites within SNL/TTR. The fiber-optic cable line will not affect any archaeological sites; it will cut through Mellan Airfield, but plans are in place for mitigative repairs.



Wild horses (*Equus ferus*), mare and colt

2.2.16 Atomic Energy Act

The purpose of the Atomic Energy Act (AEA) is to assure the proper management of source, special nuclear, and byproduct materials (42 USC § 2011 et. seq.). The DOE sets radiation protection standards and retains authority for radionuclides through department directives. Operations at SNL/TTR are subject to the requirements established in [DOE O 435.1 Change 1, Radioactive Waste Management](#), and [DOE O 458.1 Admin Change 3, Radiation Protection of the Public and the Environment](#).

Radiation protection standards are set for DOE operations so that radiation exposures to members of the public and the environment are as low as reasonably achievable and are maintained within established limits. Limits are set such that the total annual effective dose equivalent of all potential exposure pathways to the public (including air, water, and the food chain) is 100 mrem/yr. Air emissions from DOE facilities shall not cause any individual of the

public to receive an effective dose equivalent of greater than 10 mrem/yr. At SNL/TTR the only current pathway for potential exposure is through air (see [Chapter 3](#) for details).

DOE O 458.1 references the derived concentration standards for radionuclides in water that could be continuously consumed (365 days a year). This is a conservative approach, which assumes that a member of the public resides at the location continuously. Currently, there is no water pathway for radionuclides in drinking water at SNL/TTR; therefore, the DOE derived concentration standards for a water pathway are not applicable. See [Chapter 3](#) for information about the public water system at SNL/TTR.

DOE O 435.1 establishes requirements for managing radioactive waste in a manner that protects worker and public health and safety and the environment. Under this order, DOE contractor-operated facilities are required to plan, document, execute, and evaluate the management of radioactive waste (see [Chapter 3](#) for details).

Sandia complies with DOE requirements for managing radioactive waste in a manner that protects worker and public health and safety and the environment.

The control and release of property with residual radioactivity is specified in DOE O 458.1. Sandia does not release property (e.g., vehicles, equipment, or other materials) to the public with residual radioactivity above the limits specified in DOE O 458.1. Pursuant to written procedures, items that are potentially contaminated or activated are either surveyed prior to release to the public, or a process knowledge evaluation is conducted to verify that the property has not been exposed to radioactive material or to energy capable of inducing radioactivity in the material. In some cases, both a radiological survey and a process knowledge evaluation are performed. In 2015, Sandia's Radiation Protection Department processed two equipment clearance surveys. Using a graded approach, Sandia only keeps track of high-value released items (e.g., those items worth greater than \$100,000). In 2015, no such high-value items were released.

DOE issued a moratorium in January 2000 that prohibited the release of volume-contaminated metals, and subsequently suspended the release of metals for recycling purposes from DOE radiological areas in July 2000. No metals subject to the moratorium or the suspension were released from SNL/TTR in 2015.

Excess property with residual radioactivity above the limits in DOE O 458.1 is either retained for continued use within DOE facilities or transferred to the SNL/NM Radioactive and Mixed Waste Management Facility for disposal as radioactive waste. There were no releases of real property to the public in 2015.

2.2.17 Environmental Compliance Executive Orders

The following environmental compliance EOs are applicable at SNL/TTR.

Executive Order (EO) 11988, Floodplain Management, and EO 11990, Protection of Wetlands

As amended, these orders require evaluation of the potential effects of actions taken in these environmentally sensitive areas. There are no floodplains or significant wetlands at SNL/TTR; however, some very limited wetlands exist in the vicinity of several springs. These provide an important source of drinking water for wildlife in the area. Sandia complies with all applicable mandates stated in these EOs.

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

As amended, EO 12898 requires each federal agency to make environmental justice part of its mission, and sets responsibilities for agencies, including developing a strategy to identify and address environmental justice concerns. DOE/NNSA/SFO and Sandia perform a periodic analysis to assess whether their existing or proposed operations cause any disproportionate impacts on minority or low-income populations within the area of influence of Sandia operations.

EO 13693—Planning for Federal Sustainability in the Next Decade

Issued in March 2015, EO 13693 establishes an integrated strategy toward sustainability to safeguard the health of our environment and make the reduction of greenhouse gas emissions and enhanced climate resilience a priority for all federal agencies. EO 13693 sets goals in the areas of promoting sustainable buildings, increasing renewable energy, reducing water use, promoting electronics stewardship through sustainable acquisition, preventing pollution, and reducing solid waste. Sandia personnel reported sustainability-related data (e.g. pollution prevention, energy, and water use) for SNL/TTR to the corporate Site Sustainability Plan team for submittal to NNSA/SFO in 2015.

2.2.18 Department of Energy Directives

DOE directives on the Management and Operating Contract between Sandia and the DOE define the primary contractual obligations for operating SNL/TTR ([Chapter 1](#)). In 2015, Sandia met all the requirements stated in these DOE directives.

2.2.19 Quality Assurance

Sandia takes responsibility and accountability for implementing quality assurance for all its operations as specified in International Organization for Standardization (ISO) 9001-2000 ([ISO 2008](#)), the Contractor Requirements Document of [DOE O 414.1D](#), *Quality Assurance*, and 10 CFR 830, Subpart A, “Quality Assurance.” Quality assurance is implemented via policy statements, processes, and procedures, and by executing the actions specified in those processes and procedures ([10 CFR 830](#)).

2.3 Audits, Appraisals, and Inspections in 2015

Environmental programs at SNL/TTR are routinely subjected to audits, appraisals, and/or inspections by external agencies. Sandia’s internal audit group also conducts assessments, including reviews of implementation of applicable corporate policies, process, or procedures; evaluations of corrective action validation assessments; and surveillances and walkthroughs. Self-assessments evaluate performance and compliance and identify deficiencies and opportunities for improvement as well as noteworthy practices and lessons learned.

NDEP conducted one audit of SNL/TTR during 2015, a RCRA Hazardous Waste Compliance Document Inspection. No findings or discrepancies were noted.

2.4 Environmental Permits

Environmental compliance permits for SNL/TTR include those for hazardous materials storage, public water supply, stormwater, RCRA, and air quality. The State of Nevada issues permits for these SNL/TTR activities directly to DOE/NNSA/SFO, and Navarro Research and Engineering (Navarro) administers them on behalf of Sandia. Sandia and Navarro ensure that all permit conditions are met. [Table 2-5](#) lists all permits and registrations in effect in 2015.

Table 2-5. SNL/TTR permits, 2015

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
Air Quality				
Class II Air Quality Operation Permit	AP 8733-0680.03, FIN A0025	08/05/2011 (amended with corrections 10/03/2011) also (administratively amended to update Surface Area Disturbance Conditions/Fugitive Dust Control Plan 11/14/2014)	07/23/2016	<ul style="list-style-type: none"> • Portable screen • Welding operation • Carpenter area • Paint booth • Generators (9 systems) • Surface area disturbance • (> 5 acres)
Hazardous Waste (RCRA)				
Hazardous Waste Generator	NV1890011991 ^a	January 7, 1993	Indefinite	State of Nevada
Hazardous Waste (Nevada State Fire Marshal)				
Hazardous Materials Permit	FDID Number: 13007 Permit Number: 48316	March 2015	February 29, 2016	State of Nevada
Stormwater Construction (SWPPP)				
Fiber-Optic Cable Installation	DOE Number CSW-40066 SNL Number CSW-39893	October 16, 2014	Renew by July 1, 2016, until Notice of Termination is submitted	State of Nevada
TTR Test Unit Recovery Operations	DOE Number CSW-40532 SNL Number CSW-40531	October 16, 2014	Renew by July 1, 2016, until Notice of Termination is submitted	State of Nevada
Production Well (Drinking Water)				
Production Well 6	NV-3014-12NTNC ^b	October 7, 2015	September 30, 2016	State of Nevada
Permit to Operate a Treatment Plant	NV-3014-TP11-12NTNC	October 7, 2015	September 30, 2016	State of Nevada

NOTES: ^aGenerator identification number (not a permit number).

^bThe State of Nevada Bureau of Health Protection Services renews the permit for Production Well 6 (NV-3014-12NTNC) annually.

> = greater than

AP = air permit

DOE = U.S. Department of Energy

FDID = Fire Department Identification

FIN = facility identification number

NTNC = Non-Transient Non-Community

NV = Nevada

RCRA = Resource Conservation and Recovery Act

SNL = Sandia National Laboratories

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

SWPPP = Stormwater Pollution Prevention Plan

TTR = Tonopah Test Range

2.5 Occurrence Reporting

Under [DOE O 232.2 Admin. Change 1](#), the current order for occurrence reporting, an occurrence is defined as “one or more (i.e., recurring) events or conditions that adversely affect, or may adversely affect, DOE (including NNSA) or contractor personnel, the public, property, the environment, or the DOE mission. Events or conditions meeting criteria thresholds identified in DOE O 232.2, or determined to be recurring through performance analysis, are considered occurrences.” There are environmental releases that may not meet DOE O 232.2 reporting thresholds; however, they are still reportable to outside agencies. There were no reportable occurrences or environmental releases in 2015.

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Chapter 3. SNL/TTR Environmental Programs



Pronghorn antelope (*Antilocapra americana*)

OVERVIEW ■ Sandia takes the responsibility of protecting the environment seriously. Numerous programs monitor the air, water, and soil at SNL/TTR to help prevent pollution and conserve natural resources.

Sandia Corporation (Sandia) personnel conduct environmental, terrestrial, water, and air monitoring programs at Sandia National Laboratories, Tonopah Test Range (SNL/TTR), Nevada. Sandia complies with federal, state, and local regulations.

3.1 Environmental Programs

Sandia personnel collect environmental data at Tonopah Test Range (TTR), Nevada, to determine and report the impact of existing Sandia operations on the environment. Sandia's environmental programs include monitoring and surveilling air, water, and soil. The environmental program activities at SNL/TTR meet or exceed the requirements of federal, state, and local environmental regulations, as well as U.S. Department of Energy (DOE) directives in the Prime Contract between Sandia and DOE. Presidential Executive Orders and DOE guidance documents are also used to establish program criteria.

The following environmental programs and focus areas are presented in this chapter:

- Air Quality Compliance Program
- Environmental Restoration (ER) Project
- National Environmental Policy Act (NEPA) Program
- Oil Storage Program
- Terrestrial Surveillance Program
- Waste Management Program
- Water Quality Programs

3.2 Air Quality Compliance Program

Sandia operations at SNL/TTR do not involve activities that release radioactive emissions from either point sources (stacks and vents) or diffuse sources, such as outdoor testing. However, diffuse radiological emissions are produced from the resuspension of americium and plutonium, which are present at the Clean Slate ER sites. Other ER sites with minor radiological contamination, such as depleted uranium, do not produce significant air emission sources from resuspension.

3.2.1 National Emission Standards for Hazardous Air Pollutants

The Radiological National Emission Standards for Hazardous Air Pollutants (NESHAP) Program ensures that Sandia is in compliance with radiological NESHAP requirements. The EPA regulates radionuclide air emissions in accordance with 40 Code of Federal Regulations (CFR) 61, Subpart H, “National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities.” The U.S. Environmental Protection Agency (EPA) has set a maximally exposed individual (MEI) radiological dose limit of 10 mrem/yr resulting from all radiological air emissions produced from a DOE facility. CFR 61, Subpart H requires that an annual report be submitted from each DOE/NNSA site where facility sources contribute a public radiological dose of over 0.1 mrem/yr. The report includes the calculated effective dose equivalent in millirems per year for the MEI (SNL/NM 2016).

The 1996 Radiological NESHAP report for SNL/TTR described a calculated effective dose equivalent (EDE) to the MEI of 1.1 mrem/yr as a result of diffuse emissions from the Clean Slate sites (SNL/NM 1997a). Because the EPA requires continuous air monitoring for any radionuclide source that contributes a dose in excess of 0.1 mrem/yr to the MEI, Sandia instituted continuous air monitoring at a sampling site for one year from February 22, 1996, to February 25, 1997. The monitoring site was at the SNL/TTR airport, the location of the highest calculated dose for a member of the public. This site selection is discussed in the 1996 NESHAP report (SNL/NM 1997b). The dose assessment result from the continuous monitoring was 0.024 mrem/yr (Table 3-1). This was approximately four times less than the 0.1 mrem/yr threshold cutoff for which continuous monitoring would be required by the EPA. The average air concentrations are provided in Table 3-2.

Table 3-1. SNL/TTR calculated dose assessment results for on-site receptor, 1996–1997

Dose to Receptor	Location	1997 Measured Dose ^a	EPA and DOE Dose Limit for Air Pathway	Natural Background
On-site receptor (EDE to the MEI)	Airport area	0.024 mrem/yr	10 mrem/yr	350 mrem/yr ^b

NOTES: ^aDose was calculated from continuous monitoring from February 1996 to February 1997.

^bNatural background is estimated at 350 mrem/yr nationwide.

DOE = U. S. Department of Energy

MEI = maximally exposed individual

EDE = effective dose equivalent

NESHAP = National Emission Standards for Hazardous Air Pollutants

EPA = U. S. Environmental Protection Agency

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

Table 3-2. SNL/TTR average air concentration

Radionuclide	Average (Ci/m ³)
Americium-241	4.1 × 10 ⁻¹⁸
Plutonium-238	1.6 × 10 ⁻¹⁸
Plutonium-239/240	9.5 × 10 ⁻¹⁸

NOTE: SNL/TTR = Sandia National Laboratories, Tonopah Test Range

Although an annual calculated dose assessment is not required for the site, Sandia continues to produce an annual Radiological NESHAP report for SNL/TTR (SNL/NM 2016). The results from the 1996 to 1997 monitoring will continue to be used; however, if new sources or modifications to the existing sources are anticipated, they will be evaluated for applicability with NESHAP radiological guidelines.

3.2.2 Nonradiological Air Emissions

The Class II Air Quality Operating Permit for SNL/TTR requires emission reports from significant nonradionuclide sources. At SNL/TTR, these sources include a portable screen, generators, and maintenance shop activities. Maintenance shop activities at SNL/TTR included painting, welding, and carpentry. In 2015, there were emissions from the portable screen, the generators, and activities at the maintenance shop. The portable screen was operated for 64.5 hours during 2015, and contributed 0.006 tons of particulate matter emissions. Three generators operated in 2015 are part of the Class II Air Quality Operating Permit and are permitted to operate up to 500 hours per year. The first generator is 670 hp, was operated for 34 hours, and contributed 0.4 tons of combined emissions (nitrogen oxide, carbon monoxide, sulphur oxide, particulate matter with diameter equal to or less than 10 microns [PM₁₀], volatile organic compounds [VOCs], and hazardous air pollutants [HAPs]). The second generator is 268 hp, was operated for 20 hours, and contributed 0.1 tons of combined emissions (nitrogen oxide, carbon monoxide, sulphur oxide, PM₁₀, VOCs, and HAPs). The third generator is 268 hp, was operated for 0.2 hours, and contributed 0.002 tons of combined emissions (nitrogen oxide, carbon monoxide, sulphur oxide, PM₁₀, VOCs, and HAPs). The maintenance shop activities (painting, welding, and woodworking) operated for a combined 825 hours during 2015 and contributed 0.01 tons of emissions (particulate matter, VOCs, and HAPs). The actual emissions for all of these sources were well within the permit limits.

3.2.3 Other Air Quality Monitoring Activities at SNL/TTR

In addition to Sandia, other entities perform environmental monitoring activities at SNL/TTR, as described in the following sections.

U.S. Environmental Protection Agency

The EPA Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, monitored background radiation in the area of SNL/TTR as part of its Off-Site Radiation Monitoring Reports Program (EPA 1999), which is now conducted by Desert Research Institute (DRI).

Desert Research Institute of the Nevada System of Higher Education

DRI personnel train and provide monitoring station managers through the Community Environmental Monitoring Program (CEMP) to collect samples from off-site air-monitoring equipment set up at 23 locations within communities surrounding the National Nuclear Security Site (NNSS). These include the towns of Tonopah and Goldfield, which are near SNL/TTR. DRI, the environmental research arm of the Nevada System of Higher Education, maintains the equipment and sends collected samples to Test America Laboratories in St. Louis, Missouri, for analysis and reporting of gross alpha and gross beta activity of individual filters, and for gamma spectroscopy on quarterly composite samples from each station. Stations also record real-time gamma readings measured by a pressurized ion chamber, and an environmental thermoluminescent dosimeter is used to confirm gamma readings.

DRI also provides external quality assurance on samples taken by CEMP personnel through duplicate sampling of 10 percent of the station samples. Duplicate samples are analyzed by personnel at the University of Nevada, Las Vegas's radioanalytical laboratory. Data collected from DRI's CEMP are reported in the NNSS Annual Site Environmental Report.

Three DRI portable monitoring stations are in use at SNL/TTR, and they are modeled in part after the CEMP stations mentioned previously. Station 400 is located near the SNL/TTR Range Operations Center, Station 401 is located near Clean Slate 3, and the newest station (Station 402) is located near Clean Slate 1 (see [Chapter 1](#) for details on these monitoring stations).

DRI also performs other monitoring as requested by the DOE, such as archeological surveys. No cultural resource surveys were performed at SNL/TTR at the request of DOE or Sandia in 2015.

3.3 Environmental Restoration Project Activities

ER Project activities at SNL/TTR and NTTR were initiated in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. Responsibility for all SNL/TTR and NTTR ER sites resides with the DOE/ NNSA/Nevada Field Office (NFO).

The *environment* is the sum of all external conditions affecting an organism's life, development, and survival.

Since 1996, cleanup activities for selected sites located in the State of Nevada have been regulated by the Federal Facility Agreement and Consent Order (FFACO) of 1996, as amended. (See [Chapter 2](#)). The FFACO was negotiated between the State of Nevada, DOE Environmental Management, the U.S. Department of Defense (DOD), and DOE Legacy Management ([DOD, DOE, and State of Nevada 1996](#)).

The FFACO took effect in 1996, and accomplished the following:

- Established a framework for identifying Corrective Action Sites (CASs)
- Grouped CASs into Corrective Action Units (CAUs)
- Prioritized CAUs
- Implemented corrective action activities

Two ER activities are addressed by CAUs located at SNL/TTR and NTTR:

- **Industrial sites activity.** Sites historically used to support nuclear testing and SNL activities. Industrial sites include historical septic tank systems, landfills, sewage lagoons, depleted uranium sites, and ordnance testing sites.
- **Soil activity.** Areas where nuclear testing has resulted in surface and/or shallow subsurface soil contamination. Soil sites include large area soil contamination from plutonium dispersal testing.

ER site contamination includes radiological constituents (e.g., depleted uranium and plutonium) and nonradiological constituents (e.g., munitions, solvents, pesticides, septic sludge, and heavy metals).

Corrective Action Site Identification

The initial identification, description, and listing of CASs at SNL/TTR and NTTR was derived from the Preliminary Assessment and the Federal Facility Preliminary Assessment Review ([E&E 1989](#)). Twelve additional potential CASs, not included in the Preliminary Assessment, were identified using the following methods: ER site inventory processes, ordnance removal activities, geophysical surveys, former worker interviews, archive reviews, site visits, and aerial radiological and multispectral surveys (1993–1996).

The remediation activities at the Clean Slate and Double Tracks sites (Operation Roller Coaster) located at SNL/TTR are discussed in [Chapter 1](#). These sites are listed under soil CAUs/CASs in [Table 3-3](#) as CAUs 411, 412, 413, and 414. Two additional sites still subject to further activities, Project 57 (located on Nellis Range 13) and Small Boy (located on NTTR), are listed under soil CAUs in [Table 3-3](#) as CAU 415 and CAU 541, respectively. A listing of closed CAUs/CASs is available in appendices II, III, and IV of the FFACO (DOD, DOE, and State of Nevada 1996).

Table 3-3. SNL/TTR status of CAU remediation activities, 2015

Soil Site CAUs/CASs		
CAS Number	CAS Description	General Location
CAU 411—Final Closure is in process. Double Tracks plutonium dispersion (NAFR)		
NAFR-23-01	Pu contaminated soil	Nellis Range 71
CAU 412—Final Closure is in process. Clean Slate I plutonium dispersion (SNL/TTR)		
TA-23-01CS	Pu contaminated soil	Tonopah Test Range
CAU 413—Investigation phase. Clean Slate II plutonium dispersion (SNL/TTR)		
TA-23-02CS	Pu contaminated soil	Tonopah Test Range
CAU 414—Not started. Clean Slate III plutonium dispersion (SNL/TTR)		
TA-23-03CS	Pu contaminated soil	Tonopah Test Range
CAU 415—Remediation phase. Project 57 No. 1 plutonium dispersion (NTTR)		
NAFR-23-02	Pu contaminated soil	Nellis Range 13
CAU 541—Final Closure is in process. Small Boy		
05-23-04	Atmospheric tests (6), Bfa ^a site	BFa, NTTR
05-45-03	Atmospheric test site, Small Boy	Frenchman Flat, Area 5, NTTR

NOTES: A listing of closed CAU/CASs is available in appendices II, III, and IV of the FFACO (DOD, DOE, and State of Nevada 1996).

^aBFa is the site name and not an acronym.

CAS = Corrective Action Site

CAU = Corrective Action Unit

NAFR = Nellis Air Force Range

NTTR = Nevada Test and Training Range

Pu = plutonium

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

Environmental Restoration Project Activities in 2015

ER activities in 2015 included characterizing and packaging approximately 75 cubic feet of low-level waste from Clean Slate I and Clean Slate II during site investigation activities. This waste will be transported to NNSS for disposal in calendar year 2016.

Site investigation activities were completed in 2015 at the Small Boy site (CAU 541). Final approval for corrective action decisions is pending Nevada Division of Environmental Protection (NDEP) approval.

Other ER activities conducted on the SNL/TTR and NTTR sites in 2015 consisted of the annual post-closure inspections of closed and use-restricted industrial sites and the inspections of radiological postings at the Clean Slate and Double Tracks sites. The inspections were conducted in May 2015.

Air samples were also collected throughout the year at various locations on SNL/TTR and NTTR. (Details of air sample collection activities are provided in [Chapter 1](#).)

3.4 National Environmental Policy Act Program

At SNL/TTR, NEPA compliance is coordinated between personnel from SNL/TTR, Sandia National Laboratories, New Mexico (SNL/NM), and the DOE/NNSA/Sandia Field Office (SFO).

Personnel from SNL/TTR and the SNL/NM NEPA team continued to support projects at SNL/TTR, including the upgrade of the fiber-optic cable communications loop. This support included continued collaboration with DOE/NNSA/SFO, SNL/TTR staff, and various Nevada regulators to assure the installation of the fiber-optic cable would be completed and available for various tests scheduled for CY 2016. In 2015, the SNL/NM NEPA team completed ten NEPA checklists for SNL/TTR, five of which were transmitted to the DOE/NNSA/SFO for review and determination.

3.5 Oil Storage Program

The *Spill Prevention Control and Countermeasures (SPCC) Plan for SNL Tonopah Test Range* (SNL/NM 2014) pertains to oil storage equipment and secondary containments subject to 40 CFR 112, *Oil Pollution Prevention*, and 40 CFR 110, *Discharge of Oil*. The SPCC Plan must be updated at least every five years.

Two mobile refuelers (a truck and a trailer), seven aboveground storage tanks (ASTs) (Figure 3-1), a bulk storage area for 55 gal drums, and a transformer storage area are covered by the SPCC Plan at SNL/TTR. Inspections are conducted monthly. Any issues identified during the inspections are promptly corrected or are tracked via the work request process.

In 2015, improvements were made to three ASTs by adding secondary containment components to the ASTs. Improvements were also made to existing secondary containment systems for two mobile generators that were found to have faulty drain plugs. Subsequently, all mobile generators of this type were tested, and secondary containment systems were installed at locations where a generator is required.



Figure 3-1. SNL/TTR diesel fuel tank (1,000 gal) at Building 24-51

3.6 Terrestrial Surveillance Program

The Terrestrial Surveillance (TS) Program at SNL/TTR is designed and conducted to address DOE O 458.1 Admin Change 3, *Radiation Protection of the Public and the Environment*, which establishes standards and requirements to protect the public and the environment from undue risk of exposure to radiation associated with radiological activities under the control of DOE. The TS Program collects environmental media (soil) samples and analyzes these for radiological constituents, as required. As a best management practice, samples are also collected for analysis of metals. In addition to the environmental media samples, ambient external gamma radiation levels are measured using thermoluminescent dosimeters (TLDs). These surveillance activities are conducted at designated locations that are on-site, off-site, and around the perimeter of SNL/TTR. Personnel from SNL/NM and from SNL/TTR conduct the sampling annually, and the TLDs are exchanged quarterly.

Terrestrial surveillance began at SNL/TTR in 1992. A large-scale baseline sampling was conducted from 1994 through 2005 and reported in *Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, Tonopah Test Range Environs, 1994–2005* (SNL/NM 2006). In 2000, Sandia contracted with a single analytical laboratory with lower detection capabilities than those previously available for many of the metals. The same database has been used for statistical analysis from 2000 to the present.

