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NEW MEXICO

ANNUAL SITE **ENVIRONMENTAL REPORT**

2020

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

2020 Annual Site Environmental Report
for
Sandia National Laboratories, New Mexico

Prepared by
Sandia National Laboratories
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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, New Mexico. Activities at the site support research and development programs with a wide variety of national security missions, resulting in technologies for nonproliferation, homeland security, energy and infrastructure, and defense systems and assessments.

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 and monitoring programs in place at Sandia National Laboratories, New Mexico, during calendar year 2020. Environmental topics include air quality, ecology, environmental restoration, oil storage, site sustainability, terrestrial surveillance, waste management, water quality, and implementation of the National Environmental Policy Act. This report is prepared in accordance with and as required by DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*, and has been approved for public distribution.

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Note to the Reader

This Annual Site Environmental Report for Sandia National Laboratories, New Mexico, 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 this site and a commitment to protect our nation's valuable resources. With the goal of continually improving the quality of the contents of this annual report and including information that is important to you, you are invited to provide feedback, comments, or questions to:

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The Sandia National Laboratories, New Mexico, 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	
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
AIM	Assessment, Inventory, and Monitoring
B	
BSG	Burn Site Groundwater
C	
$CaCO_3$	calcium carbonate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFU	colony-forming unit
CGP	Construction General Permit
CINT	Center for Integrated Nanotechnologies
CO_2e	carbon dioxide equivalent
COVID-19	Coronavirus 2019
D	
DE	data excluded
DOD	United States Department of Defense
DOE	United States Department of Energy
DOECAP	DOE Consolidated Audit Program
DP	discharge permit
E	
E. coli	*Escherichia coli*
EISA	Energy Independence and Security Act
EMS	Environmental Management System
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPEAT	Electronic Product Environmental Assessment Tool
ES&H	Environment, Safety, and Health
F	
FFCA	Federal Facility Compliance Act
FFCO	Federal Facility Compliance Order
FY	fiscal year
H	
HDRV	Historical Disposal Requests Validation
HMX	high melting explosive
HSWA	Hazardous and Solid Waste Amendment
I	
ISO	International Organization for Standardization
K	
KAFB	Kirtland Air Force Base
L	
Lc	critical level
M	
MAPS	Monitoring Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MDA	minimal detectable activity or minimum measured activity
MDL	method detection limit
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Permit
N	
N	nitrogen
N/A	not applicable
ND	not detected
NE	not established
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
NPDES	National Pollutant Discharge Elimination System
NTESS	National Technology & Engineering Solutions of Sandia, LLC
P	
P	phosphorus
PCB	polychlorinated biphenyl
pH	potential of hydrogen
PL	Public Law
$PM_{2.5}$	particulate matter that has a diameter equal to or less than 2.5 microns
PM_{10}	particulate matter that has a diameter equal to or less than 10 microns
PQL	practical quantitation limit
R	
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine

Term	Definition
S	
Sandia	Sandia National Laboratories
SARA	Superfund Amendments and Reauthorization Act
SC Dome	Scale Compatibility Dome
SF_6	sulfur hexafluoride
SGCN	Species of Greatest Conservation Need
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
sp.	unknown species, singular
spp.	unknown species, plural
ssp.	subspecies
SWSP	stormwater sampling point

Term	Definition
T	
TA-I	Technical Area I
TA-II	Technical Area II
TA-III	Technical Area III
TA-IV	Technical Area IV
TA-V	Technical Area V
TAG	Tijeras Arroyo Groundwater
TAVG	Technical Area V Groundwater
TCLP	toxicity characteristic leaching procedure
U	
U.S.	United States

Units of Measure

Unit	Definition
°C	degree Celsius
°F	degrees Fahrenheit
Btu	British thermal unit
CFU/100 mL	colony forming units per 100 milliliters
Ci/year	curies per year
cm	centimeter
kV	kilovolt
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
µm	micrometer
m^3	cubic meter
mb	millibar

Unit	Definition
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/sa	milligrams per sample
mL	milliliter
mrem	millirem
mrem/year	millirems per year
m/sec	meters per second
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m^3	picocuries per cubic meter
pCi/sa	picocuries per sample
person-rem	person-roentgen equivalent, man
person-rem/year	person-roentgen equivalent, man per year

Data Qualifiers

Laboratory Data Qualifier

Term	Definition
*	A replicate was outside limits.
B	The analyte was detected in the blank.
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.
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 was 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 for corrected gross alpha activity.
U	The analyte was analyzed for but was not detected. The associated numerical value was the sample quantitation limit.
Uh	The analyte was absent or below the method detection limit. Laboratory preparation holding time was exceeded.
UJ	The analyte was analyzed for but was not detected. The associated value was an estimate and might be inaccurate or imprecise.

Executive Summary

Sandia National Laboratories, New Mexico

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, New Mexico (SNL/NM), during calendar year 2020.

Environmental Management System

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

Site Sustainability

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

Environmental Performance

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

Environmental Programs

Air Quality Compliance Program. Program personnel support compliance with air quality regulations, permits, and other requirements. In 2020, emissions from multiple permitted and registered stationary sources were within regulatory limits. Sandia activities resulting in greenhouse gas emissions were below federal reporting thresholds. There was one DOE-reportable occurrence involving a sulfur hexafluoride release.

Ambient Air Surveillance Program. Ambient air quality is monitored for particulate matter and analyzed for metals and radiological constituents.

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

Cultural Resource Program. Program personnel review and document potential impacts on archeologic sites and historic properties. In 2020, multiple projects required coordination with external entities. Several surveys were conducted, and results were documented.

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

Environmental Education Outreach. Program personnel interact with the community through various events and provide environmental information to Sandia personnel.

Environmental Life-Cycle Management Program. Management practices focus on sustainable use and protection of natural and cultural resources. In 2020, 157 projects were reviewed, and the environmental impacts were documented.

Environmental Release Response and Reporting Program. Program personnel are contacted in the event of an accidental spill or any type of release to the environment. In 2020, no releases to the environment met the criteria for reporting to the New Mexico Environment Department or the U.S. Environmental Protection Agency (EPA). No releases met the criteria of a DOE-reportable occurrence.

Environmental Restoration Operations. Personnel manage sites impacted by past spill, release, or disposal activities. In 2020, six sites continued to require corrective action, including three groundwater areas of concern and three active test facilities.

Long-Term Stewardship Program. Legacy sites continue to be managed. In 2020, post-closure care activities were conducted at two permitted units, and long-term monitoring and maintenance activities were conducted at numerous solid waste management units and groundwater areas of concern.

Materials Sustainability and Pollution Prevention Program. Measures are implemented to reduce resource use and waste generation. In 2020, composting operations were evaluated, and compost

bins were added at more buildings. In 2020, less waste was generated, but this was due to COVID-19 restrictions and numerous personnel telecommuting.

Meteorology Program. Atmospheric monitoring is conducted through a network of meteorological towers located across Kirtland Air Force Base. Program personnel provide services, data, and analyses to support project planning decisions.

National Environmental Policy Act Program. Program personnel coordinate with DOE to ensure National Environmental Policy Act compliance and to provide technical assistance in project planning. In 2020, 357 proposed projects were reviewed, and the environmental impacts were documented.

Oil Storage Program. Oil storage containers and equipment are managed, operated, and maintained to prevent inadvertent releases to the environment and to comply with applicable regulations. In 2020, the inventory of oil storage containers operating under the Spill Prevention, Control, and Countermeasure Plan included 47 stationary aboveground storage tanks and two underground storage tanks. Additional oil storage capacity in 55-gallon drums, mobile and portable containers, mobile refuelers, and oil-filled operational equipment is available throughout the site.

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

Radionuclide National Emission Standards for Hazardous Air Pollutants. Radionuclide air emissions from Sandia facilities are reported each year. In 2020, the primary radionuclides released from Sandia facilities were argon-41 and tritium. Calculated doses were well below the 10 mrem/year dose limit set by the EPA and DOE.

Safe Drinking Water Protection Program. Drinking water is supplied by the Kirtland Air Force Base-owned system. Sandia adheres to New Mexico Environment Department regulations during operation and maintenance of the drinking water system. In 2020, Safe Drinking Water Protection Program personnel coordinated with Kirtland Air Force Base to support compliance activities.

Stormwater Program. Three EPA National Pollutant Discharge Elimination System permits are maintained, and compliance activities are conducted. During 2020, monthly compliance inspections were conducted at approximately 45 construction and industrial sites, and water quality sampling was conducted at approximately 25 locations.

Surface Discharge Program. All planned water-based discharges to the ground surface are reviewed to comply with regulations. In 2020, 26 individual discharge requests were approved and met applicable standards. Approved releases complied with New Mexico Environment Department applicable requirements.

Terrestrial Surveillance Program. Surveillance activities are conducted at on-site and off-site locations; soil, sediment, and vegetation are sampled for various parameters. In 2020, results of the sampling events were below comparison reference values. Environmental dosimeters used to measure the dose from ambient gamma radiation indicated levels within natural background values.

Waste Management Program. Solid and hazardous wastes are collected and managed (stored, treated, and packaged for shipment to off-site permitted facilities). In 2020, the annual no-notice hazardous waste compliance evaluation inspection was not conducted. The results and findings of

the December 2019 inspection, including a notice of violation, were received in February 2020. The notice of violation was a DOE-reportable occurrence.

Wastewater Discharge Program. Wastewater is discharged from six permitted on-site outfalls. In 2020, wastewater was monitored, and one permit-mandated split sampling with the Albuquerque Bernalillo County Water Utility Authority was conducted. All routine monitoring and split sampling events met the standards set by the Albuquerque Bernalillo County Water Utility Authority Sewer Use and Wastewater Control Ordinance requirements.

Chapter 1. Introduction

Prickly pear cactus *(Opuntia species)* with fruit

OVERVIEW ▪ Sandia National Laboratories, located on Kirtland Air Force Base in Albuquerque, New Mexico, was designated a national laboratory in 1979. Operating for the National Nuclear Security Administration, the core mission is to provide science and engineering support for the nation's nuclear weapons stockpile. In addition, Sandia personnel collaborate with government agencies, the industrial sector, and universities to develop and commercialize new technologies.

This Annual Site Environmental Report was prepared in accordance with and as required by the U.S. Department of Energy (DOE) per DOE O 231.1B, Admin Change 1, *Environment Safety and Health Reporting*. This report describes the environmental protection programs currently in place at Sandia National Laboratories, New Mexico (SNL/NM). This report is made available to the public in electronic form at the following website:

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

Sandia National Laboratories, hereinafter referred to as Sandia with the exception of when using acronym to represent the facility location (SNL/NM), 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 administers the contract and oversees contractor operations. Building on its original nuclear weapons mission, Sandia research and development programs support a wide variety of national security missions, resulting in technologies for nonproliferation, homeland security, energy and infrastructure, and defense systems and assessments.

