SANDIA NATIONAL LABORATORIES

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2022

ANNUAL SITE ENVIRONMENTAL REPORT

TONOPAH NEVADA

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United States Department of Energy, National Nuclear Security Administration,
Sandia Field Office, Albuquerque, New Mexico

2022 Annual Site Environmental Report for Sandia National Laboratories, Tonopah Test Range, Nevada

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for
U.S. Department of Energy
National Nuclear Security Administration
Sandia Field Office

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. Activities at the site are conducted in support of U.S. Department of Energy weapons programs and have operated at the site since 1957.

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 Sandia National Laboratories, Tonopah Test Range during calendar year 2022. Environmental topics include cultural resource management, chemical management, air quality, ecology, environmental restoration, oil storage, site sustainability, terrestrial surveillance, waste management, water quality, wastewater discharge, 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, 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, Annual Site Environmental Report can be found at the following website:
http://www.sandia.gov/news/publications/environmental/index.html

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Acronyms and Abbreviations

Term	Definition
A	
AD	anno Domini
B	
BCE	before the common era
C	
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
D	
DoD	United States Department of Defense
DOE	United States Department of Energy
DOECAP	DOE Consolidated Audit Program
DRI	Desert Research Institute
DU	duplicate sample
E	
EEEJ	energy equity and environmental justice
EISA	Energy Independence and Security Act
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community-Right-to-Know Act
ES&H	Environment, Safety, and Health
F	
FDID	Fire Department Identification
I	
IOC	inorganic compound
ISO	International Organization for Standardization
M	
MDA	minimal detectable activity or minimum measured activity
MDL	method detection limit
N	
NA	not available
N/A	not applicable
NAC	Nevada Administrative Code
ND	not detected
NDEP	Nevada Division of Environmental Protection
NEPA	National Environmental Policy Act
NTESS	National Technology & Engineering Solutions of Sandia, LLC
P	
PCB	polychlorinated biphenyl
pH	potential of hydrogen
PL	Public Law
PQL	practical quantitation limit
R	
RCRA	Resource Conservation and Recovery Act
S	
SA	sample
Sandia	Sandia National Laboratories
SARA Title III	Superfund Amendments and Reauthorization Act
SNL/NM	Sandia National Laboratories, New Mexico
SNL/TTR	Sandia National Laboratories, Tonopah Test Range
SOC	synthetic organic compound
sp.	unknown species, singular
spp.	unknown species, plural
ssp.	subspecies
SU	standard unit
U	
U.S.	United States
USFWS	U.S. Fish and Wildlife Service
V	
var.	variety
VOC	volatile organic compound

Units of Measure

Unit	Definition
Btu	British thermal unit
°F	degrees Fahrenheit
ft	foot
kg	kilogram
µ	micron
µg/L	micrograms per liter
µCi/mL	microcuries per milliliter
µg/m^3	micrograms per cubic meter

Unit	Definition
µm	micrometer (micron)
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mrem	millirem
mrem/year	millirems per year
pCi/g	picocuries per gram
ppb	parts per billion

Data Qualifiers

Laboratory Data Qualifier

Term	Definition
*	A replicate was outside limits.
J	An estimated value, the analyte concentration was above the effective MDL and below the effective practical quantitative limit (PQL).
N	A spike was outside limits.
U	The analyte was absent or below the method detection limit.
X	The data was rejected due to the peak not meeting identification criteria.

Data Validation Qualifier

Term	Definition
BD	The associated value was below the detection limit as used in radiochemistry to identify results that are not statistically different from zero.
J	The associated numerical value was an estimated quantity.
J+	The associated numerical value is an estimated quantity with a suspected positive base.
J-	The associated numerical value was an estimated quantity with a suspected negative base.
None	There was no data validation assigned.
R	The data are unusable and rejected (compound may or may not be present).
U	The analyte was analyzed for but was not detected. The associated numerical value was the sample quantitation limit.
UJ	The analyte was analyzed for but was not detected. The associated value was an estimate and might be inaccurate or imprecise.

Executive Summary

Tonopah Test Range Area 3 Compound

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) during calendar year 2022.

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, Sandia's Environmental Management System is ISO 14001:2015 certified. SNL/TTR personnel follow the system's requirements, as verified by an internal assessment in 2020. This Environmental Management System is Sandia's primary platform for implementing the environmental management programs that help achieve annual site sustainability goals. For fiscal year 2022, hazardous materials, hazardous waste, radiological waste, release of explosives and combustion byproducts, and release of radionuclides were identified as significant aspects for SNL/TTR operations.

Site Sustainability

A site sustainability plan for all Sandia primary locations, including SNL/TTR, is prepared annually and identifies contributions toward meeting DOE sustainability goals and the broader sustainability program set forth in EO 14008, *Tackling the Climate Crisis at Home and Abroad*. Sandia's most recent plan, *Fiscal Year 2023 Site Sustainability Plan* (Sandia, 2022b), describes the performance status for fiscal year 2022. Highlights for SNL/TTR in 2022 include decreasing the year-over-year Scope 1 and Scope 2 greenhouse gas emissions relative to fiscal year 2021, completing a vulnerability assessment and resilience plan, decreasing potable water intensity by 44.2 percent relative to fiscal year 2021, and exceeding the goal for consumption of clean and renewable electric energy. Improvements to the ecomedes tool promoted sustainable acquisition and improvements to MAN-004, *Sandia National Laboratories/New Mexico Design Standards Manual*, and promoted compliance with the *Guiding Principles for Sustainable Buildings*. In fiscal year 2022, energy intensity increased by 4.9 percent relative to fiscal year 2021 at SNL/TTR.

Environmental Performance

DOE assesses environmental performance through measures and indicators and then reports on this as part of an overall performance evaluation. During the most recent evaluation for all Sandia locations, Sandia earned an overall rating of very good. There was one DOE-reportable occurrence reported at SNL/TTR in 2022.

All environmental monitoring in 2022 was 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.

Environmental Programs at 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. DOE is responsible for all SNL/TTR and Nevada Test and Training Range environmental restoration sites.

Air Quality Compliance Program. Program personnel support compliance with air quality regulations. Sandia has an air quality permit at SNL/TTR, and emissions from permitted sources complied with permitted limits in 2022. During 2022, emissions from permitted sources were 0.003 tons of hazardous air pollutants, 0.15 tons of volatile organic compounds, 0.59 tons of carbon monoxide, 0.98 tons of nitrogen oxide, 0.062 tons of particulate matter with a diameter ≤ 10 μm., and 0.00098 tons of sulfur dioxide. The permitted sources include a portable soil sorting system, facility maintenance shops, and generators.

Chemical Information System. In 2022, chemical containers at SNL/TTR were tracked along with information about any related chemical hazards.

Cultural Resource Management Program. Cultural Resource Management Program personnel review and document potential impacts on archaeological sites and historic properties. Archaeological staff reviewed five outdoor projects at SNL/TTR in 2022; no immediate archaeological concerns were found for any of the reviewed projects.

In 2022, DOE and Sandia hosted representatives of the Nevada State Historic Preservation Division at SNL/TTR to review and discuss archaeological and historic building questions regarding a

Programmatic Agreement. DOE and the Nevada State Historic Preservation Officer also completed a memorandum of agreement outlining mitigative actions for the demolition of Tower 02-00, which was part of the SNL/TTR historic district. The required action to have the photos and drawings of Tower 02-00 reviewed prior to demolition was completed. DOE and Sandia personnel will proceed with developing a programmatic agreement in 2023.

Ecology Program. Ecology Program personnel conduct project assessments to ensure 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. In 2022, Ecology Program personnel updated the avian survey protocol to better align with the North American Breeding Bird Survey and conducted a site visit to SNL/TTR. The avian surveys were conducted in June 2022. One hundred and nineteen birds from 13 species were recorded along the newly established survey routes. Horned larks (*Eremophila alpestris*) were the most recorded species during surveys. The second-most encountered species was the black throated sparrow (*Amphispiza bilineata*).

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. Corrective Action Sites at SNL/TTR is 70 sites. A listing of Corrective Action Units/Corrective Action Sites is available in Federal Facility Agreement and Consent Order. Active remediation is complete for all SNL/TTR Corrective Action Sites.

Operation Roller Coaster was conducted in May and June 1963 and subjected a series of four nuclear devices to chemical explosions, which resulted in plutonium dispersal in surrounding soils. The three Operation Roller Coaster test sites at SNL/TTR are referred to as Clean Slate I, Clean Slate II, and Clean Slate III. Post-closure monitoring at Tonopah Test Range Clean Slate I took place May 2011 through April 2017. The rest of the post-closure monitoring program was completed at the end of 2021, and the remaining equipment was removed in early 2022.

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 at SNL/TTR. In 2022, program personnel reviewed six proposed projects and submitted two Request for Environmental Analysis (AF Form 813) forms on behalf of the Sandia Field Office. Additionally, National Environmental Policy Act Program personnel prepared an environmental baseline survey to support a property transfer at SNL/TTR and partnered with SNL/TTR personnel and the Sandia Field Office to plan three coordination meetings with U.S. Air Force Nevada Test and Training Range personnel. This coordination resulted in improved alignment of environmental support activities and appropriate dual-agency oversight over the site's Coordinated Use Area.

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 in 2022.

Radionuclide National Emission Standards for Hazardous Air Pollutants. In September 2020, transfer of SNL/TTR environmental restoration sites from DOE Office of Environmental Management to DOE Office of Legacy Management stewardship was completed. The Office of Legacy Management assumed responsibility for the long-term surveillance and maintenance of these sites on September 30, 2020. In addition, as of calendar year 2021, the Desert Research Institute no longer collects data at SNL/TTR. Equipment was removed from the sites in early calendar year 2022 and the Desert Research Institute final data report was to be provided to the Office of Legacy Management in 2022.

Terrestrial Surveillance Program. Program personnel conduct surveillance activities at on-site, off-site, and perimeter locations; soil samples are collected for modified Target Analyte List metals and gamma-emitting radionuclides. The statistical analysis methodology performed on sample results was revised in 2022. When the sample results at an on-site location are significantly different from and greater than the community and perimeter results and the sample results at the on-site location are trending upward, it is noted for further evaluation.

Statistical analyses of the 2022 results for the selected radionuclides revealed no statistically significant population differences nor any increasing trends in the onsite location sample results. The results of the statistical analysis for metals identified one instance of statistical significance (population difference and increasing trend) for beryllium at on-site location S-10. The result is below the U.S. Environmental Protection Agency regional screening level for residential use and is within Nevada soil concentrations for beryllium.

Environmental dosimeters were used to measure the dose from ambient gamma radiation. The average annual dose rates are higher than the established non-urban Nevada value of 71 mrem/year. The difference may be attributed to a variety of elevations, proximity to bedrock, and the spontaneous nature of radioactivity.

Waste Management Program. Waste generated during 2022 at SNL/TTR included hazardous waste; other regulated waste; recycled materials; asbestos waste; and polychlorinated biphenyl waste. In 2022, the following amounts of waste were generated: regulated waste not regulated by the Resource Conservation and Recovery Act (643 kg), recycled materials (319,973 kg), hazardous waste regulated by the Resource Conservation and Recovery Act (91 kg), asbestos waste (1,836 kg), and polychlorinated biphenyl waste (32 kg). Site personnel shipped hazardous waste and other regulated waste off-site to permitted facilities. Waste shipped in 2022 included 67,668 kg of construction debris sent to the U.S. Air Force Construction Landfill, 12,773 kg of sanitary landfill waste sent to the U.S. Air Force Sanitary Landfill, and 14,282 kg of tires sent to Lunas Tire Recycling.

Recyclables and used oil are sent for recycling or are disposed of through a waste disposal contractor. In total, 319,973 kg of material was recycled or energy-recovered and shipped off-site in 2022. There were no radioactive waste shipments in 2022.

Water Quality Programs. The Water Quality Program includes drinking water, release reporting, septic tank systems, stormwater, wastewater, and water conservation. In 2022, no releases to the environment occurred that required reporting to the Nevada Department of Environmental Protection or any outside agency.

Site personnel routinely sample the public water system and analyze it to demonstrate conformance with primary drinking water standards. There were no exceedances of water quality standards in 2022. Four arsenic compliance samples were collected from the Area 3 distribution system for analysis in 2022. The maximum contaminant level for arsenic in drinking water is 10 ppb as a running annual average. The running annual average for arsenic in the drinking water at SNL/TTR during the fourth quarter of 2022 was 4.55 ppb. There were two precautionary Boil Water Notices issued for the SNL/TTR public water system in 2022.

In October 2021, the Nevada Division of Environmental Protection conducted a sanitary survey of the SNL/TTR public water system. On December 30, 2021, one significant deficiency related to corrosion on piping in the well pumphouse and five other deficiencies related to administrative or system design considerations were noted. In 2022, Sandia personnel actively worked with engineers as per the proposed path forward that the DOE National Nuclear Security Administration Sandia Field Office sent to the Nevada Division of Environmental Protection.

Sandia currently controls two septic tanks; the septic tank at Station 24 has been out of service for several years, and the septic tank located at 09-52 was never placed in service. On October 6, 2022, Nevada Division of Environmental Protection Bureau of Water Pollution Control personnel inspected the 09-52 septic tank and verified that it was in an inactive state. This tank was deemed "not in use," and has not been used since it was installed and permitted in January 2006.

The State of Nevada has determined that there are no industrial activities at SNL/TTR that require stormwater permitting. New construction activities that exceed one acre of soil disturbance and lie outside the boundaries of the closed basin require permitting under the construction general permit. During 2022, no construction projects required Construction General Permit coverage at SNL/TTR.

As a best management practice, Sandia personnel sample Area 3 wastewater annually at the point where wastewater leaves SNL/TTR property and enters the U.S. Air Force system. Twenty-four-hour composite wastewater samples are collected annually; during 2022, there were no excursions or violations of concentration limits.

The current SNL/TTR water conservation plan was revised in November 2020 and was approved by the State of Nevada Department of Conservation and Natural Resources, Division of Water Resources on February 17, 2021. The SNL/TTR water conservation plan provides education, conservation measures, and supply management guidance. The next plan revision is due by February 17, 2026.

Notch-leaf scorpionweed (*crenulata*)

Chapter 1. Introduction to Tonopah Test Range

Historic missile launch at 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 U.S. Department of Energy weapons programs. 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* (DOE O 231.1B, Admin Change 1 2012). This report is made available to the public in electronic form at Sandia Environmental Reports (Sandia n.d.).

Sandia National Laboratories, hereinafter referred to as Sandia—with the exception of when using an acronym to represent the facility location, Sandia National Laboratories, Tonopah Test Range (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.

While most 2022 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

Operating since 1949, Sandia's core purpose is to render exceptional service in the national interest. As a Federally Funded Research and Development Center, Sandia operates in the public interest with

objectivity and independence, free from organizational conflicts of interest, and by maintaining core competencies in missions of national significance. Our principal mission is to deliver on commitments to the nuclear deterrent, nuclear nonproliferation, and critical work for the national security community. Sandia personnel anticipate and resolve emerging national security challenges and inform the national debate for which technology policy is critical to preserving security and freedom throughout the world. Information about new technologies and accomplishments can be found at Sandia News (Sandia n.d.).

1.2 History

A brief history of Sandia and of operations at SNL/TTR follows. For more details, see Chapter 2.

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.

The Sandia workforce (for all sites) comprised approximately 15,530 employees and contractors in 2022, with 35 employees located at SNL/TTR (Sandia n.d.).

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.

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 (Sandia 1996). In 1956, a land use permit was obtained from the U.S. Air Force. In 1957, Tonopah Test Range was established for the U.S. Atomic Energy Commission (now DOE) and became operational for testing weapon systems. See Chapter 2 for more details regarding the history and establishment of SNL/TTR.

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 regarding aircraft-delivered inert test vehicles. As technologies changed, the facilities and capabilities at SNL/TTR were expanded to accommodate tests related to DOE weapons programs.

The National Nuclear Security Administration signed a land use permit in 2019 titled "Department of the Air Force Permit to National Nuclear Security Administration for Real Property Located on the Nevada Test and Training Range, Nevada" (U.S. Air Force/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.

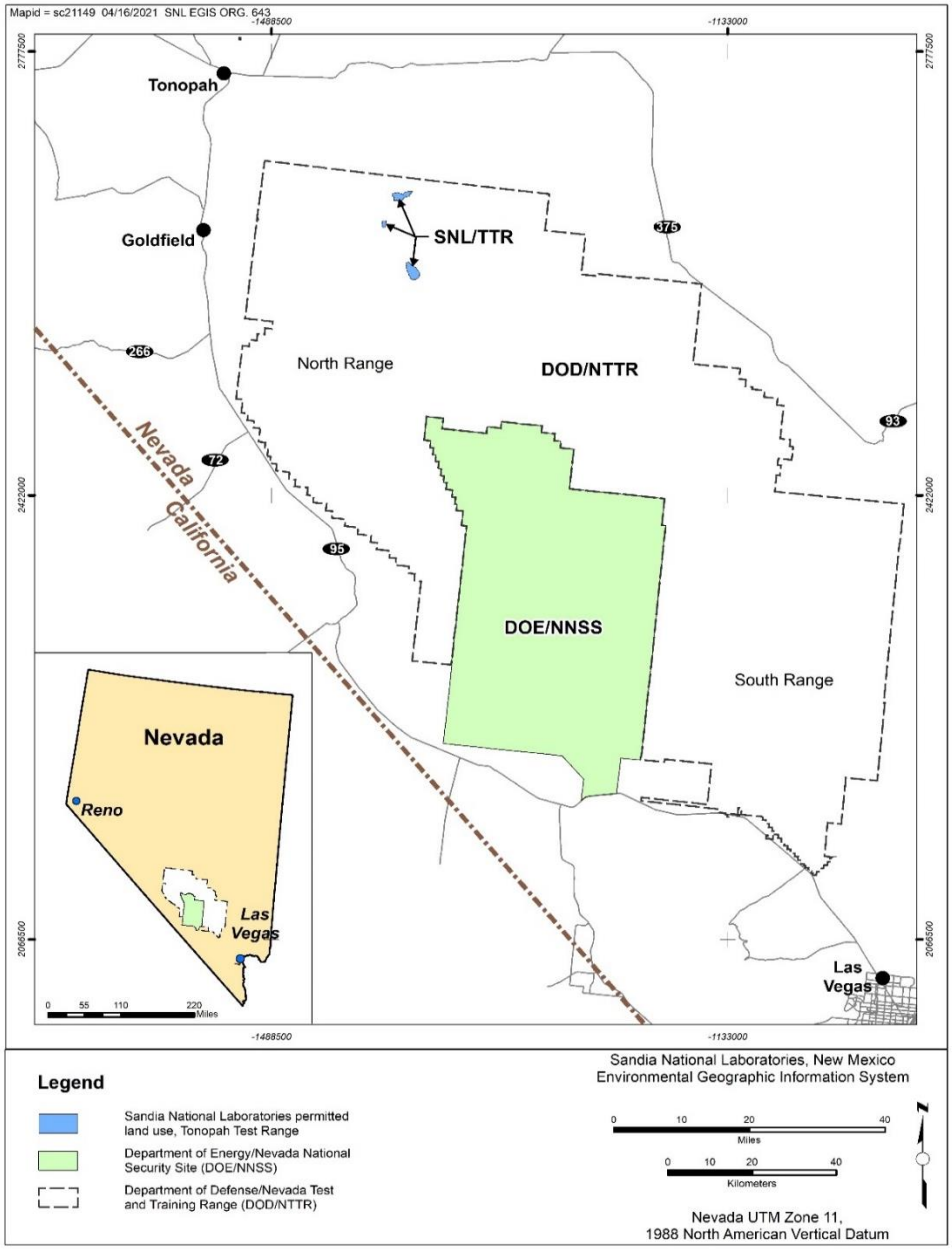

Figure 1-1. SNL/TTR location within the boundaries of the Nevada Test and Training Range

1.3 Location Description

SNL/TTR is located on withdrawn land (withheld from the public domain) that is permitted from the U.S. Air Force within the boundaries of the Nevada Test and Training Range (Figure 1-1). Sandia personnel use the land to support DOE and U.S. Air Force 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 225, and Tonopah, Nevada, population 2,179 (U.S. Census Bureau 2012). Goldfield and Tonopah are approximately 22 miles west and 32 miles northwest of the site boundary, respectively. Las Vegas, with an estimated population of 656,274 (U.S. Census Bureau n.d.), is the largest municipality in Nevada by population and is approximately 140 miles southeast of the site boundary.

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.

On behalf of the management and operating contractor for Sandia, Navarro Research and Engineering personnel perform or support most environmental program functions and facility operation and maintenance at SNL/TTR, including 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. 2021 in progress). This operation resulted in radionuclide-contaminated soils (see Section 3.4).

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. Upon completion of environmental restoration activities in 2020, long term stewardship of the restoration sites was transferred to DOE Office of Legacy Management. For more information on the sites closed under the Environmental Restoration Project, see Section 3.4.

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 and Hydrology

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 (Sandia 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 (U.S. Energy Research and Development Administration Environmental Assessment, Tonopah Test Range).

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

Surface Water

Neither the Cactus Range nor the Kawich Range of mountains have perennial streams that flow into SNL/TTR. Ephemeral streams (flowing only briefly in the immediate locality in response to precipitation) do occasionally carry spring runoff and thunderstorm runoff to a north-south string of playas in the central portion of Cactus Flat. Surface runoff within Cactus Flat evaporates from the playas within SNL/TTR (Desert Research Institute, Science Applications International Corporation 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.

Groundwater

SNL/TTR personnel obtain water from local wells. U.S. Geological Survey personnel periodically check groundwater levels of Tonopah Test Range wells and have recorded groundwater depths from 21 to 481 feet below ground surface at the site. Approximate groundwater levels have been recorded as follows:

- Production Well 6 in Area 3 has a water depth of 347 feet below ground surface. It supplies the public water system (drinking water and Area 3 fire protection) and, at one time, supplied water for road maintenance, construction, and dust control.

- Roller Coaster Well at the Construction Water Pond has a water level depth of 481 feet below the surface and is used for road maintenance, construction, and dust control.
- Area 9 Well (Well Sandia 7) near the northern end of the site has water at 129 feet below ground surface. It was formerly used to provide non-potable water to the building 9A restroom, road maintenance, construction, and dust control. This well hasn't been used for many years but is being maintained and can be put into service if needed.

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.

1.6.2 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.*) at higher 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.

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.

Climate is a description of an area's average weather conditions and the extent to which those conditions vary over long time intervals, generally decades or centuries.

1.6.3 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 to 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.

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 (Western Regional Climate Center 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.

1.7 Overview of the Environmental Management System

Sandia integrates environmental protection with its missions through the Environmental Management System. The Environmental Management System is a set of interrelated elements used to establish policy and environmental objectives that enable Sandia personnel to reduce environmental impacts and increase operating efficiency through a continuing cycle of planning, implementing, evaluating, and improving processes. The scope of Sandia's Environmental Management System encompasses all activities, products, and services that have the potential to interact with the environment at all of Sandia's numerous locations.

Sandia has established environmental programs at SNL/TTR (listed in the next section) that are instrumental in the implementation, maintenance, and continual improvement of the Environmental Management System at this site. For more information on the Environmental Management System, see Section 5.3.

1.8 Environmental Programs and Focus Areas

The following chapters and sections detail the current environmental programs and focus areas at SNL/TTR as follows:

- Cultural Resource Management Program (Chapter 2)
- National Environmental Policy Act (NEPA) Program (Section 3.1)
- Chemical Information System (Section 3.2)
- Waste Management Program (Section 3.3)
- Environmental Restoration Project (Section 3.4)
- Air Quality Compliance Program (Section 3.5)
- Oil Storage Program (Section 3.6)
- Terrestrial Surveillance Program (Section 3.7)
- Water Quality Programs (Section 3.8)
- Ecology Program (Chapter 4)

In addition, a summary of compliance efforts is provided in Chapter 5, and Chapter 6 details how quality assurance is implemented for environmental monitoring and sampling.

Bighorn sheep (*Ovis canadensis*)

Chapter 2. Cultural Resource Management Program

Building 03-57 Control Tower, contributing element to the SNL/TTR historic district
(Photo taken on August 12, 2004, by Joseph M. Bonaguidi)

OVERVIEW ■ Cultural Resource Management Program personnel coordinate cultural resource compliance, including review of archaeological resources and historic buildings. Actions that could affect cultural resources adversely 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 focused primarily on long-term preservation and protection of cultural resources and cultural resource compliance to ensure that the heritage of Sandia operating areas and their landscapes 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. 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. The Cultural Resource Management Program is focused on two main cultural resource categories: archaeological resources and historic buildings.

Between 1979 and 2022, 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) at SNL/TTR are recorded, and 12 have been recommended as eligible for inclusion in the National Register of Historic Places.

In 2003 and 2005, the Sandia historian conducted surveys of buildings and structures proposed for demolition at SNL/TTR. DOE determined that none of the properties were eligible for inclusion in the National Register of Historic Places in consultation with the Nevada State Historic Preservation Officer. In 2005, a survey and assessment of the built environment at the entire site resulted in DOE's determination that 60 properties were contributing elements to the SNL Tonopah Test Range Historic District. The Nevada State Historic Preservation Officer concurred with the findings in 2011. Fifty-seven of those buildings and structures are extant and contributing to the Historic District, based on DOE consultation with the Nevada State Historic Preservation Officer.

2.1 Cultural 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 (circa AD 1600). This time range is divided into six periods: Lake Mohave Period (10,050–5050 BCE), Pinto Period (5550–2050 BCE), Gypsum Period (2050 BCE–AD 400), Saratoga Springs Period (AD 400–1150), Late Prehistoric Period (AD 1150–1600), and Protohistoric Period (AD 1600–circa 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 Paleoindian 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 Paleoindian 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 Paleoindian Period is characterized by several distinct traditions of fluted projectile points, including Clovis, Folsom, Agate Basin, and Hell Gap arrowheads (Jennings, Anthropological Papers No. 104 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).

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.

Chert biface (Photo taken in 2018 from site 26NY16226)

2.2 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-by-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 weapons 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 targets for testing and could accommodate both low-altitude and high-altitude approaches. The U.S. Air Force 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 of the northernmost lakebed. 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 (Sandia 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 poured in the target impact area on the northern 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.

2.3 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 State Historic Preservation Officer. See Chapter 5 for details on state and federal requirements related to cultural resources.

2.4 Archaeological Resources

Sandia's archaeological staff assists Sandia personnel and DOE in maintaining compliance with the 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 archaeological staff review NEPA checklists that involve land disturbances and provides recommendations for monitoring field activities so archaeological resources are not inadvertently impacted. The archaeological staff also makes site eligibility recommendations for inclusion in the National Register of Historic Places which is provided to DOE for consultations.

2.4.1 Field Methods

Archaeological staff conduct pedestrian surveys (walking the natural landscape on foot) and record prehistoric and historic sites in accordance with Bureau of Land Management guidelines (Bureau of Land Management 2004) as required by the Nevada State Historic Preservation Officer. In addition, the archaeological staff 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. The archaeological staff prepares consultation letters and associated forms that are then submitted to DOE to use in correspondence with the Nevada State Historic Preservation Officer.

A *transect* is a sample area usually in the form a long, continuous strip.

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 archaeological staff 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 is 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 archaeological staff writes all reports of findings and associated documentation.

2.4.2 Program Activities and Results 2022: Archaeological Resources

In 2022, the archaeological staff reviewed five outdoor projects at SNL/TTR. Three of the reviewed projects included ongoing operational activities and the remaining two activities were associated with a conceptual analysis. No immediate archaeological concerns were found for any of the reviewed projects.

2.5 Historic Buildings

The Sandia historian surveys and assesses historic buildings in support of the National Historic Preservation Act, Section 106, for all properties owned by DOE and used by Sandia personnel at SNL/TTR. This includes all elements of the built environment from the Historic Period but is primarily focused on properties built for and used by Sandia since 1956.

2.5.1 Methods

Sandia's 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 2.5.2), which provides the framework for evaluating a property for historic significance (Sandia 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 property or properties, 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 on 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 and a consultation letter are submitted to DOE to support correspondence with the Nevada State Historic Preservation Officer. The historian's recommendation is also captured in the NEPA checklist subject matter expert review.

2.5.2 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 (Sandia 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 (Sandia 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 (Sandia 2005a, Sandia 2005b, Sandia 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.

In 2011, DOE completed consultation with the Nevada State Historic Preservation Office, reaching an agreement regarding the SNL/TTR historic district. The district included 60 structures and represents the key functions included in testing at the site during the Cold War (Table 2-1). 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 and 2018, 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. Agreement was not reached, and the document is considered defunct.

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 2-1. Contributing elements to the SNL/TTR historic district

Historic Resource	Function	Construction	Location
02-00	Askania camera tower	1956	Station 2 (no longer a contributing element due to planned demolition)
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 (no longer a contributing element due to renovations)
03-54	Machine shop	1960	Station 3
03-55	Photo optics building	1965	Station 3
03-56	Telescope repair and offices	1965	Station 3 (no longer a contributing element due to renovations)
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	circa 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

Historic Resource	Function	Construction	Location
09-59	Explosive bunker	1960	Station 9
09-60	Gun control bunker	1971	Station 9
09-63	Special storage facility (bunker)	1986	Station 9
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 laboratory 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

N/A = not applicable

2.5.3 Program Activities and Results 2022: Historic Buildings

In 2019, SNL/TTR personnel proposed the demolition of Tower 02-00, which is no longer in use and is blocking line of sight for other projects. The historian provided DOE with updated Nevada Architectural Resource Assessment forms for the proposed demolition. In 2022, DOE completed consultation with the Nevada State Historic Preservation Office regarding the memorandum of agreement for the demolition of Tower 02-00. In addition, the first requirement within the memorandum of agreement was completed when the Nevada State Historic Preservation Officer approved the photographs documenting Tower 02-00. In 2023, the historian will finalize a Historic American Building Survey/Historic American Engineering Record report documenting the history and architectural features of the property.