3.6.1 Regulatory Criteria

As stated previously, the TS Program is designed and conducted to address the requirements of DOE O 458.1. The TS Program is also conducted to satisfy Sandia's Environmental Management System, which is certified to the International Organization for Standardization 14001 standard. Reporting is done in accordance with DOE O 231.1B, Admin Change 1, *Environment, Safety, and Health Reporting*.

3.6.2 Sample Locations and Media

The TS Program uses three sample location classifications: on-site, perimeter, and off-site (the latter previously referred to as “community” locations). Sampling locations have been selected based on locations of previous and ongoing activities. Environmental TLDs are used to measure the cumulative ambient external radiation dose and to closely approximate the dose potentially received from natural and nonnatural sources.

The on-site sample locations (Table 3-4, Figure 3-2) are in areas of known contamination CASs and areas of potential release (sites with current outdoor testing activities).

Perimeter sample locations (Table 3-5, Figure 3-3) are located around the boundaries of SNL/TTR. Off-site sample locations (Table 3-6, Figure 3-4) are located in remote areas and areas near local population and along major roadways. Off-site sample results are used for comparison to the on-site and the perimeter sample results. Off-site and perimeter locations are sampled every five years and were not sampled in 2015 (the next sampling will be in 2018).

Table 3-4. SNL/TTR on-site terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number	Sample Location	Soil ^a	TLD ^b
Range Operations Center	S-40	Wastewater monitoring station	X ^c	
	S-41	“Danger Powerline Crossing” sign	X ^c	
	S-42	Main Road/Edward’s Freeway	X ^c	
	S-43	Range Operation Center (southwest corner)	X ^c	
	S-44	Range Operation Center (northeast corner)	X ^c	
	S-45	Storage shelters 03-38 and 03-39	X ^c	
	S-46	Sand Building	X ^c	
South Plume Area	S-47	Generator storage area	X ^c	
	S-48	North/south Mellan Airstrip–Antelope Tuff	X ^d	
	S-49	North/south Mellan Airstrip–southwest of S-48	X ^d	
	S-50	North/south Mellan Airstrip–signpost	X ^d	
	S-51	North/south Mellan Airstrip–northeast of S-50	X ^d	
Various on-site	S-52	Northeast of northwest/southeast Mellan Airstrip	X ^d	
	S-01	Antelope Lake area fence, cultural area sign	X ^d	X
	S-02	North/south Mellan Airstrip (TLD at south fencepost)	X ^d	X
	S-03	TLD at Clean Slate 2	X ^d	X
	S-04	TLD at Clean Slate 3	X ^d	X
	S-09	Roller Coaster Decontamination Area	X ^d	X
	S-10	Brownes Road/Denton Freeway	X ^d	X
	S-13	Area 3 between Building 100 and “Caution” sign		X
	S-14	Area 3 control point southwest side of fence		X
	S-15	Moody Avenue by cattle guard and entrance to chow hall and airport		X
	S-16	Area 9, near Well 7		X
	S-17	Main Lake south, near Neutron Bunkers		X
S-38	Mellan Hill–Rock Mound/Orange Block	X ^d		
S-39	Mellan Hill–north	X ^d		
S-53	Main Road/Lake Road southeast	X ^d		

NOTES: ^aSoil samples are analyzed for radionuclides by gamma spectroscopy annually.

^bTLDs are analyzed for gamma radiation.

^cSoil samples are analyzed for Target Analyte List (TAL) metals every five years (last sampled in 2013).

^dSoil samples are analyzed for Target Analyte List (TAL) metals annually.

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

TLD = thermoluminescent dosimeter

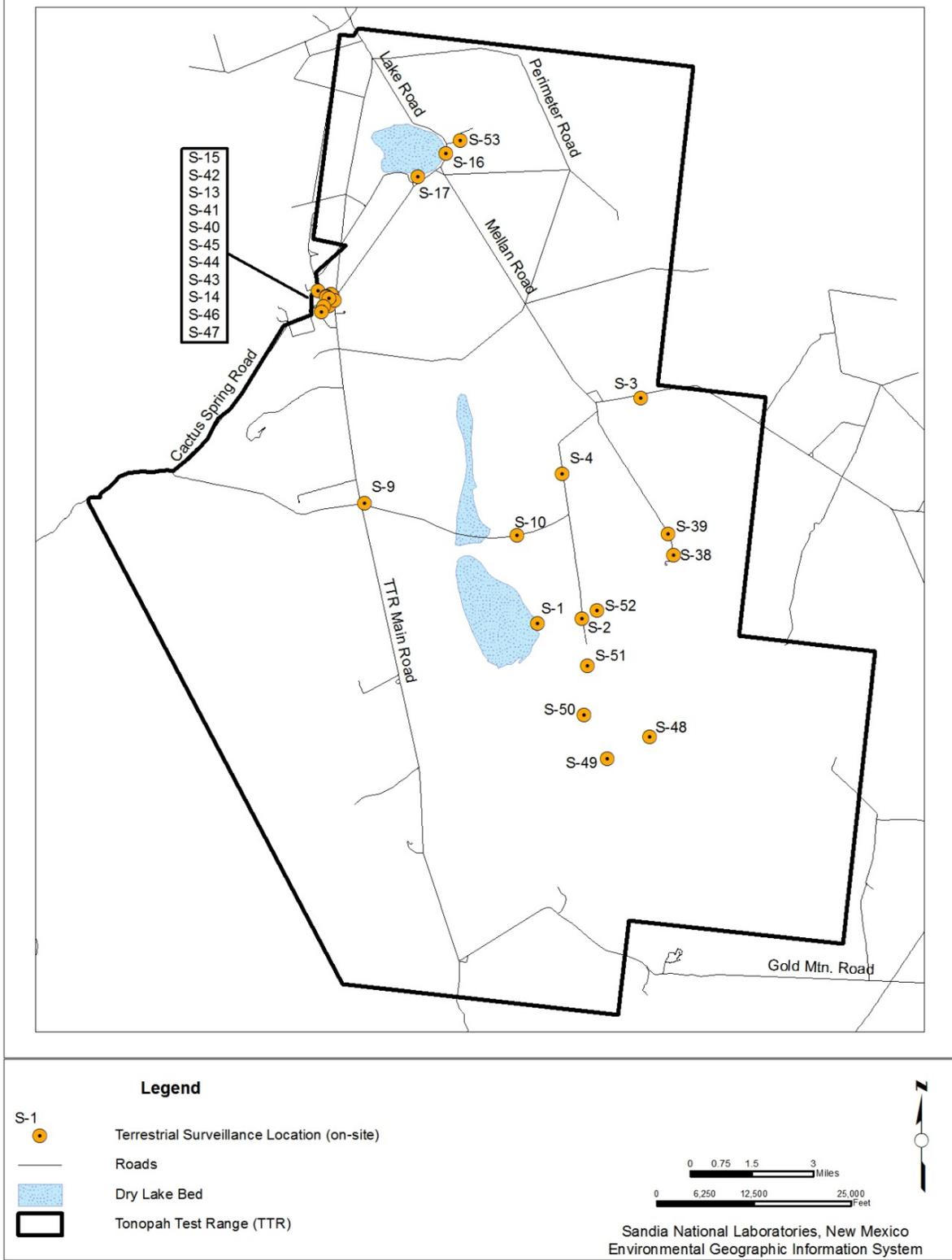


Figure 3-2. SNL/TTR on-site terrestrial surveillance locations

Table 3-5. SNL/TTR perimeter terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number	Sample Location	Soil ^{a,b}	TLD ^c
Perimeter	P-05	O&M Complex–Site 4 entrance gate		X
	P-06	Cedar Pass Road guard station	X	X
	P-07	On-base housing, south of power pole 55-11		X
	P-08	On-base housing (main guard gate/power pole CP17)	X	X
	P-11	Cactus Springs (TLD south of P-35)	X	X
	P-12	TLD at “U.S. Government Property” sign	X	X
	P-34	O&M Complex–Owan Drive post	X	
	P-35	Cactus Springs (north fencepost)	X	
	P-36	On-base housing (northeast fence line)	X	
	P-37	On-base housing (guard station)	X	

NOTES: ^aSoil samples are analyzed for radionuclides by gamma spectroscopy annually.

^bSoil samples are analyzed for Target Analyte List (TAL) metals every five years (last sampled in 2013).

^cTLDs are analyzed for gamma radiation.

O&M = Operation and Maintenance

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

TLD = thermoluminescent dosimeter

U.S. = United States

Table 3-6. SNL/TTR off-site terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number ^a	Sample Location	Soil ^{b,c}	TLD ^d
Off-Site	C-19	Mining Museum, north Goldfield		X
	C-20	State Road 6 rest area	X	
	C-21	State roads 6 and 95 Ely rest area	X	X
	C-22	Rocket	X	X
	C-23	Alkali and Silver Peak turnoff	X	
	C-24	Cattle guard	X	
	C-25	Tonopah Rangers Station	X	
	C-26	Gabbs Pole Line Road	X	
	C-27	State roads 6 and 376 junction	X	
	C-28	Stone Cabin and Willow Creek on State Road 6	X	
	C-29	State roads 6 and 375 junction	X	
	C-30	State Road 375 ranch cattle gate	X	
	C-31	Golden Arrow and Silver Bow on State Road 6	X	
	C-32	Mile marker 6 on Sandia Drive	X	
C-33	Mile marker 10 on Sandia Drive	X		

NOTES: ^aOff-site samples were previously called “community” samples, thus the C label in the location number (maintained for the database).

^bSoil samples are analyzed for radionuclides by gamma spectroscopy annually.

^cSoil samples are analyzed for Target Analyte List (TAL) metals every five years (last sampled in 2013).

^dTLDs are analyzed for gamma radiation.

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

TLD = thermoluminescent dosimeter

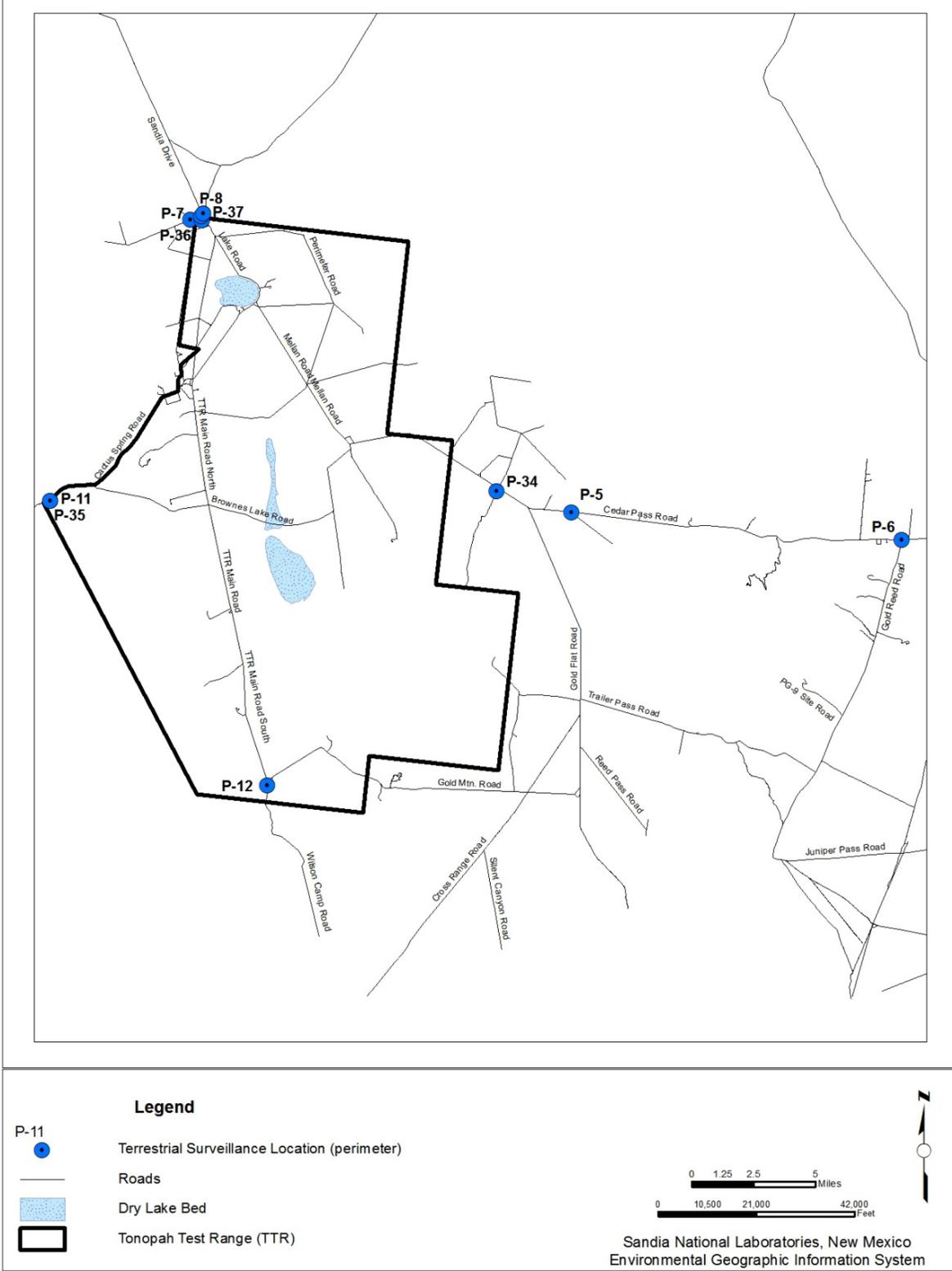


Figure 3-3. SNL/TTR perimeter terrestrial surveillance locations

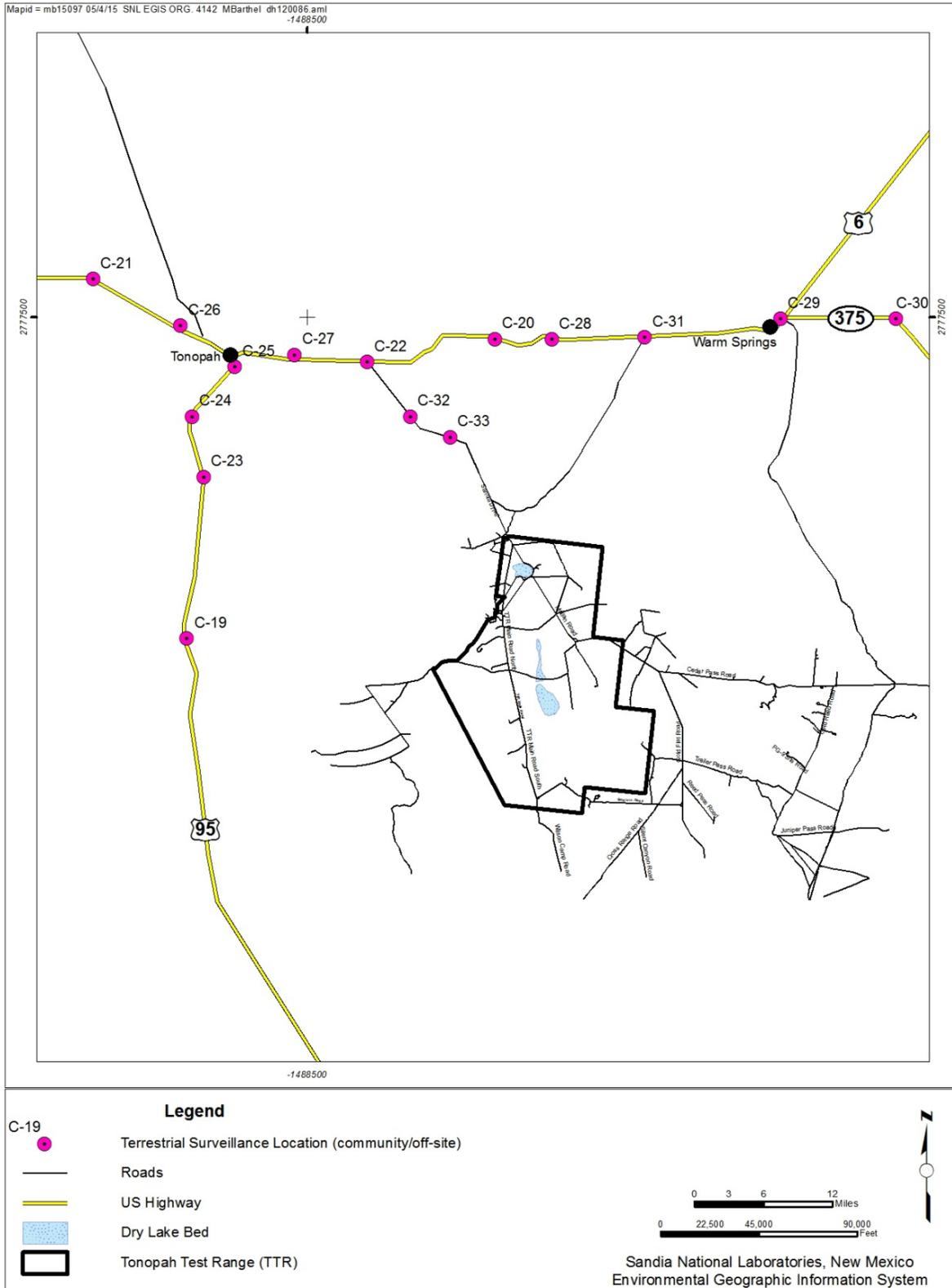


Figure 3-4. SNL/TTR off-site terrestrial surveillance locations

3.6.3 Field Methods, Analytical Parameters, and Quality Control Procedures

All SNL/TTR samples were collected in accordance with applicable SNL/NM field operating procedures for soil sampling activities.

Off-site laboratories analyzed all samples in accordance with applicable EPA analytical methods. All chemical data were reviewed and qualified in accordance with Administrative Operation Procedure 00-03, *Data Validation Procedure for Chemical and Radiochemical Data* (SNL/NM 2011).

Soil samples were analyzed for modified Target Analyte List (TAL) metals and radiological parameters, including gamma-emitting radionuclides, plutonium, and uranium. Details of the radiological parameters pertinent to SNL/TTR are as follows:

- **Gamma-emitting radionuclides.** Gamma spectroscopy is used to detect the emission of gamma radiation from radioactive materials. Radionuclide identification is possible by measuring the spectrum of gamma energies associated with a sample, since each radionuclide has a unique and consistent series of gamma emissions. Cesium-137 is an example of a long-lived gamma emitter that is prevalent in the environment at SNL/TTR (as fallout from historical nuclear weapons testing in that area). Other gamma emitters of interest at SNL/TTR are americium-241 and depleted uranium from past explosives testing.
- **Plutonium.** Due to past explosives testing, plutonium is present in some limited areas of SNL/TTR. One indicator of the presence of weapons-grade plutonium is the radionuclide americium-241. Isotopic plutonium analysis is performed on any sample for which gamma spectroscopy identified americium-241 in concentrations greater than its minimum detectable activity.
- **Uranium.** Uranium occurs naturally in soils and may also be present as a pollutant in the environment at SNL/TTR due to past testing conducted there. Total uranium analysis is used to measure all uranium isotopes present in a sample. An isotope-specific analysis may be performed to determine the possible source of uranium (i.e., natural, man-made, enriched, or depleted).

The Radiation Protection Dosimetry Program (RPDP) at SNL/NM owns, issues, and processes environmental TLDs. The technical basis for the environmental TLD monitoring program is provided in *Description and Procedures of the Environmental Radiation Dosimetry Program* (SNL/NM 1987). Dosimeters are issued and processed quarterly following established RPDP protocols.

A *dosimeter* is a device used to measure the dose of ionizing radiation received by an individual.

Field quality control samples collected at SNL/TTR included triplicate environmental samples. These samples were prepared in accordance with applicable field operating procedures. Laboratory quality control samples were prepared and analyzed as specified in accordance with established methods.

3.6.4 Sample Result Analysis and Methodology

No regulatory limits are available to directly compare concentrations of some radiological or nonradiological constituents in surface soils. Sandia personnel conduct statistical analyses to compare the results from on-site and perimeter samples to off-site results, and to establish trends that may indicate the possible release of contaminants.

Statistical Analysis and Methodology

Samples are collected from specified locations to effectively enable statistical comparisons with results from previous years. Statistical analyses are performed to determine whether a specific on-site or perimeter sample result differs from off-site sample results and to identify trends at a particular sampling location.

The results of the statistical analyses are used to prioritize possible follow-up actions, such as resampling, additional investigation, and/or notifications to applicable entities. A decision-making tool is used to help determine the appropriate level of concern for each sample result. The statistical analysis prioritization methodology (Shyr, Herrera, and Haakqer 1998) is based on a matrix of four priority levels. The decision matrix is shown in Table 3-7.

Table 3-7. SNL/TTR priority decision matrix and actions

Priority ^a	Are Results Higher Than Off-Site?	Is There an Increasing Trend?	Action
1	Yes	Yes	Immediate attention is needed. Specific investigation is planned and/or notifications will be made to applicable entities.
2	Yes	No	Some concern is warranted. Further investigation and/or notifications may be necessary.
3	No	Yes	A minor concern. Further investigation and/or notifications may be necessary.
4	No	No	No concern. No investigation will be required.

NOTES: ^aBased on a statistical analysis prioritization methodology (Shyr, Herrera, and Haakqer 1998).
SNL/TTR = Sandia National Laboratories, Tonopah Test Range

Other Standards for Comparison

In addition to the statistical analysis, sample results for metals in soil and sediment may be compared to values in the following references (presented in Table 3-8):

- Local and regional soil concentrations (Dragun and Chekiri 2005)
- EPA risk-based screening levels for soil (EPA 2015)
- U.S. surface soil surface concentrations (Kabata-Pendias 2000)

In some instances, a qualitative inspection of the data may be augmented by the graphical evaluation methodology described and documented in *Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, Tonopah Test Range Environs, 1994–2005* (SNL/NM 2006).

Environmental TLD data is compared to the annual radiation dose from natural background sources estimated equivalent of 70 mrem (NCRP 2009).

Table 3-8. SNL/TTR various reference values for metals in soil (all units in mg/kg)

Analyte	Nevada Background Soil Concentrations ^a		EPA Risk-Based Screening Levels ^b		U.S. Background Soil Concentrations ^c	
	Lower Limit	Upper Limit	Residential Soil	Industrial Soil	Lower Limit	Upper Limit
Aluminum	5,000	100,000	77,000	1,100,000	4,500	100,000
Antimony	< 1.0	1.0	31	470	0.25	0.6
Arsenic	2.9	24	0.687	3.0	1	93
Barium	150	3,000	15,000	220,000	20	1,500
Beryllium	ND	5.0	160	2,300	0.04	2.54
Cadmium	ND	11	—	—	0.41	0.57
Calcium	600	320,000	—	—	—	—
Chromium (III)	7.0	150	120,000	1,800,000	7	1,500
Cobalt	ND	20	23	350	3	50
Copper	7	150	3,100	47,000	3	300
Iron	1,000	100,000	55,000	820,000	5,000	50,000
Lead	ND	70	400	800	10	70
Magnesium	300	100,000	—	—	—	—
Manganese	30	5,000	1,800	26,000	20	3,000
Nickel	5	50	1,500	22,000	5	150
Potassium	1,900	63,000	—	—	—	—
Selenium	< 0.1	1.1	390	5,800	0.1	4
Silver	0.5	5	390	5,800	0.2	3.2
Sodium	500	100,000	—	—	—	—
Strontium	100	1,500	47,000	700,000	7	1,000
Thallium	—	—	0.78	12	0.02	2.8
Vanadium	30	150	390	5,800	0.7	98
Zinc	25	128	23,000	350,000	13	300

NOTES: ^aDragun and Chekiri 2005.

^bEPA Risk-Based Screening Levels (Target Hazard Quotient = 1.0), EPA, updated November 2015.

^cKabata-Pendias 2000.

— = not available

EPA = U.S. Environmental Protection Agency

ND = not detected

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

U.S. = United States

3.6.5 Summary of Terrestrial Surveillance Program Activities and Results in 2015

The following TS Program activities occurred in 2015:

- The annual sampling of soil at on-site locations occurred in June 2015 at designated locations.
- Environmental TLDs were exchanged and analyzed at designated locations quarterly.

The analytical results for radiological (including environmental TLDs) and nonradiological parameters for the 2015 sampling event are summarized in the following section, and the data are provided in Appendix A.

Radiological Results

The summary statistics for radiological results for 2000 through 2015 are presented in [Table 3-9](#). The respective radiological analytes are discussed in the following sections, which list the locations identified as Priority-1 and Priority-2.

