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SANDIA NATIONAL LABORATORIES

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TONOPAH

KAUA'I

H A W A I ' I

ANNUAL SITE **ENVIRONMENTAL REPORT**

2020

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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United States Department of Energy, National Nuclear Security Administration,
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2020 Annual Site Environmental Report

for Sandia National Laboratories, Tonopah Test Range, Nevada, and Kaua'i Test Facility, Hawai'i

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for
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Abstract

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration. The National Nuclear Security Administration's Sandia Field Office administers the contract and oversees contractor operations at Sandia National Laboratories, Tonopah Test Range (SNL/TTR) in Nevada and Sandia National Laboratories, Kaua'i Test Facility (SNL/KTF) in Hawai'i. Activities at SNL/TTR are conducted in support of U.S. Department of Energy weapons programs and have operated at the site since 1957. SNL/KTF has operated as a rocket preparation launching and tracking facility since 1962.

The U.S. Department of Energy and its management and operating contractor are committed to safeguarding the environment, assessing sustainability practices, and ensuring the validity and accuracy of the monitoring data presented in this Annual Site Environmental Report. This report summarizes the environmental protection, restoration, and monitoring programs in place at SNL/TTR and SNL/KTF during calendar year 2020. Environmental topics include air quality, ecology, environmental restoration, oil storage, site sustainability, terrestrial surveillance, waste management, water quality, and implementation of the National Environmental Policy Act. This report is prepared in accordance with and as required by DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*, and has been approved for public distribution.

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Note to the Reader

This Annual Site Environmental Report for Sandia National Laboratories, Tonopah Test Range, Nevada, and Sandia National Laboratories, Kauaʻi Test Facility, Hawaiʻi, 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 the community about the environmental health of these sites and a commitment to protect our nation's valuable resources. With the goal of continually improving the quality of this annual report and including information that is important to you, you are invited to provide feedback, comments, or questions to:

U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office
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The Sandia National Laboratories, Tonopah Test Range, Nevada, and Kauaʻi Test Facility, Hawaiʻi, Annual Site Environmental Report can be found at the following website:
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Contents

List of Figures v
List of Tables v
Acronyms and Abbreviations vii
Units of Measure viii
Executive Summary 1

SANDIA NATIONAL LABORATORIES TONOPAH TEST RANGE, NEVADA 5

Chapter 1. SNL/TTR Introduction 6
1.1 Purpose 6
1.2 History 7
1.2.1 Sandia National Laboratories 7
1.2.2 Sandia National Laboratories, Tonopah Test Range 7
1.3 Location Description 9
1.4 Demographics 9
1.5 Activities and Facilities 9
1.5.1 Mission Control Center 10
1.5.2 Environmental Restoration Project 10
1.6 Environmental Setting 10
1.6.1 Geology 10
1.6.2 Surface Water 10
1.6.3 Groundwater 11
1.6.4 Ecology 11
1.6.5 Climate 11

Chapter 2. SNL/TTR Compliance Summary 13
2.1 Environmental Compliance 14
2.1.1 Federal Requirements 14
2.1.2 Chemical Inventory and Toxic Release Inventory Reporting 21
2.1.3 Nevada State Environmental Requirements 22
2.2 Environmental Management System 22
2.2.1 Site Sustainability Plan 23
2.2.2 Sustainability Awards 24
2.3 Environmental Performance 25
2.3.1 Audits, Appraisals, and Inspections in 2020 25
2.3.2 Occurrence Reporting in 2020 25
2.4 Environmental Permit Status 26

Chapter 3. SNL/TTR Environmental Programs 28
3.1 National Environmental Policy Act Program 29
3.2 Environmental Life-Cycle Management Program 29
3.3 Chemical Information System 29
3.4 Waste Management Program 30
3.5 Environmental Restoration Project 31
3.5.1 Corrective Action Site Identification 32
3.5.2 History of Double Tracks and Clean Slate Sites 33
3.5.3 Environmental Restoration Project Activities in 2020 33
3.6 Air Quality Compliance Program 33
3.6.1 Nonradiological Air Emissions 33
3.6.2 Radionuclide Air Emissions 34
3.6.3 Other Air Quality Monitoring Activities at SNL/TTR 35

3.7 Oil Storage Program 36
3.8 Terrestrial Surveillance Program 36
3.8.1 Regulatory Criteria 36
3.8.2 Sample Locations and Media 36
3.8.3 Field Methods, Analytical Parameters, and Quality Control Procedures 42
3.8.4 Data Analysis and Methodology 42
3.8.5 Terrestrial Surveillance Program Results in 2020 43
3.9 Water Quality Programs 44
3.9.1 Drinking Water 44
3.9.2 Septic Tank Systems 45
3.9.3 Stormwater 46
3.9.4 Wastewater 46
3.9.5 Water Conservation 46

Chapter 4. SNL/TTR Ecology Program 47
4.1 Ecological Setting 47
4.1.1 Vegetation 48
4.1.2 Wildlife 48
4.2 Avian Surveillance 50
4.3 Federally Listed and State-Listed Threatened and Endangered Species and Species of Concern 54

Chapter 5. SNL/TTR Cultural Resource Management Program 57
5.1 Culture History 58
5.2 Historical Context 59
5.3 Regulatory Criteria 60
5.4 Archaeological Resources 60
5.4.1 Field Methods 60
5.4.2 Archaeological Assessments and Analysis in 2020 61
5.5 Historic Buildings 61
5.5.1 Methods 61
5.5.2 Previous Building Surveys, Assessments, and Determinations 62
5.5.3 Historic Building Assessments in 2020 64

Chapter 6. SNL/TTR Quality Assurance 66
6.1 Environmental Monitoring for Quality Assurance 66
6.1.1 Sample Management Office 67
6.1.2 Contract Laboratory Selection 67
6.1.3 Quality Control for Samples 67
6.1.4 Data Validation and Records Management 68
6.2 Sample Management Office Activities in 2020 68
6.2.1 Sample Handling and Analyses 69
6.2.2 Laboratory Quality Assurance Assessments and Validation 69
6.2.3 Quality Assurance Audits 69

SANDIA NATIONAL LABORATORIES KAUAʻI TEST FACILITY, HAWAIʻI 70

Chapter 7. SNL/KTF Introduction 71
7.1 Purpose 72
7.2 History 72
7.2.1 Sandia National Laboratories 72
7.2.2 Sandia National Laboratories, Kauaʻi Test Facility 72
7.3 Location Description 72
7.4 Demographics 73
7.5 Activities and Facilities 74
7.5.1 Rocket Launches in 2020 74

7.6 Environmental Setting 75
7.6.1 Geology 75
7.6.2 Surface and Groundwater Hydrology 75
7.6.3 Ecology 76
7.6.4 Climate 76

Chapter 8. SNL/KTF Compliance Summary 77
8.1 Environmental Compliance 78
8.1.1 Federal Requirements 78
8.1.2 Chemical Inventory and Toxic Release Inventory Reporting 84
8.1.3 Hawai'i State Environmental Requirements 85
8.2 Environmental Management System 85
8.2.1 Site Sustainability Plan 86
8.2.2 Sustainability Awards 87
8.3 Environmental Performance 87
8.3.1 Audits, Appraisals, and Inspections in 2020 88
8.3.2 Occurrence Reporting in 2020 88
8.4 Environmental Permit Status 88

Chapter 9. SNL/KTF Environmental Programs 90
9.1 National Environmental Policy Act Program 91
9.2 Environmental Life-Cycle Management Program 91
9.3 Chemical Information System 91
9.4 Waste Management Program 92
9.5 Environmental Restoration Project 92
9.6 Air Quality Compliance Program 92
9.7 Meteorology Program 93
9.8 Oil Storage Program 93
9.9 Terrestrial Surveillance Program 94
9.10 Water Quality Programs 94
9.10.1 Stormwater Program 94
9.10.2 Wastewater Discharge Program 94

Chapter 10. SNL/KTF Ecology Program 95
10.1 Vegetation 96
10.2 Wildlife 96
10.2.1 Birds 97
10.2.2 Mammals 98
10.2.3 Reptiles 98
10.3 Federally Listed and State-Listed Threatened and Endangered Species 99

Chapter 11. SNL/KTF Cultural Resource Management Program 100
11.1 Culture History 101
11.2 Historical Context 101
11.3 Regulatory Criteria 102
11.4 Archaeological Resources 102
11.4.1 Field Methods 102
11.4.2 Archaeological Assessments and Analysis in 2020 102
11.5 Historic Buildings 103
11.5.1 Methods 103
11.5.2 Previous Building Surveys, Assessments, and Determinations 103
11.5.3 Historic Building Assessments in 2020 103

Chapter 12. SNL/KTF Quality Assurance 105
12.1 Environmental Monitoring for Quality Assurance 105
12.1.1 Sample Management Office 106

12.1.2 Contract Laboratory Selection 106
12.1.3 Quality Control for Samples 106
12.1.4 Data Validation and Records Management 107
12.2 Sample Management Office Activities in 2020 107
12.2.1 Sample Handling and Analyses 107
12.2.2 Laboratory Quality Assurance Assessments and Validation 107
12.2.3 Quality Assurance Audits 108
Appendix A. SNL/TTR Air Monitoring Stations in 2020 109
Appendix B. SNL/TTR Terrestrial Surveillance Analytical Results in 2020 120
Glossary 122
References 128

List of Figures

Figure 1-1. SNL/TTR location within the boundaries of the Nevada Test and Training Range 8
Figure 3-1. SNL/TTR on-site terrestrial surveillance locations 39
Figure 3-2. SNL/TTR perimeter terrestrial surveillance locations 40
Figure 3-3. SNL/TTR off-site terrestrial surveillance locations 41
Figure 7-1. Kauaʻi Test Facility location on Kauaʻi, Hawaiʻi 73
Figure 7-2. Operations at Mount Haleakalā, Maui 74

Figure A-1. Air monitoring station locations 110
Figure A-2. Station 400, located near the Range Operations Center, includes an array of devices to measure radiological and meteorological conditions 112
Figure A-3. Station 401, located along the north fence that bounds the Clean Slate III contamination area, includes a solar-powered air sampler, a saltation sensor, and a meteorological tower (background, center, and foreground, respectively) 114
Figure A-4. Station 403, located along the south fence that bounds the Clean Slate III contamination area, includes a solar-powered air sampler and a meteorological tower 115
Figure A-5. Station 404, located along the north fence that bounds the Clean Slate II contamination area, includes a solar-powered air sampler and a meteorological tower 116
Figure A-6. Station 405, located along the eastern fence that bounds the Clean Slate II contamination area, includes a solar-powered air sampler, a meteorological tower, and a saltation sensor (left, center, and right, respectively) 117
Figure A-7. Wind speed and log-normal PM_{10} trends for stations 400, 401, 403, 404, and 405 for January 1–December 31, 2020 119

List of Tables

Table 2-1. SNL/TTR applicable EPCRA reporting requirements 21
Table 2-2. SNL/TTR applicable State of Nevada Administrative Code requirements 22
Table 2-3. Site Sustainability Plan performance status for key areas 23
Table 2-4. SNL/TTR environmental permits, 2020 26
Table 3-1. SNL/TTR waste generated, 2020 30
Table 3-2. SNL/TTR waste shipped, 2020 30
Table 3-3. SNL/TTR material recycled or energy-recovered and shipped off-site, 2020 31
Table 3-4. Status of remediation activities at SNL/TTR, 2020 32
Table 3-5. Permitted source emission data, 2020 33
Table 3-6. Clean Slate II and Clean Slate III soil sampling results, 2020 34
Table 3-7. Air monitoring results, 2020 35
Table 3-8. SNL/TTR on-site terrestrial surveillance locations, sample media, and parameters 37
Table 3-9. SNL/TTR perimeter terrestrial surveillance locations, sample media, and parameters 38
Table 3-10. SNL/TTR off-site terrestrial surveillance locations, sample media, and parameters 38
Table 3-11. Comparison reference values for metals in soil at SNL/TTR 43
Table 3-12. SNL/TTR dosimeter dose rate summary statistics by location classification, 2020 44
Table 3-13. SNL/TTR routine production well parameters 45
Table 4-1. SNL/TTR bird survey locations and habitat descriptions 50
Table 4-2. SNL/TTR bird species encountered and locations (all years) 51
Table 4-3. Federally listed and state-listed threatened and endangered species and State of Nevada protected species potentially occurring in Nye County, Nevada 54
Table 5-1. Facilities that are contributing elements to the SNL/TTR historic district 63
Table 8-1. SNL/KTF applicable EPCRA reporting requirements 84
Table 8-2. Site Sustainability Plan performance status for key areas 86
Table 8-3. SNL/KTF environmental permits, 2020 89
Table 10-1. Federally listed threatened or endangered species potentially occurring or confirmed at SNL/KTF 99

Table A-1. Radiological, meteorological, and environmental sensors deployed at the SNL/TTR air monitoring stations 111
Table A-2. Gross alpha results for monitoring stations, 2020 113
Table A-3. Gross beta results for monitoring stations, 2020 113
Table A-4. Plutonium-238 alpha spectrometry results, 2020 118
Table A-5. Plutonium-239/240 alpha spectrometry results, 2020 118

Table B-1. Environmental dosimeter measurements at SNL/TTR, 2020 121

Acronyms and Abbreviations

Term	Definition
A	
AD	anno Domini
B	
BCE	before the common era
C	
ca.	circa
CAU	Corrective Action Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COVID-19	Coronavirus 2019
D	
DOD	United States Department of Defense
DOE	United States Department of Energy
DOECAP	DOE Consolidated Audit Program
DRI	Desert Research Institute
E	
EISA	Energy Independence and Security Act
EMS	Environmental Management System
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community-Right-to-Know Act
EPEAT	Electronic Product Environmental Assessment Tool
ES&H	Environment, Safety, and Health
ESA	Endangered Species Act
F	
FDID	Fire Department Identification
FY	fiscal year
I	
IOC	inorganic compound
ISO	International Organization for Standardization
M	
MBTA	Migratory Bird Treaty Act
MDC	minimum detectable concentration

Term	Definition
N	
N/A	not applicable
NAFR	Nellis Air Force Range
ND	not detected
NDEP	Nevada Division of Environmental Protection
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NRS	Nevada Revised Statute
NTESS	National Technology & Engineering Solutions of Sandia, LLC
P	
PCB	polychlorinated biphenyl
pH	potential of hydrogen
PL	Public Law
PM_{10}	particulate matter that has a diameter equal to or less than 10 microns
R	
RCRA	Resource Conservation and Recovery Act
S	
Sandia	Sandia National Laboratories
SARA	Superfund Amendments and Reauthorization Act
SNL	Sandia National Laboratories
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 organic compound
sp.	unknown species, singular
spp.	unknown species, plural
ssp.	subspecies
U	
U.S.	United States
USAF	United States Air Force
V	
var.	variety
VOC	volatile organic compound

Units of Measure

Unit	Definition
Bq/m^3	Becquerel per cubic meter
Btu	British thermal unit
Ci/m	curies per meter
°F	degrees Fahrenheit
ft^3	cubic foot
kg	kilogram
µ	micron

Unit	Definition
µCi/mL	microcuries per milliliter
$\mu g/m^3$	micrograms per cubic meter
µm	micrometer (micron)
mg/kg	milligrams per kilogram
mph	miles per hour
mrem	millirem
mrem/year	millirems per year
ppb	parts per billion

Executive Summary

Wild horses (*Equus ferus*)

Sandia National Laboratories (hereinafter referred to as Sandia) is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration. This Annual Site Environmental Report was prepared in accordance with and as required by DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*, and is approved for public release. The U.S. Department of Energy (DOE) and its management and operating contractor for Sandia are committed to safeguarding the environment, continually assessing sustainability practices, and ensuring the validity and accuracy of the monitoring data presented here. This report summarizes the environmental protection, restoration, and monitoring programs in place for Sandia National Laboratories, Tonopah Test Range (SNL/TTR) and Sandia National Laboratories, Kauaʻi Test Facility (SNL/KTF) during calendar year 2020.

Environmental Management System

Sandia management takes environmental stewardship seriously. A robust Environmental Management System was established in 2005 as part of this commitment. This system ensures a systematic approach to identifying environmental aspects, setting environmental objectives, and monitoring environmental performance. Designed to meet the requirements of the globally recognized International Organization for Standardization (ISO) 14001:2015 standard, the Environmental Management System is ISO 14001:2015 certified. SNL/TTR and SNL/KTF personnel follow the system's requirements, as verified by internal assessments in 2017 and 2018, respectively. This Environmental Management System is Sandia's primary platform for implementing the environmental management programs that help achieve annual site sustainability goals.

Site Sustainability

Sustainability practices and goals are defined in an annual Site Sustainability Plan. Sandia programs met or exceeded sustainability goals in several key areas in fiscal year 2020.

Environmental Performance

DOE assesses environmental performance through measures and indicators and reports on this as part of an overall performance evaluation. During the most recent environmental performance evaluation, Sandia earned an overall rating of very good.

Environmental Programs

Sandia National Laboratories, Tonopah Test Range

Sandia personnel conduct operations at SNL/TTR in support of DOE weapons programs. Sandia activities at the Tonopah Test Range involve research and development as well as testing weapon components and delivery systems. Many of these activities require a remote testing range with a long flight corridor for airdrops and rocket launches, which the Tonopah Test Range can provide. Navarro Research and Engineering personnel perform most of the environmental program activities at SNL/TTR. The National Nuclear Security Administration's Nevada Field Office retains responsibility for cleanup and management of SNL/TTR environmental restoration sites. There were no DOE-reportable occurrences at SNL/TTR in 2020.

Air Quality Compliance Program. Program personnel support compliance with air quality regulations. In 2020, emissions from permitted sources complied with permitted limits for nonradiological air emissions.

Chemical Information System. In 2020, chemical containers were tracked along with information about any related chemical hazards.

Cultural Resource Management Program. Program personnel review and document potential impacts on archeologic sites and historic properties. In 2020, one architectural resource assessment form was prepared for a project proposed in the previously established SNL/TTR historic district.

Ecology Program. Biota is monitored as an element of the overall environmental monitoring process for compliance with wildlife regulations and laws and to support land use decisions. Ecological and wildlife awareness campaigns are conducted to ensure safe work environments and sustainable decision-making strategies. Many Ecology Program activities were not conducted in 2020 because of Coronavirus 2019 (COVID-19) restrictions.

National Environmental Policy Act Program. Program personnel coordinate with DOE to ensure National Environmental Policy Act compliance and to provide technical assistance in project planning, including preparations for the next series of B61-12 flight tests. In 2020, eight projects were reviewed, and the environmental impacts were documented.

In 2020, a process was implemented for reviewing and documenting routine maintenance activities at the Tonopah Test Range for National Environmental Policy Act compliance, including the need for biological surveys, historic building and archaeological surveys, and permits, such as discharge permits. This process has been in place for Sandia National Laboratories, New Mexico, since 2019 and was implemented at SNL/TTR in 2020.

Oil Storage Program. As a best management practice, SNL/TTR personnel routinely monitor and inspect oil storage containers and equipment to ensure safe and secure operating conditions and to prevent potential spills or releases to the environment. There were no reportable oil spills or releases in 2020.

Quality Assurance. All environmental monitoring is conducted in accordance with program-specific plans that contain applicable quality assurance elements and meet appropriate federal, state, and local requirements for conducting sampling and analysis activities.

Radionuclide National Emission Standards for Hazardous Air Pollutants. Radionuclide air emissions from Sandia facilities are reported each year. The only radionuclide sources at SNL/TTR are three environmental restoration sites, which are sources of diffuse radionuclide emissions due to the resuspension of contaminated soils. In 2020, calculated doses were well below the 10 mrem/year dose limit set by the U.S. Environmental Protection Agency and DOE.

Terrestrial Surveillance Program. In 2020, environmental dosimeters used to measure the dose from ambient gamma radiation indicated levels above comparison reference values and may be attributed to the variety of elevations, proximity to bedrock, and statistical nature of radioactivity. Soil sampling was not conducted in 2020 because of COVID-19 restrictions.

Waste Management Program. Waste generated during 2020 included hazardous waste; other regulated, recycled materials; and polychlorinated biphenyl waste. Hazardous waste and other regulated waste was shipped off-site to permitted facilities.

Water Quality Programs. The public water system is routinely sampled and analyzed to demonstrate conformance with primary drinking water standards. In 2020, all public water system sample results were below established values. There are five septic tank systems; none of these systems required maintenance, sampling, or pumping in 2020.

Sandia National Laboratories, Kaua'i Test Facility

SNL/KTF is located on the island of Kaua'i within the boundaries of the U.S. Department of Defense Pacific Missile Range Facility. The site, which has been an active rocket-launching location since 1962, provides a high-quality integrated facility for conducting a wide range of test operations. There were no DOE-reportable occurrences at SNL/KTF in 2020.

Air Quality Compliance Program. Program personnel support compliance with air quality regulations. In 2020, activities complied with permitted operating limits.

Chemical Information System. In 2020, chemical containers were tracked along with information about any related chemical hazards.

Cultural Resource Management Program. Program personnel review and document potential impacts on archeologic sites and historic properties. In 2020, no mitigative action was required.

Ecology Program. Biota is monitored as an element of the overall environmental monitoring process for compliance with wildlife regulations and laws and to support land use decisions. Ecological and wildlife awareness campaigns are conducted to ensure safe work environments and sustainable decision-making strategies. Many Ecology Program activities were not conducted in 2020 because of COVID-19 restrictions.

National Environmental Policy Act Program. Program personnel coordinate with DOE to ensure National Environmental Policy Act compliance and to provide technical assistance in project planning. In 2020, 11 projects were reviewed, and the environmental impacts were documented.

Oil Storage Program. Oil storage containers and equipment are managed, operated, and maintained to prevent inadvertent releases to the environment and to comply with applicable regulations. In 2020, there were four used oil storage drums, three generator base tanks, one underground fuel

storage tank, and one aboveground fuel storage tank at SNL/KTF. There were no reportable oil spills or releases in 2020.

Quality Assurance. All environmental monitoring is conducted in accordance with program-specific plans that contain applicable quality assurance elements and meet appropriate federal, state, and local requirements for conducting sampling and analysis activities.

Terrestrial Surveillance Program. Surveillance activities are conducted to analyze surface soil at SNL/KTF approximately every five years. No sampling occurred in 2020.

Waste Management Program. Asbestos abatement was concluded at the Mount Haleakalā site on Maui. No additional asbestos-containing materials were removed in 2020.

Water Quality Program. Drinking water is obtained through the Pacific Missile Range Facility public water system. In 2020, the three on-site septic tanks were inspected, and one was pumped. There were no compliance issues.

PART ONE

SANDIA NATIONAL LABORATORIES
TONOPAH TEST RANGE, NEVADA

Chapter 1. SNL/TTR Introduction

Tonopah Test Range

OVERVIEW ■ Tonopah Test Range is located within the boundaries of the Nevada Test and Training Range. Sandia National Laboratories personnel conduct operations at Tonopah Test Range in support of the U.S. Department of Energy Weapons Ordnance Program. The site has never been used for the detonation of nuclear weapons.

This Annual Site Environmental Report was prepared in accordance with and as required by the U.S. Department of Energy (DOE) per DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*. This report is made available to the public in electronic form at the following website:

https://www.sandia.gov/news/publications/environmental_reports/

Sandia National Laboratories, hereinafter referred to as Sandia with the exception of when using acronym to represent the facility location (SNL/TTR), is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC (NTESS), a wholly owned subsidiary of Honeywell International Inc., for the DOE National Nuclear Security Administration. The DOE National Nuclear Security Administration Sandia Field Office in Albuquerque, New Mexico, administers the contract and oversees contractor operations.

Part One of this Annual Site Environmental Report summarizes the environmental protection and monitoring programs in place at Sandia National Laboratories, Tonopah Test Range (SNL/TTR) during calendar year 2020. While all 2020 program activities were performed continuously, they are reported on a calendar-year basis unless otherwise noted (programs based on the fiscal year operate from October 1 through September 30, annually).

1.1 Purpose

Sandia personnel—who provide the synergy and interdependence between a nuclear deterrence mission and broader national security missions to forge a robust capability base and empower

solutions to complex national security problems—anticipate and resolve emerging national security challenges, innovate and discover new technologies to strengthen the nation's technological superiority, create value through products and services that solve important national security challenges, and inform the national debate for which technology policy is critical to preserving security and freedom throughout the world. Information about recent technologies developed by Sandia personnel can be found at the following website:

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

1.2 History

A brief history of Sandia National Laboratories and of operations at SNL/TTR follows. For more details, see Chapter 5.

1.2.1 Sandia National Laboratories

On November 1, 1949, Sandia Corporation, a wholly owned subsidiary of Western Electric, began managing and operating Sandia Laboratory. In 1979, Congress recognized the facility as a national laboratory. From 1993 to mid-2017, Sandia Corporation was a wholly owned subsidiary of Martin Marietta (merging with Lockheed Corporation in 1995 to form Lockheed Martin Corporation). In May 2017, the management and operating contractor changed its name to National Technology & Engineering Solutions of Sandia, LLC (NTESS), a wholly owned subsidiary of Honeywell International Inc.

1.2.2 Sandia National Laboratories, Tonopah Test Range

In the early 1950s, Sandia personnel used three 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. As testing parameters changed, these sites were deemed inadequate. See Chapter 6 for details on the history and establishment of SNL/TTR.

Sandia personnel then identified Cactus Flats, located in the northwest corner of the then-named Nellis Bombing and Gunnery Range near the town of Tonopah, Nevada, as a temporary site for testing ballistic and nonnuclear features of atomic weapons (SNL/NM 1996). In 1956, a land use permit was obtained from the U.S. Air Force (USAF). In 1957, Tonopah Test Range was established for the U.S. Atomic Energy Commission (now DOE) and became operational for testing weapon systems.

Today, the U.S. Department of Defense (DOD) Nevada Test and Training Range is divided into the North Range and the South Range. SNL/TTR permitted land use areas are located in the northwest part of this site, and the DOE Nevada National Security Site is located between the North Range and South Range (Figure 1-1). SNL/TTR includes facilities that are designed and equipped to gather data on aircraft-delivered inert test vehicles. As technologies changed, the facilities and capabilities at SNL/TTR were expanded to accommodate tests related to the DOE Weapons Ordnance Program.

The National Nuclear Security Administration signed a land use permit, "Department of the Air Force Permit to National Nuclear Security Administration for Real Property Located on the Nevada Test and Training Range, Nevada" (USAF/NNSA 2019), which is valid until November 2029. The permit is for the nonexclusive use, operation, and occupancy of an approximately 5.5-square-mile portion of the Nevada Test and Training Range.

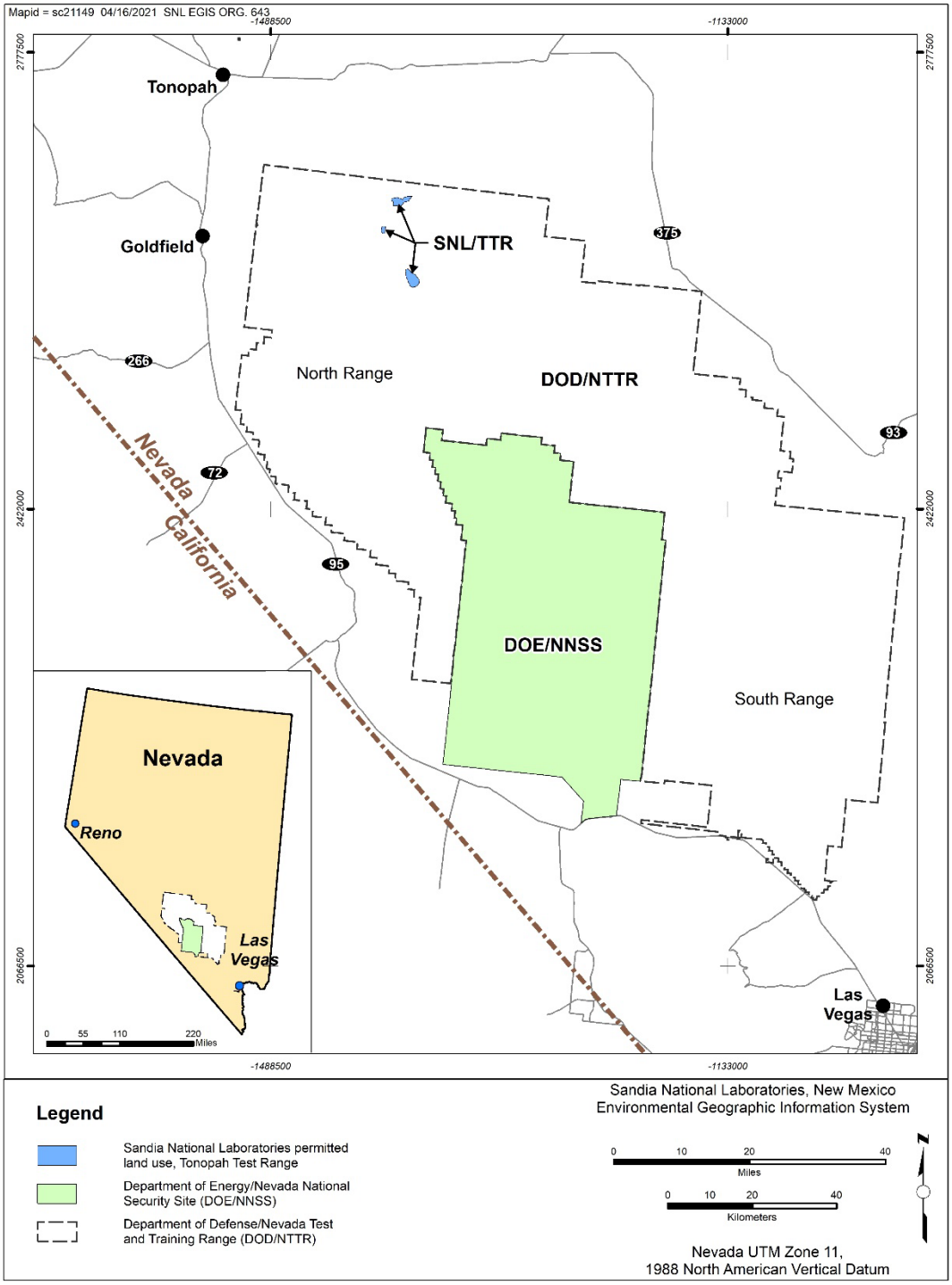

Figure 1-1. SNL/TTR location within the boundaries of the Nevada Test and Training Range

1.3 Location Description

SNL/TTR is located on withdrawn land (withheld from the public domain) that is permitted from the USAF within the boundaries of the Nevada Test and Training Range (Figure 1-1). Sandia personnel use the land to support DOE and USAF activities and missions.

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

1.4 Demographics

The nearest residents live in the towns of Goldfield, Nevada, population 268, and Tonopah, Nevada, population 2,478 (Census 2012a). Goldfield and Tonopah are approximately 22 miles west and 32 miles northwest of the site boundary, respectively. Las Vegas, with an estimated population of 651,319 (Census 2020), is the largest municipality in Nevada by population and is approximately 140 miles southeast of the site boundary. Census data for 2020 was not available at the time of publication; therefore, 2012 and 2019 data are reported.

1.5 Activities and Facilities

SNL/TTR personnel conduct operations in support of DOE weapons programs. The site offers a unique test environment for use by other government agencies and their contractors as well. The facilities, large land area, and site security are available for conducting a wide variety of tests. Activities involve conducting research and development as well as testing weapon components and delivery systems. As approved in *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE/NNSA Nevada Site Office 2013), capabilities could include the following:

- Conduct tests and experiments, including flight test operations for gravity weapons (i.e., bombs).
- Conduct ground- and air-launched rocket and missile operations.
- Conduct impact testing.
- Conduct passive testing of joint test assemblies and conventional weapons.
- Conduct fuel-air explosives testing.

The majority of test activities occur within Cactus Flat, a valley with almost no topographical relief flanked by mountains and hills. The remote range ensures public safety and national security.

Navarro Research and Engineering personnel perform or support most environmental program functions and facility operation and maintenance at SNL/TTR on behalf of the management and operating contractor for Sandia, including air monitoring, Environmental Restoration Project activities, National Environmental Policy Act (NEPA) compliance, spill response, waste management operations, and water quality monitoring. Navarro Research and Engineering personnel also support SNL/TTR personnel during tests by operating equipment and recovering test objects.

In 1963, the DOE (formerly the Atomic Energy Commission) implemented Operation Roller Coaster to evaluate the dispersal of radionuclides when nuclear devices were subjected to chemical explosions while in storage or transit (Chapman et al. 2018). This operation resulted in radionuclide-contaminated soils (see Section 3.5).

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

1.5.2 Environmental Restoration Project

The Environmental Restoration Project at SNL/TTR was initiated in 1980 to address contamination resulting primarily from the 1963 nuclear weapons destruction 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 the DOE Nevada Field Office as responsible for all environmental restoration sites at SNL/TTR. The National Nuclear Security Administration was established in 2000, and responsibility for all environmental restoration sites in Nevada still resides with the National Nuclear Security Administration Nevada Field Office, with the exception that DOE is currently addressing compliance with 40 CFR 60 Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities" and reporting requirements for environmental restoration activities. However, environmental program management at SNL/TTR is a joint effort between SNL/TTR and Sandia National Laboratories, New Mexico (SNL/NM) personnel, with oversight from DOE. For more information on the Environmental Restoration Project, see Chapter 3.

1.6 Environmental Setting

The topography at SNL/TTR is characterized by a broad, flat valley bordered by two north- and south-trending mountain ranges: Cactus Range to the west (occurring mostly within the boundaries of SNL/TTR) and 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 feet at the valley floor to 7,482 feet at Cactus Peak. The elevation of the town of Tonopah is 6,047 feet.

1.6.1 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 (SNL/NM 1982).

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).

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

1.6.2 Surface Water

The drainage system within and near SNL/TTR is composed of ephemeral stream channels that 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).

There are several small springs within the Cactus and Kawich ranges. Three occur within SNL/TTR boundaries: Cactus Spring, Antelope Spring, and Silverbow Spring. Water from these springs does not travel more than approximately 100 feet before it dissipates through evaporation and infiltration.

1.6.3 Groundwater

SNL/TTR personnel obtain water from local wells. The U.S. Geological Survey has recorded groundwater depths from 21 to 454 feet below ground surface at the site. Approximate groundwater levels have been recorded as follows:

- Antelope Mine Well in the Cactus Range at 21 feet below ground surface
- EH2 Well near the onsite airport 454 feet below ground surface
- Area 9 Well located near the northern end of the site at 131 feet below ground surface
- Production Well 6 in Area 3 at 350 feet below ground surface

1.6.4 Ecology

An ecosystem is a network of living organisms and nonliving components that interact with one another to comprise an overall environment. The ecosystem at SNL/TTR includes the interactions among many living components—such as humans, animals, insects, plants, and fungi—within several habitat types. Nonliving components within the ecosystem include air, water, mineral soil, buildings, structures, roads, and paved surfaces. The habitats of the SNL/TTR ecosystem include dwarf shrub and saltbrush shrubland in the lower elevations, Great Basin mixed desert scrub in the intermediate elevations, and an abundance of Joshua trees (*Yucca brevifolia*) and junipers (*Juniperus spp.*) with increased elevations. This ecosystem is a dynamic entity that is impacted by external and internal factors. External factors include such influences as climate, time, topography, and biota. Internal factors include the introduction of non-native species to the ecosystem and human disturbance and interactions (through development) within the various habitats.

An *ecosystem* is a network of living organisms (e.g., humans, animals, plants, and fungi) and nonliving components (e.g., air, water, mineral soil, buildings, and roads) that interact to comprise an overall environment.