In 2022, Sandia and DOE personnel hosted representatives from the Nevada State Historic Preservation Office at SNL/TTR. In addition to touring the site, staff discussed several cultural resources issues, including the development of a Programmatic Agreement to manage both elements of the SNL/TTR historic district and properties on which DOE has previously not consulted. DOE and Sandia will proceed with developing a programmatic agreement in 2023.

Chapter 3. Environmental Programs

Old car in Nevada field

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 to determine and report the impact of existing operations on the environment. Environmental program activities comply with 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 are presented in Figure 3-1.

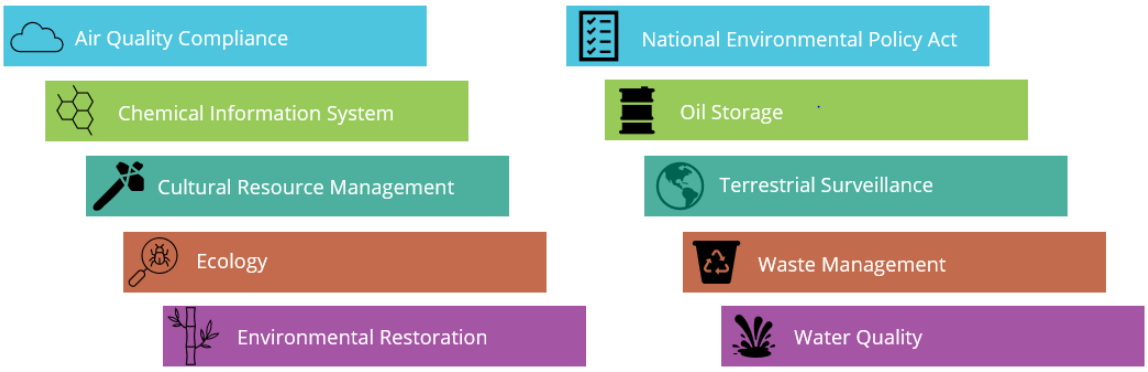

Figure 3-1. Environmental programs at SNL/TTR

3.1 National Environmental Policy Act Program

NEPA Program personnel provide technical assistance to ensure that Sandia operations and activities are reviewed for NEPA compliance at all Sandia sites, including SNL/NM; SNL/TTR; Sandia

California; the Kauai Test Facility in Hawaii; and other remote locations. For all proposed projects and activities, project owners must complete a NEPA checklist using the online NEPA Module application. A NEPA checklist is an internal form that NEPA personnel use to review proposed projects and activities for compliance with NEPA.

After reviewing a NEPA checklist, NEPA Program personnel also determine whether proposed projects and activities have been evaluated in existing NEPA documentation. In addition, other relevant environmental program subject matter experts review proposed projects and activities to identify any applicable environmental permitting and/or other requirements for the proposed work and then communicate this to project managers. Project managers are required to ensure that all environmental requirements are met.

A NEPA checklist is forwarded to DOE for review when a proposed project or activity reflects any of the following:

- The proposed project or activity is not covered by existing NEPA documentation.
- The proposed project or activity is outside the scope of an existing land-use permit.
- The proposed project or activity is at a location that is not owned by DOE or permitted to Sandia.

DOE will make a NEPA determination, which describes whether further analysis is required for the proposed action. If it is determined that projects or activities do not have a significant effect on the human environment, then the work may be categorically excluded from requirements for an environmental assessment or environmental impact statement. Projects or activities that have not been reviewed in existing NEPA documents or do not qualify for a categorical exclusion from NEPA requirements per 10 CFR 1021, *National Environmental Policy Act Implementing Procedures* (10 CFR 1021 2011), do require new or additional NEPA analyses, which may result in the need for a new environmental assessment, a new environmental impact statement, or documentation to supplement an existing environmental impact statement or environmental assessment.

The *Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada* (DOE/NNSA/Nevada Site Office 2013) analyzed the impacts of Sandia operations and ongoing activities at SNL/TTR.

3.1.1 Program Activities and Results 2022: National Environmental Policy Act

NEPA Compliance

In calendar year 2022, NEPA Program personnel participated in process improvement activities with the DOE Sandia Field Office. These activities resulted in alignment between the Sandia Field Office and Sandia NEPA Program personnel on terminology, roles, and responsibilities, and both short- and long-term process improvements.

In addition to reviewing checklists and supporting process improvement activities, NEPA Program personnel improved coordination between environmental staff, the Sandia Field Office, and SNL/TTR with the U.S. Air Force Nevada Test and Training Range. This resulted in better alignment of environmental support activities and appropriate dual-agency oversight over the site's Coordinated Use Area. To do this, NEPA Program personnel partnered with SNL/TTR personnel and the Sandia Field Office NEPA Compliance Officer to plan three coordination meetings for upcoming projects to review associated DOE and AF requirements. SNL/NM staff also teamed with U.S. Air Force Nevada Test and Training Range personnel to discuss cultural resource management best practices. The NEPA team also improved coordination with the Nevada State Historic

Preservation Office by participating in a site tour and discussing expectations for a future Programmatic Agreement for the site. Additionally, NEPA Program personnel prepared an environmental baseline survey to support a property transfer at SNL/TTR between the DOE Sandia Field Office and DoD. The team conducted site visits in May and November to conduct visual reconnaissance of the properties to be transferred.

NEPA Checklist Reviews

In 2022, NEPA Program personnel reviewed six NEPA checklists for new and ongoing activities at SNL/TTR. Of these checklists, three described activities and operations that were analyzed in previously published NEPA documents (Table 3-1). The three other checklists described activities and/or operations that had not been previously analyzed in existing NEPA documents and were sent to the NEPA Compliance Officer at the Sandia Field Office for review and determination. The Sandia Field Office NEPA Compliance Officer cited two categorical exclusions (Table 3-2).

Table 3-1. NEPA checklists reviewed in 2022 for projects and activities described in existing NEPA documentation

NEPA Document Title	Documents Cited in Sandia Determinations	Number of Citations
Final Site-Wide Environmental Impact Statement for Sandia New Mexico (1999)	DOE/EIS-0281	3
Quality Assurance Review of Previously Determined Activities	Various	1

Table 3-2. Categorical exclusions cited by the DOE NEPA Compliance Officer in determinations for activities at SNL/TTR in 2022

Categorical Exclusions	Number of Citations
B1.15 Siting/construction/operation of support buildings/support structures	2
B3.11 Outdoor tests, experiments on materials and equipment components, no source, special nuclear, or byproduct materials involved	2

Note: Determinations may cite multiple categorical exclusions.

Because SNL/TTR is located within the boundaries of the Nevada Test and Training Range, NEPA Program personnel are often required to coordinate with the Sandia Field Office and the U.S. Air Force to submit a Request for Environmental Analysis (AF Form 813). The AF Form 813 is a form used by the Air Force to document the need for environmental analysis and to provide Air Force NEPA determinations for proposed actions. The form helps narrow and focus the issues to potential environmental impacts. NEPA Program personnel submitted two AF813 forms on behalf of the Sandia Field Office in 2022.

3.2 Chemical Information System

The Chemical Information System for all Sandia locations 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 Environment, Safety, and Health (ES&H) programs, and the workforce.

The information 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 127,000 safety data sheets in its library for use by any Sandia site. 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 reduces sources, which minimizes 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.

3.2.1 Program Activities and Results 2022: Chemical Information System

In 2022, chemical containers were tracked along with information about any related chemical hazards listed in the Chemical Information System.

3.3 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, Resource Conservation and Recovery Act (RCRA) hazardous waste, other chemical waste, and nonhazardous solid waste. Waste minimization and recycling efforts are integrated into Waste Management Program activities.

Sandia 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.

3.3.1 Program Activities and Results 2022: Waste Management and Minimization

Waste Management

Waste generated and shipped from SNL/TTR to approved facilities in 2022 is presented in Table 3-3 and Table 3-4, respectively. All regulated waste was shipped off-site to permitted treatment, storage, and disposal facilities.

Table 3-3. Waste generated, 2022

Waste Type	Weight (kilograms)
Radioactive waste	0
Total non-RCRA-regulated waste	643
Total recycled materials	319,973
Total RCRA hazardous waste	91
Toxic Substances Control Act waste (asbestos)	1,836
Toxic Substances Control Act waste (PCBs)	32

Note: PCB = polychlorinated biphenyl

Table 3-4. Waste shipped, 2022

Waste Type (Facility)	Weight (kilograms)
Battery recycling (National Automotive Parts Association and Veolia)	0
Construction debris (U.S. Air Force Construction Landfill)	67,668
Sanitary landfill (U.S. Air Force Sanitary Landfill)	12,773
Tires (Lunas Tire Recycling)	14,282[a]

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

Waste Minimization

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 2022 are presented in Table 3-5.

Table 3-5. Material recycled or energy-recovered and shipped off-site, 2022

Recycled or Energy-Recovered Waste	Shipped (kilograms)
Antifreeze	0
Automotive-type batteries	0
Circuit boards	0
Mercury-containing articles	0
Non-PCB light ballasts	28
Tires	14,282
Universal waste batteries	93
Universal waste lamps	18
Used oil	416
Used oil filters	0
Recycled Metals (Desert Green Recycling)	305,136
Total	319,973[a]

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

Radioactive Waste Management

There were no radioactive waste shipments in 2022.

3.4 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. This order was negotiated between the State of Nevada, DoD, and DOE (State of Nevada, DOE, and DoD 1996). The Federal Facility Agreement and Consent Order 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

3.4.1 Corrective Action Sites

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 (Ecology and Environment 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.

A listing of Corrective Action Units/Corrective Action Sites is available in Federal Facility Agreement and Consent Order appendices II, III, and IV (State of Nevada, DOE, and DoD 1996). Active remediation is complete for all SNL/TTR Corrective Action Sites.

3.4.2 Program Activities and Results 2022: Environmental Restoration

At the request of DOE, Desert Research Institute (DRI) maintained five portable environmental monitoring stations at SNL/TTR as a part of environmental restoration site post-closure monitoring activities. The primary objective of the monitoring stations was to evaluate whether, and under what conditions, there would be wind transport of radiological contaminants from any of the Corrective Action Units associated with Operation Roller Coaster at SNL/TTR.

Operation Roller Coaster was conducted in May and June 1963 and subjected a series of four nuclear devices to chemical explosions, which resulted in plutonium dispersal in surrounding soils. 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 Clean Slate sites are listed under soil Corrective Action Units/Corrective Action Sites, and active remediation for these sites is complete.

Post-closure monitoring at Tonopah Test Range Clean Slate I took place May 2011 through April 2017. The rest of the post-closure monitoring program was completed at the end of 2021, and the remaining equipment was removed in early 2022, as follows:

- Tonopah Test Range Sandia Area 3 (Station 400), Nevada (active May 2008 to January 2022)
- Tonopah Test Range Clean Slate III north (Station 401), Nevada (active June 2008 to January 2022)
- Tonopah Test Range Clean Slate III south (Station 403), Nevada (active April 2017 to January 2022)
- Tonopah Test Range Clean Slate II north (Station 404), Nevada (active April 2017 to January 2022)
- Tonopah Test Range Clean Slate II south (Station 405), Nevada (active April 2017 to January 2022)

3.5 Air Quality Compliance Program

Air Quality Compliance Program personnel ensure that operations comply with federal and state air quality regulations promulgated in accordance with the Clean Air Act and the Clean Air Act Amendments of 1990. Program personnel also confirm that operations are compliant with 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.

3.5.1 Program Activities and Results 2022: Air Quality Compliance

Nonradiological Air Emissions

The Class II Air Quality Operating Permit for SNL/TTR requires emission reports from the following permitted sources: a portable soil sorting system, facility maintenance shops, and generators. Table 3-6 summarizes the permitted source emission data for 2022.

Table 3-6. Permitted source emission data, 2022

Carbon Monoxide	Hazardous Air Pollutant	Nitrogen Oxide	Particulate Matter with a Diameter ≤ 10 µm	Sulfur Dioxide	Volatile Organic Compound
0.59	0.003	0.98	0.062	0.00098	0.15

Note: All units are in tons per year.

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" (40 CFR 61 2021), 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.

Operations at SNL/TTR do not involve activities that release radioactive emissions from point sources (stacks and vents). However, diffuse radiological emissions historically were produced from the resuspension of americium, plutonium, and other radionuclides from the Clean Slate environmental restoration sites. Active remediation is complete on these sites and no activities that would produce radionuclide air emissions were undertaken in 2022. In September 2020, transfer of the environmental restoration sites from the DOE Office of Environmental Management to the DOE Office of Legacy Management stewardship was completed. The Office of Legacy Management assumed responsibility for the long-term surveillance and maintenance of these sites beginning September 30, 2020 (DOE/NNSA/Nevada Field Office 2020). In addition, DRI data from five portable air monitoring stations near the Clean Slate sites is no longer to be collected as of calendar year 2021. Equipment was removed from the sites in early calendar year 2022, and the final DRI report was to be provided to the Office of Legacy Management in 2022.

3.5.2 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 U.S. Environmental Protection Agency (EPA) Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, monitored background radiation around SNL/TTR as part of its Off-Site Radiation Monitoring Reports Program (EPA 1999), conducted by DRI. All monitoring stations operated by DRI on SNL/TTR were removed by DRI in January 2022.

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. None of these stations are located on SNL/TTR property.

3.6 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.

It was determined in 2019 that SNL/TTR oil storage facilities are not subject to regulation under 40 CFR 112, *Oil Pollution Prevention* (40 CFR 112 2011), because the location of all oil storage containers and equipment is within a hydrologically closed basin with no potential to impact waters of the United States. However, as a best management practice, SNL/TTR personnel continue to inspect oil storage containers and equipment monthly to ensure functional operating conditions and to monitor for potential spills or releases to the environment.

3.6.1 Program Activities and Results 2022: Oil Storage

There were no reportable oil releases at SNL/TTR in 2022.

3.7 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.

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.

In addition to the environmental media samples collected, ambient external gamma radiation levels are measured using environmental dosimeters. 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.

3.7.1 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* (DOE O 458.1, Change 4 (LtdChg) 2020), 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; the Environmental Management System is certified to ISO 14001:2015, *Environmental Management Systems –Requirements with Guidance for Use* (ISO 14001:2015 2015). Reporting is done in accordance with DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting* (DOE O 231.1B, Admin Change 1 2012).

3.7.2 Sample Locations and Media

Terrestrial Surveillance Program personnel use three sample location classifications: on-site, perimeter, and off-site. Sampling locations were selected based on locations of previous and ongoing activities. Environmental dosimeters, deployed and collected quarterly, are used to measure the cumulative ambient external radiation dose and to approximate the dose potentially received from natural and unnatural sources.

The on-site sample locations are in Corrective Action Site areas 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 populations, and along major roadways. On-site, perimeter, and off-site terrestrial surveillance locations, sample media, and parameters are described in Table 3-7, Table 3-8, and Table 3-9, respectively. On-site, perimeter, and off-site locations are presented in Figure 3-2, Figure 3-3, and Figure 3-4, respectively.

Table 3-7. On-site terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number[a]	Sample Location	Soil[b,c]	Dosimeter[d]
Range Operations Center	S-40	Wastewater monitoring station	X	
	S-42	Main Road/Edward's Freeway	X	
	S-43	Range Operations Center (southwest corner)	X	
	S-44	Range Operations Center (northeast corner)	X	
	S-45	Storage shelters 03-38 and 03-39	X	
	S-46	Sand Building	X	
	S-47	Generator storage area	X	
South Plume Area	S-49	North/south Mellan Airstrip (southwest of S-48)	X	
	S-50	North/south Mellan Airstrip (signpost)	X	
	S-52	Northeast of Mellan Airstrip	X	
Various on-site	S-01	Antelope Lake area fence, cultural area sign	X	X
	S-02	North/south Mellan Airstrip (south fencepost)	X	X
	S-03	Dosimeter at Clean Slate I	X	X
	S-04	Dosimeter at Clean Slate III	X	X
	S-09	Operation Roller Coaster Decontamination Area		X
	S-10	Brownes Road/Denton Freeway	X	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	
	S-39	Mellan Hill (north)	X	
	S-53	Main Road/Lake Road southeast	X	

[a] On-site samples are labeled S 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 annually.
[d] Dosimeters are analyzed to determine the dose from ambient gamma radiation.

Table 3-8. Perimeter terrestrial surveillance locations, sample media, and parameters

Surveillance Location	Location Number[a]	Sample Location	Soil[b,c]	Dosimeter[d]
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
	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] Perimeter samples are labeled P 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 annually.
[d] Dosimeters are analyzed to determine the dose from ambient gamma radiation.

Table 3-9. 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 annually.
[d] Dosimeters are analyzed to determine the dose from ambient gamma radiation.

Johnson's fishhook cactus (*Echinomastus johnsonii*)

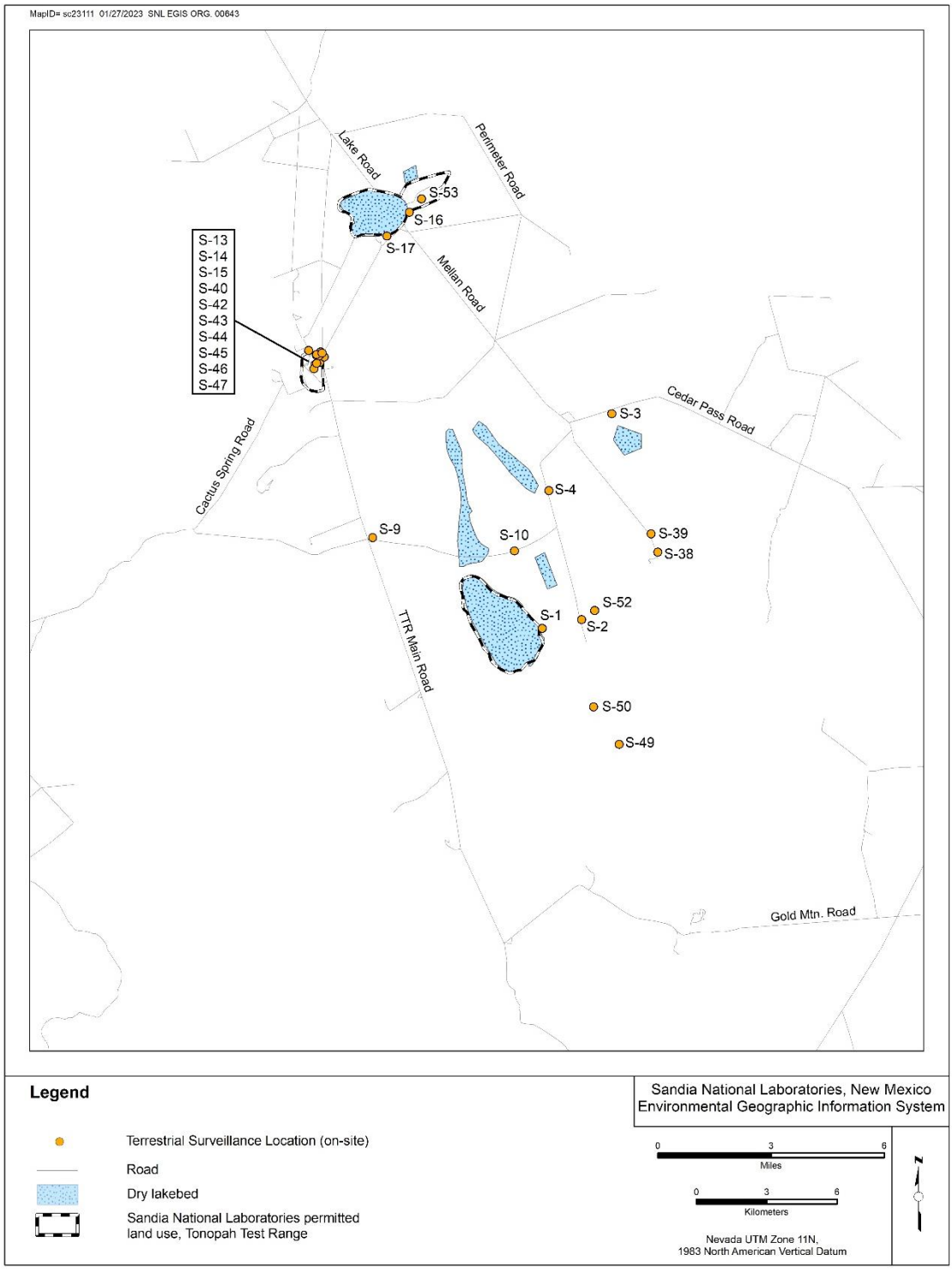

Figure 3-2. On-site terrestrial surveillance locations

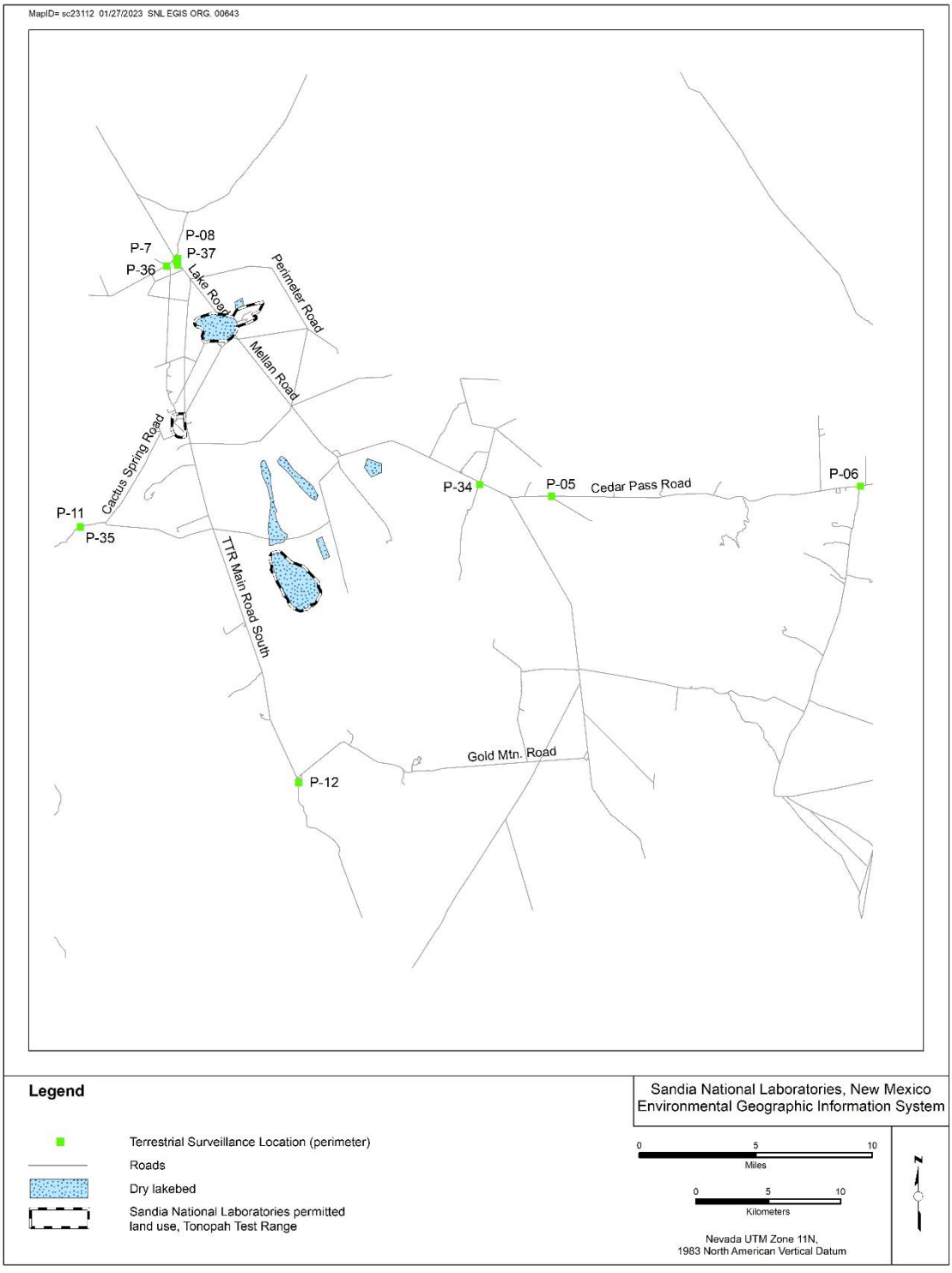

Figure 3-3. Perimeter terrestrial surveillance locations

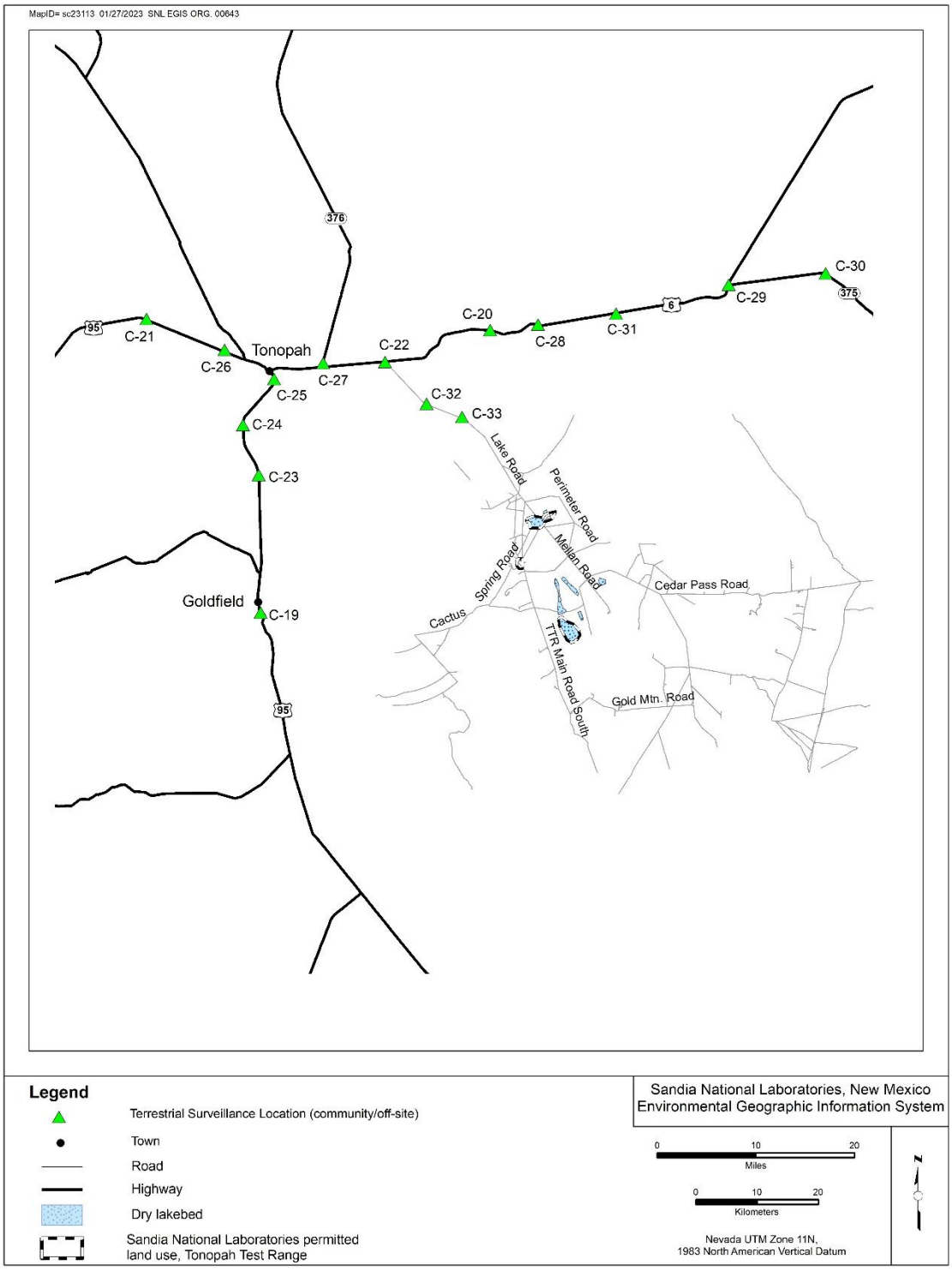

Figure 3-4. Off-site terrestrial surveillance locations

3.7.3 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 *Quality Assurance Project Plan for Terrestrial Surveillance at Sandia National Laboratories, New Mexico* (Sandia 2022).

Contract 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* (Sandia 2020). Soil samples were analyzed for modified Target Analyte List metals and gamma-emitting radionuclides. A select list of radionuclides compiled from process knowledge of operations at SNL/TTR includes the following: actinium-228, americium-241, cesium-137, tritium, uranium-235, and uranium-238.

In 2022, optically stimulated luminescent dosimeters were employed to measure ionizing radiation. The dosimeters are issued and analyzed by an accredited contract laboratory. Optically stimulated luminescent dosimeters have been used since 2018.

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 specified in Chapter 6.

3.7.4 Data Analysis and Methodology

The 2022 analytical results were reviewed by Terrestrial Surveillance Program personnel. Summary statistics, population comparisons, and trend analysis were performed and were evaluated. Additional comparisons were made with selected reference values.