While all 2020 program activities were performed continuously, they are reported in this Annual Site Environmental Report on a calendar-year basis unless otherwise noted (programs based on the fiscal year operate from October 1 through September 30, annually).

1.1 Purpose

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

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

1.2 History

Sandia operations began in 1945 as Z Division, the ordnance design, testing, and assembly arm of Los Alamos Scientific Laboratory (now Los Alamos National Laboratory). The division moved to Sandia Base (now merged into the Kirtland Air Force Base [KAFB]), located on the perimeter of Albuquerque, to be near an airfield and to work closely with the military. In 1948, Z Division became a separate branch of the Los Alamos Scientific Laboratory and was renamed Sandia Laboratory. 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 NTESS, a wholly owned subsidiary of Honeywell International Inc. For more details, see Chapter 8.

At the end of fiscal year 2020, the Sandia workforce (for all sites) comprised approximately 14,589 employees and contractors.

Sandia recognized as a national laboratory

1.3 Location Description

Figure 1-1 shows the KAFB boundary, its land designations, and the agencies that operate within those boundaries. KAFB is a military installation that spans 51,559 acres, including 20,486 acres that are withdrawn land (withheld from the public domain) from the Cibola National Forest through an

agreement with the U.S. Forest Service (DOE 1999). Located at the foot of the Manzanita Mountains, KAFB has a mean elevation of 5,384 feet and a maximum elevation of 7,986 feet. More than 450 federal government and private sector tenants and associated units operate on KAFB (USAF 2012). KAFB and SNL/NM are adjacent to Albuquerque, which borders KAFB on the base's north, northeast, west, and southwest boundaries. The Albuquerque International Sunport (airport) and Mesa del Sol—a 12,800-acre mixed-use urban area under development—are west of KAFB. Isleta Pueblo is south of the KAFB boundary.

Sandia conducts operations on DOE-owned property, non-DOE-owned property contracted from other federal and state agencies, and privately owned leased property. Sandia sites located on DOE-owned property comprise 2,938 acres and include five technical areas (DOE 1999). At non-DOE--owned property, Sandia personnel conduct operations on 5,637 acres of land permitted from the U.S. Air Force, a portion of which are on land withdrawn by the U.S. Forest Service (SNL/NM 2006). DOE leases approximately 2,750 acres from the New Mexico State Land Office (La Semilla Buffer Zone) west of the KAFB boundary. This area serves as a margin of safety and a sound buffer for testing operations. In addition, Sandia personnel conduct operations at off-site leased facilities. There are approximately 6.54 million gross square feet of existing facilities at SNL/NM (SNL/NM 2019a).

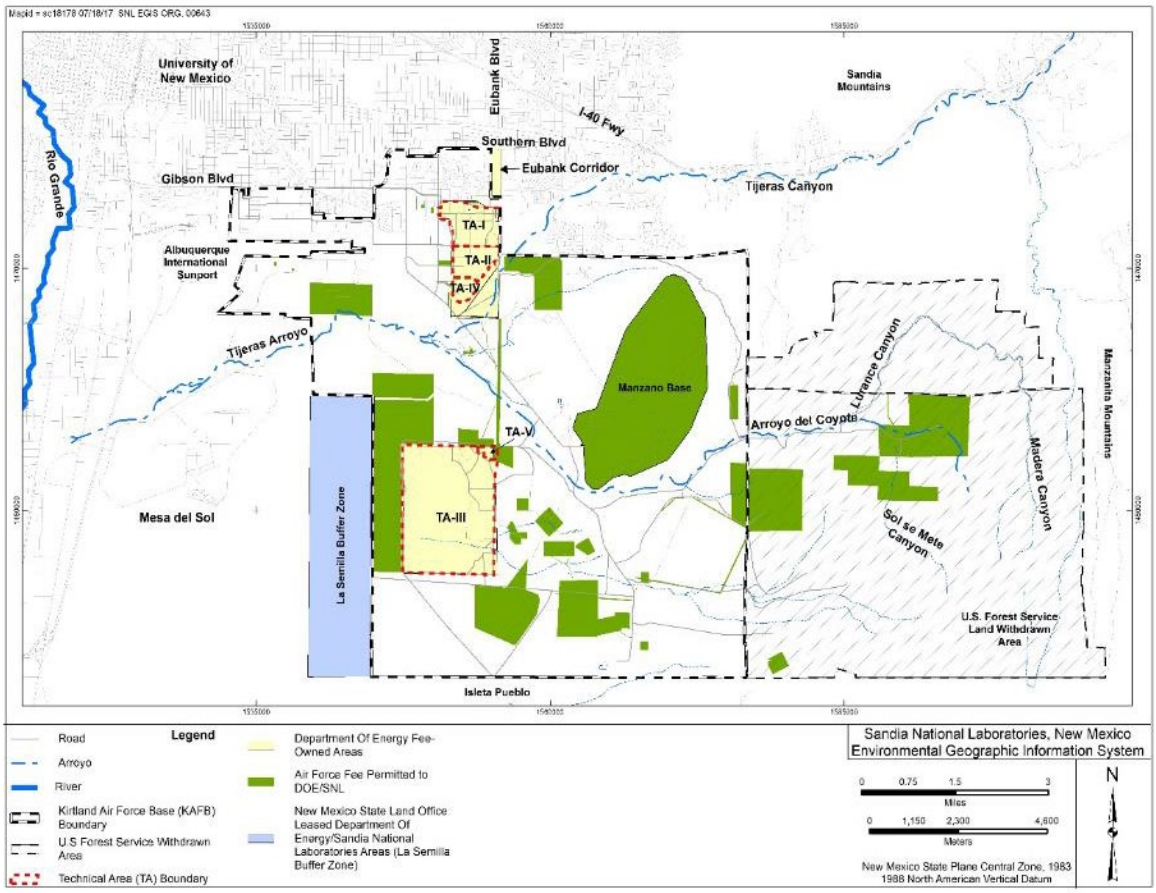

Figure 1-1. SNL/NM location, including technical areas and permitted areas

1.4 Demographics

New Mexico is the fifth-largest state in the United States, encompassing approximately 121,000 square miles. Census data for 2020 was not available at the time of publication; therefore, 2019 data is reported. New Mexico's 2019 population was 2,096,829 (Census 2020). Albuquerque is the largest city in the state, with an estimated population of 560,513 in 2019 (Census 2020). The estimated Albuquerque metro area population within a 50-mile radius (Figure 1-2) was 918,018 in 2020 (StatsAmerica 2020).

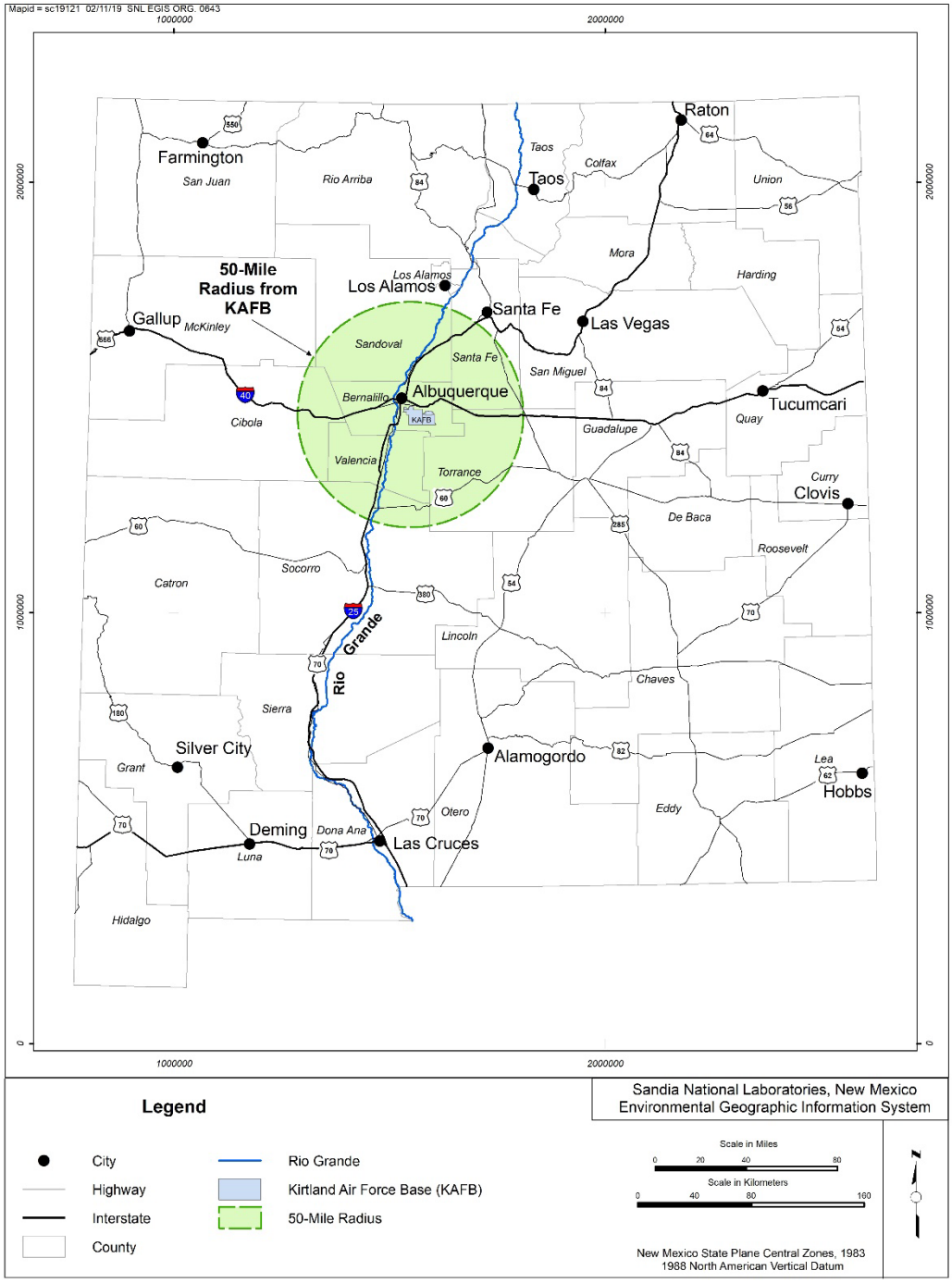

Figure 1-2. State of New Mexico, including counties

1.5 Activities and Facilities

SNL/NM consists of five secured technical areas—Technical Area I (TA-I), Technical Area II (TA-II), Technical Area III (TA-III), Technical Area IV (TA-IV), and Technical Area V (TA-V)—buildings and structures in unsecured leased areas, and several remote testing areas (Figure 1-1).