In general, the Nevada Test and Training Range land withdrawal has had a positive effect on local plant and animal life at SNL/TTR. Since much of the withdrawn area is undisturbed by human activity, large habitat areas are protected from the effects of public use. For more information on the ecology at SNL/TTR, see Chapter 4.

1.6.5 Climate

The climate at SNL/TTR is typical of high-desert, midlatitude 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 around 90°F during the day and dropping to the 50s°F at night. January conditions vary from highs in the 40s°F to lows of around 20°F.

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

Average annual precipitation at the Tonopah Airport (the closest weather station with 30 or more years of data), elevation 5,426 feet, is 5.08 inches (WRCC 2020). Typically, the months of May and

July have the highest averages of 0.54 and 0.53 inches of precipitation, respectively, and December has the lowest with 0.27 inches.

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 miles per hour. 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.

Chapter 2. SNL/TTR Compliance Summary

Wild horses (*Equus ferus*)

OVERVIEW ■ Sandia operations at SNL/TTR are required to comply with federal, state, and local environmental statutes, regulations, executive orders, and DOE directives. Regular audits, appraisals, and inspections identify areas for improvement as well as noteworthy practices.

Sandia operations are required to comply with federal, state, and local environmental requirements, including DOE directives and presidential executive orders. As part of this compliance, personnel adhere to strict reporting and permitting requirements.

All Sandia operations and activities, including those that are part of environmental programs, are performed under the Environment, Safety, and Health (ES&H) policy, which includes the following statement:

> Sandia integrates environmental, safety and health throughout the lifecycle of its operations to ensure the:
> - Protection of Members of the Workforce by providing a safe and healthful workplace.
> - Protection of the environment by preventing or minimizing pollution and waste, pursuing sustainable resource use, and protecting biodiversity and ecosystems.
> - Protection of the public through the prevention or minimization of releases of hazardous materials.
> - Satisfaction of contractual requirements.
> - Establishment, measurement, and monitoring of ES&H objectives to enhance performance and drive continual improvement.

An Integrated Safety Management System is used to incorporate safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public, and

the environment. Thus, management of safety functions becomes an integral part of mission accomplishment and meets requirements outlined by DOE. The following five core functions guide the integration of safety into all work practices: define the scope of work, analyze the hazards, develop and implement hazard controls, perform work within controls, and provide feedback for continuous improvement.

2.1 Environmental Compliance

The management and operating contract, also referred to as the Prime Contract, for Sandia serves as the overarching agreement between the DOE National Nuclear Security Administration and the management and operating contractor. The Prime Contract requires the management and operating contractor to comply with specific DOE directives as well as applicable federal, state, and local requirements for the management and operation of Sandia.

2.1.1 Federal Requirements

The Prime Contract requires compliance with federal requirements, including applicable federal laws and regulations as well as specific DOE directives. The major federal requirements that pertain to environmental protection and management at Sandia are presented below along with compliance approaches and compliance activities.

Environmental Planning

National Environmental Policy Act (NEPA) of 1969

Regulation and Compliance Approach	Compliance Activities
NEPA requires federal agencies to assess the impacts on the human and natural environment of proposed actions prior to making decisions. Sandia personnel use an online NEPA checklist to assess proposed actions and activities for potential environmental consequences. When projects or activities appear to be outside the scope of existing NEPA coverage, a NEPA checklist is prepared and forwarded to DOE for review and determination. Section 3.1 provides information on NEPA activities in 2020.	• Ensure that all environmental impacts have been assessed adequately. • Coordinate NEPA checklists with DOE personnel. • Inform project owners of environmental requirements.

Environmental Management System, Site Sustainability, Emergency Planning, and Community Right-to-Know Act

DOE O 436.1 Department Sustainability

Regulation and Compliance Approach	Compliance Activities
This order places environmental management systems and site sustainability at the forefront of environmental excellence. Sandia personnel comply with this order through implementation of an Environmental Management System (EMS), which is third-party certified to International Organization for Standardization (ISO) 14001:2015 at the Sandia primary operating location in SNL/NM. Operations at SNL/TTR follow the EMS requirements but do not need to be included in the certification, provided that an internal assessment is conducted every three years. This order also specifies requirements for compliance with Emergency Planning and Community Right-to-Know Act requirements. See "Chemical Management" and Table 2-1 for specifics on Sandia's approach to compliance with these requirements.	• Conduct an internal assessment every three years. • Enable identification of the environmental aspects and impacts of activities. • Establish and implement an annual Site Sustainability Plan.

Hazardous Waste and Environmental Restoration

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and amended in 1986

Regulation and Compliance Approach	Compliance Activities
This act establishes liability compensation, cleanup, and emergency response requirements for inactive hazardous waste sites. In addition, CERCLA requires federal facilities to report hazardous substance spills to the National Response Center. DOE performed a preliminary assessment and site inspection in 1988. This inspection confirmed that no sites qualify for the National Priorities List. Therefore, with respect to inactive hazardous waste sites, there are no CERCLA remediation requirements nor CERCLA-related assessments for natural resource damages. The Superfund Amendments and Reauthorization Act (SARA) of 1986 establishes additional reporting requirements that are addressed under "Chemical Management."	• See "Chemical Management" and Table 2-1 for compliance activities.

Federal Facility Agreement and Consent Order

Regulation and Compliance Approach	Compliance Activities
This agreement is an ongoing action with the State of Nevada, DOE, and DOD (DOD, DOE, and State of Nevada 1996). DOE has assumed responsibility for the following environmental restoration sites that are subject to this agreement: Nevada National Security Site, areas within SNL/TTR, areas within the Nevada Test and Training Range, Central Nevada Test Area, and Project Shoal Area (east of Carson City in Churchill County). Section 3.5 provides information on environmental restoration sites.	• Report air monitoring activities at environmental restoration sites. • Report environmental restoration remediation activities.

Resource Conservation and Recovery Act (RCRA), enacted in 1976, as amended

Regulation and Compliance Approach	Compliance Activities
This act sets forth the framework for managing nonhazardous and hazardous solid waste, including the hazardous waste component of mixed waste. SNL/TTR operations generate less than 1,000 kg of hazardous waste through normal operations each month, which equates to small-quantity generator status subject to manifest and pre-transport requirements in 40 CFR 262, *Standards Applicable to Generators of Hazardous Waste.* Under the small-quantity generator designation, hazardous waste can only be stored on-site for a maximum of 180 days before it must be shipped off-site for treatment and disposal at a U.S. Environmental Protection Agency (EPA) permitted facility. Small-quantity generators and conditionally exempt small-quantity generators of RCRA hazardous waste are no longer required to file a biennial hazardous waste report. Nonhazardous municipal solid waste, such as office and food refuse, is disposed of at the SNL/TTR Class II sanitary landfill (operated by a USAF operations and maintenance contractor). Section 3.4 summarizes waste management activities during 2020.	• Minimize waste via recycling and material recovery. • Collect and screen material and waste in preparation for shipment to off-site facilities for recycling, storage, treatment, or disposal.

Radiation Protection

Atomic Energy Act of 1954

Regulation and Compliance Approach	Compliance Activities
This act specifies proper management of source, special nuclear, and byproduct material. DOE has the authority to manage operations based on applicable statutes, federal regulations, and DOE directives. Sandia personnel achieve compliance through adherence to these directives and applicable regulations in 10 CFR 830, *Nuclear Safety Management*, and 10 CFR 835, *Occupational Radiation Protection*. The regulations include radiation protection standards, limits, and program requirements for protecting individuals from radiation exposure as a result of DOE activities.	• Manage materials and facilities in accordance with DOE requirements and oversight, including appropriate documentation. • Ensure that training requirements are met.

DOE O 435.1 Change 1, Radioactive Waste Management

Regulation and Compliance Approach	Compliance Activities
This order ensures that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety, and of the environment. Personnel examine the lifecycle of radioactive waste, radioactive mixed waste, transuranic waste, and transuranic mixed waste before waste is generated to ensure appropriate management. DOE authorization is requested before generating radioactive waste streams with no identified disposal path. Information about the characteristics of each waste is used to manage the waste in a manner that is consistent with applicable law. Section 3.4 summarizes waste management activities during 2020.	• Characterize and manage on-site waste. • Support inspections and audits. • Ensure that training requirements are met.

DOE O 458.1 Admin Change 4, Radiation Protection of the Public and the Environment-

Regulation and Compliance Approach	Compliance Activities
This order establishes requirements to protect the public from undue radiation exposure, demonstrate compliance with public dose limits from air pathways, control releases of radioactive discharges, control radioactive waste, protect drinking water and groundwater, protect biota, control the release of property with residual radioactivity, and manage radiation-related records. DOE issued a moratorium in January 2000 that prohibited the clearance of volume-contaminated metals, and subsequently in July 2000 suspended the clearance of metals from DOE radiological areas for recycling purposes. Chapter 3 provides information on relevant compliance with items listed in the Compliance Activities column.	• Monitor emissions and provide dose assessments. • Adhere to regulations during the operations and maintenance of the drinking water system. • Monitor biota. • Perform property clearances. In 2020, no clearance activities of property (real or personal) occurred, and no metals subject to the moratorium or the suspension were cleared.

Air Quality

Clean Air Act of 1970, as amended

Regulation and Compliance Approach	Compliance Activities
This act governs the management of nonradiological emissions with compliance achieved through adherence to the conditions of permits and applicable regulations. Radiological emissions compliance is achieved through annual reporting of radionuclide air emission and dose assessments in accordance with Subpart H of 40 CFR 61. Chapter 3 provides information on air quality compliance.	• Confirm that planned stationary sources of air pollutants (e.g., equipment) and potential emission from operations meet applicable local and federal requirements. • Maintain documentation that ensures that sources are in compliance with regulations and/or permitted operating conditions. • Submit monitoring reports, annual emissions inventories, and other compliance assurance documentation to regulatory agencies.

Water Quality

Clean Water Act of 1972 and amendments

Regulation and Compliance Approach	Compliance Activities
This act establishes a permitting structure and regulatory direction to protect the "waters of the United States" by restoring and maintaining the chemical, physical, and biological integrity of United States waters; protecting fish, wildlife, and recreation; and reducing pollutant discharges. Compliance is achieved through adherence with Nevada Division of Environmental Protection requirements. Section 3.9 provides information on water quality programs.	• Monitor all wastewater discharges. • Sample wastewater discharge annually. • Develop and update Stormwater Pollution Prevention Plans, including control measures, site inspections, and annual reporting.

Energy Independence and Security Act (EISA) of 2007, Section 438

Regulation and Compliance Approach	Compliance Activities
This section of the act requires federal agencies to manage stormwater runoff from federal development projects for the protection of water resources. Sandia projects planned through the NEPA process ("National Environmental Policy Act") are reviewed for EISA § 438 eligibility. Site planning, design, construction, and maintenance strategies are applied to maintain or restore predevelopment site hydrology. Section 3.9.3 provides information on the Stormwater Program at SNL/TTR.	• Implement Stormwater Pollution Prevention Plan steps to prevent unpermitted discharges. • Conduct inspections.

Oil Pollution Act of 1990 (§ 311)

Regulation and Compliance Approach	Compliance Activities
This act establishes requirements for the prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities. It requires the development and implementation of a Spill Prevention, Control, and Countermeasure Plan. The compliance strategy for Oil Pollution Act requirements is based on Sandia personnel developing, implementing, and maintaining a Spill Prevention, Control, and Countermeasure Plan for all applicable oil storage containers. Oil storage facilities at SNL/TTR are not subject to regulation under 40 CFR 112, *Oil Pollution Prevention*, due to the location of all oil storage containers and equipment within a hydrologically closed basin with no potential to impact waters of the United States. Section 3.7 provides information on the Oil Storage Program.	• Inspect oil storage containers routinely. • Train oil-handling personnel routinely. • Maintain an oil storage container inventory. • Incorporate oil spill prevention requirements and practices into processes, procedures, and new container installations.

Safe Drinking Water Act of 1974, as amended

Regulation and Compliance Approach	Compliance Activities
This act was established to protect the quality of drinking water in the United States, focusing on all waters actually or potentially designed for drinking use, whether from aboveground or underground sources. SNL/TTR operates under two permits issued by Nevada Division of Environmental Protection: one for the public water system and one for the arsenic removal treatment system. The Nevada Division of Environmental Protection characterizes this public water system as a Non-Transient Non-Community Water System. Section 3.9 provides information on water quality programs.	• Adhere to permit requirements. • Sample drinking water for quality parameters.

Chemical Management

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986

Regulation and Compliance Approach	Compliance Activities
This act requires reporting of toxic chemicals used and released by federal, state, and local governments and industry. In amending CERCLA of 1980, SARA Title III is recognized as EPCRA. Per EPCRA, chemical hazard information is provided to the community for awareness and enhancement of emergency planning efforts. See Table 2-1 for specifics.	• Maintain and report on a chemical inventory. • Report qualifying releases.

Federal Insecticide, Fungicide, and Rodenticide Act, enacted in 1910 and amended in 1972

Regulation and Compliance Approach	Compliance Activities
This act regulates the use of herbicides, rodenticides, and insecticides. EPA regulations and applicable label guidelines are followed.	• State-licensed subcontractors supply, handle, and apply the products.

Toxic Substances Control Act, enacted in 1976 and later amended

Regulation and Compliance Approach	Compliance Activities
This act regulates the manufacture, processing, distribution, use, and disposal of specific chemical substances and/or mixtures. Compliance with this act includes managing asbestos and polychlorinated biphenyls (PCBs). There are no PCB-contaminated transformers at SNL/TTR. Chapter 3 provides information related to managing toxic substances.	• Conduct asbestos abatement in accordance with applicable regulatory requirements.

Pollution Prevention

Pollution Prevention Act of 1990

Regulation and Compliance Approach	Compliance Activities
This act declares as national policy that pollution should be prevented or reduced at the source wherever feasible, and disposal or other release into the environment should only be done as a last resort. A toxic chemical source reduction and recycling report is required for facilities that meet the reporting requirements under EPCRA, Section 313. See the previous EPCRA discussion under "Chemical Management."	• Conduct database queries for chemical purchases annually. • Compare environmental releases with EPCRA reporting thresholds. • Prepare annual reports and submit them to federal, state, and local regulatory agencies. • Follow green purchasing practices.

Natural Resources

Bald and Golden Eagle Protection Act (16 USC § 668-668d), enacted in 1940

Endangered Species Act of 1973, amended in 1982

Executive Order 11988 of 1977, Floodplain Management, as amended

Executive Order 11990 of 1977, Protection of Wetlands, as amended

Executive Order 13112 of 1999, Invasive Species

Executive Order 13751 of 2016, Safeguarding the Nation from the Impacts of Invasive Species

Fish and Wildlife Conservation Act (Public Law [PL] 96-366), enacted in 1980, and the Lacey Act Amendments (PL 97 79), enacted in 1981

Migratory Bird Treaty Act (MBTA) of 1918 (and amendments)

Sikes Act of 1960 (PL 86-97), enacted in 1960, and the amendments of 1986 (PL 99-561) and 1997 (PL 105-85 Title XXIX), reauthorized in 2013

Wild Free-Roaming Horses and Burros Act (PL 92-195), enacted in 1971, and amendments

Regulation and Compliance Approach	Compliance Activities
A variety of statutes and presidential executive orders ensure protection and conservation of natural resources. Natural resources are protected via compliance with applicable statutes, long-term surveillance, and ecological compliance. Management is initially through the NEPA process (see "National Environmental Policy Act") and review of project plan effects. Chapter 4 provides more information about the Ecology Program.	• Conduct biological evaluations and inventory surveys.

Cultural Resources

American Indian Religious Freedom Act, enacted in 1978 and amended in 1994

Archaeological Resources Protection Act, enacted in 1979 and amended in 1988

DOE O 144.1, Department of Energy American Indian Tribal Government Interactions and Policy

DOE O 430.1C, Real Property Asset Management

DOE P 141.1, Management of Cultural Resources

National Historic Preservation Act, enacted in 1966 and amended in 2000, Section 106

Native American Graves Protection and Repatriation Act, enacted in 1990

Regulation and Compliance Approach	Compliance Activities
Multiple statutes and DOE directives provide for the management and preservation of cultural resources. Protection of cultural resources (including historical properties) is initially provided through the NEPA process (see "National Environmental Policy Act") and review of project plan effects. Sandia personnel support DOE coordination with other federal agencies and with local, state, and tribal to protect and preserve cultural resources. Chapter 5 provides more information on the Cultural Resource Management Program.	• Develop internal management plans. • Conduct cultural resource surveys. • Survey property to determine eligibility for inclusion in the National Register of Historic Places. • Prepare documentation to support planning activities and decisions. • Review NEPA checklists on identify impacts on cultural resources. • Monitor construction activities for impacts on cultural resources.

Reporting

DOE O 231.1B, Admin Change 1, Environment, Safety and Health Reporting

Regulation and Compliance Approach	Compliance Activities
This order ensures that 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 operation of DOE facilities, or DOE credibility. It enhances mission safety and promotes the sharing of effective practices to support continuous improvement and adaptation to change. Sandia personnel report on environmental program activities, monitoring results, accidental releases, and waste management operations.	• Produce an Annual Site Environmental Report.

DOE O 232.2A, Chg1 (MinChg) Occurrence Reporting and Processing of Operations Information

Regulation and Compliance Approach	Compliance Activities
This order requires timely notification to DOE about events that could adversely affect the health and safety of the public or workers, the environment, DOE missions, or DOE credibility. Sandia personnel promote organizational learning through investigation and analysis of reported events and conditions that adversely affect or may adversely affect personnel, the public, property, the environment, or the DOE mission. Section 2.3 provides further information.	• Track all environmental events.

Quality Assurance

DOE O 414.1D Admin Change 1, Quality Assurance	
Regulation and Compliance Approach	**Compliance Activities**
The purpose of this order is to achieve quality in all work and ensure that products and services meet or exceed customer requirements and expectations. All environmental sampling and analyses at SNL/TTR conform to applicable quality assurance plans, sampling plans, and field operations. Chapter 6 provides information on quality assurance.	• Develop quality assurance plans, operating plans, and sampling plans. • Provide a statement of work for contract laboratories. • Participate in quality assurance audits of contract laboratories.

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

2.1.2 Chemical Inventory and Toxic Release Inventory Reporting

The chemical inventory report and the toxic release inventory report for SNL/TTR in 2020 are submitted to EPA and support compliance with EPCRA. The chemical inventory report documents toxic chemicals in use and all chemical purchases. Table 2-1 lists the EPCRA reporting requirements.

Table 2-1. SNL/TTR applicable EPCRA reporting requirements

Section	EPCRA Section Title	Description	Reporting Required in 2020?
301–303	Emergency Planning	Sections 301–303 of EPCRA require an annual report that lists inventories of chemicals that are above the reportable threshold planning quantities, including the location of the chemicals and the emergency contacts.	Yes
304	Emergency Notification	Section 304 of EPCRA requires an immediate notification following the accidental release of a reportable quantity of extremely hazardous substances.	No
311–312	Community-Right-to-Know: Toxic Chemical Release Inventory Reporting	Sections 311–312 of EPCRA provide requirements for maintaining safety data sheets for hazardous chemicals and for submitting inventory forms for these chemicals.	Yes
313	Toxic Release Inventory	Section 313 of EPCRA requires that a Toxic Release Inventory report be submitted for facilities that release toxic chemicals listed in SARA Title III over a threshold value.	No

The chemical inventory report for SNL/TTR was submitted to EPA. In 2020, there were no reportable quantity releases of extremely hazardous substances requiring notification under Section 304 of EPCRA. A Toxic Release Inventory report was not required under Section 313 of EPCRA.

2.1.3 Nevada State Environmental Requirements

The State of Nevada administers most of the environmental requirements applicable to Sandia operations at SNL/TTR (Table 2-2).

Table 2-2. SNL/TTR applicable State of Nevada Administrative Code requirements

Chapter and Provisions
NAC-444, Sanitation
NAC-444.570 to NAC-444.980, Solid Waste Disposal
NRS-444A, Programs for Recycling
NRS-444A.010 to NRS-444A.120, Programs for Recycling
NAC-445A, Water Controls
NAC-445A.9656 to NAC-445A.9706, Septic Tanks
NAC-445A.228 to NAC-445A.272, Discharge Permits
NAC-445A.450 to NAC-445A. 6731, Public Water Systems
NAC-445B, Air Controls
NAC-445B.001 to NAC-445B.3477, Air Pollution
NAC-445B.400 to NAC-445B.774, Emissions from Engines
NAC-459, Hazardous Materials
NAC-459.9921 to NAC-459.999, Storage Tanks
NAC-477, State Fire Marshall
NAC-477.323, Permit to Store Hazardous Material
NAC-504, Wildlife Management and Propagation
NAC-534, Underground Water and Wells
NAC-534.010 to NAC-534.500, Underground Water and Wells

Note: The Nevada Administrative Code is accessed through https://www.leg.state.nv.us/NAC/CHAPTERS.HTML. The Nevada Revised Statute is accessed through https://www.leg.state.nv.us/NRS/.
NRS = Nevada Revised Statute

2.2 Environmental Management System

The EMS is a continuing cycle of planning, implementing, evaluating, and improving processes to achieve environmental goals. The EMS facilitates identification of the environmental aspects and impacts of Sandia's activities, products, and services; identification of risks and opportunities that could impact the environment; evaluation of applicable compliance obligations; establishment of environmental objectives; and, creation of plans to achieve those objectives and monitor their progress.

DOE O 436.1, *Departmental Sustainability*, provides requirements for managing sustainability practices. Sandia personnel implement this order through an ISO 14001-certified EMS. Sandia National Laboratories received initial ISO 14001:2004 certification in June 2009. In 2015, the Sandia site-specific certifications for primary operating locations in New Mexico and California were integrated into a multisite ISO 14001:2004 certification. In 2018, the EMS was recertified under the new ISO 14001:2015 (ISO 14001:2015).

SNL/TTR operations do not need to be included in the certification, provided that an internal assessment is conducted every three years to ensure that personnel follow the EMS requirements. In January 2020, an EMS assessment was conducted to evaluate conformance with ISO 14001:2015 requirements at SNL/TTR. Additional information can be found at the following external EMS website:

www.sandia.gov/about/environment/environmental_management_system/index.html

The EMS provides the following benefits:

- Improved environmental performance
- Enhanced compliance with environmental regulations
- Strengthened pollution prevention efforts
- Improved resource conservation
- Increased environmental efficiencies and reduced costs
- Enhanced image with the public, regulators, and potential new hires
- Heightened awareness of environmental issues and responsibilities

For fiscal year (FY) 2020, air emissions, hazardous materials use, and hazardous waste generation were identified as the top three significant aspects for Sandia operations. When significant aspects and negative impacts have been identified, environmental objectives—at all operating levels—are established to guide efforts toward minimizing those aspects and impacts.

Aspects are any elements of activities, products, or services that can interact with the environment, and *impacts* are any changes in the environment, whether adverse or beneficial, wholly or partially resulting from activities, products, or services.

2.2.1 Site Sustainability Plan

A Site Sustainability Plan is prepared annually to assist DOE in meeting its sustainability goals and the broader sustainability program set forth in EO 13834, *Efficient Federal Operations* (EO 13834). Sandia's most recent plan, *Fiscal Year 2021 Site Sustainability Plan* (SNL/NM 2020b), describes the performance status for FY 2020.

Sustainability goals are being met or exceeded in several key areas. Table 2-3 presents performance status for several selected key areas for all Sandia sites (except as noted). Data is from DOE Sustainability Dashboard.

Table 2-3. Site Sustainability Plan performance status for key areas

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2020
Clean and Renewable Energy	
Renewable electric energy should account for not less than 7.5 percent of the total agency electric consumption by FY 2013 and each year thereafter.	Purchased renewable energy credits to meet 20 percent of the total electric consumption forecasted for FY 2020.
Electronic Stewardship	
Purchases: Ninety-five percent of eligible acquisitions each year are EPEAT-registered products.	Acquired EPEAT-registered products for 89.32 percent of eligible electronics purchased in FY 2020.

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2020
Greenhouse Gas Reduction	
Year-over-year Scope 1 and Scope 2 greenhouse gas emissions reduction from an FY 2008 baseline. Year-over-year Scope 3 greenhouse gas emissions reduction from an FY 2008 baseline.	• Reduced Scope 1 and Scope 2 greenhouse gas emissions by 60.5 percent from the FY 2008 baseline, and reduced year-over-year emissions by 2.1 percent relative to FY 2019. • Reduced Scope 3 greenhouse gas emissions by 35.1 percent from the FY 2008 baseline, and reduced year-over-year emissions by 26.9 percent relative to FY 2019.
Organizational Resilience	
Discuss overall integration of climate resilience in emergency response, workforce, and operations procedures and protocols.	Completed a Climate Vulnerability Assessment, which highlights areas where resilience to climate change has been integrated, as well as areas for improvement.
Sustainable Acquisition	
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring that BioPreferred and biobased provisions and clauses are included in all applicable contracts.	• Flowed down sustainable acquisition requirements in applicable contracts. Included the Federal Acquisition Regulation and DOE Acquisition Regulation clauses related to sustainable acquisitions. • Established an interdepartmental team to enhance sustainable acquisition programs. • Created corporate- and division-level EMS objectives that focus on sustainable acquisitions for FY 2021. • Included all environmental specifications to be met in applicable contracts, including biobased acquisitions. Added the Federal Acquisition Regulation and DOE Acquisition Regulation clauses to Section II Terms and Conditions in the majority of contracts.
Sustainable Buildings	
At least 15 percent (by count) of owned existing buildings to be compliant with the revised *Guiding Principles* for Sustainable Buildings by FY 2021, with annual progress thereafter.	Achieved compliance with the *Guiding Principles* in 18.4 percent of the buildings.
Sustainable Energy Management	
Energy intensity reduction of 30 percent (Btu per gross square foot) in goal-subject buildings by FY 2015 from an FY 2003 baseline and 1.0 percent year-over-year thereafter.	The target for FY 2020 is a 5 percent reduction of energy intensity from FY 2015. In FY 2020, performance was reduced 0.06 percent from FY 2015. In FY 2020, performance increased by 0.27 percent compared to FY 2019.
Water Use Efficiency and Management	
Reduce potable water intensity by 20 percent relative to an FY 2007 baseline by FY 2015 and 0.5 percent year-over-year thereafter.	Results for SNL/TTR only: increased potable water intensity by 26.1 percent in FY 2020 relative to an FY 2007 baseline and reduced it by 25.6 percent relative to FY 2019.

EPEAT = Electronic Product Environmental Assessment Tool

2.2.2 Sustainability Awards

The DOE Sustainability Performance Division sponsors the DOE Sustainability Awards, which recognize outstanding sustainability contributions by individuals and teams at DOE facilities across the country. The awards celebrate excellence in energy, water, and fleet management projects and practices. Each year, Sandia EMS personnel select nominees from that year's Environmental Excellence Awards winners. In 2020, Sandia personnel submitted four nominations for the DOE

Sustainability Awards and received the 2020 Sustainability Champion Award and an Honorable Mention for the same category. Neither was for activities at SNL/TTR.

2.3 Environmental Performance

Environmental performance is measured as progress toward achieving site environmental objectives, meeting or exceeding compliance, and contributing to corporate and contract performance goals. Results are tracked and reported internally through the ES&H Assurance Dashboard, the management review process, and management reports.

Criteria for performance evaluation were set forth in the *Fiscal Year 2020 DOE/NNSA Strategic Performance Evaluation Measurement Plan (PEMP)* (DOE/NNSA/SFO 2020). Subsequently, DOE National Nuclear Security Administration Sandia Field Office prepared the *FY2020 Performance Evaluation Summary* (DOE/NNSA/SFO 2021), assessing the management and operating contractor performance for October 1, 2019, through September 30, 2020. The performance evaluation is the annual DOE National Nuclear Security Administration report card that ascribes a rating to six key performance goals and an overall rating. Sandia received a rating of excellent in three of the six goals: Mission Execution: Global Nuclear Security; DOE and Strategic Partnership Projects Mission Objectives; and Science, Technology and Engineering. A rating of very good was received in the three remaining categories: Mission Execution: Nuclear Weapons, Mission Enablement, and Mission Leadership. Sandia received an overall rating of very good.

2.3.1 Audits, Appraisals, and Inspections in 2020

Environmental programs are routinely subjected to audits, appraisals, inspections, and/or verifications by external agencies and authorities. The Sandia internal audit group also conducts assessments, including reviews of implementation of applicable policies, processes, 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. In 2020, scheduled audits were cancelled or delayed because of Coronavirus 2019 (COVID-19) restrictions.

2.3.2 Occurrence Reporting in 2020

Under DOE O 232.2A, Chg 1 (MinChg)), *Occurrence Reporting and Processing of Operations Information*, the current order for occurrence reporting, *occurrences* are defined as "events or conditions that adversely affect, or may adversely affect, DOE (including the National Nuclear Security Administration) or contractor personnel, the public, property, the environment, or the DOE mission." Events or conditions meeting the criteria thresholds identified in this order are occurrences. Whereas some environmental releases may not meet DOE O 232.2A Chg 1 (MinChg) reporting thresholds, they may still be reportable to outside agencies.

Occurrences that met DOE O 232.2A Chg 1 (MinChg) criteria were entered into the DOE Occurrence Reporting and Processing System database. For this Annual Site Environmental Report, the Occurrence Reporting and Processing System database was queried for SNL/TTR occurrences in the following reporting criteria groups (as defined by DOE O 232.2A Chg 1 [MinChg]):

- Group 5, Environmental
- Group 9, Noncompliance Notifications
- Group 10, Management Concerns and Issues (with identified environmental impact)
- Any occurrence that involved a Sandia environmental program

Qualifying occurrences that took place within a building are not provided in this report.

During 2020, no occurrences met the query criteria for reporting in the Annual Site Environmental Report.

Per DOE, *occurrences* are defined as "events or conditions that adversely affect, or may adversely affect, DOE (including the National Nuclear Security Administration) or contractor personnel, the public, property, the environment, or the DOE mission."

2.4 Environmental Permit Status

Environmental permits for SNL/TTR include those for hazardous materials storage, public water supply, stormwater, RCRA, and air-quality compliance. The State of Nevada issues permits for these activities directly to DOE, and Navarro Research and Engineering administers them on behalf of the Sandia management and operating contractor. Sandia and Navarro Research and Engineering ensure that all permit conditions are met. Table 2-4 lists permits and registrations in effect at SNL/TTR in 2020.

Table 2-4. SNL/TTR environmental permits, 2020

Permit Type	Permit Number	Issue Date	Expiration Date	Comments
Air Quality				
Class II Air Quality Operation Permit	• AP8733-0680.04 • FIN A0025, Air Case 8856 and 9500	July 23, 2016, Issuance of Revision and Renewal signed on May 22, 2020	July 23, 2021	• Welding operation • Carpenter area • Paint booth • Generators (five logged systems) • Surface area disturbance (less than five acres) • Portable Soil Sorting System
Class II General Air Quality Operating Permit for Temporary Construction Sources	• API442-3996.04 • FIN A2118 • Air Case 9739	July 30, 2018	May 7, 2022 (permit terminated November 4, 2020)	General Permit was terminated after the emission units were permitted under AP8733-0680.04
Hazardous Waste (Nevada State Fire Marshal)				
Hazardous Materials Permit	• FDID Number: 13007 • Permit Number: 88536	February 28, 2020	February 28, 2021	State of Nevada
Hazardous Waste (RCRA)				
Hazardous Waste Generator	NV1890011991[a]	January 7, 1993	Indefinite	State of Nevada
Production Well (Drinking Water)				
Permit to Operate a Treatment Plant	NY-3014-TP11-12NTNC	September 9, 2020	September 30, 2021	State of Nevada
Production Well 6	NY-3014-12-NTNC[b]	September 15, 2020	September 30, 2021	State of Nevada

Permit Type	Permit Number	Issue Date	Expiration Date	Comments
Water Conservation Plan	Reviewed and approved by Nevada Department of Conservation and Natural Resources, Division of Water Resources	February 25, 2016 – The updated plan was sent to the State for approval on January 20, 2021	February 24, 2021 (plan approval by the state has not yet been received)	State of Nevada Required by NRS540.131
Stormwater Construction General Permit				
TTR Test Unit Recovery Operations	• DOE Number: CSW-41616 • SNL Number: CSW-41615	March 24, 2016	Notice of Termination submitted January 17, 2018	State of Nevada Not required due to "Closed Basin" determination

[a] Generator identification number (not a permit number).
[b] The State of Nevada renews the permit for Production Well 6 (NV-3014-12NTNC) annually.
FDID = Fire Department Identification
NDEP = Nevada Division of Environmental Protection

Chapter 3. SNL/TTR Environmental Programs

Old times at Tonopah Test Range

OVERVIEW ■ Sandia personnel take the responsibility of protecting the environment seriously. Numerous program teams monitor the air, water, and soil at SNL/TTR.

Sandia personnel collect data at SNL/TTR to determine and report the impact of existing operations on the environment. These environmental program activities meet or exceed federal, state, and local environmental requirements as well as DOE directives in Sandia's Prime Contract. Presidential executive orders and DOE guidance documents are also used to establish program criteria.

The current environmental programs and focus areas include:

- NEPA Program
- Environmental Life-Cycle Management Program
- Chemical Information System
- Waste Management Program
- Environmental Restoration Project
- Air Quality Compliance Program
- Oil Storage Program
- Terrestrial Surveillance Program
- Water quality programs

The Ecology Program is presented in Chapter 4. The Cultural Resource Management Program is presented in Chapter 5.

3.1 National Environmental Policy Act Program

NEPA Program personnel provide technical assistance to ensure that operations comply with NEPA and the National Historic Preservation Act. For proposed projects and activities, project owners complete a NEPA checklist using NEPA Module software to assess potential environmental impacts.

After a NEPA checklist is submitted, NEPA Program personnel review projects and activities for conformance with existing DOE NEPA documents and determinations. Other applicable environmental program subject matter experts also review proposed projects and activities to determine and communicate any applicable environmental permitting and/or other requirements.

Personnel from SNL/TTR and the SNL/NM NEPA team support projects at SNL/TTR, including ES&H preparations for the next series of B61-12 flight tests. This support includes continued collaboration with the DOE National Nuclear Security Administration Sandia Field Office, SNL/TTR, SNL/NM, and Los Alamos National Laboratory personnel.

In 2020, the NEPA team completed 11 NEPA checklists for SNL/TTR, five of which were transmitted to the DOE National Nuclear Security Administration Sandia Field Office for review and completion. NEPA Program activities that required DOE review and determination in 2020 are summarized below. Of these completed NEPA checklists, none required preparation of an environmental assessment or an environmental impact statement.

Operations

NEPA checklists for the following operations were submitted to DOE in 2020:

- Continued development testing
- Continued radiological protection operations
- Continued environmental monitoring

Facility Projects

NEPA checklists for the following facility projects were submitted to DOE in 2020:

- Exterior building renovation
- Radio shelter and tower installation

3.2 Environmental Life-Cycle Management Program

Environmental Life-Cycle Management Program activities ensure long-term protection of human health and the environment. Using the NEPA process, program personnel review proposed SNL/TTR projects and activities that have the potential to impact the environment. This review provides a process for minimizing adverse environmental impacts from ongoing and future activities. In 2020, environmental impacts of eight projects were reviewed and documented.

3.3 Chemical Information System

The Chemical Information System is a comprehensive chemical information tool used to track workplace chemical and biological containers by location. The primary drivers for the Chemical Information System are state and federal regulations, including the Emergency Planning and Community Right-to-Know Act. The Chemical Information System compiles information concerning chemical hazards and appropriate protective measures for Emergency Management Operations, other ES&H programs, and the workforce.