Statistical Analysis

The statistical analysis methodology performed on soil sample results was revised in 2022. Statistical analyses were used to compare sample results at on-site locations versus community and perimeter locations and to examine trends in on-site location results. Nonparametric tests of population comparison (modified Wilcoxon and logrank) were used to compare the on-site sample results with the community and perimeter sample results. Both the Wilcoxon and the logrank tests are significant at a p-value of less than or equal to 0.05 and are of concern when the on-site location results are greater than the community and perimeter results. The nonparametric Kendall's Tau was used to determine whether there is an increasing trend in the on-site location results over time (significant at a p-value less than or equal to 0.05).

The statistical analysis results are used to identify sample results for possible follow-up actions, such as resampling and additional investigation. When the sample results at an on-site location are significantly different than and greater than the community and perimeter results and the sample results at the on-site location are trending upward, it is noted for further evaluation. A discussion of these results (see Section 3.7.5) includes location, analyte, sample matrix, and summary statistics (number of samples, mean, median, standard deviation, maximum and minimum for the on-site location data set, and the value for the current year).

Samples collected since 2010 were used for the statistical analyses as these were analyzed by the same contract laboratory with standard data quality control process specified by the contract, and the analytical results have been through the third-party data validation process in accordance with standard data qualification protocol.

Other References Comparisons

Analytical results for metals in soil samples may be compared to values in the following references (presented in Table 3-10):

- Local and regional soil concentrations (Dragun and Chekiri 2005)
- EPA regional screening levels (EPA 2022)
- Trace elements in soil (Kabata-Pendias 2000)

Table 3-10. Comparison reference values for metals in soil

Analyte	Nevada Soil Concentrations[a]		EPA Regional 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	NA	NA	0.41	0.57
Calcium	600	320,000	NA	NA	NA	NA
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	NA	NA	NA	NA
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	NA	NA	NA	NA
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	NA	NA	NA	NA
Strontium	100	1,500	47,000	700,000	7	1,000
Thallium	NA	NA	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: Dragun and Chekiri 2005
[b] Source: EPA 2022 (target hazard quotient = 1.0)
[c] Source: Kabata-Pendias 2000
NA = not available
ND = not detected

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).

3.7.5 Program Activities and Results 2022: Terrestrial Surveillance

The following Terrestrial Surveillance Program activities occurred in 2022:

- The annual soil sampling was conducted in July 2022.
- Environmental dosimeters were deployed and collected at designated locations and analyzed quarterly. The results are reported as an estimated annual dose rate.

The full analytical results for soil samples and environmental dosimeters are provided in Appendix A, "Terrestrial Surveillance Analytical Results in 2022."

Radiological Results

Radiological analyses were performed on soil samples. Statistical analyses of the 2022 results for the selected radionuclides revealed no statistically significant population differences nor any increasing trends in the on-site location sample results. No further investigation is warranted; sampling will continue in the next calendar year.

Dosimeter Results

Table 3-11 shows the average dose rate summary statistics. The 2022 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 spontaneous nature of radioactivity.

Table 3-11. Dosimeter dose rate summary statistics by location classification, 2022

Location Classification	Number of Observations	Average (mrem/ year)	Median (mrem/ year)	Standard Deviation (mrem/ year)	Minimum (mrem/ year)	Maximum (mrem/ year)
On-site	11	94	97	11.6	73	108
Perimeter	6	92	93	7.3	79	102
Off-site	3	77	90	24.8	48	92

Nonradiological Results

Nonradiological parameters include Target Analyte List metals. The results of the statistical analysis for metals identified one instance of statistical significance (population difference and increasing trend). This result was also compared to values from the references listed in Section 3.7.4 and provided in Table 3-10 and to results from previous years. Table 3-12 presents the metals results and summary statistics for the statistically significant metal.

Table 3-12. Statistically significant metals in soil summary, 2022

Analyte	Location	Number of Samples	Historical Dataset					EPA Regional Screening Levels[a]		2022 Result (mg/kg)
			Mean (mg/kg)	Median (mg/kg)	Standard Deviation (mg/kg)	Minimum (mg/kg)	Maximum (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	
Beryllium	S-10	12	0.535	0.5	0.073	0.472	0.657	160	2,300	0.64

Note: Statistical data is for 2010-2022.
[a]EPA 2022

In 2022, one on-site location (S-10) was identified as statistically significant for beryllium with a result of 0.64 mg/kg. The result is below the EPA regional screening level for residential use and is within Nevada soil concentrations for beryllium (provided in Table 3-10).

All other metals results for 2022 were not statistically significant in both tests (population and trend). No further investigation is warranted. Sampling will continue in the next calendar year.

3.8 Water Quality and Environmental Release, Response and Reporting Programs

Water quality programs focus on monitoring potable water, conserving water, sampling wastewater effluent, and implementing stormwater pollution prevention plan requirements.

SNL/TTR Environmental Release, Response, and Reporting Program personnel are contacted in the event of 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, water, air, and drain systems. A set of procedures provides specific instructions for reporting an environmental release and for developing an accurate report. Environmental Release, Response, and Reporting Program personnel implement the procedures for and document all aspects of an environmental release and report on chemical use to ensure compliance with federal, state, and local reporting requirements.

3.8.1 Program Activities and Results 2022: Environmental Release, Response and Reporting Programs

Release Event Reported to the Nevada Department of Environmental Protection

In 2022, no releases to the environment occurred that required reporting to the Nevada Department of Environmental Protection.

Release Event Categorized as a DOE Reportable Occurrence

In 2022, no releases were reported to an outside agency that met the criteria for DOE-reportable occurrences under DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information* (DOE O 232.2A, Chg 1 (MinChg) 2017)

3.8.2 Drinking Water

SNL/TTR controls three Range water wells: Production Well 6, Roller Coaster Well, and Well 7. Production Well 6 is a public water system well that supplies drinking water to the Main Compound in Area 3, and water for the Area 3 Fire Protection Distribution System. The Roller Coaster Well, which is located approximately five miles south of the Area 3 Compound, supplies water to a 0.35-acre construction water pond. Well 7 is currently inactive and is located in Area 9, approximately five miles NE of the Area 3 Compound. Outlying areas and buildings without water service use bottled water.

The SNL/TTR Area 3 public water system is permitted by the Nevada Division of Environmental Protection (NDEP) as a Non-Transient, Non-Community Water System under identification number NV003014. The well water is sampled and analyzed routinely per the NDEP requirements to demonstrate conformance with primary drinking water standards. Analytes are sampled at different intervals, as shown in Table 3-13.

The State of Nevada provides information on the SNL/TTR public water system—including water system details, sample schedules, analytical data, and any violation or enforcement actions—at NDEP Drinking Water Branch Water System Details (Nevada Division of Environmental Protection n.d.).

Sampling parameters include (but are not limited to) arsenic, coliform (total), lead and copper, nitrates, phthalate, 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), and total trihalomethanes and haloacetic aids.

Table 3-13. Routine production well parameters

Analyte	Reporting Frequency
Arsenic	Quarterly
Coliform, total	Quarterly
Dioxin	As required by the Nevada Department of Environmental Protection, usually every three years
Disinfectant, residual	Quarterly (checked daily)
Di(2-ethylhexyl) phthalate *also known as* Bis(2-ethylhexyl) phthalate	As required by the Nevada Department of Environmental Protection, 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 the Nevada Department of Environmental Protection, usually every three years
Lead and copper	As required by the Nevada Department of Environmental Protection, usually every three years
Nitrate	Annually
Secondary (13) drinking water standards	As required by the Nevada Department of Environmental Protection, 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

An NDEP-permitted treatment system for arsenic removal (permit number NV 3014 TP-11-12NTNC) is used at SNL/TTR. The arsenic removal system manufactured by AdEdge Water Technologies utilizes an adsorption process where contaminants break their bond with the water molecules and chemically adhere to the granular ferric oxide filter media. The filter media reduces total arsenic levels by up to 99 percent, including both Arsenic (III) and Arsenic (V). The system uses carbon dioxide to lower the pH of the incoming raw well water from approximately 9.2 on the pH scale to between 6.5–7.0 on the pH scale for efficient and effective operation of the arsenic removal system.

Program Activities and Results 2022: Drinking Water

In 2022, two precautionary Boil Water Notices were issued for the SNL/TTR public water system. The first notice was issued on August 25, 2022, for a loss of residual due to tank stratification and was rescinded on August 29, 2022, after the system's residual was restored and held over the weekend. The second notice was issued on December 19, 2022, for a loss of pressure at Building 03-69 only, due to a leak after the isolation valve. The notice was rescinded on January 9, 2023, after state approval was granted following repairs and sampling.

All drinking water sample results collected during 2022 were below the NDEP maximum contaminant levels established for the substances monitored.

Four arsenic compliance samples were collected from the Area 3 distribution system for analysis in 2022. The maximum contaminant level for arsenic in drinking water is 10 ppb as a running annual average. The running annual average for arsenic in the drinking water at SNL/TTR during the fourth quarter of 2022 was 4.55 ppb. The arsenic removal media was last changed out in June 2018, and it usually lasts approximately five years before needing to be replaced.

Table 3-14. Public water system monitoring activities and results, 2022

Arsenic and Coliform Results (Quarterly Sampling)					
Analyte	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Maximum Contaminant Level
Arsenic	4.7 ppb	6.2 ppb	6.1 ppb	3.6 ppb	10 ppb
Coliform	Absent	Absent	Absent	Absent	Present
Total Trihalomethanes and Haloacetic Acids Results (Annual Sampling Performed in Third Quarter)					
Total trihalomethanes	N/A	N/A	17.9 µg/L	N/A	80.0 µg/L
Haloacetic acids	N/A	N/A	4.24 µg/L	N/A	60.0 µg/L

Lead and Copper Results (Sampling Performed at Five Locations in 2022)						
Analyte	Sample Location 03-50	Sample Location 03-51	Sample Location 03-55	Sample Location 03-67	Sample Location 03-70	Maximum Contaminant Level
Lead	2.71 µg/L	1.45 µg/L	1.71 µg/L	2.52 µg/L	2.6 µg/L	15 µg/L
Copper	144 µg/L	180 µg/L	332 µg/L	289 µg/L	248 µg/L	1,300 µg/L

N/A = not applicable

During 2022, Well 6 produced 636,700 gallons of water that was chlorinated and sent to the elevated water storage tower. This equals an average monthly production of approximately 53,058 gallons during 2022. Daily production during 2022 averaged approximately 1,744 gallons.

In October 2021, NDEP conducted a sanitary survey of the SNL/TTR public water system. On December 30, 2021, one significant deficiency related to corrosion on piping in the well pumphouse and five other deficiencies related to administrative or system design considerations were noted. In 2022, Sandia personnel actively worked with engineers as per the proposed path forward that the DOE National Nuclear Security Administration Sandia Field Office sent to the NDEP.

3.8.3 Septic Tank Systems

Three of the five septic tanks located at SNL/TTR have been under U.S. Air Force control for several years; they are located at Station 36, the old Point Able Guard Station, and the Firing Range. SNL/TTR is currently responsible for two septic tanks; the septic tank at Station 24 has been out of service for several years and the septic tank located at 09-52 was never placed in service after its installation.

Program Activities and Results 2022: Septic Tank Systems

On October 6, 2022, NDEP and the Bureau of Water Pollution Control personnel inspected the 09-52 septic tank and verified that it was inactive, not in use, and verified it has not been used since it was installed and initially permitted in January 2006.

3.8.4 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.

Program Activities and Results 2022: Stormwater

New construction activities that exceed one acre of soil disturbance and lie outside the boundaries of the closed basin require permitting under the construction general permit. During 2022, no construction projects required Construction General Permit coverage at SNL/TTR.

3.8.5 Wastewater

Wastewater discharges from activities conducted at facilities in the Main Compound at Area 3 go to the U.S. Air Force facultative sewage lagoon for treatment. The U.S. Air Force is responsible for the National Pollutant Discharge Elimination System permit for wastewater discharges. The U.S. Air Force takes samples from the headwater end of the lagoon. In the past, Sandia personnel provided quarterly sampling results to the U.S. Air Force for inclusion in their U.S. Air Force Discharge Monitoring Report; however, the National Pollutant Discharge Elimination System permit was modified in 1997, and quarterly data is no longer required.

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

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 U.S. Air Force system. All sampling and quality assurance practices were conducted in 2022 accordance with program-specific sampling and analysis plans and quality assurance plans (see Chapter 6).

Program Activities and Results 2022: Wastewater

During 2022, there were no excursions or violations of concentration limits. Twenty-four-hour composite wastewater samples are collected annually, and the following parameters are analyzed:

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

Analytical results for wastewater sampled at Area 3 are provided in Appendix B, "Sanitary Outfalls Monitoring Results in 2022."

3.8.6 Water Conservation

The State Water Resources Division regulations, Nevada Revised Statutes Chapter 540, § 540.131 through 540.151, 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 supply management guidance. 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 current plan was revised in November 2020 and was approved by the State of Nevada Department of Conservation and Natural Resources, Division of Water Resources on February 17, 2021. The plan must be updated every five years; the next revision is due by February 17, 2026.

Chapter 4. Ecology Program

Red-tailed hawk (*Buteo jamaicensis*)

OVERVIEW ■ Ecology Program personnel help operations comply with wildlife regulations and laws by providing biological evaluations and surveys in support of site activities. 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 support site activity and project compliance with wildlife requirements by conducting biological evaluations and surveys. Ecological compliance promotes conservation through the protection of native wildlife and their habitats. Monitoring, primarily for birds, is conducted during the bird breeding months to measure species diversity, abundance, and land use patterns. Data collected through monitoring programs can be used to inform land management decisions. As part of the ecological compliance program 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, 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: Cactus Mountain Range is to the west (occurring mostly within the boundaries of SNL/TTR) and Kawich Mountain Range is 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 (U.S. Air Force 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 (U.S. Air Force 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 (ed) 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

The Sierra Nevada and Cascade Mountains prevent moist air from the Pacific Ocean from reaching the inland region of the Great Basin. Even with dry conditions and rugged basin and range topography, the Great Basin has a wide variety of plants. 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 feet) and is typified by budsage (*Artemisia spinescens*), Indian ricegrass (*Achnatherum hymenoides*), shadscale (*Atriplex confertifolia*), and winterfat (*Krascheninnikovia lanata*). 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 feet), with some grassland characterized by various species of budsage, hopsage (*Grayia spinosa*), horsebrush (*Tetradymia* spp.), rabbitbrush (*Chrysothamnus viscidiflorus* and *Ericameria nauseosa*), and shadscale. 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. As water is scarce in the Great Basin Desert, occurring naturally only at a few seeps and springs nearby, there are no sites with native fish at SNL/TTR. The Roller Coaster Construction Pond, a man-made structure on SNL/TTR property, is modified and stocked with goldfish (*Carassius* sp.) and mosquitofish (*Gambusia* sp.).

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 SNL/TTR.

Dry areas that are free of vegetation are found at the lowest portion of closed desert basins. These arid areas, known as *playas*, form ephemeral lakes during periods of precipitation.

Although SNL/TTR is located on 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. A notable species is the feral horse (*Equus ferus*), which is often called a wild horse or mustang. Horses were introduced to the area in the seventeenth and eighteenth centuries. Feral horses are more opportunistic than other native wildlife and are found in practically all habitat types within the SNL/TTR area. 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 1971) (16 U.S.C. 30 § 1331 et seq. 1971). 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*).

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 Nevada Test and Training Range (U.S. Air Force 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*).

In 2022, three bats, two Canyon Bats, and a Pallid Bat were successfully removed and safely relocated to nearby locations by trained personnel at SNL/TTR between June and August after the bats had been discovered day roosting near doorways of heavily trafficked buildings onsite.

4.2 Avian Surveillance

Avian surveys were established in 2004 to monitor patterns of bird richness, abundance, and distribution in the basic habitats found within the DOE-controlled land at SNL/TTR. Native birds are the primary compliance and conservation concerns at SNL/TTR and act as reliable indicators of ecosystem health.

4.2.1 Program Activities and Results 2022: Avian Surveillance

In 2022, the avian survey protocol was updated to better align with the North American Breeding Bird Survey. The North American Breeding Bird Survey is a standardized protocol with roadside routes across the continent. The updated avian survey protocol at SNL/TTR consists of three-minute point counts for avian species every half-mile along a 24.5-mile route. To capture dispersed operational areas and representative habitats, the North American Breeding Bird Survey route is split into two separate routes. See Figure 4-1 for route locations.

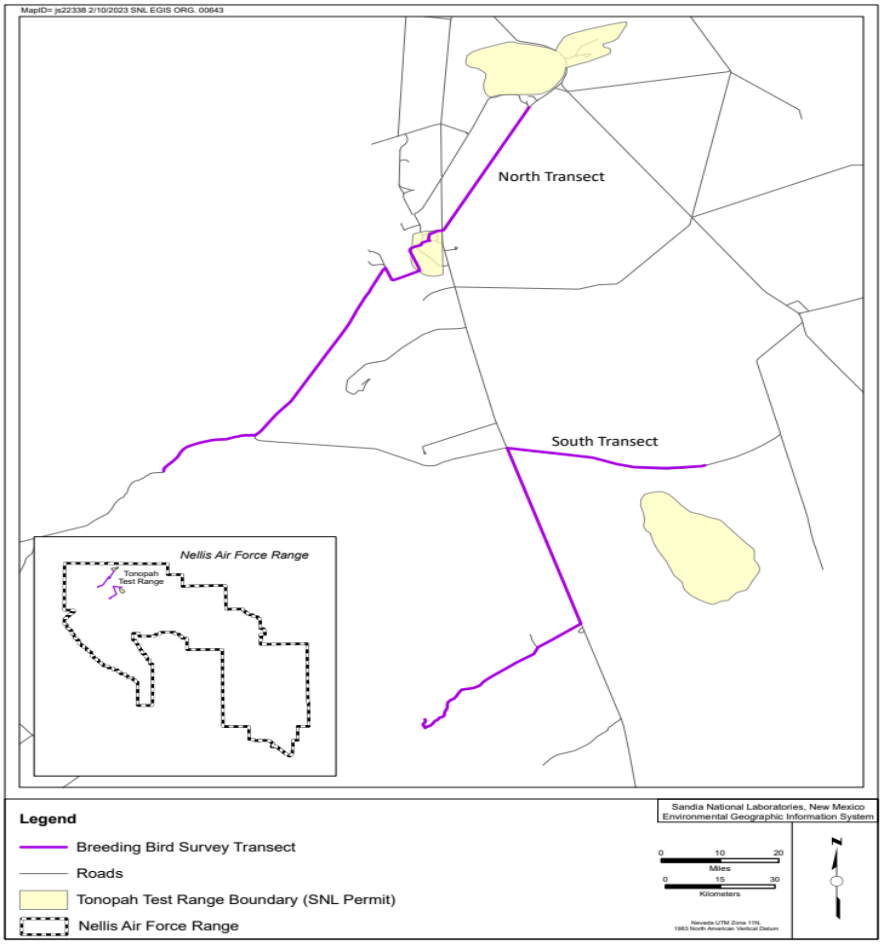

Figure 4-1. Bird survey routes

Avian surveys were conducted during 12 separate years from 2004 to 2022. Avian surveys were conducted in early June 2022. The time frame for conducting surveys is during the typical breeding season for birds in the Great Basin region. One hundred and nineteen birds from 13 species were recorded along the newly established survey routes; see Table 4-1. Horned larks were the most commonly recorded species during surveys. The second-most encountered species was the black-throated sparrow. All other species encountered were at much lower numbers.

Table 4-1. Bird survey totals

Common name	Scientific name	Total
Black-throated Sparrow	*Amphispiza bilineata*	27
Common Raven	*Corvus corax*	5
Horned Lark	*Eremophila alpestris*	54
House Finch	*Carpodacus mexicanus*	7
House Sparrow	*Passer domesticus*	1
Loggerhead Shrike	*Lanius ludovicianus*	2
Northern Mockingbird	*Mimus polyglottos*	6
Red-tailed Hawk	*Buteo jamaicensis*	2
Rock Wren	*Salpinctes obsoletus*	5
Sagebrush Sparrow	*Artemisiospiza nevadensis*	1
Say's Phoebe	*Sayornis saya*	5
Swainson's Hawk	*Buteo swainsoni*	1
Western Wood-Peewee	*Contopus sordidulus*	3
Total		**119**

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.

From all survey years, 120 species of birds have been recorded at SNL/TTR. Table 4-2 lists those bird species. It should be noted that some of the species listed were also seen in other places in the general SNL/TTR area that are not covered by the bird surveys or in locations that are no longer SNL/TTR permitted land use areas. Bird data from these historical locations are valuable for monitoring changes in species composition, distribution, and habitat preferences. Many of the waterfowl and most of the water birds were seen on the various playas when precipitation events produced standing water or at man-made water sources. As most surveys were conducted in late spring and early summer, many of the species encountered were migrants.

Table 4-2. Bird species encountered at Tonopah Test Range (all years)

Common Name	Scientific Name
American avocet	*Recurvirostra americana*
American coot	*Fulica americana*
American kestrel	*Falco sparverius*
American pipit	*Anthus rubescens*
American robin	*Turdus migratorius*
Ash-throated flycatcher	*Myiarchus cinerascens*
Barn swallow	*Hirundo rustica*
Belted kingfisher	*Megaceryle alcyon*

Common Name	Scientific Name
Black phoebe	*Sayornis nigricans*
Black-crowned night-heron	*Nycticorax nycticorax*
Black-headed grosbeak	*Pheucticus melanocephalus*
Black-necked stilt	*Himantopus mexicanus*
Black-throated gray warbler	*Setophaga nigrescens*
Black-throated sparrow	*Amphispiza bilineata*

Common Name	Scientific Name
Blue-gray gnatcatcher	*Polioptila caerulea*
Blue grosbeak	*Passerina caerulea*
Bonaparte's gull	*Chroicocephalus philadelphia*
Brewer's blackbird	*Euphagus cyanocephalus*
Brewer's sparrow	*Spizella breweri*
Brown-headed cowbird	*Molothrus ater*
Bufflehead	*Bucephala albeola*
Bullock's oriole	*Icterus bullockii*
Burrowing owl	*Athene cunicularia*
Calliope hummingbird	*Selasphorus calliope*
Canvasback	*Aythya valisineria*
Canyon wren	*Catherpes mexicanus*
Cassin's kingbird	*Tyrannus vociferans*
Cassin's sparrow	*Peucaea cassinii*
Cassin's vireo	*Vireo cassinii*
Chipping sparrow	*Spizella passerina*
Chukar	*Alectoris chukar*
Cinnamon teal	*Anas cyanoptera*
Cliff swallow	*Petrochelidon pyrrhonota*
Common raven	*Corvus corax*
Common yellowthroat	*Geothlypis trichas*
Cooper's hawk	*Accipiter cooperii*
Dusky flycatcher	*Empidonax oberholseri*
Eared grebe	*Podiceps nigricollis*
Eurasian collared-dove	*Streptopelia decaocto*
European starling	*Sturnus vulgaris*
Ferruginous hawk	*Buteo regalis*
Gadwall	*Anas strepera*
Golden eagle	*Aquila chrysaetos*
Gray flycatcher	*Empidonax wrightii*
Great egret	*Ardea alba*
Greater yellowlegs	*Tringa melanoleuca*
Great horned owl	*Bubo virginianus*
Great-tailed grackle	*Quiscalus mexicanus*
Green-tailed towhee	*Pipilo chlorurus*
Green-winged teal	*Anas crecca*
Hermit thrush	*Catharus guttatus*
Herring gull	*Larus argentatus*
Horned grebe	*Podiceps auritus*
Horned lark	*Eremophila alpestris*
House finch	*Carpodacus mexicanus*
House sparrow	*Passer domesticus*
House wren	*Troglodytes aedon*
Juniper titmouse	*Baeolophus ridgwayi*
Killdeer	*Charadrius vociferus*

Common Name	Scientific Name
Ladder-backed woodpecker	*Picoides scalaris*
Lark sparrow	*Chondestes grammacus*
Lazuli bunting	*Passerina amoena*
Least sandpiper	*Calidris minutilla*
Lincoln's sparrow	*Melospiza lincolnii*
Loggerhead shrike	*Lanius ludovicianus*
MacGillivray's warbler	*Geothlypis tolmiei*
Mallard	*Anas platyrhynchos*
Mourning dove	*Zenaida macroura*
Nashville warbler	*Leiothlypis ruficapilla*
Northern mockingbird	*Mimus polyglottos*
Northern pintail	*Anas acuta*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Northern shoveler	*Anas clypeata*
Northern waterthrush	*Parkesia noveboracensis*
Olive-sided flycatcher	*Contupus cooperi*
Orange-crowned warbler	*Leiothlypis celata*
Pacific-slope flycatcher	*Empidonax difficilis*
Palm warbler	*Setophaga palmarum*
Pine siskin	*Carduelis pinus*
Prairie falcon	*Falco mexicanus*
Redhead	*Aythya americana*
Red-necked phalarope	*Phalaropus lobatus*
Red-tailed hawk	*Buteo jamaicensis*
Red-winged blackbird	*Agelaius phoeniceus*
Ring-billed gull	*Larus delawarensis*
Rock wren	*Salpinctes obsoletus*
Ruby-crowned kinglet	*Regulus calendula*
Sagebrush sparrow	*Artemisiospiza nevadensis*
Sage thrasher	*Oreoscoptes montanus*
Savannah sparrow	*Passerculus sandwichensis*
Say's phoebe	*Sayornis saya*
Scott's oriole	*Icterus parisorum*
Sharp-shinned hawk	*Accipiter striatus*
Snowy egret	*Egretta thula*
Sora	*Porzana carolina*
Spotted sandpiper	*Actitis macularius*
Spotted towhee	*Pipilo maculatus*
Summer tanager	*Piranga rubra*
Swainson's hawk	*Buteo swainsoni*
Townsend's warbler	*Setophaga townsendi*
Tree swallow	*Tachycineta bicolor*
Turkey vulture	*Cathartes aura*
Vermilion flycatcher	*Pyrocephalus rubinus*
Vesper sparrow	*Pooecetes gramineus*

Common Name	Scientific Name
Violet-green swallow	*Tachycineta thalassina*
Virginia rail	*Rallus limicola*
Virginia's warbler	*Oreothlypis virginiae*
Warbling vireo	*Vireo gilvus*
Western kingbird	*Tyrannus verticalis*
Western sandpiper	*Calidris mauri*
Western tanager	*Piranga ludoviciana*
Western wood-pewee	*Contopus sordidulus*
White-crowned sparrow	*Zonotrichia leucophrys*

Common Name	Scientific Name
White-faced ibis	*Plegadis chihi*
White-winged dove	*Zenaida asiatica*
Wilson's phalarope	*Phalaropus tricolor*
Wilson's warbler	*Cardellina pusilla*
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*
Yellow-rumped warbler	*Setophaga coronata*
Yellow warbler	*Setophaga petechia*

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 503 (NAC 503 2018), Nevada Administrative Code 504 (NAC 504 2018), Administrative Code 527 (NAC 527 2012), and Nevada Administrative Code 501 (NAC 501 2018)).

Currently, no federally listed threatened or endangered species are known to be found at SNL/TTR. The only federally listed species found at the Nevada Test and Training Range is the Mojave Desert tortoise (*Gopherus agassizii*) (U.S. Air Force 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. Located near the center of Nye County, the county list of federally protected species is used to reference such species potentially occurring at SNL/TTR.

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 also includes state-listed species that may potentially occur in Nye County, Nevada, and flags the species that have been observed at SNL/TTR.