Table 3-9. SNL/TTR radiological summary statistics, 2000–2015

Analyte	Location Classification	Number of Samples	Mean (pCi/g)	Median (pCi/g)	Standard Deviation (pCi/g)	Minimum (pCi/g)	Maximum (pCi/g)
Americium-241	Perimeter	130	0.02	0.022	0.056	-0.24 U	0.15 U
	On-site	335	0.31	0.053	1.1	-0.23 U	11
	Off-site	228	0.023	0.025	0.046	-0.20 U	0.16 U
Cesium-137	Perimeter	130	0.20	0.16	0.15	0.012	0.88
	On-site	346	0.24	0.22	0.18	0.0 U	1.5
	Off-site	228	0.21	0.16	0.15	-0.0017 U	0.93
Plutonium-238	Perimeter	17	0.0042	0.0028	0.0076	-0.0056	0.028
	On-site	111	0.16	0.018	0.86	-0.010	8.4
	Off-site	34	0.0028	0.00094	0.0054	-0.0037	0.024
Plutonium-239/240	Perimeter	17	0.021	0.016	0.017	0.0014	0.07
	On-site	111	15	0.41	115	-0.0082	1200 J
	Off-site	34	0.014	0.011	0.013	-0.0011	0.05
Plutonium-242	On-site	5	3.5	3.5	0.032	3.5	3.5
Uranium-235	Perimeter	130	0.074	0.071	0.053	-0.059	0.25
	On-site	346	0.087	0.079	0.062	-0.071 BD	0.39
	Off-site	228	0.084	0.077	0.059	-0.10 BD	0.29
Uranium-238	Perimeter	130	1.24	1.26	0.51	0.0029	2.6
	On-site	324	1.3	1.3	0.51	0.032	3.1
	Off-site	224	1.3	1.2	0.51	0.14	3.09 J
Analyte	Location Classification	Number of Samples	Mean (mg/kg)	Median (mg/kg)	Standard Deviation (mg/kg)	Minimum (mg/kg)	Maximum (mg/kg)
Uranium	Perimeter	72	0.71	0.69	0.18	0.43	1.5
	On-site	262	0.72	0.71	0.15	0.43	1.5
	Off-site	126	0.75	0.69	0.20	0.46	1.5

NOTES: BD = below detection limit as used in radiochemistry to identify results that are not statistically different from zero

J = the associated value is an estimated quantity

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

U = the analyte was analyzed for but was not detected; the associated numerical value is the sample quantitation limit

Americium-241

The results of the statistical analysis for americium-241 identified one Priority-1 on-site location (S-51 soil) with a value of 8.6 pCi/g, and one Priority-2 on-site location (S-09 soil) with a value of 2.03 pCi/g ([Table 3-10](#)).

Americium-241 at location S-51 continues to be identified as Priority-1. This location is at the edge of South Plume Area and is expected to have elevated readings. This is consistent with the hot particle theory, where the presence of americium-241 or plutonium-239/240 in a heterogeneous sample skews the apparent average concentration, making it appear greater than it is. Sampling and trend analyses will continue for americium-241 (and plutonium-239/240) at this location. Historical results for americium-241 at S-51 are presented in [Figure 3-5](#).

No locations were identified as Priority-3 for americium-241.

Table 3-10. SNL/TTR radiological summary statistics for Priority-1 and Priority-2 sample locations, 2015

Priority	Analyte	Location	Mean (pCi/g)	Median (pCi/g)	Standard Deviation (pCi/g)	Minimum (pCi/g)	Maximum (pCi/g)	2015 Result (pCi/g)
Priority-1	Americium-241	S-51	3.6	4.1	3.4	-0.0095	11	8.6
Priority-1	Plutonium-239/240	S-51	30	7.6	50	0.15	132	132 J+
Priority-2	Americium-241	S-09	1.7	1.3	1.1	0.47	3.6	2.03
Priority-2	Plutonium-239/240	S-09	90	4.9	307	2.0 J	1,200 J	11.3 J

NOTES: J = the associated value is an estimated quantity SNL/TTR = Sandia National Laboratories, Tonopah Test Range
 J+ = the associated numerical value is an estimated quantity with a suspected positive bias

Plutonium-239/240

The results of the statistical analysis for plutonium-239/240 identified one Priority-1 on-site location (S-51 soil) with a result of 132 J+ pCi/g (Table 3-10). There was also a Priority-2 on-site location (S-09 soil) with a result of 11.3 J pCi/g. The J and J+ qualified data are estimated quantities. The results for S-51 and S-09 are consistent with historical values. This is related to the elevated americium-241 results discussed previously. Sampling and trend analysis will continue for plutonium-239/240 (and americium-241) at these locations. Historical results for plutonium-239/240 at S-51 are presented in Figure 3-5.

During the data validation process, an analytical result may be qualified with a "J." This signifies an increased level of uncertainty in the measurement, and the result is considered an estimated quantity. A "J+" or "J-" signifies a suspected positive or negative bias of the quantity reported.

No locations were identified as Priority-3 for plutonium-239/240.

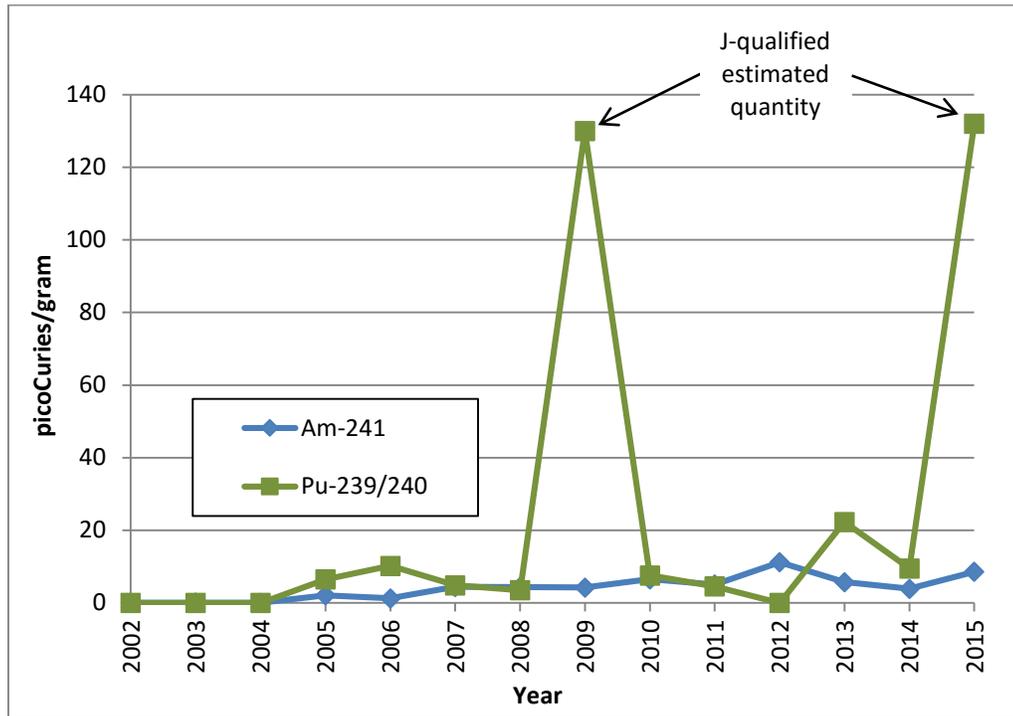


Figure 3-5. SNL/TTR historical americium-241 and plutonium-239/240 and at sampling location S-51

Thermoluminescent Dosimeter Statistical Results

TLDs were deployed, collected, and analyzed at SNL/TTR on a quarterly basis in 2015. TLD summary statistics for 2000–2015 are provided in Figure 3-6 and Table 3-11. The results for on-site and perimeter locations were statistically different, with higher values, from the off-site locations.

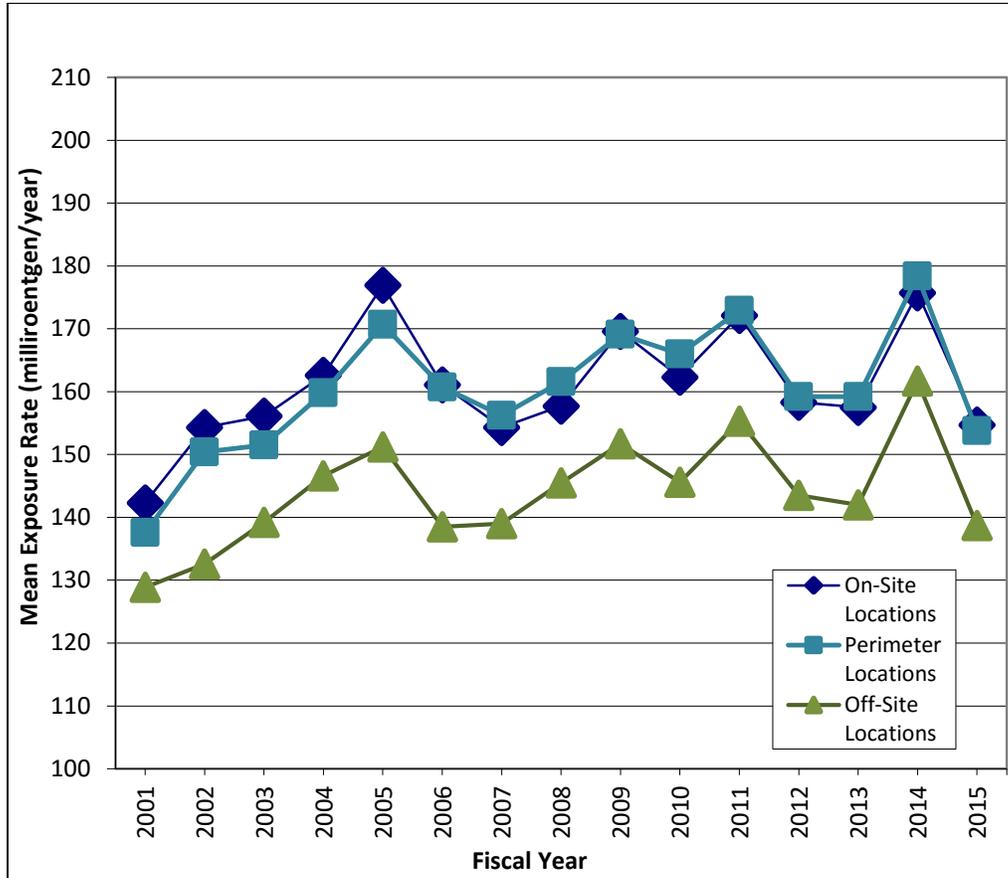


Figure 3-6. SNL/TTR TLD exposure rates by year and location classification

Table 3-11. SNL/TTR TLD exposure rate summary statistics by location classification, 2000–2015

Location Classification	Number of Observations	Mean mR/yr	Median mR/yr	Standard Deviation mR/yr	Minimum mR/yr	Maximum mR/yr	2015 ^a Result mR/yr
On-site	154	161.2	159.4	13.2	129.9	217.3	154.7
Perimeter	83	160.4	157.6	15.9	131.1	207.6	153.8
Off-site	44	143.4	146.8	16.1	115.6	173.6	138.7

NOTES: ^aTLD data is reported on a fiscal year basis.
 SNL/TTR = Sandia National Laboratories, Tonopah Test Range
 TLD = thermoluminescent dosimeter

Nonradiological Parameters and Results

Nonradiological parameters include modified TAL metals. In addition to the statistical analysis, all results may also be compared to values from the references listed in Section 3.6.4 and provided in Table 3-8.

In 2015, soil samples were collected at the locations listed in [Table 3-4](#), [Table 3-5](#), and [Table 3-6](#). Thirteen locations were sampled for metals analysis; other locations are only sampled for metals every five years and were not sampled in 2015 (the next sampling will be in 2018). The results of the statistical analyses for metals are provided in [Table 3-12](#).

Table 3-12. SNL/TTR metals summary statistics for Priority-2 sample locations, 2015

Priority	Analyte	Location	Sample Matrix	Mean (mg/kg)	Median (mg/kg)	Standard Deviation (pCi/g)	Minimum (pCi/g)	Maximum (pCi/g)	2015 Result (mg/kg)
Priority-2	Cobalt	S-09	Soil	5.8	6.0	0.55	4.9	6.7	6.01

NOTE: SNL/TTR = Sandia National Laboratories, Tonopah Test Range

Cobalt

One on-site location (S-09 soil) was identified as Priority-2 for cobalt, with a result of 6.01 mg/kg. The result was below the EPA risk-based screening levels (for residential soil) shown in [Table 3-8](#), and is assumed to represent a natural background.

No other locations were identified as Priority-1, Priority-2, or Priority-3 for any of the TAL metals.

Additional Activities and Variances

There were no other TS Program activities at SNL/TTR in 2015. There were no variances from the planned activities.

3.7 Waste Management Program

Navarro manages all waste generated at SNL/TTR—which excludes any waste generated by ER activities—under the Waste Management Program. Waste categories include radioactive waste, Resource Conservation and Recovery Act hazardous waste, other chemical waste, and nonhazardous solid waste. Waste minimization and recycling efforts are integrated into Waste Management Program activities.

Waste generated and shipped from SNL/TTR to approved facilities in 2015 is presented in [Table 3-13](#) and [Table 3-14](#). All regulated waste was shipped off-site to permitted treatment, storage, and disposal facilities.



Commercial solid waste dumpster

Table 3-13. SNL/TTR waste generated, 2015

Waste Type	Weight (kg)	Weight (lb)
Total RCRA hazardous waste	91 ^a	200
Total non-RCRA-regulated waste	1,212 ^b	2,666
Total recycled materials	3,635	7,997
Toxic Substances Control Act waste (PCB)	82	180
Toxic Substances Control Act waste (asbestos)	57	125
Radioactive waste	0	0

NOTES: ^a30 kg of the "Total RCRA hazardous waste" total was recycled and is also included in the "Total recycled materials" total.

^b408 kg of the "Total non-RCRA-regulated waste" total was recycled and is also included in the "Total recycled materials" total.

PCB = polychlorinated biphenyl

RCRA = Resource Conservation and Recovery Act

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

Table 3-14. SNL/TTR waste shipped, 2015

Waste Type	Weight (kg)	Weight (lb)
Sanitary Landfill		
USAF Sanitary Landfill	31,575	69,465
Construction Debris		
USAF Construction Landfill	103,211	227,064
Tires		
Lunas Tire Recycling	1,355 ^a	2,981
Battery Recycling		
National Automotive Parts Association and Veolia	745 ^a	1,639
Hydrocarbon Contaminated Waste		
Veolia	741 ^b	1630

NOTES: ^aThese totals are also included in the "Total recycled materials" total located in [Table 3-13](#).

^bThis total is also included in the "Total non-RCRA-regulated waste" total located in [Table 3-13](#).

SNL/TTR = Sandia National Laboratories, Tonopah Test Range

USAF = U.S. Air Force

Waste Minimization Program

SNL/TTR is committed to achieving significant reductions in the amount of chemical and hazardous wastes generated on-site. Waste minimization includes recycling and recovering the following materials:

- Solvents
- E-waste, including computers, monitors, radios, and electronics
- Fuels and oil
- Tires
- Antifreeze (on-site recycling unit)
- Lead acid batteries
- Freon (on-site recovery unit)
- Fluorescent and sodium bulbs
- Mercury-containing equipment

Recyclables and used oil are sent for recycling or are disposed of through a waste disposal contractor. Recycled or energy-recovered quantities shipped off-site in 2015 are presented in [Table 3-15](#).

Table 3-15. SNL/TTR material recycled or energy-recovered and shipped off-site, 2015

Recycled or Energy-Recovered Waste	Shipped (kg)	Shipped (lb)
Automotive type batteries	730	1606
Universal waste batteries	15	33
Universal waste lamps	358	788
Mercury-containing articles	15	33
Non-PCB light ballasts	754	1,659
Antifreeze	200	440
Used oil	82	180
Used oil filters	126	277
Tires	1,355	2,981
Total	3,635	7,997

NOTES: PCB = polychlorinated biphenyl
SNL/TTR = Sandia National Laboratories, Tonopah Test Range

Radioactive Waste Management

There were no radioactive waste shipments in 2015.

3.8 Water Quality Programs

The SNL/TTR water quality programs focus on monitoring potable water, conserving water, sampling wastewater effluent, and sampling stormwater.

3.8.1 Production Well Monitoring

SNL/TTR uses three active wells: Production Well 6 ([Figure 3-7](#)), Well 7, and the Roller Coaster Well. The most active are Production Well 6 and the Roller Coaster Well. Production Well 6 is a public water system (PWS) well that supplies drinking water to the SNL/TTR Main Compound in Area 3. Production Well 6 is the only well at SNL/TTR that has been sampled for contaminants. Outlying areas and buildings without water service use bottled water. The other wells are not used for potable purposes (construction and dust suppression only), and there are no regulatory sampling requirements for them.



Figure 3-7. SNL/TTR Production Well 6 pump house, provides Area 3 drinking water

All PWS drinking water sampling is conducted in accordance with requirements set by the State of Nevada (NDEP). Analytes are sampled at different intervals, as shown in Table 3-16. The NDEP currently provides public monitoring and reporting requirements for each PWS around March annually. The PWS at SNL/TTR is permitted by the NDEP as a non-transient, non-community water system under identification number NV003014. Production Well 6 supplies potable water for the SNL/TTR Area 3 Drinking Water Distribution System and the Area 3 Fire Protection Water Distribution System. The well water is routinely sampled and analyzed per NDEP requirements to demonstrate conformance with primary drinking water standards.

Table 3-16. SNL/TTR routine production well parameters

Analyte	Reporting Frequency
Coliform, total	Quarterly
Arsenic	Quarterly
Disinfectant, residual	Quarterly (checked daily)
Total trihalomethanes and haloacetic acids (5)	Annually
Di(2-ethylhexyl) phthalate (DEHP) <i>also known as Bis(2-ethylhexyl) phthalate</i>	As required by NDEP, usually every 3 years
Nitrate	Annually
IOCs Phase II, IOCs Phase V, nitrite, nitrate and nitrite (total) SOCs Phase II, SOCs Phase V, VOCs Phase I and II, VOCs Phase V	As required by NDEP, usually every 3 years
Lead and copper	As required by NDEP, usually every 3 years
Dioxin	As required by NDEP, usually every 3 years
Secondary (13) drinking water standards	As required by NDEP, usually every 3 years

NOTES: IOC = inorganic compound
 NDEP = Nevada Division of Environmental Protection
 SNL/TTR = Sandia National Laboratories, Tonopah Test Range
 SOC = synthetic organic compound
 VOC = volatile organic compound

The State of Nevada maintains information on the SNL/TTR PWS, including water system details, sample schedules, sample results, and any violation or enforcement actions at the following location:

<https://ndep.nv.gov/BSDW/>

Sampling parameters include (but are not limited to) total coliform, arsenic, nitrates, total trihalomethanes and haloacetic acids, copper and lead, phthalate, and secondary inorganic compounds (aluminum, color, copper [free], iron, magnesium, manganese, methylene blue active substances foaming agent [surfactant], odor, potential of hydrogen [pH], silver, total dissolved solids, and zinc).

SNL/TTR also has an NDEP-permitted treatment system for arsenic removal (permit number NV-3014 TP-11-12NTNC). The arsenic removal system has performed well since the installation of a carbon dioxide (pH adjustment) system in June 2008. The untreated water is required to be between 6.5 and 7.0 on the pH scale for efficient and effective operation of the arsenic removal system.

Summary of Production Well Monitoring Activities and Results in 2015

In 2015, no SNL/TTR PWS Drinking Water Public Notice warnings were issued and all sample results were below the maximum contaminant levels (MCLs) established for the substances monitored.

Four compliance arsenic samples were collected in 2015. All samples contained 2 ppb arsenic, or less. The MCL for arsenic in drinking water is 10 ppb as a running annual average. The running annual average for arsenic in the drinking water at SNL/TTR during 2015 was 1.25 ppb.

During 2015, Production Well 6 produced 541,000 gal of water that was chlorinated and sent to the elevated water storage tower. This equals an average monthly production of approximately 45,000 gal during 2015. Daily production during 2015 averaged approximately 1,482 gal.

Also during 2015, approximately 189,600 gal of water was treated in the PWS Treatment Plant (identification number NV003014-TP11) to remove arsenic (Figure 3-8) before being sent to the drinking water distribution system. This equates to a monthly average of approximately 15,800 gal and a daily consumption rate of 519 gal.

A total of 281 lb of carbon dioxide (Figure 3-9) was used during 2015 for pH adjustment (23.5 lb per month, or 0.77 lb per day on average).



Figure 3-8. SNL/TTR water treatment facility arsenic removal system



Figure 3-9. SNL/TTR water treatment facility carbon dioxide pH adjustment system

3.8.2 Water Conservation

The State Water Resources Division regulations require a water conservation plan for permitted water systems and major water users in Nevada (DOE/NV 1992). The SNL/TTR Water Conservation Plan provides education, conservation measures, and an estimate of the amount of water that may be conserved each year as a result of the adoption of this plan. To date, the amount of water estimated to be conserved has been met. The plan must be updated every five years (the next revision is due in 2016).

3.8.3 Sewage System and Septic Tank Monitoring

Wastewater discharges from SNL/TTR activities conducted at facilities in the Main Compound at Area 3 go to the U.S. Air Force (USAF) facultative sewage lagoon for treatment. As a best management practice, either Sandia or Navarro personnel take annual wastewater samples from Area 3 at the point where wastewater leaves SNL/TTR property and enters the USAF system.

The USAF is responsible for the National Pollutant Discharge Elimination System (NPDES) permit for wastewater discharges. The USAF takes samples from the headwater end of the lagoon. In the past, Sandia personnel provided quarterly sampling results to the USAF for inclusion into their USAF Discharge Monitoring Report; however, the NPDES permit was modified in 1997 and no longer stipulates the requirement of quarterly data from Sandia. Therefore, Sandia now only provides annual wastewater sampling results. These systems are sampled as a best management practice and do not require sampling by the NDEP. During 2015, there were no excursions or violations of concentration limits. The 24-hour composite wastewater samples are collected on an annual basis, and the following parameters are analyzed:

- Total cyanide (cyanide-containing compounds are not used at SNL/TTR)
- pH
- Total suspended solids
- Phenolic compounds (phenol-containing compounds are not used at SNL/TTR)
- Chemical oxygen demand
- VOCs
- Semivolatile organic compounds
- Metals (arsenic, cadmium, chromium, copper, nickel, silver, zinc, lead, selenium, and mercury)
- Total petroleum hydrocarbons
- Oil and grease
- Tritium, gamma spectroscopy, and gross alpha and gross beta

The analytical results for wastewater sampled at Area 3 are provided in Appendix B.

Septic tank systems are sampled as needed. DOE/NNSA owns five septic tank systems located on-site at SNL/TTR: 36-01, 09-52 (inactive/never used), 24-01, Firing Range, and SNL/TTR Main Gate (Point Able Guard Station). These septic tank systems are used in remote locations and are maintained by the SNL/TTR Facilities group. The sewage from these locations flows into septic tank systems and associated drain fields. None of these systems required maintenance, sampling, or pumping in 2015. All other remaining septic tank systems have been closed or are undergoing closure and are being addressed by the ER Project.

3.8.4 Stormwater Sampling

Currently, Sandia has no requirement to perform stormwater sampling at SNL/TTR.

PART TWO



SANDIA NATIONAL LABORATORIES, KAUA'I TEST FACILITY, HAWAI'I

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Chapter 4. SNL/KTF Introduction



Island of Kaua'i

OVERVIEW ■ Kaua'i Test Facility has been an active rocket launching facility since 1962. The Remote Range Department, under Sandia, manages and conducts the rocket launching activities at SNL/KTF, including one rocket launch in 2015. The site has been used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering reentry vehicles, and scientific studies of atmospheric and exoatmospheric phenomena, and currently supports Missile Defense Agency programs.

This Annual Site Environmental Report (ASER) is prepared in accordance with and as required by U.S. Department of Energy (DOE) Order 231.1B, Admin Change 1, *Environment, Safety, and Health Reporting* (DOE O 231.1B, Admin Change 1). Sandia Corporation (Sandia), a wholly owned subsidiary of Lockheed Martin Corporation, manages and operates Sandia National Laboratories, Kaua'i Test Facility (SNL/KTF) for the DOE/National Nuclear Security Administration (NNSA). The DOE/NNSA/Sandia Field Office (SFO) in Albuquerque, New Mexico, administers the contract and oversees contractor operations at the site.

Part Two of this ASER summarizes the environmental protection and monitoring programs in place at SNL/KTF during calendar year 2015 unless otherwise noted. Sandia makes this report available to the general public in printed and electronic form.