The inventory system provides the chemical or product name, its location and quantity, and information about who is responsible for the chemical. Chemical hazards are reported on safety data sheets, and the Chemical Information System currently contains more than 120,000 safety data sheets in its library. This electronic inventory helps chemical users and their managers assess and manage workplace hazards. Easy access to this inventory facilitates availability searches. It also improves the ability to share chemicals and thus help reduce sources, which helps to minimize chemical purchases and waste disposal expenses.

A pre-procurement module, ChemPro, is used to request permission for new chemical purchases. The system runs a series of queries, comparing the requested purchasing information to regulatory limits, and determines whether the requested chemical and volume are approved for use and storage in the specified location. If approved, the requestor is given a chemical approval number, which must be provided to the chemical vendor as part of the purchasing process. ChemPro allows for proactive environmental and safety planning.

3.4 Waste Management Program

Navarro Research and Engineering manages all waste generated at SNL/TTR—which excludes any waste generated by environmental restoration activities—under the Waste Management Program. Waste categories include radioactive waste, RCRA 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 2020 is presented in Table 3-1 and Table 3-2, respectively. All regulated waste was shipped off-site to permitted treatment, storage, and disposal facilities.

Table 3-1. SNL/TTR waste generated, 2020

Waste Type	Weight (pounds)
Radioactive waste	0
Total non-RCRA-regulated waste	430
Total recycled materials	286
Total RCRA hazardous waste	142
Toxic Substances Control Act waste (asbestos)	0
Toxic Substances Control Act waste (PCBs)	41

Table 3-2. SNL/TTR waste shipped, 2020

Waste Type (Facility)	Weight (pounds)
Battery recycling (National Automotive Parts Association and Veolia)	39[a]
Construction debris (USAF Construction Landfill)	628,767
Sanitary landfill (USAF Sanitary Landfill)	32,380
Tires (Lunas Tire Recycling)	0

[a] This quantity is also included in the "Total recycled materials" quantity located in Table 3-1.

Waste Minimization

SNL/TTR personnel are 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: antifreeze (on-site recycling unit); e-waste, including computers, monitors, radios,

and electronics; fluorescent and sodium bulbs; freon (on-site recovery unit); fuels and oil; lead acid batteries; mercury-containing equipment; solvents; and tires.

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 2020 are presented in Table 3-3.

Table 3-3. SNL/TTR material recycled or energy-recovered and shipped off-site, 2020

Recycled or Energy-Recovered Waste	Shipped (pounds)
Antifreeze	0
Automotive-type batteries	0
Mercury-containing articles	0
Non-PCB light ballasts	133
Tires	0
Universal waste batteries	39
Universal waste lamps	114
Used oil	0
Used oil filters	115
Total	401[a]

[a] Weights have been rounded to the nearest integer.

Radioactive Waste Management

There were no radioactive waste shipments in 2020.

3.5 Environmental Restoration Project

Environmental restoration activities were initiated at SNL/TTR and the Nevada Test and Training Range in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. DOE is responsible for all SNL/TTR and Nevada Test and Training Range environmental restoration sites.

Since 1996, cleanup activities for selected sites located in the State of Nevada have been regulated by the Federal Facility Agreement and Consent Order of 1996, as amended (see Chapter 2). This order was negotiated between the State of Nevada, DOD, and DOE (DOD, DOE, and State of Nevada 1996).

The Federal Facility Agreement and Consent Order took effect in 1996 and accomplished the following:

- Established a framework for identifying Corrective Action Sites
- Grouped Corrective Action Sites into Corrective Action Units
- Prioritized Corrective Action Units for remediation
- Implemented corrective action activities

Three environmental restoration activities are addressed by Corrective Action Units located at SNL/TTR and the Nevada Test and Training Range:

- Industrial sites activity occurs at sites historically used to support nuclear testing and Sandia activities. Industrial sites include historical septic tank systems, landfills, sewage lagoons, depleted uranium sites, and ordnance testing sites.

- Long-term monitoring activity occurs at areas where closed Federal Facility Agreement and Consent Order sites have land use restrictions or contamination left in place and require some form of post-closure monitoring.
- Soil activity occurs at 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.

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

3.5.1 Corrective Action Site Identification

The initial identification, description, and listing of Corrective Action Sites at SNL/TTR and the Nevada Test and Training Range were derived from the Preliminary Assessment and the Federal Facility Preliminary Assessment Review (E&E 1989). Twelve additional potential Corrective Action Sites, not included in the Preliminary Assessment, were identified, thereby increasing the total number of Corrective Action Sites to 70 using the following methods: environmental restoration site inventory processes, ordnance removal activities, geophysical surveys, former worker interviews, archive reviews, site visits, and aerial radiological and multispectral surveys.

The Clean Slate and Double Tracks sites (Operation Roller Coaster) are listed under soil Corrective Action Units/Corrective Action Sites in Table 3-4 as CAU 411, CAU 412, CAU 413, and CAU 414. Project 57 (located on Nellis Range 4808A) and Small Boy (located on the Nevada Test and Training Range) are listed as CAU 415 and CAU 541, respectively, in Table 3-4. As of 2020, CAU 411, CAU 412, CAU 413, CAU 414, CAU 415, and CAU 541 have all been closed. A listing of Corrective Action Units/Corrective Action Sites is available in Federal Facility Agreement and Consent Order appendices II, III, and IV (DOD, DOE, and State of Nevada 1996).

Table 3-4. Status of remediation activities at SNL/TTR, 2020

Corrective Action Site Number	Corrective Action Site Description	General Location
CAU 411— Closed. Double Tracks plutonium dispersion (NAFR)		
NAFR-23-01	Plutonium-contaminated soil	Nellis Range 71N
CAU 412— Closed. Clean Slate I plutonium dispersion (SNL/TTR)		
TA-23-01CS	Plutonium-contaminated soil	Tonopah Test Range
CAU 413—Closed. Clean Slate II plutonium dispersion (SNL/TTR)		
TA-23-02CS	Plutonium-contaminated soil	Tonopah Test Range
CAU 414— Closed. Clean Slate III plutonium dispersion (SNL/TTR)		
TA-23-03CS	Plutonium-contaminated soil	Tonopah Test Range
CAU 415—Closed. Project 57 No. 1 plutonium dispersion (Nevada Test and Training Range)		
NAFR-23-02	Plutonium-contaminated soil	Nellis Range 13
CAU 541—Closed. Small Boy		
05-23-04	Atmospheric tests (six), BFa[a] site	BFa, Nevada Test and Training Range
05-45-03	Atmospheric test site, Small Boy	Frenchman Flat, Area 5, Nevada Test and Training Range

[a] BFa is the site name and not an acronym.
NAFR = Nellis Air Force Range

3.5.2 History of Double Tracks and Clean Slate Sites

Operation Roller Coaster, conducted in May and June 1963, subjected a series of four nuclear devices to chemical explosions, which resulted in plutonium dispersal in surrounding soils. Three of these tests were conducted within the boundaries of SNL/TTR; the fourth was conducted at the Nevada Test and Training Range just west of SNL/TTR. The three Operation Roller Coaster test sites at SNL/TTR are referred to as Clean Slate I, Clean Slate II, and Clean Slate III. The fourth test site is referred to as Double Tracks. In 1996 and 1997, interim corrective actions were performed at Double Tracks and Clean Slate I. In 2016, DOE completed the remaining corrective actions at Double Tracks and Clean Slate I, and the Nevada Division of Environmental Protection approved the Final Closure Report. These two sites have been determined to be Clean Closed as defined in the Federal Facility Agreement and Consent Order. Clean Slate II and Clean Slate III were Clean Closed in 2018 and 2019, respectively. All four Operation Roller Coaster sites are presently fenced and have radiological signage posted.

DOE is responsible for remediation of these and all other environmental restoration sites at SNL/TTR. DOE and Sandia personnel will continue to be responsible for all other environmental compliance at these sites.

3.5.3 Environmental Restoration Project Activities in 2020

During 2020, at the request of DOE, Desert Research Institute (DRI) maintained five portable environmental monitoring stations at SNL/TTR as part of Project Post Closure Monitoring, an environmental restoration activity (Figure A-1). 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 Corrective Action Units associated with Operation Roller Coaster at SNL/TTR. Detailed discussion of the air monitoring results for the Clean Slate monitoring stations is provided in an annual report, *Tonopah Test Range Air Monitoring: CY 2020 Meteorological, Radiological, and Wind Transported Particulate Observations* (Chapman et al. 2021 in progress). A summary of air monitoring stations and 2020 results is provided in Appendix A, "SNL/TTR Air Monitoring Stations in 2020."

3.6 Air Quality Compliance Program

Air Quality Compliance Program personnel support Sandia in ensuring that operations comply with air quality regulations promulgated by the federal and state government in accordance with the Clean Air Act and the Clean Air Act Amendments of 1990. Program personnel also ensure that operations are compliant with regulatory requirements and the SNL/TTR Class II Air Quality Operating Permit issued by the State of Nevada. In Nye County, the Nevada Department of Environmental Protection implements air quality regulations and standards established by EPA and the State of Nevada.

3.6.1 Nonradiological Air Emissions

The Class II Air Quality Operating Permit for SNL/TTR requires emission reports from the following permitted nonradionuclide sources: a portable soil sorting system, facility maintenance shops, and generators. Table 3-5 summarizes the permitted source emission data for 2020.

Table 3-5. Permitted source emission data, 2020

Carbon Monoxide	Hazardous Air Pollutant	Nitrogen Oxide	Particulate Matter with a Diameter ≤ 10 µm	Sulfur Dioxide	Volatile Organic Compound
0.68	0.03	1.01	0.07	0.16	0.22

Note: All units are in tons per year.

3.6.2 Radionuclide Air Emissions

EPA tracks radionuclide air emissions in accordance with 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," and has set a maximally exposed individual radiological dose limit of 10 mrem/year resulting from all radiological air emissions produced from any DOE facility. Radionuclide emission releases at SNL/TTR and annual dose assessments are reported in the *Radionuclide National Emission Standards for Hazardous Air Pollutants Annual Report for Calendar Year 2020, Sandia National Laboratories, Tonopah Test Range* (SNL/NM 2021).

Currently, operations at SNL/TTR do not involve activities that release radioactive emissions from point sources (stacks and vents). However, diffuse radiological emissions are produced from the resuspension of americium, plutonium, and other radionuclides that are present at the Clean Slate environmental restoration sites (see Section 3.5).

Radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAP) compliance activities included calculating the dose from resuspension of the Clean Slate source term to a maximally exposed individual using the 1988 Clean Air Act Assessment Package dose code. The resuspension calculations were conservative and demonstrated the need for air monitoring at the Clean Slate sites (SNL/NM 1995).

Soil removal activities were conducted at Clean Slate sites II and III in 2018. These activities included soil disturbance, excavation, soil removal, and packaging and shipping contaminated soil and debris (see Section 3.5). Using soil data derived from the Clean Slate sites (DOE/NV/EMNP 2017a; DOE/NV/EMNP 2017b) provided in Table 3-6, the dose to the maximally exposed individual was determined using the Clean Air Act Assessment Package dose code to evaluate applicability with radiological NESHAP guidelines. Data from an ambient air sampler, Station 400 (Table 3-7), was compared to the modeled maximally exposed individual to ensure model accuracy. Detailed discussion of the air monitoring results for the Clean Slate monitoring stations is provided in an annual report, *Tonopah Test Range Air Monitoring: CY 2020 Meteorological, Radiological, and Wind Transported Particulate Observations* (Chapman et al. 2021 in progress).

Table 3-6. Clean Slate II and Clean Slate III soil sampling results, 2020

Source, Name, Location	Description	Source Type	Monitoring Method	Radionuclide	Releases (Curies)
Soil disturbance at Clean Slate II Site	Approximately 1.80 ft^3 of soil was disturbed	Area	Calculated	Americium 241	6.80E-16
				Cesium 137	1.64E-18
				Plutonium 238	7.78E-17
				Plutonium 239	7.79E-15
				Plutonium 240	1.83E-15
				Plutonium 241	7.70E-14
				Thorium 232	1.63E-18
				Uranium 234	1.52E-18
				Uranium 235	4.62E-19
				Uranium 238	4.86E-18

Source, Name, Location	Description	Source Type	Monitoring Method	Radionuclide	Releases (Curies)
Soil disturbance at Clean Slate III Site	Approximately 6.10 ft^3 acres of soil was disturbed	Area	Calculated	Americium 241	2.50E-15
				Americium 243	5.41E-17
				Cesium 137	6.58E-19
				Plutonium 238	2.38E-16
				Plutonium 239	2.90E-14
				Plutonium 240	6.78E-14
				Plutonium 241	2.84E-14
				Thorium 232	6.47E-17
				Uranium 234	5.13E-18
				Uranium 235	1.57E-18
				Uranium 238	1.65E-17

Table 3-7. Air monitoring results, 2020

Source, Name, Location	Description	Source Type	Monitoring Method	Radionuclide	Measured Maximum Average (µCi/mL)
Station 400	Quarterly data is averaged	Measured	Periodic (twice quarterly)	Plutonium 238	1.62E-16
				Plutonium 239	1.19E-16

The Nellis USAF airport, located off-site and to the west of SNL/TTR, is currently used as the location of the maximally exposed individual. The dose to the non-Sandia public maximally exposed individual was calculated to be 7.26E-14 mrem/year from soil data from Clean Slate II and Clean Slate III. The calculated dose from air monitoring data was determined to be 1.60E-11 mrem/year from Station 400. Both values are significantly below the EPA annual dose limit of 10 mrem/year.

3.6.3 Other Air Quality Monitoring Activities at SNL/TTR

In addition to Sandia environmental program personnel, 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 DRI.

Desert Research Institute of the Nevada System of Higher Education

DRI, the environmental research arm of the Nevada System of Higher Education, trains and provides monitoring station managers through the Community Environmental Monitoring Program to collect samples from off-site air monitoring stations at 23 locations within communities surrounding the Nevada National Security Site. These include the towns of Tonopah and Goldfield, which are near SNL/TTR. DRI personnel maintain the air-monitoring equipment and send a quarterly sample of collected air filters from each station for analysis. DRI provides external quality assurance on samples collected at Community Environmental Monitoring Program stations through duplicate sampling of 10 percent of the station samples. Data collected at the monitoring stations are reported in the Nevada National Security Site Annual Site Environmental Report.

3.7 Oil Storage Program

The Oil Storage Program supports management, operation, and maintenance of oil storage containers and equipment at SNL/TTR to prevent spills or releases of oil that could potentially damage water resources, impact soil, or otherwise adversely affect the environment.

Although it was determined in 2019 that SNL/TTR oil storage facilities are not subject to regulation under 40 CFR 112, *Oil Pollution Prevention*, because of the location of all oil storage containers and equipment within a hydrologically closed basin with no potential to impact waters of the United States, SNL/TTR site personnel continue to perform monthly inspections of oil storage containers and equipment to ensure functional operating conditions and to monitor for potential spills or releases to the environment as a best management practice.

There were no reportable oil spills or releases at SNL/TTR in 2020.

3.8 Terrestrial Surveillance Program

Terrestrial Surveillance Program personnel collect environmental media (soil) samples, which are analyzed for radiological constituents, as required. As a best management practice, samples are also collected to analyze metals. Terrestrial surveillance began at SNL/TTR in 1992.

In addition to the environmental media samples collected, ambient external gamma radiation levels are measured using environmental dosimeters. Optically stimulated luminescent dosimeters have been employed to measure ionizing radiation since 2018. These surveillance activities are conducted at designated locations that are on-site, off-site, and around the perimeter of SNL/TTR. Soil sampling is conducted annually, and the dosimeters are exchanged quarterly.

Soil is loose, unconsolidated mineral or organic materials on the immediate surface of the earth that support plant growth. *Sediment* is particles or aggregates derived from rocks, soil, or biological material that are subsequently transported and deposited. *Vegetation* is plant life or the total plant cover of an area.

3.8.1 Regulatory Criteria

The Terrestrial Surveillance Program is designed and conducted to address DOE O 458.1, Change 4 (LtdChg)), *Radiation Protection of the Public and the Environment,* which establishes standards and requirements to protect the public and the environment from undue risk from radiation associated with radiological activities under the control of DOE.

The Terrestrial Surveillance Program is also conducted to satisfy implementation of Sandia's Environmental Management System, which is certified to ISO 14001:2015, *Environmental Management Systems –Requirements with Guidance for Use*. Reporting is done in accordance with DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*.

3.8.2 Sample Locations and Media

Terrestrial Surveillance Program personnel use 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 dosimeters, deployed and collected quarterly, are used to measure cumulative ambient external radiation dose and to approximate the dose potentially received from natural and unnatural sources.

The on-site sample locations are in areas of known contamination: corrective action sites and areas of potential release (sites with current outdoor testing activities). Perimeter sample locations are located around the boundaries of SNL/TTR. Off-site sample locations are in remote areas, areas near local population, and along major roadways. On-site, perimeter, and off-site terrestrial surveillance locations, sample media, and parameters are described in Table 3-8, Table 3-9, and Table 3-10, respectively. On-site, perimeter, and off-site locations are presented in Figure 3-1, Figure 3-2, and Figure 3-3, respectively.

Table 3-8. SNL/TTR on-site terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number	Sample Location	Soil[a]	Dosimeter[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 Operations Center (southwest corner)	X[c]	
	S-44	Range Operations Center (northeast corner)	X[c]	
	S-45	Storage shelters 03-38 and 03-39	X[c]	
	S-46	Sand Building	X[c]	
	S-47	Generator storage area	X[c]	
South Plume Area	S-49	North/south Mellan Airstrip (southwest of S-48)	X[d]	
	S-50	North/south Mellan Airstrip (signpost)	X[d]	
	S-52	Northeast of Mellan Airstrip	X[d]	
Various on-site	S-01	Antelope Lake area fence, cultural area sign	X[d]	X
	S-02	North/south Mellan Airstrip (south fencepost)	X[d]	X
	S-03	Dosimeter at Clean Slate I	X[d]	X
	S-04	Dosimeter at Clean Slate III	X[d]	X
	S-09	Operation 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]	

[a] Soil samples are analyzed for radionuclides by gamma spectroscopy annually.
[b] Dosimeters are analyzed to determine the dose from ambient gamma radiation.
[c] Soil samples are analyzed for Target Analyte List metals every five years.
[d] Soil samples are analyzed for Target Analyte List metals annually.

Table 3-9. SNL/TTR perimeter terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number	Sample Location	Soil[a,b]	Dosimeter[c]
Perimeter	P-05	Operation and Maintenance 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 (dosimeter south of P-35)	X	X
	P-12	Dosimeter at "U.S. Government Property" sign	X	X
	P-34	Operation and Maintenance 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	

[a] Soil samples are analyzed for radionuclides by gamma spectroscopy annually.
[b] Soil samples are analyzed for Target Analyte List metals every five years.
[c] Dosimeters are analyzed to determine the dose from ambient gamma radiation.

Table 3-10. SNL/TTR off-site terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number[a]	Sample Location	Soil[b,c]	Dosimeter[d]
Off-site	C-19	Goldfield Museum		X
	C-20	State Road 6 Rest Area	X	
	C-21	State Road 6 and State Road 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 Road 6 and State Road 376 junction	X	
	C-28	Stone Cabin and Willow Creek on State Road 6	X	
	C-29	State Road 6 and State Road 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	

[a] Off-site samples were previously called "community" samples, thus the *C* label in the location number (maintained for the database).
[b] Soil samples are analyzed for radionuclides by gamma spectroscopy annually.
[c] Soil samples are analyzed for Target Analyte List metals every five years (not sampled in 2019).
[d] Dosimeters are analyzed to determine the dose from ambient gamma radiation.

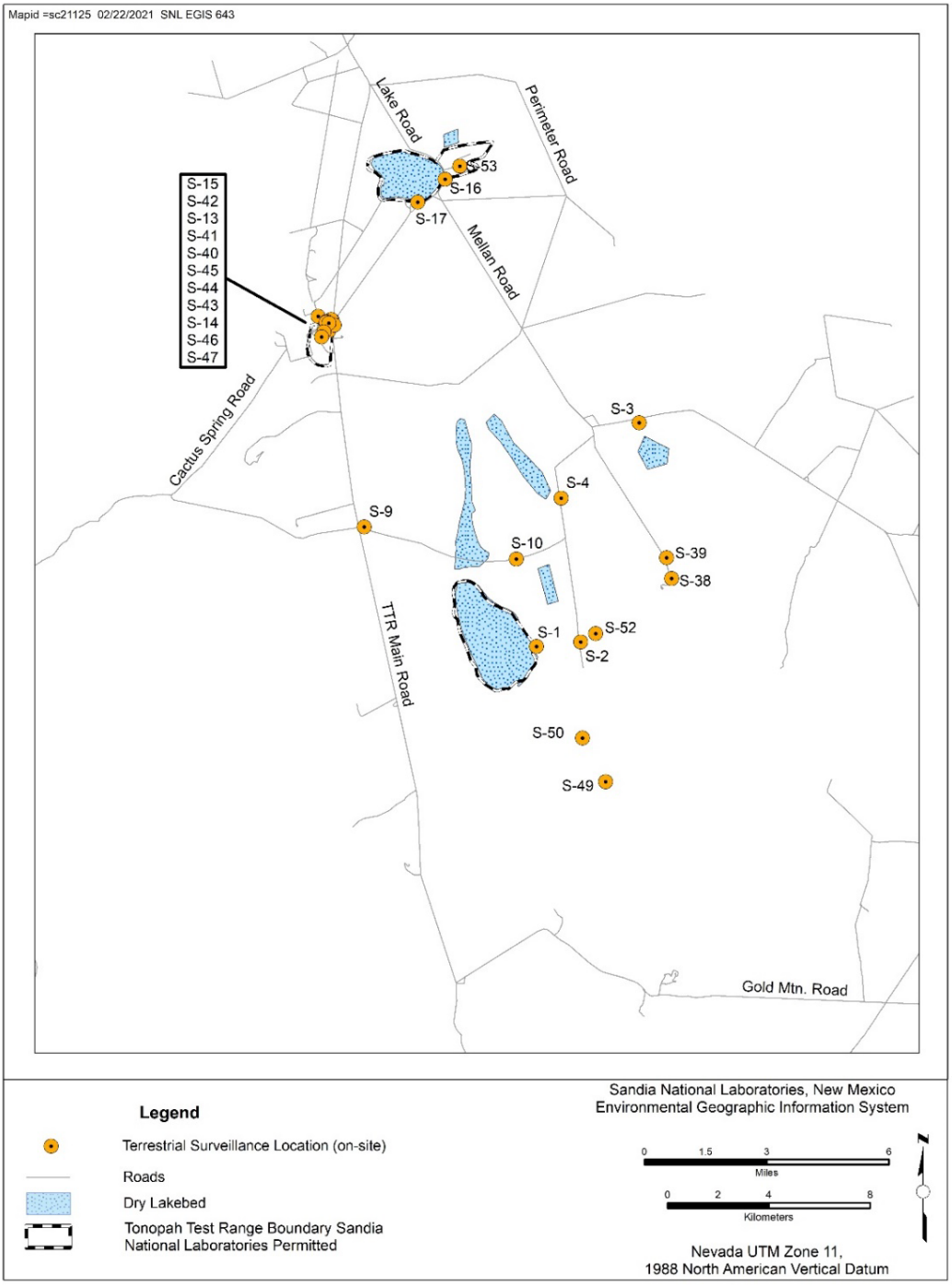

Figure 3-1. SNL/TTR on-site terrestrial surveillance locations

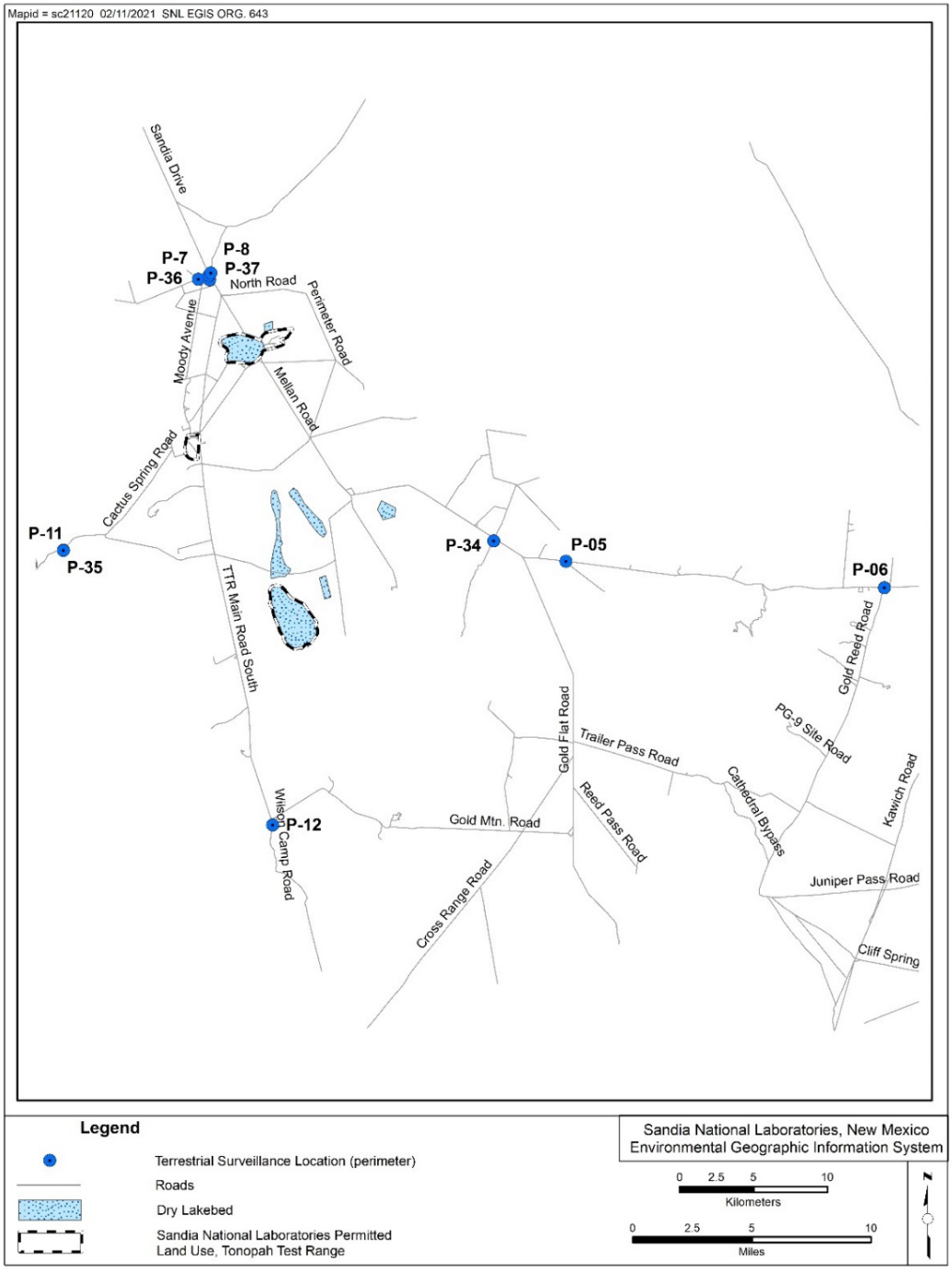

Figure 3-2. SNL/TTR perimeter terrestrial surveillance locations

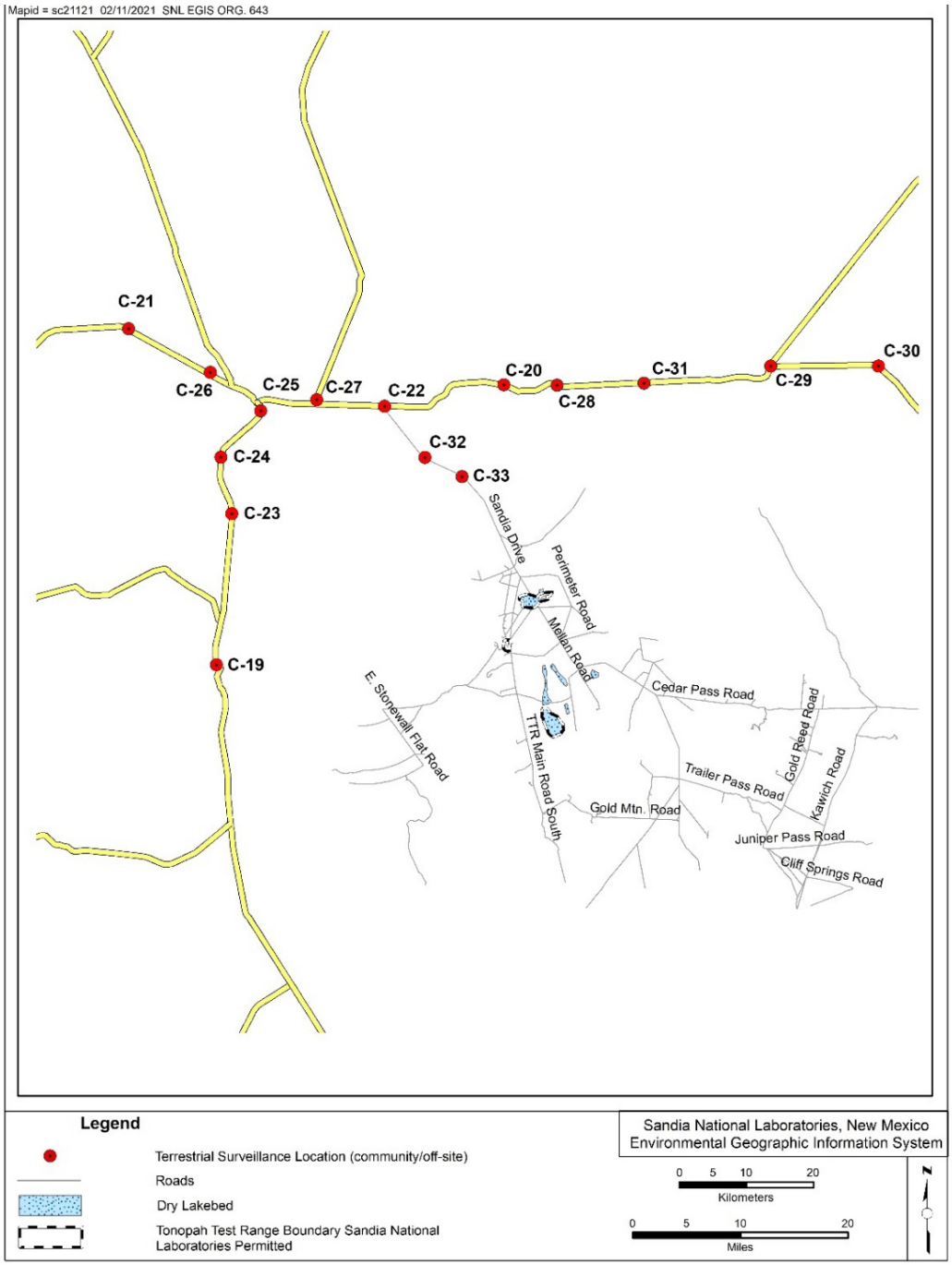

Figure 3-3. SNL/TTR off-site terrestrial surveillance locations

3.8.3 Field Methods, Analytical Parameters, and Quality Control Procedures

All samples are collected in accordance with applicable field operating procedures for soil sampling activities and with the *Quality Assurance Project Plan for Terrestrial Surveillance at Sandia National Laboratories, New Mexico* (SNL/NM 2019a).

Off-site laboratories analyze all samples in accordance with applicable EPA analytical methods. All chemical data is reviewed and qualified in accordance with *Data Validation Procedure for Chemical and Radiochemical Data* (SNL/NM 2020a).

Soil samples are analyzed for modified Target Analyte List metals and radiological parameters, including gamma-emitting radionuclides and plutonium. 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:** Because of past explosives testing, plutonium is present in some limited areas at 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.

The dosimeters are issued and analyzed by an accredited off-site laboratory.

Field-quality control samples include triplicate environmental samples. These samples are prepared in accordance with applicable field operating procedures. Laboratory-quality control samples are prepared and analyzed in accordance with established methods.

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

3.8.4 Data Analysis and Methodology

The statistical analysis methodology performed on sample results is being revised. Therefore, general statistics, population comparisons, and trend analysis were not conducted.

Environmental dosimeter data may be compared to established natural background (terrestrial and cosmic) radiation levels in the non-urban areas of Nevada. Levels in these areas are elevated when compared to much of the United States due to the higher elevation and the presence of radionuclides in the soil and bedrock. The radiation dose from natural background sources (indoor radon not included) in non-urban areas of Nevada is 71 mrem/year (Mauro and Briggs 2005).

Analytical results for metals in soil samples may be compared to values in the following references (presented in Table 3-11):

- Local and regional soil concentrations (Dragun and Chekiri 2005)
- EPA risk-based soil screening levels (EPA 2020)
- Trace elements in soil (Kabata-Pendias 2000)

Table 3-11. Comparison reference values for metals in soil at SNL/TTR

Analyte	Nevada Soil Concentrations[a]		EPA Risk-Based Soil Screening Levels[b]		Trace Elements in Soil[c]	
	Lower Limit (mg/kg)	Upper Limit (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	Lower Limit (mg/kg)	Upper Limit (mg/kg)
Aluminum	5,000	100,000	77,000	1,100,000	4,500	100,000
Antimony	< 1.0	1.0	31	470	0.25	0.60
Arsenic	2.9	24	0.68	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	7.0	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	5.0	50	1,500	22,000	5	150
Potassium	1,900	63,000	—	—	—	—
Selenium	< 0.1	1.1	390	5,800	0.10	4.0
Silver	0.5	5.0	390	5,800	0.20	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
Uranium (total)	1.9	4.2	16	230	0.30	10.7
Vanadium	30	150	390	5,800	0.7	98
Zinc	25	128	23,000	350,000	13	300

[a] Source: Drag^un and Chekiri 2005.
[b] Source: EPA (Target Hazard Quotient = 1.0) 2020.
[c] Source: Kabata-Pendias 2000.
— = not available
ND = not detected

3.8.5 Terrestrial Surveillance Program Results in 2020

The following Terrestrial Surveillance Program activities occurred in 2020:

- The annual soil sampling was not conducted in 2020 because of COVID-19 access restrictions.
- Environmental dosimeters were deployed and collected at designated locations and analyzed quarterly. The results are reported as an estimated annual dose rate.

The analytical results for environmental dosimeters are provided in Appendix B, "SNL/TTR Terrestrial Surveillance Analytical Results in 2020."

Dosimeter Results

Table 3-12 shows the average dose rate summary statistics. The 2020 dosimeter data is presented, but trend analyses will not be performed until several more years of data are available. The average annual dose rates are higher than the established non-urban Nevada value of 71 mrem/year (Mauro

and Briggs 2005). The difference may be attributed to a variety of elevations, proximity to bedrock, and the statistical nature of radioactivity.

Table 3-12. SNL/TTR dosimeter dose rate summary statistics by location classification, 2020

Location Classification	Number of Observations	Mean (mrem/ year)	Median (mrem/ year)	Standard Deviation (mrem/ year)	Minimum (mrem/ year)	Maximum (mrem/ year)
On-site	11	108	109	12.2	82	124
Perimeter	6	106	109	9.6	93	116
Off-site	3	98	108	18.5	77	111

Variances from Planned Activities

Terrestrial Surveillance Program soil sampling in 2020 was not conducted because of COVID-19 access restrictions.

3.9 Water Quality Programs

The SNL/TTR water quality programs focus on monitoring potable water, conserving water, sampling wastewater effluent, and implementing Stormwater Pollution Prevention Plan requirements.

3.9.1 Drinking Water

SNL/TTR personnel use three active wells: Production Well 6, 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 well that supplies drinking water to the Main Compound in Area 3 and the Area 3 Fire Protection Water Distribution System. 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.