All projects with potential biological impacts at SNL/TTR are reviewed by the Ecology Program. This review process provides project specific requirements and best management practices to ensure compliance with the Endangered Species Act, the Migratory Bird Treaty Act, and other associated federal, state, and local laws. Coordination with state and/or federal officials and the implementation of any requisite mitigation occurs prior to initiating proposed 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 Endangered Species Act Status	Nevada Status	Observed at SNL/TTR
Animals				
Invertebrates				
Ash Meadows naucorid	*Ambrysus amargosus*	Threatened	No designation	

Common Name	Scientific Name	Federal Endangered Species Act Status	Nevada Status	Observed at SNL/TTR
Monarch butterfly	*Danaus plexippus*	Candidate	No designation	
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*	No designation	Protected	
Big Smoky Valley tui chub	*Gila bicolor spp. 8*	No designation	Protected	
Bonytail	*Gila elegans*	Endangered	Endangered	
Devils Hole pupfish	*Cyprinodon diabolis*	Endangered	Endangered	
Hot Creek Valley tui chub	*Siphateles bicolor ssp. 5*	No designation	Protected	
Humpback Chub	*Gila cypha*	Threatened	No designation	
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	Threatened	Game	
Moapa dace	*Moapa coriacea*	Endangered	Endangered	
Monitor Valley speckled dace	*Rhinichthys osculus spp. 5*	No designation	Protected	
Moorman White River springfish	*Crenichthys baileyi thermophilus*	No designation	Protected	
Oasis Valley speckled dace	*Rhinichthys osculus spp. 6*	No designation	Protected	
Railroad Valley springfish	*Crenichthys nevadae*	Threatened	Threatened	
Railroad Valley tui chub	*Gila bicolor spp. 7*	No designation	Protected	
Warm Springs amargosa pupfish	*Cyprinodon nevadensis pectoralis*	Endangered	Endangered	
White River desert sucker	*Catostomus clarkii intermedius*	No designation	Protected	
White River speckled dace	*Rhinichthys osculus ssp. 7*	No designation	Protected	
White River spinedace	*Lepidomeda albivallis*	Endangered	Endangered	
Reptiles and Amphibians				
Amargosa toad	*Anaxyrus nelsoni*	No designation	Protected	
Banded Gila monster	*Heloderma suspectum cinctum*	No designation	Protected	
Columbia spotted frog (Great Basin Distinct Population Segment)	*Rana luteiventris*	Candidate	Protected	
Desert tortoise (Mojave population)	*Gopherus agassizii*	Threatened	Threatened	
Dixie Valley toad	*Anaxyrus williamsi*	Under Review	Sensitive	
Hot Creek toad	*Anaxyrus monfontanus*	No designation	Protected	
Northern leopard frog	*Lithobates pipiens*	No designation	Protected	
Railroad Valley toad	*Anaxyrus nevadensis*	No designation	Protected	
Sonoran mountain kingsnake	*Lampropeltis pyromelana*	No designation	Protected	
Mammals				
Allen's big-eared bat	*Idionycteris phyllotis*	No designation	Protected	
American pika	*Ochotona princeps*	No designation	Protected	
Ash Meadows montane vole	*Microtus montanus nevadensis*	No designation	Protected	
Big brown bat	*Eptesicus fuscus*	No designation	Protected	
California leaf-nosed bat	*Macrotus californicus*	No designation	Protected	

Common Name	Scientific Name	Federal Endangered Species Act Status	Nevada Status	Observed at SNL/TTR
California myotis	*Myotis californicus*	No designation	Protected	
Canyon bat	*Parastrellus hesperus*	No designation	Protected	
Dark kangaroo mouse	*Microdipodops megacephalus*	No designation	Protected	
Fringed myotis	*Myotis thysanodes*	No designation	Protected	
Hoary bat	*Lasiurus cinereus*	No designation	Protected	
Little brown bat	*Myotis lucifugus*	Under Review	Sensitive	
Long-eared myotis	*Myotis evotis*	No designation	Protected	
Long-legged myotis	*Myotis volans*	No designation	Protected	
Mexican free-tailed bat	*Tadarida brasiliensis*	No designation	Protected	
Pale kangaroo mouse	*Microdipodops pallidus*	No designation	Protected	
Pallid bat	*Antrozous pallidus*	No designation	Protected	
Palmer's chipmunk	*Neotamias palmeri*	No designation	Protected	
Silver-haired bat	*Lasionycteris noctivagans*	No designation	Protected	
Spotted bat	*Euderma maculatum*	No designation	Threatened	
Townsend's big-eared bat	*Corynorhinus townsendii*	No designation	Sensitive	
Western jumping mouse	*Zapus princeps*	No designation	Protected	
Western red bat	*Lasiurus blossevillii*	No designation	Sensitive	
Western small-footed myotis	*Myotis ciliolabrum*	No designation	Protected	
Birds				
Bald eagle	*Haliaeetus leucocephalus*	No designation	Protected	
Bendire's Thrasher	*Toxostoma bendirei*	Vulnerable	Threatened	
Brewer's sparrow	*Spizella breweri*	No designation	Sensitive	●
Golden eagle	*Aquila chrysaetos*	No designation	Sensitive	●
Greater sage-grouse	*Centrocercus urophasianus*	Candidate	Protected	
Loggerhead shrike	*Lanius ludovicianus*	No designation	Sensitive	●
Northern goshawk	*Accipiter gentilis*	No designation	Sensitive	
Peregrine falcon	*Falco peregrinus*	No designation	Sensitive	
Sage thrasher	*Oreoscoptes montanus*	No designation	Sensitive	●
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered	
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	No designation	
Yuma Ridgeway's rail	*Rallus obsoletus yumanensis*	Endangered	Endangered	
Plants				
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	Endangered	
Armored hedgehog cactus	*Echinocereus engelmannii var. armatus*	No designation	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*	No designation	Protected	
Branched pencil cholla	*Cylindropuntia ramosissima*	No designation	Protected	●
Clokey pincushion	*Escobaria vivipara var. rosea*	No designation	Protected	

Common Name	Scientific Name	Federal Endangered Species Act Status	Nevada Status	Observed at SNL/TTR
Cottontop cactus	*Echinocactus polycephalus*	No designation	Protected	●
Desert pincushion	*Escobaria vivipara var. deserti*	No designation	Protected	
Eastwood milkweed	*Asclepias eastwoodiana*	No designation	Protected	●
Hermit cactus	*Sclerocactus polyancistrus*	No designation	Protected	●
Joshua tree	*Yucca brevifolia*	No designation	Protected	●
Mojave barrel cactus	*Ferocactus cylindraceus var. lecontei*	No designation	Protected	
Mountain cactus	*Pediocactus simpsonii*	No designation	Protected	
Nye pincushion cactus	*Sclerocactus nyensis*	No designation	Protected	
Old man prickly pear cactus or Grizzlybear cactus	*Opuntia erinacea var. erinacea*	No designation	Protected	●
Sand cholla or sagebrush cholla	*Grusonia pulchella*	No designation	Protected	●
Silver cholla	*Cylindropuntia echinocarpa*	No designation	Protected	●
Sodaville milkvetch	*Astragalus lentiginosus var. sesquimetralis*	No designation	Endangered	
Spring-loving centaury	*Centaurium namophilum*	Threatened	Endangered	
Sunnyside green gentian	*Frasera gypsicola*	No designation	Endangered	
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened	Endangered	
Williams combleaf	*Polyctenium williamsiae*	No designation	Endangered	

var. = variety
spp. = plural

Federal ESA Status:
Endangered - Any species which is in danger of extinction throughout all or a significant portion of its range.
Threatened - Any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
Candidate - Any species for which the Service has sufficient information on its biological status and threats to propose it as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Candidate species are not protected by the take prohibitions of section 9 of the ESA.

Nevada Status:
Endangered – Means when a species or subspecies is in danger of extinction throughout all or a significant portion of its range.
Threatened –Means when a species or subspecies is likely to become an endangered species in the near future throughout all or a significant portion of its range.
Sensitive – Means when a species or subspecies is classified as sensitive by the Commission pursuant to NAC 503.104 (NAC 503.104 2004).
Protected – Means when a species or subspecies is classified as protected by the Commission pursuant to NAC 503.103 (NAC 503.103 2004).

Chapter 5. Compliance Summary

Tonopah Test Range blacktop

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 reporting and permitting requirements.

All operations and activities, including those that are part of environmental programs, are performed in accordance with Sandia's 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.
- Compliance with applicable ES&H requirements, including 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.

5.1 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.

The National Nuclear Security Administration, a semiautonomous agency within the U.S. Department of Energy, is responsible for enhancing national security through the military application of nuclear science.

5.1.1 Federal Requirements

The Prime Contract requires compliance with federal requirements, including applicable federal laws and regulations as well as specific DOE directives. The significant 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 of 1969

The National Environmental Policy Act (NEPA) of 1969 (42 USC § 4321 1969) is a planning tool that requires federal agencies to assess the impacts of proposed actions on the human and natural environment prior to making decisions. The Council on Environmental Quality (40 CFR 1500–1508 2005) is the agency responsible for implementing NEPA through issuing guidance and interpreting regulations that implement NEPA procedural requirements. DOE codified its NEPA implementing procedures in 10 CFR 1021, *National Environmental Policy Act* (10 CFR 1021 2011). Personnel use the NEPA module (an online tool that uses a checklist format) to document proposed actions and activities and assesses them for potential environmental consequences and impacts. When projects or activities appear to be outside the scope of existing NEPA documentation, a new NEPA checklist is prepared and forwarded to DOE for review and determination. Section 3.1 provides information on NEPA activities in 2022.	Compliance activities: • Ensure that potential environmental impacts have been assessed adequately • Coordinate NEPA assessments 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 Departmental Sustainability

DOE O 436.1, *Departmental Sustainability* (DOE O 436.1 2011), places environmental management systems and site sustainability at the forefront of environmental excellence. This order requires development of a site sustainability plan to identify contributions toward meeting DOE sustainability goals and an environmental management system for a continuing cycle of planning, implementing, evaluating, and improving processes to achieve environmental goals.

Personnel comply with this order through implementation of an environmental management system, which is third-party certified to ISO 14001:2015 (ISO 14001:2015 2015) at SNL/NM (the primary operating location). Operations at SNL/TTR follow the Environmental Management System requirements but are not included in the certification.

This order also specifies requirements for compliance with Emergency Planning and Community Right-to-Know Act (EPCRA) requirements.

DOE O 436.1, *Departmental Sustainability* (DOE O 436.1 2011), was in effect during 2022, the time period covered by this annual site environmental report. This order was superseded by DOE O 436.1A in 2023 (DOE O 436.1A 2023).

See "Chemical Management" and Table 5-1 for information on Sandia's approach to compliance with these requirements.

Compliance activities:

- Follow the environmental management system requirements, including identification of the environmental aspects and impacts of activities
- Establish and implement an annual site sustainability plan for Sandia locations including SNL/TTR
- Fulfill emergency planning and reporting requirements
- See "Chemical Management" and Table 5-1 for compliance activities

Hazardous Waste and Environmental Restoration

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

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. § 9601 1980), and amended in 1986, establishes liability compensation, cleanup, and emergency response requirements for inactive hazardous waste sites. In addition, CERCLA requires federal facilities to respond and report hazardous substance spills to the National Response Center and perform any necessary response action.

DOE performed a preliminary assessment and site inspection in 1988 at SNL/TTR. 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) Title III of 1986 (42 U.S.C. § 9601 1986) establishes additional reporting requirements that are addressed under "Chemical Management."

Compliance activities:

- See "Chemical Management" for compliance activities

Federal Facility Agreement and Consent Order

The Federal Facility Agreement and Consent Order is an ongoing action with DoD, DOE, and the State of Nevada (State of Nevada, DOE, and DoD 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 3.4 provides information on environmental restoration sites.	Compliance activities: • Report site post-closure inspection activities

Resource Conservation and Recovery Act, enacted in 1976, as amended

The Resource Conservation and Recovery Act (RCRA) of 1976, enacted in 1976, as amended (42 U.S.C. § 6901 et seq. 1976) 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* (40 CFR 262 2021). Under the small-quantity generator designation, hazardous waste can only be stored on-site for a maximum of 270 days at this location before it must be shipped off-site for treatment and disposal at an 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 U.S. Air Force operations and maintenance contractor). Section 3.3 provides information on waste management activities.	Compliance activities: • 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

The Atomic Energy Act of 1954 (42 U.S.C. § 2011 1954) 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* (10 CFR 830 2016), and 10 CFR 835, *Occupational Radiation Protection* (10 CFR 835 2021). The regulations include radiation protection standards, limits, and program requirements for protecting individuals from radiation exposure as a result of DOE activities.	Compliance 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

DOE O 435.1, Change 1, *Radioactive Waste Management* (DOE O 435.1, Change 1 2001), 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 3.3 provides information on waste management activities.	Compliance activities: • Characterize and manage on-site waste • Support inspections and audits • Ensure that training requirements are met

DOE O 458.1 Chg 4 (LtdChg), Radiation Protection of the Public and the Environment

DOE O 458.1, Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment* (DOE O 458.1, Change 4 (LtdChg) 2020), 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.	Compliance activities: • 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 2022, 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

The Clean Air Act of 1970, as amended (42 U.S.C. § 7401 1970), 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, *National Emission Standards for Hazardous Air Pollutants* (40 CFR 61 2021). Section 3.5 provides information on air quality compliance.	Compliance activities: • 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

The Clean Water Act of 1972 (33 U.S.C. § 1251 1972) and amendments 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 NDEP requirements. Section 3.8 provides information on drinking water.	Compliance activities: • 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 of 2007, Section 438

The Energy Independence and Security Act (EISA) of 2007 (42 U.S.C. § 17001 2007), Section 438 requires federal agencies to manage stormwater runoff from federal development projects for the protection of water resources. Sandia projects undergo a NEPA review (see "National Environmental Policy Act of 1969") and may identify the need to further address stormwater runoff under EISA § 438 applicability. Site planning, design, construction, and maintenance strategies are applied to maintain or restore predevelopment site hydrology. Section 3.8.4 provides information on the Stormwater Program.	Compliance activities: • Implement stormwater pollution prevention plan steps to prevent unpermitted discharges • Conduct inspections

Oil Pollution Act of 1990 (§ 311)

The Oil Pollution Act of 1990 (33 U.S.C. § 40 1990) (§ 311) 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. Oil storage facilities at SNL/TTR are not subject to regulation under 40 CFR 112, *Oil Pollution Prevention* (40 CFR 112 2011), 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. However, personnel implement best management practices to prevent potential oil spills or releases to the environment. Section 3.6 provides information on the Oil Storage Program.	Compliance activities: • Inspect aboveground 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

The Safe Drinking Water Act of 1974, as amended (42 U.S.C. § 300f 1974), 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 Drinking Water permits issued by the NDEP: one for operation of a Public Water System and one to operate a Treatment Plant for Arsenic Reduction and Chlorination. NDEP characterizes this public water system as a "Non-Transient Non-Community Water System." Section 3.8.2 provides information on Sandia's drinking water program.	Compliance activities: • Adhere to permit requirements • Sample drinking water for quality parameters

America's Water Infrastructure Act of 2018

The America's Water Infrastructure Act of 2018 (33 U.S.C. § 2201 2018) improves drinking water and water quality, deepens infrastructure investments, enhances public health and quality of life, increases jobs, and bolsters the economy. The act's provisions represent changes to the Safe Drinking Water Act. Section 3.8.2 provides information on drinking water.	Compliance activities: • There are no activities associated with this requirement

Chemical Management

Emergency Planning and Community Right-to-Know Act of 1986

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 U.S.C. § 11001 et seq. 1986), also known as Title III of the Superfund Amendments and Reauthorization Act (SARA Title III) requires the reporting of toxic chemicals used and released by federal, state, and local governments and industry. Per EPCRA, chemical hazard information is provided to the community for awareness and enhancement of emergency planning efforts. In Nevada, the Nevada State Fire Marshal and State Emergency Response Commission utilize the Nevada Combined Hazardous Materials Reporting System to satisfy state requirements for hazardous materials reporting and chemical inventory reporting under EPCRA. These are submitted as a single report. See Table 5-1 for more details.	Compliance activities: • Maintain and report on a chemical inventory using the Nevada Combined Hazardous Materials Reporting System • Report qualifying releases

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

The Federal Insecticide, Fungicide, and Rodenticide Act, enacted in 1910 and amended in 1972 (7 U.S.C. § 136 1910), regulates the use of herbicides, rodenticides, and insecticides. EPA regulations and applicable label guidelines are followed.	Compliance activities: • Contract state-licensed subcontractors to supply, handle, and apply covered products

Toxic Substances Control Act, enacted in 1976 and later amended

The Toxic Substances Control Act, enacted in 1976 and later amended (15 U.S.C. § 2601 et seq. 1976), 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.	Compliance activities: • Conduct asbestos abatement in accordance with applicable regulatory requirements

Pollution Prevention

Pollution Prevention Act of 1990

The Pollution Prevention Act of 1990 (42 U.S.C. § 133 1990) 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."	Compliance activities: • 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

The Bald and Golden Eagle Protection Act (16 USC § 668-668d), enacted in 1940 (16 U.S.C. § 668-668d 1940), prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Conduct biological evaluations and inventory surveys • Consultation with the U.S. Fish and Wildlife Service (USFWS) Service as appropriate

Endangered Species Act of 1973, amended in 1982

The Endangered Species Act of 1973, amended in 1982 (16 U.S.C. 1531 et. seq. 1973) provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The lead federal agencies for implementing the act are the USFWS and the National Marine Fisheries Service. The USFWS maintains a worldwide list of endangered species; species include birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees. Chapter 4 provides more information on threatened and endangered species that may occur on SNL/TTR.	Compliance activities: • Collect ecological data • Provide ecological surveillance for maintenance of regulatory compliance • Consultation with the USFWS as appropriate

Executive Order 11988 of 1977, Floodplain Management, as amended

Executive Order 11988, Floodplain Management, (EO 11988 1977), requires federal agencies to consider impacts associated with the occupancy and modification of floodplains; reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Review NEPA checklists to identify impacts on floodplains • Preserve and protect ecological resources

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

Executive Order 11990, Protection of Wetlands, as amended (EO 11990 1977), requires federal agencies to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Review NEPA checklists to identify impacts on wetlands • Preserve and protect ecological resources

Executive Order 13112 of 1999, Invasive Species

Executive Order 13112, Invasive Species (EO 13112 1999) called upon executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. It also created a coordinating body—the Invasive Species Council, also referred to as the National Invasive Species Council—to oversee implementation of the order, encourage proactive planning and action, develop recommendations for international cooperation, and take other steps to improve the federal response to invasive species. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Monitor biota • Collect ecological data • Produce mitigation strategies as necessary

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

Executive Order 13751, Safeguarding the Nation from the Impacts of Invasive Species (EO 13751 2016), amended Executive Order 13112 and directs actions to continue coordinated federal prevention and control efforts related to invasive species. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Monitor biota • Collect ecological data • Produce mitigation strategies as necessary

Fish and Wildlife Conservation Act
Lacey Act Amendments of 1981

The Fish and Wildlife Conservation Act (16 U.S.C. 49 1980), enacted in 1980, and the Lacey Act Amendments of 1981 (16 U.S.C. 3371-3378 1981), were established so that wildlife will receive equal consideration with other natural resources regarding maintenance of the ecosystem. Relevancy to an ecological program is stated in 16 USC 661, *Conservancy*, which states that purpose as follows: "(1) to provide assistance to, and cooperate with, Federal, State, and public or private agencies and organizations in the development, protection, rearing, and stocking of all species . . . (2) to make surveys and investigations of the wildlife of the public domain." Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Ecology Program personnel consider Fish and Wildlife Conservation Act compliance when evaluating NEPA checklists

Migratory Bird Treaty Act of 1918 (and amendments)

The Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq. 1918) implemented the 1916 Convention for the protection of migratory birds. The original statute implemented the agreement between the United States and Great Britain (for Canada) and later amendments implemented treaties between the United States and Mexico, the United States and Japan, and the United States and Russia. The act prevents the taking, possession, killing, transportation, and importation of migratory birds or their eggs, parts, and nests. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Collect ecological data • Provide ecological surveillance for maintenance of regulatory compliance • Consultation with the USFWS as appropriate

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

The Sikes Act, as amended (PL 105-85 1997), was reauthorized in 2013. The act protects and enhances fish, wildlife, and other natural resources that exist on and are associated with military lands in the United States. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • The Ecology Program considers the Sikes Act when evaluating NEPA checklists

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

The Wild Free-Roaming Horses and Burros Act (PL 92-195 1971), enacted in 1971, and amendments (16 U.S.C. 30 § 1331 et seq. 1971), declares that wild free-roaming horses and burros are living symbols of the historic and pioneer spirit of the West, that they contribute to the diversity of life forms within the nation, and that they enrich the lives of the American people. The policy states that wild free-roaming horses and burros shall be protected from capture, branding, harassment, or death; to accomplish this, areas where they are presently found are to be considered an integral part of the natural system of the nation's public lands. The Bureau of Land Management's Las Vegas District is responsible for management of wild horses at SNL/TTR. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Coordinate with the Bureau of Land Management as appropriate

Cultural Resources

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

The American Indian Religious Freedom Act of 1978, as amended in 1994 (PL 103-344 1994), is a federal law and joint resolution of Congress, which protects and preserves the traditional religious rights and cultural practices of American Indians, Eskimos, Aleuts, and native Hawaiians.

See Chapter 2 for information on the Cultural Resource Management Program.

Compliance activities:

- Conduct cultural resource surveys and the monitoring of construction activities
- Prepare documentation to support planning activities and decisions
- Review NEPA checklists to identify impacts on cultural resources
- Support consultation with American Indian tribes

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

The Archaeological Resources Protection Act of 1979 (PL 96-95 1979) secures, for the present and future benefit of the American people, the protection of archaeological resources and sites that are on public lands and Indian lands, and fosters increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals. Section 4 of the statute and Sections 16.5–16.12 of the regulations describe the requirements that must be met before federal authorities can issue a permit to excavate or remove any archaeological resource on federal or Indian Lands. The curation requirements of artifacts, other materials excavated or removed, and the records related to the artifacts and materials are described in Section 5 of the act. These regulations affect all federally owned or administered archaeological collections.

See Chapter 2 for information on the Cultural Resource Management Program.

Compliance activities:

- Develop internal management plans
- Conduct cultural resource surveys and the monitoring of construction activities
- Prepare documentation to support planning activities and decisions
- Review NEPA checklists to identify impacts on cultural resources

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

DOE O 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy* (DOE O 144.1 2009), sets forth the principles to be followed by DOE to ensure an effective implementation of a government-to-government relationships with American Indian and Alaska Native tribal governments. This order provides direction to all DOE officials, staff, and contractors regarding fulfillment of trust obligations and other responsibilities arising from DOE actions that may potentially impact American Indian and Alaska Native traditional, cultural, and religious values and practices; natural resources; and treaty and other federally recognized and reserved rights.

See Chapter 2 for information on the Cultural Resource Management Program.

Compliance activities:

- Develop internal management plans
- Conduct cultural resource surveys and the monitoring of construction activities
- Prepare documentation to support planning activities and decisions
- Review NEPA checklists to identify impacts on cultural resources
- Support consultation with American Indian Tribes

DOE O 430.1C, Real Property Asset Management

DOE O 430.1C, *Real Property Asset Management* (DOE O 430.1C 2019), establishes an integrated corporate-level, performance-based approach to the life-cycle management of real property assets. It links real property asset planning, programming, budgeting and evaluation to the multifaceted DOE missions. Successful implementation of this order will enable DOE to carry out stewardship responsibilities, and will ensure that facilities and infrastructure are properly sized and, in a condition to meet mission requirements today and in the future. See Chapter 2 for information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys and the monitoring of construction activities • 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

DOE P 141.1, Management of Cultural Resources

The purpose of DOE P 141.1, *Management of Cultural Resources* (DOE P 141.1 2011), is twofold: (1) to ensure that all DOE programs and field elements integrate cultural resources management into their missions and activities and (2) to raise the level of awareness and accountability among DOE contractors concerning the importance of DOE cultural resource-related legal and trust responsibilities. See Chapter 2 for information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys and monitor construction activities • 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

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

The National Historic Preservation Act of 1966 (PL 89-665 1966), as amended, and codified in 16 U.S.C. (16 U.S.C. 2016), is legislation intended to preserve historical and archaeological sites in the United States. The act sets federal policy for preserving our nation's heritage by establishing a federal government and tribal government partnership, establishing the National Register of Historic Places and National Historic Landmarks Programs, mandating the selection of qualified State Historic Preservation Officers, establishing the Advisory Council on Historic Preservation, charging federal agencies with responsible stewardship, and establishing the role of certified local governments within the states.

The National Register of Historic Places (36 CFR 60 2012) is authorized by the National Historic Preservation Act of 1966. It is the federal government's official list of districts, sites, buildings, structures, and objects deemed worthy of preservation for their historical significance.

See Chapter 2 for information on the Cultural Resource Management Program.

Compliance activities:

- Develop internal management plans
- Conduct cultural resource surveys 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
- Conduct cultural resource surveys and monitor construction activities

Native American Graves Protection and Repatriation Act, enacted in 1990

The Native American Graves Protection and Repatriation Act (PL 101-601 1990) developed a systematic process for determining the rights of Indian tribe and Native Hawai'ian lineal descendants and their representative organizations to protect certain Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony with which they are affiliated.

See Chapter 2 for information on the Cultural Resource Management Program.

Compliance activities:

- Develop internal management plans
- Conduct cultural resource surveys and monitor construction activities
- Prepare documentation to support planning activities and decisions
- Review NEPA checklists to identify impacts on cultural resources

Reporting

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

DOE O 231.1B, Admin Change 1 *Environment, Safety and Health Reporting* (DOE O 231.1B, Admin Change 1 2012), 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.

Information on property clearance activities can be found in DOE O 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*.

Compliance activities:

- Produce an Annual Site Environmental Report
- Environmental program personnel report on environmental program activities, monitoring results, accidental releases, and waste management operations

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

DOE O 232.2A, Chg 1 (MinChg), Occurrence Reporting and Processing of Operations Information, *Occurrence Reporting and Processing of Operations Information* (DOE O 232.2A, Chg 1 (MinChg) 2017), 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 5.4.2 provides further information.	Compliance activities: • Track all environmental events

Quality Assurance

DOE O 414.1D Change 2 (LtdChg), Quality Assurance

DOE O 414.1D, Change 2 (LtdChg), *Quality Assurance* (DOE O 414.1D, Change 2 (LtdChg) 2020), is intended to achieve quality in all work and ensure that products and services meet or exceed customer requirements and expectations. 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.	Compliance activities: • Develop quality assurance plans, operating plans, and sampling plans for all Sandia locations • Provide a statement of work for contract laboratories for all Sandia locations • Participate in quality assurance audits of all contract laboratories that provides services for all Sandia locations

5.1.2 Chemical Inventory and Toxic Release Inventory Reporting

The chemical inventory report and the toxic release inventory report for SNL/TTR in 2022 are submitted to EPA and support compliance with EPCRA. The chemical inventory report documents toxic chemicals in use and all chemical purchases. Table 5-1 lists the EPCRA reporting requirements.

Table 5-1. SNL/TTR applicable EPCRA reporting requirements

Section	EPCRA Section Title	Description	Reporting Required in 2022
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

Section	EPCRA Section Title	Description	Reporting Required in 2022
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 and the Nevada State Fire Marshal and State Emergency Response Commission. In 2022, 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.

5.1.3 Nevada State Environmental Requirements

The State of Nevada administers most of the environmental requirements applicable to Sandia operations at SNL/TTR (Table 5-2).

Table 5-2. Applicable State of Nevada Administrative Code requirements

Chapter and Provisions
NAC-444, Sanitation
NAC- 444.570 to NAC- 444.7499, Solid Waste Disposal
NAC-444A, Programs for Recycling
NAC-444A.005 to NRS-444A.655, Programs for Recycling
NAC-445A, Water Controls
NAC-445A.228 to NAC-445A.263, Discharge Permits
NAC-445A.450 to NAC-445A. 6731, Public Water Systems
NAC-445A.9656 to NAC-445A.9706, Septic Tanks
NAC-445B, Air Controls
NAC-445B.001 to NAC-445B.3477, Air Pollution
NAC-445B.400 to NAC-445B.846, Emissions from Engines
NAC-477, State Fire Marshal
NAC-477.323, Permit to Store Hazardous Material
NAC-501, Administration and Enforcement of Wildlife Laws
NAC-503, Hunting, Fishing and Trapping; Miscellaneous Protective Measures
NAC-504, Wildlife Management and Propagation
NAC-527, Protection and Preservation of Timbered Lands, Trees and Flora
NAC-534, Underground Water and Wells
NAC-534.010 to NAC-534.500, Underground Water and Wells

Sources:
Nevada Administrative Code (Nevada Administrative Code n.d.)

5.2 Nevada Administrative Code Index (Nevada Administrative Code n.d.)Energy Equity and Environmental Justice

Making a difference in society, especially in overburdened and underserved communities, has been a key part of Sandia's commitment to deliver exceptional service in the national interest. Sandia's energy equity and environmental justice (EEEJ) efforts focus on (1) improving the health, safety, and resilience of communities and (2) addressing the threat of climate change. Three executive orders address environmental justice: EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, Section 1-1 (EO 12898 1994); EO 14008, *Tackling the Climate Crisis at Home and Abroad*, Section 219 (EO 14008 2021); and EO 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, Section 402 (EO 14057 2021).

In 2022, personnel began a strategic initiative to map Sandia's EEEJ capabilities; identify gaps and opportunities for future work; develop clear, cohesive, and comprehensive communications that detail capabilities; and provide recommendations to Sandia leadership regarding the future of EEEJ research and development. Information on EEEJ-related projects and activities will be gathered during 2023 as a part of this strategic initiative. In 2022, the EEEJ team hosted two internal EEEJ-focused workshops: *Energy Equity and Environmental Justice Workshop* and Implementing Energy Equity & Environmental Justice into Research and Development Workshop. More information can be found at Sandia Energy (Sandia n.d.).

5.3 Environmental Management System

The Environmental Management System is a continuing cycle of planning, implementing, evaluating, and improving processes to achieve environmental goals. This system 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.

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.

DOE O 436.1, *Departmental Sustainability* (DOE O 436.1 2011), provides requirements for managing sustainability practices. Sandia personnel implement this order through an ISO 14001-certified environmental management system. 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 2021, the Environmental Management System was recertified to ISO 14001:2015 (ISO 14001:2015 2015).

In January 2020, an Environmental Management System assessment was conducted to evaluate conformance with ISO 14001:2015 requirements at SNL/TTR.

The Environmental Management System 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 2022, hazardous materials, hazardous waste, radiological waste, release of explosives and combustion byproducts, and release of radionuclides were identified as significant aspects for SNL/TTR 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.

5.3.1 Site Sustainability Plan

Sandia prepares an annual site sustainability plan for all Sandia locations which identifies contributions toward meeting DOE sustainability goals and the broader sustainability program set forth in EO 14008, *Tackling the Climate Crisis at Home and Abroad* (EO 14008 2021). Sandia's most recent plan, *Fiscal Year 2023 Site Sustainability Plan* (Sandia, 2022b), describes the performance status for fiscal year 2022 of all primary Sandia locations, including SNL/TTR.

Table 5-3 presents performance status for selected key areas for all Sandia primary sites (except as noted). The data is from the DOE Sustainability Dashboard.