4.1 Mission

Sandia's enduring core mission is to provide science and engineering support for the nation's nuclear weapons stockpile. Today, the mission encompasses additional critical aspects of national security, including developing technologies and strategies for responding to emerging threats, protecting and preventing the disruption of critical infrastructures, and supporting the

nonproliferation of weapons of mass destruction. Sandia also collaborates with representatives from other government agencies, the industrial sector, and universities to develop and commercialize new technologies. Information about recent technologies developed at Sandia can be found at:

<http://www.sandia.gov/news/index.html>

4.1.1 Operating Contract and DOE Directives

The Prime Contract between Sandia and the DOE (DE-AC04-94AL85000) defines the contractual obligations for managing and operating SNL/KTF. The DOE directives that pertain to environmental protection and management are as follows:

- [DOE O 231.1B, Admin Change 1](#), *Environment, Safety, and Health Reporting*, ensures that the DOE receives information about events that have affected or could adversely affect the health, safety, and security of the public or workers, the environment, the operations of DOE facilities, or DOE's credibility. This ASER is prepared in accordance with this directive.
- [DOE O 435.1 Change 1](#), *Radioactive Waste Management*, ensures that all radioactive waste is managed in a manner that is protective of worker and public health and safety, and the environment. Under this directive, contractors that manage and operate DOE facilities are required to plan, document, execute, and evaluate the management of DOE radioactive waste.
- [DOE O 458.1 Admin Change 3](#), *Radiation Protection of the Public and the Environment*, establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities under the control of the DOE pursuant to the Atomic Energy Act.
- [DOE O 232.2 Admin. Change 1](#), *Occurrence Reporting and Processing of Operations Information*, provides timely notification to the DOE complex about events that could adversely affect the health and safety of the public or workers, the environment, DOE missions, or DOE's credibility.
- [DOE O 436.1](#), *Departmental Sustainability*, was established to ensure that Environmental Management Systems (EMSs) and site sustainability are at the forefront of environmental excellence. The intent of this directive is implemented through an International Organization for Standardization (ISO) 14001-certified EMS. Although it is not part of the scope of the certification, Sandia implements EMS at SNL/KTF consistent with the ISO 14001 standard ([ISO 2004](#)). Conformance to the standard is verified through internal EMS assessments. SNL/KTF assessments were conducted in 2011 and 2014.

SNL/KTF, located on the island of Kaua'i, exists as a facility within the boundaries of the U.S. DoD Pacific Missile Range Facility.

4.2 Location Description

SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense (DoD) Pacific Missile Range Facility (PMRF). SNL/KTF is located on the island of Kaua'i at the north end of the PMRF ([Figure 4-1](#)). Remote facilities used in support of SNL/KTF operations include Mount Haleakala (Maui) and Kahili Point (Kaua'i).

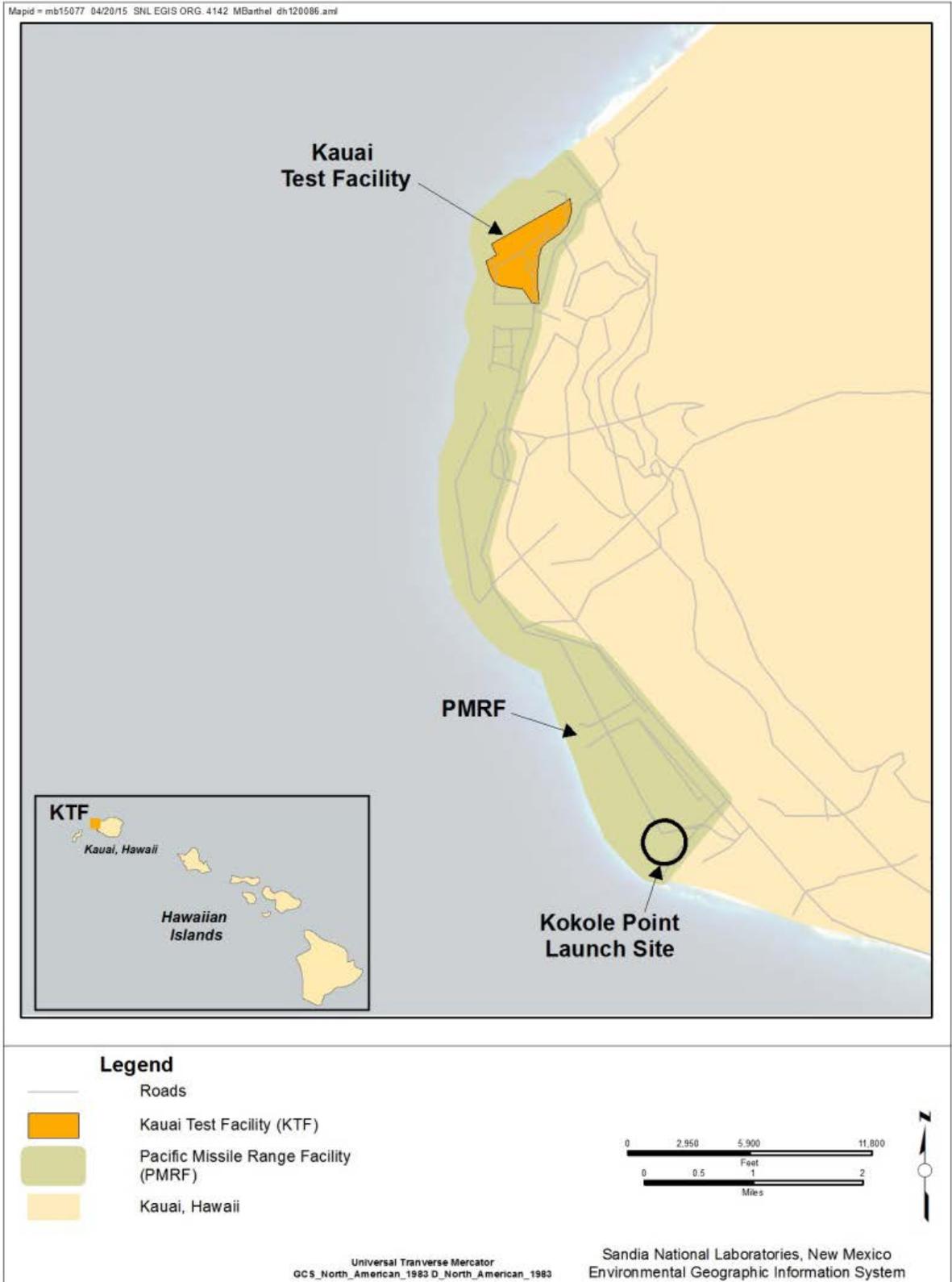


Figure 4-1. SNL/KTF location on Kaua'i, Hawai'i

4.3 Facilities and Operations

The Kaua'i Test Facility (KTF) has been an active rocket launching facility since 1962. The Remote Range Department, under Sandia, manages and conducts rocket launching activities at SNL/KTF. The site has been used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering reentry vehicles, and scientific studies of atmospheric and exoatmospheric phenomena, and currently supports Missile Defense Agency programs. Nuclear devices have never been launched from SNL/KTF, only monitoring rockets associated with atmospheric testing.

The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. Later construction, completed in March 2005, extended the Missile Service Tower to support DOE and the Missile Defense Agency. The most recent construction has been an upgrade of the launch field power system. From 1992 to 2015, SNL/KTF personnel have supported 91 launches from SNL/KTF, PMRF, or other mission assets.

The KTF launch field was originally designed to accommodate 40 launchpads, but only 15 pads were constructed. Of these, 11 have had their launchers removed. Beyond the original plan, two additional launchpads were constructed: one at Pad 41 (Kokole Point) and one at Pad 42 (Missile Service Tower). In addition to rocket launchpad sites, SNL/KTF facilities include missile and payload assembly buildings, launch operations and data acquisition facilities, maintenance shops, and a trailer dock compound for administration and other office processing.

The administrative area of SNL/KTF, known as the Main Compound, and the launch field are located within fenced areas near the North Nohili access road in PMRF. Inside the compound, a number of trailers and structures are connected together with a network of concrete docks and covered walkways. The majority of these facilities are used during mission operations to support customer and defense contractor personnel and technical staff from SNL, New Mexico; general maintenance activities are performed during noncampaign operations. Additionally, there are a number of permanent buildings and shelters in the Main Compound and launch field, some of which are in use year-round to support and maintain SNL/KTF facilities. Remote facilities include Mount Haleakala (Maui) and Kahili Point (Kaua'i), but Sandia has not used them for several years. In 2015, a Mount Haleakala Advanced Actions Decontamination and Demolition Pre-Action Study was signed since Kaua'i Test Facility no longer supports missions at this site. The Kokole Point launch complex and associated facilities were transferred to the U.S. Navy in 2013.

4.4 Rocket Launches in 2015

SNL/KTF supported one rocket launch in 2015. The launch was covered by the SNL/KTF Environmental Assessment, published in July 1992 ([DOE/AL 1992](#)), and the U.S. Navy Hawai'i Range Complex Environmental Impact Statement ([U.S. Navy 2008](#)):

- Operational Responsive Space, SuperStrypi, November 3, 2015 (launched from PMRF)

4.5 Demographics

There were 14 permanent on-site personnel at SNL/KTF in 2015. During campaign operations when rocket launches occurred, approximately 100 additional people worked at SNL/KTF. The closest population center to SNL/KTF are the towns of Kekaha and Waimea (Census 2010 population 5,561), which are eight and ten miles southeast from the site, respectively.

Chapter 5. SNL/KTF Compliance Summary



Sunset in Hawai'i

OVERVIEW ■ SNL/KTF operations comply with all federal, state, and local environmental regulations. Releases and occurrences are reported according to numerous permit requirements. Regular audits, appraisals, and inspections identify areas for improvement as well as noteworthy practices.

Sandia Corporation (Sandia) conducts operations at Sandia National Laboratories, Kaua'i Test Facility (SNL/KTF) in compliance with federal, state, and local environmental regulations, including U.S. Department of Energy (DOE) directives and Presidential Executive Orders (EOs). As a part of this compliance, Sandia adheres to strict reporting and permitting requirements.

All operations and activities at SNL/NM, including those in the environmental programs, are performed under the corporate Environment, Safety and Health (ES&H) policy which states:

It is the policy of Sandia National Laboratories to perform work in a safe and environmentally responsible manner by committing to: maintain a safe workplace, prevent incidents, and protect the public; protect the environment, conserve resources, and prevent pollution; maintain compliance with legal and other requirements; and strive for continual improvement. DOE's Integrated Safety Management System (ISMS) is a key element of the Sandia Management Model. ISMS provides the framework for managing ES&H activities and functions while integrating them into all SNL operations.

5.1 Compliance Status with Federal Regulations

Table 5-1 summarizes Sandia's compliance with environmental regulations for operations at SNL/KTF in 2015. Table 5-2 lists the applicable permits in place at SNL/KTF.

Table 5-1. SNL/KTF applicable major environmental regulations

Regulation/Statute	Description
Clean Air Act and Clean Air Act Amendments	Provides standards to protect the nation’s air quality
Clean Water Act	Provides a permitting structure and regulatory direction (i.e., the National Pollutant Discharge Elimination System) for restoring and maintaining the chemical, physical, and biological integrity of U.S. waters; protecting fish, wildlife and recreation; and reducing pollutant discharges
Comprehensive Environmental Response, Compensation, and Liability Act	Provides federal funding for cleanup of inactive waste sites on the National Priorities List and mandates requirements for reportable releases of hazardous substances (also known as “Superfund”)
Cultural Resources Acts	Includes various acts that protect archeological, historical, and religious sites and resources
Emergency Planning and Community-Right-to-Know Act	Mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community (also known as the Superfund Amendments and Reauthorization Act, Title III)
Endangered Species Act	Provides special protection status for federally listed threatened or endangered species
Executive Orders	Several Executive Orders provide specific protection for wetlands, floodplains, and environmental justice in minority and low-income populations, and encourage greening the government through leadership in environmental management
Federal Facility Compliance Act	Directs federal agencies regarding environmental compliance
Federal Insecticide, Fungicide, and Rodenticide Act	Controls the distribution and use of various pesticides
Migratory Bird Treaty Act of 1918	Prevents the taking, killing, possessing, transporting, and importing of migratory birds, their eggs, parts, and nests
National Environmental Policy Act	Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision making
Oil Pollution Act	Sets forth requirements for the prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities
Resource Conservation and Recovery Act	Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks
Safe Drinking Water Act	Enacts specific health standards for drinking water sources
Toxic Substances Control Act	Specifies rules for the manufacture, processing, distribution, use, and disposal of specific chemical substances and mixtures such as asbestos and polychlorinated biphenyls

NOTE: SNL/KTF = Sandia National Laboratories, Kaua’i Test Facility

Table 5-2. SNL/KTF permits in place, 2015

Type	Permit Number	Date Issued	Expiration Date	Regulatory Agency
Noncovered Source Permit (two stand-by diesel generators)	NSP 0429-01-N	September 28, 2015	September 28, 2020	State of Hawai'i
Underground storage tank (2,500 gal)	Permit Pending Issuance, as of March 18, 2016	Pending	Five years from issue date	Hawai'i Department of Health

NOTE: SNL/KTF = Sandia National Laboratories, Kaua'i Test Facility

5.1.1 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the “Superfund,” addresses areas of past spills and releases. SNL/KTF has no current Environmental Restoration areas located on-site.

The U.S. Environmental Protection Agency (EPA) designated ongoing oversight of SNL/KTF to the Hawai'i Department of Health Hazard Evaluation and Emergency Response Office. The EPA recommended continued reevaluation for environmental contamination due to the rocket launching facility (EPA 1996). Rocket exhaust continues to be the main source of metals and other nonreportable air emission releases at SNL/KTF.

5.1.2 Emergency Planning and Community Right-to-Know Act

The Emergency Planning and Community Right-to-Know Act (EPCRA), also known as Superfund Amendments and Reauthorization Act (SARA) Title III, establishes emergency planning requirements for federal, state, and local governments and industry. The SARA Title III amended CERCLA requirements for releases to the environment and chemical inventory reporting as directed by the EPCRA, sections 304, 311, and 312. All required information has been submitted to the State of Hawai'i. There were no reportable releases at SNL/KTF under EPCRA in 2015. Table 5-3 lists EPCRA reporting requirements.

5.1.3 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act and the Hawai'i Revised Statutes regulate the generation, transportation, treatment, storage, and disposal of hazardous chemical waste and nonhazardous solid wastes. Applicable regulations are listed in the reference section of the statutes (State of Hawai'i Environmental Regulations). Some hazardous waste is generated through normal operations at SNL/KTF. SNL/KTF is classified as a conditionally exempt small-quantity generator and is subject to the applicable requirements.

5.1.4 Federal Facility Compliance Act

The Federal Facility Compliance Act requires federal facilities to comply with all federal, state, and local requirements for hazardous and solid waste, including full compliance with the restrictions and prohibitions on extended storage of wastes that do not meet the applicable hazardous waste treatment standards. Extended storage at DOE facilities is typically associated with mixed wastes (wastes that have hazardous and radioactive components) that have been generated on-site. Sandia operations at SNL/KTF do not generate mixed waste and Sandia currently has no mixed waste stored on-site; therefore, these requirements are not applicable at SNL/KTF.

Table 5-3. SNL/KTF applicable EPCRA reporting requirements, 2015

Section	EPCRA Section Title	Requires Reporting?		Description
		Yes	No	
302-303	Emergency Planning	✓		Sandia personnel prepare an annual report that lists chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 (Appendix B), including the location of the chemicals and emergency contacts. The DOE/NNSA/SFO distributes the report to the required entities.
304	Emergency Notification		✓	No reportable quantity releases of an EHS, as defined by CERCLA, were reported in 2015.
311-312	SDS/MSDSs Chemical Purchase Inventory Report	✓		There are two "Community Right-to-Know" reporting requirements: (1) Sandia personnel complete the EPA Tier II forms for all hazardous chemicals present at the SNL/KTF facility at any one time in amounts equal to or greater than 10,000 lb, and for all EHSs present at the facility in an amount greater than or equal to 500 lb or the Threshold Planning Quantity, whichever is lower, and provide the report to DOE/NNSA/SFO for distribution to the required entities; and (2) Sandia personnel provide Safety Data Sheets for each chemical entry on a Tier II form and provides the report to DOE/NNSA/SFO prior to distribution to the required entities.
313	Toxic Chemical Release Forms		✓	Section 313 of EPCRA requires that facilities that release toxic chemicals listed in SARA Title III over a threshold value must submit a TRI report. In 2015 no releases resulting from SNL/KTF operations were reported above the threshold requiring a TRI report.

NOTES: CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
 CFR = Code of Federal Regulations
 DOE/NNSA/SFO = U.S. Department of Energy/National Nuclear Security Administration/Sandia Field Office
 EHS = extremely hazardous substance
 EPA = U.S. Environmental Protection Agency
 EPCRA = Emergency Planning and Community Right-to-Know Act
 MSDS = Material Safety Data Sheet
 SARA = Superfund Amendments and Reauthorization Act
 SDS = Safety Data Sheet
 SNL/KTF = Sandia National Laboratories, Kua'i Test Facility
 TRI = Toxic Release Inventory

5.1.5 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies (and other organizations that perform federally sponsored projects) to consider environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues, and include this information in early project planning and decision making. Proposed actions that would not significantly impact the human environment are categorically excludable from additional NEPA documentation (as identified in DOE 10 Code of Federal Regulations [CFR] Part 1021, National Environmental Policy Act Implementing Procedures). Other proposed actions may fit within a class of actions that have environmentally significant impacts associated with them. For this class of proposed actions, the agency must prepare an environmental assessment or an environmental impact statement before making an irretrievable commitment of resources or funding. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to choose a course of action with the least environmental impacts. At SNL/KTF, NEPA compliance is coordinated between personnel from SNL/KTF, SNL, New Mexico (SNL/NM), and the U.S. Department of Energy/National Nuclear Security Administration/Sandia Field Office (DOE/NNSA/SFO).

5.1.6 Endangered Species Act

The Endangered Species Act (ESA) applies to both private individuals and federal agencies. Federal agencies must ensure that any action they authorize, fund, or carry out will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. At SNL/KTF, ESA compliance is addressed under the NEPA Program and the Ecology Program. If potentially significant impacts to sensitive species or habitats are found as a result of a proposed action, an environmental assessment or an environmental impact statement must be prepared.

Table 5-4 presents the threatened and endangered species on state and federal lists potentially occurring on the island of Kauaʻi.

Table 5-4. SNL/KTF threatened and endangered species potentially occurring on Kauaʻi, Hawaiʻi

Common Name	Scientific Name	Federal Status	State Status
Plants			
Ferns and Allies			
Pendant kihi fern	<i>Adenophorus periens</i>	Endangered	Endangered
No common name	<i>Asplenium diellacinatum</i>	Proposed endangered	Proposed endangered
No common name	<i>Asplenium dielmannii</i>	Endangered	Endangered
No common name	<i>Asplenium dielpallidum</i>	Endangered	Endangered
Pauoa	<i>Ctenitis squamigera</i>	Endangered	Endangered
Asplenium-leaved diellia	<i>Diellia erecta</i>	Endangered	Endangered
No common name	<i>Diplazium molokaiense</i>	Endangered	Endangered
No common name	<i>Doryopteris angelica</i>	Endangered	Endangered
Palapalai aumakua	<i>Dryopteris crinalis var. podosorus</i>	Endangered	Endangered
kilau	<i>Dryopteris glabra var. pusilla</i>	Proposed endangered	Proposed endangered
Wawaeʻiole	<i>Huperzia mannii</i>	Endangered	Endangered
Wawaeʻiole	<i>Huperzia nutans</i>	Endangered	Endangered
Flowering Plants			
Liliwai	<i>Acaena exigua</i>	Endangered	Endangered
No common name	<i>Achyranthes mutica</i>	Endangered	Endangered
Mahoe	<i>Alectryon macrococcus</i>	Endangered	Endangered
Paʻiniu	<i>Astelia waialealae</i>	Endangered	Endangered
No common name	<i>Bonamia menziesii</i>	Endangered	Endangered
Olulu	<i>Brighamia insignis</i>	Endangered	Endangered
ʻAwikiwiki	<i>Canavalia napaliensis</i>	Endangered	Endangered
ʻAwikiwiki	<i>Canavalia pubescens</i>	Endangered	Endangered
Awiwi	<i>Centaurium sebaeoides</i>	Endangered	Endangered
Papala	<i>Charpentiera densiflora</i>	Endangered	Endangered
Haha	<i>Cyanea asarifolia</i>	Endangered	Endangered
Haha	<i>Cyanea dolichopoda</i>	Endangered	Endangered
Haha	<i>Cyanea eleleensis</i>	Endangered	Endangered
Haha	<i>Cyanea kolekoleensis</i>	Endangered	Endangered
Haha	<i>Cyanea kuhihewa</i>	Endangered	Endangered
Haha	<i>Cyanea recta</i>	Threatened	Threatened
Haha	<i>Cyanea remyi</i>	Endangered	Endangered
Haha	<i>Cyanea rivularis</i>	Endangered	Endangered
Haha	<i>Cyanea undulata</i>	Endangered	Endangered
No common name	<i>Cyperus pennatiformis</i>	Endangered	Endangered
Puʻukaʻa	<i>Cyperus trachysanthos</i>	Endangered	Endangered

See note at end of table.

Table 5-4. SNL/KTF threatened and endangered species potentially occurring on Kaua'i, Hawai'i (continued)

Common Name	Scientific Name	Federal Status	State Status
Plants (continued)			
Flowering Plants (continued)			
Mapele	<i>Cyrtandra cyaneoides</i>	Endangered	Endangered
Ha'iwale	<i>Cyrtandra limahuliensis</i>	Threatened	Threatened
Ha'iwale	<i>Cyrtandra oenobarba</i>	Endangered	Endangered
Haiwale	<i>Cyrtandra paliku</i>	Endangered	Endangered
No common name	<i>Delissea rhytidosperra</i>	Endangered	Endangered
No common name	<i>Delissea undulata</i>	Endangered	Endangered
Na'ena'e	<i>Dubautia imbricata imbricata</i>	Endangered	Endangered
Naenae	<i>Dubautia kalalauensis</i>	Endangered	Endangered
Naenae	<i>Dubautia kenwoodii</i>	Endangered	Endangered
Koholapehu	<i>Dubautia latifolia</i>	Endangered	Endangered
Na'ena'e	<i>Dubautia pauciflorula</i>	Endangered	Endangered
Na'ena'e	<i>Dubautia plantaginea magnifolia</i>	Endangered	Endangered
Na'ena'e	<i>Dubautia waialealae</i>	Endangered	Endangered
'Akoko	<i>Euphorbia eleanoriae</i>	Endangered	Endangered
'Akoko	<i>Euphorbia haeleleana</i>	Endangered	Endangered
'Akoko	<i>Euphorbia halemanui</i>	Endangered	Endangered
'Akoko	<i>Euphorbia remyi</i> var. <i>Kaua'iensis</i>	Endangered	Endangered
'Akoko	<i>Euphorbia remyi</i> var. <i>remyi</i>	Endangered	Endangered
Heau	<i>Exocarpos luteolus</i>	Endangered	Endangered
Mehamehame	<i>Flueggea neowawraea</i>	Endangered	Endangered
Nanu	<i>Gardenia remyi</i>	Proposed endangered	Proposed endangered
Nohoanu	<i>Geranium Kaua'iense</i>	Endangered	Endangered
No common name	<i>Gouania meyenii</i>	Endangered	Endangered
Honohono	<i>Haplostachys haplostachya</i>	Endangered	Endangered
No common name	<i>Hesperomannia lydgatei</i>	Endangered	Endangered
Kaua'i hau kuahiwi	<i>Hibiscadelphus distans</i>	Endangered	Endangered
Hau kuahiwi	<i>Hibiscadelphus woodii</i>	Endangered	Endangered
Clay's hibiscus	<i>Hibiscus clayi</i>	Endangered	Endangered
Koki'o ke'oke'o	<i>Hibiscus waimeae</i> ssp. <i>hannerae</i>	Endangered	Endangered
Hilo ischaemum	<i>Ischaemum byrone</i>	Endangered	Endangered
Aupaka	<i>Isodendron laurifolium</i>	Endangered	Endangered
Aupaka	<i>Isodendron longifolium</i>	Threatened	Threatened
'Ohe	<i>Joinvillea ascendens ascendens</i>	Proposed endangered	Proposed endangered
Kampua'a	<i>Kadua (=Hedyotis) fluviatilis</i>	Proposed endangered	Proposed endangered
'Awiwi	<i>Kadua cookiana</i>	Endangered	Endangered
No common name	<i>Kadua haupuensis</i>	Proposed endangered	Proposed endangered
No common name	<i>Kadua</i> st. <i>-johnii</i>	Endangered	Endangered
No common name	<i>Keysseria (=Lagenifera) erici</i>	Endangered	Endangered
No common name	<i>Keysseria (=Lagenifera) helenae</i>	Endangered	Endangered
Koki'o	<i>Kokia Kaua'iensis</i>	Endangered	Endangered
Kamakahala	<i>Labordia helleri</i>	Endangered	Endangered
Kamakahala	<i>Labordia lydgatei</i>	Endangered	Endangered
Kamakahala	<i>Labordia pumila</i>	Endangered	Endangered
Kamakahala	<i>Labordia tinifolia</i> var. <i>wahiawaensis</i>	Endangered	Endangered
No common name	<i>Lepidium orbiculare</i>	Proposed Endangered	Proposed Endangered

See note at end of table.