All sampling and quality assurance practices for public water system drinking water were conducted in accordance with requirements set by the Nevada Division of Environmental Protection. Analytes are sampled at different intervals, as shown in Table 3-13. The Nevada Division of Environmental Protection currently provides public monitoring and reporting requirements for each public water system around March annually. The public water system at SNL/TTR is permitted by the Nevada Division of Environmental Protection as a Non-Transient, Non-Community Water System under identification number NV003014. The well water is sampled and analyzed routinely per Nevada Division of Environmental Protection requirements to demonstrate conformance with primary drinking water standards.

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

https://ndwis.ndep.nv.gov/DWW/JSP/WaterSystemDetail.jsp?tinwsys_is_number=296666&tinwsys_st_code=NV&wsnumber=NV0003014

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

Table 3-13. SNL/TTR routine production well parameters

Analyte	Reporting Frequency
Arsenic	Quarterly
Coliform, total	Quarterly
Dioxin	As required by NDEP, usually every three years
Disinfectant, residual	Quarterly (checked daily)
Di(2-ethylhexyl) phthalate *also known as* Bis(2-ethylhexyl) phthalate	As required by NDEP, usually every three years
Ethyl benzene	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 three years
Lead and copper	As required by NDEP, usually every three years
Nitrate	Annually
Secondary (13) drinking water standards	As required by NDEP, usually every three years
Total trihalomethanes and haloacetic acids (5)	Annually
Total xylene	Annually

IOC = inorganic compound
SOC = synthetic organic compound
VOC = volatile organic compound

A Nevada Division of Environmental Protection-permitted treatment system for arsenic removal (permit number NV-3014 TP-11-12NTNC) is used at SNL/TTR. The arsenic removal system has performed well since the installation of a carbon dioxide (pH adjustment) system in June 2008. The untreated water is maintained 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 2020

In 2020, two precautionary Boil Water Notices were issued for the SNL/TTR public water system. Both notices were issued due to loss of pressure events resulting from repairs to leaking water mains. The first notice was issued on March 23, 2020, and was rescinded on April 6, 2020, after state approval was granted following repairs and sampling. The second notice was issued on December 10, 2020, and was rescinded on January 4, 2021, after state approval was granted following repairs and sampling.

All drinking water sample results collected during 2020 were below the Nevada Division of Environmental Protection maximum contaminant levels established for the substances monitored.

Four arsenic compliance samples were collected from the Area 3 distribution system for analysis in 2020. The maximum contaminant level for arsenic in drinking water is 10 ppb as a running annual average. The maximum running annual average for arsenic in the drinking water at SNL/TTR occurred during the first quarter of 2020 and was 2.19 ppb. The arsenic removal media was last changed out in June 2018, and it usually lasts approximately five years before needing to be replaced.

During 2020, Production Well 6 produced 1,043,800 gallons of water that was chlorinated and sent to the elevated water storage tower. This equals an average monthly production of approximately 87,000 gallons during 2020. Daily production during 2020 averaged approximately 2,860 gallons.

3.9.2 Septic Tank Systems

Septic tank systems are sampled as needed. DOE 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). The USAF currently occupies the facilities using the septic tanks at 36-01, the Firing Range, and the SNL/TTR Main Gate. The only septic tank being used by Sandia personnel at this time is located at Building 24-01. Sewage from these locations flows into septic tank systems and associated drain fields. None of these systems required maintenance, sampling, or pumping in 2020. All other remaining septic tank systems have been closed or are undergoing closure and are being addressed by Environmental Restoration Project personnel.

3.9.3 Stormwater

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. Currently, stormwater sampling is not required at SNL/TTR.

New construction activities that exceed one acre of soil disturbance require permitting under the Construction General Permit. During 2020, there were no construction projects requiring permit coverage at SNL/TTR.

Wastewater is the spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.

3.9.4 Wastewater

Wastewater discharges from activities conducted at facilities in the Main Compound at Area 3 go to the USAF facultative sewage lagoon for treatment. The USAF is responsible for the National Pollutant Discharge Elimination System 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 in their USAF Discharge Monitoring Report; however, the National Pollutant Discharge Elimination System permit was modified in 1997, and quarterly data is no longer required.

As a best management practice, SNL/NM personnel sample Area 3 wastewater annually at the point where wastewater leaves SNL/TTR property and enters the USAF system. All sampling and quality assurance practices were conducted in accordance with program-specific sampling and analysis plans and Quality Assurance Plans (see Chapter 6).

No wastewater was sampled at SNL/TTR in 2020 because of COVID-19 restrictions.

3.9.5 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 states that when the average annual consumption is significantly greater than 37 gallons per capita per day, plan revisions will be considered to include additional conservation measures. The plan must be updated every five years (the next revision is due in March 2021). The current plan was revised in November 2020, and DOE has sent the plan to the State of Nevada Department of Conservation and Natural Resources, Division of Water Resources for approval.

Chapter 4. SNL/TTR Ecology Program

Pronghorn (*Antilocapra americana*)

OVERVIEW ■ Ecology Program personnel monitor biota as an element of the overall environmental monitoring process. Ecological data is collected on plants and wildlife to support documentation, land use decisions, and ecological and wildlife awareness campaigns to ensure safe work environments and sustainable decision-making strategies. Ecology Program personnel help operations comply with wildlife regulations and laws by providing biological evaluations and surveys in support of site activities.

At SNL/TTR, Ecology Program personnel support site activity and project compliance with wildlife requirements by conducting biological evaluations and surveys. The surveys, primarily for birds, are conducted in late spring to measure species diversity, abundance, and land use patterns. As part of the Avian Protection Plan for SNL/TTR, utility poles associated with Sandia projects are also surveyed for any potential risks to birds that may roost or nest on the poles.

The data are used to support NEPA documentation, land use decisions, ecological and wildlife awareness campaigns, and sustainable decision-making strategies, and to help ensure safe work environments.

4.1 Ecological Setting

The topography at SNL/TTR is characterized by a broad, flat valley with two north- and south-trending mountain ranges: the Cactus Mountain Range to the west (occurring mostly within the boundaries of SNL/TTR) and the Kawich Mountain Range to the east. Cactus Flat is the name given to the valley floor where the main operational area of SNL/TTR is located. To the south, the landscape consists of low hills and outcrops. Elevations range from 5,347 feet at the valley floor to 7,482 feet at Cactus Peak (USAF 1997).

The area north of the SNL/TTR boundary is comprised of public lands administered by the U.S. Bureau of Land Management and the U.S. Forest Service. The land is currently used to graze cattle; there is a substantial irrigated farming operation north of SNL/TTR. The Nevada Wild Horse Range, which is administered by the U.S. Bureau of Land Management (USAF 1997), is to the east of SNL/TTR.

A *biogeographic province* is a large region characterized as distinct from other regions, mostly based on different dominant vegetation and wildlife habitat types.

SNL/TTR, in general, is situated within the Great Basin biogeographic province, as described by Brown (Brown 1982). A biogeographic province is a large region characterized as distinct from other regions, mostly based on different dominant vegetation and wildlife habitat types.

4.1.1 Vegetation

Most of the SNL/TTR vegetation can be subdivided into several general types. The vegetation of the lower elevation portions, such as Cactus Flat, is primarily dwarf shrub and saltbrush shrubland (with a vegetation height of less than or equal to 1.6 ft) and is typified by shadscale (*Atriplex confertifolia*), budsage (*Artemisia spinescens*), winterfat (*Krascheninnikovia lanata*), and Indian ricegrass (*Achnatherum hymenoides*). Intermediate elevation slopes are dominated by Great Basin mixed desert scrub, and the shrub cover tends to be taller (greater than or equal to 1.6 ft), with some grassland characterized by various species of horsebrush (*Tetradymia* spp.), rabbitbrush (*Chrysothamnus viscidiflorus* and *Ericameria nauseosa*), hopsage (*Grayia spinosa*), shadscale, and budsage. As the elevation increases, Joshua trees (*Yucca brevifolia*) and junipers (*Juniperus* spp.) start to increase in abundance. The understory becomes that of black sagebrush (*Artemisia nova*) and rabbitbrush.

The abbreviation sp. is used when the actual specific name cannot or need not be specified and spp. (plural) indicates several species. The abbreviation ssp. refers to a subspecies.

Surface water at Cactus Spring and Antelope Spring can support emergent vegetation and a few deciduous trees.

4.1.2 Wildlife

Wildlife at SNL/TTR is typical of the Great Basin biogeographic province. There are no sites with fish at SNL/TTR, except for a potential presence at the Roller Coaster Construction Pond. The Roller Coaster Construction Pond was modified and stocked with goldfish (*Carassius* sp.) and mosquitofish (*Gambusia* sp.).

A notable species is feral horses (*Equus ferus*), which are often called wild horses or mustangs. Horses were introduced to the area in the seventeenth and eighteenth centuries. Though wild horses compete with livestock and wildlife for limited forage, they are protected under the Wild Free-Roaming Horses and Burros Act (PL 92-195).

The bird species typically found in the valley floor are those associated with the sagebrush community and include common nighthawk (*Chordeiles minor*), common raven (*Corvus corax*), green-tailed towhee (*Pipilo chlorurus*), horned lark (*Eremophila alpestris*), mourning dove (*Zenaida macroura*), sagebrush sparrow (*Artemisiospiza nevadensis*), and sage thrasher (*Oreoscoptes montanus*).

From the valley floor, going up in elevation, the vegetation changes to include Joshua trees and junipers, and the bird diversity increases. Common birds in this zone include ash-throated flycatchers (*Myiarchus cinerascens*), black-throated sparrows (*Amphispiza bilineata*), loggerhead shrikes (*Lanius ludovicianus*), mourning doves, Scott's orioles (*Icterus parisorum*), and western kingbirds (*Tyrannus verticalis*). Several of these species can be observed nesting in the Joshua trees. At even higher elevations, where there are steep rocky slopes, chukars (*Alectoris chukar*), which were introduced into the area, and rock wrens (*Salpinctes obsoletus*) may be encountered. Common ravens are widespread across all of SNL/TTR.

Although SNL/TTR is a high desert, the playas will have standing water if there is plenty of precipitation. During seasonal migrations—should the playas have water—ducks, geese, and water birds can be found at these playas and at man-made retention ponds. A few waterfowl and other water birds may breed at the small permanent man-made bodies of water. At Roller Coaster Construction Pond, the freshwater habitat attracts several bird species that would not otherwise be found at SNL/TTR. Common yellowthroats (*Geothlypis trichas*) and Bullock's orioles (*Icterus bullockii*) are known to nest at this pond. Other bird species that have been encountered at this pond, and potentially could nest there, include red-winged blackbird (*Agelaius phoeniceus*), vermilion flycatcher (*Pyrocephalus rubinus*), western kingbird, and western wood-pewee (*Contopus sordidulus*).

Several raptor species are known to use the SNL/TTR area for hunting, roosting, and breeding. Some of these birds include American kestrels (*Falco sparverius*), barn owls (*Tyto alba*), ferruginous hawks (*Buteo regalis*), golden eagles (*Aquila chrysaetos*), great horned owls (*Bubo virginianus*), prairie falcons (*Falco mexicanus*), red-tailed hawks (*Buteo jamaicensis*), and Swainson's hawks (*Buteo swainsoni*).

Reptile species that have been observed include coachwhip (*Masticophis flagellum*), Great Basin gopher snake (*Pituophis catenifer deserticola*), Great Basin rattlesnake (*Crotalus oreganus lutosus*), long-nosed leopard lizard (*Gambelia wislizenii*), sagebrush lizard (*Sceloporus graciosus*), and western patch-nosed snake (*Salvadora hexalepis*).

Mule deer (*Odocoileus hemionus*), desert bighorn (*Ovis canadensis nelsoni*), mountain lions (*Puma concolor*), pronghorn (*Antilocapra americana*), and feral horses are the notable large mammal species that occur at SNL/TTR. In general, mule deer, desert bighorn, and mountain lions reside in the higher elevations of the mountain ranges. Pronghorn are usually seen in the open, short-grass and scattered brush habitat of the valley floor. Feral horses are more opportunistic and are found in practically all habitat types within the SNL/TTR area.

Common medium-sized mammals found within the SNL/TTR area include American badgers (*Taxidea taxus*), black-tailed jackrabbits (*Lepus californicus*), bobcats (*Lynx rufus*), coyotes (*Canis latrans*), and kit foxes (*Vulpes macrotis*).

The smaller mammals and rodents that are common at SNL/TTR include deer mice (*Peromyscus spp.*), desert cottontails (*Sylvilagus audubonii*), desert woodrats (*Neotoma lepida*), Merriam's kangaroo rats (*Dipodomys merriami*), and white-tailed antelope squirrels (*Ammospermophilus leucurus*).

Six species of bats have been identified as occurring at the DOD Nevada Test and Training Range (USAF 1997). These bat species are likely to be found at SNL/TTR. All these bat species primarily use caves, abandoned mines, trees, and buildings for roosts; they include California myotis (*Myotis californicus*), canyon bat (*Parastrellus hespereus*), fringe myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), pallid bat (*Antrozous pallidus*), and Townsend's big-eared bat (*Corynorhinus townsendii*).

4.2 Avian Surveillance

Avian surveys were established in 2004 to monitor patterns of bird richness and abundance in the basic habitats found within the DOE-controlled land at SNL/TTR. There are eight bird survey locations; see Table 4-1 for location and habitat descriptions. Six of these locations consist of driving routes and/or transects, and two locations are single points. One of the single-point locations is the Roller Coaster Construction Pond; the other is adjacent to office and maintenance buildings. Renewed land use agreements may alter the location of future avian surveys.

Surveys were conducted annually from 2004 through 2019 (with the exception of six years) during late spring to early summer (mid-May through June). Scheduling conflicts (e.g., restricted site access during testing activities) prevented surveys in 2006, 2013, 2014, 2015, 2017, 2018, and again in 2020. The surveys in 2020 were not conducted because of COVID-19 restrictions. From all survey years, 114 species of birds have been recorded at SNL/TTR. Table 4-2 lists those bird species and the survey locations where they were encountered. It should be noted that some of the species listed were also seen in other places at SNL/TTR that are not covered by the bird surveys. Many of the waterfowl and most of the water birds were seen on the various playas when rain or snow events produced standing water.

Avian surveys were established in 2004 to monitor patterns of bird richness and abundance in the basic habitats found within the DOE-controlled land at SNL/TTR.

During the 10 years that these surveys have been conducted, two bird species have been encountered at every survey location at least once (horned lark and common raven). Both species are year-round residents. Horned larks are the most abundant species at SNL/TTR. On average across the 10 years and all the survey locations, 64 horned larks were encountered per year. Common ravens, being large black birds, are quite conspicuous and are likely to be seen or heard practically every day. However, their overall abundance is much lower than that of horned larks. On average across the 10 years, 8.5 common ravens were encountered per year.

Table 4-1. SNL/TTR bird survey locations and habitat descriptions

Approximate Location of the Bird Surveys	Habitat Description
Antelope Peak	Scattered Joshua tree/juniper and mixed desert shrub
Antelope Spring	Mixed desert scrub, some grassland
Area 3	Buildings and other structures
Area 9	Dwarf shrub
Area 49	Dwarf shrub
Cactus Spring	Scattered Joshua tree/juniper and mixed desert shrub **Note:** An ephemeral spring with emergent vegetation and two deciduous trees is close to one point of this survey.
Mellon Airstrip	Dwarf shrub
Roller Coaster Construction Pond	Small open water pond with emergent vegetation and numerous deciduous trees

As these surveys were conducted in late spring and early summer, many of the species encountered were migrants. As seen in Table 4-2, a large percentage of the total number of species encountered during these surveys were found at the Roller Coaster Construction Pond (76 of the 114 bird species, or 67 percent) and at Cactus Spring (34 of the 114 species, or 30 percent). The surface water along

with the associated emergent vegetation and tall deciduous trees provide a major stop habitat for migrant birds as well as for the resident birds.

Biota is the animal and plant life of a given region; *biotic* is relating to or resulting from living organisms.

Table 4-2. SNL/TTR bird species encountered and locations (all years)

Common Name	Scientific Name	AP	AS	A3	A9	A49	CS	MA	CP	Other
Cinnamon teal	*Anas cyanoptera*								●	
Northern shoveler	*Anas clypeata*								●	
Gadwall	*Anas strepera*								●	●
Northern pintail	*Anas acuta*								●	●
Green-winged teal	*Anas crecca*								●	●
Canvasback	*Aythya valisineria*									●
Redhead	*Aythya americana*									●
Bufflehead	*Bucephala albeola*									●
Chukar	*Alectoris chukar*	●					●			
Horned grebe	*Podiceps auritus*									●
Eared grebe	*Podiceps nigricollis*									●
Eurasian collared-dove	*Streptopelia decaocto*			●					●	
White-winged dove	*Zenaida asiatica*			●					●	
Mourning dove	*Zenaida macroura*			●			●		●	
Calliope hummingbird	*Selasphorus calliope*						●			
Virginia rail	*Rallus limicola*								●	
Sora	*Porzana carolina*								●	
American coot	*Fulica americana*								●	
Black-necked stilt	*Himantopus mexicanus*								●	●
American avocet	*Recurvirostra americana*								●	●
Killdeer	*Charadrius vociferus*				●				●	
Spotted sandpiper	*Actitis macularius*								●	●
Wilson's phalarope	*Phalaropus tricolor*								●	●
Bonaparte's gull	*Chroicocephalus philadelphia*									●
Ring-billed gull	*Larus delawarensis*									●
Herring gull	*Larus argentatus*									●
Great egret	*Ardea alba*								●	●
Snowy egret	*Egretta thula*								●	●
Black-crowned night-heron	*Nycticorax nycticorax*								●	
White-faced ibis	*Plegadis chihi*									●
Turkey vulture	*Cathartes aura*			●	●			●	●	
Golden eagle	*Aquila chrysaetos*					●	●			●
Sharp-shinned hawk	*Accipiter striatus*								●	
Cooper's hawk	*Accipiter cooperii*								●	
Swainson's hawk	*Buteo swainsoni*	●		●		●				●
Red-tailed hawk	*Buteo jamaicensis*	●		●	●	●			●	●
Ferruginous hawk	*Buteo regalis*									●

Common Name	Scientific Name	AP	AS	A3	A9	A49	CS	MA	CP	Other
Great horned owl	*Bubo virginianus*			●	●					
Burrowing owl	*Athene cunicularia*									●
Belted kingfisher	*Megaceryle alcyon*								●	
Ladder-backed woodpecker	*Picoides scalaris*						●			
American kestrel	*Falco sparverius*	●								●
Prairie falcon	*Falco mexicanus*	●	●					●	●	
Ash-throated flycatcher	*Myiarchus cinerascens*				●					
Cassin's kingbird	*Tyrannus vociferans*				●					
Western kingbird	*Tyrannus verticalis*			●	●	●				
Olive-sided flycatcher	*Contupus cooperi*	●							●	
Western wood-pewee	*Contopus sordidulus*	●	●				●		●	
Gray flycatcher	*Empidonax wrightii*						●		●	
Dusky flycatcher	*Empidonax oberholseri*						●		●	
Pacific-slope flycatcher	*Empidonax difficilis*								●	
Black phoebe	*Sayornis nigricans*								●	
Say's phoebe	*Sayornis saya*			●	●			●		
Vermilion flycatcher	*Pyrocephalus rubinus*								●	
Loggerhead shrike	*Lanius ludovicianus*	●	●		●	●	●			
Cassin's vireo	*Vireo cassinii*								●	
Warbling vireo	*Vireo gilvus*								●	
Common raven	*Corvus corax*	●	●	●	●	●	●	●		●
Horned lark	*Eremophila alpestris*	●	●	●	●	●	●	●	●	●
Tree swallow	*Tachycineta bicolor*			●					●	●
Violet-green swallow	*Tachycineta thalassina*			●	●				●	●
Northern rough-winged swallow	*Stelgidopteryx serripennis*			●					●	●
Barn swallow	*Hirundo rustica*			●						●
Cliff swallow	*Petrochelidon pyrrhonota*			●					●	●
Juniper titmouse	*Baeolophus ridgwayi*	●								
Rock wren	*Salpinctes obsoletus*	●	●				●			
Canyon wren	*Catherpes mexicanus*	●					●			
House wren	*Troglodytes aedon*								●	
Blue-gray gnatcatcher	*Polioptila caerulea*								●	
Ruby-crowned kinglet	*Regulus calendula*					●	●		●	
Hermit thrush	*Catharus guttatus*								●	
American robin	*Turdus migratorius*						●		●	
Sage thrasher	*Oreoscoptes montanus*	●	●				●			
Northern mockingbird	*Mimus polyglottos*	●	●		●		●			
European starling	*Sturnus vulgaris*			●					●	
House sparrow	*Passer domesticus*			●						●
American pipit	*Anthus rubescens*						●		●	
House finch	*Carpodacus mexicanus*		●	●			●			
Pine siskin	*Carduelis pinus*						●			
Cassin's sparrow	*Peucaea cassinii*	●								
Black-throated sparrow	*Amphispiza bilineata*	●	●		●	●	●			

Common Name	Scientific Name	AP	AS	A3	A9	A49	CS	MA	CP	Other
Lark sparrow	*Chondestes grammacus*			●	●				●	
Chipping sparrow	*Spizella passerina*						●		●	
Brewer's sparrow	*Spizella breweri*	●	●				●	●	●	
White-crowned sparrow	*Zonotrichia leucophrys*	●					●	●	●	
Sagebrush sparrow	*Artemisiospiza nevadensis*		●		●	●		●		
Vesper sparrow	*Pooecetes gramineus*					●	●			
Savannah sparrow	*Passerculus sandwichensis*							●	●	
Lincoln's sparrow	*Melospiza lincolnii*								●	
Green-tailed towhee	*Pipilo chlorurus*	●								
Spotted towhee	*Pipilo maculatus*								●	
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*							●	●	
Bullock's oriole	*Icterus bullockii*					●	●		●	
Scott's oriole	*Icterus parisorum*	●					●			
Red-winged blackbird	*Agelaius phoeniceus*								●	
Brown-headed cowbird	*Molothrus ater*								●	
Brewer's blackbird	*Euphagus cyanocephalus*						●		●	
Great-tailed grackle	*Quiscalus mexicanus*			●					●	
Northern waterthrush	*Parkesia noveboracensis*								●	
Orange-crowned warbler	*Leiothlypis celata*								●	
Nashville warbler	*Leiothlypis ruficapilla*								●	
Virginia's warbler	*Oreothlypis virginiae*								●	
MacGillivray's warbler	*Geothlypis tolmiei*								●	
Common yellowthroat	*Geothlypis trichas*								●	
Yellow warbler	*Setophaga petechia*						●		●	
Palm warbler	*Setophaga palmarum*								●	
Yellow-rumped warbler	*Setophaga coronata*	●				●	●	●	●	
Black-throated gray warbler	*Setophaga nigrescens*								●	
Townsend's warbler	*Setophaga townsendi*						●		●	
Wilson's warbler	*Cardellina pusilla*						●		●	
Summer tanager	*Piranga rubra*								●	
Western tanager	*Piranga ludoviciana*	●							●	
Black-headed grosbeak	*Pheucticus melanocephalus*						●		●	
Blue grosbeak	*Passerina caerulea*								●	
Lazuli bunting	*Passerina amoena*		●						●	

NOTE: Species are listed by taxonomic classification.

A3 = Area 3
A9 = Area 9
A49 = Area 49
AP = Antelope Peak
AS = Antelope Spring
CP = Roller Coaster Construction Pond
CS = Cactus Spring
MA = Mellon Airstrip

4.3 Federally Listed and State-Listed Threatened and Endangered Species and Species of Concern

The purpose of the Endangered Species Act is to protect all animal, plant, and insect species that are federally listed as threatened or endangered. The State of Nevada has its own regulations for the protection of various species of plants and animals (Nevada Administrative Code 504).

Currently there are no known federally listed threatened or endangered species found at SNL/TTR. The only federally listed species found at the Nevada Test and Training Range is the Mojave Desert tortoise (*Gopherus agassizii*) (USAF 1997), which is not found at SNL/TTR. Table 4-3 lists federally protected species under the Endangered Species Act that are known to occur in Nye County, Nevada.

A few plant and animal species at SNL/TTR are protected by the State of Nevada, including several cacti and succulents, such as branched pencil cholla (*Cylindropuntia ramosissima*), cottontop cactus (*Echinocactus polycephalus*), and spinystar/beehive cactus (*Escobaria vivipara*). Table 4-3 includes those species that may potentially occur in Nye County, Nevada, and those species that have been observed at SNL/TTR.

Activities at SNL/TTR that could potentially impact protected species are addressed in the NEPA analysis and documentation process. Coordination with state and/or federal officials and the implementation of any requisite mitigation would occur prior to initiating these activities.

Table 4-3. Federally listed and state-listed threatened and endangered species and State of Nevada protected species potentially occurring in Nye County, Nevada

Common Name	Scientific Name	Federal ESA Status	Nevada Status	Observed at SNL/TTR
Plants				
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	Endangered	
Armored hedgehog cactus	*Echinocereus engelmannii var. armatus*	—	Protected	
Ash Meadows blazingstar	*Mentzelia leucophylla*	Threatened	Endangered	
Ash Meadows gumplant	*Grindelia fraxinopratensis*	Threatened	Endangered	
Ash Meadows ivesia (mousetail)	*Ivesia kingii var. eremica*	Threatened	Endangered	
Ash Meadows milkvetch	*Astragalus phoenix*	Threatened	Endangered	
Ash Meadows sunray	*Enceliopsis nudicaulis var. corrugata*	Threatened	Endangered	
Blaine pincushion	*Sclerocactus blainei*	—	Protected	
Branched pencil cholla	*Cylindropuntia ramosissima*	—	Protected	✓
Clokey pincushion	*Escobaria vivipara var. rosea*	—	Protected	
Cottontop cactus	*Echinocactus polycephalus*	—	Protected	✓
Desert pincushion	*Escobaria vivipara var. deserti*	—	Protected	
Eastwood milkweed	*Asclepias eastwoodiana*	—	Protected	✓
Hermit cactus	*Sclerocactus polyancistrus*	—	Protected	✓
Joshua tree	*Yucca brevifolia*	—	Protected	✓
Mojave barrel cactus	*Ferocactus cylindraceus var. lecontei*	—	Protected	
Mountain cactus	*Pediocactus simpsonii*	—	Protected	
Nye pincushion cactus	*Sclerocactus nyensis*	—	Protected	
Old man prickly pear cactus or Grizzlybear cactus	*Opuntia erinacea var. erinacea*	—	Protected	✓
Sand cholla or sagebrush cholla	*Grusonia pulchella*	—	Protected	✓

Common Name	Scientific Name	Federal ESA Status	Nevada Status	Observed at SNL/TTR
Silver cholla	*Cylindropuntia echinocarpa*	—	Protected	✓
Sodaville milkvetch	*Astragalus lentiginosus var. sesquimetralis*	—	Endangered	
Spring-loving centaury	*Centaurium namophilum*	Threatened	Endangered	
Sunnyside green gentian	*Frasera gypsicola*	—	Endangered	
Williams combleaf	*Polyctenium williamsiae*	—	Endangered	
Animals				
Invertebrates				
Ash Meadows naucorid	*Ambrysus amargosus*	Threatened	—	
Fishes				
Ash Meadows amargosa pupfish	*Cyprinodon nevadensis mionectes*	Endangered	Threatened	
Ash Meadows speckled dace	*Rhinichthys osculus nevadensis*	Endangered	Endangered	
Big Smoky Valley speckled dace	*Rhinichthys osculus lariversi*	—	Sensitive	
Big Smoky Valley tui chub	*Gila bicolor spp. 8*	—	Sensitive	
Devils Hole pupfish	*Cyprinodon diabolis*	Endangered	Endangered	
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	Threatened	Game	
Monitor Valley speckled dace	*Rhinichthys osculus spp. 5*	—	Sensitive	
Moorman White River springfish	*Crenichthys baileyi thermophilus*	—	Protected	
Oasis Valley speckled dace	*Rhinichthys osculus spp. 6*	—	Sensitive	
Railroad Valley springfish	*Crenichthys nevadae*	Threatened	Threatened	
Railroad Valley tui chub	*Gila bicolor spp. 7*	—	Sensitive	
Warm Springs amargosa pupfish	*Cyprinodon nevadensis pectoralis*	Endangered	Endangered	
White River desert sucker	*Catostomus clarkii intermedius*	—	Protected	
White River spinedace	*Lepidomeda albivallis*	Endangered	Endangered	
Reptiles and Amphibians				
Amargosa toad	*Anaxyrus nelsoni*	—	Protected	
Banded gila monster	*Heloderma suspectum cinctum*	—	Protected	
Columbia spotted frog (Great Basin Distinct Population Segment)	*Rana luteiventris*	Candidate	Protected	
Desert tortoise (Mojave population)	*Gopherus agassizii*	Threatened	Threatened	
Northern leopard frog	*Lithobates pipiens*	—	Protected	
Sonoran mountain kingsnake	*Lampropeltis pyromelana*	—	Protected	
Mammals				
Allen's big-eared bat	*Idionycteris phyllotis*	—	Protected	
American pika	*Ochotona princeps*	—	Protected	
Ash Meadows montane vole	*Microtus montanus nevadensis*	—	Sensitive	
California leaf-nosed bat	*Macrotus californicus*	—	Sensitive	
Dark kangaroo mouse	*Microdipodops megacephalus*	—	Protected	
Fringed myotis	*Myotis thysanodes*	—	Protected	
Mexican free-tailed bat	*Tadarida brasiliensis*	—	Protected	
Pale kangaroo mouse	*Microdipodops pallidus*	—	Protected	
Pallid bat	*Antrozous pallidus*	—	Protected	
Palmer's chipmunk	*Neotamias palmeri*	—	Sensitive	
Spotted bat	*Euderma maculatum*	—	Threatened	

Common Name	Scientific Name	Federal ESA Status	Nevada Status	Observed at SNL/TTR
Townsend's big-eared bat	*Corynorhinus townsendii*	—	Sensitive	
Western red bat	*Lasiurus blossevillii*	—	Sensitive	
Birds				
Bald eagle	*Haliaeetus leucocephalus*	—	Endangered	
Brewer's sparrow	*Spizella breweri*	—	Sensitive	✓
Golden eagle	*Aquila chrysaetos*	—	Sensitive	✓
Greater sage-grouse	*Centrocercus urophasianus*	Candidate		
Loggerhead shrike	*Lanius ludovicianus*	—	Sensitive	✓
Northern goshawk	*Accipiter gentilis*	—	Sensitive	
Peregrine falcon	*Falco peregrinus*	—	Endangered	
Sage thrasher	*Oreoscoptes montanus*	—	Sensitive	✓
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered	
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	Sensitive	
Yuma Ridgeway's rail	*Rallus obsoletus yumanensis*	Endangered	Endangered	

— = no designation
ESA = Endangered Species Act
var. = variety

Chapter 5. SNL/TTR Cultural Resource Management Program

Historic Rohn Tower 24-09 at SNL/TTR

OVERVIEW ■ Cultural Resource Management Program personnel coordinate cultural resource compliance, including review of archaeological resources and historic buildings. Actions that could adversely affect cultural resources are analyzed initially in a NEPA checklist review. DOE is responsible for ensuring that impacts on cultural resources are assessed and appropriate actions are taken to mitigate those impacts.

The Cultural Resource Management Program is primarily focused on long-term preservation and protection of cultural resources and cultural resource compliance to ensure that the heritage of an area and its landscape are maintained. Long-term preservation and protection practices also ensure that data are available to make proper land use decisions and to assist with environmental planning. The Cultural Resource Management Program is composed of two main parts: archeological resources and historic buildings.

Cultural resources are places and physical evidence of past human activity: a site, an object, a landscape, a structure, or a natural feature of significance to a group of people traditionally associated with it.

Between 1979 and 2020, 185 archaeological surveys—mostly linear surveys (occurring along roads and utility lines) as well as multiple transect surveys on large blocks of land—have been conducted. Currently, 220 historic sites (sites having cultural heritage value) are recorded, and 12 have been recommended as eligible for inclusion in the National Register of Historic Places.

5.1 Culture History

Through the years, several theoretical frameworks have been proposed to define traditions and value systems in southern Nevada. The framework for the prehistoric period covers the time from the earliest documented human occupation of the area (ca. 11,050 BCE) until the earliest European exploration of the area (ca. AD 1600). This time range is divided into six periods: Lake Mohave (10,050–5050 BCE), Pinto (5550–2050 BCE), Gypsum (2050 BCE–AD 400), Saratoga Springs (AD 400–1150), Late Prehistoric (AD 1150–1600), and Protohistoric (AD 1600–ca. 1830).

The Lake Mohave Period corresponds to the earliest known human occupation of the area, encompassing the terminal Pleistocene and early Holocene epochs. This includes the Paleo-Indian Period and the Early Archaic Period. The Lake Mohave Period, and the following Pinto and Gypsum periods, constitute the period of human occupation in North America before agriculture was adopted in the area.

The groups of humans present during the Paleo-Indian Period are generally described as small, highly mobile bands of hunter-gatherers adapted to a climate that was cooler and wetter than the present (Martin and Plog 1973). The Paleo-Indian Period is characterized by several distinct traditions of fluted projectile points, including Clovis, Folsom, Agate Basin, and Hell Gap arrowheads (Jennings 1980). The Early Archaic Period is generally characterized by an economy focusing on the exploitation of wild plant and animal resources.

The Archaic tradition in the Great Basin was initially described as a period of relatively stable foraging referred to as the Desert Culture (Jennings and Norbeck 1955).

The Pinto Period is coterminous (occurring at the same time) with the Middle Archaic Period in southern Nevada, which was hallmarked by specialized stone tools (Ezzo 1996). The Late Archaic period, also referred to as the Gypsum Period, was marked by warmer, more temperate conditions, which led to an increase in the availability of large game animals as well as increased plant resources (Roth 2012).

Chert biface

The Saratoga Springs Period (also known as the Virgin Anasazi occupation) corresponds to a time of significant and far-reaching cultural changes in southern Nevada (Ezzo 1996). The initial Virgin Anasazi occupation of the area is characterized by the presence of small, highly mobile groups occupying scattered, small sites on a temporary, perhaps seasonal, basis (Ezzo 1996).

With the end of the Virgin Anasazi occupation in southern Nevada and the practice of small-scale agriculture, the area became the home of peoples who were more mobile and increasingly dependent on hunting and foraging (Ezzo 1996). The Late Prehistoric Period saw the appearance of an identifiable Southern Paiute, or Numic-speaking, people in the Great Basin and southern Nevada who were later encountered by early explorers and immigrants (Fowler 1982; Kelly and Fowler 1986).

The first Spanish explorers to see the Colorado River were members of Francisco de Coronado's expedition in the 1540s who sought out mineral wealth. Mining became an important activity in the region, and, by 1910, small mining camps were established in the Kawich (Golden Arrow and Silverbow) and Cactus (Wellington, Antelope Springs, and Cactus Spring) ranges, as well as in the Trappman Hills (Wilson's Camp and Trappman's Camp). Older mining ventures at Nixon and Gold Reed are less than 12 miles away to the southeast of the Tonopah area. These early twentieth-century mining locales lie on opposing flanks of the Kawich Range at a pass just north of Quartzite Mountain.

5.2 Historical Context

In anticipation of entering World War II, the United States military expanded its air forces training and support facilities. In October 1940, a 69 × 90-mile area near Tonopah was transferred to the War Department for development as a gunnery range. After construction and preparation, the Tonopah Army Air Field opened in 1942 as a training field. Eight bombardment squadrons and 12 fighter squadrons were trained there by 1943, when the base was expanded to host B-24 Liberator training. The range also hosted some guided bomb testing activities before the war ended.