Table 5-3. Site sustainability plan performance status, 2022

DOE Goal/Sandia Objective	Sandia Performance Status in Fiscal Year 2022
Clean and Renewable Energy	
Increase consumption of clean and renewable electric energy.	Exceeded this goal. Used purchased renewable energy credits.
Greenhouse Gas Reduction	
Reduce Scope 1 and 2 greenhouse gas emissions.	Decreased the year-over-year Scope 1 and Scope 2 greenhouse gas emissions relative to fiscal year 2021.[a]
Organizational Resilience	
Implement climate adaptation and resilience measures.	Completed a vulnerability assessment and resilience plan.[a]
Acquisition and Procurement	
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring that all sustainability clauses are included as appropriate.	Completed modifications to the ecomedes tool, conducted user testing and feedback, and launched the tool. Provided subcontractors with a user's guide, training, and a video tutorial on the new reporting mechanism.
Sustainable Buildings	
Increase the number of owned buildings that are compliant with the *Guiding Principles for Sustainable Buildings* (Council on Environmental Quality 2020).	Improved the SNL design manual.
Energy Management	
Reduce energy use intensity (Btu per gross square foot) in goal-subject buildings.	Increased energy intensity by 4.9 percent relative to fiscal year 2021.[a]
Water Management	
Reduce potable water use intensity (gallons per gross square foot).	Decreased potable water intensity by 44.2 percent relative to fiscal year 2021. [a]

Guiding Principles = *Guiding Principles for Sustainable Federal Buildings* (Council on Environmental Quality 2020)
[a] = Performance status is specific to SNL/TTR. Other objectives were achieved Sandia-wide and, therefore, apply to SNL/TTR.

5.3.2 Sustainability Awards in 2022

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, Environmental Management System personnel select nominees from that year's Environmental Excellence Awards winners. In 2022, Sandia personnel submitted 14 nominations for the internal Environmental Excellence Awards, and of those, two were selected for the DOE Sustainability Awards. SNL/TTR personnel are encouraged to participate; no nominations were received for SNL/TTR in 2022.

5.3.3 Vulnerability Assessment and Resilience Plan

In fiscal year 2022, Sandia personnel completed a climate vulnerability assessment and resilience plan. The plan assessed anticipated changes in climate by the year 2050 and the climate hazards that would result from such changes (Table 5-4). The following hazards were projected to be "almost certain" with climate change at SNL/TTR: drought, heat wave, riverine flooding, increase in the mean number of days with a maximum temperature greater than or equal to 95°F, and increase in winter weather.

Table 5-4. Climate hazards and projected annual likelihood and frequencies at SNL/TTR

Regional Hazards Impacting the Site	Hazard Description	Current Hazard Likelihood	Projected Climate Change Effect	Projected Hazard Likelihood with Climate Change
Cold wave	A three-day period where the temperatures do not get above 32°F	Anticipated	No change	Anticipated
Strong wind	Wind gusts that are greater than or equal to 58 mph; this includes thunderstorm and non-thunderstorm winds	Anticipated	No change	Anticipated
Drought		Almost Certain	Increase	Almost certain
Wildfire	Wildfires where response is needed for fires greater than 100 acres	Extremely Unlikely	Increase	Unlikely
Heat wave	A three-day period where the average high is greater than or equal to 100°F	Likely	Increase	Almost certain
Precipitation	For arid locations, a one-inch day is 10 to 20 percent of annual rainfall	Anticipated	Increase	Likely
Riverine flooding	Streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow	Likely	Increase	Almost certain
Other	Mean number of days with a minimum temperature below 32°F	Almost certain	Decrease	Likely
Other	Mean number of days with a maximum temperature greater than or equal to 95°F	Almost certain	Increase	Almost certain
Winter weather		Almost certain	No change	Almost certain

The climate vulnerability assessment and resilience plan also assessed potential risks posed by the anticipated climate hazards and recommends solutions to increase resilience at SNL/TTR. Details on climate hazard risks by asset and infrastructure type at SNL/TTR can be found in Appendix C. Table 5-5 displays the resilience solution portfolio identified in the plan. These solutions are focused on addressing resilience planning gaps for extreme temperatures, increased precipitation and flooding, and increased winds.

Table 5-5. Resilience solutions portfolio for SNL/TTR

Solution	Hazards Addressed	Priority Rank (High, Medium, or Low)
Install high-efficiency redundant HVAC systems	Rise in temperature, drop in temperature	High
Inspect, repair, and replace roofs	Precipitation, strong winds	High
Change the grade of the area surrounding the generator building	Precipitation, flooding	High
Review road systems and flooding pathways	Flooding, rise in temperature, drop in temperature	Medium
Upgrade telecommunications and IT systems (install underground lines where feasible)	Drop in temperature, rise in temperature, strong winds	Low
Upgrade the electrical infrastructure	Drop in temperature, rise in temperature, strong winds	High

5.4 Environmental Performance

Environmental performance is measured for all Sandia locations 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.

Additionally, criteria for Sandia performance evaluation were set forth in the *Fiscal Year 2022 DOE/NNSA Strategic Performance Evaluation Measurement Plan (PEMP)* (DOE/NNSA/SFO 2023). Subsequently, the DOE National Nuclear Security Administration Sandia Field Office prepared the *FY2022 Performance Evaluation Summary* report (DOE/NNSA/SFO 2021b), assessing the management and operating contractor performance including environment, health, and safety for October 1, 2021, through September 30, 2022. 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. An overall rating of very good was received in for all Sandia locations in three remaining categories: Mission Execution: Nuclear Weapons, Mission Enablement, and Mission Leadership. Sandia received an overall rating of very good.

5.4.1 Audits, Appraisals, and Inspections in 2022

Sandia 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 the implementation of applicable policies, processes, or procedures; evaluations of corrective action validation assessments; and surveillances and walk-throughs. Self-assessments evaluate performance and compliance and identify deficiencies and opportunities for improvement as well as noteworthy practices and lessons learned. In 2022, there were two external audits: one related to hazardous waste and one related to a septic tank at SNL/TTR. (Table 5-6).

Table 5-6. Environmental-related external audits, assessments, inspections, and violations, 2022

Appraising Agency/Authority	Title/Description	Date	Summary
Nevada Division of Environmental Protection Bureau of Sustainable Management	Hazardous Waste inspection/records audit	5/4/2022	No findings
Nevada Division of Environmental Protection Bureau of Water Pollution Control	Verification inspection that 09-52 Septic Tank has never been used	10/6/2022	Verified, no findings

5.4.2 Occurrence Reporting in 2022

Under DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information* (DOE O 232.2A, Chg 1 (MinChg) 2017), *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 (DOE O 232.2A, Chg 1 (MinChg) 2017). For this Annual Site Environmental Report, the Occurrence Reporting and Processing System database was queried for 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 2022, one occurrence met the query criteria for reporting in the Annual Site Environmental Report. Table 5-7 presents this occurrence and also cross-references DOE O 232.2A reportable occurrences that were reportable to an outside agency, if applicable (DOE O 232.2A, Chg 1 (MinChg) 2017).

Table 5-7. Occurrence reports per DOE O 232.2A, 2022

Reporting Criteria	Month	Report Level	Report Number and Title	Also Reported to an Outside Agency
Group 9 - Noncompliance Notifications 9(1) Any written notification from an outside regulatory agency that a site/facility is considered to be in noncompliance with a schedule or requirement. See Section 3.8.2.	Inspection performed October 2021 Official Results received December 2021 Occurrence report filed January 2022	Informational	**NA--SS-SNL-NMSITE-2022-0001** Deficiencies Identified during the Nevada Department of Environmental Protection Inspection of the Tonopah Test Range Drinking Water System	Nevada Division of Environmental Protection

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."

5.5 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 5-8 lists permits and registrations in effect at SNL/TTR in 2022.

Table 5-8. Environmental permits, 2022

Permit Type	Permit Number	Issue Date	Expiration Date	Comments
Air Quality				
Class II Air Quality Operation Permit	• AP8733-0680.05 • FIN A0025, Air Case 10804 and 10805	July 23, 2021, issuance of revision October 20, 2021, renewal signed	July 23, 2026	• Welding operation • Carpenter area • Paint booth • Generators (five logged systems) • Surface area disturbance (less than five acres) • Portable Soil Sorting System
Hazardous Waste (Nevada State Fire Marshal)				
Hazardous Materials Permit	• FDID Number: 137 • Permit Number: 92964	February 28, 2022	February 28, 2023	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 30, 2022	September 30, 2023	State of Nevada
Production Well 6	NY-3014-12-NTNC[b]	September 30, 2022	September 30, 2023	State of Nevada
Water Conservation Plan	Reviewed and approved by Nevada Department of Conservation and Natural Resources, Division of Water Resources	February 17, 2021	February 17, 2026	State of Nevada Required by NRS540.131

[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

Chapter 6. Quality Assurance

Coyote (*Canis latrans*)

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 2015); DOE O 414.1D Change 2 (LtdChg), *Quality Assurance*, Attachment 1, "Contractor Requirements Document" (DOE O 414.1D, Change 2 (LtdChg) 2020); and 10 CFR 830, *Nuclear Safety Management*, Subpart A, "Quality Assurance Requirements" (10 CFR 830 2016)—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 for all Sandia locations. 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 on a calendar-year basis unless noted otherwise. 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 relinquished from field team members; they also 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 stationed in 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* (Sandia 2022). 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 *Sandia National Laboratories/New Mexico Sample Management Office Statement of Work for Analytical Laboratories* (Sandia 2020). 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.

Contract laboratories perform work in compliance with the *Sandia National Laboratories/New Mexico Sample Management Office Statement of Work for Analytical Laboratories* (Sandia 2020). 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 Institute, The 2009).

6.1.3 Quality Control for Samples

Project-specified quality control samples are submitted to contract laboratories in order 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 *Sandia National Laboratories/New Mexico Sample Management Office Statement of Work for Analytical Laboratories* (Sandia 2020). 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 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* (ISO 9001:2015 2015), and ISO 14001, *Environmental Management Systems* (ISO 14001:2015 2015).

6.2 Sample Management Office Activities

Sample Management Office activities in 2022 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 2022, Sample Management Office personnel processed 172 samples in support of the Terrestrial Surveillance Program. Of the 172 samples, 16 were submitted as field and analytical quality control samples to assist with data validation and decision-making.

During 2022, General Engineering Laboratories in Charleston, South Carolina, was employed to analyze soil samples, and 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 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 2021).

In 2022, DOECAP and/or the accrediting bodies conducted assessments at six contracted laboratories, including one that processed samples from SNL/TTR, 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 2022 in DOECAP assessment reports or other applicable DOE programs.

Appendix A. Terrestrial Surveillance Analytical Results in 2022

Wild horse (*Equus ferus*)

Table A-1. Radiological results in soil, 2022

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-20	Actinium-228	1.74	±0.243	0.093	0.0444		None	SA	HASL 300
	Americium-241	0.00694	±0.0583	0.117	0.0571	U	BD	SA	HASL 300
	Cesium-137	0.0907	±0.0297	0.0252	0.0121		None	SA	HASL 300
	Uranium-235	0.0674	±0.131	0.115	0.0565	U	BD	SA	HASL 300
	Uranium-238	0.895	±1.25	0.921	0.451	U	BD	SA	HASL 300
C-21	Actinium-228	1.31	±0.165	0.0687	0.0328		None	SA	HASL 300
	Americium-241	-0.0032	±0.0409	0.0723	0.0355	U	BD	SA	HASL 300
	Cesium-137	0.0905	±0.0227	0.0185	0.00891		None	SA	HASL 300
	Uranium-235	0.123	±0.101	0.102	0.0499		None	SA	HASL 300
	Uranium-238	1.58	±0.836	0.62	0.304		J	SA	HASL 300
C-22	Actinium-228	1.62	±0.195	0.0828	0.04		None	SA	HASL 300
	Americium-241	0.115	±0.0644	0.0361	0.0179	X	R	SA	HASL 300
	Cesium-137	0.0942	±0.0252	0.0224	0.0109		None	SA	HASL 300
	Uranium-235	0.0337	±0.138	0.107	0.0525	U	BD	SA	HASL 300
	Uranium-238	3.08	±0.96	0.354	0.175		None	SA	HASL 300
C-23	Actinium-228	1.47	±0.179	0.0812	0.039		None	SA	HASL 300
	Americium-241	0.0363	±0.0447	0.081	0.0398	U	BD	SA	HASL 300
	Cesium-137	0.128	±0.0279	0.0213	0.0103		None	SA	HASL 300
	Uranium-235	0.0362	±0.13	0.098	0.0482	U	BD	SA	HASL 300
	Uranium-238	0.702	±0.909	0.666	0.328	X	R	SA	HASL 300
C-24	Actinium-228	1.7	±0.219	0.107	0.0512		None	SA	HASL 300
	Americium-241	0.0233	±0.0256	0.0411	0.0202	U	BD	SA	HASL 300
	Cesium-137	0.179	±0.0369	0.0284	0.0137		None	SA	HASL 300
	Uranium-235	0.101	±0.151	0.13	0.0637	U	BD	SA	HASL 300
	Uranium-238	1.86	±0.703	0.414	0.204		None	SA	HASL 300
C-25	Actinium-228	2.17	±0.257	0.0858	0.0416		None	SA	HASL 300
	Americium-241	0.00653	±0.0705	0.129	0.0635	U	BD	SA	HASL 300
	Cesium-137	0.0218	±0.0222	0.0225	0.011	U	BD	SA	HASL 300
	Uranium-235	0.0658	±0.125	0.102	0.0501	U	BD	SA	HASL 300
	Uranium-238	1	±1.15	1	0.494	U	BD	SA	HASL 300

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-26	Actinium-228	1.73	±0.225	0.0889	0.0426		None	SA	HASL 300
	Americium-241	−0.0623	±0.0803	0.142	0.0697	U	BD	SA	HASL 300
	Cesium-137	0.226	±0.0348	0.0251	0.0121		None	SA	HASL 300
	Uranium-235	0.127	±0.153	0.126	0.062	X	R	SA	HASL 300
	Uranium-238	1.6	±1.56	1.11	0.544		J	SA	HASL 300
C-27	Actinium-228	1.76	±0.208	0.0766	0.0372		None	SA	HASL 300
	Americium-241	0.0139	±0.074	0.129	0.0631	U	BD	SA	HASL 300
	Cesium-137	0.105	±0.0245	0.0202	0.00982		None	SA	HASL 300
	Uranium-235	0.012	±0.116	0.12	0.059	U	BD	SA	HASL 300
	Uranium-238	1.68	±1.48	0.99	0.487		J	SA	HASL 300
C-28	Actinium-228	1.71	±0.21	0.0737	0.0354		None	SA	HASL 300
	Americium-241	−0.0259	±0.0666	0.122	0.06	U	BD	SA	HASL 300
	Cesium-137	0.0989	±0.0245	0.0199	0.00963		None	SA	HASL 300
	Uranium-235	0.012	±0.103	0.109	0.0537	U	BD	SA	HASL 300
	Uranium-238	0.969	±1.26	0.936	0.46	X	R	SA	HASL 300
C-29	Actinium-228	1.42	±0.18	0.0705	0.0343		None	SA	HASL 300
	Actinium-228	1.55	±0.195	0.0832	0.0401		None	DU	HASL 300
	Actinium-228	1.48	±0.189	0.0665	0.0324		None	DU	HASL 300
	Americium-241	−0.0145	±0.0696	0.115	0.0566	U	BD	SA	HASL 300
	Americium-241	0.0642	±0.11	0.175	0.0864	U	BD	DU	HASL 300
	Americium-241	0.0124	±0.0614	0.112	0.055	U	BD	DU	HASL 300
	Cesium-137	0.0502	±0.0174	0.0181	0.00883		J	SA	HASL 300
	Cesium-137	0.0445	±0.0261	0.0229	0.0111		J	DU	HASL 300
	Cesium-137	0.0424	±0.0152	0.0176	0.00858		J	DU	HASL 300
	Uranium-235	0.0699	±0.112	0.105	0.0519	U	BD	SA	HASL 300
	Uranium-235	0.0744	±0.0885	0.149	0.0736	U	BD	DU	HASL 300
	Uranium-235	0.0459	±0.111	0.106	0.052	U	BD	DU	HASL 300
	Uranium-238	1.29	±1.98	1.38	0.683	U	BD	DU	HASL 300
	Uranium-238	1.65	±1.2	0.895	0.441		J	SA	HASL 300
	Uranium-238	1.26	±1.16	0.882	0.435		J	DU	HASL 300
C-30	Actinium-228	1.35	±0.185	0.0964	0.0462		None	SA	HASL 300

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-30	Americium-241	0.0112	±0.0461	0.0914	0.0448	U	BD	SA	HASL 300
	Cesium-137	0.157	±0.0367	0.0233	0.0112		None	SA	HASL 300
	Uranium-235	0.054	±0.12	0.111	0.0545	U	BD	SA	HASL 300
	Uranium-238	1.08	±1.03	0.744	0.365		J	SA	HASL 300
C-31	Actinium-228	1.89	±0.219	0.0731	0.0353		None	SA	HASL 300
	Americium-241	-0.009	±0.0408	0.0642	0.0317	U	BD	SA	HASL 300
	Cesium-137	0.0382	±0.0235	0.0198	0.00959		J	SA	HASL 300
	Uranium-235	0.135	±0.104	0.108	0.0533		J	SA	HASL 300
	Uranium-238	1.76	±0.77	0.575	0.284		None	SA	HASL 300
C-32	Actinium-228	1.46	±0.2	0.0835	0.0403		None	SA	HASL 300
	Americium-241	0.00446	±0.0504	0.0935	0.0459	U	BD	SA	HASL 300
	Cesium-137	0.109	±0.0262	0.0211	0.0102		None	SA	HASL 300
	Uranium-235	0.0632	±0.119	0.0955	0.0469	U	BD	SA	HASL 300
	Uranium-238	1.87	±1.39	0.747	0.367		J	SA	HASL 300
C-33	Actinium-228	1.6	±0.185	0.0665	0.0321		None	SA	HASL 300
	Americium-241	0.0324	±0.0518	0.0498	0.0246	U	BD	SA	HASL 300
	Cesium-137	0.0523	±0.0186	0.019	0.00926		J	SA	HASL 300
	Uranium-235	0.185	±0.105	0.0926	0.0456	X	R	SA	HASL 300
	Uranium-238	0.743	±0.648	0.46	0.227		J	SA	HASL 300
P-06	Actinium-228	1.88	±0.22	0.0723	0.0349		None	SA	HASL 300
	Americium-241	0.101	±0.0886	0.0807	0.0398		J	SA	HASL 300
	Cesium-137	0.547	±0.053	0.0189	0.00914		None	SA	HASL 300
	Uranium-235	0.147	±0.111	0.108	0.0529		J	SA	HASL 300
	Uranium-238	1.81	±0.969	0.664	0.327		J	SA	HASL 300
P-08	Actinium-228	1.64	±0.201	0.0674	0.0326		None	SA	HASL 300
	Americium-241	−0.0086	±0.0391	0.076	0.0373	U	BD	SA	HASL 300
	Cesium-137	0.0737	±0.0194	0.0178	0.00865		None	SA	HASL 300
	Uranium-235	0.00521	±0.0635	0.101	0.0495	U	BD	SA	HASL 300
	Uranium-238	0.924	±0.931	0.632	0.311	X	R	SA	HASL 300
P-12	Actinium-228	2.03	±0.235	0.0713	0.0345		None	SA	HASL 300
	Actinium-228	1.99	±0.224	0.0966	0.0467		None	DU	HASL 300

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-12	Actinium-228	2.17	±0.259	0.105	0.0503		None	DU	HASL 300
	Americium-241	0.0456	±0.0545	0.0874	0.0431	U	BD	SA	HASL 300
	Americium-241	0.00616	±0.0256	0.0434	0.0215	U	BD	DU	HASL 300
	Americium-241	−0.0197	±0.0619	0.116	0.0568	U	BD	DU	HASL 300
	Cesium-137	0.138	±0.0271	0.0199	0.00967		None	SA	HASL 300
	Cesium-137	0.154	±0.032	0.025	0.0121		None	DU	HASL 300
	Cesium-137	0.158	±0.0332	0.028	0.0135		None	DU	HASL 300
	Uranium-235	0.0359	±0.107	0.109	0.0537	U	BD	SA	HASL 300
	Uranium-235	0.0854	±0.0953	0.154	0.0757	U	BD	DU	HASL 300
	Uranium-235	0.124	±0.157	0.122	0.0599	X	R	DU	HASL 300
	Uranium-238	1.41	±0.915	0.728	0.36		J	SA	HASL 300
	Uranium-238	1.61	±1.11	0.984	0.483		J	DU	HASL 300
	Uranium-238	1.89	±0.789	0.42	0.208		None	DU	HASL 300
P-34	Actinium-228	2.09	±0.245	0.086	0.0413		None	SA	HASL 300
	Americium-241	0.00566	±0.0544	0.0992	0.0487	U	BD	SA	HASL 300
	Cesium-137	0.187	±0.0308	0.0219	0.0106		None	SA	HASL 300
	Uranium-235	0.0463	±0.119	0.122	0.0597	U	BD	SA	HASL 300
	Uranium-238	1.43	±1.28	0.821	0.403		J	SA	HASL 300
P-35	Actinium-228	1.97	±0.237	0.0867	0.0416		None	SA	HASL 300
	Americium-241	0.00888	±0.0606	0.104	0.051	U	BD	SA	HASL 300
	Cesium-137	0.371	±0.0484	0.0257	0.0124		None	SA	HASL 300
	Uranium-235	0.0616	±0.146	0.124	0.0608	U	BD	SA	HASL 300
	Uranium-238	1.71	±1.28	0.863	0.425		J	SA	HASL 300
P-36	Actinium-228	1.66	±0.217	0.1	0.0482		None	SA	HASL 300
	Americium-241	−0.0162	±0.0977	0.179	0.0879	U	BD	SA	HASL 300
	Cesium-137	0.167	±0.0311	0.0263	0.0127		None	SA	HASL 300
	Uranium-235	0.0285	±0.122	0.152	0.0747	U	BD	SA	HASL 300
	Uranium-238	0.863	±1.37	1.36	0.666	U	BD	SA	HASL 300
P-37	Actinium-228	1.63	±0.249	0.118	0.0564		None	SA	HASL 300
	Americium-241	0.0158	±0.0204	0.0354	0.0174	U	BD	SA	HASL 300
	Cesium-137	0.0252	±0.0303	0.0325	0.0156	U	BD	SA	HASL 300

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-37	Uranium-235	0.0941	±0.142	0.114	0.056	U	BD	SA	HASL 300
	Uranium-238	1.11	±0.678	0.341	0.168		None	SA	HASL 300
S-02	Actinium-228	2.19	±0.269	0.113	0.054		None	SA	HASL 300
	Americium-241	0.0282	±0.028	0.0436	0.0215	U	BD	SA	HASL 300
	Cesium-137	0.199	±0.0376	0.0302	0.0145		None	SA	HASL 300
	Uranium-235	0.175	±0.16	0.13	0.0635		J	SA	HASL 300
	Uranium-238	1.26	±0.627	0.416	0.205		None	SA	HASL 300
S-03	Actinium-228	2.15	±0.239	0.0849	0.041		None	SA	HASL 300
	Actinium-228	2.15	±0.235	0.0668	0.0324		None	DU	HASL 300
	Actinium-228	2.27	±0.256	0.0877	0.0421		None	DU	HASL 300
	Americium-241	0.119	±0.0977	0.0837	0.0412		J	DU	HASL 300
	Americium-241	0.152	±0.142	0.109	0.0538		J	DU	HASL 300
	Americium-241	0.377	±0.0641	0.0384	0.019		None	SA	HASL 300
	Cesium-137	0.213	±0.0348	0.0243	0.0118		None	SA	HASL 300
	Cesium-137	0.203	±0.0265	0.0179	0.00874		None	DU	HASL 300
	Cesium-137	0.144	±0.0329	0.0252	0.0122		None	DU	HASL 300
	Uranium-235	0.00535	±0.0908	0.122	0.0602	U	BD	SA	HASL 300
	Uranium-235	0.0782	±0.136	0.129	0.0635	U	BD	DU	HASL 300
	Uranium-235	0.0982	±0.102	0.0857	0.0423	X	R	DU	HASL 300
	Uranium-238	1.47	±1.01	0.66	0.325		J	DU	HASL 300
	Uranium-238	1.62	±1.17	0.928	0.457		J	DU	HASL 300
	Uranium-238	2.17	±0.788	0.376	0.187		None	SA	HASL 300
S-04	Actinium-228	2.06	±0.243	0.102	0.0488		None	SA	HASL 300
	Americium-241	0.0337	±0.0992	0.165	0.081	U	BD	SA	HASL 300
	Cesium-137	0.244	±0.0389	0.0289	0.014		None	SA	HASL 300
	Uranium-235	0.145	±0.166	0.153	0.0751	U	BD	SA	HASL 300
	Uranium-238	1.7	±1.47	1.27	0.625		J	SA	HASL 300
S-10	Actinium-228	2.16	±0.251	0.101	0.0486		None	SA	HASL 300
	Americium-241	0.0957	±0.127	0.205	0.101	U	BD	SA	HASL 300
	Cesium-137	0.0498	±0.0285	0.027	0.013		J	SA	HASL 300
	Uranium-235	0.133	±0.184	0.155	0.0764	U	BD	SA	HASL 300

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-10	Uranium-238	0.412	±1.85	1.59	0.784	U	BD	SA	HASL 300
S-38	Actinium-228	1.95	±0.23	0.0907	0.0434		None	SA	HASL 300
	Americium-241	0.0484	±0.0626	0.103	0.0506	U	BD	SA	HASL 300
	Cesium-137	0.209	±0.0353	0.0246	0.0119		None	SA	HASL 300
	Uranium-235	0.0816	±0.144	0.127	0.0625	U	BD	SA	HASL 300
	Uranium-238	2.41	±1.55	0.826	0.406		J	SA	HASL 300
S-39	Actinium-228	2.23	±0.251	0.0686	0.0328		None	SA	HASL 300
	Americium-241	0.167	±0.135	0.0899	0.0443		J	SA	HASL 300
	Cesium-137	0.234	±0.0301	0.0209	0.0101		None	SA	HASL 300
	Uranium-235	0.132	±0.132	0.122	0.0598	X	R	SA	HASL 300
	Uranium-238	1.43	±1.12	0.766	0.377		J	SA	HASL 300
S-40	Actinium-228	1.95	±0.248	0.0824	0.0393		None	SA	HASL 300
	Americium-241	−0.0048	±0.0903	0.159	0.0777	U	BD	SA	HASL 300
	Cesium-137	0.0698	±0.0229	0.0228	0.0109		None	SA	HASL 300
	Uranium-235	0.0876	±0.157	0.143	0.07	U	BD	SA	HASL 300
	Uranium-238	0.794	±1.43	1.22	0.599	U	BD	SA	HASL 300
S-42	Actinium-228	1.88	±0.238	0.0914	0.0438		None	SA	HASL 300
	Americium-241	0.0126	±0.0877	0.15	0.0734	U	BD	SA	HASL 300
	Cesium-137	0.202	±0.0327	0.0253	0.0122		None	SA	HASL 300
	Uranium-235	0.0892	±0.163	0.143	0.07	U	BD	SA	HASL 300
	Uranium-238	1.75	±1.58	1.19	0.582		J	SA	HASL 300
S-43	Actinium-228	1.77	±0.254	0.119	0.0563		None	SA	HASL 300
	Americium-241	0.0381	±0.0631	0.121	0.0589	U	BD	SA	HASL 300
	Cesium-137	0.0428	±0.0385	0.0319	0.0153		J	SA	HASL 300
	Uranium-235	0.195	±0.176	0.154	0.0752	X	R	SA	HASL 300
	Uranium-238	1.58	±1.2	0.978	0.479		J	SA	HASL 300
S-44	Actinium-228	2.08	±0.248	0.0755	0.0368		None	SA	HASL 300
	Americium-241	−0.044	±0.0628	0.115	0.0565	U	BD	SA	HASL 300
	Cesium-137	0.00887	±0.0178	0.0203	0.00994	U	BD	SA	HASL 300
	Uranium-235	−0.0331	±0.0636	0.0954	0.0471	U	BD	SA	HASL 300
	Uranium-238	1.23	±1.04	0.898	0.443		J	SA	HASL 300

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-45	Actinium-228	1.91	±0.239	0.0903	0.0431		None	SA	HASL 300
	Americium-241	0.0124	±0.111	0.175	0.0857	U	BD	SA	HASL 300
	Cesium-137	0.0143	±0.0161	0.0272	0.0131	U	BD	SA	HASL 300
	Uranium-235	0.0173	±0.132	0.143	0.0703	U	BD	SA	HASL 300
	Uranium-238	1.15	±1.78	1.32	0.647	U	BD	SA	HASL 300
S-46	Actinium-228	1.86	±0.253	0.11	0.053		None	SA	HASL 300
	Americium-241	−0.0176	±0.0866	0.165	0.081	U	BD	SA	HASL 300
	Cesium-137	0.0219	±0.0228	0.0284	0.0137	U	BD	SA	HASL 300
	Uranium-235	0.0698	±0.136	0.134	0.0658	U	BD	SA	HASL 300
	Uranium-238	1.06	±1.46	1.23	0.604	U	BD	SA	HASL 300
S-47	Actinium-228	1.74	±0.223	0.0853	0.0407		None	SA	HASL 300
	Americium-241	−0.0048	±0.0767	0.147	0.0719	U	BD	SA	HASL 300
	Cesium-137	0.108	±0.0274	0.0242	0.0116		None	SA	HASL 300
	Uranium-235	0.125	±0.154	0.13	0.0639	U	BD	SA	HASL 300
	Uranium-238	0.896	±1.55	1.13	0.552	U	BD	SA	HASL 300
S-49	Actinium-228	2.02	±0.253	0.0878	0.042		None	SA	HASL 300
	Actinium-228	1.9	±0.233	0.0895	0.0428		None	DU	HASL 300
	Actinium-228	1.94	±0.235	0.0861	0.041		None	DU	HASL 300
	Americium-241	0.0823	±0.0912	0.101	0.0495	U	BD	DU	HASL 300
	Americium-241	0.148	±0.114	0.0923	0.0452		J	DU	HASL 300
	Americium-241	1.04	±0.168	0.0724	0.0357		None	SA	HASL 300
	Cesium-137	0.187	±0.0351	0.026	0.0126		None	SA	HASL 300
	Cesium-137	0.18	±0.0302	0.024	0.0115		None	DU	HASL 300
	Cesium-137	0.179	±0.0392	0.0243	0.0117		None	DU	HASL 300
	Uranium-235	0.131	±0.148	0.142	0.0697	U	BD	SA	HASL 300
	Uranium-235	0.0823	±0.107	0.127	0.062	U	BD	DU	HASL 300
	Uranium-235	0.184	±0.155	0.133	0.0652		J	DU	HASL 300
	Uranium-238	1.03	±0.773	0.665	0.328		J	SA	HASL 300
	Uranium-238	1.64	±1.09	0.872	0.429		J	DU	HASL 300
	Uranium-238	1.59	±1.03	0.78	0.383		J	DU	HASL 300
S-50	Actinium-228	2.07	±0.249	0.0862	0.0417		None	SA	HASL 300

Location	Analyte	Activity (pCi/g)	Total Propagated Uncertainty (pCi/g)	Minimum Detectable Activity (pCi/g)	Critical Level (pCi/g)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-50	Americium-241	−0.0013	±0.0775	0.144	0.0708	U	BD	SA	HASL 300
	Cesium-137	0.309	±0.0446	0.0228	0.0111		None	SA	HASL 300
	Uranium-235	0.0542	±0.127	0.134	0.0657	U	BD	SA	HASL 300
	Uranium-238	0.335	±1.31	1.13	0.552	U	BD	SA	HASL 300
S-52	Actinium-228	1.98	±0.261	0.0912	0.0436		None	SA	HASL 300
	Americium-241	0.0802	±0.144	0.148	0.073	U	BD	SA	HASL 300
	Cesium-137	0.231	±0.0387	0.0269	0.013		None	SA	HASL 300
	Uranium-235	0.0686	±0.167	0.15	0.0738	U	BD	SA	HASL 300
	Uranium-238	1.19	±1.64	1.18	0.579	X	R	SA	HASL 300
S-53	Actinium-228	1.8	±0.251	0.11	0.0522		None	SA	HASL 300
	Americium-241	−0.0492	±0.107	0.175	0.0857	U	BD	SA	HASL 300
	Cesium-137	0.00811	±0.0203	0.0321	0.0154	U	BD	SA	HASL 300
	Uranium-235	0.103	±0.171	0.169	0.0829	U	BD	SA	HASL 300
	Uranium-238	1.48	±2.01	1.41	0.692	X	R	SA	HASL 300

[a] Blank cells indicate that the laboratory did not qualify the data.