Table 5-4. SNL/KTF threatened and endangered species potentially occurring on Kauaʻi, Hawaiʻi (continued)

Common Name	Scientific Name	Federal Status	State Status
Plants (continued)			
Flowering Plants (continued)			
Nehe	<i>Lipochaeta fauriei</i>	Endangered	Endangered
Nehe	<i>Lipochaeta micrantha</i>	Endangered	Endangered
No common name	<i>Lobelia niihauensis</i>	Endangered	Endangered
lehua makanoē	<i>Lysimachia daphnoides</i>	Endangered	Endangered
No common name	<i>Lysimachia filifolia</i>	Endangered	Endangered
No common name	<i>Lysimachia iniki</i>	Endangered	Endangered
No common name	<i>Lysimachia pendens</i>	Endangered	Endangered
No common name	<i>Lysimachia scopulensis</i>	Endangered	Endangered
No common name	<i>Lysimachia venosa</i>	Endangered	Endangered
Alani	<i>Melicope degeneri</i>	Endangered	Endangered
Alani	<i>Melicope haupuensis</i>	Endangered	Endangered
Alani	<i>Melicope knudsenii</i>	Endangered	Endangered
Alani	<i>Melicope pallida</i>	Endangered	Endangered
Alani	<i>Melicope paniculata</i>	Endangered	Endangered
Alani	<i>Melicope puberula</i>	Endangered	Endangered
Alani	<i>Melicope quadrangularis</i>	Endangered	Endangered
Uhi uhi	<i>Mezoneuron kavaianse</i>	Endangered	Endangered
Kolea	<i>Myrsine fosbergii</i>	Proposed endangered	Proposed endangered
Kolea	<i>Myrsine knudsenii</i>	Endangered	Endangered
Kolea	<i>Myrsine linearifolia</i>	Threatened	Threatened
Kolea	<i>Myrsine mezii</i>	Endangered	Endangered
ʻAiea	<i>Nothoctrum latifolium</i>	Proposed endangered	Proposed endangered
ʻAiea	<i>Nothoctrum peltatum</i>	Endangered	Endangered
Lau ʻehu	<i>Panicum niihauense</i>	Endangered	Endangered
Makou	<i>Peucedanum sandwicense</i>	Threatened	Threatened
No common name	<i>Phyllostegia helleri</i>	Proposed endangered	Proposed endangered
No common name	<i>Phyllostegia knudsenii</i>	Endangered	Endangered
No common name	<i>Phyllostegia renovans</i>	Endangered	Endangered
No common name	<i>Phyllostegia waimeae</i>	Endangered	Endangered
No common name	<i>Phyllostegia wawrana</i>	Endangered	Endangered
Hoʻawa	<i>Pittosporum napaliense</i>	Endangered	Endangered
No common name	<i>Platanthera holochila</i>	Endangered	Endangered
Pilo kea lau liʻi	<i>Platydesma rostrata</i>	Endangered	Endangered
Mann’s bluegrass	<i>Poa mannii</i>	Endangered	Endangered
Hawaiʻian bluegrass	<i>Poa sandvicensis</i>	Endangered	Endangered
No common name	<i>Poa siphonoglossa</i>	Endangered	Endangered
No common name	<i>Polyscias bisattenuata</i>	Endangered	Endangered
No common name	<i>Polyscias flynnii</i>	Endangered	Endangered
No common name	<i>Polyscias racemosa</i>	Endangered	Endangered
Loʻulu (=Naʻenaʻe)	<i>Pritchardia hardyi</i>	Endangered	Endangered
Loʻulu	<i>Pritchardia napaliensis</i>	Endangered	Endangered
Loʻulu	<i>Pritchardia viscosa</i>	Endangered	Endangered
Kopiko	<i>Psychotria grandiflora</i>	Endangered	Endangered
Kopiko	<i>Psychotria hobydi</i>	Endangered	Endangered
Kaulu	<i>Pteralyxia Kauaʻiensis</i>	Endangered	Endangered
Makou	<i>Ranunculus mauiensis</i>	Proposed Endangered	Proposed Endangered

See note at end of table.

Table 5-4. SNL/KTF threatened and endangered species potentially occurring on Kauaʻi, Hawaiʻi (continued)

Common Name	Scientific Name	Federal Status	State Status
Plants (continued)			
Flowering Plants (continued)			
No common name	<i>Remya Kauaʻiensis</i>	Endangered	Endangered
No common name	<i>Remya montgomeryi</i>	Endangered	Endangered
No common name	<i>Santalum involutum</i>	Proposed endangered	Proposed endangered
Dwarf naupaka	<i>Scaevola coriacea</i>	Endangered	Endangered
Maʻoliʻoli	<i>Schiedea apokremnos</i>	Endangered	Endangered
No common name	<i>Schiedea attenuata</i>	Endangered	Endangered
No common name	<i>Schiedea helleri</i>	Endangered	Endangered
No common name	<i>Schiedea Kauaʻiensis</i>	Endangered	Endangered
Kuawawaenuhu	<i>Schiedea lychnoides</i>	Endangered	Endangered
No common name	<i>Schiedea membranacea</i>	Endangered	Endangered
No common name	<i>Schiedea nuttallii</i>	Endangered	Endangered
No common name	<i>Schiedea spergulina</i> var. <i>leiopoda</i>	Endangered	Endangered
No common name	<i>Schiedea spergulina</i> var. <i>spergulina</i>	Threatened	Threatened
Laulihilihi	<i>Schiedea stellarioides</i>	Endangered	Endangered
No common name	<i>Schiedea viscosa</i>	Endangered	Endangered
Ohai	<i>Sesbania tomentosa</i>	Endangered	Endangered
No common name	<i>Sicyos lanceoloideus</i>	Proposed endangered	Proposed endangered
No common name	<i>Silene lanceolata</i>	Endangered	Endangered
Popolo ku mai	<i>Solanum incompletum</i>	Endangered	Endangered
Popolo	<i>Solanum nelsonii</i>	Proposed endangered	Proposed endangered
ʻAiakeakua, popolo	<i>Solanum sandwicense</i>	Endangered	Endangered
No common name	<i>Spermolepis Hawaiʻiensis</i>	Endangered	Endangered
No common name	<i>Stenogyne campanulata</i>	Endangered	Endangered
No common name	<i>Stenogyne kealiae</i>	Endangered	Endangered
No common name	<i>Viola helenae</i>	Endangered	Endangered
Nani waiʻaleʻale	<i>Viola Kauaʻiensis</i> var. <i>wahiawaensis</i>	Endangered	Endangered
No common name	<i>Wikstroemia skottsbergiana</i>	Proposed endangered	Proposed endangered
Dwarf iliau	<i>Wilkesia hobbyi</i>	Endangered	Endangered
No common name	<i>Xylosma crenatum</i>	Endangered	Endangered
Aʻe	<i>Zanthoxylum Hawaiʻiense</i>	Endangered	Endangered
Animals			
Mammals			
Hawaiʻian hoary bat	<i>Lasiurus cinereus semotus</i>	Endangered	Endangered
Birds			
Hawaiʻian (=koloa) Duck	<i>Anas wyvilliana</i>	Endangered	Endangered
Hawaiʻian Goose	<i>Branta (=Nesochen) sandvicensis</i>	Endangered	Endangered
Hawaiʻian Coot	<i>Fulica americana alai</i>	Endangered	Endangered
Hawaiʻian Common Gallinule	<i>Gallinula chloropus sandvicensis</i>	Endangered	Endangered
Nukupū (Honeycreeper)	<i>Hemignathus lucidus</i>	Endangered	Endangered
Kauaʻi Akialoa (Honeycreeper)	<i>Hemignathus procerus</i>	Endangered	Endangered
Hawaiʻian Stilt	<i>Himantopus mexicanus knudseni</i>	Endangered	Endangered
Akekee	<i>Loxops caeruleirostris</i>	Endangered	Endangered
Kauaʻi ʻoʻo (Honeyeater)	<i>Moho braccatus</i>	Endangered	Endangered

See note at end of table.

Table 5-4. SNL/KTF threatened and endangered species potentially occurring on Kaua'i, Hawai'i (continued)

Common Name	Scientific Name	Federal Status	State Status
Animals (continued)			
Birds (continued)			
Large Kaua'i '(=kamao) Thrush	<i>Myadestes myadestinus</i>	Endangered	Endangered
Small Kaua'i '(=puaiohi) Thrush	<i>Myadestes palmeri</i>	Endangered	Endangered
Band-rumped Storm Petrel	<i>Oceanodroma castro</i>	Proposed endangered	Proposed endangered
Akikiki	<i>Oreomystis bairdi</i>	Endangered	Endangered
Akikiki	<i>Oreomystis bairdi</i>	Endangered	Endangered
'O'u (Honeycreeper)	<i>Psittirostra psittacea</i>	Endangered	Endangered
Hawai'ian Petrel	<i>Pterodroma sandwichensis</i>	Endangered	Endangered
Newell's Townsend's Shearwater	<i>Puffinus auricularis newelli</i>	Threatened	Threatened
Reptiles			
Green sea turtle	<i>Chelonia mydas</i>	Threatened	Threatened
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	Endangered
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	Endangered
Olive Ridley sea turtle	<i>Lepidochelys olivacea</i>	Threatened	Threatened
Snails			
Newcomb's snail	<i>Erinna newcombi</i>	Threatened	Threatened
Arachnids			
Kaua'i cave wolf or pe'e pe'e maka 'ole spider	<i>Adelocosa anops</i>	Endangered	Endangered
Insects			
Pomace fly (no common name)	<i>Drosophila musaphilia</i>	Endangered	Endangered
Hawai'ian picture-wing fly	<i>Drosophila sharpi</i>	Endangered	Endangered
Pacific Hawai'ian damselfly	<i>Megalagrion pacificum</i>	Endangered	Endangered
Orangeblack Hawai'ian damselfly	<i>Megalagrion xanthomelas</i>	Proposed Endangered	Proposed Endangered
Crustaceans			
Kaua'i cave amphipod	<i>Spelaeorchestia koloana</i>	Endangered	Endangered

NOTE: SNL/KTF = Sandia National Laboratories, Kaua'i Test Facility

5.1.7 Cultural Resources Acts

The three primary cultural resources acts applicable at SNL/KTF are:

- National Historic Preservation Act
- Archaeological Resources Protection Act
- American Indian Religious Freedom Act

At SNL/KTF, cultural resources compliance is coordinated through the NEPA Program. Actions that could adversely affect cultural resources are initially analyzed in a NEPA checklist review. It is a DOE/NNSA/SFO responsibility to ensure that impacts to cultural resources are assessed and appropriate actions taken to mitigate any impact. In 2015, no historic properties were threatened; no buildings previously unassessed were modified or demolished. SFO did not have occasion to consult with the Hawai'i State Historic Preservation Officer.

5.1.8 Migratory Bird Treaty Act of 1918

The Migratory Bird Treaty Act (MBTA) of 1918 implemented the 1916 Convention for the Protection of Migratory Birds. The original statute implemented the agreement between the U.S. and Great Britain (for Canada), and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia. In addition to the special

consideration afforded to species listed as threatened and endangered, most birds are protected under the MBTA of 1918, as amended. At SNL/KTF, the MBTA is coordinated through NEPA reviews and the Ecology Program.

5.1.9 Environmental Compliance Executive Orders

The primary EOs related to environmental compliance at SNL/KTF are as follows (for additional information on these EOs, see [Chapter 2](#)):

- EO 11988, *Floodplain Management*, as amended
- EO 11990, *Protection of Wetlands*, as amended
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended
- EO 13693, *Planning for Federal Sustainability in the Next Decade*

5.1.10 Department of Energy Directives

DOE directives on the Management and Operating Contract that pertain to environmental protection and management are discussed in [Chapter 4](#). In 2015, Sandia adhered to requirements stated in these DOE directives.



Hawai'i

5.1.11 Clean Air Act and Clean Air Act Amendments of 1990

Ambient air quality at SNL/KTF is regulated by Hawai'i Administrative Rules, Title 11, Chapter 59 under the jurisdiction of the Hawai'i Department of Health, Clean Air Branch. Currently, no facilities at SNL/KTF require federal air permits. Within the boundaries of the Pacific Missile Range Facility, the DOE holds no federal air emission permits for SNL/KTF. Rocket launches are mobile sources and do not require any reporting of reportable quantity releases.

The two electrical generators at SNL/KTF are permitted for operation by the State of Hawai'i under a Noncovered Source Permit ([Hawaii DOH 2015](#)). These generators are subject to the

provisions of the following federal regulations (the specific requirements of these standards are detailed in special conditions within the permit):

- [40 CFR 60](#), *Standards of Performance for New Stationary Sources*, Subpart A, “General Provisions”
- [40 CFR Part 60](#), *Standards of Performance for New Stationary Sources*, Subpart III, “Standards of Performance for Stationary Compression Ignition Internal Combustion Engines”

Ambient air is any unconfined portion of the atmosphere: open air, surrounding air.

5.1.12 Clean Water Act

The Clean Water Act establishes guidelines to protect the “waters of the United States” by regulating the discharge of pollutants. There were no compliance issues at SNL/KTF with respect to any state or federal water pollution regulations in 2015.

5.1.13 Oil Pollution Act

Aboveground storage tanks (ASTs) are subject to EPA regulations [40 CFR 112](#), *Oil Pollution Prevention*, and [40 CFR 110](#), *Discharge of Oil*. Underground storage tanks (USTs) are regulated by Hawai'i Administrative Rules, Title 11, Chapter 281, *Underground Storage Tanks*. There are four DOE-owned storage tanks at SNL/KTF: one 2,500 gal underground storage tank, one 10,000 gal aboveground storage tank, and two 300 gal generator base tanks inside the Main Compound. The underground storage tank requires a permit with the State of Hawai'i. SNL/KTF operates under the U.S. Navy's spill control guidelines contained in the *Spill Prevention, Control, and Countermeasure Plan, Pacific Missile Range Facility, Kaula'i, Hawai'i* ([NAVFAC Hawaii 2012](#)).

5.1.14 Safe Drinking Water Act

The Safe Drinking Water Act does not apply directly to activities at SNL/KTF because all drinking water is either supplied by the Pacific Missile Range Facility drinking water system or purchased from commercial suppliers.

5.1.15 Toxic Substances Control Act

The Toxic Substances Control Act regulates polychlorinated biphenyls (PCBs) and asbestos. The transformers on the SNL/KTF site have been tested and are free of PCBs. A comprehensive asbestos survey was conducted by the SNL/NM Asbestos Management Team in July 2008. A total of 110 cubic yards of asbestos-containing materials were identified at SNL/KTF, and 91 cubic yards were identified at the Mount Haleakala site on Maui.

5.1.16 Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act controls the distribution and application of pesticides including herbicides, insecticides, and rodenticides. All pesticide use at SNL/KTF follows EPA requirements.

5.2 Releases and Occurrences

There was one reportable occurrence at SNL/KTF in 2015.

5.3 Occurrence Reporting

Under DOE O 232.2 Admin. Change 1, the current order for occurrence reporting, an occurrence is defined as “one or more (i.e., recurring) events or conditions that adversely affect, or may adversely affect, DOE (including NNSA) or contractor personnel, the public, property, the environment, or the DOE mission. Events or conditions meeting criteria thresholds identified in DOE O 232.2, or determined to be recurring through performance analysis, are considered occurrences.” There are environmental releases that may not meet DOE O 232.2 reporting thresholds; however, they are still reportable to outside agencies. In 2015, there was one occurrence report at SNL/KTF (Table 5-5).

Table 5-5. DOE O 232.2 occurrence reports, 2015

Reporting Criteria	Month	Significance Category	Report Number and Title
Group 9 Noncompliance Notifications 9(1)—Any written notification from an outside regulatory agency that a site/facility is considered to be in noncompliance with a schedule or requirement (e.g., Notice of Violation, Notice of Intent to Sue, Notice of Noncompliance, Warning Letter, Finding of Violation, Finding of Alleged Violation, Administrative Order, or equivalent notification or enforcement action).	September	SC4	NA--SS-SNL-5000-2015-0004 Field Citation—Failure to Perform Annual Liquid Tightness Test on Spill Bucket A Field Citation was issued to SNL/KTF for failure to complete annual liquid tightness testing on the spill bucket of the UST used to store fuel. The situation was remedied with new equipment and procedures.

NOTES: DOE = U.S. Department of Energy
 SNL/KTF = Sandia National Laboratories, Kua’i Test Facility
 SC = Significance Category
 UST = underground storage tank

Chapter 6. SNL/KTF Environmental Programs



Green sea turtle off the coast of Kaua'i (*Chelonia mydas*)

OVERVIEW ■ Sandia's environmental programs monitor air, soil, and water at the Kaua'i Test Facility. In addition, personnel surveilled wastewater, meteorological, and noise emissions. Sandia is classified as a conditionally exempt small-quantity generator, and follows applicable requirements for managing hazardous waste generated through normal operations.

Sandia Corporation (Sandia) personnel conduct environmental, terrestrial, water, and air monitoring programs at Sandia National Laboratories, Kaua'i Test Facility (SNL/KTF) in Hawai'i. Sandia complies with federal, state, and local regulations.

Sandia's environmental programs and focus areas at SNL/KTF include the following:

- Air Quality Compliance Program
- Environmental Restoration (ER) Project
- Meteorological Program
- National Environmental Policy Act (NEPA) Program
- Noise Monitoring
- Terrestrial Surveillance Program
- Waste Management Program
- Water Quality programs

Environmental surveillance activities at SNL/KTF in 2015 included wastewater, air emission, meteorological, and noise monitoring.

6.1 Air Quality Compliance Program

Based on air monitoring results of the Strategic Target System (STARS) Flight Test Unit 1 (FTU-1) in February 1993 (SNL/NM 1993) and the Countermeasures Demonstration Experiment (CDX) rocket launch in the summer of 1992 (NDEP 2011; SNL/NM 1992), it was determined that rocket launches at SNL/KTF were not a significant source of air pollutants. Launches are infrequent, and recorded emissions did not exceed federal or state standards. Because the STARS-type rocket produces the greatest air emissions and remained within

acceptable limits, it can be assumed that future launches of this type will also be within acceptable limits. Therefore, no further air emission monitoring is planned at this time. If a new rocket type is launched from SNL/KTF that differs in emission substance from the STARS rocket or air emission requirements change, then future monitoring may be considered.

As required by the State of Hawai'i, the 2015 Annual Emissions Report for air emissions was submitted to the State of Hawai'i in 2016 ([DOE/NNSA/SFO 2016a](#)). The annual fee was submitted for 2015 as required. Sandia was in compliance with all air quality regulations at SNL/KTF in 2015.

The two semiannual monitoring reports for 2015 were submitted to the State of Hawai'i within the required timelines ([DOE/NNSA/SFO 2016a](#) and [DOE/NNSA/SFO 2016b](#)); they indicated that operation of the Kaua'i Test Facility's generators are in compliance with the permitted operating limits. The highest total combined operating hours for a rolling 12-month period was 1,773.80 hours, which occurred in the period from April to March 2015 ([DOE/NNSA/SFO 2016a](#)).

6.2 Environmental Restoration Project

There are currently no ER sites at SNL/KTF. On September 30, 1996, the EPA granted a Site Evaluation Accomplished determination for the three ER sites identified in 1995 ([EPA 1996](#)). This confirmed that SNL/KTF met all Comprehensive Environmental Response, Compensation, and Liability Act requirements and no additional sampling or remediation would be necessary in the three areas.

6.3 Meteorological Program

Due to the infrequency of launches, no formal meteorological monitoring equipment is in place for SNL/KTF. On-site meteorological instruments are used during test periods only to characterize ground-level and atmospheric wind conditions that will affect a rocket's flight. Climatic information representative of SNL/KTF is obtained from the Pacific Missile Range Facility (PMRF), and severe weather notifications are automatically issued by the PMRF Emergency Operations Center to all SNL/KTF resident personnel.

6.4 National Environmental Policy Act Program

In 2015, the SNL, New Mexico (SNL/NM) NEPA Program provided support to several Sandia customers for their associated programmatic activities performed at either SNL/KTF or PMRF.

The NEPA team completed five NEPA checklists for SNL/KTF, four of which were transmitted to the U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office ([DOE/NNSA/SFO](#)) for review and determination in 2015.

6.5 Noise Monitoring

In accordance with the Quiet Communities Act of 1978 (42 U.S.C. 4901 et seq.), noise monitoring was conducted in February 1993 during a STARS FTU-1 launch to confirm the determination made in the STARS Environmental Impact Statement that noise produced from the largest launch at SNL/KTF would be below maximum acceptable levels ([SNL/NM 1993](#)). Data collected in the nearest town of Kekaha indicated that levels were no louder than noise generated from passing vehicles on a nearby highway.

6.6 Terrestrial Surveillance Program

The Terrestrial Surveillance Program at SNL/KTF collects and analyzes surface soil samples every five years for Target Analyte List (TAL) metals to determine whether there has been release to the environment due to SNL/KTF operations. The last sampling event was conducted in 2012, confirming that operations made no detectable environmental impact (from metals) to the soil. The next sampling event will be conducted in 2017.

6.6.1 Statistical Analysis

A statistical analysis was performed on samples collected in 2002, 2007, and 2012 for TAL metals. The results and the baseline concentrations at the SNL/KTF site were presented in the *Calendar Year 2012 Annual Site Environmental Report for Tonopah Test Range, Nevada and Kaha'i Test Facility, Hawai'i* (SNL/NM 2013). Summary statistics for the 2012 sampling event are presented in Table 6-1. On-site and off-site locations were compared to determine whether any analyte showed differences between the two location types (there are no perimeter sampling locations at SNL/KTF).

Table 6-1. SNL/KTF summary statistics for metals in soil, 2012 (all units in mg/kg)

Analyte	Mean	Median	SD	Minimum	Maximum
Aluminum	6,496	6,400	2,811	2,270	13,100
Antimony	0.80	0.42	0.75	0.31	3.27
Arsenic	18.72	10.70	16.98	5.96	62.80
Barium	25.79	12.10	36.17	6.86	151.00
Beryllium	0.12	0.11	0.07	0.05	0.27
Cadmium	0.27	0.24	0.13	0.11	0.51
Calcium	259,529	261,000	52,847	185,000	343,000
Chromium	50.48	47.10	21.51	22.20	93.70
Cobalt	18.58	16.30	10.85	4.04	40.08
Copper	37.73	12.30	97.13	5.40	413.00
Iron	19,875	19,400	9,209	7,670	39,600
Lead	4.78	1.63	7.50	0.49	30.70
Magnesium	34,906	28,500	14,462	23,000	66,400
Manganese	381	390	190	118	878
Nickel	221	174	156	42	556
Potassium	325	216	278	100	1,020
Selenium	0.32	0.32	0.01	0.30	0.33
Silver	1.48	1.49	0.69	0.10	2.82
Sodium	2,170	2,010	674	1,650	4,450
Thallium	0.06	0.06	0.00	0.06	0.06
Uranium	1.26	1.29	0.20	0.95	1.68
Vanadium	26.11	29.90	9.70	9.21	40.00
Zinc	335	63	749	21	3,140

NOTES: SD = standard deviation

SNL/KTF = Sandia National Laboratories, Kaha'i Test Facility

6.6.2 Sampling Locations

Terrestrial surveillance began at SNL/KTF in 1994. Sampling occurred in 1999, 2002, 2007, and 2012. Routine terrestrial surveillance is conducted at on-site and off-site locations that remain essentially the same from sampling period to sampling period (Appendix C). Sample locations may be modified as necessary to reflect current operations or to supplement data from existing locations.

The sampling locations, number of samples, and analyses performed are prioritized based on the following criteria:

- On-site sampling locations are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate. On-site sampling locations are listed in [Table 6-2](#). Figure C-1 (Appendix C) shows the 17 on-site locations.
- Off-site sampling locations are selected in remote natural settings, in areas near local population centers, and along highways. These locations provide a measurement of environmental conditions unaffected by Sandia activities at SNL/KTF. Data collected from off-site locations serve as a reference point to compare with data collected at on-site locations. [Table 6-3](#) lists the off-site sample locations. Figure C-2 (Appendix C) shows the 11 off-site locations.

Table 6-2. SNL/KTF on-site terrestrial surveillance locations

Surveillance Location	Location Number	Sample Location
Various on-site	S-12	Near Wind Radar Road
	S-13	SNL/KTF sign, DOE Trail Road
	S-14	Building 638
	S-15	Between Building 638 and Building 639
	S-16	Building 639 (east)
	S-17	Building 640 (east)
	S-18	Building 640 (west)
	S-19	Building 685 (west)
	S-20	Missile Assembly Building parking lot
	S-21	Building 645 and Building 645A (south)
	S-22	Missile Service Tower Hill
S-23	Pad 1 (west corner)	
Main Compound	S-24	Main Compound, northeast corner fence
	S-25	Main Compound, southeast corner fence
	S-26	Main Compound, north fence
	S-27	Main Compound, northwest of Launch Operations Building
	S-28	Diesel fuel tank (southeast corner), DOE Trail

NOTES: DOE = U.S. Department of Energy
SNL/KTF = Sandia National Laboratories, Kaula'i Test Facility

Table 6-3. SNL/KTF off-site terrestrial surveillance locations

Location Number	Sample Location
C-01	“Recreational Area I Beach Access” sign, North Nohili Road
C-02	“No Trespassing” sign, west of Location C-01
C-03	North Nohili Road and Hoku Road
C-04	Hoku Road, west of Building 515
C-05	Polihale State Park, Monkey Pod Tree
C-06	Polihale State Park, “Camping” sign
C-07	Polihale State Park, “Caution Road Narrows” sign
C-08	North Nohili Road and Palai Olani Road
C-09	Kokole Point Launch Area, Building H10
C-10	Kokole Point Launch Area (west)
C-11	Kokole Point Launch Area (south)

NOTES: Off-site samples were previously called “community samples,” thus the C label in the location number (maintained for the database).