1.5.1 The Technical Areas

TA-I is located in the northern portion of KAFB, and operations there include the main administrative center and numerous laboratories and offices. A majority of activities performed in TA-I are dedicated to weapon design, research and development on weapon systems, limited production of weapon systems components, technology transfer, high-performance computing, and energy research programs. Facilities in TA-I include several assembly and manufacturing areas; environmental test facilities; and various laboratories, such as the Ion Beam Laboratory, the Advanced Manufacturing Processes Laboratory, the Neutron Generator Facility, the Processing and Environmental Technology Laboratory, the Joint Computational Engineering Laboratory, the Sandia Tomography and Radionuclide Transport Laboratory, and the Microsystems and Engineering Sciences Applications Complex.

TA-II, located south of TA-I, includes both technical facilities and infrastructure support. Buildings include the Explosives Components Facility, the Hazardous Waste Handling Unit, the Solid Waste Collection and Recycling Center, the Construction and Demolition Recycle Center, and the National Infrastructure Simulation and Analysis Center.

TA-III, located in the south-central part of KAFB, is the largest and most remote of the technical areas. There are large outdoor test areas as well as facilities that can accommodate indoor testing. The area is used for engineering test activities that require large-scale safety and/or security buffers, such as collision-testing sled tracks, centrifuges, vibration test facilities, and impact test complexes. A few of the outdoor test areas include the Rocket Sled Test Facility, the Water Impact/Drop Tower Complex, and the Terminal Ballistics Facility. A few of the indoor test facilities include the Centrifuge Facility, the Mechanical Shock Facility, and the Thermal Test Complex. The Radioactive and Mixed Waste Management Unit is in the southern portion of TA-III. The Mixed Waste Landfill, the Chemical Waste Landfill, and the Corrective Action Management Unit are also located in TA-III.

TA-IV, located south of TA-II, includes facilities used to conduct research and development activities in inertial confinement fusion, pulsed power, and nuclear particle acceleration. Accelerators located in TA-IV include the Z Accelerator, the Advanced Pulsed Power Research Module, the Radiographic Integrated Test Stand, the High-Energy Radiation Megavolt Electron Source III, the Saturn Accelerator, the Repetitive High-Energy Pulsed Power I Accelerator, the High-Power Microwave Laboratory, and the Short-Pulse High Intensity Nanosecond X Radiator.

TA-V, located adjacent to the northeast portion of TA-III, includes facilities that routinely handle radioactive materials used in experimental research and development programs. Capabilities include reactor technology, radiation transport techniques, radiation damage on materials, and radiation vulnerability assessments. Some of the facilities in TA-V include the Gamma Irradiation Facility, the Annular Core Research Reactor, the Sandia Pulsed Reactor, and the Auxiliary Hot Cell Unit.

1.5.2 Other Facilities and Areas

Several remote test areas are located east and southeast of TA-III within the canyons and foothills of the U.S. Forest Service withdrawn area—Arroyo del Coyote, Lurance Canyon, Madera Canyon, and Sol se Mete Canyon—on the west side of the Manzano Mountains (Figure 1-1). The remote test areas are known collectively as Coyote Test Field. These areas are used for environmental and

developmental testing, including explosive ordnance testing, impact testing, rocket firing experiments, and open-burn thermal testing.

Sandia personnel operate several facilities on a combination of properties leased or owned by DOE outside the boundaries of KAFB. The Center for Integrated Nanotechnologies, the Microsystems and Engineering Sciences Applications Technology and Operations Prototype, the International Programs Building, the Innovation Parkway Office Center, and the National Museum of Nuclear Science and History are all located on Eubank Boulevard Southeast within one mile of KAFB. There are also off-site projects, including the Advanced Materials Laboratory at the University of New Mexico, the North Slope Sites in Alaska, and the Weapons Evaluation Test Laboratory at the Pantex Plant in Texas.

1.6 Environmental Setting

SNL/NM is set in the high desert region of central New Mexico. The mountains on the east and the plateaus on the west create a diverse range of geological, hydrological, ecological, and climatic settings. A maximum elevation of 7,986 feet occurs on the eastern edges of KAFB; the mean elevation is 5,384 feet.

The most prominent topographic feature in the Albuquerque area is the Sandia Mountains, which are east of the city. The Sandia Mountains form a 13-mile-long escarpment distinguished by steep cliffs, pinnacles, and narrow canyons; the tallest point is Sandia Crest at 10,678 feet. The Sandia Mountains are divided from the Manzanita Mountains (to the south) by Tijeras Canyon (Figure 1-1).

Tijeras Arroyo, a major topographic feature, is situated diagonally northeast to southwest on KAFB. The watershed drained by Tijeras Arroyo includes the southern Sandia Mountains, the Manzanita Mountains, and the north end of the Manzano Mountains. The arroyo is normally dry except during heavy downpours, which can cause flash floods. The arroyo originates in Tijeras Canyon and runs coincident with the Tijeras Fault for several miles before deviating to the southwest; it discharges to the Rio Grande approximately six miles from the western boundary of KAFB.

1.6.1 Geology and Hydrology

SNL/NM and KAFB are situated in a geologic setting that was subjected to relatively recent episodes of basaltic volcanism and ongoing regional rifting (crustal extension). The Rio Grande Rift formed a series of connected, down-dropped basins filled with sedimentary deposits. The Rio Grande Rift extends for about 450 miles from Leadville, Colorado, into New Mexico; Albuquerque and KAFB are within this rift valley.

The Albuquerque Basin, a major structural feature, is approximately 30 miles wide and 100 miles long.

The Albuquerque Basin is a major structural feature and is one of several north–south-trending sediment-filled basins formed by the Rio Grande Rift. The Albuquerque Basin is approximately 30 miles wide, 100 miles long, and 3,000 square miles in area (Grant 1982). On the east, uplifted fault blocks manifested by the Sandia, Manzanita, and Manzano mountains bound the basin. The western side of the basin is bound by the Lucero Uplift to the south and by the Rio Puerco Fault Belt and the Nacimiento Uplift at the northern end. There is major structural relief but relatively little topographic relief along the Rio Puerco Fault Belt on the northwestern side of the basin. The Albuquerque Basin is drained to the south through the Rio Puerco and the Rio Grande.

Several faults run through KAFB (Figure 1-3). The Tijeras Fault, which has been traced as far north as Madrid, New Mexico, trends southwesterly through Tijeras Canyon and across KAFB. The Tijeras Fault is a strike-slip fault on which movement is horizontal and parallel to the strike of the fault. Early movement along the Tijeras Fault can be traced to the late Precambrian Period, 570 million years ago, and traces of the fault 20 miles northeast of KAFB have been active as recently as the late Pleistocene epoch, 12,000 years ago. The system of minor faults associated with the Tijeras Fault on KAFB is collectively referred to as the Tijeras Fault Complex. The Tijeras Fault Complex marks a distinct boundary between the Precambrian and Paleozoic bedrock geology on the east and the Tertiary and Quaternary sediment-filled basin to the west. This geologic boundary also forms a boundary between the two major groundwater regimes at KAFB.

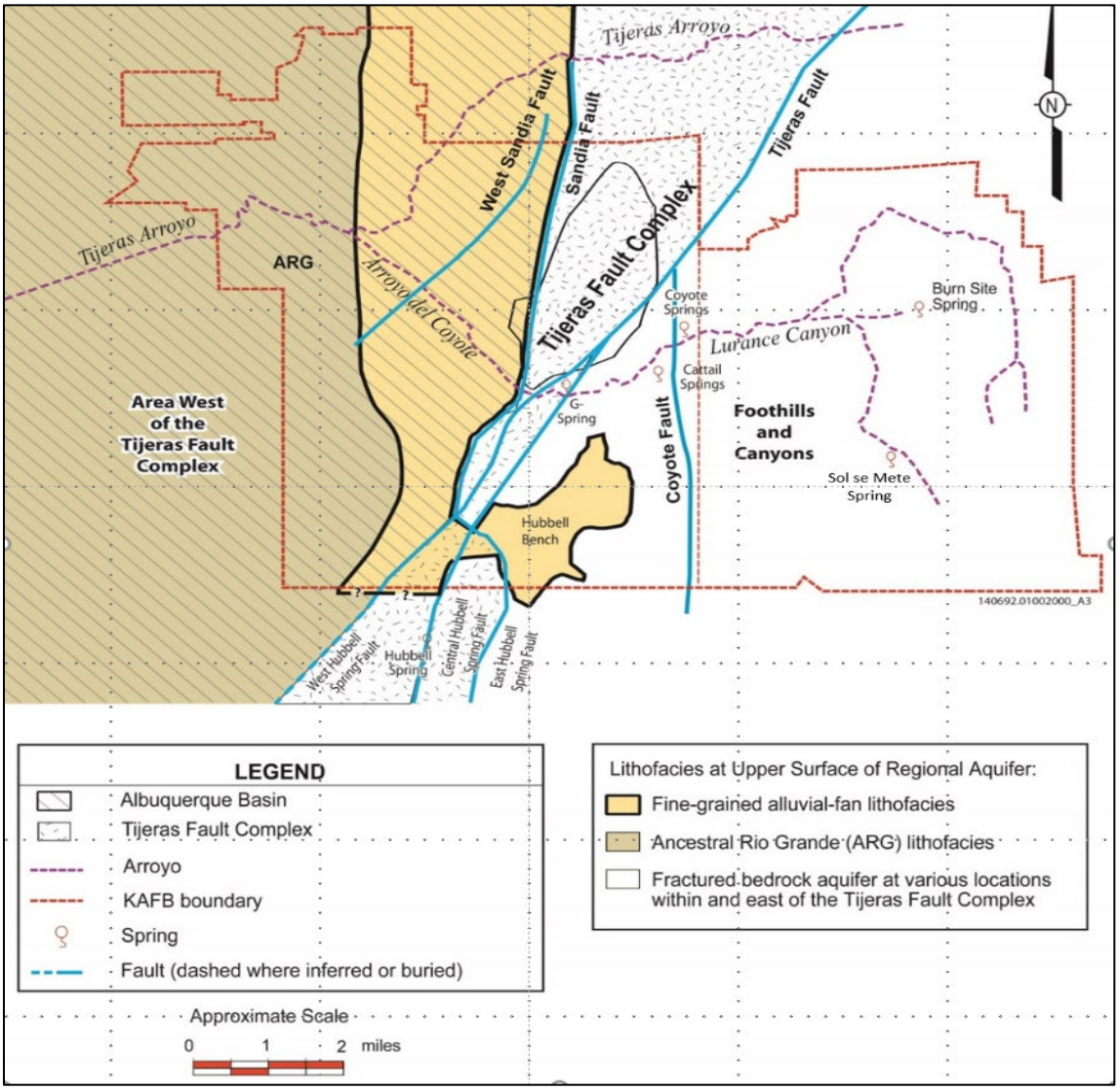

Figure 1-3. Faults and hydrogeologically distinct areas

The Sandia Fault establishes the eastern boundary of the Albuquerque Basin on KAFB. The up-thrown side of the fault is manifested as the Sandia and Manzanita mountains. The total vertical structural offset is on the order of 4.3 miles. South of KAFB, the basin's eastern boundary is the Hubbell Spring Fault. The Sandia Fault and Hubbell Spring Fault systems are north-trending, down-to-the-west, en echelon normal faults, which formed in the mid to late Tertiary Period (25 million

years and younger) (Lozinsky and Tedford 1991; Woodward 1982). The Sandia Fault converges with the Tijeras Fault and the Hubbell Spring Fault in the region of KAFB, identified as the Tijeras Fault Complex.