Laboratory Data Qualifier
U = The analyte was absent or below the method detection limit.
X = The data was rejected due to the peak not meeting identification criteria.

Data Validation Qualifier
BD = The associated value was below the detection limit as used in radiochemistry to identify results that are not statistically different from zero.
J = The associated numerical value was an estimated quantity.
None = There was no data validation assigned.
R = The data are unusable and rejected (compound may or may not be present).

Sample Type
DU = duplicate sample
SA = sample

Analytical Method
HASL 300 (DOE 1997)

Table A-2. Environmental dosimeter measurements, 2022

Location Number	First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)
C-19	47.1	11.1	41.7	9.6	44.8	12.4	56.8	15.3
C-21	59	23	50	17.9	50.8	18.4	72.7	31.1
C-22	57.3	21.3	50.4	18.3	52.8	20.4	73.9	32.3
P-05	58.6	22.7	53.1	20.9	56.2	23.8	67	25.4
P-06	60	24.1	47.9	15.8	54.3	21.9	70.7	29.1
P-07	61.2	25.3	49.1	17	53.7	21.3	70.3	28.7
P-08	56.2	20.2	47.5	15.4	51.2	18.8	66.4	24.8
P-11	58.8	22.9	50.3	18.1	56.1	23.7	71.5	30
P-12	64.8	28.8	48.4	16.3	55.1	22.7	75.6	34
S-01	61	25	50	17.9	56.5	24.1	72.3	30.7
S-02	57.5	21.5	51.8	19.7	54.8	22.4	77.9	36.3
S-03	60.5	24.5	52.1	20	56.4	24	76.9	35.4
S-04	61.6	25.6	54.4	22.3	57.9	25.5	76.3	34.7
S-09	57.2	21.2	47	14.9	50.7	18.3	66.5	25
S-10	63.5	27.5	48.9	16.8	55.1	22.7	78.2	36.6
S-13	56.9	20.9	49.6	17.5	49.2	16.8	81.9	40.3
S-14	56	20	47.8	15.7	52.3	19.9	64.5	22.9
S-15	60.2	24.2	48.3	16.2	59	26.6	72	30.4
S-16	61	25	49.3	17.2	58.1	25.7	68.5	26.9
S-17	53.6	17.6	46.8	14.7	44	11.6	70.6	29

Table A-3. Nonradiological results in soil, 2022

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-20	Aluminum	10600	38	83.6		J	SA	SW-846 3050B/6020B
	Antimony	0.284	0.284	1.72	U	None	SA	SW-846 3050B/6010D
	Arsenic	2.88	0.283	0.836		None	SA	SW-846 3050B/6020B
	Beryllium	0.461	0.0167	0.0836		None	SA	SW-846 3050B/6020B
	Cadmium	0.131	0.0167	0.167	J	None	SA	SW-846 3050B/6020B
	Chromium	5.44	0.167	0.502		None	SA	SW-846 3050B/6020B
	Copper	5.54	0.0552	0.334	*	J	SA	SW-846 3050B/6020B
	Iron	9930	55.2	167		J	SA	SW-846 3050B/6020B
	Lead	9.46	0.0836	0.334		None	SA	SW-846 3050B/6020B
	Magnesium	3040	1.67	5.02		None	SA	SW-846 3050B/6020B
	Nickel	4.04	0.0836	0.334		None	SA	SW-846 3050B/6020B
	Selenium	0.82	0.301	0.836	J	None	SA	SW-846 3050B/6020B
	Silver	0.148	0.0861	0.43	J	None	SA	SW-846 3050B/6010D
	Thallium	0.142	0.117	0.334	J	None	SA	SW-846 3050B/6020B
	Uranium	0.732	0.011	0.0334		None	SA	SW-846 3050B/6020B
	Zinc	43.1	0.669	3.34		J	SA	SW-846 3050B/6020B
C-21	Aluminum	7560	4.14	9.11		J	SA	SW-846 3050B/6020B
	Antimony	1.38	0.314	1.9	JB	1.90U	SA	SW-846 3050B/6010D
	Arsenic	5.91	0.308	0.911		None	SA	SW-846 3050B/6020B
	Beryllium	0.317	0.0182	0.0911		None	SA	SW-846 3050B/6020B
	Cadmium	0.0982	0.0182	0.182	J	None	SA	SW-846 3050B/6020B
	Chromium	5.2	0.182	0.546		None	SA	SW-846 3050B/6020B
	Copper	7.17	0.0601	0.364	*	J	SA	SW-846 3050B/6020B
	Iron	8010	6.01	18.2		J	SA	SW-846 3050B/6020B
	Lead	13.8	0.0911	0.364		None	SA	SW-846 3050B/6020B
	Magnesium	3890	1.82	5.46		None	SA	SW-846 3050B/6020B
	Nickel	3.74	0.0911	0.364		None	SA	SW-846 3050B/6020B
	Selenium	0.807	0.328	0.911	J	None	SA	SW-846 3050B/6020B
	Silver	1.09	0.0951	0.475		None	SA	SW-846 3050B/6010D
	Thallium	0.128	0.128	0.364	U	None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-21	Uranium	0.817	0.012	0.0364		None	SA	SW-846 3050B/6020B
	Zinc	36.1	0.729	3.64		J	SA	SW-846 3050B/6020B
C-22	Aluminum	10400	42.5	93.5		J	SA	SW-846 3050B/6020B
	Antimony	0.534	0.294	1.78	JB	1.78U	SA	SW-846 3050B/6010D
	Arsenic	5	0.316	0.935		None	SA	SW-846 3050B/6020B
	Beryllium	0.504	0.0187	0.0935		None	SA	SW-846 3050B/6020B
	Cadmium	0.194	0.0187	0.187		None	SA	SW-846 3050B/6020B
	Chromium	5.25	0.187	0.561		None	SA	SW-846 3050B/6020B
	Copper	6.6	0.0617	0.374	*	J	SA	SW-846 3050B/6020B
	Iron	10300	61.7	187		J	SA	SW-846 3050B/6020B
	Lead	14.1	0.0935	0.374		None	SA	SW-846 3050B/6020B
	Magnesium	4120	1.87	5.61		None	SA	SW-846 3050B/6020B
	Nickel	4.91	0.0935	0.374		None	SA	SW-846 3050B/6020B
	Selenium	0.99	0.336	0.935		None	SA	SW-846 3050B/6020B
	Silver	0.141	0.089	0.445	J	None	SA	SW-846 3050B/6010D
	Thallium	0.133	0.131	0.374	J	None	SA	SW-846 3050B/6020B
	Uranium	0.548	0.0123	0.0374		None	SA	SW-846 3050B/6020B
	Zinc	39.1	0.748	3.74		J	SA	SW-846 3050B/6020B
C-23	Aluminum	8920	4.45	9.78		J	SA	SW-846 3050B/6020B
	Antimony	0.365	0.316	1.92	JB	1.92U	SA	SW-846 3050B/6010D
	Arsenic	4.5	0.331	0.978		None	SA	SW-846 3050B/6020B
	Beryllium	0.377	0.0196	0.0978		None	SA	SW-846 3050B/6020B
	Cadmium	0.148	0.0196	0.196	J	None	SA	SW-846 3050B/6020B
	Chromium	4.62	0.196	0.587		None	SA	SW-846 3050B/6020B
	Copper	8.4	0.0646	0.391	*	J	SA	SW-846 3050B/6020B
	Iron	9100	6.46	19.6		J	SA	SW-846 3050B/6020B
	Lead	13.6	0.0978	0.391		None	SA	SW-846 3050B/6020B
	Magnesium	3570	1.96	5.87		None	SA	SW-846 3050B/6020B
	Nickel	4.77	0.0978	0.391		None	SA	SW-846 3050B/6020B
	Selenium	0.589	0.352	0.978	J	None	SA	SW-846 3050B/6020B
	Silver	0.134	0.0958	0.479	J	None	SA	SW-846 3050B/6010D

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-23	Thallium	0.137	0.137	0.391	U	None	SA	SW-846 3050B/6020B
	Uranium	0.552	0.0129	0.0391		None	SA	SW-846 3050B/6020B
	Zinc	34.3	0.783	3.91		J	SA	SW-846 3050B/6020B
C-24	Aluminum	16700	43.1	94.7		J	SA	SW-846 3050B/6020B
	Antimony	0.806	0.315	1.91	JB	1.91U	SA	SW-846 3050B/6010D
	Arsenic	13.8	0.32	0.947		None	SA	SW-846 3050B/6020B
	Beryllium	0.723	0.0189	0.0947		None	SA	SW-846 3050B/6020B
	Cadmium	0.535	0.0189	0.189		J-	SA	SW-846 3050B/6020B
	Chromium	9.76	0.189	0.568		None	SA	SW-846 3050B/6020B
	Copper	13	0.0625	0.379	*	J	SA	SW-846 3050B/6020B
	Iron	14900	62.5	189		J	SA	SW-846 3050B/6020B
	Lead	25.4	0.0947	0.379		None	SA	SW-846 3050B/6020B
	Magnesium	6930	1.89	5.68		None	SA	SW-846 3050B/6020B
	Nickel	9.68	0.0947	0.379		None	SA	SW-846 3050B/6020B
	Selenium	0.933	0.341	0.947	J	None	SA	SW-846 3050B/6020B
	Silver	0.981	0.0954	0.477		None	SA	SW-846 3050B/6010D
	Thallium	0.335	0.133	0.379	J	None	SA	SW-846 3050B/6020B
	Uranium	0.998	0.0125	0.0379		None	SA	SW-846 3050B/6020B
	Zinc	46.9	0.758	3.79		J	SA	SW-846 3050B/6020B
C-25	Aluminum	14000	43.3	95.1		J	SA	SW-846 3050B/6020B
	Antimony	0.316	0.316	1.92	U	None	SA	SW-846 3050B/6010D
	Arsenic	7.99	0.321	0.951		None	SA	SW-846 3050B/6020B
	Beryllium	0.805	0.019	0.0951		None	SA	SW-846 3050B/6020B
	Cadmium	0.0983	0.019	0.19	J	None	SA	SW-846 3050B/6020B
	Chromium	6.92	0.19	0.57		None	SA	SW-846 3050B/6020B
	Copper	8.46	0.0627	0.38	*	J	SA	SW-846 3050B/6020B
	Iron	12900	62.7	190		J	SA	SW-846 3050B/6020B
	Lead	12.5	0.0951	0.38		None	SA	SW-846 3050B/6020B
	Magnesium	5270	1.9	5.7		None	SA	SW-846 3050B/6020B
	Nickel	6.2	0.0951	0.38		None	SA	SW-846 3050B/6020B
	Selenium	0.839	0.342	0.951	J	None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-25	Silver	0.108	0.0958	0.479	J	None	SA	SW-846 3050B/6010D
	Thallium	0.14	0.133	0.38	J	None	SA	SW-846 3050B/6020B
	Uranium	1.3	0.0125	0.038		None	SA	SW-846 3050B/6020B
	Zinc	41.2	0.76	3.8		J	SA	SW-846 3050B/6020B
C-26	Aluminum	12100	40.1	88.2		J	SA	SW-846 3050B/6020B
	Antimony	0.58	0.298	1.81	JB	1.81U	SA	SW-846 3050B/6010D
	Arsenic	5.52	0.298	0.882		None	SA	SW-846 3050B/6020B
	Beryllium	0.501	0.0176	0.0882		None	SA	SW-846 3050B/6020B
	Cadmium	0.251	0.0176	0.176		None	SA	SW-846 3050B/6020B
	Chromium	6.63	0.176	0.529		None	SA	SW-846 3050B/6020B
	Copper	11.2	0.0582	0.353	*	J	SA	SW-846 3050B/6020B
	Iron	10100	58.2	176		J	SA	SW-846 3050B/6020B
	Lead	9.98	0.0882	0.353		None	SA	SW-846 3050B/6020B
	Magnesium	5320	1.76	5.29		None	SA	SW-846 3050B/6020B
	Nickel	5.97	0.0882	0.353		None	SA	SW-846 3050B/6020B
	Selenium	0.819	0.317	0.882	J	None	SA	SW-846 3050B/6020B
	Silver	0.358	0.0903	0.451	J	None	SA	SW-846 3050B/6010D
	Thallium	0.146	0.123	0.353	J	None	SA	SW-846 3050B/6020B
	Uranium	0.795	0.0116	0.0353		None	SA	SW-846 3050B/6020B
	Zinc	31.6	0.705	3.53		J	SA	SW-846 3050B/6020B
C-27	Aluminum	17700	41	90.1		J	SA	SW-846 3050B/6020B
	Antimony	0.72	0.296	1.8	JB	1.80U	SA	SW-846 3050B/6010D
	Arsenic	7.47	0.305	0.901		None	SA	SW-846 3050B/6020B
	Beryllium	0.68	0.018	0.0901		None	SA	SW-846 3050B/6020B
	Cadmium	0.25	0.018	0.18		None	SA	SW-846 3050B/6020B
	Chromium	12.2	0.18	0.541		None	SA	SW-846 3050B/6020B
	Copper	11.2	0.0595	0.36	*	J	SA	SW-846 3050B/6020B
	Iron	14700	59.5	180		J	SA	SW-846 3050B/6020B
	Lead	11.9	0.0901	0.36		None	SA	SW-846 3050B/6020B
	Magnesium	6230	1.8	5.41		None	SA	SW-846 3050B/6020B
	Nickel	7.94	0.0901	0.36		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-27	Selenium	0.955	0.324	0.901		None	SA	SW-846 3050B/6020B
	Silver	0.228	0.0898	0.449	J	None	SA	SW-846 3050B/6010D
	Thallium	0.188	0.126	0.36	J	None	SA	SW-846 3050B/6020B
	Uranium	0.872	0.0119	0.036		None	SA	SW-846 3050B/6020B
	Zinc	41.8	0.721	3.6		J	SA	SW-846 3050B/6020B
C-28	Aluminum	12900	45.2	99.4		J	SA	SW-846 3050B/6020B
	Antimony	0.419	0.288	1.75	JB	1.75U	SA	SW-846 3050B/6010D
	Arsenic	2.77	0.336	0.994		None	SA	SW-846 3050B/6020B
	Beryllium	0.558	0.0199	0.0994		None	SA	SW-846 3050B/6020B
	Cadmium	0.105	0.0199	0.199	J	None	SA	SW-846 3050B/6020B
	Chromium	6.67	0.199	0.596		None	SA	SW-846 3050B/6020B
	Copper	5.93	0.0656	0.398	*	J	SA	SW-846 3050B/6020B
	Iron	11500	65.6	199		J	SA	SW-846 3050B/6020B
	Lead	11.1	0.0994	0.398		None	SA	SW-846 3050B/6020B
	Magnesium	3740	1.99	5.96		None	SA	SW-846 3050B/6020B
	Nickel	4.92	0.0994	0.398		None	SA	SW-846 3050B/6020B
	Selenium	0.714	0.358	0.994	J	None	SA	SW-846 3050B/6020B
	Silver	0.108	0.0874	0.437	J	None	SA	SW-846 3050B/6010D
	Thallium	0.142	0.139	0.398	J	None	SA	SW-846 3050B/6020B
	Uranium	0.685	0.0131	0.0398		None	SA	SW-846 3050B/6020B
	Zinc	31.8	0.795	3.98		J	SA	SW-846 3050B/6020B
C-29	Aluminum	10600	42.8	94		J	SA	SW-846 3050B/6020B
	Aluminum	9970	43.3	95.1		J	DU	SW-846 3050B/6020B
	Aluminum	9100	39.2	86.1		J	DU	SW-846 3050B/6020B
	Antimony	2.65	0.281	1.7	B	J+	SA	SW-846 3050B/6010D
	Antimony	3.74	0.316	1.92	B	J+	DU	SW-846 3050B/6010D
	Antimony	3.38	0.289	1.75	B	J+	DU	SW-846 3050B/6010D
	Arsenic	13.4	0.318	0.94		None	SA	SW-846 3050B/6020B
	Arsenic	11.2	0.321	0.951		None	DU	SW-846 3050B/6020B
	Arsenic	15.2	0.291	0.861		None	DU	SW-846 3050B/6020B
	Beryllium	0.69	0.0188	0.094		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-29	Beryllium	0.676	0.019	0.0951		None	DU	SW-846 3050B/6020B
	Beryllium	0.647	0.0172	0.0861		None	DU	SW-846 3050B/6020B
	Cadmium	1.49	0.0188	0.188		J-	SA	SW-846 3050B/6020B
	Cadmium	0.756	0.019	0.19		J-	DU	SW-846 3050B/6020B
	Cadmium	0.739	0.0172	0.172		J-	DU	SW-846 3050B/6020B
	Chromium	8.97	0.188	0.564		None	SA	SW-846 3050B/6020B
	Chromium	8.16	0.19	0.57		None	DU	SW-846 3050B/6020B
	Chromium	8.17	0.172	0.516		None	DU	SW-846 3050B/6020B
	Copper	12.6	0.062	0.376	*	J	SA	SW-846 3050B/6020B
	Copper	11.9	0.0627	0.38	*	J	DU	SW-846 3050B/6020B
	Copper	14.2	0.0568	0.344	*	J	DU	SW-846 3050B/6020B
	Iron	11100	62	188		J	SA	SW-846 3050B/6020B
	Iron	10600	62.7	190		J	DU	SW-846 3050B/6020B
	Iron	10800	56.8	172		J	DU	SW-846 3050B/6020B
	Lead	16.7	0.094	0.376		None	SA	SW-846 3050B/6020B
	Lead	13.5	0.0951	0.38		None	DU	SW-846 3050B/6020B
	Lead	14.2	0.0861	0.344		None	DU	SW-846 3050B/6020B
	Magnesium	10900	18.8	56.4		None	SA	SW-846 3050B/6020B
	Magnesium	8950	1.9	5.7		None	DU	SW-846 3050B/6020B
	Magnesium	8090	1.72	5.16		None	DU	SW-846 3050B/6020B
	Nickel	17.8	0.094	0.376		None	SA	SW-846 3050B/6020B
	Nickel	15.8	0.0951	0.38		None	DU	SW-846 3050B/6020B
	Nickel	19.8	0.0861	0.344		None	DU	SW-846 3050B/6020B
	Selenium	1.34	0.338	0.94		None	SA	SW-846 3050B/6020B
	Selenium	1.17	0.342	0.951		None	DU	SW-846 3050B/6020B
	Selenium	1.53	0.31	0.861		None	DU	SW-846 3050B/6020B
	Silver	0.085	0.085	0.425	U	None	SA	SW-846 3050B/6010D
	Silver	0.0958	0.0958	0.479	U	None	DU	SW-846 3050B/6010D
	Silver	0.439	0.439	2.19	U	None	DU	SW-846 3050B/6010D
	Thallium	0.418	0.132	0.376		None	SA	SW-846 3050B/6020B
	Thallium	0.313	0.133	0.38	J	None	DU	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-29	Thallium	0.318	0.12	0.344	J	None	DU	SW-846 3050B/6020B
	Uranium	1.03	0.0124	0.0376		None	SA	SW-846 3050B/6020B
	Uranium	0.96	0.0125	0.038		None	DU	SW-846 3050B/6020B
	Uranium	1.02	0.0114	0.0344		None	DU	SW-846 3050B/6020B
	Zinc	74.1	0.752	3.76		J	SA	SW-846 3050B/6020B
	Zinc	61.6	0.76	3.8		J	DU	SW-846 3050B/6020B
	Zinc	77.8	0.688	3.44		J	DU	SW-846 3050B/6020B
C-30	Aluminum	9040	39.4	86.7		J	SA	SW-846 3050B/6020B
	Antimony	0.56	0.32	1.94	JB	1.94U	SA	SW-846 3050B/6010D
	Arsenic	4.22	0.293	0.867		None	SA	SW-846 3050B/6020B
	Beryllium	0.297	0.0173	0.0867		None	SA	SW-846 3050B/6020B
	Cadmium	0.143	0.0173	0.173	J	J-	SA	SW-846 3050B/6020B
	Chromium	4.52	0.173	0.52		None	SA	SW-846 3050B/6020B
	Copper	3.79	0.0572	0.347	*	J+	SA	SW-846 3050B/6020B
	Iron	8530	57.2	173		J	SA	SW-846 3050B/6020B
	Lead	9.2	0.0867	0.347		None	SA	SW-846 3050B/6020B
	Magnesium	3760	1.73	5.2		None	SA	SW-846 3050B/6020B
	Nickel	3.54	0.0867	0.347		None	SA	SW-846 3050B/6020B
	Selenium	0.933	0.312	0.867		None	SA	SW-846 3050B/6020B
	Silver	0.0971	0.0971	0.485	U	None	SA	SW-846 3050B/6010D
	Thallium	0.121	0.121	0.347	U	None	SA	SW-846 3050B/6020B
	Uranium	0.745	0.0114	0.0347		None	SA	SW-846 3050B/6020B
	Zinc	20.8	0.693	3.47		J	SA	SW-846 3050B/6020B
C-31	Aluminum	14700	42.9	94.3		J	SA	SW-846 3050B/6020B
	Antimony	0.295	0.295	1.79	U	None	SA	SW-846 3050B/6010D
	Arsenic	8.03	0.319	0.943		None	SA	SW-846 3050B/6020B
	Beryllium	0.628	0.0189	0.0943		None	SA	SW-846 3050B/6020B
	Cadmium	0.132	0.0189	0.189	J	None	SA	SW-846 3050B/6020B
	Chromium	6.1	0.189	0.566		None	SA	SW-846 3050B/6020B
	Copper	6.51	0.0623	0.377	*	J	SA	SW-846 3050B/6020B
	Iron	10700	62.3	189		J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-31	Lead	7.24	0.0943	0.377		None	SA	SW-846 3050B/6020B
	Magnesium	3840	1.89	5.66		None	SA	SW-846 3050B/6020B
	Nickel	4.69	0.0943	0.377		None	SA	SW-846 3050B/6020B
	Selenium	0.907	0.34	0.943	J	None	SA	SW-846 3050B/6020B
	Silver	0.0894	0.0894	0.447	U	None	SA	SW-846 3050B/6010D
	Thallium	0.176	0.132	0.377	J	None	SA	SW-846 3050B/6020B
	Uranium	1.13	0.0125	0.0377		None	SA	SW-846 3050B/6020B
	Zinc	32.6	0.755	3.77		J	SA	SW-846 3050B/6020B
C-32	Aluminum	10200	43.7	96		J	SA	SW-846 3050B/6020B
	Antimony	0.313	0.313	1.9	U	None	SA	SW-846 3050B/6010D
	Arsenic	2.49	0.324	0.96		None	SA	SW-846 3050B/6020B
	Beryllium	0.42	0.0192	0.096		None	SA	SW-846 3050B/6020B
	Cadmium	0.113	0.0192	0.192	J	None	SA	SW-846 3050B/6020B
	Chromium	4.14	0.192	0.576		None	SA	SW-846 3050B/6020B
	Copper	4.45	0.0633	0.384	*	J	SA	SW-846 3050B/6020B
	Iron	8160	6.33	19.2		J	SA	SW-846 3050B/6020B
	Lead	6.33	0.096	0.384		None	SA	SW-846 3050B/6020B
	Magnesium	3020	1.92	5.76		None	SA	SW-846 3050B/6020B
	Nickel	3.1	0.096	0.384		None	SA	SW-846 3050B/6020B
	Selenium	0.741	0.345	0.96	J	None	SA	SW-846 3050B/6020B
	Silver	0.0949	0.0949	0.474	U	None	SA	SW-846 3050B/6010D
	Thallium	0.134	0.134	0.384	U	None	SA	SW-846 3050B/6020B
	Uranium	0.619	0.0127	0.0384		None	SA	SW-846 3050B/6020B
	Zinc	21.9	0.768	3.84		J	SA	SW-846 3050B/6020B
C-33	Aluminum	9910	43.3	95.1		J	SA	SW-846 3050B/6020B
	Antimony	0.292	0.292	1.77	U	None	SA	SW-846 3050B/6010D
	Arsenic	2.67	0.321	0.951		None	SA	SW-846 3050B/6020B
	Beryllium	0.402	0.019	0.0951		None	SA	SW-846 3050B/6020B
	Cadmium	0.0494	0.019	0.19	J	None	SA	SW-846 3050B/6020B
	Chromium	5.56	0.19	0.57		None	SA	SW-846 3050B/6020B
	Copper	3.67	0.0627	0.38	*	J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-33	Iron	8920	6.27	19		J	SA	SW-846 3050B/6020B
	Lead	5.33	0.0951	0.38		None	SA	SW-846 3050B/6020B
	Magnesium	3590	1.9	5.7		None	SA	SW-846 3050B/6020B
	Nickel	3.34	0.0951	0.38		None	SA	SW-846 3050B/6020B
	Selenium	0.652	0.342	0.951	J	None	SA	SW-846 3050B/6020B
	Silver	0.0883	0.0883	0.442	U	None	SA	SW-846 3050B/6010D
	Thallium	0.133	0.133	0.38	U	None	SA	SW-846 3050B/6020B
	Uranium	0.655	0.0125	0.038		None	SA	SW-846 3050B/6020B
	Zinc	22.8	0.76	3.8		J	SA	SW-846 3050B/6020B
P-06	Aluminum	12200	42.1	92.6		J	SA	SW-846 3050B/6020B
	Antimony	0.324	0.324	1.96	U	None	SA	SW-846 3050B/6010D
	Arsenic	3.77	0.313	0.926		None	SA	SW-846 3050B/6020B
	Beryllium	0.602	0.0185	0.0926		None	SA	SW-846 3050B/6020B
	Cadmium	0.274	0.0185	0.185		None	SA	SW-846 3050B/6020B
	Chromium	5.51	0.185	0.556		None	SA	SW-846 3050B/6020B
	Copper	5.75	0.0611	0.37	*	J	SA	SW-846 3050B/6020B
	Iron	9120	6.11	18.5		J	SA	SW-846 3050B/6020B
	Lead	8.57	0.0926	0.37		None	SA	SW-846 3050B/6020B
	Magnesium	5170	1.85	5.56		None	SA	SW-846 3050B/6020B
	Nickel	4.58	0.0926	0.37		None	SA	SW-846 3050B/6020B
	Selenium	0.836	0.333	0.926	J	None	SA	SW-846 3050B/6020B
	Silver	0.098	0.098	0.49	U	None	SA	SW-846 3050B/6010D
	Thallium	0.132	0.13	0.37	J	None	SA	SW-846 3050B/6020B
	Uranium	0.647	0.0122	0.037		None	SA	SW-846 3050B/6020B
	Zinc	33.1	0.741	3.7		J	SA	SW-846 3050B/6020B
P-08	Aluminum	5560	3.86	8.47		J	SA	SW-846 3050B/6020B
	Antimony	0.278	0.278	1.68	U	None	SA	SW-846 3050B/6010D
	Arsenic	1.77	0.286	0.847		None	SA	SW-846 3050B/6020B
	Beryllium	0.251	0.0169	0.0847		None	SA	SW-846 3050B/6020B
	Cadmium	0.0756	0.0169	0.169	J	None	SA	SW-846 3050B/6020B
	Chromium	2.94	0.169	0.508		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-08	Copper	2.92	0.0559	0.339	*	J	SA	SW-846 3050B/6020B
	Iron	5010	5.59	16.9		J	SA	SW-846 3050B/6020B
	Lead	5.99	0.0847	0.339		None	SA	SW-846 3050B/6020B
	Magnesium	1680	1.69	5.08		None	SA	SW-846 3050B/6020B
	Nickel	1.98	0.0847	0.339		None	SA	SW-846 3050B/6020B
	Selenium	0.536	0.305	0.847	J	None	SA	SW-846 3050B/6020B
	Silver	0.0842	0.0842	0.421	U	None	SA	SW-846 3050B/6010D
	Thallium	0.119	0.119	0.339	U	None	SA	SW-846 3050B/6020B
	Uranium	0.638	0.0112	0.0339		None	SA	SW-846 3050B/6020B
	Zinc	20.4	0.678	3.39		J	SA	SW-846 3050B/6020B
P-12	Aluminum	14400	45	99		J	SA	SW-846 3050B/6020B
	Aluminum	13700	43.6	95.8		J	DU	SW-846 3050B/6020B
	Aluminum	11600	44.9	98.6		J	DU	SW-846 3050B/6020B
	Antimony	0.276	0.276	1.67	U	None	SA	SW-846 3050B/6010D
	Antimony	0.279	0.279	1.69	U	None	DU	SW-846 3050B/6010D
	Antimony	0.317	0.317	1.92	U	1.92UJ	DU	SW-846 3050B/6010D
	Arsenic	6.4	0.335	0.99		None	SA	SW-846 3050B/6020B
	Arsenic	7.98	0.324	0.958		None	DU	SW-846 3050B/6020B
	Arsenic	7.1	0.333	0.986		None	DU	SW-846 3050B/6020B
	Beryllium	0.738	0.0198	0.099		None	SA	SW-846 3050B/6020B
	Beryllium	0.749	0.0192	0.0958		None	DU	SW-846 3050B/6020B
	Beryllium	0.743	0.0197	0.0986		None	DU	SW-846 3050B/6020B
	Cadmium	0.218	0.0198	0.198		None	SA	SW-846 3050B/6020B
	Cadmium	0.232	0.0192	0.192		None	DU	SW-846 3050B/6020B
	Cadmium	0.256	0.0197	0.197		None	DU	SW-846 3050B/6020B
	Chromium	7.3	0.198	0.594		None	SA	SW-846 3050B/6020B
	Chromium	7.67	0.192	0.575		None	DU	SW-846 3050B/6020B
	Chromium	8.2	0.197	0.592		None	DU	SW-846 3050B/6020B
	Copper	8.07	0.0653	0.396	*	J	SA	SW-846 3050B/6020B
	Copper	8.15	0.0632	0.383	*	J	DU	SW-846 3050B/6020B
	Copper	15	0.0651	0.394	N	J	DU	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-12	Iron	12400	65.3	198		J	SA	SW-846 3050B/6020B
	Iron	12300	63.2	192		J	DU	SW-846 3050B/6020B
	Iron	11600	65.1	197		J	DU	SW-846 3050B/6020B
	Lead	13.6	0.099	0.396		None	SA	SW-846 3050B/6020B
	Lead	16.1	0.0958	0.383		None	DU	SW-846 3050B/6020B
	Lead	14	0.0986	0.394		None	DU	SW-846 3050B/6020B
	Magnesium	5710	1.98	5.94		None	SA	SW-846 3050B/6020B
	Magnesium	5550	1.92	5.75		None	DU	SW-846 3050B/6020B
	Magnesium	4710	1.97	5.92		None	DU	SW-846 3050B/6020B
	Nickel	6.9	0.099	0.396		None	SA	SW-846 3050B/6020B
	Nickel	6.88	0.0958	0.383		None	DU	SW-846 3050B/6020B
	Nickel	7.51	0.0986	0.394		None	DU	SW-846 3050B/6020B
	Selenium	1.48	0.356	0.99		None	SA	SW-846 3050B/6020B
	Selenium	1.33	0.345	0.958		None	DU	SW-846 3050B/6020B
	Selenium	1.38	0.355	0.986		None	DU	SW-846 3050B/6020B
	Silver	0.088	0.0836	0.418	J	None	SA	SW-846 3050B/6010D
	Silver	0.126	0.0846	0.423	J	None	DU	SW-846 3050B/6010D
	Silver	0.096	0.096	0.48	U	None	DU	SW-846 3050B/6010D
	Thallium	0.172	0.139	0.396	J	None	SA	SW-846 3050B/6020B
	Thallium	0.174	0.134	0.383	J	None	DU	SW-846 3050B/6020B
	Thallium	0.154	0.138	0.394	J	None	DU	SW-846 3050B/6020B
	Uranium	0.755	0.0131	0.0396		None	SA	SW-846 3050B/6020B
	Uranium	0.75	0.0126	0.0383		None	DU	SW-846 3050B/6020B
	Uranium	0.574	0.013	0.0394		None	DU	SW-846 3050B/6020B
	Zinc	41.4	0.792	3.96		J	SA	SW-846 3050B/6020B
	Zinc	39.2	0.766	3.83		J	DU	SW-846 3050B/6020B
	Zinc	38.9	0.789	3.94		None	DU	SW-846 3050B/6020B
P-34	Aluminum	6460	3.82	8.39		J	SA	SW-846 3050B/6020B
	Antimony	0.308	0.308	1.87	U	1.87UJ	SA	SW-846 3050B/6010D
	Arsenic	2.14	0.284	0.839		None	SA	SW-846 3050B/6020B
	Beryllium	0.397	0.0168	0.0839		J+	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-34	Cadmium	0.114	0.0168	0.168	J	None	SA	SW-846 3050B/6020B
	Chromium	3.73	0.168	0.503		None	SA	SW-846 3050B/6020B
	Copper	4.47	0.0554	0.336	N	J	SA	SW-846 3050B/6020B
	Iron	5760	5.54	16.8		J	SA	SW-846 3050B/6020B
	Lead	7.81	0.0839	0.336		None	SA	SW-846 3050B/6020B
	Magnesium	2070	1.68	5.03		None	SA	SW-846 3050B/6020B
	Nickel	3.58	0.0839	0.336		None	SA	SW-846 3050B/6020B
	Selenium	1.1	0.302	0.839		None	SA	SW-846 3050B/6020B
	Silver	0.0933	0.0933	0.466	U	None	SA	SW-846 3050B/6010D
	Thallium	0.117	0.117	0.336	U	None	SA	SW-846 3050B/6020B
	Uranium	0.626	0.0111	0.0336		None	SA	SW-846 3050B/6020B
	Zinc	22.4	0.671	3.36		None	SA	SW-846 3050B/6020B
P-35	Aluminum	8610	40	87.9		J	SA	SW-846 3050B/6020B
	Antimony	0.778	0.308	1.87	JB	1.87UJ	SA	SW-846 3050B/6010D
	Arsenic	2.23	0.297	0.879		None	SA	SW-846 3050B/6020B
	Beryllium	0.634	0.0176	0.0879		None	SA	SW-846 3050B/6020B
	Cadmium	0.127	0.0176	0.176	J	None	SA	SW-846 3050B/6020B
	Chromium	3.7	0.176	0.527		None	SA	SW-846 3050B/6020B
	Copper	5.95	0.058	0.351	N	J	SA	SW-846 3050B/6020B
	Iron	9450	58	176		J	SA	SW-846 3050B/6020B
	Lead	9.44	0.0879	0.351		None	SA	SW-846 3050B/6020B
	Magnesium	3630	1.76	5.27		None	SA	SW-846 3050B/6020B
	Nickel	4.36	0.0879	0.351		None	SA	SW-846 3050B/6020B
	Selenium	1.22	0.316	0.879		None	SA	SW-846 3050B/6020B
	Silver	0.0933	0.0933	0.466	U	None	SA	SW-846 3050B/6010D
	Thallium	0.123	0.123	0.351	U	None	SA	SW-846 3050B/6020B
	Uranium	0.4	0.0116	0.0351		None	SA	SW-846 3050B/6020B
	Zinc	33.6	0.703	3.51		None	SA	SW-846 3050B/6020B
P-36	Aluminum	5080	4.11	9.04		J	SA	SW-846 3050B/6020B
	Antimony	0.317	0.317	1.92	U	1.92UJ	SA	SW-846 3050B/6010D
	Arsenic	1.82	0.306	0.904		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-36	Beryllium	0.252	0.0181	0.0904		J+	SA	SW-846 3050B/6020B
	Cadmium	0.0718	0.0181	0.181	J	None	SA	SW-846 3050B/6020B
	Chromium	2.81	0.181	0.542		None	SA	SW-846 3050B/6020B
	Copper	5.03	0.0597	0.362	N	J	SA	SW-846 3050B/6020B
	Iron	4540	5.97	18.1		J	SA	SW-846 3050B/6020B
	Lead	3.93	0.0904	0.362		None	SA	SW-846 3050B/6020B
	Magnesium	1560	1.81	5.42		None	SA	SW-846 3050B/6020B
	Nickel	2.28	0.0904	0.362		None	SA	SW-846 3050B/6020B
	Selenium	0.609	0.325	0.904	J	None	SA	SW-846 3050B/6020B
	Silver	0.146	0.096	0.48	J	None	SA	SW-846 3050B/6010D
	Thallium	0.127	0.127	0.362	U	None	SA	SW-846 3050B/6020B
	Uranium	0.714	0.0119	0.0362		None	SA	SW-846 3050B/6020B
	Zinc	16.1	0.723	3.62		None	SA	SW-846 3050B/6020B
P-37	Aluminum	6940	4.28	9.42		J	SA	SW-846 3050B/6020B
	Antimony	0.292	0.292	1.77	U	1.77UJ	SA	SW-846 3050B/6010D
	Arsenic	2.56	0.318	0.942		None	SA	SW-846 3050B/6020B
	Beryllium	0.322	0.0188	0.0942		J+	SA	SW-846 3050B/6020B
	Cadmium	0.0972	0.0188	0.188	J	None	SA	SW-846 3050B/6020B
	Chromium	4.1	0.188	0.565		None	SA	SW-846 3050B/6020B
	Copper	6.4	0.0621	0.377	N	J	SA	SW-846 3050B/6020B
	Iron	6370	6.21	18.8		J	SA	SW-846 3050B/6020B
	Lead	5.57	0.0942	0.377		None	SA	SW-846 3050B/6020B
	Magnesium	2840	1.88	5.65		None	SA	SW-846 3050B/6020B
	Nickel	3.59	0.0942	0.377		None	SA	SW-846 3050B/6020B
	Selenium	0.612	0.339	0.942	J	None	SA	SW-846 3050B/6020B
	Silver	0.332	0.0883	0.442	J	None	SA	SW-846 3050B/6010D
	Thallium	0.132	0.132	0.377	U	None	SA	SW-846 3050B/6020B
	Uranium	0.669	0.0124	0.0377		None	SA	SW-846 3050B/6020B
	Zinc	31.3	0.753	3.77		None	SA	SW-846 3050B/6020B
S-02	Aluminum	9340	45.1	99.2		J	SA	SW-846 3050B/6020B
	Antimony	0.313	0.313	1.89	U	None	SA	SW-846 3050B/6010D