In August 1945, Tonopah Army Air Field was placed on inactive status; two years later it was declared excess. The airfield was turned over to the town of Tonopah as the Tonopah Airport, and the test and training space to the southeast was incorporated into Nellis Air Force Base.

In July 1945, Los Alamos Scientific Laboratory in New Mexico underwent a reorganization that gathered ordnance engineering activities into Z Division. Z Division was moved to Sandia Base near Albuquerque. Z Division grew quickly and was redesignated Sandia Laboratory, a branch of Los Alamos, in 1948. Continued growth of both sites led to their separation; Sandia Corporation, a subsidiary of Western Electric, took over management of Sandia Laboratory on November 1, 1949.

Sandia Laboratory's assignment to design and test the nonnuclear components and subsystems of nuclear weapons included ballistic studies of weapon shapes. Sandia Laboratory personnel established a practice bombing range near Los Lunas, New Mexico, and then obtained use of a former Navy site near the Salton Sea in southern California. By the mid-1950s, however, population growth in the Salton Sea area conflicted with the growing number of weapon programs in development at that location.

After using a temporary site in 1954 on Yucca Lake within the Nevada Test Site, Sandia settled on the Cactus Flats area in the northwestern section of the Las Vegas Bombing and Gunnery Range (now Nellis Air Force Base). The series of dry lakebeds running north–south between the Cactus and Kawich ranges served as natural targets for testing and could accommodate low-altitude as well as high-altitude approaches. The USAF authorized the Atomic Energy Commission to use the property

for Sandia Laboratory operations beginning November 9, 1956. Approximately 35 miles southeast of Tonopah, Nevada, the site was named Tonopah Test Range.

Testing began on February 4, 1957. Flights were tracked along the east and west sides of the dry lakebeds, concentrating on the main target in the dry lakebed at the north end. Ultimately, additional targets and stations were added toward the south. To support ground-launched tests and to develop diagnostic rockets to support high-altitude nuclear testing, Sandia personnel added a rocket launch capability. Demand for both drop and rocket testing continued, and site capabilities were extended in response. On September 1, 1960, SNL/TTR was named Sandia Laboratory's permanent test range, and the Salton Sea Test Base range was closed (SNL/NM 2017).

Expansion was rapid in the early years. More tracking and data capture stations were added along the line of flight to the target, the control point facilities were expanded, and a control tower was added. A concrete hard target was added in the target impact area on the northernmost lakebed.

After the initial rounds of construction in the late 1950s and early 1960s, when operations were largely defined at SNL/TTR, additional modifications occurred more slowly, primarily consisting of upgrading and replacing equipment. A major upgrade and some new construction were completed in the 1980s when a new control tower was built and many of the facilities were refurbished. A decline in testing after the end of the Cold War meant a lull in improvements, but twenty-first-century support of nuclear weapon life-extension programs required maintenance and renovation at some of the facilities to upgrade and ensure consistent test support.

5.3 Regulatory Criteria

Ensuring compliance with federal and state requirements supports the long-term preservation and protection of cultural resources, prevents mission delays, and maintains trust and a strong relationship with DOE and the Nevada Historic Preservation Division. See Chapter 2.

5.4 Archaeological Resources

The Sandia archaeologist helps Sandia personnel and DOE maintain compliance with National Historic Preservation Act, Section 106, requirements. This ensures that (1) cultural resources and their historic and cultural heritage are preserved and protected and (2) data are available to make appropriate land-use and environmental planning decisions at SNL/TTR.

The archaeologist reviews NEPA checklists that involve land disturbances and provides recommendations for monitoring field activities so archeological resources are not impacted adversely. The archaeologist also makes site eligibility recommendations for inclusion in the National Register of Historic Places.

5.4.1 Field Methods

Archaeological personnel conduct pedestrian surveys (walking the natural landscape on foot) and record prehistoric and historic sites in accordance with Bureau of Land Management guidelines (BLM 2004) as required by the Nevada State Historic Preservation Office. In addition, the archaeologist provides recommendations regarding the potential effect of proposed undertakings on prehistoric and historic properties. These include recommendations regarding a site's eligibility for nomination to the National Register of Historic Places for Cultural Properties and Historic Preservation and project mitigation.

A pedestrian survey lightly impacts surface soils. Survey transects are spaced 50 ft apart, with no more than 40 acres surveyed per person per day. All cultural resources that are at least 50 years old

are recorded on field forms. Archaeological sites are defined by the presence of either a cultural feature or 10 or more artifacts that are at least 50 years old and are separated by no more than 66 feet. Areas where cultural materials are sparse (fewer than 10 items) and are at least 50 years old are recorded as isolated occurrences. The archaeologist generates a Nevada Intermountain Antiquities Computer System form for archaeological sites in Nevada. Archaeological sites are mapped both manually on graph paper and digitally. Digital maps are created using a global positioning system unit with sub-meter accuracy. Each map includes the site boundary and the locations of the datum, any features identified, artifact concentrations, important or diagnostic artifacts, drainages or other landscape features, and topographic contours. Each site, including any cultural features or tools, is photographed. All artifacts are analyzed in the field unless more than 50 artifacts of a given class (e.g., lithic [stone], prehistoric ceramic, or historic) are present, in which case a sample of at least 50 are analyzed. Lithic and prehistoric ceramic artifacts are analyzed using standard in-field techniques. Ceramics, projectile points, and other diagnostic artifacts are identified by type and cultural affiliation when sufficient attributes for a reliable determination are present. Isolated occurrences and their location are recorded and analyzed. The archaeologist writes all reports of findings and associated documentation.

5.4.2 Archaeological Assessments and Analysis in 2020

In 2020, the archaeologist reviewed five outdoor projects, which included several reroofing projects along with their associated laydown yards and ongoing operational activities. All the reviewed projects found no immediate archaeological concerns.

Old times at Tonopah

5.5 Historic Buildings

The Sandia historian surveys and assesses buildings and structures and makes recommendations to DOE regarding National Register of Historic Places eligibility for SNL/TTR properties.

5.5.1 Methods

Although the historian does provide internal input on proposed projects as requested, most historic building assessments are triggered by the NEPA process. While a NEPA checklist is in subject matter expert review, the historian reviews the project details, reviews existing photographs of and documents about the facilities involved, conducts any additional research in the archives and building drawings collection to understand the property's past and current role in SNL/TTR operations, and evaluates the building's history within the themes (field testing and stockpile surveillance) provided by the 2005 context statement (Section 5.4.2), which provides the framework for evaluating a

property for historic significance (SNL/NM 2005a). Note is made of any previous surveys and resulting determinations as to the property's eligibility for the National Register of Historic Places.

If there are any questions regarding proposed work and its potential impact on a building, the historian discusses the matter with the project owner and the NEPA specialist. The project owner may submit renderings of the anticipated appearance of the property after work is completed, and the historian may suggest alternate locations, materials, or methods to avoid adverse effects on the property.

The context statement completed in 2005 is used in historic building assessments and recommendations as the background against which properties are evaluated. Any recommendation that a property is historic includes the relevant established Nevada theme under which it falls as well as its period of significance.

Once a property is understood in context, the historian makes a recommendation as to whether it is eligible for inclusion in the National Register of Historic Places, summarizing past determinations and any subsequent changes to the property. The historian also makes a recommendation as to whether proposed work will have an adverse effect on any historic properties or districts, including the property where the work is occurring. Information regarding the property, photographs, maps, a description of the proposed work, any impacts, and the overall recommendation on eligibility as a historic property are captured on a Nevada Architectural Resource Assessment form. The Architectural Resource Assessment form is submitted as an attachment to the NEPA checklist for DOE review and use in consultation with the Nevada State Historic Preservation Office.

5.5.2 Previous Building Surveys, Assessments, and Determinations

In the spring of 2002, the Sandia historian began to assess properties at SNL/TTR, with an initial focus on buildings scheduled for demolition in 2003 and 2004. The assessments were completed and submitted to DOE on Nevada Architectural Resource Assessment forms (SNL/NM 2003). In consultation with the Nevada State Historic Preservation Office, DOE determined that none of the properties were historic, and Sandia proceeded with demolition.

The historian also prepared a context statement for the site (SNL/NM 2004). The context statement concentrated on the Cold War as the primary time period and focus for the built environment at SNL/TTR within the State of Nevada's established themes. The period of significance for Tonopah was 1956 to 1989. The historian continued the historic building survey for the remaining properties at the site through 2005, including archival research, photo documentation, and preparation of Architectural Resource Assessment forms. Additional support and architectural evaluations were provided by a consulting firm, e^2M, which resulted in a revised context statement, survey document, and completed Architectural Resource Assessment forms (SNL/NM 2005a; SNL/NM 2005b; SNL/NM 2005c).

In 2010, because of the age of the survey documents, the assessment was reviewed and the properties were reconsidered. The existing property lists and the status of the buildings remained unchanged. The survey conclusions were affirmed. The recommendation was to include key and representative facilities as contributing elements in an SNL/TTR historic district (Table 5-1).

In 2011, DOE completed consultation with the Nevada State Historic Preservation Office, reaching an agreement regarding the SNL/TTR historic district. The district includes 60 structures and represents the key functions included in testing at the site during the Cold War. In 2012, DOE provided the Nevada State Historic Preservation Office with samples of the documentation created to mitigate the effects of future demolition of properties within the district. The Nevada State Historic Preservation Office reviewed the sample documentation and agreed with its suitability.

In 2016, DOE met with the Nevada State Historic Preservation Office to finalize details of a memorandum of agreement covering the SNL/TTR historic district and mitigative efforts for future demolition and renovation at the site. In 2018, DOE again met with the Nevada State Historic Preservation Office to finalize the approach and the agreement details, which is not yet signed. DOE continues to proceed with Section 106 of the National Historic Preservation Act consultation on projects that will affect SNL/TTR properties, whether they are contributing elements to the historic district or not.

Table 5-1. Facilities that are contributing elements to the SNL/TTR historic district

Historic Resource	Function	Construction	Location
02-00	Askania camera tower	1956	Station 2
02-01	ME-16 tracking telescope	1958	Station 2
03-32	Water tank	1961	Station 3
03-33	Water tank	1962	Station 3
03-50	Engineering tag and physical security office	1956	Station 3
03-51	Administration building	1962	Station 3
03-53	Generator building	1965	Station 3
03-54	Machine shop	1960	Station 3
03-55	Photo optics building	1965	Station 3
03-56	Telescope repair and offices	1965	Station 3
03-57	Operations and control	1980	Station 3
03-62	Welding shop	1960	Station 3
03-65	Radio shop and offices	1960	Station 3
09-04	Camera tower	1970s	Station 9
09-10	Camera tower	1970	Station 9
09-11	Camera tower	1970	Station 9
09-19	Camera tower	1965	Station 9
09-22	Underground room	ca. 1970	Station 9
09-25	Storage igloo	1960	Station 9
09-26	Storage igloo	1960	Station 9
09-27	Storage igloo	1960	Station 9
09-28	Storage igloo	1960	Station 9
09-29	Storage igloo	1960	Station 9
09-30	Storage igloo	1960	Station 9
09-31	Storage igloo	1960	Station 9
09-32	Storage igloo	1960	Station 9
09-33	Storage igloo	1960	Station 9
09-34	Storage igloo	1960	Station 9
09-50	Fire control bunker	1957	Station 9
09-51	Fire control bunker	1964	Station 9
09-52	Assembly building (9A)	1956	Station 9
09-54	Assembly building	1960	Station 9
09-55	Assembly building	1964	Station 9
09-56	Explosive bunker	1960	Station 9
09-57	Explosive bunker	1960	Station 9
09-59	Explosive bunker	1960	Station 9
09-60	Gun control bunker	1971	Station 9
09-63	Special storage facility (bunker)	1986	Station 9

Historic Resource	Function	Construction	Location
13-00	ME-16 tracking telescope	1977	Area 13
16-00	ME-16 tracking telescope	1960	Area 16
22-00	Contraves camera tower	1960	Area 22 (removed)
24-00	Radar antenna building	1971	Station 24
24-01	Radar lab and office	1961/1975	Station 24
24-02	LA-24 telescope	1970	Station 24
24-03	Teletrac antenna	1970	Station 24
24-04	Bore site tower	1962	Station 24
24-09	Rohn Tower	1962	Station 24
24-10	Antenna tower platform	1970	Station 24
24-11	Antenna support tower	1970	Station 24
24-52	Bore site storage	Date Unknown	Station 24
24-53	Communications building	1960	Station 24
32-01	Main gate guardhouse	1982	Main Gate
Contraves camera	Contraves camera	1960s	N/A
Hard target	Target	1960	Main target area
Launcher 2	Missile launcher	1956	Station 9
Launcher 3	Missile launcher	1956	Station 9
Launcher 4	Missile launcher	1956	Station 9
Launcher 5	Missile launcher	1956	Station 9
ME-16 tracking telescope	Tracking telescope	1958	N/A
Rocket sign	Tonopah Test Range sign	1960	Beyond main gate

ca. = circa
N/A = not applicable

5.5.3 Historic Building Assessments in 2020

In 2019, the historian provided DOE with updated Nevada Architectural Resource Assessment forms for the proposed demolition of Tower 02-00 and Dome 02-01, which are no longer in use. In anticipation of the preparation of a memorandum of agreement regarding the demolition, the historian drafted a Historic American Building Survey/Historic American Engineering Record report documenting the history and architectural features of Tower 02-00 and Dome 02-01 in 2019. It will be finalized with the Historic American Building Survey/Historic American Engineering Record office when the memorandum is signed. In 2020, DOE continued consultation with the Nevada State Historic Preservation Office begun in 2019 regarding the proposed demolition of Tower 02-00.

Building 03-53, the Generator Building, needed significant maintenance to its roof and exterior walls in 2019. DOE consulted with the Nevada State Historic Preservation Officer about replacing the roof and walls; the two organizations signed a memorandum of agreement requiring mitigation of adverse effects to the building's historic integrity through documentation. The building was photographed and, per the memorandum of agreement, in 2020, the Sandia historian completed a photo log and provided the photos and photo log to DOE. The Nevada State Historic Preservation Officer approved the photo log, and SNL/TTR personnel undertook building renovations. The memorandum of agreement requires completion of a report to capture the building's architecture and use history. That will be completed in 2021.

In 2020, Sandia personnel proposed to re-stucco Building 03-51, the Administration Building. The historian prepared a Nevada Architectural Resource Assessment form for the building and recommended that the proposed work would not have an adverse effect on the building's historic integrity. DOE consulted with the Nevada State Historic Preservation Officer, which concurred with the DOE determination of no adverse effect. Work will proceed on the building in 2021.

Chapter 6. SNL/TTR Quality Assurance

Johnson's fishhook cactus (*Echinomastus johnsonii*)

OVERVIEW ■ Personnel in various programs collect environmental samples and analyze them for radiological and nonradiological constituents. Quality control samples are sent to contract laboratories to ensure that the samples meet statistically established control criteria or prescribed acceptance control limits.

Sandia personnel are responsible for implementing quality assurance for operations—as specified in ISO 9001, *Quality Management Systems—Requirements* (ISO 9001:2015); DOE O 414.1D, *Quality Assurance* (DOE O 414.1D Change 2 (LtdChg)), Attachment 1, "Contractor Requirements Document"; and 10 CFR Part 830, *Nuclear Safety Management* (10 CFR 830), Subpart A, "Quality Assurance Requirements"—via policy statements and processes, and by executing the actions specified in those policies and processes. Sandia management is responsible for ensuring the quality of the company's products; for assessing its operations, programs, projects, and business systems; and for identifying deficiencies and effecting continuous improvements.

6.1 Environmental Monitoring for Quality Assurance

Environmental monitoring (which includes sampling) is conducted in accordance with program-specific sampling and analysis plans, work plans, or quality assurance plans, which contain quality assurance elements. These documents meet applicable federal, state, and local requirements for conducting sampling and analysis activities. Personnel in various programs collect environmental samples and submit them for analysis of radiological and nonradiological constituents. Sandia personnel (and contractors) follow quality assurance measures described in this section. DRI personnel follow their own quality control measures for activities they perform.

Project sampling and analysis plans (or equivalent) include critical elements, such as procedures for collecting samples, preserving and handling samples, controlling samples, controlling laboratory quality, setting required limits of detection, controlling field quality, ensuring health and safety,

setting schedules and frequency for sampling, reviewing data, determining data acceptability, and reporting.

6.1.1 Sample Management Office

Sample Management Office personnel are responsible for quality assurance and quality control of samples once field team members relinquish the samples to the Sample Management Office. In addition, Sample Management Office personnel provide guidance and sample management support for field activities. However, program leads are responsible for each program's overall adherence to and compliance with any sampling and analysis activity performed. Sample Management Office personnel, located at SNL/NM, package, ship, and track environmental samples to off-site contracted laboratories.

There are instances when SNL/TTR personnel ship samples directly to off-site laboratories, rather than to the Sample Management Office at SNL/NM. Terrestrial Surveillance Program soil samples collected annually are shipped from SNL/TTR directly to an off-site laboratory.

6.1.2 Contract Laboratory Selection

All off-site commercial laboratories under contract are selected based on performance objectives, licenses and accreditations, and appraisals (pre-award assessments) as described in the *Quality Assurance Project Plan for the Sample Management Office* (SNL/NM 2019b). All laboratories must employ EPA test procedures whenever possible; when these are not available, other suitable and validated test procedures are applied. Laboratory instruments must be calibrated in accordance with established procedures, methods, and the Sample Management Office Statement of Work for Analytical Laboratories (SNL/NM 2020d). All calibrations and detection limits must be verified before analyzing samples and reporting data. Once a laboratory has passed an initial appraisal and has been awarded a contract, Sample Management Office personnel are responsible for continuously monitoring laboratory performance to ensure that the laboratory meets its contractual requirements during annual audits.

Sample Management Office contract laboratories perform work in compliance with the Sample Management Office Statement of Work for Analytical Laboratories. Contract laboratories are required to participate in applicable DOE and EPA programs for blind audit check sampling to monitor the overall accuracy of analyses routinely performed on SNL/TTR samples. These contract laboratories are required to participate in the DOE Mixed Analyte Performance Evaluation Program. Contract laboratories also participate in commercial vendor programs designed to meet the evaluation requirements given in the proficiency testing section (Chapter II) of the National Environmental Laboratory Accreditation Conference Standard (NELAC 2003).

6.1.3 Quality Control for Samples

Project-specified quality control samples are submitted to contract laboratories to meet project data quality objectives and sampling and analysis plan requirements. Various field quality control samples may be collected to assess the data's quality and final usability. Errors, some of which are unavoidable, can be introduced into the sampling process, including potential contamination of samples in the field or during transportation. In addition, sample results can be affected by the variability present at each sample location.

With each sample batch, laboratory quality control samples are prepared concurrently at defined frequencies and analyzed in accordance with established methods. Contract laboratory personnel determine the analytical accuracy, precision, contamination, and matrix effects associated with each analytical measurement.

Quality control sample results are compared either to control criteria that is statistically established or to prescribed acceptance control limits. Analytical results generated concurrently with quality control sample results within established limits are considered acceptable. If quality control analytical results exceed control limits, the results are qualified and corrective action is initiated if warranted as defined in the Sample Management Office Statement of Work for Analytical Laboratories (SNL/NM 2020d). Reanalysis is then performed for samples in the analytical batch as specified in the Statement of Work and contract laboratory procedures. Quality control sample summaries are included in analytical reports prepared by contract laboratory personnel.

Environmental dosimetry is provided by optically stimulated luminescence technology. Dosimeters are issued and analyzed by an accredited off-site laboratory and measure x-ray, gamma, and beta radiation. Quality control dosimeters are used, and standard laboratory procedures are followed for processing all dosimeters.

6.1.4 Data Validation and Records Management

Sample collection, analysis request and chain of custody documentation, and measurement data are reviewed and validated for each sample collected. Analytical data reported by contract laboratories are reviewed to assess laboratory and field precision, accuracy, completeness, representativeness, and comparability with respect to each particular program's method of compliance and data quality objectives.

The data are validated at a minimum of three levels as follows:

- The analytical laboratory validates data according to the laboratory's quality assurance plan, standard operating procedures, and client-specific requirements.
- Sample Management Office personnel review the analytical reports, corresponding sample collection, and analysis request and chain of custody documentation for completeness and laboratory contract compliance.
- A program lead reviews program objectives, regulatory compliance, and project-specific data quality requirements, and makes the final decision regarding the data's usability and reporting.

In addition to the three minimum validation levels, a technical assistance contractor may validate analytical data under direction of Sample Management Office personnel in accordance with applicable procedures and requirements. The purpose is to identify, through evaluation of supporting documentation, those monitoring results that do not meet the expected precision and accuracy of an analytical method. Terrestrial Surveillance Program data are validated by a technical assistance contractor providing this additional level of quality assurance.

All analytical data packages, analysis request and chain of custody documents, and data validation reports are submitted to a Sandia record depository for cataloging and storage in accordance with internal procedures, DOE requirements, and the document control requirements of ISO 9001, *Quality Management*, and ISO 14001, *Environmental Management Systems*.

6.2 Sample Management Office Activities in 2020

Sample Management Office activities in 2020 included sample packaging, shipping, and tracking to off-site contracted laboratories, and reviewing all data deliverables for compliance with contract and data quality requirements.

6.2.1 Sample Handling and Analyses

In 2020, Sample Management Office personnel processed 88 dosimeters in support of the SNL/TTR Terrestrial Surveillance Program. Of the 88 dosimeters, four were submitted as field and analytical quality control samples to assist with data validation and decision-making.

In 2020, Sample Management Office personnel processed 88 dosimeters in support of the SNL/TTR Terrestrial Surveillance Program.

During 2020, Landauer, Inc., in Glenwood, Illinois, was employed to analyze environmental dosimeters.

6.2.2 Laboratory Quality Assurance Assessments and Validation

Sample Management Office personnel participate in third-party independent assessments and validation of National Environmental Laboratory Accreditation Conference-approved laboratories used by SNL/NM program and project personnel. Specific checks were made for documentation completeness, proper equipment calibration, proper laboratory practices, and batch quality control data.

6.2.3 Quality Assurance Audits

The Sample Management Office participates in the DOE Consolidated Audit Program (DOECAP), which ensures that subcontracted commercial analytical environmental laboratories are audited on their ability to provide data results that are valid, reliable, and defensible. Commercial laboratories are to use the assessment process provided by one of three approved third-party accrediting bodies unless separate arrangements are made with DOECAP. The accrediting bodies conduct assessments using the requirements of the DOD/DOE *Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (DOD/DOE 2019).

In 2020, DOECAP and/or the accrediting bodies conducted assessments at nine Sample Management Office contract laboratories using *Quality Systems Manual* requirements. The audit reports, laboratory responses, and closure letters are all posted on and tracked through the DOECAP website. Decisions regarding sample distribution to contract laboratories were based on audit information, including corrective actions, if needed.

No findings for SNL/TTR samples were issued in 2020 in DOECAP assessment reports or other applicable DOE programs.

PART TWO

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

Chapter 7. SNL/KTF Introduction

Rocket launch at the Kaua'i Test Facility

OVERVIEW ■ The Kaua'i Test Facility has been an active rocket-launching facility since 1962. Sandia National Laboratories personnel support a variety of missions, including research and development, operational training, and test and evaluation. Launch projects are conducted for various government agencies and organizations on a noninterference basis.

This Annual Site Environmental Report was prepared in accordance with and as required by DOE per DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*. This report is made available to the public in electronic form at the following website:

https://www.sandia.gov/news/publications/environmental_reports/

Sandia National Laboratories, hereinafter referred to as Sandia with the exception of when using acronym to represent the facility location (SNL/KTF), is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC (NTESS), a wholly owned subsidiary of Honeywell International Inc., for the DOE National Nuclear Security Administration. Sandia personnel manage and operate the Kaua'i Test Facility in Hawai'i for DOE. The DOE National Nuclear Security Administration Sandia Field Office in Albuquerque, New Mexico, administers the contract and oversees contractor operations.

Part Two of this Annual Site Environmental Report summarizes the environmental protection and monitoring programs in place for Sandia National Laboratories, Kaua'i Test Facility (SNL/KTF) during calendar year 2020. While all 2020 program activities were performed continuously, they are reported on a calendar-year basis unless otherwise noted (programs based on the fiscal year operate from October 1 through September 30, annually).

7.1 Purpose

Sandia personnel—who provide the synergy and interdependence between a nuclear deterrence mission and broader national security missions to forge a robust capability base and empower solutions to complex national security problems—anticipate and resolve emerging national security challenges, innovate and discover new technologies to strengthen the nation's technological superiority, create value through products and services that solve important national security challenges, and inform the national debate for which technology policy is critical to preserving security and freedom throughout the world. Information about recent technologies developed by Sandia personnel can be found at the following website:

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

7.2 History

A brief history of Sandia National Laboratories and of operations at SNL/KTF follows. For more details see Chapter 11.

7.2.1 Sandia National Laboratories

On November 1, 1949, Sandia Corporation, a wholly owned subsidiary of Western Electric, began managing and operating Sandia Laboratory. In 1979, Congress recognized the facility as a national laboratory. From 1993 to mid-2017, Sandia Corporation was a wholly owned subsidiary of Martin Marietta (merging with Lockheed Corporation in 1995 to form Lockheed Martin Corporation). In May 2017, the managing and operating contractor changed its name to National Technology & Engineering Solutions of Sandia, LLC (NTESS), a wholly owned subsidiary of Honeywell International Inc.

7.2.2 Sandia National Laboratories, Kaua'i Test Facility

SNL/KTF has been an active rocket-launching facility since 1962. 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 2020, SNL/KTF personnel have supported 114 launches from SNL/KTF, the Pacific Missile Range Facility, and other mission assets.

The SNL/KTF launch field was originally designed to accommodate 40 launchpads, but only 15 pads were constructed. Of these, 11 have had their launchers removed. An additional launchpad, Pad 41 (Kokole Point), was constructed at the southern point of Pacific Missile Range Facility (Figure 7-1). The Kokole Point launch complex and associated facilities were transferred to the U.S. Navy in 2013; however, Sandia programs may launch from this location on a case-by-case basis for campaign operations. In addition to rocket launchpad sites, 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.

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

7.3 Location Description

SNL/KTF is located on the western coast of Kaua'i, Hawai'i. A tenant of and located within the DOD Pacific Missile Range Facility, there are agricultural fields to the north and east with the Pacific Ocean on the northwest and southwest of SNL/KTF (Figure 7-1).

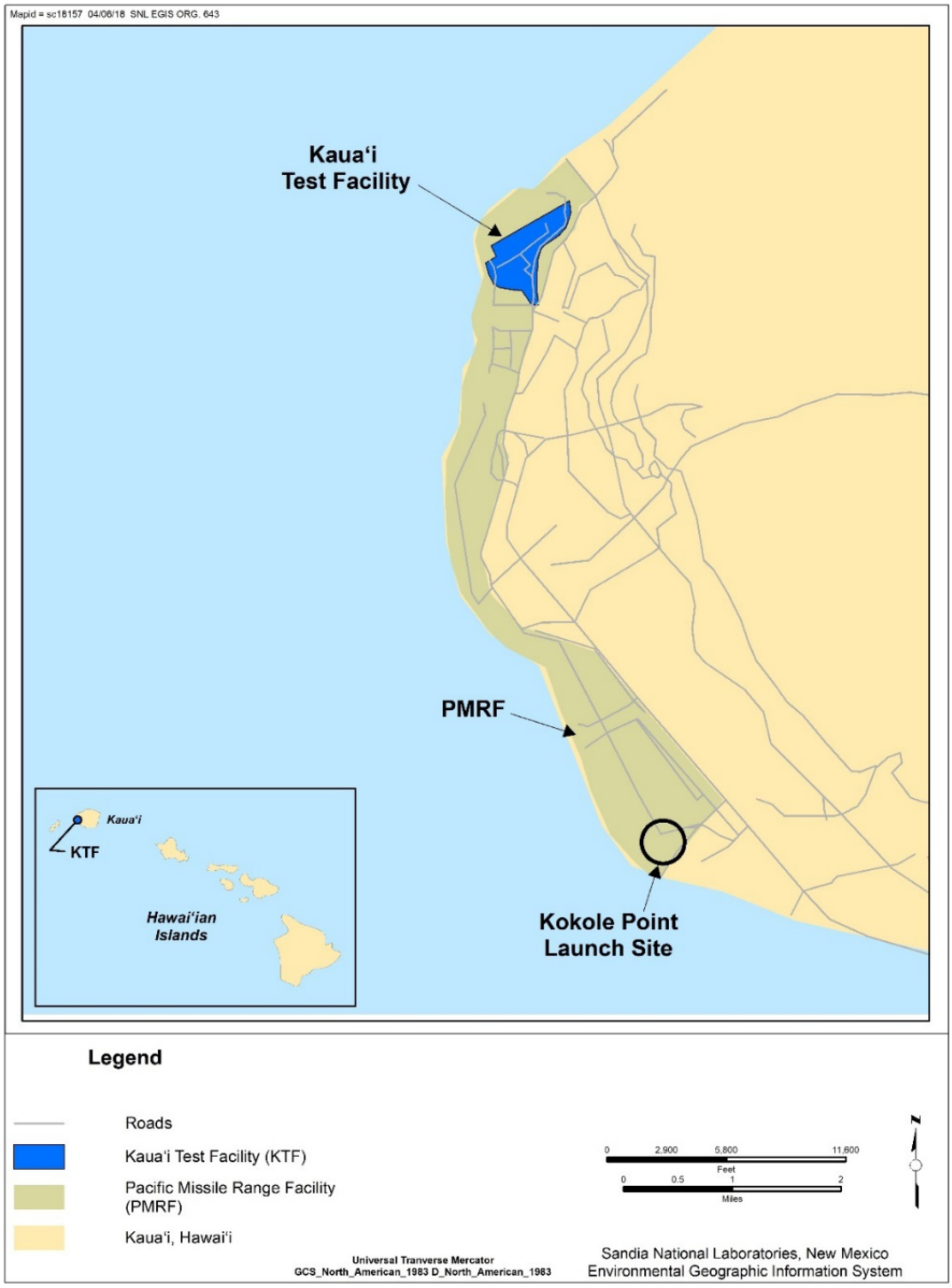

Figure 7-1. Kaua'i Test Facility location on Kaua'i, Hawai'i

7.4 Demographics

There were 15 permanent on-site personnel at SNL/KTF in 2020. During campaign operations when rocket launches occurred, approximately 200 additional people worked there. The closest towns of Kekaha and Waimea—with populations of 3,537 and 1,855, respectively (Census 2012b)—

are located approximately 10 miles southeast of the site. Census data for 2020 was not available at the time of publication; therefore, 2012 data is reported.

7.5 Activities and Facilities

SNL/KTF facilities and personnel support a variety of missions, including research and development, operational training, and testing and evaluation. Personnel conduct launch activities for multiple mission partners, other organizations, and government agencies on a noninterference basis. SNL/KTF provides a high-quality integrated facility for conducting a wide range of test operations. These operations support the launch of sounding rocket flight vehicles and payload experiments within a highly dynamic flight environment for component development and flight testing. Resources are available for assembling, testing, and launching instrumented rockets and rocket payloads; receiving, recording, and processing telemetry; and transferring data with remote airborne and ship-borne instrumentation platforms. Operations do not (currently or in the past) involve radioactive materials.

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. Inside the compound, several trailers and structures are connected by a network of concrete docks and covered walkways. Most of these facilities are used during mission operations to support customers, defense contractor personnel, and technical staff from SNL/NM; general maintenance activities are performed during noncampaign operations. In addition, there are 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.

Sandia personnel conducted operations at Mount Haleakalā on the island of Maui (Figure 7-2). The Sandia facility consisted of one building and a large structure used for telemetry operations, which provided high-altitude tracking for tests conducted at SNL/KTF. The site is being transferred to the Federal Aviation Administration (part of the U.S. Department of Transportation). Extensive decontamination and demolition work was done at the site in support of the transfer. The decontamination and demolition activities were completed in 2020, leaving behind two concrete slabs and the large structure to be used by other organizations; transfer is expected to be completed in 2021.

Figure 7-2. Operations at Mount Haleakalā, Maui

7.5.1 Rocket Launches in 2020

SNL/KTF personnel supported three rocket launches in 2020. The launches—covered by the *Site-Wide Environmental Assessment, Sandia National Laboratories, Kaua'i Test Facility* published in March 2019 (DOE/NNSA 2019)—included the following:

- March 19, 2020, Navy's Strategic Systems Programs, FEX-01 (launched from SNL/KTF)

- August 12, 2020, Naval Service Warfare Center, ARAV-SSO, PD2020 (launched from SNL/KTF)
- August 12, 2020, Naval Service Warfare Center, ARAV-A, PD2020 (launched from SNL/KTF)

7.6 Environmental Setting

Kauaʻi is the oldest, northernmost, and fourth-largest island of the main island chain within the volcanic Hawaiʻian Archipelago. Kauaʻi's varied geographic and topographic features include Waimea Canyon, cliffs of the Na Pali Coast, twin peaks of the old volcano (Mount Kawaikini and Mount Waiʻaleʻale, elevation 5,243 feet and 5,148 feet, respectively), the Alakaʻi Swamp, the flat-lying coastal Mana Plain, and the Barking Sands dune field (DOE/AL 1992).

Kauaʻi is the oldest, northernmost, and fourth-largest island of the main island chain within the volcanic Hawaiʻian Archipelago.

The low-lying coastal Mana Plain flanks the western slope of the island, forming gentle slopes from the volcanic uplands to the coastal margin (U.S. Navy 2010). The area is relatively flat, ranging in elevation from approximately 5 to 20 feet above mean sea level. Beach dunes parallel to the Pacific Ocean rise above the launch field to a maximum elevation of approximately 100 feet above mean sea level.

7.6.1 Geology

Kauaʻi consists of a single massive shield volcano, located at the island's center, which built up from the sea floor by many thousands of thin flows of basaltic lava. The volcanic deposits are now deeply eroded and partly veneered with subsequent volcanic flows. Volcanic rocks exposed on the western half of the island are the oldest and are composed of Pliocene basaltic flows of the Waimea Volcanic Series (U.S. Navy 2010).

Toward the end of the growth of the shield volcano, a period of collapse, faulting, erosion, and subsequent volcanism affected the original surface. The collapse created a broad caldera that is 10 to 12 miles across. Erosion has since destroyed the original surface, and the Alakaʻi Swamp occupies slightly dissected remnants.

The rocks of Kauaʻi are all volcanic except for minor amounts of sediment derived from the volcanic rocks by erosion and a narrow, discontinuous fringe of calcareous reef and beach deposits (MacDonald, Davis, and Cox 1960). The Mana Plain is composed of a wedge of terrestrial and marine sediment (alluvium, lagoon, beach, and dune deposits) that overlie the volcanic basement (DOE/AL 1992).

7.6.2 Surface and Groundwater Hydrology

There are no natural surface water drainages on SNL/KTF, as the sand at the surface is too permeable for rainwater to accumulate and travel laterally (DOE/AL 1992).

The three geologic units (volcanic bedrock, alluvium, and dune deposits) underlying SNL/KTF constitute three different but hydraulically connected aquifers. The groundwater from all three units tends to be brackish, not potable, and is not suitable for irrigation (DOE/AL 1992). No groundwater wells are located on SNL/KTF.

7.6.3 Ecology

A description of the ecological setting—including vegetation types, wildlife, protected species, and threatened and endangered species—at the Pacific Missile Range Facility and SNL/KTF is detailed in Chapter 10.

7.6.4 Climate

The climate at SNL/KTF is typical of maritime subtropical islands. Average yearly temperatures range between 84°F and 66°F. August is the warmest month of the year, with daytime highs averaging 87°F and lows averaging 69°F. January is the coolest month, with daytime highs averaging 79°F and lows averaging 62°F. The region is strongly influenced by the Pacific subtropical high-pressure system. There are two main seasons in tropical and subtropical areas: a wet season and a dry or windy season.