Groundwater

The hydrogeological system at KAFB is divided into two areas separated by the Tijeras Fault Complex (Figure 1-3, modified from *Site-Wide Hydrogeologic Characterization Project, Calendar Year 1995 Annual Report* [SNL/NM 1995]). To the east of the Tijeras Fault Complex, the hydrogeology is characterized by fractured and faulted bedrock covered by a thin layer of mostly dry alluvium. Depths to groundwater east of the Tijeras Fault Complex range from approximately 44 to 360 feet below ground surface. On the west side of the Tijeras Fault Complex, groundwater in the regional aquifer is contained in alluvial sediments, and depths to groundwater range from approximately 451 to 571 feet below ground surface.

A perched groundwater system overlies the regional aquifer in the north portion of KAFB. The system extends from TA-I south to the Tijeras Arroyo Golf Course. The western extent of the perched groundwater system lies between Wyoming Boulevard and the Albuquerque International Sunport's east–west runway. The eastern extent is just east of the KAFB landfill and may be bounded by the West Sandia Fault. The groundwater gradient within the perched groundwater system is to the southeast, and the depth to groundwater is approximately 269 feet below ground surface in the west and 350 feet below ground surface in the east.

The primary regional aquifer in the Albuquerque Basin is within the upper unit and, to a lesser degree, the middle unit of the Santa Fe Group Aquifer System. Albuquerque Bernalillo County Water Utility Authority (ABCWUA) water supply wells generally are located in the most productive portion of the aquifer on the east side of the Rio Grande. The highest-yield wells are screened in the sediments associated with Ancestral Rio Grande deposits (Figure 1-3). Prior to extensive urban development in the Albuquerque area beginning in the 1950s, regional groundwater in the KAFB area primarily flowed to the southwest. As a result of groundwater withdrawal, the local water table has dropped by as much as 141 feet (Thorn, McAda, and Kernodle 1993). Groundwater withdrawal from KAFB and ABCWUA wells at the north end of KAFB have created a trough-like depression in the water table, causing flow to be diverted northeast in the direction of the well fields.

Until recently, water levels declined nearly 1.5 feet per year, which was associated with long-term pumping of KAFB and ABCWUA production wells. However, since late 2008, hydrographs for regional aquifer wells in the northern part of KAFB show an increasing trend in groundwater elevations. Presumably, this is in response to ABCWUA transitioning to surface water withdrawals for potable water supplies and decreasing dependence on production wells immediately north of KAFB.

Surface Water

Two perennial springs are located on KAFB (Coyote Springs and Sol se Mete Spring). In addition, one perennial spring (Hubbell Spring) is located immediately south of the KAFB boundary on Isleta Pueblo. Numerous ephemeral springs occur in the foothills and in the eastern reach of Arroyo del Coyote.

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/NM 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 in the SNL/NM ecosystem include grasslands,

woodland, arroyo shrub, scattered piñon-juniper, and closed canopy piñon-juniper. This ecosystem is a dynamic entity that is impacted by external and internal factors. External factors include such influences as climate, time, topography, and biota. Internal factors include the introduction of non-native species to the ecosystem and human disturbance and interactions (through development) within the various habitats.

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

The desert grasslands of New Mexico have been heavily disturbed during the last 150 years, with a steady transition of what was once extensive grassland into shrubland (Dick-Preddie, Moir, and Spellenberg 1996; McClaran and Van Devender 1997). SNL/NM and KAFB grasslands have been excluded from grazing since the 1940s. Prior to this time, the grasslands were affected by anthropogenic (human-based) activities. The extent and severity of alteration to the grasslands has not been well documented. Grasslands at SNL/NM and KAFB are found both within and outside the Sandia technical areas between elevations of 5,200 and 5,700 feet. The SNL/NM and KAFB grasslands, which can best be described as fragments of historic grasslands, are bordered by urban Albuquerque to the north and west, forest lands to the east, and cattle-grazing shrublands to the south. These grasslands provide necessary habitat to support many species of birds, reptiles, amphibians, and mammals.

SNL/NM and KAFB woodland areas rise to the east from the grassland areas. The woodlands are typical of those in central New Mexico, consisting almost entirely of piñon-pine and juniper species mosaics, commonly referred to as piñon-juniper habitat. At the highest elevations of SNL/NM and KAFB-managed lands, scattered ponderosa pines are present in low numbers.

There are large tracts within the SNL/NM and KAFB area that are undeveloped, resulting in a considerable diversity of plant and animal communities. Table 1-1 lists some of the common species of birds, mammals, reptiles, amphibians, and plants that have been encountered on-site. Chapter 7 provides more information on the ecology of the area.

Table 1-1. Plants and animals commonly identified in various life zones across KAFB

Common Name	Scientific Name	Common Name	Scientific Name
Birds			
American kestrel	*Falco sparverius*	Ladder-backed woodpecker	*Picoides scalaris*
Black-chinned hummingbird	*Archilochus alexandri*	Loggerhead shrike	*Lanius ludovicianus*
Black-throated sparrow	*Amphispiza bilineata*	Northern mockingbird	*Mimus polyglottos*
Common raven	*Corvus corax*	Red-tailed hawk	*Buteo jamaicensis*
Dark-eyed junco	*Junco hyemalis*	Spotted towhee	*Pipilo maculatus*
Horned lark	*Eremophila alpestris*	Western kingbird	*Tyrannus verticalis*
House finch	*Haemorhous mexicanus*	Western meadowlark	*Sturnella neglecta*
Mammals			
American black bear	*Ursus americanus*	Deer mouse	*Peromyscus maniculatus*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*	Desert cottontail	*Sylvilagus audubonii*
Black-tailed jackrabbit	*Lepus californicus*	Gray fox	*Urocyon cinereoargenteus*
Bobcat	*Felis rufus*	Gunnison's prairie dog	*Cynomys gunnisoni*
Coyote	*Canis latrans*	Mule deer	*Odocoileus hemionus*

Common Name	Scientific Name	Common Name	Scientific Name
Reptiles and Amphibians			
Chihuahuan spotted whiptail	*Aspidoscelis exsanguis*	Great plains skink	*Eumeces obsoletus*
Desert side-blotched lizard	*Uta stansburiana*	Long-nosed snake	*Rhinocheilus lecontei*
Eastern collared lizard	*Crotaphytus collaris*	New Mexico spadefoot toad	*Spea multiplicata*
Gopher snake	*Pituophis catenifer*	New Mexico whiptail	*Aspidoscelis neomexicana*
Greater short-horned lizard	*Phrynosoma hernandesi*	Prairie rattlesnake	*Crotalus viridis*
Plants			
Apache plume	*Fallugia paradoxa*	New Mexico feathergrass	*Hesperostipa neomexicana*
Black grama	*Bouteloua eriopoda*	One-seed juniper	*Juniperus monosperma*
Blue grama	*Bouteloua gracilis*	Piñon pine	*Pinus edulis*
Bush muhly	*Muhlenbergia porteri*	Purple three-awn	*Aristida purpurea*
Intermediate yucca	*Yucca intermedia*	Ring muhly	*Muhlenbergia torreyi*
James' galleta	*Hilaria jamesii*	Shrub live oak	*Quercus turbinella*

1.6.3 Climate

Large diurnal temperature ranges, summer monsoons, and frequent drying winds characterize the regional climate in the Albuquerque Basin and the Sandia, Manzanito, and Manzano mountains.

Temperatures are typical of midlatitude dry continental climates, with summer high temperatures in the basin around 90°F and winter high temperatures around 50°F. Daily low temperatures range from around 60°F in the summer to around 20°F in the winter. The dry continental climate also produces low average humidity in the late spring and early summer prior to the onset of the monsoon season. Daytime relative humidity can be between 10 and 20 percent in the spring and early summer, with an average humidity near 30 percent. Winter relative humidity averages near 50 percent.

Precipitation varies across the region, with many locations in the higher elevations of the mountains receiving annual rainfall twice that of locations in the Albuquerque Basin. The winter season in the Albuquerque Basin and around SNL/NM is generally dry, with an average of less than 1.5 inches of precipitation falling between December and February. Most precipitation falls between July and October, mainly in the form of brief, heavy rain showers. According to the National Climatic Data Center, the average annual precipitation is approximately 9.45 inches at Albuquerque International Sunport (NCDC 2020).

Site-specific meteorology is influenced by proximity to topographic features, such as mountains, canyons, and arroyos. These features influence local wind patterns across the site. Canyons and arroyos tend to channel or funnel wind, whereas mountains create upslope and downslope diurnal wind-flow patterns. Winds tend to blow toward the mountains or up the Rio Grande Valley during the day, and nocturnal winds tend to blow down the mountain toward the Rio Grande Valley. These topographically induced wind flows can be enhanced or negated by weather systems that move across the southwestern United States. The strongest winds occur in the spring when monthly wind speeds average 10 miles per hour and wind gusts commonly reach 50 miles per hour. Chapter 5 provides more information on meteorological conditions.

Chapter 2. Compliance Summary

Coyote (*Canis latrans*)

OVERVIEW ■ Sandia operations 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. Permits and registrations in effect in 2020 are listed in Chapter 10.

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

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

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

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

2.1 Environmental Compliance

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

2.1.1 Federal Environmetal Requirements

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

Environmental Planning

National Environmental Policy Act (NEPA) of 1969	
Regulation and Compliance Approach	**Compliance Activities**
NEPA requires federal agencies to assess the impacts on the human and natural environment of proposed actions prior to making decisions. Sandia personnel use an online NEPA checklist to assess proposed actions and activities for potential environmental consequences. When projects or activities appear to be outside the scope of existing NEPA coverage, a NEPA checklist is prepared and forwarded to DOE for review and determination. Section 3.1 provides information on NEPA activities in 2020.	• Ensure that all environmental impacts have been assessed adequately. • Coordinate NEPA checklists with DOE personnel. • Inform project owners of environmental requirements.