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-02	Arsenic	3.73	0.335	0.992		None	SA	SW-846 3050B/6020B
	Beryllium	0.515	0.0198	0.0992		None	SA	SW-846 3050B/6020B
	Cadmium	0.0923	0.0198	0.198	J	None	SA	SW-846 3050B/6020B
	Chromium	4.39	0.198	0.595		None	SA	SW-846 3050B/6020B
	Copper	4.16	0.0655	0.397		None	SA	SW-846 3050B/6020B
	Iron	7880	6.55	19.8		J	SA	SW-846 3050B/6020B
	Lead	8.05	0.0992	0.397	N	J	SA	SW-846 3050B/6020B
	Magnesium	2790	1.98	5.95		None	SA	SW-846 3050B/6020B
	Nickel	4.36	0.0992	0.397		None	SA	SW-846 3050B/6020B
	Selenium	1.27	0.357	0.992		None	SA	SW-846 3050B/6020B
	Silver	0.0947	0.0947	0.473	U	None	SA	SW-846 3050B/6010D
	Thallium	0.148	0.139	0.397	J	None	SA	SW-846 3050B/6020B
	Uranium	0.938	0.0131	0.0397		None	SA	SW-846 3050B/6020B
	Zinc	30	0.794	3.97		None	SA	SW-846 3050B/6020B
S-03	Aluminum	10300	44.3	97.5		J	SA	SW-846 3050B/6020B
	Aluminum	8580	4.43	9.73		J	DU	SW-846 3050B/6020B
	Aluminum	8610	4.01	8.8		J	DU	SW-846 3050B/6020B
	Antimony	0.283	0.283	1.72	U	None	SA	SW-846 3050B/6010D
	Antimony	0.284	0.284	1.72	U	None	DU	SW-846 3050B/6010D
	Antimony	0.304	0.304	1.84	U	None	DU	SW-846 3050B/6010D
	Arsenic	6.15	0.329	0.975		None	SA	SW-846 3050B/6020B
	Arsenic	3.67	0.329	0.973		None	DU	SW-846 3050B/6020B
	Arsenic	3.69	0.298	0.88		None	DU	SW-846 3050B/6020B
	Beryllium	0.517	0.0195	0.0975		None	SA	SW-846 3050B/6020B
	Beryllium	0.388	0.0195	0.0973		None	DU	SW-846 3050B/6020B
	Beryllium	0.429	0.0176	0.088		None	DU	SW-846 3050B/6020B
	Cadmium	0.187	0.0195	0.195	J	None	SA	SW-846 3050B/6020B
	Cadmium	0.132	0.0195	0.195	J	None	DU	SW-846 3050B/6020B
	Cadmium	0.173	0.0176	0.176	J	None	DU	SW-846 3050B/6020B
	Chromium	6.21	0.195	0.585		None	SA	SW-846 3050B/6020B
	Chromium	4.47	0.195	0.584		None	DU	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-03	Chromium	4.28	0.176	0.528		None	DU	SW-846 3050B/6020B
	Copper	6.54	0.0643	0.39		None	SA	SW-846 3050B/6020B
	Copper	4.6	0.0642	0.389		None	DU	SW-846 3050B/6020B
	Copper	4.75	0.0581	0.352		None	DU	SW-846 3050B/6020B
	Iron	10200	64.3	195		J	SA	SW-846 3050B/6020B
	Iron	6980	6.42	19.5		J	DU	SW-846 3050B/6020B
	Iron	7170	5.81	17.6		J	DU	SW-846 3050B/6020B
	Lead	9.48	0.0975	0.39	N	J	SA	SW-846 3050B/6020B
	Lead	8.3	0.0973	0.389	N	J	DU	SW-846 3050B/6020B
	Lead	8.53	0.088	0.352	N	J	DU	SW-846 3050B/6020B
	Magnesium	3200	1.95	5.85		None	SA	SW-846 3050B/6020B
	Magnesium	2570	1.95	5.84		None	DU	SW-846 3050B/6020B
	Magnesium	2640	1.76	5.28		None	DU	SW-846 3050B/6020B
	Nickel	5.35	0.0975	0.39		None	SA	SW-846 3050B/6020B
	Nickel	3.85	0.0973	0.389		None	DU	SW-846 3050B/6020B
	Nickel	3.82	0.088	0.352		None	DU	SW-846 3050B/6020B
	Selenium	1.51	0.351	0.975		None	SA	SW-846 3050B/6020B
	Selenium	1.23	0.35	0.973		None	DU	SW-846 3050B/6020B
	Selenium	1.28	0.317	0.88		None	DU	SW-846 3050B/6020B
	Silver	0.0858	0.0858	0.429	U	None	SA	SW-846 3050B/6010D
	Silver	0.0861	0.0861	0.43	U	None	DU	SW-846 3050B/6010D
	Silver	0.0921	0.0921	0.46	U	None	DU	SW-846 3050B/6010D
	Thallium	0.159	0.136	0.39	J	None	SA	SW-846 3050B/6020B
	Thallium	0.136	0.136	0.389	U	None	DU	SW-846 3050B/6020B
	Thallium	0.123	0.123	0.352	U	None	DU	SW-846 3050B/6020B
	Uranium	1.18	0.0129	0.039		None	SA	SW-846 3050B/6020B
	Uranium	0.835	0.0128	0.0389		None	DU	SW-846 3050B/6020B
	Uranium	0.786	0.0116	0.0352		None	DU	SW-846 3050B/6020B
	Zinc	28.4	0.78	3.9		None	SA	SW-846 3050B/6020B
	Zinc	22.3	0.778	3.89		None	DU	SW-846 3050B/6020B
	Zinc	22.3	0.704	3.52		None	DU	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-04	Aluminum	7840	3.89	8.55		J	SA	SW-846 3050B/6020B
	Antimony	0.317	0.317	1.92	U	None	SA	SW-846 3050B/6010D
	Arsenic	3.03	0.289	0.855		None	SA	SW-846 3050B/6020B
	Beryllium	0.463	0.0171	0.0855		None	SA	SW-846 3050B/6020B
	Cadmium	0.172	0.0171	0.171		None	SA	SW-846 3050B/6020B
	Chromium	3.68	0.171	0.513		None	SA	SW-846 3050B/6020B
	Copper	4.51	0.0564	0.342		None	SA	SW-846 3050B/6020B
	Iron	7170	5.64	17.1		J	SA	SW-846 3050B/6020B
	Lead	6.54	0.0855	0.342	N	J	SA	SW-846 3050B/6020B
	Magnesium	2940	1.71	5.13		None	SA	SW-846 3050B/6020B
	Nickel	3.17	0.0855	0.342		None	SA	SW-846 3050B/6020B
	Selenium	1.07	0.308	0.855		None	SA	SW-846 3050B/6020B
	Silver	0.096	0.096	0.48	U	None	SA	SW-846 3050B/6010D
	Thallium	0.12	0.12	0.342	U	None	SA	SW-846 3050B/6020B
	Uranium	0.8	0.0113	0.0342		None	SA	SW-846 3050B/6020B
	Zinc	25.1	0.684	3.42		None	SA	SW-846 3050B/6020B
S-10	Aluminum	10900	44.2	97.1		J	SA	SW-846 3050B/6020B
	Antimony	0.321	0.321	1.95	U	None	SA	SW-846 3050B/6010D
	Arsenic	3.62	0.328	0.971		None	SA	SW-846 3050B/6020B
	Beryllium	0.64	0.0194	0.0971		None	SA	SW-846 3050B/6020B
	Cadmium	0.16	0.0194	0.194	J	None	SA	SW-846 3050B/6020B
	Chromium	5.41	0.194	0.583		None	SA	SW-846 3050B/6020B
	Copper	6.95	0.0641	0.388		None	SA	SW-846 3050B/6020B
	Iron	9270	6.41	19.4		J	SA	SW-846 3050B/6020B
	Lead	7.72	0.0971	0.388	N	J	SA	SW-846 3050B/6020B
	Magnesium	4010	1.94	5.83		None	SA	SW-846 3050B/6020B
	Nickel	5.25	0.0971	0.388		None	SA	SW-846 3050B/6020B
	Selenium	1.3	0.35	0.971		None	SA	SW-846 3050B/6020B
	Silver	0.0973	0.0973	0.486	U	None	SA	SW-846 3050B/6010D
	Thallium	0.148	0.136	0.388	J	None	SA	SW-846 3050B/6020B
	Uranium	0.837	0.0128	0.0388		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-10	Zinc	31.9	0.777	3.88		None	SA	SW-846 3050B/6020B
S-38	Aluminum	16400	43.9	96.5		J	SA	SW-846 3050B/6020B
	Antimony	0.328	0.328	1.99	U	None	SA	SW-846 3050B/6010D
	Arsenic	5.61	0.326	0.965		None	SA	SW-846 3050B/6020B
	Beryllium	0.841	0.0193	0.0965		None	SA	SW-846 3050B/6020B
	Cadmium	0.201	0.0193	0.193		J+	SA	SW-846 3050B/6020B
	Chromium	8.9	0.193	0.579		None	SA	SW-846 3050B/6020B
	Copper	8.01	0.0637	0.386		None	SA	SW-846 3050B/6020B
	Iron	12100	63.7	193		J	SA	SW-846 3050B/6020B
	Lead	11	0.0965	0.386	N	J	SA	SW-846 3050B/6020B
	Magnesium	6210	1.93	5.79		None	SA	SW-846 3050B/6020B
	Nickel	7.87	0.0965	0.386		None	SA	SW-846 3050B/6020B
	Selenium	1.44	0.347	0.965		None	SA	SW-846 3050B/6020B
	Silver	0.0994	0.0994	0.497	U	None	SA	SW-846 3050B/6010D
	Thallium	0.218	0.135	0.386	J	None	SA	SW-846 3050B/6020B
	Uranium	0.858	0.0127	0.0386		None	SA	SW-846 3050B/6020B
	Zinc	36.3	0.772	3.86		None	SA	SW-846 3050B/6020B
S-39	Aluminum	8810	4.14	9.09		J	SA	SW-846 3050B/6020B
	Antimony	0.32	0.32	1.94	U	None	SA	SW-846 3050B/6010D
	Arsenic	5.2	0.307	0.909		None	SA	SW-846 3050B/6020B
	Beryllium	0.499	0.0182	0.0909		None	SA	SW-846 3050B/6020B
	Cadmium	0.356	0.0182	0.182		None	SA	SW-846 3050B/6020B
	Chromium	4.46	0.182	0.545		None	SA	SW-846 3050B/6020B
	Copper	5.4	0.06	0.364		None	SA	SW-846 3050B/6020B
	Iron	7890	6	18.2		J	SA	SW-846 3050B/6020B
	Lead	8.98	0.0909	0.364	N	J	SA	SW-846 3050B/6020B
	Magnesium	3170	1.82	5.45		None	SA	SW-846 3050B/6020B
	Nickel	4.18	0.0909	0.364		None	SA	SW-846 3050B/6020B
	Selenium	1.63	0.327	0.909		None	SA	SW-846 3050B/6020B
	Silver	0.0971	0.0971	0.485	U	None	SA	SW-846 3050B/6010D
	Thallium	0.127	0.127	0.364	U	None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-39	Uranium	0.97	0.012	0.0364		None	SA	SW-846 3050B/6020B
	Zinc	29.1	0.727	3.64		None	SA	SW-846 3050B/6020B
S-40	Aluminum	5940	4.28	9.42		J	SA	SW-846 3050B/6020B
	Antimony	0.311	0.311	1.88	U	None	SA	SW-846 3050B/6010D
	Arsenic	2.76	0.318	0.942		None	SA	SW-846 3050B/6020B
	Beryllium	0.333	0.0188	0.0942		None	SA	SW-846 3050B/6020B
	Cadmium	0.126	0.0188	0.188	J	None	SA	SW-846 3050B/6020B
	Chromium	2.53	0.188	0.565		None	SA	SW-846 3050B/6020B
	Copper	3.35	0.0621	0.377		None	SA	SW-846 3050B/6020B
	Iron	4830	6.21	18.8		J	SA	SW-846 3050B/6020B
	Lead	4.63	0.0942	0.377	N	J	SA	SW-846 3050B/6020B
	Magnesium	2310	1.88	5.65		None	SA	SW-846 3050B/6020B
	Nickel	2.84	0.0942	0.377		None	SA	SW-846 3050B/6020B
	Selenium	1.01	0.339	0.942		None	SA	SW-846 3050B/6020B
	Silver	0.0942	0.0942	0.471	U	None	SA	SW-846 3050B/6010D
	Thallium	0.132	0.132	0.377	U	None	SA	SW-846 3050B/6020B
	Uranium	0.445	0.0124	0.0377		None	SA	SW-846 3050B/6020B
	Zinc	19	0.753	3.77		None	SA	SW-846 3050B/6020B
S-42	Aluminum	11800	40.9	89.9		J	SA	SW-846 3050B/6020B
	Antimony	0.325	0.325	1.97	U	None	SA	SW-846 3050B/6010D
	Arsenic	5.32	0.304	0.899		None	SA	SW-846 3050B/6020B
	Beryllium	0.579	0.018	0.0899		None	SA	SW-846 3050B/6020B
	Cadmium	0.223	0.018	0.18		None	SA	SW-846 3050B/6020B
	Chromium	6.16	0.18	0.54		None	SA	SW-846 3050B/6020B
	Copper	7.8	0.0594	0.36		None	SA	SW-846 3050B/6020B
	Iron	10800	59.4	180		J	SA	SW-846 3050B/6020B
	Lead	10.1	0.0899	0.36	N	J	SA	SW-846 3050B/6020B
	Magnesium	4350	1.8	5.4		None	SA	SW-846 3050B/6020B
	Nickel	7.09	0.0899	0.36		None	SA	SW-846 3050B/6020B
	Selenium	1.32	0.324	0.899		None	SA	SW-846 3050B/6020B
	Silver	0.236	0.0986	0.493	J	None	SA	SW-846 3050B/6010D