SNL/KTF is located on the lee side of the island, which reduces the amount of annual rainfall as compared to the eastern and mountainous areas of Kauaʻi. The lee side exhibits desert-like conditions, with an average annual rainfall of approximately 23 inches. The wet season generally starts in October and extends into March. June to August are the driest months of the year; less than one inch of rain is recorded on average for each month (WRCC 2020).

Winds are mostly from easterly directions on Kauaʻi. The northeast and southeast trade winds generally blow between 15 and 25 miles an hour. This global subtropical trade wind pattern occasionally becomes disrupted in the winter when cool, wet systems approach the island from the west or northwest. Relative humidity ranges from 60 to 70 percent in the summer to near 80 percent during the wet season. Direct hits from typhoons or hurricanes are rare in the Hawaiʻian Islands, though damage from nearby storms may occur. The most destructive hurricane to hit Kauaʻi was Hurricane Iniki in September 1992.

Chapter 8. SNL/KTF Compliance Summary

Sunflower (*Helianthus* spp.)

OVERVIEW ■ Sandia operations at SNL/KTF are required to comply with federal, state, and local environmental statutes, regulations, executive orders, and DOE directives. Regular audits, appraisals, and inspections identify areas for improvement as well as noteworthy practices.

Sandia operations at SNL/KTF are required to comply with federal, state, and local environmental requirements, including DOE directives and presidential executive orders. As part of this compliance, personnel adhere to strict reporting and permitting requirements.

All operations and activities, including those that are part of environmental programs, are performed in accordance with the ES&H policy, which includes the following statement:

> Sandia integrates environmental, safety and health throughout the lifecycle of its operations to ensure the:
> - Protection of Members of the Workforce by providing a safe and healthful workplace.
> - Protection of the environment by preventing or minimizing pollution and waste, pursuing sustainable resource use, and protecting biodiversity and ecosystems.
> - Protection of the public through the prevention or minimization of releases of hazardous materials.
> - Satisfaction of contractual requirements.
> - Establishment, measurement, and monitoring of ES&H objectives to enhance performance and drive continual improvement.

An Integrated Safety Management System is used to incorporate safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public,

and the environment. Thus, management of safety functions becomes an integral part of mission accomplishment and meets requirements outlined by DOE. The following five core functions guide the integration of safety into all work practices: define the scope of work, analyze the hazards, develop and implement hazard controls, perform work within controls, and provide feedback and continuous improvement.

8.1 Environmental Compliance

The management and operating contract, also referred to as the Prime Contract, for Sandia serves as the overarching agreement between the DOE National Nuclear Security Administration and the management and operating contractor. The Prime Contract requires the management and operating contractor to comply with specific DOE directives as well as applicable federal, state, and local requirements for the management and operation of Sandia.

8.1.1 Federal Requirements

The Prime Contract requires compliance with federal requirements, including applicable federal laws and regulations as well as specific DOE directives. The major federal requirements that pertain to environmental protection and management are presented below along with the compliance approach and compliance activities.

Environmental Planning

National Environmental Policy Act (NEPA) of 1969

Regulation and Compliance Approach	Compliance Activities
NEPA requires federal agencies to assess the impacts on the human and natural environment of proposed actions prior to making decisions. Personnel use an online NEPA checklist to assess proposed actions and activities for potential environmental consequences at SNL/KTF. When projects or activities appear to be outside the scope of existing NEPA documentation, a NEPA checklist is prepared and forwarded to DOE for review and determination. Section 9.1 provides information on NEPA activities.	• Ensure that all environmental impacts have been assessed adequately. • Coordinate NEPA checklists with DOE personnel. • Inform project owner of environmental requirements.

Environmental Management System, Site Sustainability, Emergency Planning, and Community Right-to-Know Act

DOE O 436.1 Department Sustainability

Regulation and Compliance Approach	Compliance Activities
This order places environmental management systems and site sustainability at the forefront of environmental excellence. Personnel comply with this order through implementation of an EMS, which is third-party certified to ISO 14001:2015 at SNL/NM (the primary operating location). Operations at SNL/KTF follow the EMS requirement but do not need to be included in the certification provided that an internal assessment is conducted every three years. This order also specifies requirements for compliance with Emergency Planning and Community Right-to-Know Act requirements. See "Chemical Management" and Table 8-1 for specifics.	• Conduct an internal assessment every three years. • Enable identification of the environmental aspects and impacts of activities. • Establish and implement an annual Site Sustainability Plan.

Hazardous Waste and Environmental Restoration

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and amended in 1986

Regulation and Compliance Approach	Compliance Activities
This act establishes liability compensation, cleanup, and emergency response requirements for inactive hazardous waste sites. In addition, CERCLA requires federal facilities to report hazardous substance spills to the National Response Center. EPA designated ongoing oversight of SNL/KTF to the State of Hawai'i, Department of Health, Hazard Evaluation and Emergency Response Office. EPA recommended continued reevaluation for environmental contamination due to ongoing activities at the launch facility at SNL/KTF (EPA 1996). Environmental restoration sites located on-site at SNL/KTF have been closed through the regulatory process. SARA establishes additional reporting requirements that are addressed under "Chemical Management."	• See "Chemical Management" and Table 8-1 for compliance activities.

Federal Facility Compliance Act of 1992

Regulation and Compliance Approach	Compliance Activities
This 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. SNL/KTF operations do not generate mixed waste, and no mixed waste is currently stored on-site; therefore, these requirements are not applicable at SNL/KTF.	• No activities are associated with this requirement.

Resource Conservation and Recovery Act (RCRA), enacted in 1976, as amended

Regulation and Compliance Approach	Compliance Activities
This act sets forth the framework for managing nonhazardous and hazardous solid waste, including the hazardous waste component of mixed waste. SNL/KTF operations generate less than 100 kg of hazardous waste through normal operations each month, which equates to very small-quantity generator status subject to manifest and pre-transport requirements in 40 CFR 262, *Standards Applicable to Generators of Hazardous Waste.* Under the authority of the Hawai'i Revised Statutes and with delegated authority from EPA under RCRA, the Hawai'i State Department of Health administers the underground storage tank regulatory program in Hawai'i. As a result, the single SNL/KTF underground storage tank is permitted and regulated under Hawai'i Administrative Rules, Title 11, Chapter 281, "Underground Storage Tanks." (See "State of Hawai'i Environmental Regulations.") Section 9.4 provides information on waste management.	• Minimize waste via recycling and material recovery. • Collect and screen material and waste in preparation for shipment to off-site facilities for recycling, storage, treatment, or disposal.

Radiation Protection

Atomic Energy Act of 1954

Regulation and Compliance Approach	Compliance Activities
This act specifies proper management of source, special nuclear, and byproduct material. DOE has the authority to manage operations based on appliable statutes, federal regulations, and DOE directives. SNL/KTF operations do not (currently or in the past) involve radioactive materials (see Section 7.5); therefore, these requirements are not applicable at SNL/KTF.	• No activities are associated with this requirement.

Air Quality

Clean Air Act of 1970, as amended

Regulation and Compliance Approach	Compliance Activities
This act governs the management of nonradiological emissions with compliance achieved through adherence to the conditions of permits and applicable regulations. Air pollutants from stationary and mobile sources at SNL/KTF are regulated by Hawai'i Administrative Rules, Title 11, Chapter 60.1, "Air Pollution Control," under the jurisdiction of the Hawai'i State Department of Health, Clean Air Branch. (See "State of Hawai'i Environmental Regulations.") Ambient air quality at SNL/KTF is regulated by Hawai'i Administrative Rules, Title 11, Chapter 59, "Ambient Air Quality Standards," under the jurisdiction of the Hawai'i State Department of Health, Clean Air Branch. (See "State of Hawai'i Environmental Regulations"). Section 9.6 provides information on air quality compliance.	• Confirm that planned stationary sources of air pollutants (e.g., equipment) and potential emission from operations meet applicable local and federal requirements. • Maintain documentation that ensures that sources are in compliance with regulations and/or permitted operating conditions. • Submit monitoring reports, annual emissions inventories, and other compliance assurance documentation to regulatory agencies.

Water Quality

Clean Water Act of 1972 and amendments

Regulation and Compliance Approach	Compliance Activities
This act establishes a permitting structure and regulatory direction to protect the "waters of the United States" by restoring and maintaining the chemical, physical, and biological integrity of United States waters; protecting fish, wildlife, and recreation; and reducing pollutant discharges. There are no drinking water or groundwater monitoring wells at SNL/KTF. Sanitary sewer discharge is monitored at three on-site state-registered septic tanks. Stormwater permits, inspections, and sampling are not required for normal operations. However, new construction activities that exceed one acre of soil disturbance require permitting under the Construction General Permit. When needed, Stormwater Pollution Prevention Plans are developed and include control measures, site inspections, and annual reporting requirements. See Section 9.10 for more information on water quality programs.	• Perform periodic septic tank inspections. • Pump septic tanks as needed. • Implement Stormwater Pollution Prevention Plan steps to prevent unpermitted discharges. • Conduct inspections.

Energy Independence and Security Act (EISA) of 2007, Section 438

Regulation and Compliance Approach	Compliance Activities
This section of the act requires federal agencies to manage stormwater runoff from federal development projects for the protection of water resources. Sandia projects planned through the NEPA process (see "National Environmental Policy Act") are reviewed for EISA § 438 eligibility. Site planning, design, construction, and maintenance strategies are applied to maintain or restore predevelopment site hydrology. See Section 9.10 for more information on water quality programs.	• Identify projects that require EISA compliance. • Develop drainage plans and design detention features. • Conduct inspections and maintenance of detention features.

Oil Pollution Act of 1990 (§ 311)

Regulation and Compliance Approach	Compliance Activities
This act establishes requirements for the prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities. It requires the development and implementation of a Spill Prevention, Control, and Countermeasure Plan. Aboveground oil storage containers at SNL/KTF operate under the Pacific Missile Range Facility Spill Prevention, Control, and Countermeasure Plan (DoN 2017), in compliance with 40 CFR 112, *Oil Pollution Prevention* (40 CFR 112), and the Clean Water Act. A single underground gasoline storage tank (2,500 gallons) is maintained on-site and is subject to regulation under Hawai'i Administrative Rules, Title 11, Chapter 281, "Underground Storage Tanks." Section 9.8 provides information on the Oil Storage Program.	• Inspect oil storage containers routinely. • Train oil-handling personnel routinely. • Maintain an oil storage container inventory. • Incorporate oil spill prevention requirements and practices into processes, procedures, and new container installations.

Safe Drinking Water Act of 1974, as amended

Regulation and Compliance Approach	Compliance Activities
This act was established to protect the quality of drinking water in the United States, focusing on all waters actually or potentially designed for drinking use, whether from aboveground or underground sources. All drinking water at SNL/KTF is supplied by the Pacific Missile Range Facility drinking water system or by a vendor.	• No activities are associated with this requirement.

Chemical Management

Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986

Regulation and Compliance Approach	Compliance Activities
This act requires reporting of toxic chemicals used and released by federal, state, and local governments and industry. In amending the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, SARA Title III is recognized as EPCRA. Chemical hazard information is provided to the community for awareness and enhancement of emergency planning efforts. See Table 8-1 for specifics.	• Maintain and report on a chemical inventory. • Report qualifying releases.

Federal Insecticide, Fungicide, and Rodenticide Act, enacted in 1910 and amended in 1972

Regulation and Compliance Approach	Compliance Activities
This act regulates the use of herbicides, rodenticides, and insecticides. EPA regulations and applicable label guidelines are followed.	• State-licensed subcontractors supply, handle, and apply the products.

Toxic Substances Control Act, enacted in 1976 and later amended

Regulation and Compliance Approach	Compliance Activities
This act regulates the manufacture, processing, distribution, use, and disposal of specific chemical substances and/or mixtures. Compliance with this act includes managing asbestos and PCBs. There are no transformers containing PCBs at SNL/KTF. Section 9.4 provides information on asbestos management.	• Conduct asbestos abatement in accordance with applicable regulatory requirements.

Pollution Prevention

Pollution Prevention Act of 1990

Regulation and Compliance Approach	Compliance Activities
This act declares as national policy that pollution should be prevented or reduced at the source wherever feasible. Source reduction is defined as any practice that decreases the amount of any hazardous substance, pollutant, or contaminant from entering any waste stream or from being released into the environment prior to recycling, treatment, or disposal. A toxic chemical source reduction and recycling report is required for facilities that meet the reporting requirements under EPCRA, Section 313. See the previous EPCRA discussion under "Chemical Management."	• Conduct database queries for chemical purchases annually. • Compare environmental releases with EPCRA reporting thresholds • Prepare annual reports and submit them to federal, state, and local regulatory agencies. • Follow green purchasing practices.

Natural Resources

Endangered Species Act of 1973, amended in 1982

Executive Order 11988 of 1977, Floodplain Management, as amended

Executive Order 11990 of 1977, Protection of Wetlands, as amended

Executive Order 13112 of 1999, Invasive Species

Executive Order 13751 of 2016, Safeguarding the Nation from the Impacts of Invasive Species

Fish and Wildlife Conservation Act (PL 96-366), enacted in 1980, and the Lacey Act Amendments (PL 97 79), enacted in 1981

Migratory Bird Treaty Act (MBTA) of 1918 (and amendments)

Sikes Act of 1960 (PL 86-97), enacted in 1960, and the amendments of 1986 (PL 99-561) and 1997 (PL 105-85 Title XXIX), reauthorized in 2013

Regulation and Compliance Approach	Compliance Activities
A variety of statutes and presidential executive orders ensure protection and conservation of natural resources. Natural resources are protected via compliance with applicable statutes, long-term surveillance, and ecological compliance. Management is initially through the NEPA process (see "National Environmental Policy Act") and review of project plan effects. Chapter 10 provides more information on the Ecology Program.	• Monitor biota. • Collect ecological data.

Cultural Resources

American Indian Religious Freedom Act, enacted in 1978 and amended in 1994

Archaeological Resources Protection Act, enacted in 1979 and amended in 1988

DOE O 144.1, Department of Energy American Indian Tribal Government Interactions and Policy

DOE O 430.1C, Real Property Asset Management

DOE P 141.1, Management of Cultural Resources

Native American Graves Protection and Repatriation Act, enacted in 1990

National Historic Preservation Act, enacted in 1966 and amended in 2000, Section 106

Regulation and Compliance Approach	Compliance Activities
Multiple statutes and DOE directives provide for the management and preservation of cultural resources. Protection of cultural resources (including historical properties) is initially provided through the NEPA process (see "National Environmental Policy Act") and review of project plan effects. Cultural Resource Management Program personnel support DOE coordination with other federal agencies (local, state, and tribal) to protect and preserve cultural resources. Chapter 11 provides more information about the Cultural Resource Management Program.	• Develop internal management plans. • Conduct cultural resource surveys. • Survey property to determine eligibility for inclusion in the National Register of Historic Places. • Prepare documentation to support planning activities and decisions. • Review NEPA checklists to identify impacts on cultural resources. • Monitor construction activities for impacts on cultural resources.

Reporting

DOE O 231.1B, Admin Change 1, Environment, Safety and Health Reporting

Regulation and Compliance Approach	Compliance Activities
This order ensures that 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 operation of DOE facilities, or DOE credibility. It enhances mission safety and promotes the sharing of effective practices to support continuous improvement and adaptation to change. Environmental program personnel report on environmental program activities, monitoring results, accidental releases, and waste management operations.	• Produce an Annual Site Environmental Report.

DOE O 232.2A, Chg1 (MinChg) Occurrence Reporting and Processing of Operations Information

Regulation and Compliance Approach	Compliance Activities
This order requires timely notification to DOE about events that could adversely affect the health and safety of the public or workers, the environment, DOE missions, or DOE credibility. Sandia personnel promote organizational learning through investigation and analysis of reported events and conditions that adversely affect or may adversely affect personnel, the public, property, the environment, or the DOE mission.	• Track all environmental events.

Quality Assurance

DOE O 414.1D Admin Change 1, Quality Assurance	
Regulation and Compliance Approach	**Compliance Activities**
The purpose of this order is to achieve quality in all work and ensure that products and services meet or exceed customer requirements and expectations. All environmental sampling and analyses at SNL/KTF conform to applicable quality assurance plans, sampling plans, and field operations. Chapter 12 provides information on quality assurance.	• Develop quality assurance plans, operating plans, and sampling plans. • Provide a statement of work for contract laboratories. • Participate in quality assurance audits of contract laboratories.

Canyons and waterfall at SNL/KTF

8.1.2 Chemical Inventory and Toxic Release Inventory Reporting

The chemical inventory report and the toxic release inventory report for SNL/KTF in 2020 were submitted to EPA and support compliance with EPCRA. The chemical inventory report documents toxic chemicals in use and all chemical purchases. Table 8-1 lists the EPCRA reporting requirements.

Table 8-1. SNL/KTF applicable EPCRA reporting requirements

Section	EPCRA Section Title	Description	Reporting Required in 2020?
301–303	Emergency Planning	Sections 301–303 of EPCRA require an annual report that lists the inventories of chemicals that are above the reportable threshold planning quantities, including the location of the chemicals and the emergency contacts.	Yes
304	Emergency Notification	Section 304 of EPCRA requires an immediate notification following the accidental release of a reportable quantity of extremely hazardous substances.	No
311–312	Community-Right-to-Know: Toxic Chemical Release Inventory Reporting	Sections 311–312 of EPCRA provide requirements for maintaining safety data sheets for hazardous chemicals and for submitting inventory forms for these chemicals.	Yes

Section	EPCRA Section Title	Description	Reporting Required in 2020?
313	Toxic Release Inventory	Section 313 of EPCRA requires that a Toxic Release Inventory report be submitted for facilities that release toxic chemicals listed in SARA Title III over a threshold value.	No

The chemical inventory report for SNL/KTF was submitted to EPA. In 2020, there were no reportable quantity releases of extremely hazardous substances requiring notification under Section 304 of EPCRA. A Toxic Release Inventory report was not required under Section 313 of EPCRA.

8.1.3 Hawai'i State Environmental Requirements

The following State of Hawai'i requirements are applicable to environmental program operations at SNL/KTF.

Hawai'i Administrative Rules

- HAR Title 11 Chapter 20, Rules Relating to Potable Water Systems
- HAR Title 11 Chapter 58, Solid Waste Management Control
- HAR Title 11 Chapter 60, Air Pollution Control
- HAR Title 11 Chapter 62, Wastewater Systems
- HAR Title 11 Chapter 281, Underground Storage Tanks

Hawai'i Revised Statutes

- HRS Chapter 195 Natural Area Reserved Systems
- HRS Chapter 340E Safe Drinking Water

8.2 Environmental Management System

The EMS is a continuing cycle of planning, implementing, evaluating, and improving processes to achieve environmental goals. The EMS facilitates the identification of the environmental aspects and impacts of Sandia's activities, products, and services; identification of risks and opportunities that could impact the environment; evaluation of applicable compliance obligations; establishment of environmental objectives; and creation of plans to achieve those objectives and monitor their progress.

DOE O 436.1, *Departmental Sustainability*, provides requirements for managing sustainability practices. This order is implemented through an ISO 14001-certified EMS. Sandia National Laboratories received initial ISO 14001:2004 certification in June 2009. In 2015, the site-specific certifications for primary operating locations in New Mexico and California were integrated into a multisite ISO 14001:2004 certification. In 2018, the EMS was recertified under the new ISO 14001:2015 (ISO 14001:2015).

SNL/KTF operations do not need to be included in the certification, provided that an internal assessment is conducted every three years to ensure that personnel follow the EMS requirements. In January 2018, an EMS assessment was conducted to evaluate conformance with ISO 14001:2004 requirements at SNL/KTF. Additional information can be found at the following external EMS website:

www.sandia.gov/about/environment/environmental_management_system/index.html

The EMS provides the following benefits:

- Improved environmental performance
- Enhanced compliance with environmental regulations
- Strengthened pollution prevention efforts
- Improved resource conservation
- Increased environmental efficiencies and reduced costs
- Enhanced image with the public, regulators, and potential new hires
- Heightened awareness of environmental issues and responsibilities

Aspects are any elements of activities, products, or services that can interact with the environment, and *impacts* are any changes in the environment, whether adverse or beneficial, wholly or partially resulting from activities, products, or services.

For FY 2020, air emissions, hazardous materials use, and hazardous waste generation were identified as the top three significant aspects for Sandia operations. When significant aspects and negative impacts have been identified, environmental objectives—at all operating levels—are established to guide efforts toward minimizing those aspects and impacts.

8.2.1 Site Sustainability Plan

A Site Sustainability Plan is prepared annually to assist DOE in meeting its sustainability goals and the broader sustainability program set forth in EO 13834, *Efficient Federal Operations* (EO 13834). The most recent plan, *Fiscal Year 2021 Site Sustainability Plan* (SNL/NM 2020b), describes the performance status for FY 2020.

Sustainability goals are being met or exceeded in several key areas. Table 8-2 presents performance status for several selected key areas for all Sandia sites. Data is from the DOE Sustainability Dashboard.

Table 8-2. Site Sustainability Plan performance status for key areas

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2020
Clean and Renewable Energy	
Renewable electric energy should account for not less than 7.5 percent of a total agency electric consumption by FY 2013 and each year thereafter.	Purchased renewable energy credits to meet 20 percent of the total electric consumption forecasted for FY 2020.
Electronic Stewardship	
Purchases: Ninety-five percent of eligible acquisitions each year are EPEAT-registered products.	Acquired EPEAT-registered products for 89.32 percent of eligible electronics purchased in FY 2020.
Greenhouse Gas Reduction	
Year-over-year Scope 1 and Scope 2 greenhouse gas emissions reduction from an FY 2008 baseline. Year-over-year Scope 3 greenhouse gas emissions reduction from an FY 2008 baseline.	• Reduced Scope 1 and Scope 2 greenhouse gas emissions by 60.5 percent from the FY 2008 baseline, and reduced year-over-year emissions by 2.1 percent relative to FY 2019. • Reduced Scope 3 greenhouse gas emissions by 35.1 percent from the FY 2008 baseline, and reduced year-over-year emissions by 26.9 percent relative to FY 2019.

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2020
Organizational Resilience	
Discuss overall integration of climate resilience in emergency response, workforce, and operations procedures and protocols.	Completed a Climate Vulnerability Assessment, which highlights areas where resilience to climate change has been integrated, as well as areas for improvement.
Sustainable Acquisition	
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring that BioPreferred and biobased provisions and clauses are included in all applicable contracts.	• Flowed down sustainable acquisition requirements in applicable contracts. Included the Federal Acquisition Regulation and DOE Acquisition Regulation clauses related to sustainable acquisitions. • Established an interdepartmental team to enhance sustainable acquisition programs. • Created corporate- and division-level EMS objectives that focus on sustainable acquisitions for FY 2021. • Included all environmental specifications to be met in applicable contracts, including biobased acquisitions. Added the Federal Acquisition Regulation and DOE Acquisition Regulation clauses to Section II Terms and Conditions in the majority of the contracts.
Sustainable Buildings	
At least 15 percent (by count) of owned existing buildings to be compliant with the revised *Guiding Principles* for Sustainable Buildings by FY 2021, with annual progress thereafter.	Achieved compliance with the *Guiding Principles* in 18.4 percent of the buildings.

EPEAT = Electronic Product Environmental Assessment Tool

8.2.2 Sustainability Awards

The DOE Sustainability Performance Division sponsors the DOE Sustainability Awards, which recognize outstanding sustainability contributions by individuals and teams at DOE facilities across the country. The awards celebrate excellence in energy, water, and fleet management projects and practices. Each year, EMS personnel select nominees from that year's Environmental Excellence Awards winners. In 2020, four nominations were submitted for the DOE Sustainability Awards, and the 2020 Sustainability Champion Award was received along with an Honorable Mention in the same category. Neither items were for activities at SNL/KTF.

8.3 Environmental Performance

Environmental performance is measured as progress toward achieving site environmental objectives, meeting or exceeding compliance, and contributing to corporate and contract performance goals. Results are tracked and reported internally through the ES&H Assurance Dashboard, the management review process, and management reports.

Criteria for performance evaluation were set forth in the *Fiscal Year (FY) 2020 DOE/NNSA Strategic Performance Evaluation and Measurement Plan (PEMP)* (DOE/NNSA/SFO 2020). Subsequently, the DOE National Nuclear Security Administration Sandia Field Office prepared the *FY2020 Performance Evaluation Summary* (DOE/NNSA/SFO 2021), assessing the management and operating contractor performance for October 1, 2019, through September 30, 2020. The performance evaluation is the annual DOE National Nuclear Security Administration report card that ascribes a rating to six key performance goals and an overall rating. Sandia received a rating of excellent in three of the six goals: Mission Execution: Global Nuclear Security; DOE and Strategic Partnership Projects Mission Objectives; and Science, Technology and Engineering. A rating of very good was received in the

three remaining categories: Mission Execution: Nuclear Weapons, Mission Enablement, and Mission Leadership. Sandia received an overall rating of very good.

8.3.1 Audits, Appraisals, and Inspections in 2020

Environmental programs are routinely subjected to audits, appraisals, inspections, and/or verifications by external agencies. The internal audit group also conducts assessments, including reviews of implementation of applicable policies, processes, 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. In 2020, there were no audits, appraisals, or inspections because of COVID-19 restrictions.

8.3.2 Occurrence Reporting in 2020

Under DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information*, the current order for occurrence reporting, *occurrences* are defined as "events or conditions that adversely affect, or may adversely affect, DOE (including the National Nuclear Security Administration) or contractor personnel, the public, property, the environment, or the DOE mission." Events or conditions meeting the criteria thresholds identified in this order are occurrences. Whereas some environmental releases may not meet DOE O 232.2A Chg1 (MinChg) reporting thresholds, they may still be reportable to outside agencies.

Per DOE, *occurrences* are defined as "events or conditions that adversely affect, or may adversely affect, DOE (including the National Nuclear Security Administration) or contractor personnel, the public, property, the environment, or the DOE mission."

Occurrences that met DOE O 232.2A Chg1 (MinChg) criteria were entered into the DOE Occurrence Reporting and Processing System database. For this Annual Site Environmental Report, the Occurrence Reporting and Processing System database was queried for SNL/KTF occurrences in the following reporting criteria groups (as defined by DOE O 232.2A Chg1 [MinChg]):

- Group 5, Environmental
- Group 9, Noncompliance Notifications
- Group 10, Management Concerns and Issues (with identified environmental impact)
- Any occurrence that involved a Sandia environmental program

Qualifying occurrences that took place within a building are not provided in this report.

During 2020, no occurrences met the query criteria for reporting in the Annual Site Environmental Report.

8.4 Environmental Permit Status

Environmental permits for SNL/KTF include those for a wastewater system, diesel generators, and an underground storage tank issued by the State of Hawai'i. Table 8-3 lists the applicable environmental permits in effect at SNL/KTF in 2020.

Table 8-3. SNL/KTF environmental permits, 2020

Permit Type	Permit Number	Issue Date	Expiration Date	Regulatory Agency
Individual wastewater system	File #4056-SNL, TMK: (4) 1-2-002:013	December 1, 2004	Not applicable	State of Hawai'i Department of Health
Noncovered source permit (two stand-by diesel generators)	NSP 0429-01-N	September 28, 2015	September 27, 2020*	State of Hawai'i Department of Health
Underground storage tank (2,500 gallons)	P-2016-064	June 8, 2016	June 8, 2021	State of Hawai'i Department of Health

* Renewal application was received by the Hawai'i Department of Health Clean Air Branch on July 2, 2020.

Chapter 9. SNL/KTF Environmental Programs

Sunset in Hawai'i

OVERVIEW ■ Sandia personnel take the responsibility of protecting the environment seriously. Numerous program teams monitor the environment and perform activities at SNL/KTF to help prevent pollution and conserve natural resources.

Sandia personnel collect data at SNL/KTF to determine and report the impact of existing operations on the environment. These environmental program activities meet or exceed federal, state, and local environmental requirements as well as DOE directives in Sandia's Prime Contract. Presidential executive orders and DOE guidance documents are also used to establish program criteria.

The current environmental programs and focus areas include:

- NEPA Program
- Environmental Life-Cycle Management Program
- Chemical Information System
- Waste Management Program
- Environmental Restoration Project
- Air Quality Compliance Program
- Meteorology Program
- Oil Storage Program
- Terrestrial Surveillance Program
- Water Quality programs

The Ecology Program is presented in Chapter 10, and the Cultural Program is presented in Chapter 11.

9.1 National Environmental Policy Act Program

NEPA Program personnel provide technical assistance to ensure that operations comply with NEPA and the National Historic Preservation Act. For proposed projects and activities, project owners complete a NEPA checklist using the NEPA Module application to assess potential environmental impacts.

After a NEPA checklist is submitted, NEPA Program personnel review projects and activities for conformance with existing DOE NEPA documents and determinations. Other applicable environmental program subject matter experts also review proposed projects and activities to determine and communicate any applicable environmental permitting and/or other requirements.

DOE analyzed the impacts of Sandia operations, presented in *Site-Wide Environmental Assessment, Sandia National Laboratories, Kaua'i Test Facility* (DOE/NNSA 2019), for the continued operation of SNL/KTF.

In 2020, the NEPA Program team completed 11 NEPA checklists for SNL/KTF, eight of which were transmitted to DOE for review and completion. NEPA Program personnel supported several customers with associated programmatic activities performed at either SNL/KTF or the Pacific Missile Range Facility and provided support for decontamination and demolition of various facilities.

The following NEPA activities required DOE review and determination in 2020. Of these completed NEPA checklists, none required preparation of an environmental assessment or an environmental impact statement.

Operations

NEPA checklists for the following operations were submitted to DOE in 2020:

- Environmental monitoring
- Prototype design for integration testing of flight technologies (three projects)
- Radar experiment installation

Facility Projects

- NEPA checklists for the following facility projects were submitted to DOE in 2020:

Demolition and removal of structures

- Generator replacement
- Geotechnical study for an administrative building

9.2 Environmental Life-Cycle Management Program

Environmental Life-Cycle Management Program activities ensure long-term protection of human health and the environment. Using the NEPA process, program personnel review proposed SNL/KTF projects and activities that have the potential to impact the environment. This review provides a process for minimizing adverse environmental impacts from ongoing and future activities. In 2020, environmental impacts of seven projects were reviewed and documented.

9.3 Chemical Information System

The Chemical Information System is a comprehensive chemical information tool used to track workplace chemical and biological containers by location. The primary drivers for the Chemical Information System are state and federal regulations, including the Emergency Planning and Community Right-to-Know Act. The Chemical Information System compiles information

concerning chemical hazards and appropriate protective measures for Emergency Management Operations, other ES&H programs, and the workforce.

The inventory system provides the chemical or product name, its location and quantity, and information about who is responsible for the chemical. Chemical hazards are reported on safety data sheets, and the Chemical Information System currently contains more than 120,000 safety data sheets in its library. This electronic inventory helps chemical users and their managers assess and manage workplace hazards. Easy access to this inventory facilitates availability searches. It also improves the ability to share chemicals and thus help reduce sources, which helps to minimize chemical purchases and waste disposal expenses.

A pre-procurement module, ChemPro is used to request permission for new chemical purchases. The system runs a series of queries, comparing the requested purchasing information to regulatory limits, and determines whether the requested chemical and volume is approved for use and storage in the specified location. If approved, the requestor is given a chemical approval number, which must be provided to the chemical vendor as part of the purchasing process. ChemPro allows for proactive environmental and safety planning.

9.4 Waste Management Program

Some hazardous waste is generated through normal operations at SNL/KTF. The site is classified as a conditionally exempt small-quantity generator or very small quantity generator, and personnel follow applicable requirements. EPA Region 9 and the Hawai'i State Department of Health issued a generator identification (HI-0000-363309) to Sandia on September 23, 1994.

At SNL/KTF, compliance with the Toxic Substances Control Act involves management of asbestos and PCBs. The transformers on the SNL/KTF site have been tested and are free of PCBs (IT 1993). Asbestos abatement-related activities are conducted in accordance with applicable regulatory requirements as needed.

The SNL/NM asbestos management team conducted a comprehensive asbestos survey in July 2008. One hundred and ten cubic yards of asbestos-containing materials were identified at SNL/KTF, and 91 cubic yards were identified at the Mount Haleakalā site on Maui.

In 2020, asbestos abatement was concluded at the Mount Haleakalā site on Maui. No additional asbestos-containing materials were removed in 2020.

9.5 Environmental Restoration Project

All environmental restoration sites at SNL/KTF have been closed through the regulatory process. On September 30, 1996, EPA granted a Site Evaluation Accomplished determination for the three environmental restorations sites identified in 1995 (EPA 1996). Because SNL/KTF operations met all CERCLA requirements, there is no ongoing remediation at SNL/KTF.

9.6 Air Quality Compliance Program

As required, the 2020 Annual Emissions Report for air emissions was submitted to the State of Hawai'i (DOE/NNSA 2020a). The annual fee was submitted to the State of Hawai'i for 2020 as required by the Noncovered Source Permit. All operations at SNL/KTF followed permitted operating limits.

The two diesel-fired power generators at SNL/KTF are permitted for operation by the State of Hawai'i under a Noncovered Source Permit (Hawai'i 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 60, *Standards of Performance for New Stationary Sources*, Subpart IIII, "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines"

Rocket launches are considered mobile sources of air emissions, and rocket launch emissions are included in the review against Toxic Release Inventory reporting thresholds.

The two monitoring reports for the Noncovered Source Permit were submitted to the State of Hawai'i for 2020 operations within required timelines (DOE/NNSA 2020a; DOE/NNSA 2020b). The highest total combined operating hours for a rolling 12-month period was 999.1 hours, which occurred in the period from April 2019 to March 2020.

9.7 Meteorology Program

On-site meteorological instruments are used during test periods to characterize ground-level and atmospheric wind conditions. Climatic information, representative of SNL/KTF, is obtained from Pacific Missile Range Facility personnel, and severe weather notifications are issued automatically by the Pacific Missile Range Facility Emergency Operations Center to all SNL/KTF resident personnel.

9.8 Oil Storage Program

The Oil Storage Program supports regulatory compliance associated with the management, operation, and maintenance of oil storage containers and equipment at SNL/KTF. Aboveground oil storage containers at SNL/KTF operate under the Pacific Missile Range Facility Spill Prevention, Control, and Countermeasure Plan (DoN 2017) as required by 40 CFR 112, *Oil Pollution Prevention* (40 CFR 112) and the Clean Water Act. The Pacific Missile Range Facility Spill Prevention, Control, and Countermeasure Plan describes the oil storage facilities at the SNL/KTF site and the mitigation controls in place to prevent inadvertent discharges of oil.

The SNL/KTF inventory of oil storage containers operating under the Pacific Missile Range Facility Spill Prevention, Control, and Countermeasure Plan include:

- One portable diesel fuel generator base tank (192 gallons)
- One stationary aboveground diesel fuel storage tank (10,000 gallons)
- Two stationary diesel fuel generator base tanks (300 gallons each)
- Four 55-gallon drums used for collecting and storing oil

In addition to aboveground oil storage containers at SNL/KTF, a single underground gasoline storage tank (2,500 gallons) is maintained on-site and is subject to regulation under the Hawai'i Administrative Rules, Title 11, Chapter 281, *Underground Storage Tanks*. The underground storage tank is permitted with the Hawai'i State Department of Health. The tank leak detection system equipment is inspected and functionally tested annually in accordance with requirements.

There were no reportable oil spills or releases at SNL/KTF in 2020.

9.9 Terrestrial Surveillance Program

Terrestrial Surveillance Program personnel collect environmental media (soil) samples at SNL/KTF approximately every five years. Environmental surveillance began at SNL/KTF in 1994 and continued in 1999, 2002, 2007, 2012, and 2018. Sampling activities were not conducted in 2020. Previous sampling results can be found in earlier Annual Site Environmental Reports.