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

DOE O 436.1, Department Sustainability	
Regulation and Compliance Approach	**Compliance Activities**
This order places environmental management systems and site sustainability at the forefront of environmental excellence. Sandia personnel comply with this order through implementation of an Environmental Management System (EMS) which is third-party certified to International Organization for Standardization (ISO) 14001:2015 at the Sandia primary operating location in New Mexico. This order also specifies requirements for compliance with Emergency Planning and Community Right-to-Know Act requirements. See "Chemical Management" and Table 2-2 for specifics on Sandia's approach to compliance with these requirements.	• Facilitate ISO 14001:2015 audits by a third-party registrar. • Enable identification of the environmental aspects and impacts of activities. • Maintain an EMS and associated documentation. • Establish and implement an annual Site Sustainability Plan.

Hazardous Waste and Environmental Restoration

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

Regulation and Compliance Approach	Compliance Activities
This act establishes liability compensation, cleanup, and emergency response requirements for inactive hazardous waste sites. In addition, CERCLA requires federal facilities to report hazardous substance spills to the National Response Center. DOE performed a preliminary assessment and site inspection in 1988. This inspection confirmed that no sites qualify for the National Priorities List. Therefore, with respect to inactive hazardous waste sites, there are no CERCLA remediation requirements nor CERCLA-related assessments for natural resource damages. The Superfund Amendments and Reauthorization Act (SARA) of 1986 establishes additional reporting requirements that are addressed under "Chemical Management."	• See "Chemical Management" and Table 2-2 for compliance activities. • Administer and monitor solid waste management units (Chapter 3).

Federal Facility Compliance Act of 1992

Regulation and Compliance Approach	Compliance Activities
On October 4, 1995, the New Mexico Environment Department (NMED) issued a Federal Facility Compliance Order to DOE and the management and operating contractor for Sandia National Laboratories (NMED 1995). The Federal Facility Compliance Order was developed pursuant to the Federal Facility Compliance Act and provides requirements for achieving compliance with the requirements of 40 CFR 268.50, *Prohibitions on Storage of Restricted Wastes*, for mixed waste. Section 3.5 provides information on Sandia's Waste Management Program.	• Maintain the Site Treatment Plan (SNL/NM 2020g), including its inventory of wastes subject to the compliance act and its schedule for processing the waste.

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

Regulation and Compliance Approach	Compliance Activities
This act sets forth the framework for management of hazardous solid waste, including the hazardous waste component of mixed waste. Wastes generated from activities and operations are collected and managed at several locations as described in Section 3.5. NMED, DOE, and the management and operating contractor for Sandia National Laboratories entered a Compliance Order on Consent in 2004 (NMED 2004). This Compliance Order on Consent requires corrective actions for releases of hazardous waste or hazardous constituents as well as for releases of nitrate and perchlorate from activities and operations. The Federal Facility Compliance Act amended RCRA (see "Federal Facility Compliance Act"). In addition, underground storage tank requirements were added as Subtitle I to RCRA in 1984 and, since 1990, the U.S. Environmental Protection Agency (EPA) has authorized the State of New Mexico, through NMED, to administer and enforce their approved program in lieu of the federal program detailed in 40 CFR 280, *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)*. See Section 2.1.2 for state requirements for solid and hazardous management and Section 3.7 for environmental restoration activities.	• Operate hazardous and mixed waste management units under two permits issued by NMED. • Collect and screen material and waste in preparation for shipment to off-site facilities for recycling, storage, treatment, or disposal. • Conduct investigations and remediation for past releases of hazardous waste and hazardous constituents at SNL/NM.

Radiation Protection

Atomic Energy Act of 1954

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

DOE O 435.1 Change 1, Radioactive Waste Management

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

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

Regulation and Compliance Approach	Compliance Activities
This order establishes requirements to protect the public from undue radiation exposure, demonstrate compliance with public dose limits from air pathways, control releases of radioactive discharges, control radioactive waste, protect drinking water and groundwater, protect biota, control the release of property with residual radioactivity, and manage radiation-related records. DOE issued a moratorium in January 2000 that prohibited the clearance of volume-contaminated metals, and subsequently in July 2000 suspended the clearance of metals from DOE radiological areas for recycling purposes. Chapters 3 through 7 provide information on relevant compliance, as indicated in the Compliance Activities column.	• Monitor emissions and provide dose assessments (Chapter 5). • Monitor radioactive releases to the sanitary sewer (Chapter 6). • Manage permitted radioactive waste units (Chapter 3). • Adhere to regulations during operation and maintenance of the drinking water system (Chapter 5). • Monitor groundwater (Chapter 3). • Monitor biota (Chapter 4 and Chapter 7). • Perform property clearances (during 2020, 287 personal property clearance surveys were processed, no metals subject to the moratorium or the suspension were cleared, and no real property was cleared).

Air Quality

Clean Air Act of 1970, as amended

Regulation and Compliance Approach	Compliance Activities
This act governs the management of nonradiological emissions through adherence to the conditions of permits and applicable regulations. Radiological emissions compliance is achieved through annual reporting of radionuclide air emission and dose assessments in accordance with Subpart H of 40 CFR 61. Chapter 5 provides information on air quality compliance.	• Confirm that planned stationary sources of air pollutants (e.g., equipment) and potential emissions from operations meet applicable local and federal requirements. • Maintain documentation that ensures that sources are in compliance with regulations and/or permitted operating conditions. • Submit monitoring reports, annual emissions inventories, and other compliance assurance documentation to regulatory agencies.

Water Quality

Clean Water Act of 1972 and amendments

Regulation and Compliance Approach	Compliance Activities
This act establishes a permitting structure and regulatory direction to protect the "waters of the United States" by restoring and maintaining the chemical, physical, and biological integrity of United States waters; protecting fish, wildlife, and recreation; and reducing pollutant discharges. At Sandia, sanitary sewer discharge is monitored at six on-site stations permitted by the ABCWUA to meet regulatory compliance. Approval for surface water discharge is determined after evaluation with NMED applicable requirements. EPA Region 6 is the constituent agency responsible for regulating stormwater discharges under the National Pollutant Discharge Elimination System (NPDES) in New Mexico. NPDES permitting requirements apply to "waters of the United States" as defined in the Clean Water Act. Stormwater is managed via NPDES permits, which include the Municipal Separate Storm Sewer System (MS4) Permit, the Multi-Sector General Permit (MSGP), and the Construction General Permit (CGP). EPA retains authority over the Stormwater Program. Chapter 6 provides information on compliance with water quality regulations.	• Evaluate proposed water and water-based compounds being discharged to the ground surface for potential contaminants. • Monitor all wastewater discharges. • Obtain NPDES permits, conduct routine assessments, and monitor stormwater. • Develop and update Stormwater Pollution Prevention Plans, including control measures, site inspections, and annual reporting.

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

Regulation and Compliance Approach	Compliance Activities
This section of the act requires federal agencies to manage stormwater runoff from federal development projects for the protection of water resources. Sandia projects planned through the NEPA process (see "National Environmental Policy Act") are reviewed for EISA § 438 eligibility, which can be required under either the MSGP and/or the MS4 Permit. Site planning, design, construction, and maintenance strategies are applied to maintain or restore predevelopment site hydrology. Section 6.4 provides information on the Stormwater Program.	• Implement Stormwater Pollution Prevention Plan steps to prevent unpermitted discharges. • Conduct inspections.

Oil Pollution Act of 1990 (§ 311)

Regulation and Compliance Approach	Compliance Activities
This act establishes requirements for the prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities. It requires the development and implementation of a Spill Prevention, Control, and Countermeasure Plan. Sandia personnel develop, implement, and maintan a Spill Prevention, Control, and Countermeasure Plan for all applicable oil storage containers. Implementing regulations are found in 40 CFR 112, *Oil Pollution Prevention*. Section 6.2 provides information on the Oil Storage Program.	• Inspect bulk oil storage containers routinely. • Train oil-handling personnel routinely. • Maintain an oil storage container inventory. • Incorporate oil spill prevention requirements and practices into processes, procedures, and new container installations.

Safe Drinking Water Act of 1974, as amended

Regulation and Compliance Approach	Compliance Activities
This act was established to protect the quality of drinking water in the United States, focusing on all waters actually or potentially designed for drinking use, whether from aboveground or underground sources. The KAFB Public Water System provides potable water for Sandia facilities, and KAFB is responsible for meeting drinking water requirements as the supplier. Sandia personnel adhere to specific requirements from the State of New Mexico as NMED is authorized to administer and enforce safe drinking water requirements in lieu of the federal program detailed in 40 CFR 141, *National Primary Drinking Water Regulations* implementing regulations. Section 6.3 provides information on safe drinking water.	• Sample drinking water quality parameters routinely. • Inspect water quality associated with new construction water line disinfection and line repair activities.

Chemical Management

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

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

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

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

Toxic Substances Control Act, enacted in 1976 and later amended-

Regulation and Compliance Approach	Compliance Activities
This act regulates the manufacture, processing, distribution, use, and disposal of specific chemical substances and/or mixtures. At Sandia, compliance with this act involves managing asbestos and polychlorinated biphenyls (PCBs).	• Conduct asbestos abatement in accordance with applicable regulatory requirements.

Chapter 3 provides information related to managing toxic substances.	• Evaluate electrical equipment for PCBs when they are taken out of service.

Pollution Prevention

Pollution Prevention Act of 1990	
Regulation and Compliance Approach	**Compliance Activities**
This act declares as national policy that pollution should be prevented or reduced at the source wherever feasible and disposed of or released into the environment only as a last resort. A toxic chemical source reduction and recycling report is required for facilities that meet the reporting requirements under EPCRA, Section 313. See the previous EPCRA discussion under "Chemical Management."	• Conduct database queries for chemical purchases annually. • Compare environmental releases with EPCRA reporting thresholds. • Prepare annual reports and submit them to federal, state, and local regulatory agencies. • Follow green purchasing practices.

Natural Resources

Bald and Golden Eagle Protection Act (16 USC § 668-668d), enacted in 1940 Endangered Species Act of 1973, amended in 1982 Executive Order 11988 of 1977, Floodplain Management, as amended Executive Order 11990 of 1977, Protection of Wetlands, as amended Executive Order 13112, of 1999, Invasive Species Executive Order 13751, of 2016, Safeguarding the Nation from the Impacts of Invasive Species Fish and Wildlife Conservation Act (Public Law [PL] 96-366), enacted in 1980, and the Lacey Act Amendments (PL 97 79), enacted in 1981 Migratory Bird Treaty Act (MBTA) of 1918 (and amendments) Sikes Act of 1960 (PL 86-97), enacted in 1960, and the amendments of 1986 (PL 99-561) and 1997 (PL 105-85 Title XXIX), reauthorized in 2013	
Regulation and Compliance Approach	**Compliance Activities**
A variety of statutes and presidential executive orders ensure the protection and conservation of natural resources. Natural resources are protected via compliance with applicable statutes, long-term surveillance, and ecological compliance. Management is initially through the NEPA process (see "National Environmental Policy Act"), review of project plan effects, and Eco Ticket (a web-based monitoring system) requests. Required applicable permits are obtained to conduct natural resource work. Chapter 7 provides more information on the Ecology Program.	• Conduct biological surveys. • Collect ecological resource inventory data. • Assess, inventory, and monitor vegetation. • Relocate wildlife.