SNL/KTF = Sandia National Laboratories, Kaua’i Test Facility

6.7 Waste Management Program

Some hazardous waste is generated through normal operations at SNL/KTF. Sandia is classified as a conditionally exempt small-quantity generator, and follows applicable requirements. EPA Region IX and the Hawai’i Department of Health issued a generator identification (HI-0000-363309) to Sandia on September 23, 1994 (the expiration date was not specified).



Hawai’ian Goose (*Branta sandvicensis*)

6.8 Water Quality Program

Activities at SNL/KTF produce only sanitary sewage, which is directed into three DOE/NNSA-owned septic tanks, and stormwater runoff is directed into two French drains and four area drains with pumping systems in accordance with Hawai’i Underground Injection Control regulations (Hawai’i Administrative Rules Title 11, Chapter 23). Two of the septic tanks, the Launch Operations Building and the Missile Assembly Building, were registered with the State of Hawai’i in 1988. A newer septic tank for the main office compound was registered in 2004. The septic tank systems are pumped periodically and inspected by licensed, state-certified contractors. There are no drinking water wells in the area of SNL/KTF. Historically, no contaminants have been identified above the reporting limits from past sampling events. During 2015, no septic tank systems were sampled at SNL/KTF.

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Glossary



Indian paintbrush (*Castilleja ssp.*) at SNL/TTR

A

aboveground storage tank (AST) A fixed, stationary, or otherwise permanently installed storage tank that is wholly or partially above the ground surface and used to contain oil of any kind (petroleum, non-petroleum, synthetic, animal and vegetable). ASTs at SNL are metal construction, field erected or shop-built, and include integral generator base tanks.

aeolian Relating to or arising from the action of the wind.

ambient air Any unconfined portion of the atmosphere: open air, surrounding air.

audit (1) An examination of records or financial accounts to check their accuracy. (2) An adjustment or correction of accounts. (3) An examined and verified account.

B

background radiation Relatively constant low-level radiation from environmental sources such as building materials, cosmic rays, and ingested radionuclides in the body.

D

dosimeter A device used to measure the dose of ionizing radiation received by an individual.

E

ecology The relationship of living things to one another and their environment, or the study of such relationships.

ephemeral spring A spring that flows only briefly in the immediate locality.

F

fault A fracture in the continuity of a rock formation caused by the earth's crust shifting or dislodging, after which adjacent surfaces are displaced relative to one another and parallel to the plane of fracture.

G

groundwater The water found beneath the earth's surface in pore spaces and in fractures of rock formations.

H

hazardous substance (1) Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. (2) Any substance the EPA requires to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment.

I

Integrated Safety Management System

(ISMS) A set of guidelines that systematically integrate safety into management and work practices at all levels so missions are accomplished while protecting the worker, the public, and the environment.

L

lagoon (1) A shallow pond where sunlight, bacterial action, and oxygen work to purify wastewater; also used for storing wastewater. (2) A shallow body of water, often separated from the sea by coral reefs or sandbars.

M

mixed waste Radioactive waste that contains both source material, special nuclear material, or by-product material subject to the Atomic Energy Act of 1954, as amended; also a hazardous component subject to the Resource Conservation and Recovery Act, as amended.

N

nitrate A compound containing nitrogen that can exist in the atmosphere or as a dissolved gas in water and which can have harmful effects on humans and animals. Nitrates in water can cause severe illness in infants and domestic animals. A plant nutrient and inorganic fertilizer, nitrate is found in septic systems, animal feedlots, agricultural fertilizers, manure, industrial wastewaters, sanitary landfills, and garbage dumps.

Q

quality control A system used to determine analytical accuracy, precision, and contamination when samples are collected and to assess the data's quality and usability.

R

radioactive waste Any waste that emits energy as rays, waves, streams, or energetic particles. Radioactive materials are often mixed with hazardous waste from nuclear reactors, research institutions, or hospitals.

S

saltation The movement of hard particles such as sand over an uneven surface in a turbulent flow of air or water.

Sandia Management Model A web-based, interactive description of Sandia, describing activities, responsibilities, and success rates. This model is a high-level depiction intended to be viewed by a broad audience for a comprehensible and dynamic experience in understanding how Sandia operates.

T

tritium A radioactive hydrogen isotope with an atomic mass of 3 and a half-life of 12.5 years, prepared artificially for use as a tracer and as a constituent of hydrogen bombs.

U

underground storage tank (UST) A storage tank installed completely below grade, covered with earth, and used to contain oil of any kind (petroleum, non-petroleum, synthetic, animal, or vegetable). USTs at SNL are double-wall, fiberglass-reinforced plastic construction.

U.S. Forest Service (USFS) withdrawal area

A portion of Kirtland Air Force Base consisting of land within the Cibola National Forest that has been withdrawn from public access for use by the U.S. Air Force and the DOE.

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- Toxic Substances Control Act (TSCA) of 1976 (15 U.S.C. §2601 et seq.).

Note: U.S.C. = United States Code.

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Hawai'i Administrative Rules (HAR), Title 11, Chapter 59, "Ambient Air Quality Standards."

State of Nevada Environmental Regulations

Nevada regulatory information can be found at the Nevada State Legislature website:

<http://www.leg.state.nv.us/>.

A listing of the Nevada Administration Code (NAC) can be found at *<http://www.leg.state.nv.us/NAC>*.

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Appendix A. 2015 SNL/TTR Terrestrial Surveillance Results



Joshua tree (*Yucca brevifolia*)

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Appendix A presents the SNL/TTR terrestrial surveillance results for calendar year 2015.

Table A-1. Radiological results for off-site soil sampling locations, calendar year 2015

Location	Analyte	Activity	MDA (pCi/g)	Data Qualifiers	Data Validation Qualifiers	Analytical Method
C-20	Americium-241	.0388 ± .0878	0.147	U	BD	HASL 300
	Cesium-137	.0308 ± .0149	0.0195		J	HASL 300
	Uranium-235	.0685 ± .0931	0.111	U	BD	HASL 300
	Uranium-238	1.02 ± 1.23	1.12	U	BD	HASL 300
C-21	Americium-241	.0398 ± .0328	0.0452	U	BD	HASL 300
	Cesium-137	.2 ± .0342	0.0269		None	HASL 300
	Uranium-235	.101 ± .21	0.143	U	BD	HASL 300
	Uranium-238	1.84 ± .772	0.448		None	HASL 300
C-22	Americium-241	.0376 ± .0395	0.0457	U	BD	HASL 300
	Cesium-137	.121 ± .0278	0.0253		None	HASL 300
	Uranium-238	1.45 ± .601	0.435		None	HASL 300
C-23	Americium-241	.048 ± .0568	0.0905	U	BD	HASL 300
	Cesium-137	.143 ± .0386	0.0313		None	HASL 300
	Uranium-235	.0565 ± .145	0.172	U	BD	HASL 300
	Uranium-238	1.32 ± .94	0.834		J	HASL 300
C-24	Americium-241	-.0325 ± .0947	0.153	U	BD	HASL 300
	Cesium-137	.149 ± .0343	0.0315		None	HASL 300
	Uranium-235	.0922 ± .139	0.19	U	BD	HASL 300
	Uranium-238	1.48 ± 1.36	1.3		J	HASL 300
C-25	Americium-241	.112 ± .119	0.167	U	BD	HASL 300
	Cesium-137	.23 ± .0341	0.0302		None	HASL 300
	Uranium-235	-.0559 ± .11	0.174	U	BD	HASL 300
	Uranium-238	.702 ± 1.11	1.35	U	BD	HASL 300
C-26	Americium-241	.0221 ± .0625	0.108	U	BD	HASL 300
	Cesium-137	.317 ± .0324	0.0191		None	HASL 300
	Uranium-235	.0992 ± .101	0.111	U	BD	HASL 300
	Uranium-238	1.15 ± .963	0.89		J	HASL 300
C-27	Americium-241	.0184 ± .0191	0.0287	U	BD	HASL 300
	Cesium-137	.431 ± .045	0.0267		None	HASL 300
	Uranium-235	.107 ± .0741	0.0974		J	HASL 300
	Uranium-238	1.18 ± .405	0.283		None	HASL 300
C-28	Americium-241	-.00903 ± .0205	0.0278	U	BD	HASL 300
	Cesium-137	.29 ± .0369	0.0261		None	HASL 300
	Uranium-235	.0311 ± .0596	0.0937	U	BD	HASL 300
	Uranium-238	.886 ± .379	0.278		None	HASL 300
C-29	Americium-241	.0774 ± .0698	0.1	U	BD	HASL 300
	Americium-241	.0306 ± .0397	0.0618	U	BD	HASL 300
	Americium-241	.126 ± .114	0.142	U	BD	HASL 300
	Cesium-137	.144 ± .0248	0.0233		None	HASL 300
	Cesium-137	.204 ± .0259	0.0181		None	HASL 300
	Cesium-137	.129 ± .0222	0.0212		None	HASL 300
	Uranium-235	.106 ± .108	0.113	U	BD	HASL 300
	Uranium-235	.0832 ± .101	0.119	U	BD	HASL 300
	Uranium-235	.106 ± .133	0.14	U	BD	HASL 300

Table A-1. Radiological results for off-site soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Activity	MDA (pCi/g)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
C-29	Uranium-238	1.48 ± .75	0.559		J	HASL 300
	Uranium-238	1.16 ± .866	0.829		J	HASL 300
C-30	Americium-241	-.0123 ± .0689	0.118	U	BD	HASL 300
	Cesium-137	.13 ± .03	0.0295		None	HASL 300
	Uranium-235	.0142 ± .0976	0.175	U	BD	HASL 300
C-31	Americium-241	.0446 ± .0275	0.0446	U	BD	HASL 300
	Cesium-137	.18 ± .022	0.0193		None	HASL 300
	Uranium-235	.0426 ± .0954	0.0979	U	BD	HASL 300
	Uranium-238	1.27 ± .426	0.302		None	HASL 300
C-32	Cesium-137	.0556 ± .0282	0.032		J	HASL 300
	Uranium-235	.129 ± .17	0.168	U	BD	HASL 300
	Uranium-238	.572 ± 1.29	1.15	U	BD	HASL 300
C-33	Americium-241	.0822 ± .0668	0.0945	U	BD	HASL 300
	Cesium-137	.118 ± .0395	0.0333		None	HASL 300
	Uranium-235	.178 ± .171	0.189	U	BD	HASL 300
	Uranium-238	2.27 ± 1.16	0.841		J	HASL 300

See notes at end of appendix.

Table A-2. Radiological results for perimeter soil sampling locations, calendar year 2015

Location	Analyte	Activity	MDA (pCi/g)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
P-06	Americium-241	.0214 ± .0433	0.0697	U	BD	HASL 300
	Cesium-137	.092 ± .0259	0.0245		None	HASL 300
	Uranium-235	.0611 ± .106	0.128	U	BD	HASL 300
	Uranium-238	1.36 ± .593	0.625		J	HASL 300
P-08	Americium-241	.0496 ± .0626	0.0984	U	BD	HASL 300
	Cesium-137	.0892 ± .0246	0.0272		None	HASL 300
	Uranium-235	.0451 ± .092	0.169	U	BD	HASL 300
P-11	Americium-241	.0201 ± .0924	0.151	U	BD	HASL 300
	Americium-241	.00618 ± .0524	0.0871	U	BD	HASL 300
	Cesium-137	.367 ± .0406	0.0219		None	HASL 300
	Cesium-137	.435 ± .0487	0.0217		None	HASL 300
	Uranium-235	.0681 ± .114	0.131	U	BD	HASL 300
	Uranium-235	.0404 ± .104	0.124	U	BD	HASL 300
	Uranium-238	2.02 ± 1.53	1.19		J	HASL 300
	Uranium-238	1.49 ± 1.05	0.761		J	HASL 300
P-12	Americium-241	.0207 ± .0236	0.0388	U	BD	HASL 300
	Cesium-137	.295 ± .0407	0.0277		None	HASL 300
	Uranium-235	.035 ± .113	0.116	U	BD	HASL 300
	Uranium-238	1.2 ± .546	0.384		None	HASL 300
P-34	Americium-241	.0217 ± .0433	0.0717	U	BD	HASL 300
	Cesium-137	.271 ± .0286	0.0172		None	HASL 300
	Uranium-235	.11 ± .0983	0.0988		J	HASL 300
	Uranium-238	1.6 ± .963	0.619		J	HASL 300
P-35	Americium-241	.0665 ± .071	0.109	U	BD	HASL 300
	Cesium-137	.266 ± .0324	0.0229		None	HASL 300
	Uranium-235	.0255 ± .13	0.145	U	BD	HASL 300
	Uranium-238	1.2 ± 1.04	0.927		J	HASL 300
P-36	Americium-241	.0495 ± .0761	0.13	U	BD	HASL 300
	Cesium-137	.106 ± .0283	0.0294		None	HASL 300
	Uranium-235	.167 ± .2	0.176	U	BD	HASL 300
	Uranium-238	1.04 ± 1.23	1.07	U	BD	HASL 300
P-37	Americium-241	-.0151 ± .0695	0.119	U	BD	HASL 300
	Cesium-137	.0367 ± .0281	0.0331		J	HASL 300
	Uranium-235	.086 ± .162	0.169	U	BD	HASL 300
	Uranium-238	1.32 ± 1.09	1.04		J	HASL 300

See notes at end of appendix.

Table A-3. Radiological results for south plume area soil sampling locations, calendar year 2015

Location	Analyte	Activity	MDA (pCi/g)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-48	Americium-241	.065 ± .082	0.134	U	BD	HASL 300
	Cesium-137	.197 ± .0245	0.0203		None	HASL 300
	Uranium-235	.0682 ± .109	0.117	U	BD	HASL 300
	Uranium-238	.997 ± 1.05	1.04	U	BD	HASL 300
S-49	Americium-241	.502 ± .0566	0.0384		None	HASL 300
	Cesium-137	.436 ± .0444	0.0256		None	HASL 300
	Plutonium-238	.048 ± .0237	0.0444		J	DOE EML HASL-300, Pu
	Plutonium-239/240	1.01 ± .137	0.0519	*	J	DOE EML HASL-300, Pu
	Uranium-235	.198 ± .121	0.134		J	HASL 300
	Uranium-238	1.39 ± .539	0.374		None	HASL 300
S-50	Americium-241	.074 ± .114	0.123	U	BD	HASL 300
	Cesium-137	.47 ± .0453	0.0207		None	HASL 300
	Uranium-235	.128 ± .119	0.112		J	HASL 300
	Uranium-238	.572 ± .993	0.975	U	BD	HASL 300
S-51	Americium-241	8.63 ± .803	0.0552		None	HASL 300
	Cesium-137	.282 ± .0372	0.0316		None	HASL 300
	Plutonium-238	2.75 ± 2.18	5.36	U	BD	DOE EML HASL-300, Pu
	Plutonium-239/240	132 ± 19	6.26	*	J+	DOE EML HASL-300, Pu
	Uranium-235	.187 ± .166	0.163		J	HASL 300
	Uranium-238	1.34 ± .668	0.521		J	HASL 300
S-52	Americium-241	.216 ± .15	0.217	U	BD	HASL 300
	Cesium-137	.101 ± .0213	0.0223		None	HASL 300
	Uranium-235	.0824 ± .115	0.142	U	BD	HASL 300
	Uranium-238	1.43 ± 1.43	1.45	U	BD	HASL 300

See notes at end of appendix.

Table A-4. Radiological results for range operations center on-site soil sampling locations, calendar year 2015

Location	Analyte	Activity	MDA (pCi/g)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-40	Americium-241	.0949 ± .0938	0.146	U	BD	HASL 300
	Cesium-137	.0727 ± .0227	0.0228		None	HASL 300
	Uranium-235	.186 ± .152	0.126		J	HASL 300
	Uranium-238	1.24 ± 1.24	1.14		J	HASL 300
S-41	Americium-241	.0167 ± .0833	0.148	U	BD	HASL 300
	Cesium-137	.0271 ± .0165	0.0216		J	HASL 300
	Uranium-235	.0575 ± .0986	0.119	U	BD	HASL 300
	Uranium-238	2.71 ± 1.48	1.14		J	HASL 300
S-42	Americium-241	.082 ± .0734	0.112	U	BD	HASL 300
	Cesium-137	.223 ± .0263	0.02		None	HASL 300
	Uranium-235	.0165 ± .107	0.112	U	BD	HASL 300
	Uranium-238	1.35 ± 1.09	0.888		J	HASL 300
S-43	Americium-241	.0433 ± .0417	0.0627	U	BD	HASL 300
	Cesium-137	.0442 ± .0165	0.021		J	HASL 300
	Uranium-235	.104 ± .114	0.117	U	BD	HASL 300
	Uranium-238	1.83 ± .811	0.564		None	HASL 300
S-44	Americium-241	.0153 ± .103	0.184	U	BD	HASL 300
	Cesium-137	.133 ± .0324	0.0315		None	HASL 300
	Uranium-235	.138 ± .185	0.194	U	BD	HASL 300
	Uranium-238	1.81 ± 1.62	1.51		J	HASL 300
S-45	Americium-241	.0935 ± .0502	0.165	U	BD	HASL 300
	Cesium-137	.0468 ± .031	0.0468	U	BD	HASL 300
	Uranium-235	.12 ± .176	0.203	U	BD	HASL 300
	Uranium-238	2.16 ± 1.29	1.42		J	HASL 300
S-46	Americium-241	.0142 ± .0754	0.0952	U	BD	HASL 300
	Cesium-137	.0564 ± .0282	0.0291		J	HASL 300
	Uranium-235	.103 ± .188	0.173	U	BD	HASL 300
	Uranium-238	.452 ± .813	0.864	U	BD	HASL 300
S-47	Americium-241	.044 ± .1	0.171	U	BD	HASL 300
	Cesium-137	.121 ± .0333	0.0277		None	HASL 300
	Uranium-235	.114 ± .146	0.178	U	BD	HASL 300
	Uranium-238	2 ± 1.55	1.41		J	HASL 300

See notes at end of appendix.

Table A-5. Radiological results for various on-site soil sampling locations, calendar year 2015

Location	Analyte	Activity	MDA (pCi/g)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-02	Americium-241	.0674 ± .0824	0.107	U	BD	HASL 300
	Cesium-137	.251 ± .0293	0.0249		None	HASL 300
	Uranium-235	.085 ± .106	0.142	U	BD	HASL 300
	Uranium-238	1.65 ± .996	0.903		J	HASL 300
S-03	Cesium-137	.218 ± .0316	0.022		None	HASL 300
	Uranium-235	.0252 ± .119	0.125	U	BD	HASL 300
	Uranium-238	1.7 ± 1.34	1.04		J	HASL 300
S-04	Americium-241	-.0116 ± .0892	0.15	U	BD	HASL 300
	Cesium-137	.248 ± .0338	0.0206		None	HASL 300
	Uranium-235	.0335 ± .0753	0.119	U	BD	HASL 300
	Uranium-238	.856 ± 1.11	1.15	U	BD	HASL 300
S-09	Americium-241	2.03 ± .209	0.118		None	HASL 300
	Cesium-137	.173 ± .0254	0.022		None	HASL 300
	Plutonium-238	.0883 ± .0321	0.0399		J	DOE EML HASL-300, Pu
	Plutonium-239/240	11.3 ± 1.14	0.0467	*	J	DOE EML HASL-300, Pu
	Uranium-235	.22 ± .141	0.132		J	HASL 300
	Uranium-238	1.1 ± .901	0.98		J	HASL 300
S-10	Americium-241	.061 ± .0412	0.061	U	BD	HASL 300
	Cesium-137	.0915 ± .0269	0.0312		J	HASL 300
	Uranium-235	.255 ± .134	0.155		J	HASL 300
	Uranium-238	1.07 ± .576	0.442		J	HASL 300
S-38	Americium-241	.025 ± .0802	0.13	U	BD	HASL 300
	Cesium-137	.14 ± .0236	0.0217		None	HASL 300
	Uranium-235	.025 ± .102	0.119	U	BD	HASL 300
	Uranium-238	.644 ± 1.26	1.04	U	BD	HASL 300
S-39	Cesium-137	.655 ± .0631	0.0251		None	HASL 300
	Uranium-235	-.0223 ± .0968	0.165	U	BD	HASL 300
	Uranium-238	1.48 ± 1.49	1.64	U	BD	HASL 300
S-53	Americium-241	.0583 ± .0651	0.104	U	BD	HASL 300
	Cesium-137	.167 ± .0365	0.0366		None	HASL 300
	Uranium-235	-.00296 ± .11	0.194	U	BD	HASL 300
	Uranium-238	1.56 ± 1.09	0.94		J	HASL 300

See notes at end of appendix.

Table A-6. TLD measurements by quarter and location class, fiscal year 2015

Location Class	Location Number	1st Quarter (97 Days)		2nd Quarter (89 Days)		3rd Quarter (92 Days)		4th Quarter (92 Days)	
		Exposure (mR)	Total Propagated Uncertainty						
On-Site	S-01	50.0	3.4	40.2	0.8	35.7	1.1	35.1	0.9
	S-02	44.7	0.8	38.6	1.4	36.2	1.0	34.9	1.2
	S-03	45.3	3.4	40.7	1.2	37.8	0.9	35.6	1.0
	S-04	45.8	1.1	40.7	1.6	37.3	1.1	35.6	0.6
	S-09	42.0	1.4	35.5	1.3	33.6	1.0	31.3	0.8
	S-10	45.2	0.7	40.4	1.6	36.4	0.9	36.0	0.5
	S-13	43.0	1.5	40.3	1.9	36.5	1.0	37.0	4.8
	S-14	40.1	1.1	35.8	0.7	33.0	1.3	32.6	2.1
	S-15	43.9	0.8	40.4	1.2	37.0	0.9	35.6	1.8
	S-16	45.0	1.7	39.9	0.8	38.1	1.5	34.5	1.0
	S-17	45.2	2.3	38.3	2.3	37.3	1.6	33.8	0.5
Perimeter	P-05	44.5	0.9	39.2	1.2	36.7	1.2	35.1	0.4
	P-06	44.0	0.7	37.8	1.3	34.6	1.2	33.4	1.1
	P-07	41.5	0.7	37.4	1.5	33.0	1.2	32.2	0.7
	P-08	40.0	0.7	35.6	1.4	32.8	1.1	31.0	0.5
	P-11	52.5	1.3	46.4	0.8	42.5	1.4	40.8	0.4
	P-12	41.6	1.5	39.7	1.9	36.0	0.9	34.6	0.9
Community	C-19	33.7	2.2	29.6	0.7	27.2	1.1	25.9	0.4
	C-21	45.2	0.7	37.3	1.1	35.3	1.6	35.8	1.6
	C-22	42.5	0.7	37.2	0.9	34.1	0.9	32.3	1.0

See notes at end of appendix.

Table A-7. Nonradiological results for south plume area soil sampling locations, calendar year 2015

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-48	Aluminum	13500	14.3	47.5		J	SW846 3050B/6020
	Antimony	0.311	0.311	0.943	NU	UJ	SW846 3050B/6010B
	Arsenic	2.96	0.19	0.951		None	SW846 3050B/6020
	Barium	244	0.475	1.9		J	SW846 3050B/6020
	Beryllium	0.599	0.019	0.0951		None	SW846 3050B/6020
	Cadmium	0.176	0.019	0.19	J	None	SW846 3050B/6020
	Calcium	5170	6.27	19		None	SW846 3050B/6020
	Chromium	6.37	0.19	0.57		None	SW846 3050B/6020
	Cobalt	3.94	0.057	0.19		None	SW846 3050B/6020
	Copper	7.44	0.0627	0.19		None	SW846 3050B/6020
	Iron	10400	31.4	95.1		J	SW846 3050B/6020
	Lead	10.8	0.0951	0.38		None	SW846 3050B/6020
	Magnesium	5530	1.9	5.7		None	SW846 3050B/6020
	Manganese	480	0.951	4.75		None	SW846 3050B/6020
	Nickel	6.31	0.0951	0.38		None	SW846 3050B/6020
	Potassium	5820	76	285		None	SW846 3050B/6020
	Selenium	0.956	0.314	0.951		None	SW846 3050B/6020
	Silver	0.0943	0.0943	0.472	U	None	SW846 3050B/6010B
	Sodium	776	15.2	47.5	N	None	SW846 3050B/6020
	Thallium	0.14	0.057	0.38	J	None	SW846 3050B/6020
Uranium	0.517	0.0125	0.038		None	SW846 3050B/6020	
Vanadium	27.2	0.0943	0.472	*	None	SW846 3050B/6010B	
Zinc	33.3	0.38	1.9		J	SW846 3050B/6020	
S-49	Aluminum	13400	13.9	46.4		J	SW846 3050B/6020
	Antimony	0.314	0.314	0.951	NU	UJ	SW846 3050B/6010B
	Arsenic	3.41	0.186	0.928		None	SW846 3050B/6020
	Barium	250	0.464	1.86		J	SW846 3050B/6020
	Beryllium	0.617	0.0186	0.0928		None	SW846 3050B/6020
	Cadmium	0.271	0.0186	0.186		None	SW846 3050B/6020
	Calcium	6730	6.12	18.6		None	SW846 3050B/6020

See notes at end of appendix.