9.10 Water Quality Programs

Water quality-related programs at SNL/KTF ensure compliance with local, state, and federal requirements. There are no drinking water or groundwater monitoring wells at SNL/KTF. All drinking water at SNL/KTF is supplied by the Pacific Missile Range Facility public water system.

9.10.1 Stormwater Program

Stormwater runoff is directed into four area drains with pumping systems. Stormwater permits, inspections, and sampling are not required for normal operations.

New construction activities that exceed one acre of soil disturbance require permitting under the Construction General Permit. No construction activities required permit coverage during 2020.

Wastewater is the spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.

9.10.2 Wastewater Discharge Program

Activities at SNL/KTF produce only sanitary sewage, which is directed into three DOE-owned and state-registered septic tanks; all the tanks are currently in use and do not impact any protected waters. The first septic tank was built in 1965 and was replaced in 2004. Two additional septic tanks were built in 1990 to serve other areas. The septic tank systems are pumped periodically and are inspected by licensed, state-certified contractors. During 2020, all three septic tank systems were inspected with one tank being pumped. There were no wastewater sampling events in 2020.

Chapter 10. SNL/KTF Ecology Program

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

OVERVIEW ■ Ecology Program personnel monitor biota as an element of the overall environmental monitoring process. Ecological data is collected on plants and wildlife to support documentation, land use decisions, and ecological and wildlife awareness campaigns to ensure safe work environments and sustainable decision-making strategies. Ecology Program personnel help operations comply with wildlife regulations and laws by providing biological evaluations and surveys in support of site activities.

At SNL/KTF, Ecology Program personnel support site activity and project compliance with wildlife requirements by conducting biological evaluations and surveys. Ecology Program personnel conduct limited biological surveys at SNL/KTF.

Numerous species on the island of Kaua'i are protected by the Endangered Species Act. Many of these are forest species for whom SNL/KTF provides little or no suitable habitat. These species would not likely occur at SNL/KTF; however, their historical or future occurrence at SNL/KTF cannot be ruled out. The Endangered Species Act and Migratory Bird Treaty Act lists of threatened or endangered species is discussed in Section 10.3.

In 2014, the Navy prepared a biological assessment (U.S. Navy 2014) of the potential for Pacific Missile Range Facility infrastructure, operations, and maintenance to affect listed species (DOE/NNSA 2019). The infrastructure and activities conducted at SNL/KTF were included. The assessment was submitted to the U.S. Fish and Wildlife Service with a request for formal consultation. In 2018, the U.S. Fish and Wildlife Service issued biological and conference opinions for the Pacific Missile Range Facility (USFWS 2018) and for SNL/KTF as a tenant. These biological opinions contain measures to minimize the take on Newell's shearwater (*Puffinus newelli)* because of artificial lighting and collisions with communication towers.

10.1 Vegetation

There are seven recognized vegetation types on the undeveloped portions of the Pacific Missile Range Facility, which include SNL/KTF: kiawe/koa-haole scrub, a`ali`i-nama scrub, pohinahina, naupaka dune, strand, drainage-way wetlands, and ruderal (plant species that are first to colonize disturbed areas) vegetation. Kiawe/koa-haole and a`ali`i-nama scrub are the dominant vegetation types in the undeveloped portions of the Pacific Missile Range Facility and SNL/KTF. Kiawe/ koa-haole is the dominant vegetation type present in the relatively undisturbed areas of the sand dunes associated with SNL/KTF and Polihale State Park as well as along the cliff face in a restricted easement area. Because of off-highway vehicle restrictions, sand dune-related vegetation within the Pacific Missile Range Facility and SNL/KTF boundaries is less disturbed than vegetation in Polihale State Park. A well-developed native strand community exists along the shoreline. Common plants that inhabit the sandy beach habitat on Kauaʻi include beach naupaka, pohinahina, pohuehue, milo, and hau.

The composition of the kiawe/koa-haole vegetation community can vary from pure stands of kiawe to pure stands of koa-haole or any combination of the two. The kiawe trees often attain a height of 45 feet or more. The understory is commonly koa-haole except where the kiawe trees form a canopy. The height of the koa-haole depends to a large degree on the presence or absence of the kiawe trees. Ground cover varies and may consist of pure stands of Guinea grass (*Panicum maximum*), lantana (*Lantana camara*), or clove basil (*Ocimum gratissimum*). However, the most common ground cover is mixed forbs (herbaceous flowering plants that are not a grass) and grasses.

Biota is the animal and plant life of a given region; *biotic* is relating to or resulting from living organisms.

The majority of SNL/KTF is occupied by an open, woody scrub or a ruderal community of plants, which is mowed regularly. The open scrub community is mostly comprised of introduced species, although there are some Hawaiʻian taxa to be found along the roads. These are worthy of mention because, even in such highly disturbed areas as roadways, the native plants can and do persist. Taken together, the open scrub communities occupy most of the land area.

Two wetlands areas exist along parts of the coastline west of SNL/KTF. The U.S. Fish and Wildlife Service has classified these areas as Marine System, Subtidal Subsystem, Reef Class, Coral Subclass, and Subtidal. There is also a wetlands area to the south of SNL/KTF along Nohili Ditch, which is classified as Riverine System, Lower Perennial Subsystem, Open Water/Unknown Bottom Class, Permanent, Non-Tidal, and Excavated. There is potential for aquatic vegetation types and accompanying waterbird species to be present on or near SNL/KTF property during wet periods. Ditches along the eastern edge of SNL/KTF and several reservoirs on the Mana Plain, including the Mana Base Pond near the entrance to the Pacific Missile Range Facility, serve as waterbird habitats and sanctuaries.

Two federally listed plant species have been observed north of, but not on, the Pacific Missile Range Facility. Ohai (*Sesbania tomentosa*), a spreading shrub, is a federally endangered species that has been observed in the sand dunes to the north of the Pacific Missile Range Facility in Polihale State Park and could potentially occur at SNL/KTF. Lau`ehu (*Panicum niihauense*), an endangered species of rare grass, has been observed near Queens Pond, also north of the Pacific Missile Range Facility (SNL/NM 2020c).

10.2 Wildlife

Numerous birds, mammals, and reptiles have been observed and documented at and near SNL/KTF. Species that are listed as protected, threatened, or endangered are noted.

10.2.1 Birds

More than 50 species of birds have been identified in the general Pacific Missile Range Facility area, although not specifically at SNL/KTF. Endemic species include: Hawai'ian coot (*Fulica alai*), Hawai'ian duck (*Anas wyvilliana*), Hawai'ian gallinule (formerly Hawai'ian moorhen) (*Gallinula galleta sandvicensis*), Hawai'ian petrel (*Petrodroma sandwichensis*), Hawai'ian short-eared owl (*Asio flammeus sandwichensis*), Hawai'ian stilt (*Himantopus mexicanus knudseni*), and Newell's shearwater. Common introduced (non-native) species include the African silverbill (*Euodice cantans*), common myna (*Acridotheres tristis),* house sparrow (*Passer domesticus*), Java sparrow (*Lonchura oryzivora),* red-crested cardinal (*Paroaria coronata*), and zebra dove (*Geopelia striata*). Past wildlife surveys of birds and mammals conducted at SNL/KTF found 20 species of birds throughout the facility.

Bird species protected under the Migratory Bird Treaty Act that have been observed at SNL/KTF include the black-crowned night-heron (*Nycticorax nycticorax*), brown noddy (*Anous stolidus*), great frigatebird (*Fregata minor*), Laysan albatross (*Diomedea immutabilis*), and ruddy turnstone (*Arenaria interpres)*. The Laysan albatross uses the lawn-like ruderal vegetation areas for courtship and nesting. Up to six pairs of Laysan albatross have been observed in the SNL/KTF area. Other species known to exist within or near SNL/KTF are band-rumped storm petrel (*Oceanodroma castro*), barn owl (*Tyto alba*), Pacific golden plover (*Pluvialis fulva*), sanderling (*Calidris alba*), wandering tattler (*Heteroscelus incanus*), and wedge-tailed shearwater (*Puffinus pacificus chlororyncus*).

Five of the bird species observed at SNL/KTF are federally listed as endangered: Hawai'ian coot, Hawai'ian duck, Hawai'ian gallinule, Hawai'ian petrel, and Hawai'ian stilt. In addition, Newell's shearwater, observed at the Pacific Missile Range Facility, is federally listed as threatened. These species all have special protections under the Endangered Species Act as administered by the U.S. Fish and Wildlife Service.

The Hawai'ian coot, Hawai'ian duck, Hawai'ian gallinule, and Hawai'ian stilt use wetlands habitat (such as the Nohili Ditch system, ditch systems along the eastern edge of SNL/KTF, and several reservoirs on the Mana Plain) for breeding, nesting, and feeding.

The Hawai'ian goose is currently listed as threatened after having been listed as endangered in 2019. The Hawai'ian goose is frequently encountered and regularly nests at the Pacific Missile Range Facility Main Base. SNL/KTF lacks suitable nesting habitat for the Hawai'ian goose.

The Newell's shearwater is a pelagic (open sea) species that once nested on all the major Hawai'ian Islands. However, it has become extinct on the islands of Hawai'i, Maui, Molokai, and Oahu due to the introduction of the mongoose in the late 1800s. Kaua'i provides the last Hawai'ian habitat for this federally listed threatened species.

Newell's shearwaters nest during the spring and summer months (April to November) in the interior mountains of Kaua'i. Nestlings leave the breeding grounds in October and November, departing by themselves shortly after nightfall and heading for the open ocean, guided by the reflection of moonlight on the water. Being inexperienced and naturally attracted to bright lights, they have a tendency to collide with trees, utility lines, buildings, and automobiles. The most critical period when Newell's shearwaters might have flight accidents is one week before and one week after the new moon in October and in November.

The Hawai'ian petrel may traverse the area from their nesting grounds to the sea. Fledging of the Hawai'ian petrel occurs in October, slightly earlier than for the Newell's shearwater.

Mitigation measures that have been implemented to minimize fallout for the Newell's shearwater also benefit other protected seabirds that are susceptible to disorientation from artificial lighting. No fallout was reported on SNL/KTF in 2020.

10.2.2 Mammals

Thirteen species of mammals are known to occur on the island of Kauaʻi. Eleven of these species are exotic (Tomich 1986). Past surveys found mammal species such as feral dogs (*Canis lupus familiaris*), feral cats (*Felis catus*), and small rodents (*Muroidea* spp.) within SNL/KTF. Feral dogs are known to roam the areas around SNL/KTF. At least four species of rodents are expected to be present at SNL/KTF: house mouse (*Mus musculus*), Norway rat (*Rattus norvegicus*), roof rat (*Rattus rattus*), and Pacific rat (*Rattus exulans*).

An *exotic* species, which may be invasive or noninvasive, is not native to the environment.

The Hawaiʻian hoary bat (*Aeorestes semotus*) is protected under the Endangered Species Act as endangered. The species is most common in regions between sea level and 4,000 feet that receive 20 to 90 inches of rain per year. This bat species uses trees or, possibly, rock shelters for roosting (Baldwin 1950). The Hawaiʻian hoary bat has been recorded at the Pacific Missile Range Facility, and it is known to feed offshore and to occur at the Polihale State Park north of SNL/KTF.

The humpback whale (*Megaptera novaeangliae*) is protected under the Marine Mammal Protection Act and is protected as an endangered species under the Endangered Species Act. It is a migratory species that winters in tropical waters near coasts and islands and spends summers in temperate or subtropical waters (Johnson and Wolman 1984).

The Hawaiʻian monk seal (*Monachus schauinslandi*) is protected under the Marine Mammal Protection Act, is protected as an endangered species under the Endangered Species Act, and is one of two mammals endemic to Hawaiʻi. Hawaiʻian monk seals use sandy beaches to give birth and use vegetation behind beaches for shelter. Hawaiʻian monk seals are only occasionally reported around the main Hawaiʻian Islands (USFWS 2018), although they have been observed at the Pacific Missile Range Facility (The Traverse Group 1988).

The false killer whale (*Pseudorca crassidens*) is protected under the Marine Mammal Protection Act and is protected as an endangered species under the Endangered Species Act. Large members of the dolphin family, they have been sighted off the west coast of Kauaʻi near the Pacific Missile Range Facility and were documented during a marine species survey in 2012 (NASA 2013). A final recovery plan and final recovery implementation strategy is anticipated to be completed for this species in 2021. In addition, a five-year status review to determine whether the endangered listing status is still appropriate is expected to be completed in 2021.

10.2.3 Reptiles

Of the five species of marine turtles listed on the Endangered Species Act that are known to occur near SNL/KTF, only two are considered residents while the other three may just pass through. Currently, no listed terrestrial reptiles or amphibians are expected to occur within the vicinity of SNL/KTF.

The Pacific green sea turtle (*Chelonia mydas*) is protected under the Endangered Species Act as threatened. The species inhabits pelagic habitat as juveniles and benthic (deep sea) habitat around all the Hawaiʻian Islands as adults. Adult turtles are known to rest along ledges and in caves and to forage in shallow intertidal and subtidal waters around the main islands. The turtles use sandy beaches for nesting during the summer months. Hatchlings emerge between July and October. Pacific green sea turtles occasionally nest at the southern end of the Pacific Missile Range Facility and north of Kokole Point (Balazs, Forsyth, and Kam 1987).

Pacific green sea turtles are known to routinely utilize Barking Sands coastal waters for foraging and beaches for basking. Pacific green turtles are commonly observed basking on the beach and in the waters at the Nohili Ditch outfall or what is commonly referred to as the Turtle Cove area. Green turtles have been documented nesting at Barking Sands frequently in recent years with a total of nine confirmed nests laid between 2015 and 2020. Nests have been observed on the southern coast of Barking Sands and the beach near the southern end of the airfield. There is no shoreline within the SNL/KTF boundary.

The hawksbill turtle is relatively rare and while there are no known reports of hawksbills nesting near the Pacific Missile Range Facility, they have been reported in the open waters off Kauaʻi.

10.3 Federally Listed and State-Listed Threatened and Endangered Species

Federally listed and state-listed threatened and endangered species potentially occurring or confirmed at SNL/KTF can be found in Table 10-1 (SNL/NM 2020c).

Table 10-1. Federally listed threatened or endangered species potentially occurring or confirmed at SNL/KTF

Common Name	Scientific Name	Federal Status
Birds		
Hawaiʻian duck	*Anas wyvilliana*	Endangered
Hawaiʻian goose	*Branta sandvicensis*	Threatened
Hawaiʻian coot	*Fulica alai*	Endangered
Hawaiʻian gallinule	*Gallina galleta sandvicensis*	Endangered
Hawaiʻian black-necked stilt	*Himantopus mexicanus knudseni*	Endangered
Band-rumped storm petrel	*Oceanodroma castro*	Endangered
Hawaiʻian petrel	*Petrodoma sanwichensis*	Endangered
Short-tailed albatross	*Phoebastria albatrus*	Endangered
Newell's shearwater	*Puffinis newelii*	Threatened
Mammals		
Hawaiʻian hoary bat	*Aeorestes semotus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Hawaiʻian monk seal	*Monachus schauinslandi*	Endangered
False killer whale	*Pseudorca crassidens*	Endangered
Reptiles		
Loggerhead turtle	*Caretta caretta*	Endangered
Pacific green sea turtle	*Cheldonia mydas*	Threatened
Leatherback turtle	*Dermochelys coriacea*	Endangered
Hawksbill turtle	*Eretmochelys imbricata*	Endangered
Olive Ridley turtle	*Lepidochelys olivacea*	Threatened
Plants		
Lauʻehu	*Panicum niihauense*	Endangered
Ohai	*Sesbania tomentosa*	Endangered

Chapter 11. SNL/KTF Cultural Resource Management Program

Dome housing tracking telescope, Kaua'i Test Facility

OVERVIEW ■ Cultural Resource Management Program personnel coordinate cultural resource compliance, including review of archaeological sites and historic buildings. Actions that could adversely affect cultural resources are analyzed initially in a NEPA checklist review. DOE is responsible for ensuring that impacts on cultural resources are assessed and appropriate actions are taken to mitigate those impacts.

The Cultural Resource Management Program is primarily focused on long-term preservation and protection of cultural resources and cultural resource compliance to ensure that the heritage of an area and its landscape are maintained. Long-term preservation and protection practices also ensure that data are available to make proper land use decisions and to assist with environmental planning. The Cultural Resource Management Program is composed of two main parts: archeological resources and historic buildings.

Cultural resources are places and physical evidence of past human activity: a site, an object, a landscape, a structure, or a natural feature of significance to a group of people traditionally associated with it.

Approximately six archaeological surveys have been conducted between 1976 and 2020 at SNL/KTF. Monitoring of all construction activities has been required in the areas from Kekaha to the south and Polihale to the north of the Pacific Missile Range Facility, as well as in intermediate areas.

11.1 Culture History

Three major historical periods are used to define traditions on Kauaʻi: Pre-Contact (ca. AD 450–1778) to Early Historic (AD 1778–1800), Contact (AD 1778–1850), and Māhele (AD 1830–1870).

Much of the knowledge regarding traditional land use patterns at SNL/KTF is based on what was recorded at the time of, and shortly after, Western contact. Early records (such as journals kept by travelers and missionaries) documented Hawaiʻian traditions from that time, and archaeological investigations have assisted with understanding the past. Kauaʻi consists of six moku (land divisions that section off portions of the island): Kona, Puna, Koʻolau, Haleleʻa, Napali, and Waimea (Moffat and Fitzpatrick 1995). Ahupuaʻa (smaller land divisions within the moku) incorporate the natural resources necessary for traditional subsistence strategies. SNL/KTF is located in the ahupuaʻa of Waiawa, which is in the Kona district of Kauaʻi.

A *moku* is a land division that sections off portions of the island.

Previous archaeological work within and near Barking Sands on the Mānā Plain led to the identification of prehistoric habitation and multiple types of features made by and utilized by humans (i.e., a fire pit, bedrock mortars, and shelters). Archaeological and historical records of the area revealed that Native Hawaiʻians used five environmental zones during traditional (Contact and Māhele) times in the western region of Kauaʻi: coastal and beach dunes, marshlands, cliff slopes, valleys, and upper mountain slopes. Archaeological studies along the coast and further inland revealed habitation, religious sites, and agricultural sites that date from AD 1120–1310 (Sweeney 1994).

11.2 Historical Context

Private plane pilots used a pasture near Barking Sands, Kaua'i, as a landing field in the 1920s. In 1928, the Territorial Aeronautical Commission had the area surveyed and took control of the landing field. One of three landing fields on Kaua'i, the Barking Sands Landing Field (also identified as Mana Airport), was intended as a stopover for transpacific flights.

In the lead up to United States involvement in World War II, the military improved and expanded the facilities at Barking Sands. Both the U.S. Army and the U.S. Navy used the site during the war, acquiring additional land and building up the facilities.

The U.S. Air Force took over Barking Sands in 1948, renaming it Bonham Air Force Base. In 1954, Bonham Air Force Base was declared excess, although no disposal action was taken. Subsequently, the Navy leased the base, and it was transferred from the Air Force to the Navy in 1966. It is now known as the Pacific Missile Range Facility, a 7.5-mile-long, 0.5-mile-wide strip of coastal land.

In 1962, Sandia was looking for a site to set up a rocket-launching facility in support of the Operation Dominic nuclear test series based in the Pacific at Christmas and Johnston islands. The Atomic Energy Commission obtained permission for Sandia to use space at Bonham, near Barking Sands. Sandia engineers surveyed the site and planned for 40 launchpads. It was an ideal site, located on the northwest side of Kaua'i where Sandia personnel could take advantage of existing tracking radar systems.

Meant to be temporary, Sandia's site was used to launch diagnostic rockets to support analysis of Operation Dominic's high-altitude nuclear shots. Sandia personnel were able to launch instrumentation rockets simultaneously with small rockets launched from Johnston Island 700 miles away.

Sandia operations in Kaua'i were expected to end after Operation Dominic concluded in 1962. However, when ratifying the 1963 Limited Test Ban Treaty, the U.S. Congress placed conditions—safeguards—on its approval. The United States needed to maintain a readiness to resume nuclear testing should another nation break the treaty or should the United States have an imperative to test nuclear weapons. As part of the support for this Readiness Program, Sandia personnel maintained the test range on Kaua'i, establishing a permit with the Navy to continue using the SNL/KTF site at the Pacific Missile Range Facility. The readiness requirement was dropped in the 1970s, but Sandia's well-established rocket-launching capabilities remained in demand and SNL/KTF remains in use.

11.3 Regulatory Criteria

Ensuring compliance with federal requirements supports the long-term preservation and protection of cultural resources, prevents mission delays, and maintains trust and a strong relationship with DOE and the Hawai'i State Historic Preservation Division. See Chapter 8.

11.4 Archaeological Resources

The Sandia archaeologist helps Sandia personnel and DOE maintain compliance with National Historic Preservation Act, Section 106, requirements. This ensures that (1) cultural resources and their historic and cultural heritage are preserved and protected and (2) data are available to make appropriate land use and environmental planning decisions at SNL/KTF.

The archaeologist reviews NEPA checklists that involve land disturbances and provides recommendations for monitoring field activities so archeological resources are not impacted adversely. The archaeologist also makes site eligibility recommendations for inclusion in the National Register of Historic Places. In addition, the archaeologist ensures that local, native Hawai'ian cultural resource management firms that are permitted to work in the area perform the archaeological work.

11.4.1 Field Methods

Local archaeological personnel who hold state-required permits to conduct archaeological work in Hawai'i at SNL/KTF are contracted to conduct pedestrian surveys and monitor all work that will disturb land. In addition, the contracted archaeological personnel provide recommendations regarding the potential effect of proposed undertakings on prehistoric and historic properties. These include recommendations regarding a site's eligibility for nomination to the National Register of Historic Places for Cultural Properties and Historic Preservation and project mitigation.

The contracted archeological personnel write all reports of findings and associated documentation and provide them to the Sandia archaeologist for review. The reports are then provided to DOE.

11.4.2 Archaeological Assessments and Analysis in 2020

In 2020, the Sandia archaeologist reviewed three NEPA checklists for outdoor projects, which included launch and facility operations and geotechnical borings. All ground-disturbing activities had requirements to use an archaeological monitor for all the work. The archaeological monitoring was completed onsite by permitted, local Hawaiian archaeologists to monitor the ground disturbing activities.

11.5 Historic Buildings

Since 2006, environmental planning and cultural resources management at SNL/KTF have included historic building assessments and compliance with National Historic Preservation Act, Section 106, requirements. The Sandia historian conducts historic building assessments and makes recommendations to DOE regarding National Register of Historic Places eligibility for SNL/KTF properties.

11.5.1 Methods

Although the historian does provide input on proposed projects as requested, most historic building assessments are triggered by the NEPA process. While a NEPA checklist is in subject matter expert review, the historian reviews the project details, reviews existing photographs of and documents about the facilities involved, conducts any additional research in the archives and building drawings collection to understand the property's past and current role in SNL/KTF operations, and evaluates the building's history. Note is made of any previous assessments and resulting determinations as to the property's eligibility for the National Register of Historic Places.

If there are any questions regarding proposed work and its potential impact on a building, the historian discusses the matter with the project owner and the NEPA specialist. The project owner may submit renderings of the anticipated appearance of the property after work is completed, and the historian may suggest alternate locations, materials, or methods to avoid adverse effects on the property.

Once a property is understood in context, the historian makes a recommendation as to whether it is eligible for inclusion in the National Register of Historic Places, summarizing past determinations and any subsequent changes to the property. The historian also makes a recommendation as to whether proposed work will have an adverse effect on any historic properties or districts, including the property where the work is occurring. Information regarding the property, photographs, a description of the proposed work, any impacts, and the overall recommendation on eligibility are captured on a Hawai'i Historic Resources Inventory form. The Historic Resources Inventory form is submitted as an attachment to the NEPA checklist for DOE review and use in consultation with the Hawai'i State Historic Preservation Office.

11.5.2 Previous Building Surveys, Assessments, and Determinations

The Sandia historian conducted a historic building survey of SNL/KTF in 2006. This survey serves as the basis for understanding the properties at the site and for generating Hawai'i Historic Resources Inventory forms as properties face renovation or demolition. No site-wide assessment or historic context statement (providing the framework for evaluating a property for historic significance) exists. No sitewide consultation has occurred.

For each project undertaken since 2006—including minor repair activities, large-scale renovations, and demolition—DOE, in consultation with the Hawai'i State Historic Preservation Office, has determined that the properties involved are not eligible for the National Register of Historic Places. This is largely because the SNL/KTF property has undergone significant modification (and removal) of key early facilities and no longer represents its historic Cold War and Readiness Program activities.

11.5.3 Historic Building Assessments in 2020

In 2020, the historian reviewed two SNL/KTF projects and provided Historic Resources Inventory forms for each.

A project to replace backup generators and controls involved minor modifications to Building K673, the Main Substation. The historian reviewed the proposed work and the building's history, then prepared a Historic Resources Inventory form indicating that the building is not historic and that the proposed work would have no effect on the building's design, appearance, or purpose. DOE did not consult with the Hawai'i State Historic Preservation Officer but determined that the work would have no adverse effect on any historic properties.

As part of an overall cleanup effort at SNL/KTF, it was proposed that Building K638, the Propellant Decontamination Shelter, and Building K639, the Oxidizer Shelter, should be demolished as they were no longer in use. The cleanup also included removing equipment from the site salvage yard and demolishing a trailer that is no longer in use. The trailer and equipment stored in the salvage yard had been moved previously and were no longer representative of any work at SNL/KTF, so were determined not to require historic building assessment. The historian assessed buildings K638 and K639, which had not been used for more than 20 years. Both were minor support facilities that did not represent any historic activities at the site. Historic Resources Inventory forms were prepared for each building and provided to DOE, recommending that the buildings were not eligible for the National Register of Historic Places and that their demolition would have no effect on any historic properties or districts.

Chapter 12. SNL/KTF Quality Assurance

Hills in Kaua'i

OVERVIEW ■ Personnel in various programs collect environmental samples and analyze them for nonradiological constituents. Quality control samples are sent to contract laboratories to ensure that the samples meet statistically established control criteria or prescribed acceptance control limits.

Sandia personnel are responsible for implementing quality assurance for operations—as specified in ISO 9001, *Quality Management Systems—Requirements* (ISO 9001:2015); the Contractor Requirements Document of DOE O 414.1D, Quality Requirements (DOE O 414.1D Change 2 (LtdChg)), Attachment 1, "Contractor Requirements Document"; and 10 CFR 830, *Nuclear Safety Management* (10 CFR 830), Subpart A, "Quality Assurance Requirements"—via policy statements and processes, and by executing the actions specified in those policies and processes. Sandia management is responsible for ensuring the quality of the company's products; for assessing its operations, programs, projects, and business systems; and for identifying deficiencies and effecting continuous improvements.

12.1 Environmental Monitoring for Quality Assurance

Environmental monitoring (which includes sampling) is conducted in accordance with program-specific sampling and analysis plans, work plans, or quality assurance plans, which contain quality assurance elements. These documents meet applicable federal, state, and local requirements for conducting sampling and analysis activities. Personnel in various programs collect environmental samples and submit them for analysis of radiological and nonradiological constituents.

Project sampling and analysis plans (or equivalent) include critical elements, such as procedures for collecting samples, preserving and handling samples, controlling samples, controlling laboratory quality, setting required limits of detection, controlling field quality, ensuring health and safety, setting schedules and frequency for sampling, reviewing data, determining data acceptability, and reporting.

12.1.1 Sample Management Office

Sample Management Office personnel are responsible for quality assurance and quality control of samples once field team members relinquish the samples to the Sample Management Office. In addition, Sample Management Office personnel provide guidance and sample management support for field activities. However, program leads are responsible for each program's overall adherence to and compliance with any sampling and analysis activity performed. Sample Management Office personnel, located at SNL/NM, package, ship, and track environmental samples to off-site contract laboratories.

There are instances when SNL/KTF personnel ship samples directly to off-site laboratories, rather than to the Sample Management Office at SNL/NM. For example, Terrestrial Surveillance Program soil samples are shipped from SNL/KTF directly to an off-site laboratory.

12.1.2 Contract Laboratory Selection

All off-site commercial laboratories under contract are selected based on performance objectives, licenses and accreditations, and appraisals (pre-award assessments) as described in the *Quality Assurance Project Plan for the Sample Management Office* (SNL/NM 2019b). All laboratories must employ EPA test procedures whenever possible; when these are not available, other suitable and validated test procedures are applied. Laboratory instruments must be calibrated in accordance with established procedures, methods, and the Sample Management Office Statement of Work for Analytical Laboratories (SNL/NM 2020d). All calibrations and detection limits must be verified before analyzing samples and reporting data. Once a laboratory has passed an initial appraisal and has been awarded a contract, Sample Management Office personnel are responsible for continuously monitoring laboratory performance to ensure that the laboratory meets its contractual requirements during annual audits.

Sample Management Office contract laboratories perform work in compliance with the Sample Management Office Statement of Work for Analytical Laboratories. Contract laboratories are required to participate in applicable DOE and EPA programs for blind audit check sampling to monitor the overall accuracy of analyses routinely performed on SNL/KTF samples. These contract laboratories are required to participate in the DOE Mixed Analyte Performance Evaluation Program. Contract laboratories also participate in commercial vendor programs designed to meet the evaluation requirements given in the proficiency testing section (Chapter II) of the National Environmental Laboratory Accreditation Conference Standard (NELAC 2003).

12.1.3 Quality Control for Samples

Project-specified quality control samples are submitted to contract laboratories to meet project data quality objectives and sampling and analysis plan requirements. Various field quality control samples may be collected to assess the data's quality and final usability. Errors, some of which are unavoidable, can be introduced into the sampling process, including potential contamination of samples in the field or during transportation. In addition, sample results can be affected by the variability present at each sample location.

With each sample batch, laboratory quality control samples are prepared concurrently at defined frequencies and analyzed in accordance with established methods. Contract laboratory personnel determine the analytical accuracy, precision, contamination, and matrix effects associated with each analytical measurement.

Quality control sample results are compared either to statistically established control criteria or to prescribed acceptance control limits. Analytical results generated concurrently with quality control sample results within established limits are considered acceptable. If quality control analytical results

exceed control limits, the results are qualified and corrective action is initiated if warranted, as defined in the Sample Management Office Statement of Work for Analytical Laboratories (SNL/NM 2020d). Reanalysis is then performed for samples in the analytical batch as specified in the Statement of Work and contract laboratory procedures. Quality control sample summaries are included in analytical reports prepared by contract laboratory personnel.

12.1.4 Data Validation and Records Management

Sample collection, analysis request and chain of custody documentation, and measurement data are reviewed and validated for each sample collected. Analytical data reported by contract laboratories are reviewed to assess laboratory and field precision, accuracy, completeness, representativeness, and comparability with respect to each program's method of compliance and data quality objectives.

The data are validated at a minimum of three levels:

- The analytical laboratory validates data according to the laboratory's quality assurance plan, standard operating procedures, and client-specific requirements.
- Sample Management Office personnel review the analytical reports, corresponding sample collection, and analysis request and chain-of-custody documentation for completeness and laboratory contract compliance.
- A program lead reviews program objectives, regulatory compliance, and project-specific data quality requirements, and makes the final decision regarding the data's usability and reporting.

In addition to the three minimum validation levels, a technical assistance contractor may validate analytical data under direction of Sample Management Office personnel in accordance with applicable procedures and requirements. The purpose is to identify, through evaluation of supporting documentation, those monitoring results that do not meet the expected precision and accuracy of an analytical method. Terrestrial Surveillance Program data are validated by a technical assistance contractor providing this additional level of quality assurance.

All analytical data packages, analysis request and chain-of-custody documents, and data validation reports are submitted to a Sandia record depository for cataloging and storage in accordance with internal procedures, DOE requirements, and the document control requirements of ISO 9001, *Quality Management*, and ISO 14001, *Environmental Management Systems*.

12.2 Sample Management Office Activities in 2020

Sample Management Office activities in 2020 included sample packaging, shipping, and tracking to off-site contracted laboratories, and reviewing all data deliverables for compliance with contract and data quality requirements.

12.2.1 Sample Handling and Analyses

In 2020, no samples were collected for the Terrestrial Surveillance Program or other environmental programs or projects at SNL/KTF.

12.2.2 Laboratory Quality Assurance Assessments and Validation

Sample Management Office personnel participate in third-party independent assessments and validation of National Environmental Laboratory Accreditation Conference-approved laboratories used by SNL/NM program and project personnel. Specific checks were made for documentation completeness, proper equipment calibration, proper laboratory practices, and batch quality control data.

12.2.3 Quality Assurance Audits

The Sample Management Office participates in DOECAP, which ensures that subcontracted commercial analytical environmental laboratories are audited on their ability to provide data results that are valid, reliable, and defensible. Commercial laboratories are to use the assessment process provided by one of three approved third-party accrediting bodies unless separate arrangements are made with DOECAP. The accrediting bodies conduct assessments using the requirements of the DOD/DOE *Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (DOD/DOE 2019).

In 2020, DOECAP and/or the accrediting bodies conducted assessments at nine Sample Management Office contract laboratories using *Quality Systems Manual* requirements. The audit reports, laboratory responses, and closure letters are all posted on and tracked through the DOECAP website. Decisions regarding sample distribution to contract laboratories were based on audit information, including corrective actions, if needed.

No findings were issued in 2020 in DOECAP assessment reports or other applicable DOE programs.

Appendix A. SNL/TTR Air Monitoring Stations in 2020

Great Basin fritillary (*Speyeria egleis*)

A.1 Introduction

During 2020, DRI maintained five portable air monitoring stations near the Clean Slate sites as part of Project Post Closure Monitoring, an environmental restoration activity. The monitoring stations collect data on selected meteorological and environmental parameters (e.g., wind speed, wind 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. Detailed presentation and discussion of the air monitoring results for the Clean Slate monitoring stations is provided in an annual report, *Tonopah Test Range Air Monitoring: CY 2020 Meteorological, Radiological, and Wind Transported Particulate Observations* (Chapman et al. 2021 in progress). Station 400 is located near the SNL/TTR Range Operations Center. Stations 401 and 403 are located near Clean Slate III. Stations 404 and 405 are located near Clean Slate II (see Figure A-1). Station 402 no longer exists.