Cultural Resources

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

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

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

DOE O 430.1C, Real Property Asset Management

DOE P 141.1, Management of Cultural Resources

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

Native American Graves Protection and Repatriation Act, enacted in 1990

Regulation and Compliance Approach	Compliance Activities
Multiple statutes prescribe the management and preservation of cultural resources. Protection of cultural resources (including historical properties) is initially provided through the NEPA process (see "National Environmental Policy Act") and review of project plans. Sandia personnel support DOE coordination with other federal agencies and with local, state, and tribal agencies to protect and preserve cultural resources. Chapter 8 provides more information about the Cultural Resource Management Program.	• Develop management plans. • Conduct cultural resource surveys. • Survey property to determine eligibility for inclusion in the National Register of Historic Places. • Prepare documentation to support planning activities and decisions. • Review NEPA checklists for impacts on cultural resources. • Monitor construction activities for impacts on cultural resources.

Reporting

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

Regulation and Compliance Approach	Compliance Activities
This order ensures that DOE receives information about events that have affected or could adversely affect the health, safety, and security of the public or workers, the environment, the operation of DOE facilities, or DOE credibility. It enhances mission safety and promotes the sharing of effective practices to support continuous improvement and adaptation to change. Sandia personnel report on environmental program activities, monitoring results, accidental releases, and waste management operations.	• Produce an Annual Site Environmental Report.

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

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

Quality Assurance

DOE O 414.1D Admin Change 1, Quality Assurance	
Regulation and Compliance Approach	**Compliance Activities**
The purpose of this order is to achieve quality in all work and ensure that products and services meet or exceed customer requirements and expectations. All environmental sampling and analyses at Sandia conform to applicable quality assurance plans, sampling plans, and field operations. Chapter 9 provides information on quality assurance.	• Develop quality assurance plans, operating plans, and sampling plans. • Provide a statement of work for contract laboratories. • Participate in quality assurance audits of contract laboratories.

Prickly pear cactus (*Opuntia*)

2.1.2 New Mexico State and Local Environmental Requirements

New Mexico state and local environmental requirements applicable to Sandia operations include the following.

New Mexico State Statute and Bernalillo County, New Mexico, Air Quality Standards

The EPA program for attaining and maintaining National Ambient Air Quality Standards requires local agencies to develop a comprehensive permitting program. In accordance with the Air Quality Control Act, NMSA 1978, §§ 74-2-1 to-17, the Albuquerque Bernalillo County Air Quality Control Board has developed a set of regulations that govern mobile and stationary sources of air pollution in Bernalillo County, New Mexico.

- **Fugitive dust permitting.** The City of Albuquerque implements 20.11.20 NMAC, *Fugitive Dust Control*, to ensure that every person shall use reasonably available control measures or other effective measures on an ongoing basis to prevent or abate fugitive dust if the fugitive dust may, with reasonable probability, injure human health or animal or plant life, or may unreasonably interfere with public welfare, visibility, or the reasonable use of property.
- **National Emission Standards for Hazardous Air Pollutants (NESHAP).** EPA develops and implements NESHAPs to limit the release of air pollutants that are known to cause or are suspected of causing cancer, birth defects, reproduction problems, and other serious illnesses. These standards are authorized by Section 112 of the Clean Air Act, and the regulations are published in 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants*, and 40 CFR 63, *National Emission Standards for Hazardous Air Pollutants for Source Categories*, which the City of Albuquerque implements in Bernalillo County. NESHAPs initially were established for seven

pollutants, including asbestos, radionuclides, and beryllium. EPA changed the approach to NESHAPs with the 1990 Clean Air Act Amendments to focus the requirements on source categories rather than on individual hazardous air pollutants. Since then, NESHAPs have been implemented for a number of sources, including halogenated solvent cleaning, semiconductor manufacturing, surface coating operations, and stationary engines.

- **New Source Performance Standards and New Source Review requirements.** As part of an effort to control pollution in the United States, New Source Performance Standards and New Source Review permitting requirements identify the minimum level of air pollution controls from a new stationary source. The performance standards are authorized by Section 111 of the Clean Air Act, and the regulations are published in 40 CFR 60, *Standards of Performance for New Stationary Sources*. The New Source Review preconstruction permitting requirements include criteria pollutants as authorized by Section 110 of the Clean Air Act. In addition, sources may also be subject to siting requirements found in Part C, *Prevention of Significant Deterioration of Air Quality* and Part D, *Plan Requirements for Nonattainment Areas* of Title I of the Clean Air Act. The permitting regulations are codified in 40 CFR 51, *Requirements for Preparation, Adoption, and Submittal of Implementation Plans*, and 40 CFR 52, *Approval and Promulgation of Implementation Plans*. Both the performance standards and permitting requirements are administered and enforced by the City of Albuquerque, as delegated by the EPA. New Source Performance Standards are established for a number of source categories, including boilers and stationary engines. New Source Review requirements provide assurance to the public that any new, or modified source of air pollutants will be protective of human health and the environment, and that advances in pollution control will occur concurrently with industrial expansion.
- **Open burn permitting.** The City of Albuquerque enforces 20.11.21 NMAC, *Open Burning*, to ensure that all persons conduct open burning in a manner that prevents or abates emissions that are visible and that produce noxious by-products of combustion.
- **Ozone-depleting substances requirements.** Based on the requirements of Title VI of the Clean Air Act, EPA has established regulations to protect the stratospheric ozone layer by managing ozone-depleting substances.

The Clean Air Act Amendments of 1990 contain provisions under Title V that require an operating permit for all major sources of air pollutants. A *major* source is defined as a facility with the potential to emit 100 tons per year or greater of any criteria pollutant, 10 tons per year of any hazardous air pollutant, or 25 tons per year of any combination of hazardous air pollutants. Operating permits are issued by the City of Albuquerque.

New Mexico State Statutes and Regulations Related to Natural and Cultural Resources

The following New Mexico statutes related to natural resources and cultural resources are applicable to Sandia operations:

- *Hunting and Fishing Regulations,* New Mexico Statutes Annotated (NMSA) 1978, Article 2
- *General Provisions,* NMSA 1978, §§ 17-2-13 to-15 protecting songbirds; hawks, vultures, and owls; and horned toads, respectively
- *Wildlife Conservation Act,* NMSA 1978, §§ 17-2-37 to-46
- *Habitat Protection Act,* NMSA 1978, §§ 17-6-1 to-11
- *Endangered Plants,* NMSA 1978, § 75-6-1
- *Protection of Native New Mexico Plants,* NMSA 1978, §§ 76-8-1 to-4
- *Cultural Properties and Historic Preservation, Permits to Conduct Archaeological Investigations on State Land,* 4.10.8 New Mexico Administrative Code (NMAC)
- *Cultural Properties and Historic Preservation, Standards for Survey and Inventory,* 4.10.15 NMAC

New Mexico State Statutes and Regulations Related to Petroleum Storage Tanks

Under the authority of the New Mexico Hazardous Waste Act of 1978, NMSA 1978, §§ 74-4-1 through 74-4-14, and the New Mexico Groundwater Protection Act of 1978, NMSA 1978, §§ 74-6B-1 through -14, as well as with delegated authority from EPA under RCRA, NMED administers and enforces the underground storage tank regulatory program in New Mexico. Applicable SNL/NM underground and aboveground storage tanks are regulated under 20.5 NMAC, *Petroleum Storage Tanks*. See Chapter 6 for more information.

New Mexico State Statutes and Regulations Related to Solid and Hazardous Waste Management

Under RCRA, EPA delegates authority to state programs for nonhazardous solid waste and hazardous solid waste, also simply referred to as hazardous waste. NMED administers and enforces the solid waste program in New Mexico under the authority of the New Mexico Solid Waste Act, NMSA 1978, §§ 74-9-1 to-43. Solid waste management activities at SNL/NM are conducted pursuant to 20.9 NMAC, *Solid Waste*. See Chapter 3 for more information.

NMED administers the hazardous waste program in New Mexico under the authority of the New Mexico Hazardous Waste Act. Hazardous waste management activities at SNL/NM are conducted pursuant to 20.4 NMAC*, Hazardous Waste*. See Chapter 3 for more information.

New Mexico Water Quality Control Commission

The New Mexico Water Quality Act, NMSA 1978, §§ 74-6-1 to-17, establishes a Water Quality Control Commission and defines its authority to adopt water quality standards and direct programs consistent with the Clean Water Act. All discharges made to the ground or surface water must be evaluated for compliance with standards adopted for the protection of groundwater and surface water quality prior to discharge (20.6.2 NMAC, *Ground and Surface Water Protection*). See Chapter 6 for more information.

2.2 Environmental Management System

The EMS is a continuing cycle of planning, implementing, evaluating, and improving processes to achieve environmental goals. The EMS facilitates identification of the environmental aspects and impacts of Sandia 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 and monitor those environmental objectives and 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*, presents requirements for an EMS and sustainability practices. Sandia personnel implement this order through an ISO 14001-certified EMS. Sandia National Laboratories received initial ISO 14001:2004 certification in June 2009. In 2015, the Sandia site-specific certifications for primary operating locations in New Mexico and California were integrated into a multi-site ISO 14001:2004 certification. In 2018, the EMS was recertified under the new ISO 14001:2015 (ISO 14001:2015). To maintain this certification, audits by a third-party registrar are required annually to ensure continued conformance with the standard. Additional information can be found at the following external EMS website:

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

The EMS provides the following benefits:

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

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

2.2.1 Site Sustainability Plan

A Site Sustainability Plan is prepared annually to assist DOE in meeting its sustainability goals and the broader sustainability program set forth in EO 13834, *Efficient Federal Operations*. Sandia's most recent plan, *Fiscal Year 2021 Site Sustainability Plan* (SNL/NM 2020c), describes the performance status for FY 2020. Additional information about pollution prevention activities is provided in Chapter 3.

Sustainability goals are being met or exceeded in several key areas. Table 2-1 presents performance status for several selected key areas (SNL/NM 2020c).