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-42	Thallium	0.205	0.126	0.36	J	None	SA	SW-846 3050B/6020B
	Uranium	0.649	0.0119	0.036		None	SA	SW-846 3050B/6020B
	Zinc	33.6	0.719	3.6		None	SA	SW-846 3050B/6020B
S-43	Aluminum	7290	4.42	9.71		J	SA	SW-846 3050B/6020B
	Antimony	0.319	0.319	1.93	U	None	SA	SW-846 3050B/6010D
	Arsenic	5.53	0.328	0.971		None	SA	SW-846 3050B/6020B
	Beryllium	0.385	0.0194	0.0971		None	SA	SW-846 3050B/6020B
	Cadmium	0.236	0.0194	0.194		None	SA	SW-846 3050B/6020B
	Chromium	2.86	0.194	0.583		None	SA	SW-846 3050B/6020B
	Copper	4.33	0.0641	0.388		None	SA	SW-846 3050B/6020B
	Iron	6850	6.41	19.4		J	SA	SW-846 3050B/6020B
	Lead	7.58	0.0971	0.388	N	J	SA	SW-846 3050B/6020B
	Magnesium	2420	1.94	5.83		None	SA	SW-846 3050B/6020B
	Nickel	2.78	0.0971	0.388		None	SA	SW-846 3050B/6020B
	Selenium	1.05	0.35	0.971		None	SA	SW-846 3050B/6020B
	Silver	0.0967	0.0967	0.484	U	None	SA	SW-846 3050B/6010D
	Thallium	0.136	0.136	0.388	U	None	SA	SW-846 3050B/6020B
	Uranium	0.727	0.0128	0.0388		None	SA	SW-846 3050B/6020B
	Zinc	74.5	0.777	3.88		None	SA	SW-846 3050B/6020B
S-44	Aluminum	11200	44.5	97.8		J	SA	SW-846 3050B/6020B
	Antimony	0.305	0.305	1.85	U	None	SA	SW-846 3050B/6010D
	Arsenic	5.46	0.331	0.978		None	SA	SW-846 3050B/6020B
	Beryllium	0.687	0.0196	0.0978		None	SA	SW-846 3050B/6020B
	Cadmium	0.177	0.0196	0.196	J	None	SA	SW-846 3050B/6020B
	Chromium	5.3	0.196	0.587		None	SA	SW-846 3050B/6020B
	Copper	7.09	0.0646	0.391		None	SA	SW-846 3050B/6020B
	Iron	9720	6.46	19.6		J	SA	SW-846 3050B/6020B
	Lead	11.2	0.0978	0.391	N	J	SA	SW-846 3050B/6020B
	Magnesium	3820	1.96	5.87		None	SA	SW-846 3050B/6020B
	Nickel	4.93	0.0978	0.391		None	SA	SW-846 3050B/6020B
	Selenium	1.32	0.352	0.978		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-44	Silver	0.0924	0.0924	0.462	U	None	SA	SW-846 3050B/6010D
	Thallium	0.174	0.137	0.391	J	None	SA	SW-846 3050B/6020B
	Uranium	0.845	0.0129	0.0391		None	SA	SW-846 3050B/6020B
	Zinc	129	0.783	3.91		None	SA	SW-846 3050B/6020B
S-45	Aluminum	8870	43.3	95.2		J	SA	SW-846 3050B/6020B
	Antimony	0.57	0.311	1.88	JB	1.88U	SA	SW-846 3050B/6010D
	Arsenic	3.89	0.322	0.952		None	SA	SW-846 3050B/6020B
	Beryllium	0.522	0.019	0.0952		None	SA	SW-846 3050B/6020B
	Cadmium	0.771	0.019	0.19		None	SA	SW-846 3050B/6020B
	Chromium	32.7	0.19	0.571		None	SA	SW-846 3050B/6020B
	Copper	7.92	0.0629	0.381		None	SA	SW-846 3050B/6020B
	Iron	9600	62.9	190		J	SA	SW-846 3050B/6020B
	Lead	16.6	0.0952	0.381	N	J	SA	SW-846 3050B/6020B
	Magnesium	6090	1.9	5.71		None	SA	SW-846 3050B/6020B
	Nickel	11.2	0.0952	0.381		None	SA	SW-846 3050B/6020B
	Selenium	1.17	0.343	0.952		None	SA	SW-846 3050B/6020B
	Silver	0.0942	0.0942	0.471	U	None	SA	SW-846 3050B/6010D
	Thallium	0.171	0.133	0.381	J	None	SA	SW-846 3050B/6020B
	Uranium	0.637	0.0126	0.0381		None	SA	SW-846 3050B/6020B
	Zinc	286	0.762	3.81		None	SA	SW-846 3050B/6020B
S-46	Aluminum	8990	41.7	91.7		J	SA	SW-846 3050B/6020B
	Antimony	0.314	0.314	1.9	U	None	SA	SW-846 3050B/6010D
	Arsenic	5.39	0.31	0.917		None	SA	SW-846 3050B/6020B
	Beryllium	0.544	0.0183	0.0917		None	SA	SW-846 3050B/6020B
	Cadmium	0.256	0.0183	0.183		None	SA	SW-846 3050B/6020B
	Chromium	8.57	0.183	0.55		None	SA	SW-846 3050B/6020B
	Copper	12.6	0.0606	0.367		None	SA	SW-846 3050B/6020B
	Iron	9410	60.6	183		J	SA	SW-846 3050B/6020B
	Lead	13.5	0.0917	0.367	N	J	SA	SW-846 3050B/6020B
	Magnesium	3710	1.83	5.5		None	SA	SW-846 3050B/6020B
	Nickel	5.78	0.0917	0.367		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-46	Selenium	1.08	0.33	0.917		None	SA	SW-846 3050B/6020B
	Silver	0.347	0.0951	0.475	J	None	SA	SW-846 3050B/6010D
	Thallium	0.159	0.128	0.367	J	None	SA	SW-846 3050B/6020B
	Uranium	0.696	0.0121	0.0367		None	SA	SW-846 3050B/6020B
	Zinc	121	0.734	3.67		None	SA	SW-846 3050B/6020B
S-47	Aluminum	9520	42.8	94.2		J	SA	SW-846 3050B/6020B
	Antimony	0.321	0.321	1.95	U	None	SA	SW-846 3050B/6010D
	Arsenic	3.17	0.318	0.942		None	SA	SW-846 3050B/6020B
	Beryllium	0.51	0.0188	0.0942		None	SA	SW-846 3050B/6020B
	Cadmium	0.217	0.0188	0.188		None	SA	SW-846 3050B/6020B
	Chromium	6.19	0.188	0.565		None	SA	SW-846 3050B/6020B
	Copper	7.06	0.0621	0.377		None	SA	SW-846 3050B/6020B
	Iron	9230	62.1	188		J	SA	SW-846 3050B/6020B
	Lead	14.8	0.0942	0.377	N	J	SA	SW-846 3050B/6020B
	Magnesium	4050	1.88	5.65		None	SA	SW-846 3050B/6020B
	Nickel	5.6	0.0942	0.377		None	SA	SW-846 3050B/6020B
	Selenium	1.15	0.339	0.942		None	SA	SW-846 3050B/6020B
	Silver	0.0973	0.0973	0.486	U	None	SA	SW-846 3050B/6010D
	Thallium	0.136	0.132	0.377	J	None	SA	SW-846 3050B/6020B
	Uranium	0.573	0.0124	0.0377		None	SA	SW-846 3050B/6020B
	Zinc	35.4	0.753	3.77		None	SA	SW-846 3050B/6020B
S-49	Aluminum	11000	41.7	91.7		J	SA	SW-846 3050B/6020B
	Aluminum	14000	42.8	94		J	DU	SW-846 3050B/6020B
	Aluminum	12800	38.5	84.6		J	DU	SW-846 3050B/6020B
	Antimony	0.322	0.322	1.95	U	None	SA	SW-846 3050B/6010D
	Antimony	0.287	0.287	1.74	U	None	DU	SW-846 3050B/6010D
	Antimony	0.321	0.321	1.95	U	None	DU	SW-846 3050B/6010D
	Arsenic	2.86	0.31	0.917		None	SA	SW-846 3050B/6020B
	Arsenic	3.81	0.318	0.94		None	DU	SW-846 3050B/6020B
	Arsenic	3.23	0.286	0.846		None	DU	SW-846 3050B/6020B
	Beryllium	0.486	0.0183	0.0917		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-49	Beryllium	0.723	0.0188	0.094		None	DU	SW-846 3050B/6020B
	Beryllium	0.571	0.0169	0.0846		None	DU	SW-846 3050B/6020B
	Cadmium	0.239	0.0183	0.183		None	SA	SW-846 3050B/6020B
	Cadmium	0.248	0.0188	0.188		None	DU	SW-846 3050B/6020B
	Cadmium	0.245	0.0169	0.169		None	DU	SW-846 3050B/6020B
	Chromium	4.83	0.183	0.55		None	SA	SW-846 3050B/6020B
	Chromium	7.75	0.188	0.564		None	DU	SW-846 3050B/6020B
	Chromium	6.26	0.169	0.508		None	DU	SW-846 3050B/6020B
	Copper	6.51	0.0606	0.367		None	SA	SW-846 3050B/6020B
	Copper	9.18	0.062	0.376		None	DU	SW-846 3050B/6020B
	Copper	7.68	0.0558	0.338		None	DU	SW-846 3050B/6020B
	Iron	8700	6.06	18.3		J	SA	SW-846 3050B/6020B
	Iron	11000	62	188		J	DU	SW-846 3050B/6020B
	Iron	9830	55.8	169		J	DU	SW-846 3050B/6020B
	Lead	10.1	0.0917	0.367	N	J	SA	SW-846 3050B/6020B
	Lead	15.2	0.094	0.376	N	J	DU	SW-846 3050B/6020B
	Lead	10.7	0.0846	0.338	N	J	DU	SW-846 3050B/6020B
	Magnesium	4310	1.83	5.5		None	SA	SW-846 3050B/6020B
	Magnesium	5770	1.88	5.64		None	DU	SW-846 3050B/6020B
	Magnesium	4790	1.69	5.08		None	DU	SW-846 3050B/6020B
	Nickel	4.98	0.0917	0.367		None	SA	SW-846 3050B/6020B
	Nickel	7.44	0.094	0.376		None	DU	SW-846 3050B/6020B
	Nickel	6.21	0.0846	0.338		None	DU	SW-846 3050B/6020B
	Selenium	1.62	0.33	0.917		None	SA	SW-846 3050B/6020B
	Selenium	1.49	0.338	0.94		None	DU	SW-846 3050B/6020B
	Selenium	1.41	0.305	0.846		None	DU	SW-846 3050B/6020B
	Silver	0.0977	0.0977	0.488	U	None	SA	SW-846 3050B/6010D
	Silver	0.0871	0.0871	0.436	U	None	DU	SW-846 3050B/6010D
	Silver	0.0973	0.0973	0.486	U	None	DU	SW-846 3050B/6010D
	Thallium	0.128	0.128	0.367	U	None	SA	SW-846 3050B/6020B
	Thallium	0.203	0.132	0.376	J	None	DU	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-49	Thallium	0.157	0.118	0.338	J	None	DU	SW-846 3050B/6020B
	Uranium	0.704	0.0121	0.0367		None	SA	SW-846 3050B/6020B
	Uranium	0.709	0.0124	0.0376		None	DU	SW-846 3050B/6020B
	Uranium	0.753	0.0112	0.0338		None	DU	SW-846 3050B/6020B
	Zinc	30.9	0.734	3.67		None	SA	SW-846 3050B/6020B
	Zinc	41.2	0.752	3.76		None	DU	SW-846 3050B/6020B
	Zinc	35.2	0.677	3.38		None	DU	SW-846 3050B/6020B
S-50	Aluminum	13000	44.8	98.4		J	SA	SW-846 3050B/6020B
	Antimony	0.31	0.31	1.88	U	None	SA	SW-846 3050B/6010D
	Arsenic	3.15	0.333	0.984		None	SA	SW-846 3050B/6020B
	Beryllium	0.598	0.0197	0.0984		None	SA	SW-846 3050B/6020B
	Cadmium	0.199	0.0197	0.197		None	SA	SW-846 3050B/6020B
	Chromium	6.27	0.197	0.591		None	SA	SW-846 3050B/6020B
	Copper	6.97	0.065	0.394		None	SA	SW-846 3050B/6020B
	Iron	9830	65	197		J	SA	SW-846 3050B/6020B
	Lead	10.2	0.0984	0.394	N	J	SA	SW-846 3050B/6020B
	Magnesium	4430	1.97	5.91		None	SA	SW-846 3050B/6020B
	Nickel	5.74	0.0984	0.394		None	SA	SW-846 3050B/6020B
	Selenium	1.26	0.354	0.984		None	SA	SW-846 3050B/6020B
	Silver	0.37	0.094	0.47	J	None	SA	SW-846 3050B/6010D
	Thallium	0.156	0.138	0.394	J	None	SA	SW-846 3050B/6020B
	Uranium	0.668	0.013	0.0394		None	SA	SW-846 3050B/6020B
	Zinc	41.4	0.787	3.94		None	SA	SW-846 3050B/6020B
S-52	Aluminum	8360	39.5	86.8		J	SA	SW-846 3050B/6020B
	Antimony	0.279	0.279	1.69	U	None	SA	SW-846 3050B/6010D
	Arsenic	3.19	0.293	0.868		None	SA	SW-846 3050B/6020B
	Beryllium	0.454	0.0174	0.0868		None	SA	SW-846 3050B/6020B
	Cadmium	0.16	0.0174	0.174	J	None	SA	SW-846 3050B/6020B
	Chromium	4.41	0.174	0.521		None	SA	SW-846 3050B/6020B
	Copper	5.03	0.0573	0.347		None	SA	SW-846 3050B/6020B
	Iron	7120	57.3	174		J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-52	Lead	8.62	0.0868	0.347	N	J	SA	SW-846 3050B/6020B
	Magnesium	2810	1.74	5.21		None	SA	SW-846 3050B/6020B
	Nickel	4.02	0.0868	0.347		None	SA	SW-846 3050B/6020B
	Selenium	1.09	0.313	0.868		None	SA	SW-846 3050B/6020B
	Silver	0.0846	0.0846	0.423	U	None	SA	SW-846 3050B/6010D
	Thallium	0.122	0.122	0.347	U	None	SA	SW-846 3050B/6020B
	Uranium	0.806	0.0115	0.0347		None	SA	SW-846 3050B/6020B
	Zinc	26.4	0.694	3.47		None	SA	SW-846 3050B/6020B
S-53	Aluminum	6320	4.48	9.84		J	SA	SW-846 3050B/6020B
	Antimony	0.656	0.325	1.97	JB	1.97UJ	SA	SW-846 3050B/6010D
	Arsenic	2.84	0.333	0.984		None	SA	SW-846 3050B/6020B
	Beryllium	0.382	0.0197	0.0984		J+	SA	SW-846 3050B/6020B
	Cadmium	0.181	0.0197	0.197	J	None	SA	SW-846 3050B/6020B
	Chromium	4.18	0.197	0.591		None	SA	SW-846 3050B/6020B
	Copper	10.8	0.065	0.394	N	J	SA	SW-846 3050B/6020B
	Iron	5650	6.5	19.7		J	SA	SW-846 3050B/6020B
	Lead	4.64	0.0984	0.394		None	SA	SW-846 3050B/6020B
	Magnesium	2540	1.97	5.91		None	SA	SW-846 3050B/6020B
	Nickel	3.43	0.0984	0.394		None	SA	SW-846 3050B/6020B
	Selenium	0.726	0.354	0.984	J	None	SA	SW-846 3050B/6020B
	Silver	0.0984	0.0984	0.492	U	None	SA	SW-846 3050B/6010D
	Thallium	0.138	0.138	0.394	U	None	SA	SW-846 3050B/6020B
	Uranium	0.584	0.013	0.0394		None	SA	SW-846 3050B/6020B
	Zinc	16.7	0.787	3.94		None	SA	SW-846 3050B/6020B

[a] Blank cells indicate that the laboratory did not qualify the data.

Laboratory Data Qualifier
* = A replicate was outside limits.
J = The associated value is an estimated quantity.
N = A spike was outside limits.
U = The analyte was absent or below the method detection limit.
Sample Type: DU = duplicate sample; SA = sample
Analytical Method
SW-846 (EPA 1986)

Data Validation Qualifier
J = The associated numerical value was an estimated quantity.
J- = The associated numerical value was an estimated quantity with a suspected negative base.
J+ = The associated numerical value is an estimated quantity with a suspected positive base.
None = There was no data validation assigned.
U = The analyte was analyzed for but was not detected. The associated numerical value was the sample quantitation limit.
UJ = The analyte was analyzed for but was not detected. The associated value was an estimate and might be inaccurate or imprecise.

Appendix B. Sanitary Outfalls Monitoring Results in 2022

Western fence lizard (*Sceloporus occidentalis*)

Table B-1. Sanitary outfalls of general chemistry and metals analyses, June 2022

Station	Date Collected	Analyte	Result	MDL	Laboratory Data Qualifiers[a]	Units	Analytical Method
TTR	8-Jun-2022	Fluoride	2.13	0.033		mg/L	EPA 300.0
TTR	8-Jun-2022	Cyanide, total	0.019	0.00167	*	mg/L	EPA 335.4
TTR	8-Jun-2022	Ammonia	51	0.85	B	mg/L	SM 4500 NH3 H
TTR	8-Jun-2022	Chemical Oxygen Demand	267	8.95		mg/L	EPA 410.4
TTR	8-Jun-2022	Solids, total suspended	113	5.33		mg/L	SM 2540D
TTR	8-Jun-2022	pH	8.11	0.01	H	SU	SM 4500-H B
TTR	8-Jun-2022	Aluminum	0.584	0.0193		mg/L	EPA 200.8
TTR	8-Jun-2022	Arsenic	0.0153	0.002		mg/L	EPA 200.8
TTR	8-Jun-2022	Boron	0.752	0.026		mg/L	EPA 200.8
TTR	8-Jun-2022	Cadmium		0.0003	U	mg/L	EPA 200.8
TTR	8-Jun-2022	Chromium		0.003	U	mg/L	EPA 200.8
TTR	8-Jun-2022	Copper	0.071	0.0003		mg/L	EPA 200.8
TTR	8-Jun-2022	Lead	0.0051	0.0005		mg/L	EPA 200.8
TTR	8-Jun-2022	Mercury		0.000067	U	mg/L	EPA 245.1/245.2
TTR	8-Jun-2022	Molybdenum	0.013	0.0002		mg/L	EPA 200.8
TTR	8-Jun-2022	Nickel	0.0036	0.0006		mg/L	EPA 200.8
TTR	8-Jun-2022	Selenium	0.00155	0.0015	J	mg/L	EPA 200.8
TTR	8-Jun-2022	Silver	0.000302	0.0003	J	mg/L	EPA 200.8
TTR	8-Jun-2022	Zinc	0.134	0.0033		mg/L	EPA 200.8
TTR	8-Jun-2022	Oil and grease	6.6	1.49	N	mg/L	EPA 1664A/1664B
TTR	8-Jun-2022	Total petroleum hydrocarbons		1.49	NU	mg/L	EPA 1664A/1664B
TTR	8-Jun-2022	Phenols, total	0.0195	0.00167		mg/L	SW846 9066
TTR	8-Jun-2022	Phosphorus, total as P	6.35	0.1	B	mg/L	EPA 365.4

[a] Blank cells indicate that the data did not require a data qualifier.

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

Laboratory Data Qualifier

* = A replicate was outside limits.
B = The analyte was detected in the blank.
H = Analytical holding time was exceeded.
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.
N = A spike was outside limits.
U = The analyte was absent or below the method detection limit.

Analytical Method

EPA 200.8 (EPA 1994)
EPA 300.0 (EPA 1993)
EPA 335.4 (EPA 1993)
EPA 365.4 (EPA 1974)
EPA 410.4 (EPA 1993)
EPA 1664A/1664B (EPA 1999)/ (EPA 2010)
SM 4500-H B (American Public Health Association 2016)
SW846 (EPA 1986)

Table B-2. Sanitary outfalls of radiological analyses, June 2022

Station	Date Collected	Analyte	Activity (pCi/L)	MDA (pCI/L)	Laboratory Data Qualifiers[a]	Analytical Method
TTR	8-Jun-2022	Actinium-228	−13.7 ± 15.8	15.7	U	EPA 901.1
TTR	8-Jun-2022	Alpha, gross	4.42 ± 1.68	2.36		EPA 900.0/SW846 9310
TTR	8-Jun-2022	Americium-241	2.12 ± 10.6	17.5	U	EPA 901.1
TTR	8-Jun-2022	Beryllium-7	15.1 ± 17.4	29.9	U	EPA 901.1
TTR	8-Jun-2022	Beta, gross	27.4 ± 1.61	1.45		EPA 900.0/SW846 9310
TTR	8-Jun-2022	Bismuth-212	20.5 ± 27.9	48.5	U	EPA 901.1
TTR	8-Jun-2022	Bismuth-214	9.8 ± 10.2	6.99	X	EPA 901.1
TTR	8-Jun-2022	Cesium-137	−0.878 ± 2.11	3.48	U	EPA 901.1
TTR	8-Jun-2022	Cobalt-60	1.01 ± 1.88	3.59	U	EPA 901.1
TTR	8-Jun-2022	Lead-212	4.38 ± 6.34	6.47	U	EPA 901.1
TTR	8-Jun-2022	Lead-214	−6.5 ± 8.07	7.24	U	EPA 901.1
TTR	8-Jun-2022	Neptunium-237	0.322 ± 3.44	6.23	U	EPA 901.1
TTR	8-Jun-2022	Potassium-40	48.3 ± 67.2	32.7	X	EPA 901.1
TTR	8-Jun-2022	Radium-223	−17.3 ± 34.8	59.5	U	EPA 901.1
TTR	8-Jun-2022	Radium-224	47.3 ± 62.1	53.3	U	EPA 901.1
TTR	8-Jun-2022	Radium-226	9.06 ± 79.3	56.3	U	EPA 901.1
TTR	8-Jun-2022	Radium-228	−13.7 ± 15.8	15.7	U	EPA 901.1
TTR	8-Jun-2022	Sodium-22	−0.301 ± 1.85	3.33	U	EPA 901.1
TTR	8-Jun-2022	Thorium-227	−1.94 ± 13.2	22.7	U	EPA 901.1
TTR	8-Jun-2022	Thorium-231	−12 ± 38.5	41.2	U	EPA 901.1
TTR	8-Jun-2022	Thorium-234	57.8 ± 192	139	U	EPA 901.1
TTR	8-Jun-2022	Tritium	−28.4 ± 73.6	136	U	EPA 906.0 Modified
TTR	8-Jun-2022	Uranium-235	8.35 ± 21.5	17.7	U	EPA 901.1
TTR	8-Jun-2022	Uranium-238	57.8 ± 192	139	U	EPA 901.1

[a] Blank cells indicate that the data did not require a data qualifier.

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

Laboratory Data Qualifier:
U = The analyte was absent or below the method detection limit.
X = The data was rejected due to the peak not meeting identification criteria.

Analytical Method:
EPA 900.0/SW846 9310 (EPA 1980) (EPA 1986)
EPA 901.1 (EPA 1980)
EPA 906.0 Modified (EPA 1980)

Table B-3. Sanitary outfalls of semivolatile organic compounds, June 2022

Station	Date Collected	Analyte	Result (µg/L)[a]	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
TTR	8-Jun-2022	Acenaphthene		3	U	EPA 625.1
TTR	8-Jun-2022	Acenaphthylene		3	U	EPA 625.1
TTR	8-Jun-2022	Anthracene		3	U	EPA 625.1
TTR	8-Jun-2022	Benzidine		39	NU	EPA 625.1
TTR	8-Jun-2022	Benzo(a)anthracene		3	U	EPA 625.1
TTR	8-Jun-2022	Benzo(a)pyrene		3	U	EPA 625.1
TTR	8-Jun-2022	Benzo(b)fluoranthene		3	U	EPA 625.1
TTR	8-Jun-2022	Benzo(ghi)perylene		3	U	EPA 625.1
TTR	8-Jun-2022	Benzo(k)fluoranthene		3	U	EPA 625.1
TTR	8-Jun-2022	4-Bromophenyl phenyl ether		30	U	EPA 625.1
TTR	8-Jun-2022	Butylbenzyl phthalate		3	U	EPA 625.1
TTR	8-Jun-2022	4-Chloro-3-methylphenol		30	*NU	EPA 625.1
TTR	8-Jun-2022	bis(2-Chloroethoxy)methane		30	*NU	EPA 625.1
TTR	8-Jun-2022	bis(2-Chloroethyl)ether		30	NU	EPA 625.1
TTR	8-Jun-2022	bis-Chloroisopropyl ether		30	NU	EPA 625.1
TTR	8-Jun-2022	2-Chloronaphthalene		4.1	U	EPA 625.1
TTR	8-Jun-2022	2-Chlorophenol		30	NU	EPA 625.1
TTR	8-Jun-2022	4-Chlorophenyl phenyl ether		30	U	EPA 625.1
TTR	8-Jun-2022	Chrysene		3	U	EPA 625.1
TTR	8-Jun-2022	Di-n-butyl phthalate		3	U	EPA 625.1
TTR	8-Jun-2022	Di-n-octyl phthalate		3	U	EPA 625.1
TTR	8-Jun-2022	Dibenz[a,h]anthracene		3	U	EPA 625.1
TTR	8-Jun-2022	3,3'-Dichlorobenzidine		30	NU	EPA 625.1
TTR	8-Jun-2022	2,4-Dichlorophenol		30	NU	EPA 625.1
TTR	8-Jun-2022	Diethylphthalate		3	U	EPA 625.1
TTR	8-Jun-2022	2,4-Dimethylphenol		30	*NU	EPA 625.1
TTR	8-Jun-2022	Dimethylphthalate		3	U	EPA 625.1
TTR	8-Jun-2022	Dinitro-o-cresol		30	U	EPA 625.1
TTR	8-Jun-2022	2,4-Dinitrophenol		50	NU	EPA 625.1
TTR	8-Jun-2022	2,4-Dinitrotoluene		30	U	EPA 625.1
TTR	8-Jun-2022	2,6-Dinitrotoluene		30	U	EPA 625.1

Station	Date Collected	Analyte	Result (µg/L)[a]	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
TTR	8-Jun-2022	Diphenyl amine		30	U	EPA 625.1
TTR	8-Jun-2022	1,2-Diphenylhydrazine		30	U	EPA 625.1
TTR	8-Jun-2022	bis(2-Ethylhexyl)phthalate		3	U	EPA 625.1
TTR	8-Jun-2022	Fluoranthene		3	U	EPA 625.1
TTR	8-Jun-2022	Fluorene		3	U	EPA 625.1
TTR	8-Jun-2022	Hexachlorobenzene		30	U	EPA 625.1
TTR	8-Jun-2022	Hexachlorobutadiene		30	*NU	EPA 625.1
TTR	8-Jun-2022	Hexachlorocyclopentadiene		30	NU	EPA 625.1
TTR	8-Jun-2022	Hexachloroethane		30	NU	EPA 625.1
TTR	8-Jun-2022	Indeno(1,2,3-c,d)pyrene		3	U	EPA 625.1
TTR	8-Jun-2022	Isophorone		35	*NU	EPA 625.1
TTR	8-Jun-2022	Naphthalene		3	U	EPA 625.1
TTR	8-Jun-2022	Nitro-benzene		30	*NU	EPA 625.1
TTR	8-Jun-2022	2-Nitrophenol		30	NU	EPA 625.1
TTR	8-Jun-2022	4-Nitrophenol		30	NU	EPA 625.1
TTR	8-Jun-2022	n-Nitrosodimethylamine		30	U	EPA 625.1
TTR	8-Jun-2022	n-Nitrosodipropylamine		30	*NU	EPA 625.1
TTR	8-Jun-2022	Pentachlorophenol		30	NU	EPA 625.1
TTR	8-Jun-2022	Phenanthrene		3	U	EPA 625.1
TTR	8-Jun-2022	Phenol		30	NU	EPA 625.1
TTR	8-Jun-2022	Pyrene		3	U	EPA 625.1
TTR	8-Jun-2022	1,2,4-Trichlorobenzene		30	*NU	EPA 625.1
TTR	8-Jun-2022	2,4,6-Trichlorophenol		30	NU	EPA 625.1

[a] Blank cells indicate a non-detect for the analyte.

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

Laboratory Data Qualifier
* = A replicate was outside limits.
N = A spike was outside limits
U = The analyte was absent or below the method detection limit.
X = The data was rejected due to the peak not meeting identification criteria.

Analytical Method
EPA 625.1 (EPA 2016)

Table B-4. Sanitary outfalls of volatile organic compounds, June 2022

Station	Date Collected	Analyte	Result (µg/L)[a]	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
TTR	8-Jun-2022	Acrolein		1.67	HNU	EPA 624.1
TTR	8-Jun-2022	Acrylonitrile		1.67	UH	EPA 624.1
TTR	8-Jun-2022	Benzene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Bromodichloromethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Bromoform		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Bromomethane		0.337	UH	EPA 624.1
TTR	8-Jun-2022	Carbon tetrachloride		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Chlorobenzene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Chloroethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	2-Chloroethyl vinyl ether		1.67	HNU	EPA 624.1
TTR	8-Jun-2022	Chloroform	0.44	0.333	HJ	EPA 624.1
TTR	8-Jun-2022	Chloromethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Dibromochloromethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,2-Dichlorobenzene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,3-Dichlorobenzene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,4-Dichlorobenzene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Dichlorodifluoromethane		0.355	UH	EPA 624.1
TTR	8-Jun-2022	1,1-Dichloroethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,2-Dichloroethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,1-Dichloroethene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	trans-1,2-Dichloroethene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,2-Dichloropropane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	cis-1,3-Dichloropropene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	trans-1,3-Dichloropropene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Ethyl benzene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Methylene chloride	1.87	0.5	JHB	EPA 624.1
TTR	8-Jun-2022	1,1,2,2-Tetrachloroethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Tetrachloroethene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Toluene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,1,1-Trichloroethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	1,1,2-Trichloroethane		0.333	UH	EPA 624.1

Station	Date Collected	Analyte	Result (µg/L)[a]	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
TTR	8-Jun-2022	Trichloroethene		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Trichlorofluoromethane		0.333	UH	EPA 624.1
TTR	8-Jun-2022	Vinyl chloride		0.333	UH	EPA 624.1

[a] Blank cells indicate a non-detect for the analyte.

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

Laboratory Data Qualifier
B = The analyte was detected in the blank.
H = Analytical holding time was exceeded.
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.
N = A spike was outside limits
U = The analyte was absent or below the method detection limit.

Analytical Method
EPA 624.1 (EPA 2016)

Appendix C. Climate Hazard Risks

View from Antelope Peak

Table C-1. Climate hazard risks by asset and infrastructure type at SNL/TTR

Asset and Infrastructure System Type	Asset or Infrastructure Name/Identifier	Cold Wave	Strong Wind	Drought	Wildfire	Heat Wave	Precipitation	Riverine Flooding	Mean No. of Days with a Min. Temp. below 32°F	Mean No. of Days with a Max. Temp. ≥ to 95°F	Winter Weather
Workforce (e.g., outdoor workers, researchers, or office staff)	Members of the Workforce	8.3	5.5	6.0	7.3	9.8	7.0	9.8	8.3	9.8	7.0
Buildings, may be broken down by type (e.g., those with critical functions or office buildings)	1	7.0	4.5	6.0	7.5	10.0	8.0	6.0	7.0	10.0	6.0
Energy generation and distribution systems	2	7.0	4.5	6.0	7.5	10.0	8.0	6.0	7.0	10.0	6.0
Energy generation and distribution systems	3	7.0	4.5	6.0	7.5	10.0	8.0	8.0	7.0	10.0	6.0
Other	4	2.5	2.5	4.0	5.5	5.5	6.0	4.0	3.5	5.5	4.0
IT and telecommunication systems	5	3.5	3.5	5.0	6.5	6.5	7.0	5.0	None	6.5	5.0
Ecology and land preservation	Site flora and fauna	7.5	5.5	9.0	6.5	9.0	6.0	9.0	8.5	9.0	6.5
Energy generation and distribution systems	On-site powerlines, transformers, compressor stations	4.5	4.5	None	7.5	7.5	5.5	6.0	None	7.5	6.0
IT and telecommunication systems	On-site phones, radios, fiberoptic, internet	4.5	4.5	None	7.5	None	5.5	6.0	5.5	6.0	None
Transportation and fleet infrastructure	On-site roads and bridges	2.5	None	None	5.5	4.0	3.5	4.0	3.5	4.0	4.0
Water and wastewater systems	On-site septic tanks, drinking and wastewater transmission and distribution system	5.0	None	5.0	6.5	6.5	4.5	5.0	7.0	6.5	5.0
On-site waste disposal facility	On-site hazardous waste storage	None	None	None	5.5	None	3.5	4.0	None	None	None

Risk Score and Color Key	
High	≥ 7
Medium	3.5 ≤ 7
Low	< 3.5
None	Zero calculated risk

SNL/TTR, old settlement at TTR

Glossary

Tonopah Test Range sunrise

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.

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

climate A description of an area's average weather conditions and the extent to which those conditions vary over long time intervals, generally decades or centuries.
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 use 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.
environment The sum of all external conditions affecting an organism's life, development, and survival.
environmental assessment An 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 program 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.

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.

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 integrates 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 National Emissions Standards for Hazardous Air Pollutants 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).

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

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.

S

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).

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.

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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Tonopah Test Range telemetry station

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