Table A-7. Nonradiological results for south plume area soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-49	Chromium	6.1	0.186	0.557		None	SW846 3050B/6020
	Cobalt	3.86	0.0557	0.186		None	SW846 3050B/6020
	Copper	7.51	0.0612	0.186		None	SW846 3050B/6020
	Iron	9470	30.6	92.8		J	SW846 3050B/6020
	Lead	11.3	0.0928	0.371		None	SW846 3050B/6020
	Magnesium	5850	1.86	5.57		None	SW846 3050B/6020
	Manganese	536	0.928	4.64		None	SW846 3050B/6020
	Nickel	6.29	0.0928	0.371		None	SW846 3050B/6020
	Potassium	6730	74.2	278		None	SW846 3050B/6020
	Selenium	0.995	0.306	0.928		None	SW846 3050B/6020
	Silver	0.0951	0.0951	0.475	U	None	SW846 3050B/6010B
	Sodium	1050	14.8	46.4	N	None	SW846 3050B/6020
	Thallium	0.135	0.0557	0.371	J	None	SW846 3050B/6020
	Uranium	0.675	0.0122	0.0371		None	SW846 3050B/6020
	Vanadium	21.5	0.0951	0.475	*	None	SW846 3050B/6010B
Zinc	35.2	0.371	1.86		J	SW846 3050B/6020	
S-50	Aluminum	10300	14.6	48.8		J	SW846 3050B/6020
	Antimony	0.32	0.32	0.969	NU	UJ	SW846 3050B/6010B
	Arsenic	3.34	0.195	0.977		None	SW846 3050B/6020
	Barium	202	0.488	1.95		J	SW846 3050B/6020
	Beryllium	0.5	0.0195	0.0977		None	SW846 3050B/6020
	Cadmium	0.285	0.0195	0.195		None	SW846 3050B/6020
	Calcium	5090	6.45	19.5		None	SW846 3050B/6020
	Chromium	5.24	0.195	0.586		None	SW846 3050B/6020
	Cobalt	3.66	0.0586	0.195		None	SW846 3050B/6020
	Copper	6.54	0.0645	0.195		None	SW846 3050B/6020
	Iron	9150	32.2	97.7		J	SW846 3050B/6020
	Lead	20.9	0.0977	0.391		None	SW846 3050B/6020
	Magnesium	4740	1.95	5.86		None	SW846 3050B/6020

See notes at end of appendix.

Table A-7. Nonradiological results for south plume area soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-50	Manganese	526	0.977	4.88		None	SW846 3050B/6020
	Nickel	5.25	0.0977	0.391		None	SW846 3050B/6020
	Potassium	5010	78.1	293		None	SW846 3050B/6020
	Selenium	0.812	0.322	0.977	J	None	SW846 3050B/6020
	Silver	0.127	0.0969	0.484	J	None	SW846 3050B/6010B
	Sodium	1040	15.6	48.8	N	None	SW846 3050B/6020
	Thallium	0.127	0.0586	0.391	J	None	SW846 3050B/6020
	Uranium	0.461	0.0129	0.0391		None	SW846 3050B/6020
	Vanadium	29.6	0.0969	0.484	*	None	SW846 3050B/6010B
	Zinc	34	0.391	1.95		J	SW846 3050B/6020
S-51	Aluminum	12300	13.6	45.2		J	SW846 3050B/6020
	Antimony	0.383	0.302	0.916	JN	J-	SW846 3050B/6010B
	Arsenic	3.95	0.181	0.904		None	SW846 3050B/6020
	Barium	189	0.452	1.81		J	SW846 3050B/6020
	Beryllium	0.616	0.0181	0.0904		None	SW846 3050B/6020
	Cadmium	0.209	0.0181	0.181		None	SW846 3050B/6020
	Calcium	7300	5.97	18.1		None	SW846 3050B/6020
	Chromium	6.03	0.181	0.542		None	SW846 3050B/6020
	Cobalt	4.27	0.0542	0.181		None	SW846 3050B/6020
	Copper	7.14	0.0597	0.181		None	SW846 3050B/6020
	Iron	10300	29.8	90.4		J	SW846 3050B/6020
	Lead	10.7	0.0904	0.362		None	SW846 3050B/6020
	Magnesium	4380	1.81	5.42		None	SW846 3050B/6020
	Manganese	579	0.904	4.52		None	SW846 3050B/6020
	Nickel	6.14	0.0904	0.362		None	SW846 3050B/6020
	Potassium	5210	72.3	271		None	SW846 3050B/6020
	Selenium	0.944	0.298	0.904		None	SW846 3050B/6020
	Silver	0.0916	0.0916	0.458	U	None	SW846 3050B/6010B
	Sodium	420	14.5	45.2	N	None	SW846 3050B/6020
	Thallium	0.143	0.0542	0.362	J	None	SW846 3050B/6020
Uranium	0.75	0.0119	0.0362		None	SW846 3050B/6020	

See notes at end of appendix.

Table A-7. Nonradiological results for south plume area soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-51	Vanadium	19.9	0.0916	0.458	*	None	SW846 3050B/6010B
	Zinc	32.2	0.362	1.81		J	SW846 3050B/6020
S-52	Aluminum	7190	2.75	9.17		J	SW846 3050B/6020
	Antimony	0.387	0.321	0.973	JN	J-	SW846 3050B/6010B
	Arsenic	3.11	0.183	0.917		None	SW846 3050B/6020
	Barium	94.3	0.0917	0.367		J	SW846 3050B/6020
	Beryllium	0.412	0.0183	0.0917		None	SW846 3050B/6020
	Cadmium	0.156	0.0183	0.183	J	None	SW846 3050B/6020
	Calcium	2190	6.06	18.3		None	SW846 3050B/6020
	Chromium	3.88	0.183	0.55		None	SW846 3050B/6020
	Cobalt	2.48	0.055	0.183		None	SW846 3050B/6020
	Copper	4.71	0.0606	0.183		None	SW846 3050B/6020
	Iron	6590	30.3	91.7		J	SW846 3050B/6020
	Lead	7.52	0.0917	0.367		None	SW846 3050B/6020
	Magnesium	2350	1.83	5.5		None	SW846 3050B/6020
	Manganese	333	0.917	4.59		None	SW846 3050B/6020
	Nickel	3.72	0.0917	0.367		None	SW846 3050B/6020
	Potassium	2840	73.4	275		None	SW846 3050B/6020
	Selenium	0.646	0.303	0.917	J	None	SW846 3050B/6020
	Silver	0.0973	0.0973	0.486	U	None	SW846 3050B/6010B
	Sodium	239	14.7	45.9	N	None	SW846 3050B/6020
	Thallium	0.0923	0.055	0.367	J	None	SW846 3050B/6020
Uranium	0.675	0.0121	0.0367		None	SW846 3050B/6020	
Vanadium	12	0.0973	0.486	*	None	SW846 3050B/6010B	
Zinc	22.2	0.367	1.83		J	SW846 3050B/6020	

See notes at end of appendix.

Table A-8. Non-radiological results for various on-site soil sampling locations, calendar year 2015

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-02	Aluminum	9690	13.5	45.1		J	SW846 3050B/6020
	Antimony	0.324	0.324	0.98	NU	UJ	SW846 3050B/6010B
	Arsenic	4.61	0.181	0.903		NONE	SW846 3050B/6020
	Barium	128	0.0903	0.361		J	SW846 3050B/6020
	Beryllium	0.578	0.0181	0.0903		NONE	SW846 3050B/6020
	Cadmium	0.117	0.0181	0.181	J	NONE	SW846 3050B/6020
	Calcium	2850	5.96	18.1		NONE	SW846 3050B/6020
	Chromium	4.57	0.181	0.542		NONE	SW846 3050B/6020
	Cobalt	3.31	0.0542	0.181		NONE	SW846 3050B/6020
	Copper	4.7	0.0596	0.181		NONE	SW846 3050B/6020
	Iron	7910	29.8	90.3		J	SW846 3050B/6020
	Lead	9.06	0.0903	0.361		NONE	SW846 3050B/6020
	Magnesium	3440	1.81	5.42		NONE	SW846 3050B/6020
	Manganese	426	0.903	4.51		NONE	SW846 3050B/6020
	Nickel	4.97	0.0903	0.361		NONE	SW846 3050B/6020
	Potassium	3700	72.2	271		NONE	SW846 3050B/6020
	Selenium	0.907	0.298	0.903		NONE	SW846 3050B/6020
	Silver	0.098	0.098	0.49	U	NONE	SW846 3050B/6010B
	Sodium	496	14.4	45.1	N	NONE	SW846 3050B/6020
	Thallium	0.148	0.0542	0.361	J	NONE	SW846 3050B/6020
Uranium	0.835	0.0119	0.0361		NONE	SW846 3050B/6020	
Vanadium	14.1	0.098	0.49	*	NONE	SW846 3050B/6010B	
Zinc	28.5	0.361	1.81		J	SW846 3050B/6020	
S-03	Aluminum	8390	2.88	9.6		J	SW846 3050B/6020
	Antimony	0.309	0.309	0.936	NU	UJ	SW846 3050B/6010B
	Arsenic	3.47	0.192	0.96		NONE	SW846 3050B/6020
	Barium	107	0.096	0.384		J	SW846 3050B/6020
	Beryllium	0.455	0.0192	0.096		NONE	SW846 3050B/6020
	Cadmium	0.208	0.0192	0.192		NONE	SW846 3050B/6020
	Calcium	2190	6.33	19.2		NONE	SW846 3050B/6020
	Chromium	4.97	0.192	0.576		NONE	SW846 3050B/6020

See notes at end of appendix.

Table A-8. Nonradiological results for various on-site soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-03	Cobalt	3.12	0.0576	0.192		NONE	SW846 3050B/6020
	Copper	5.56	0.0633	0.192		NONE	SW846 3050B/6020
	Iron	8270	31.7	96		J	SW846 3050B/6020
	Lead	8.71	0.096	0.384		NONE	SW846 3050B/6020
	Magnesium	3190	1.92	5.76		NONE	SW846 3050B/6020
	Manganese	363	0.96	4.8		NONE	SW846 3050B/6020
	Nickel	4.64	0.096	0.384		NONE	SW846 3050B/6020
	Potassium	2840	76.8	288		NONE	SW846 3050B/6020
	Selenium	0.733	0.317	0.96	J	NONE	SW846 3050B/6020
	Silver	0.0936	0.0936	0.468	U	NONE	SW846 3050B/6010B
	Sodium	291	15.4	48	N	NONE	SW846 3050B/6020
	Thallium	0.104	0.0576	0.384	J	NONE	SW846 3050B/6020
	Uranium	0.708	0.0127	0.0384		NONE	SW846 3050B/6020
	Vanadium	15.6	0.0936	0.468	*	NONE	SW846 3050B/6010B
Zinc	25.7	0.384	1.92		J	SW846 3050B/6020	
S-04	Aluminum	6530	2.94	9.78		J	SW846 3050B/6020
	Antimony	0.317	0.317	0.96	NU	UJ	SW846 3050B/6010B
	Arsenic	3.41	0.196	0.978		NONE	SW846 3050B/6020
	Barium	101	0.0978	0.391		J	SW846 3050B/6020
	Beryllium	0.457	0.0196	0.0978		NONE	SW846 3050B/6020
	Cadmium	0.224	0.0196	0.196		NONE	SW846 3050B/6020
	Calcium	2670	6.46	19.6		NONE	SW846 3050B/6020
	Chromium	3.46	0.196	0.587		NONE	SW846 3050B/6020
	Cobalt	2.26	0.0587	0.196		NONE	SW846 3050B/6020
	Copper	4.13	0.0646	0.196		NONE	SW846 3050B/6020
	Iron	6560	32.3	97.8		J	SW846 3050B/6020
	Lead	7.71	0.0978	0.391		NONE	SW846 3050B/6020
	Magnesium	3070	1.96	5.87		NONE	SW846 3050B/6020
	Manganese	392	0.978	4.89		NONE	SW846 3050B/6020
Nickel	3.05	0.0978	0.391		NONE	SW846 3050B/6020	

See notes at end of appendix.

Table A-8. Nonradiological results for various on-site soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-04	Potassium	3210	78.3	294		NONE	SW846 3050B/6020
	Selenium	0.572	0.323	0.978	J	NONE	SW846 3050B/6020
	Silver	0.096	0.096	0.48	U	NONE	SW846 3050B/6010B
	Sodium	260	15.7	48.9	N	NONE	SW846 3050B/6020
	Thallium	0.0998	0.0587	0.391	J	NONE	SW846 3050B/6020
	Uranium	0.617	0.0129	0.0391		NONE	SW846 3050B/6020
	Vanadium	11	0.096	0.48	*	NONE	SW846 3050B/6010B
	Zinc	24.7	0.391	1.96		J	SW846 3050B/6020
S-09	Aluminum	12400	14.4	48		J	SW846 3050B/6020
	Antimony	0.325	0.325	0.986	NU	UJ	SW846 3050B/6010B
	Arsenic	3.7	0.192	0.96		NONE	SW846 3050B/6020
	Barium	153	0.096	0.384		J	SW846 3050B/6020
	Beryllium	0.669	0.0192	0.096		NONE	SW846 3050B/6020
	Cadmium	0.13	0.0192	0.192	J	NONE	SW846 3050B/6020
	Calcium	6460	6.33	19.2		NONE	SW846 3050B/6020
	Chromium	6.84	0.192	0.576		NONE	SW846 3050B/6020
	Cobalt	6.01	0.0576	0.192		NONE	SW846 3050B/6020
	Copper	7.3	0.0633	0.192		NONE	SW846 3050B/6020
	Iron	13900	31.7	96		J	SW846 3050B/6020
	Lead	11.1	0.096	0.384		NONE	SW846 3050B/6020
	Magnesium	5140	1.92	5.76		NONE	SW846 3050B/6020
	Manganese	478	0.96	4.8		NONE	SW846 3050B/6020
	Nickel	6.33	0.096	0.384		NONE	SW846 3050B/6020
	Potassium	3880	76.8	288		NONE	SW846 3050B/6020
	Selenium	0.88	0.317	0.96	J	NONE	SW846 3050B/6020
	S-09	Silver	0.0986	0.0986	0.493	U	UJ
Sodium		260	15.4	48	N	NONE	SW846 3050B/6020
Thallium		0.197	0.0576	0.384	J	NONE	SW846 3050B/6020
Uranium		0.635	0.0127	0.0384		NONE	SW846 3050B/6020
Vanadium		34.3	0.0986	0.493	*	NONE	SW846 3050B/6010B

See notes at end of appendix.

Table A-8. Nonradiological results for various on-site soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-09	Zinc	38	0.384	1.92		J	SW846 3050B/6020
S-10	Aluminum	8310	2.81	9.36		J	SW846 3050B/6020
	Antimony	0.313	0.313	0.947	NU	UJ	SW846 3050B/6010B
	Arsenic	3.45	0.187	0.936		NONE	SW846 3050B/6020
	Barium	119	0.0936	0.375		J	SW846 3050B/6020
	Beryllium	0.487	0.0187	0.0936		NONE	SW846 3050B/6020
	Cadmium	0.147	0.0187	0.187	J	NONE	SW846 3050B/6020
	Calcium	3960	6.18	18.7		NONE	SW846 3050B/6020
	Chromium	4.2	0.187	0.562		NONE	SW846 3050B/6020
	Cobalt	3.04	0.0562	0.187		NONE	SW846 3050B/6020
	Copper	5	0.0618	0.187		NONE	SW846 3050B/6020
	Iron	8250	30.9	93.6		J	SW846 3050B/6020
	Lead	7.05	0.0936	0.375		NONE	SW846 3050B/6020
	Magnesium	3560	1.87	5.62		NONE	SW846 3050B/6020
	Manganese	395	0.936	4.68		NONE	SW846 3050B/6020
	Nickel	4.07	0.0936	0.375		NONE	SW846 3050B/6020
	Potassium	3780	74.9	281		NONE	SW846 3050B/6020
	Selenium	0.672	0.309	0.936	J	NONE	SW846 3050B/6020
	Silver	0.0947	0.0947	0.473	U	NONE	SW846 3050B/6010B
	Sodium	555	15	46.8	N	NONE	SW846 3050B/6020
	Thallium	0.103	0.0562	0.375	J	NONE	SW846 3050B/6020
Uranium	0.569	0.0124	0.0375		NONE	SW846 3050B/6020	
Vanadium	14.1	0.0947	0.473	*	NONE	SW846 3050B/6010B	
Zinc	29.5	0.375	1.87		J	SW846 3050B/6020	
S-38	Aluminum	12000	13.9	46.5		J	SW846 3050B/6020
	Antimony	0.383	0.319	0.965	JN	J-	SW846 3050B/6010B
	Arsenic	4.37	0.186	0.929		NONE	SW846 3050B/6020
	Barium	98.1	0.0929	0.372		J	SW846 3050B/6020
	Beryllium	0.631	0.0186	0.0929		NONE	SW846 3050B/6020

See notes at end of appendix.

Table A-8. Nonradiological results for various on-site soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-38	Cadmium	0.119	0.0186	0.186	J	NONE	SW846 3050B/6020
	Calcium	16900	30.7	92.9		NONE	SW846 3050B/6020
	Chromium	6.21	0.186	0.558		NONE	SW846 3050B/6020
	Cobalt	3.23	0.0558	0.186		NONE	SW846 3050B/6020
	Copper	5.93	0.0613	0.186		NONE	SW846 3050B/6020
	Iron	9330	30.7	92.9		J	SW846 3050B/6020
	Lead	8.5	0.0929	0.372		NONE	SW846 3050B/6020
	Magnesium	5390	1.86	5.58		NONE	SW846 3050B/6020
	Manganese	229	0.929	4.65		NONE	SW846 3050B/6020
	Nickel	6.01	0.0929	0.372		NONE	SW846 3050B/6020
	Potassium	4260	74.3	279		NONE	SW846 3050B/6020
	Selenium	0.656	0.307	0.929	J	NONE	SW846 3050B/6020
	Silver	0.0965	0.0965	0.483	U	NONE	SW846 3050B/6010B
	Sodium	606	14.9	46.5	N	NONE	SW846 3050B/6020
	Thallium	0.142	0.0558	0.372	J	NONE	SW846 3050B/6020
	Uranium	0.794	0.0123	0.0372		NONE	SW846 3050B/6020
	Vanadium	18.6	0.0965	0.483	*	NONE	SW846 3050B/6010B
Zinc	29.4	0.372	1.86		J	SW846 3050B/6020	
S-39	Aluminum	8800	2.81	9.36		J	SW846 3050B/6020
	Antimony	0.403	0.297	0.899	JN	J-	SW846 3050B/6010B
	Arsenic	4.6	0.187	0.936		NONE	SW846 3050B/6020
	Barium	151	0.0936	0.375		J	SW846 3050B/6020
	Beryllium	0.512	0.0187	0.0936		NONE	SW846 3050B/6020
	Cadmium	0.262	0.0187	0.187		NONE	SW846 3050B/6020
	Calcium	4210	6.18	18.7		NONE	SW846 3050B/6020
	Chromium	4.74	0.187	0.562		NONE	SW846 3050B/6020
	Cobalt	3.45	0.0562	0.187		NONE	SW846 3050B/6020
	Copper	5.72	0.0618	0.187		NONE	SW846 3050B/6020
	Iron	8130	30.9	93.6		J	SW846 3050B/6020
	Lead	10.9	0.0936	0.375		NONE	SW846 3050B/6020

See notes at end of appendix.

Table A-8. Nonradiological results for various on-site soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
S-39	Magnesium	4490	1.87	5.62		NONE	SW846 3050B/6020
	Manganese	628	0.936	4.68		NONE	SW846 3050B/6020
	Nickel	4.83	0.0936	0.375		NONE	SW846 3050B/6020
	Potassium	3370	74.9	281		NONE	SW846 3050B/6020
	Selenium	0.728	0.309	0.936	J	NONE	SW846 3050B/6020
	Silver	0.133	0.0899	0.45	J	NONE	SW846 3050B/6010B
	Sodium	310	15	46.8	N	NONE	SW846 3050B/6020
	Thallium	0.115	0.0562	0.375	J	NONE	SW846 3050B/6020
	Uranium	0.702	0.0124	0.0375		NONE	SW846 3050B/6020
	Vanadium	15.7	0.0899	0.45	*	NONE	SW846 3050B/6010B
	Zinc	31.8	0.375	1.87		J	SW846 3050B/6020
S-53	Aluminum	6190	2.85	9.49		J	SW846 3050B/6020
	Antimony	0.439	0.319	0.965	JN	J-	SW846 3050B/6010B
	Arsenic	3.31	0.19	0.949		NONE	SW846 3050B/6020
	Barium	183	0.0949	0.38		J	SW846 3050B/6020
	Beryllium	0.372	0.019	0.0949		NONE	SW846 3050B/6020
	Cadmium	0.118	0.019	0.19	J	NONE	SW846 3050B/6020
	Calcium	6920	6.26	19		NONE	SW846 3050B/6020
	Chromium	3.25	0.19	0.569		NONE	SW846 3050B/6020
	Cobalt	1.89	0.0569	0.19		NONE	SW846 3050B/6020
	Copper	4.25	0.0626	0.19		NONE	SW846 3050B/6020
	Iron	5760	31.3	94.9		J	SW846 3050B/6020
	Lead	5.72	0.0949	0.38		NONE	SW846 3050B/6020
	Magnesium	2550	1.9	5.69		NONE	SW846 3050B/6020
	Manganese	189	0.19	0.949		NONE	SW846 3050B/6020
	Nickel	2.89	0.0949	0.38		NONE	SW846 3050B/6020
	Potassium	3450	75.9	285		NONE	SW846 3050B/6020
	Selenium	0.852	0.313	0.949	J	NONE	SW846 3050B/6020
	Silver	0.0965	0.0965	0.483	U	NONE	SW846 3050B/6010B
	Sodium	687	15.2	47.4	N	NONE	SW846 3050B/6020

See notes at end of appendix.

Table A-8. Nonradiological results for various on-site soil sampling locations, calendar year 2015 (continued)

Location	Analyte	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Lab Data Qualifiers	Data Validation Qualifiers	Analytical Method
	Thallium	0.0873	0.0569	0.38	J	NONE	SW846 3050B/6020
	Uranium	0.53	0.0125	0.038		NONE	SW846 3050B/6020
	Vanadium	14.3	0.0965	0.483	*	NONE	SW846 3050B/6010B
	Zinc	18	0.38	1.9		J	SW846 3050B/6020

See notes at end of appendix.

NOTES:**Units**

mg/kg = milligrams per kilogram

mR = milliroentgen

pCi/g = picocuries per gram

MDL or MDA

MDA = minimal detectable activity or minimum measured activity in a sample required to ensure a 95% probability that the measured activity is accurately quantified above the critical level

MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific

PQL

PQL = practical quantitation limit; the lowest concentration of analytes in a sample that can be determined reliably within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions

Laboratory Data Qualifier

J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL

N = a spike was outside limits

U = analyte is absent or below the method detection limit

* = a replicate was outside limits

Data Validation Qualifier

BD = below detection limit as used in radiochemistry to identify results that are not statistically different from zero

J = associated value is an estimated quantity

J+ = The associated numerical value is an estimated quantity with a suspected positive base

J- = The associated numerical value is an estimated quantity with a suspected negative base

None = no data validation for corrected gross alpha activity

U = The analyte was analyzed for but was not detected. The associated numerical value is the sample quantitation limit

UJ = The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise

Analytical Method

DOE (U.S. Department of Energy) Environmental Measurements Laboratory. 1997. *The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300, 28th ed., vol. 1. New York, NY: DOE.

HASL = Health and Safety Laboratory

EML = Environmental Measurements Laboratory

Appendix B. 2015 SNL/TTR Wastewater Sampling Results



Playa lake, Tonopah Test Range

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Appendix B presents the June 2015.

Table B-1. Sanitary Outfalls of inorganic Analyses, June 2015

Station	Date Collected	Sample ID	Analyte	Result (mg/L)	MDL (mg/L)	Lab Data Qualifiers	Analytical Method
TTR	10-Jun-2015	097887-001	Aluminum	0.459	0.068		SW846 3010/6010B
		097887-001	Arsenic		0.005	U	SW846 3010/6010B
		097887-001	Boron	0.767	0.015		SW846 3010/6010B
		097887-001	Cadmium		0.001	U	SW846 3010/6010B
		097887-001	Chromium	0.00305	0.001	J	SW846 3010/6010B
		097887-001	Copper	0.181	0.003		SW846 3010/6010B
		097887-001	Lead		0.0033	U	SW846 3010/6010B
		097887-001	Mercury	0.000086	0.000067	J	SW846 7470A
		097887-001	Molybdenum	0.0195	0.002		SW846 3010/6010B
		097887-001	Nickel	0.00399	0.0015	J	SW846 3010/6010B
		097887-001	Selenium		0.006	U	SW846 3010/6010B
		097887-001	Silver		0.001	U	SW846 3010/6010B
		097887-001	Zinc	0.237	0.0033		SW846 3010/6010B
		097887-002	Cyanide, total	0.00611	0.00167		SW846 9012B
		097887-003	Solids, total suspended	758	14.3	*	SM 2540D
		097887-007	Phenols, Total	0.103	0.00175	BN	SW846 9066
		097887-008	Grease and oil	18.8	1.14	N	EPA 1664A/1664B
		097887-009	Grease and oil	17.5	1.19	N	EPA 1664A/1664B
		097887-009	Total Petroleum Hydrocarbons	1.95	1.19	JN	EPA 1664A/1664B
		097887-013	Chemical Oxygen Demand	556	6.67		EPA 410.4

See notes at end of appendix.