Table 2-1. Site Sustainability Plan performance status for key areas

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2020
Clean and Renewable Energy	
Renewable electric energy should account for not less than 7.5 percent of the total agency electric consumption by FY 2013 and each year thereafter.	Purchased renewable energy credits to meet 20 percent of the total electric consumption forecasted for FY 2020.
Electronic Stewardship	
Purchases: Ninety-five percent of eligible acquisitions each year are EPEAT-registered products.	Acquired EPEAT-registered products for 89.32 percent of eligible electronics purchased in FY 2020.
End of life: One hundred percent of used electronics are reused or recycled using environmentally sound disposition options each year.	Results for SNL/NM and Sandia National Laboratories, California (SNL/CA) combined: One hundred percent of used electronics were reused or recycled.
Greenhouse Gas Reduction	
Year-over-year Scope 1 and Scope 2 greenhouse gas emissions reduction from an FY 2008 baseline. Year-over-year Scope 3 greenhouse gas emissions reduction from an FY 2008 baseline.	• Reduced Scope 1 and Scope 2 greenhouse gas emissions by 60.5 percent from the FY 2008 baseline, and reduced year-over-year emissions by 2.1 percent relative to FY 2019. • Reduced Scope 3 greenhouse gas emissions by 35.1 percent from the FY 2008 baseline, and reduced year-over-year by 26.9 percent relative to FY 2019.

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2020
Organizational Resilience	
Discuss overall integration of climate resilience in emergency response, workforce, and operations procedures and protocols.	Completed a Climate Vulnerability Assessment, which highlights areas where resilience to climate change have been integrated, as well as areas for improvement.
Pollution Prevention and Waste Reduction	
Reduce at least 50 percent of nonhazardous solid waste sent to treatment and disposal facilities. Reduce construction and demolition materials and debris sent to treatment and disposal facilities. Year-over-year reduction; no set target.	Results for SNL/NM only: Met this objective by diverting 62 percent of nonhazardous solid waste. Reduced construction and demolition waste by 86 percent through diversion.
Sustainable Acquisition	
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring that BioPreferred and biobased provisions and clauses are included in all applicable contracts.	• Flowed down sustainable acquisition requirements in applicable contracts. Included the Federal Acquisition Regulation and DOE Acquisition Regulation clauses related to sustainable acquisitions. • Established an interdepartmental team to enhance sustainable acquisition programs. • Created corporate- and division-level EMS objectives that focus on sustainable acquisitions for FY 2021. • Included all environmental specifications to be met in applicable contracts, including biobased acquisitions. Added the Federal Acquisition Regulation and DOE Acquisition Regulation clauses to Section II Terms and Conditions in the majority of contracts.
Sustainable Buildings	
At least 15 percent (by count) of owned existing buildings to be compliant with the revised *Guiding Principles* for Sustainable Buildings by FY 2021, with annual progress thereafter.	Achieved compliance with the *Guiding Principles* in 18.4 percent of the buildings.
Sustainable Energy Management	
Energy intensity reduction of 30 percent (Btu per gross square foot) in goal-subject buildings by FY 2015 from an FY 2003 baseline and 1.0 percent year-over-year thereafter.	The target for FY 2020 is a 5 percent reduction of energy intensity from FY 2015. In FY 2020, performance was a 0.06 percent reduction from FY 2015. In FY 2020, performance increased by 0.27 percent compared to FY 2019.
Water Use Efficiency and Management	
Reduce potable water intensity by 20 percent relative to an FY 2007 baseline by FY 2015 and 0.5 percent year-over-year thereafter.	Results for SNL/NM only: reduced potable water intensity by 31.1 percent in FY 2020 relative to an FY 2007 baseline and reduced it by 13.8 percent relative to FY 2019.

EPEAT = Electronic Product Environmental Assessment Tool

2.2.2 Sustainability Awards

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

The individual who received the Sustainability Champion Award has been actively engaged with the Zero Waste by 2025 challenge, organizing and leading the installation of recycling stations and expanding them to receive almost every type of recyclable material as well as single-handedly implementing composting throughout the building where the individual works. This is the first actualized effort to implement composting in a secure area, and it has reduced solid waste by 37 pounds per person, which is equivalent to 3,256 pounds annually.

The individual who received a Sustainability Champion Honorable Mention has led innovative energy conservation efforts for more than five years to improve building metering; reduce the use of water, natural gas, and electricity; and promote energy-efficient electronics. As a result, energy consumption was reduced by nearly four percent.

Sunrise over the Sandia foothills

2.3 Environmental Performance

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

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

2.3.1 Audits, Assessments, and Inspections in 2020

Environmental programs are routinely subjected to audits, assessments, inspections, and/or verifications by external agencies and authorities. Table 2-2 summarizes the 2020 audits, including any findings, notices of violation, or other environmental occurrences. The Sandia internal audit

group also conducts assessments, including reviews of implementation of applicable policies, processes, or procedures; evaluations of corrective action validation assessments; and surveillances and walkthroughs. Self-assessments evaluate performance and compliance and identify deficiencies and opportunities for improvement as well as noteworthy practices and lessons learned.

The NMED DOE Oversight Bureau provides independent verification of environmental monitoring results obtained by Sandia personnel on behalf of DOE. The Oversight Bureau achieves verification through the following:

- Assesses DOE management of its New Mexico facilities to ensure attainment of public health and environmental standards
- Provides inputs to DOE for prioritization of its cleanup and compliance activities
- Develops and implements an independent monitoring and oversight program
- Increases public knowledge and awareness of environmental matters at DOE facilities in New Mexico

The NMED DOE Oversight Bureau performs sampling and monitoring activities in conjunction with Sandia environmental program personnel. In 2020, this included air, water, vegetation, and soil/sediment sampling programs. The samples were analyzed by independent laboratories under contract to the NMED DOE Oversight Bureau. More information can be found at the following website:

https://www.env.nm.gov/doeob/

Table 2-2. Environmental-related external audits, assessments, inspections, and violations, 2020

Appraising Agency/Authority	Title/Description	Date	Summary
NMED, Hazardous Waste Bureau	Fiscal Year 2020 annual no-notice hazardous waste compliance evaluation inspection	December 2019, results February 2020	One notice of violation, 16 findings
ABCWUA	Permit 2069G renewal inspection and 2069I Industrial Wastewater Permit Inspection	February 2020	No findings, Permit 2069G issued
City of Albuquerque Air Quality Program	Fugitive Dust Permit Closeout Visit	February 2020	No findings
ABCWUA	Industrial Wastewater Permit Inspection (2069A, 2069F, 2069K, 2238A)	June 2020	No findings
Orion Registrar	ISO 14001 Surveillance Audit	July 2020	Two minor nonconformances, nine observations, and six noteworthy practices
ABCWUA	ABCWUA Outfall semiannual sampling/permitted outfall assessments	October 2020	No findings
NMED, Petroleum Storage Tank Bureau	Records Review Inspection	November 2020	No findings

2.3.2 Occurrence Reporting in 2020

Under DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information*, the current order for occurrence reporting, *occurrences* are defined as "events or conditions that adversely affect, or may adversely affect, DOE (including the National Nuclear Security Administration) or contractor personnel, the public, property, the environment, or the DOE mission." Events or conditions meeting the criteria thresholds identified in this order are occurrences. Whereas some environmental releases may not meet DOE O 232.2A MinChg1 reporting thresholds, they may still be reportable to outside agencies.

Occurrences that meet DOE O 232.2A, Chg 1 (MinChg1) criteria are entered into the DOE Occurrence Reporting and Processing System database. For this Annual Site Environmental Report, the Occurrence Reporting and Processing System database was queried for occurrences in the following reporting criteria groups (as defined by DOE O 232.2A MinCh1):

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

Per DOE, an *occurrence* is 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.

During 2020, three occurrences met the criteria for reporting in this Annual Site Environmental Report as shown in Table 2-3. Table 2-3 also cross-references DOE O 232.2A reportable occurrences that were reportable to an outside agency, if applicable.

Table 2-3. Occurrence reports per DOE O 232.2A, 2020

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.	March	Informational	**NA--SS-SNL-NMSITE-2020-0001** New Mexico Environment Department Hazardous Waste Notice of Violation	N/A
Group 5 - Environmental - 5A(4) - Any discrete release of sulfur hexafluoride (SF_6) due to an event or DOE operation equal to or exceeding 115 pounds (1,247 metric tons of CO_2e according to 40 CFR Part 98, Subpart A, Table A-1, *Global Warming Potentials*) or 115 pounds more than the normal release quantity if the SF_6 release is a common by-product of the operation.	April	Informational	**NA--SS-SNL-1000-2020-0005** Z Machine Sulfur Hexafluoride Release	N/A

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.	June	Informational	**NA--SS-SNL-4000-2020-0007** Fugitive Dust Control Notice of Violation for Building 812 Construction	N/A

CO_2e = carbon dioxide equivalent
N/A = not applicable
SF_6 = sulfur hexafluoride

2.4 Reporting Requirements Other than to DOE

External reporting requirements (other than to DOE) are necessary for both routine and nonroutine releases of pollutants or hazardous substances. Release information may be used to evaluate facility operation compliance, waste-handling activities, and emergency response programs. Table 2-4 summarizes the primary reporting requirements for qualifying releases. EPCRA reporting requirements are also included.

Table 2-4. Reporting requirements to outside agencies (other than DOE)

Report	Description	Agency and Regulation	Required Reporting in 2020?
Accidental Slug Discharge Notification	ABCWUA requires notification to its Wastewater Utility Division of any accidental release or slug discharge to the sanitary sewer that may cause potential problems for publicly owned treatment works. The user shall report to the ABCWUA as follows: • Immediate verbal notification to the ABCWUA Industrial Pretreatment Engineer • Written notification to the ABCWUA Industrial Pretreatment Engineer within five days following such occurrence describing the cause of the discharge and measures to be taken to prevent similar future occurrences	ABCWUA Sewer Use and Wastewater Control Ordinance	Yes Events reported to the ABCWUA are discussed in Chapter 6.
Annual NESHAP Dose Assessment Report	EPA requires reporting on a dose assessment of the calculated effective dose equivalent to the maximally exposed individual based on the assumption that an exposed individual resides 24 hours per day at an area of highest incident radiation.	EPA 40 CFR 61, Subpart H	Yes Dose assessment is discussed in Chapter 5.
EPCRA Emergency Planning	Sections 301–303 of EPCRA require an annual report that lists the chemical inventories above the reportable threshold planning quantities, including the location of the chemicals and the emergency contacts.	EPA 40 CFR 350, 355, 370, and 372	Yes Reports submitted to the EPA are discussed in Chapter 6.
EPCRA Emergency Notification	Section 304 of EPCRA requires immediate notification about the accidental release of a reportable quantity of extremely hazardous substances.		No