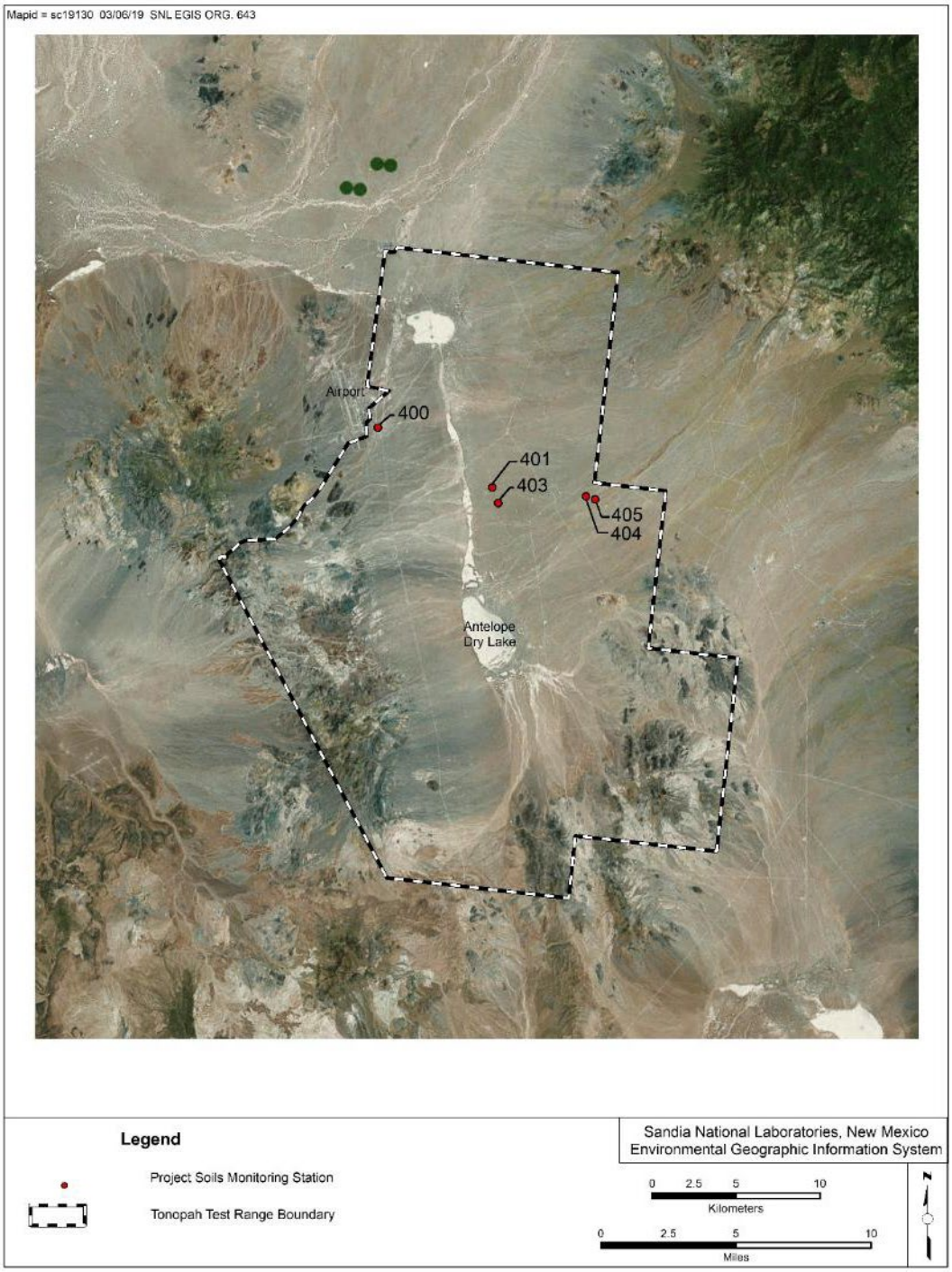

Figure A-1. Air monitoring station locations

A.2 Air Monitoring Station Capabilities and Results

The air monitoring stations are equipped with multiple environmental monitoring systems (Table A-1). All stations have an air sampler that collects airborne dust particles continuously. Filters are recovered, and new filters are deployed every two weeks. The meteorological instruments at all stations include the following sensors: an anemometer (wind speed), a wind direction vane, a tipping bucket rain gauge, a temperature and relative humidity probe, a soil moisture probe, a soil

temperature probe, and an ambient air particulate size profiler. Additional sensors are present at select stations.

Table A-1. Radiological, meteorological, and environmental sensors deployed at the SNL/TTR air monitoring stations

Instrument or Measurement	Station 400	Station 401	Station 403	Station 404	Station 405
Wind speed	✓	✓	✓	✓	✓
Wind direction	✓	✓	✓	✓	✓
Precipitation	✓	✓	✓	✓	✓
Temperature	✓	✓	✓	✓	✓
Relative humidity	✓	✓	✓	✓	✓
Solar radiation	✓	N/A	✓	✓	✓
Barometric pressure	✓	N/A	✓	✓	✓
Soil temperature	✓	✓	✓	✓	✓
Soil moisture	✓	✓	✓	✓	✓
Airborne particle size profiler	✓	✓	✓	✓	✓
Continuous airborne particle collector	✓	✓	✓	✓	✓
Saltation sensor	N/A	✓	✓	✓	✓
Gamma radiation pressurized ionization chamber	✓	✓	✓	N/A	N/A
MiniVol (manually activated low-volume air sampler)	✓	N/A	N/A	N/A	N/A

N/A = not applicable

At the remote monitoring stations (all except Station 400 at the Range Operation Center), power for the air sampler and meteorological station is provided by a solar array and a battery bank, mounted on a trailer. DRI personnel constructed this mobile version of a solar-powered air sampler based on a design currently being used by the USAF at the Nevada Test and Training Range. Internal airflow monitoring and self-adjustment capabilities allow the air sampler to maintain a near-constant flow rate as it collects samples. An internal totalizer computes the volume of air passed through the collection filter during the run time.

Data from the sensors are stored on a data logger and transmitted through a Geostationary Operational Environmental Satellite transmitter to the Western Regional Climate Center. Collectively, the data are used to evaluate the transport of soil material by saltation and suspension as related to environmental conditions, including association of high wind events with concentrations of suspended material and radionuclide concentrations.

Regular quality assurance procedures include ensuring sensor functionality, calibrating air volume passing through the air sampler monthly, and performing data quality checks on the Western Regional Climate Center database.

Descriptions of additional capabilities of the individual monitoring stations and monitoring results are presented in the following sections.

Station 400: Range Operations Center

Station 400 is a portable station with all monitoring and sampling systems mounted on a 7-foot by 14-foot trailer. The station is located approximately 100 yards south–southwest of the Range Operations Center.

Station 400: Capabilities

Station 400 includes the environmental monitoring systems and sensors described in Table A-1. This station also has a pressurized ionization chamber that undergoes regular quality checks for response to a gamma source. The atmospheric sensors also include a pyranometer (solar radiation) and a barometer. In addition to the real-time instruments and continuous air sampler, Station 400 is equipped with a MiniVol (Airmetrics, Springfield, Oregon), a manually activated low-volume air sampler that can collect air samples on quartz and Teflon filter media, which allows for different types of chemical and elemental analyses. This air sampler is intended to run in the event of a 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 configuration as currently deployed is shown in Figure A-2.

Figure A-2. Station 400, located near the Range Operations Center, includes an array of devices to measure radiological and meteorological conditions

Station 400: Air Sampling Results

Station 400 is equipped with a continuous air particulate sampler from which a 2-inch glass-fiber air filter sample is collected every two weeks. These samples are delivered to Eurofins TestAmerica Laboratories, Inc. in St. Louis, Missouri, quarterly for batch processing. Between December 18, 2019, and December 30, 2020, 25 air particulate filter samples were collected and analyzed for gross alpha and gross beta activity. The filter that was deployed from December 2 through December 16, 2020, was damaged prior to shipment to the analytical laboratory and was therefore not sent for analysis. It should also be noted that the filter that was installed on March 11, 2020, was not collected until April 9, 2020, as access to the site was restricted during that period because of COVID-19. Table A-2 and Table A-3 provide gross alpha and gross beta results for Station 400 for 2020.

In previous years, filters were also analyzed by gamma spectroscopy, but that analysis was discontinued in 2020. Gamma spectroscopy was performed to identify americium-241 as an indicator of plutonium, so the sample would be flagged for alpha spectroscopy analysis of plutonium isotopes. Evaluation of data from previous years confirmed that all detections of americium-241 by gamma spectroscopy coincided with the highest gross alpha measurement, indicating that gross alpha results are effective for identifying samples with possible plutonium. The alpha spectroscopy results are discussed in Section A.3. This process also applies to filters from Station 401, Station 403, Station 404, and Station 405.

Table A-2. Gross alpha results for monitoring stations, 2020

Station Location	Number of Samples	Concentration ($\times 10^{-15}$ µCi/mL [3.7×10^{-5} Bq/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	25	1.99	0.84	0.74	3.86
401	25	3.17	1.94	1.08	10.29
403	26	3.10	1.02	1.49	4.80
404	26	3.22	1.41	0.89	7.65
405	25	2.71	0.89	1.10	4.50

Table A-3. Gross beta results for monitoring stations, 2020

Station Location	Number of Samples	Concentration ($\times 10^{-14}$ µCi/mL [3.7×10^{-4} Bq/m^3])			
		Mean	Standard Deviation	Minimum	Maximum
400	25	2.11	0.61	1.07	3.18
401	25	2.56	1.22	1.08	7.43
403	26	3.06	1.18	1.40	6.45
404	26	2.88	1.06	1.29	5.19
405	25	2.71	1.03	1.24	4.93

Station 401: Clean Slate III

Station 401 consists of a solar-powered air sampler (sampler and solar panels) mounted on a 7-foot by 14-foot trailer and includes a portable meteorological tower. Station 401 is located on the northeastern boundary of the Clean Slate III contamination area.

Station 401: Capabilities

Station 401 includes the environmental monitoring systems and sensors described in Table A-1. This station also has a pressurized ionization chamber that undergoes regular quality checks for response to a gamma source. Station 401 includes a saltation sensor to evaluate the frequency of saltation events as a function of wind speed and wind direction measured by the meteorological equipment. The configuration of the solar-powered air sampler, saltation sensor, and portable meteorological tower prior to relocation in June 2018 (when the station was moved 1,400 feet east to distance it from an area of vehicle activity associated with remediation) is shown in Figure A-3.

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

Station 401: Air Sampling Results

Station 401 is equipped with a continuous air particulate sampler from which a 2-inch glass-fiber air filter sample is collected every two weeks. These samples are delivered to Eurofins TestAmerica Laboratories, Inc. in St. Louis, Missouri, quarterly for batch processing. Between December 18, 2019, and December 30, 2020, 25 air particulate filter samples were collected and analyzed for gross alpha and gross beta activity. The filter that was deployed from January 2 through January 15, 2020, was rendered invalid due to air sampler malfunction. It should also be noted that the filter that was installed on March 11, 2020, was not collected until April 9, 2020, as access to the site was restricted during that period due to COVID-19. Table A-2 and Table A-3 provide gross alpha and gross beta results for Station 401 for 2020.

Station 403: Clean Slate III

In April 2017, DRI established Station 403 at the south end of Clean Slate III and installed a portable meteorological tower.

Station 403: Capabilities

Station 403 includes the environmental monitoring systems and sensors described in Table A-1. This station also has a pressurized ionization chamber that undergoes regular quality checks for response to a gamma source. The atmospheric sensors also include a pyranometer and a barometer. Station 403 has a saltation sensor to evaluate the frequency of saltation events as a function of wind speed and wind direction measured by the meteorological equipment. The configuration of the solar-powered air sampler and portable meteorological tower is shown in Figure A-4.

Figure A-4. Station 403, located along the south fence that bounds the Clean Slate III contamination area, includes a solar-powered air sampler and a meteorological tower

Station 403: Air Sampling Results

Station 403 is equipped with a continuous air particulate sampler from which a 2-inch glass-fiber air filter sample is collected every two weeks. These samples are delivered to Eurofins TestAmerica Laboratories, Inc. in St. Louis, Missouri, quarterly for batch processing. Between December 18, 2019, and December 30, 2020, 26 air particulate filter samples were collected and analyzed for gross alpha and gross beta activity. It should be noted that the filter that was installed on March 11, 2020, was not collected until April 9, 2020, as access to the site was restricted during that period because of COVID-19. Table A-2 and Table A-3 contain gross alpha and gross beta results for Station 403 for 2020.

Station 404: Clean Slate II

In April 2017, DRI established Station 404 at the north end of Clean Slate II and installed a portable meteorological tower.

Station 404: Capabilities

Station 404 includes the environmental monitoring systems and sensors described in Table A-1. This station also has a pyranometer, a barometer, and a saltation sensor. The configuration of the air sampler and portable meteorological tower is shown in Figure A-5.

Figure A-5. Station 404, located along the north fence that bounds the Clean Slate II contamination area, includes a solar-powered air sampler and a meteorological tower

Station 404: Air Sampling Results

Station 404 is equipped with a continuous air particulate sampler from which a 2-inch glass-fiber air filter sample is collected every two weeks. These samples are delivered to Eurofins TestAmerica Laboratories, Inc. in St. Louis, Missouri, quarterly for batch processing. Between December 18, 2019, and December 30, 2020, 26 air particulate filter samples were collected and analyzed for gross alpha and gross beta activity. It should be noted that the filter that was installed on March 11, 2020, was not collected until April 9, 2020, as access to the site was restricted during that period because of COVID-19. Table A-2 and Table A-3 provide gross alpha and gross beta results for Station 404 for 2020.

Station 405: Clean Slate II

In April 2017, DRI established Station 405 at the southeastern edge of Clean Slate II and installed a portable meteorological tower.

Station 405: Capabilities

Station 405 includes the environmental monitoring systems and sensors described in Table A-1. This station also has a pyranometer, a barometer, and a saltation sensor. The configuration of the air sampler, saltation sensor, and portable meteorological tower is shown in Figure A-6.

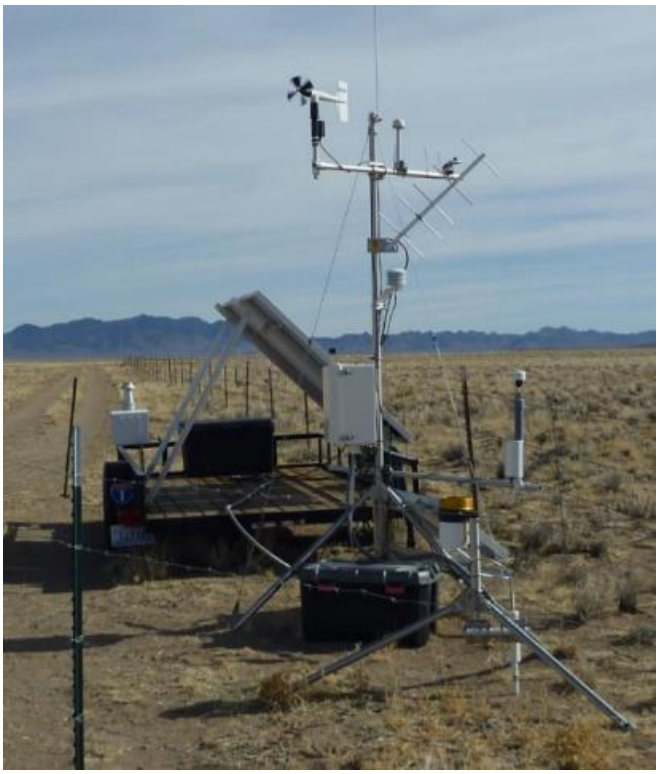

Figure A-6. Station 405, located along the eastern fence that bounds the Clean Slate II contamination area, includes a solar-powered air sampler, a meteorological tower, and a saltation sensor (left, center, and right, respectively)

Station 405: Air Sampling Results

Station 405 is equipped with a continuous air particulate sampler from which a 2-inch glass-fiber air filter sample is collected every two weeks. These samples are delivered quarterly to Eurofins TestAmerica Laboratories, Inc. in St. Louis, Missouri, for batch processing. Between December 18, 2019, and December 30, 2020, 25 air particulate filter samples were collected and analyzed for gross alpha and gross beta activity. It should be noted that the filter that was installed on March 11, 2020, was not collected until April 9, 2020, as access to the site was restricted during that period because of COVID-19. Table A-2 and Table A-3 provide gross alpha and gross beta results for Station 405 for 2020.

A.3 Alpha Spectrometry Results

Air filters collected in 2020 underwent alpha spectrometry analysis for plutonium isotopes at Eurofins TestAmerica Laboratories, Inc. Every quarter, after gross alpha spectroscopy analyses were completed, the filter with the highest gross alpha result was selected for alpha spectrometry analysis, and one to two additional filters were also selected at random for analysis.

Table A-4 and Table A-5 summarize the alpha spectrometry results for plutonium-238 and plutonium-239/240 for all stations in 2020. Neither plutonium-238 nor plutonium-239/240 were detected on any filters from Station 400. Plutonium-238 was detected on one sample from the Clean Slate II monitoring station (Station 405), and plutonium-238 was detected on one sample from the Clean Slate III station (Station 401). Plutonium-239/240 was detected on 11 samples from the Clean Slate II stations (seven from Station 404 and four from Station 405), and plutonium-239/240 was

detected on six samples collected from the Clean Slate III stations (four from Station 401 and two from Station 403).

Table A-4. Plutonium-238 alpha spectrometry results, 2020

Station Number	Number of Samples Analyzed	Number of Samples > MDC Plutonium-238	Quarter of year when Plutonium-238 Detected	Plutonium-238 Concentration ($\times 10^{-16}$ µCi/mL [3.7×10^{-6} Bq/m^3])			
				Mean	Standard Deviation	Minimum	Maximum
400	9	0	N/A	N/A	N/A	N/A	N/A
401	8	1	2	1.65	N/A	1.65	1.65
403	10	0	N/A	N/A	N/A	N/A	N/A
404	9	0	N/A	N/A	N/A	N/A	N/A
405	10	1	3	4.78	N/A	4.78	4.78

MDC = minimum detectable concentration
N/A = not applicable

Table A-5. Plutonium-239/240 alpha spectrometry results, 2020

Station Number	Number of Samples Analyzed	Number of Samples > MDC Plutonium-239/240	Quarter of year when Plutonium-239/240 Detected	Plutonium-239/240 Concentration ($\times 10^{-16}$ µCi/mL [3.7×10^{-6} Bq/m^3])			
				Mean	Standard Deviation	Minimum	Maximum
400	9	0	N/A	N/A	N/A	N/A	N/A
401	8	4	1, 2, 3	73.82	100.99	2.42	216.74
403	10	2	3	2.15	0.09	2.09	2.21
404	9	7	2, 3, 4	3.39	2.43	1.00	8.12
405	10	4	2, 3	72.44	142.07	0.85	285.55

N/A = not applicable

Air Particulate Migration

Dust transport by suspension and saltation is strongly dependent on wind speed, with dust concentrations in the air generally low at the monitored sites until the wind speed is greater than approximately 15 to 20 mph. Winds below 15 mph occurred more than 90 percent of the time at all stations, ranging from a low of 90.3 percent at Station 401 to a high of 93.2 percent at Stations 403 and 405. Sustained winds greater than 20 mph occurred with a frequency ranging from 1.6 percent at Station 403 to 3.0 percent at Station 401. Occurrence frequency of winds over 20 mph at stations 401, 404, and 405 was approximately 1.9 percent. The maximum observed sustained 10-minute winds during 2020 occurred at Station 401 where, for one 10-minute period, an average wind speed of 36.2 mph was recorded. The maximum recorded wind gust based on a three-second wind speed reading also occurred at Station 401 at 58.4 mph. Maximum wind gusts at other stations ranged from 48.5 mph at Station 405 to 57.3 mph at Station 400.

Figure A-6 shows the average respirable particulate matter (having a diameter equal to or less than 10 µ [PM_{10}]) concentrations for 5 mph wind-speed intervals at the five monitoring stations. The PM_{10} concentration observed for each wind-speed interval was similar for all the monitoring stations and increased exponentially as wind speed increased. At high wind speeds, PM_{10} concentrations are highly dependent on nearby dust sources, which can result in a significant

increase of airborne particulate matter. PM_{10} concentrations at all stations were less than approximately 12 µg/m³ for wind speeds below 15 mph. At Station 400, average PM_{10} concentration peaked at 262 µg/m³ for wind speeds greater than 30 mph. The Clean Slate III stations recorded the highest dust concentrations, with a PM_{10} concentration of 681 µg/m³ at Station 401 at wind speeds greater than 35 mph, and 639 µg/m³ for wind speeds greater than 30 mph at Station 403. The highest PM_{10} concentrations at Clean Slate II in 2020 were 333 µg/m³ for winds greater than 30 mph at Station 404 and 391 µg/m³ for winds greater than 30 mph at Station 405.

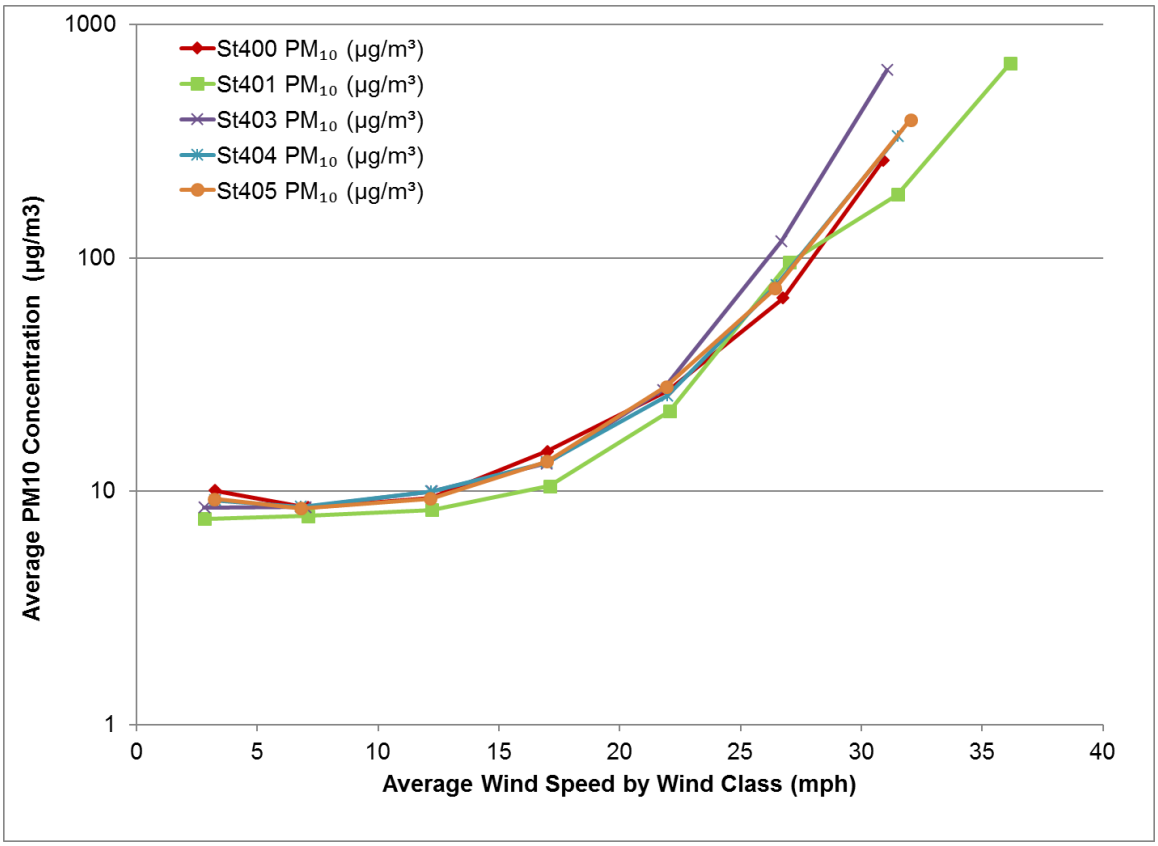

Figure A-7. Wind speed and log-normal PM_{10} trends for stations 400, 401, 403, 404, and 405 for January 1–December 31, 2020

Appendix B. SNL/TTR Terrestrial Surveillance Analytical Results in 2020

SNL/TTR blacktop

Table B-1. Environmental dosimeter measurements at SNL/TTR, 2020

Location Class	Location Number	First Quarter (111 Days)		Second Quarter (63 Days)		Third Quarter (94 Days)		Fourth Quarter (98 Days)	
		Gross Exposure (mrem)	Net Exposure (mrem)	Gross Exposure (mrem)	Net Exposure (mrem)	Gross Exposure (mrem)	Net Exposure (mrem)	Gross Exposure (mrem)	Net Exposure (mrem)
Off-Site	C-19	62	24.7	40.9	9.6	51	19.9	63.6	22.9
	C-21	66.8	29.5	48	16.7	61.4	30.2	75	34.2
	C-22	63.9	26.6	48.5	17.2	61.9	30.8	73.6	32.9
Perimeter	P-05	66.5	29.2	48.7	17.3	62.2	31.1	70.3	29.5
	P-06	67.9	30.6	47.6	16.3	63.4	32.3	74	33.2
	P-07	66.1	28.9	43.8	12.5	58.3	27.2	64.7	23.9
	P-08	63.2	25.9	48.4	17	59.7	28.6	64.4	23.7
	P-11	65.1	27.8	48.3	17	70	38.9	68.4	27.6
	P-12	66.1	28.8	50.8	19.5	62.3	31.2	77.1	36.3
On-Site	S-01	70.8	33.5	45.1	13.8	64.5	33.3	71.4	30.7
	S-02	Not available	Not available	48	16.7	63.9	32.8	72.7	32
	S-03	70.2	32.9	51.1	19.8	64.7	33.5	78.8	38.1
	S-04	65.9	28.6	50	18.7	65.9	34.8	80.7	39.9
	S-09	64.9	27.7	44.1	12.8	62.3	31.2	73.4	32.6
	S-10	72.9	35.7	49.5	18.2	61.8	30.7	72.7	32
	S-13	71.2	33.9	44.8	13.5	59.1	27.9	73.9	33.2
	S-14	63.9	26.6	44.1	12.8	58.8	27.7	69	28.2
	S-15	69.7	32.4	49.9	18.5	60.3	29.2	73.8	33.1
	S-16	66.1	28.8	46.9	15.6	62.3	31.2	71.3	30.6
	S-17	64.4	27.1	48.2	16.8	59.4	28.3	69.9	29.2

Glossary

Kaua'i, Hawai'i

A

abatement The act of reducing the degree or intensity of, or eliminating, pollution.

aboveground storage tank 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, or vegetable).

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

analyte A substance or chemical constituent undergoing analysis.

appraisal A documented activity performed according to written procedures and specified criteria to evaluate an organization's compliance and conformance with programs, standards, and other requirements contained in orders, laws, and regulations or in other requirements.

aquifer An underground geological formation, or a group of formations, containing water.

asbestos A mineral fiber that can pollute air or water and cause cancer or asbestosis when inhaled. Uses for asbestos-containing material include, but are not limited to, electrical and heat insulation, paint filler, reinforcing agents in rubber and plastics (e.g., tile mastic), and cement reinforcement.

aspect Any element of activities, products, or services that can interact with the environment.

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.

basin (1) A low-lying area, wholly or largely surrounded by higher land, which ranges from a small, nearly enclosed valley to an extensive, mountain-rimmed depression. (2) An entire area drained by a given stream and its tributaries. (3) An area in which the rock strata are inclined downward from all sides toward the center. (4) An area in which sediment accumulates.

best management practice The preferred method or practice for managing operations.

biogeographic province A large region characterized as distinct from other regions, mostly on the basis of different dominant vegetation and wildlife habitat types.

biota The animal and plant life of a given region.

biotic Relating to or resulting from living organisms.

C

contamination The introduction into water, air, or soil of microorganisms, chemicals, toxic substances, wastes, or wastewater in a concentration that makes the medium unfit for its next intended use. Also applies to the surfaces of objects, buildings, and various household and agricultural-use products.

corrective action (1) Steps taken to clean up spills resulting from the failure to follow hazardous waste management procedures or from other mistakes. The process includes designing cleanup procedures to guide hazardous waste treatment, storage, and disposal. (2) An action identified to correct a problem or prevent its recurrence.

D

data quality objective A strategic, systematic process for planning scientific data-collection efforts.

decontamination The removal of adverse substances such as noxious chemicals, harmful bacteria or other organisms, or radioactive material from exposed individuals, rooms and furnishings in buildings, or the exterior environment.

demolition The act or process of wrecking or destroying, especially destruction by explosives.

discharge Any liquid or solid that flows or is placed onto any land or into any water. This includes precipitation discharges to storm drains, accidental or intentional spilling, and leaking, pumping, pouring, emitting, emptying, or dumping any material or substance onto any land or into any water.

diurnal (1) Relating to or occurring in a 24-hour period; daily. (2) Occurring or active during the daytime rather than at night (e.g., diurnal animals).

dosimeter A device used to measure the dose of ionizing radiation.

E

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

ecosystem A network of living organisms (e.g., humans, animals, plants, and fungi) and nonliving components (e.g., air, water, mineral soil, buildings, and roads) that interact to comprise an overall environment.

effluent Wastewater (treated or untreated) that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Electronic Product Environmental Assessment Tool A set of criteria for six categories of technology products to determine the environmental attributes of particular electronic office products.

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

environmental assessment An environmental analysis prepared pursuant to NEPA to determine whether a federal action would significantly affect the environment and thus require a more detailed environmental impact statement.

environmental impact statement A document required of federal agencies by NEPA for major projects or legislative proposals that significantly affect the environment. A tool for decision-making, it describes an undertaking's positive and negative effects and cites alternative actions.

environmental management A program designed to maintain compliance with federal, state, and local requirements.

Environmental Management System A continuing cycle of planning, evaluating, implementing, and improving processes and actions undertaken to achieve environmental goals.

environmental monitoring The collection and analysis of samples or direct measurements of environmental media such as air, water, and soil.

environmental release Any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of material into the

environment, which may include (but is not limited to) soil, air, and drain systems.

Environmental Restoration A project chartered with assessing and, if necessary, remediating inactive waste sites.

environmental restoration site Any location on the environmental restoration site list that has been identified as an area that is (or may be) contaminated—either on or beneath the land surface—as a result of operations. Contaminants may be chemicals, radioactive material, or both.

environmental surveillance A program that includes soil and vegetation surveys, water sampling, and analysis in an attempt to identify and quantify long-term effects of pollutants resulting from operations.

environment, safety, and health A program designed to protect and preserve the environment and to ensure the safety and health of an organization's employees, contractors, visitors, and the public.

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

exotic species A species, which may be invasive or noninvasive, that is not native to the environment.

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.

fauna (1) Animals, especially the animals of a particular region or period, considered as a group. (2) A catalog of the animals of a specific region or period.

flora (1) Plants. (2) The plant life characterizing a specific geographic region or environment.

fungicide An agent that destroys fungi or inhibits their growth.

G

gamma radiation Very high-energy and high-frequency electromagnetic radiation that is emitted by the nuclei of radioactive substances during decay, or by the interactions of high-energy electrons with matter. They are similar to but have a shorter wavelength than X-rays.

geology The scientific study of the Earth's origin, history, and structure.

greenhouse gas emission An air pollutant comprised of an aggregate group of six greenhouse gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride measured as carbon dioxide equivalent.

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

H

habitat The place or environment where a plant or animal naturally or normally lives and grows.

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 that 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.

herbicide A chemical pesticide designed to control or destroy plants, weeds, or grasses.

I

impact Any change in the environment, whether adverse or beneficial, wholly or partially resulting from activities, products, or services.

insecticide A pesticide compound specifically used to kill or prevent the growth of insects.

Integrated Safety Management System A set of guidelines that systematically integrate safety into management and work practices at all levels so that 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

maximally exposed individual A member of the public who is located in an area that receives or has the potential to receive the maximum radiological dose from air emissions of a NESHAP radionuclide source. The dose estimates are based on realistic, yet conservative, input parameters.

migratory birds All birds listed within the Migratory Bird Treaty Act, 50 CFR 10.13, or which are a mutation or hybrid of any such species, including any part, nest, or egg.

Mixed Analyte Performance Evaluation Program A DOE quality assurance tool for environmental analytical services. It includes radiological, stable inorganic, and organic constituents (i.e., mixed analytes) in the same single-blind sample for analytical performance evaluation. The samples use various matrices, including soils, water, vegetation, and air filters. Program samples are not a mixed waste.

mixed waste Waste that contains both hazardous waste (as defined by RCRA and its amendments) and radioactive waste (as defined by the Atomic Energy Act and its amendments).

moku A land division that sections off portions of a Hawai'ian island.

N

National Emission Standards for Hazardous Air Pollutants Emission standards set by EPA for air pollutants not covered by National Ambient Air Quality Standards that may cause an increase in fatalities or in serious, irreversible, or incapacitating illness. Primary standards are designed to protect human health; secondary standards are designed to protect public welfare (e.g., building facades, visibility, crops, and domestic animals).

National Environmental Policy Act The basic national charter for protecting the environment. It establishes policy, sets goals, and provides the means for carrying out the act.

National Pollutant Discharge Elimination System A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by EPA, a state, a tribal government, or a territorial government.

natural resource A resource (actual or potential) supplied by nature.

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 illnesses 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.

nitrite (1) An intermediate in the process of nitrification. (2) Nitrous oxide salts used in food preservation.

O

occurrence Events or conditions that adversely affect, or may adversely affect, DOE (including the National Nuclear Security Administration) or contractor personnel, the public, property, the environment, or the DOE mission.

optically stimulated luminescent dosimeter A device used to measure ionizing radiation.

outfall The place where effluent is discharged into receiving waters.

P

PM_{10} Particulate matter that has a diameter equal to or less than 10 microns.

pollutant Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

polychlorinated biphenyl A family of highly toxic organic chlorine compounds. Because of their persistence, toxicity, and ecological damage via water pollution, the manufacture of PCBs was discontinued in the United States in 1976.

potable water Water free from impurities present in quantities that are sufficient to cause disease or harmful physiological effects.

Q

quality assurance A system of procedures, checks, audits, and corrective actions to ensure that research design and performance, environmental monitoring and sampling, and other technical and reporting activities are of the highest achievable quality.

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.

radiological contaminant A radioactive material deposited in any place where it is not desired, particularly where its presence may be harmful.

radionuclide A radioactive particle, man-made or natural, with a distinct atomic weight number.

radon A colorless, naturally occurring, radioactive, inert gas formed by the radioactive decay of radium atoms in soil or rocks.

reportable quantity A quantity of material, product compound, or contaminant that is reportable to a regulatory agency when released to the environment.

rodenticide A chemical or agent used to destroy rats or other rodent pests, or to prevent them from damaging food or crops.

ruderal Plant species that are first to colonize a disturbed area.

S

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

Sample Management Office A Sandia office where personnel manage environmental analytical laboratory contracts and assist with processing and tracking samples undergoing chemical and radiochemical analyses performed at these laboratories.

sampling and analysis plan A plan that contains criteria required for conducting sampling activities.

sediment Transported and deposited particles or aggregates derived from rocks, soil, or biological material.

soil All loose, unconsolidated mineral or organic materials on the immediate surface of the earth that support plant growth.

solid waste (1) Any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility. (2) Any discarded material—including solid, liquid, semisolid, or contained gaseous material—resulting from industrial, commercial, mining, or agricultural operations or from community activities.

stormwater Water runoff from rainfall or snowmelt, including that discharged to the sanitary sewer system.

surface water Water that has not penetrated much below the surface of the ground.

sustainability Those actions taken to maximize energy and water efficiency; minimize chemical toxicity and harmful environmental releases, particularly greenhouse gas; promote renewable and other clean energy development; and conserve natural resources while sustaining assigned mission activities.

T

threatened or endangered species A species present in such small numbers that it is at risk of extinction.

topography The physical features of a surface area, including relative elevations and the position of natural and man-made features.

toxic chemical Any chemical listed in EPA regulations under "Emergency Planning and Community Right-to-Know Act of 1986–Section 313: Guidance for Reporting Toxic Chemicals."

transect A sample area (i.e., vegetation) usually in the form of a long, continuous strip.

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 A storage tank installed completely below the ground surface, covered with earth, and used to contain oil of any kind (petroleum, non-petroleum, synthetic, animal, or vegetable).

U.S. Environmental Protection Agency A government agency tasked with protecting human health and the environment.

V

vegetation Plant life or the total plant cover of an area.

volatile organic compound An organic chemical compound with a high vapor causing it to evaporate.

W

waste management A method for dealing with the waste from humans and organisms, including minimizing, handling, processing, storing, recycling, transporting, and final disposal.

wastewater The spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter.

water pollution The presence in water of enough harmful or objectionable material to damage the water's quality.

watershed A region or area bounded peripherally by a divide and draining ultimately to a particular watercourse or body of water.

wetland An area that is saturated by surface water or groundwater, having vegetation adapted for life under those soil conditions, such as swamps, bogs, fens, marshes, and estuaries.

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