Table B-2. Summary of Sanitary Outfalls of Radiological Analyses, June 2015

Station	Date Collected	Sample ID	Analyte	Activity (pCi/L)	MDA (pCi/L)	Lab Data Qualifiers	Analytical Method
TTR	10-Jun-2015	097887-010	Actinium-228	-6.8 ± 10.9	13.6	U	EPA 901.1
		097887-010	Americium-241	3.22 ± 6.82	9.87	U	EPA 901.1
		097887-010	Beryllium-7	12.6 ± 17.9	30.6	U	EPA 901.1
		097887-010	Bismuth-212	5.16 ± 24.6	42.9	U	EPA 901.1
		097887-010	Bismuth-214	.0301 ± 8.06	6.51	U	EPA 901.1
		097887-010	Cesium-137	1.36 ± 1.99	3.39	U	EPA 901.1
		097887-010	Cobalt-60	1.56 ± 2.15	3.23	U	EPA 901.1
		097887-010	Lead-212	.995 ± 5.95	5.77	U	EPA 901.1
		097887-010	Lead-214	1.71 ± 6.59	7.03	U	EPA 901.1
		097887-010	Neptunium-237	-5.41 ± 5.05	5.67	U	EPA 901.1
		097887-010	Potassium-40	59.8 ± 45.4	27.8		EPA 901.1
		097887-010	Radium-223	21 ± 40.9	59.8	U	EPA 901.1
		097887-010	Radium-224	45.2 ± 41.8	56.7	U	EPA 901.1
		097887-010	Radium-226	77 ± 78.9	54.6	X	EPA 901.1
		097887-010	Radium-228	-6.8 ± 10.9	13.6	U	EPA 901.1
		097887-010	Sodium-22	-.078 ± 1.78	3.17	U	EPA 901.1
		097887-010	Thorium-227	-.714 ± 16.3	24	U	EPA 901.1
		097887-010	Thorium-231	-12.2 ± 30.9	36.4	U	EPA 901.1
		097887-010	Thorium-234	.913 ± 94.5	100	U	EPA 901.1
		097887-010	Uranium-235	1.67 ± 17.1	17.7	U	EPA 901.1
		097887-010	Uranium-238	.913 ± 94.5	100	U	EPA 901.1
		097887-011	Alpha, gross	.495 ± 2.26	4.05	U	EPA 900.0/SW846 9310
		097887-011	Beta, gross	26.7 ± 4.95	2.55		EPA 900.0/SW846 9310
		097887-012	Tritium	85.7 ± 124	209	U	EPA 906.0 Modified

See notes at end of appendix.

Table B-3. Radiological results for south plume area soil sampling locations, calendar year 2015

Station	Date Collected	Sample ID	Analyte	Result (ug/L)	MDL (ug/L)	Lab Data Qualifiers	Analytical Method
TTR	10-Jun-2015	097887-006	1,1'-Biphenyl		3	Uh	SW846 3510C/8270D
		097887-006	Acenaphthene		0.3	Uh	SW846 3510C/8270D
		097887-006	Acenaphthylene		0.3	Uh	SW846 3510C/8270D
		097887-006	Acetophenone		3	Uh	SW846 3510C/8270D
		097887-006	Anthracene		0.3	Uh	SW846 3510C/8270D
		097887-006	Atrazine		3	NUh	SW846 3510C/8270D
		097887-006	Benzaldehyde		3	Uh	SW846 3510C/8270D
		097887-006	Benzo(a)anthracene		0.3	Uh	SW846 3510C/8270D
		097887-006	Benzo(a)pyrene		0.3	Uh	SW846 3510C/8270D
		097887-006	Benzo(b)fluoranthene		0.3	Uh	SW846 3510C/8270D
		097887-006	Benzo(ghi)perylene	0.36	0.3	Jh	SW846 3510C/8270D
		097887-006	Benzo(k)fluoranthene		0.3	Uh	SW846 3510C/8270D
		097887-006	Bromophenyl phenyl ether, 4-		3	Uh	SW846 3510C/8270D
		097887-006	Butylbenzyl phthalate		3	Uh	SW846 3510C/8270D
		097887-006	Caprolactam		3	Uh	SW846 3510C/8270D
		097887-006	Carbazole		0.3	Uh	SW846 3510C/8270D
		097887-006	Chloro-3-methylphenol, 4-		3	NUh	SW846 3510C/8270D
		097887-006	Chlorobenzenamine, 4-		3.3	NUh	SW846 3510C/8270D
		097887-006	Chloroethoxy)methane, bis(2-		3	Uh	SW846 3510C/8270D
		097887-006	Chloroethyl)ether, bis(2-		3	Uh	SW846 3510C/8270D
		097887-006	Chloroisopropyl)ether, bis(1-		3	Uh	SW846 3510C/8270D
		097887-006	Chloronaphthalene, 2-		0.41	Uh	SW846 3510C/8270D
		097887-006	Chlorophenol, 2-		3	Uh	SW846 3510C/8270D
		097887-006	Chlorophenyl phenyl ether, 4-		3	Uh	SW846 3510C/8270D
		097887-006	Chrysene		0.3	Uh	SW846 3510C/8270D

See notes at end of appendix.

Table B-3. Radiological results for south plume area soil sampling locations, calendar year 2015

Station	Date Collected	Sample ID	Analyte	Result (ug/L)	MDL (ug/L)	Lab Data Qualifiers	Analytical Method
TTR	10-Jun-2015	097887-006	Cresol, m,p-	46	3.7	h	SW846 3510C/8270D
		097887-006	Cresol, o-		3	Uh	SW846 3510C/8270D
		097887-006	Di-n-butyl phthalate		3	Uh	SW846 3510C/8270D
		097887-006	Di-n-octyl phthalate		3	Uh	SW846 3510C/8270D
		097887-006	Dibenz[a,h]anthracene	0.32	0.3	Jh	SW846 3510C/8270D
		097887-006	Dibenzofuran		3	Uh	SW846 3510C/8270D
		097887-006	Dichlorobenzidine, 3,3'-		3	Uh	SW846 3510C/8270D
		097887-006	Dichlorophenol, 2,4-		3	Uh	SW846 3510C/8270D
		097887-006	Diethylphthalate		3	Uh	SW846 3510C/8270D
		097887-006	Dimethylphenol, 2,4-		3	Uh	SW846 3510C/8270D
		097887-006	Dimethylphthalate		3	Uh	SW846 3510C/8270D
		097887-006	Dinitro-o-cresol		3	Uh	SW846 3510C/8270D
		097887-006	Dinitrophenol, 2,4-		5	Uh	SW846 3510C/8270D
		097887-006	Dinitrotoluene, 2,4-		3	Uh	SW846 3510C/8270D
		097887-006	Dinitrotoluene, 2,6-		3	Uh	SW846 3510C/8270D
		097887-006	Dioxane, 1,4-		3	Uh	SW846 3510C/8270D
		097887-006	Diphenyl amine		3	Uh	SW846 3510C/8270D
		097887-006	Ethylhexyl)phthalate, bis(2-		3	Uh	SW846 3510C/8270D
		097887-006	Fluoranthene		0.3	Uh	SW846 3510C/8270D
		097887-006	Fluorene		0.3	Uh	SW846 3510C/8270D
		097887-006	Hexachlorobenzene		3	Uh	SW846 3510C/8270D
097887-006	Hexachlorobutadiene		3	*Uh	SW846 3510C/8270D		
097887-006	Hexachlorocyclopentadiene		3	Uh	SW846 3510C/8270D		

See notes at end of appendix.

Table B-3. Radiological results for south plume area soil sampling locations, calendar year 2015

Station	Date Collected	Sample ID	Analyte	Result (ug/L)	MDL (ug/L)	Lab Data Qualifiers	Analytical Method
		097887-006	Hexachloroethane		3	*Uh	SW846 3510C/8270D
		097887-006	Indeno(1,2,3-c,d)pyrene		0.3	Uh	SW846 3510C/8270D
		097887-006	Isophorone		3.5	Uh	SW846 3510C/8270D
		097887-006	Methylnaphthalene, 2-		0.3	Uh	SW846 3510C/8270D
		097887-006	Naphthalene		0.3	Uh	SW846 3510C/8270D
		097887-006	Nitro-benzene		3	Uh	SW846 3510C/8270D
		097887-006	Nitroaniline, 2-		3	Uh	SW846 3510C/8270D
		097887-006	Nitroaniline, 3-		3	NUh	SW846 3510C/8270D
		097887-006	Nitroaniline, 4-		3	Uh	SW846 3510C/8270D
		097887-006	Nitrophenol, 2-		3	Uh	SW846 3510C/8270D
		097887-006	Nitrophenol, 4-		3	Uh	SW846 3510C/8270D
		097887-006	Nitrosodipropylamine, n-		3	Uh	SW846 3510C/8270D
		097887-006	Pentachlorophenol		3	Uh	SW846 3510C/8270D
		097887-006	Phenanthrene		0.3	Uh	SW846 3510C/8270D
		097887-006	Phenol	17.8	3	h	SW846 3510C/8270D
		097887-006	Pyrene		0.3	Uh	SW846 3510C/8270D
		097887-006	Trichlorobenzene, 1,2,4-		3	Uh	SW846 3510C/8270D
		097887-006	Trichlorophenol, 2,4,5-		3	Uh	SW846 3510C/8270D
		097887-006	Trichlorophenol, 2,4,6-		3	Uh	SW846 3510C/8270D

See notes at end of appendix.

Table B-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, June 2015

Station	Date Collected	Sample ID	Analyte	Result (ug/L)	MDL (ug/L)	Lab Data Qualifiers	Analytical Method
TTR	10-Jun-2015	097887-005	Acetone	10.8	1.5		SW846 8260B DOE-AL
		097887-005	Benzene		0.3	U	SW846 8260B DOE-AL
		097887-005	Bromochloromethane		0.3	U	SW846 8260B DOE-AL
		097887-005	Bromodichloromethane		0.3	U	SW846 8260B DOE-AL
		097887-005	Bromoform		0.3	U	SW846 8260B DOE-AL
		097887-005	Bromomethane		0.3	U	SW846 8260B DOE-AL
		097887-005	Butanone, 2-	1.73	1.5	J	SW846 8260B DOE-AL
		097887-005	Carbon disulfide		1.5	U	SW846 8260B DOE-AL
		097887-005	Carbon tetrachloride		0.3	U	SW846 8260B DOE-AL
		097887-005	Chlorobenzene		0.3	U	SW846 8260B DOE-AL
		097887-005	Chloroethane		0.3	U	SW846 8260B DOE-AL
		097887-005	Chloroform		0.3	U	SW846 8260B DOE-AL
		097887-005	Chloromethane	0.33	0.3	J	SW846 8260B DOE-AL
		097887-005	Cyclohexane		0.3	U	SW846 8260B DOE-AL
		097887-005	Dibromo-3-chloropropane, 1,2-		0.5	U	SW846 8260B DOE-AL
		097887-005	Dibromochloromethane	0.39	0.3	J	SW846 8260B DOE-AL
		097887-005	Dibromoethane, 1,2-		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichlorobenzene, 1,2-		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichlorobenzene, 1,3-		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichlorobenzene, 1,4-	12.1	0.3		SW846 8260B DOE-AL
		097887-005	Dichlorodifluoromethane		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichloroethane, 1,1-		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichloroethane, 1,2-		0.3	U	SW846 8260B DOE-AL
097887-005	Dichloroethene, 1,1-		0.3	U	SW846 8260B DOE-AL		
097887-005	Dichloroethene, cis-1,2-		0.3	U	SW846 8260B DOE-AL		

See notes at end of appendix.

Table B-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, June 2015

Station	Date Collected	Sample ID	Analyte	Result (ug/L)	MDL (ug/L)	Lab Data Qualifiers	Analytical Method
TTR	10-Jun-2015	097887-005	Dichloroethene, trans-1,2-		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichloropropane, 1,2-		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichloropropene, cis-1,3-		0.3	U	SW846 8260B DOE-AL
		097887-005	Dichloropropene, trans-1,3-		0.3	U	SW846 8260B DOE-AL
		097887-005	Ethyl benzene		0.3	U	SW846 8260B DOE-AL
		097887-005	Hexanone, 2-		1.5	U	SW846 8260B DOE-AL
		097887-005	Isopropylbenzene		0.3	U	SW846 8260B DOE-AL
		097887-005	Methyl acetate		1.5	U	SW846 8260B DOE-AL
		097887-005	Methylcyclohexane		0.3	U	SW846 8260B DOE-AL
		097887-005	Methylene chloride	1.56	1	JB	SW846 8260B DOE-AL
		097887-005	Pentanone, 4-methyl-, 2-	1.61	1.5	J	SW846 8260B DOE-AL
		097887-005	Styrene		0.3	U	SW846 8260B DOE-AL
		097887-005	Tert-butyl methyl ether		0.3	U	SW846 8260B DOE-AL
		097887-005	Tetrachloroethane, 1,1,2,2-		0.3	U	SW846 8260B DOE-AL
		097887-005	Tetrachloroethene		0.3	U	SW846 8260B DOE-AL
		097887-005	Toluene		0.3	U	SW846 8260B DOE-AL
		097887-005	Trichloro-1,2,2-trifluoroethane, 1,1,2-		2	U	SW846 8260B DOE-AL
		097887-005	Trichlorobenzene, 1,2,3-		0.3	U	SW846 8260B DOE-AL
		097887-005	Trichlorobenzene, 1,2,4-		0.3	U	SW846 8260B DOE-AL
		097887-005	Trichloroethane, 1,1,1-		0.3	U	SW846 8260B DOE-AL
		097887-005	Trichloroethane, 1,1,2-		0.3	U	SW846 8260B DOE-AL
		097887-005	Trichloroethene		0.3	U	SW846 8260B DOE-AL
		097887-005	Trichlorofluoromethane		0.3	U	SW846 8260B DOE-AL

See notes at end of appendix.

Table B-4. Summary of Sanitary Outfalls of Volatile Organic Compounds, June 2015

Station	Date Collected	Sample ID	Analyte	Result (ug/L)	MDL (ug/L)	Lab Data Qualifiers	Analytical Method
		097887-005	Vinyl chloride		0.3	U	SW846 8260B DOE-AL
		097887-005	Xylene		0.3	U	SW846 8260B DOE-AL
		097887-005	Xylene, m-, p-		0.3	U	SW846 8260B DOE-AL
		097887-005	Xylene, o-		0.3	U	SW846 8260B DOE-AL

See notes at end of appendix.

NOTES:

Units

mg/L = milligrams per liter
pCi/L – picocuries per liter
ug/L = micrograms per liter

MDL or MDA

MDA = minimal detectable activity or minimum measured activity in a sample required to ensure a 95% probability that the measured activity is accurately quantified above the critical level

MDL = method detection limit

PQL

PQL = practical quantitation limit; the lowest concentration of analytes in a sample that can be determined reliably within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions

TTR

Tonopah Test Range

Laboratory Data Qualifier

B = analyte detected in the blank
h = analytical holding time was exceeded
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = Results associated with a spike analysis that was outside control limits.
U = The analyte was analyzed for, but not detected. For organic and inorganic analytes the result is less than the effective MDL concentration.
X = Data rejected due to peak not meeting identification criteria.
* = Recovery or %RPD not within acceptance limits and/or spike amount not compatible with the sample or the duplicate RPS's are not applicable where the concentrations falls below the effective PQL.

Data Validation Qualifier

BD = below detection limit as used in radiochemistry to identify results that are not statistically different from zero
J = associated value is an estimated quantity
J+ = The associated numerical value is an estimated quantity with a suspected positive base
J- = The associated numerical value is an estimated quantity with a suspected negative base
None = no data validation for corrected gross alpha activity
U = The analyte was analyzed for but was not detected. The associated numerical value is the sample quantitation limit
UJ = The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise

Analytical Method

DOE (U.S. Department of Energy) Environmental Measurements Laboratory. 1997. *The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300, 28th ed., vol. 1. New York, NY: DOE.

DOE AL (U.S. Department of Energy) Albuquerque Office Operations

EPA (U.S. Environmental Protection Agency). 1980. Prescribed Procedures for the Measurement of Radioactivity in Drinking Water. EPA 600-4-80-032. Method 900.0, Method 901.1,

EML = Environmental Measurements Laboratory

SM = Standard Method

SW = Solid Waste

Appendix C. SNL/KTF Sampling Location Maps



Lawai, Hawai'i

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Appendix C presents maps of sampling locations at Sandia National Laboratories, Kaua'i Test Facility.

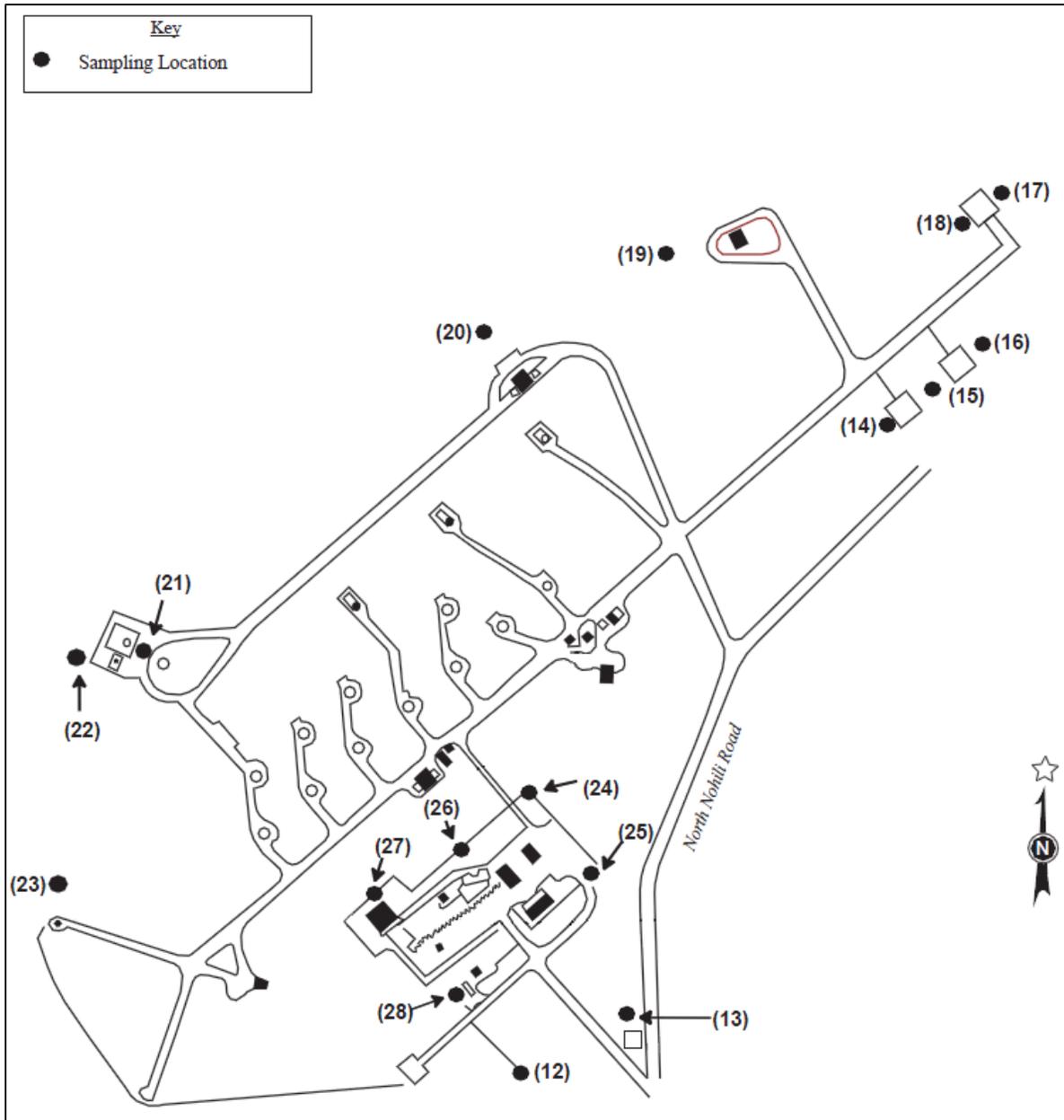


Figure C-1. On-site sampling locations at SNL/KTF

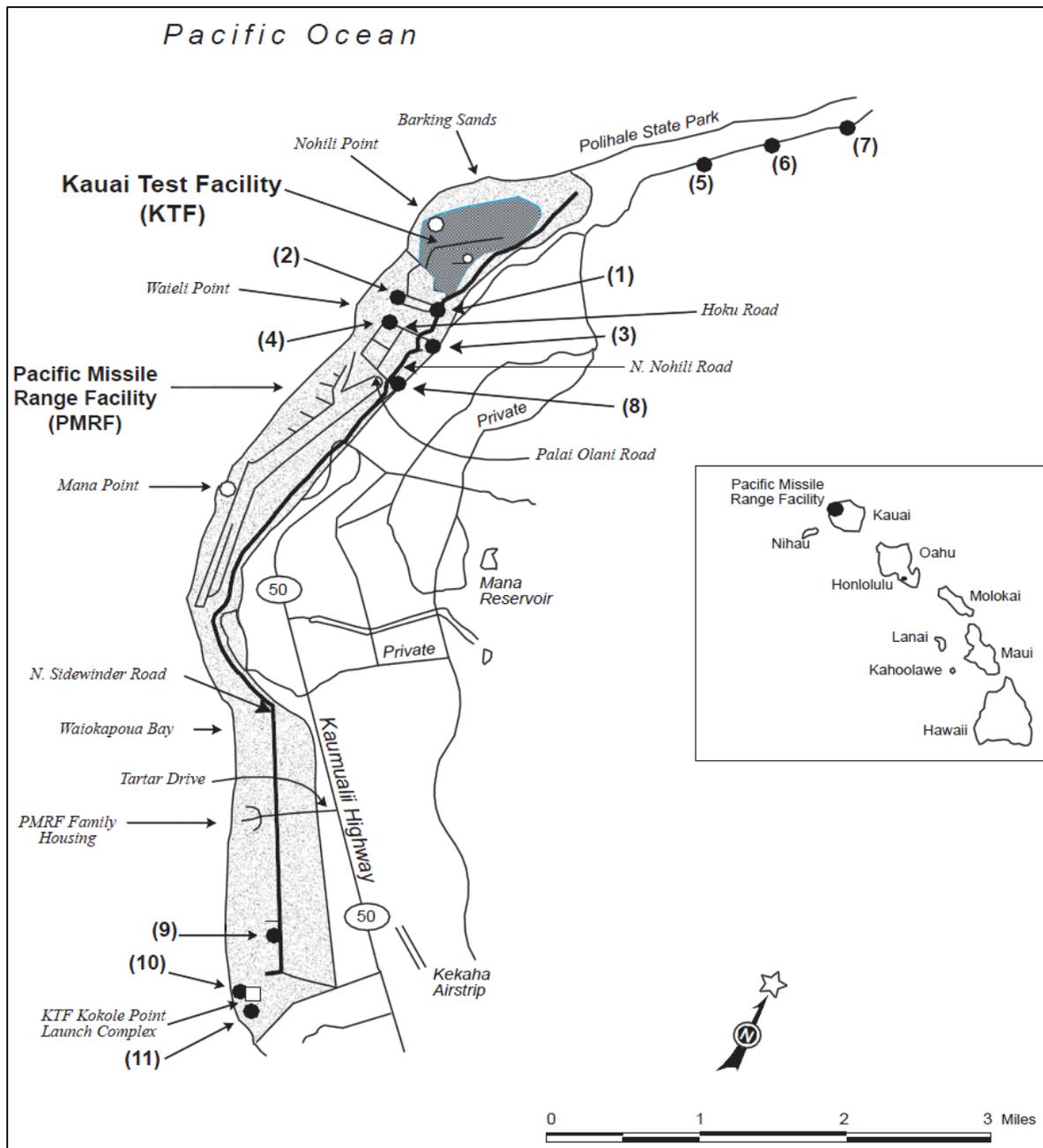


Figure C-2. Off-site sampling locations near SNL/KTF

- NOTES:** DOE = U.S. Department of Energy
 KTF = Kaua'i Test Facility
 LOB = Launch Operations Building
 MAB = Missile Assembly Building
 PMRF = Pacific Missile Range Facility
 SNL/KTF = Sandia National Laboratories, Kaua'i Test Facility
 SNL/TTR = Sandia National Laboratories, Tonopah Test Range