Report	Description	Agency and Regulation	Required Reporting in 2020?
EPCRA Community-Right-to-Know: Hazardous Chemical Storage Reporting	Sections 311–312 of EPCRA provide requirements for maintaining safety data sheets for hazardous chemicals and for submitting inventory forms for these chemicals. Maintenance of safety data sheets is discussed in Chapter 3.		Yes Reports submitted to EPA are discussed in Chapter 6.
EPCRA Community-Right-to-Know: Toxic Chemical Release Inventory Reporting	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.		Yes Reports submitted to EPA are discussed in Chapter 6.
Notification of Environmental Release	NMED requires reporting of any discharge from any facility of oil or other water contaminants in such quantity as may with reasonable probability (1) injure or be detrimental to human health, animal life, or plant life or (2) be harmful to property or unreasonably interfere with the public welfare or use of the property. The owner/operator shall report to the appropriate agency within NMED as follows: • Verbal notification as soon as possible after learning of such a discharge, but in no event more than 24 hours thereafter • Written notification within one week verifying the prior verbal notification • Written notification within 15 days describing any corrective actions taken and/or to be taken relative to the discharge	NMED 20.6.2.1203 NMAC	No
Notification of Unauthorized Non-Stormwater Discharge	EPA requires reporting of unauthorized non-stormwater discharges that may endanger human health or the environment. The owner/operator shall report to EPA Region 6 office as follows: • Verbal notification as soon as possible after learning of such a discharge, but in no event more than 24 hours thereafter • Written notification within five days to EPA Region 6 Office for the NPDES Stormwater Program	EPA NPDES Multi-Sector General Permit Part 7.7	No
Petroleum Storage Tanks Reporting and Investigation of Suspected and Confirmed Releases	NMED requires reporting of any suspected or confirmed release from a storage tank system. The system owner shall report a suspected or confirmed release as follows: • Verbal notification within 24 hours describing conditions and other pertinent information • Written notification within 7 days, including additional information on source and cause of release, estimated volume, and any actions taken to mitigate immediate damage	NMED 20.5.118 NMAC	Yes Events reported to the NMED are discussed in Chapter 6.

Chapter 3. Environmental Programs

Coyote Springs

OVERVIEW ■ Sandia personnel take the responsibility of protecting the environment seriously. Numerous program teams monitor the air, water, and soil to help prevent pollution and conserve natural resources.

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

Environmental monitoring began at SNL/NM in 1959, when the principal objective was to monitor radioactive effluents and determine any associated environmental impacts. Since then, environmental programs and waste management, along with other ES&H activities, have expanded greatly. The current environmental programs and focus areas include:

- NEPA Program
- Environmental Education Outreach
- Chemical Information System and Chemical Exchange Program
- Materials Sustainability and Pollution Prevention Program
- Waste Management Program
- Environmental Life-Cycle Management Program
- Environmental Restoration Operations
- Long-Term Stewardship Program

The following additional environmental programs are presented in separate chapters:

- Terrestrial Surveillance Program (Chapter 4)
- Air Quality Compliance and related programs (Chapter 5)
- Water Quality programs (Chapter 6)
- Ecology Program (Chapter 7)
- Cultural Resources Program (Chapter 8)

3.1 National Environmental Policy Act Program

NEPA Program personnel provide technical assistance to ensure that operations comply with NEPA at all Sandia locations: SNL/NM; SNL/CA; Tonopah Test Range, Nevada; Kaua'i Test Facility, Hawai'i; and other remote locations as needed. For proposed projects and activities, project owners complete a NEPA checklist using NEPA Module software to identify potential environmental impacts.

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

DOE has analyzed the impacts of Sandia operations in a Site-Wide Environmental Impact Statement, which currently covers the activities that were occurring when the document was prepared in 1999 and supplemented in 2004. In addition, various environmental assessments provide NEPA documentation for specific activities.

If the activities described in a checklist are covered by existing NEPA coverage, NEPA Program personnel may approve the checklist. A NEPA checklist is forwarded to DOE for review and determination when a proposed project or activity meets any of the following concerns:

- 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 or permitted to Sandia.

Projects or activities that do not have coverage under existing NEPA documents or do not qualify for a categorical exclusion (per 10 CFR 1021, *National Environmental Policy Act Implementing Procedures*) require new or additional analyses, which may result in the need for a new environmental assessment, environmental impact statement, or supplemental document to existing environmental impact statements and environmental assessments including the Site-Wide Environmental Impact Statement. Sandia personnel continue to assist DOE in the development of a new site-wide environmental impact statement.

3.1.1 National Environmental Policy Act Activities in 2020

In 2020, the NEPA Program team participated in the following environmental activities:

- During Coronavirus 2019 (COVID-19), Sandia personnel responded with innovative solutions to help the nation with the health crisis. This effort required rapid engagement by NEPA Program personnel to ensure that projects had sufficient NEPA coverage for work to proceed. Projects reviewed for NEPA compliance included work in the following areas:
    - Aerosol testing
    - Biotechnology and bioengineering research and development

    - Computer modeling
    - Diagnostic testing
    - Personal protective equipment research and development
- NEPA Program personnel reviewed routine maintenance activities at SNL/NM for NEPA compliance, including the need for biological surveys, historic building and archaeological surveys, and permits, such as discharge permits. Overall, 165 maintenance activities were reviewed using the Routine Maintenance Criteria SharePoint site.
- NEPA Program personnel supported a capital acquisition project for the new Power Sources Capability Facility in TA-II. A siting and planning checklist and a geotechnical borings checklist were submitted to and approved by DOE. In addition, a NEPA checklist was submitted for construction and operation of the new Power Sources Capability facility.

Along with these activities, NEPA Program personnel reviewed 357 proposed activities in 2020, including continuation of routine operations. Of these, 195 checklist reviews were completed internally and 153 NEPA checklists were transmitted to DOE for review and determination. Further, 9 NEPA checklists were transmitted to the U.S. Air Force for review and determination because the proposed projects would take place on KAFB permitted land.

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

Roof Asset Management Program Projects

The Roof Asset Management Program—under DOE, Office of Defense Nuclear Nonproliferation, Research and Development Program—is set up to replace existing roofing systems that have reached the end of their life. At SNL/NM, the scope includes removing existing membrane roofs and replacing them with new thermoplastic olefin membrane roofs.

In 2020, NEPA Program personnel completed 24 NEPA checklists for Roof Asset Management Program projects.

Facility Projects

NEPA Program personnel review projects for new construction, demolition and disposal of structures, and work on existing or new parking lots, roads, and utilities systems.

In 2020, NEPA Program personnel reviewed:

- Electrical substation
- Entrance vestibule
- Laboratory consolidation and reconfiguration project
- New buildings (seven)
    - Approximately 15,000-square-foot building for office and laboratory space
    - Approximately 24,000-square-foot building for office and training space
    - Approximately 40,000-square-foot building for office space
    - Communication tower
    - Modular office building
    - Single-story metal building for storing materials
    - Single-story metal building for training activities

- Rocket display at the National Museum of Nuclear Science and History
- Solar power structure
- Storage facility for personal protective equipment
- Transportainer projects (two)
  - Additional temporary transportainer for testing activities
  - Up to five additional transportainers for storage and light laboratory space

NEPA Program personnel also reviewed utility projects:

- Chiller replacements
- Cooling tower
- Electric and utility lines replacement
- Fiber-optic installation
- Fire protection upgrade
- Infrastructure and facility revitalization (six projects)
- Public address installation
- Temporary wind turbine
- Water meter installation

Unmanned Aerial System Projects

In 2020, NEPA Program personnel reviewed three projects for unmanned aerial systems. These proposed projects consisted of research, development, testing, and evaluation.

Other Projects

NEPA Program personnel also reviewed projects for:

- Erosion and drainage control
- Geotechnical borings
- Lease agreements
- Research and development
- Sandia operations, including:
  - Energy
  - Global security
  - National security programs
  - Nuclear weapons
- Waste shipments

3.2 Environmental Education Outreach

Environmental Education Outreach personnel reach out to both the local community and to Sandia personnel through organized events. In addition to complying with requirements, it is recognized that communicating with the local community and Sandia personnel about reducing environmental impacts at work and at home is important. An integrated approach is employed to communicate environmental awareness to personnel via newsletters, annual campaigns, and outreach events.

Environmental Education Outreach activities include participating in or hosting several in-house and public outreach and awareness events annually. Events conducted in 2020 included a virtual Earth Day and a virtual presentation of the annual Environmental Excellence Awards. Environmental education models are used in presentations and include topics such as air quality, landfills, groundwater, and watersheds. In 2020, environmental professionals recorded a demonstration of the watershed module and distributed it electronically to local schools. Sandia personnel and community members are encouraged to provide feedback and to ask questions about any of Sandia's environmental programs.

The annual Environmental Excellence Awards are presented in recognition of Sandia personnel who demonstrate environmental excellence in areas such as energy and water conservation, environmental protection, waste minimization, and recycling. Since the inception of the awards in 2006, there have been 268 nominations for contributions to the vision of environmental excellence.

3.3 Chemical Information System and Chemical Exchange Program

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

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

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

The Chemical Exchange Program reduces the amount of usable chemicals disposed of as waste and instead makes them available for reuse, thereby lowering the cost for both new acquisitions and disposal.

The Chemical Exchange Program was developed in 1989 as a hazardous waste management waste minimization program. The goal is to reduce the amount of usable chemicals disposed of as waste and instead make them available for reuse, thereby lowering the cost for both new acquisitions and disposal. This program has been through multiple transformations since its inception, and in 2008 the Chemical Exchange Program was introduced as a module within the Chemical Information System. The Chemical Information System/Chemical Exchange Program team continues to develop a more user-friendly, web-based, interactive tool for using the Chemical Exchange Program.

3.4 Materials Sustainability and Pollution Prevention Program

The Materials Sustainability and Pollution Prevention Program is a central element in the Environmental Management System and applies to all activities that involve procuring and using resources and generating waste. Program personnel provide guidance and specify strategies and methods for reducing the quantity and toxicity of waste and pollutants, conserving energy and resources, and purchasing environmentally preferable products. Program focus areas include waste minimization, sustainable acquisitions, electronics stewardship, recycling and composting of solid waste, and awareness and outreach. Integration of materials sustainability into operations is promoted.

3.4.1 Waste Minimization

Waste minimization is accomplished by reducing or eliminating the generation of wastes and other pollutants at the source, including segregation, substitution, and reuse of materials that could otherwise create future environmental legacies. Since establishing the goal of Zero Waste by 2025, the diversion rate has gone from 47 percent in the baseline year of 2008 to 65 percent in 2020. The goal will be considered accomplished when operations meet the internationally accepted definition of Zero Waste. This means reducing waste by 90 percent from the baseline year, i.e., generating less than 23 pounds per person of commercial solid waste per year.

3.4.2 Sustainable Acquisition

Sustainable acquisitions are one way to reduce environmental impacts. This includes integrating products with reduced environmental impact into purchase agreements and ongoing operations and maintenance. Products containing recycled and biobased content, those designed with identified environmentally preferable attributes, and those with third-party-certified green labels are preferred. In 2020, working groups were established to evaluate process improvements that would increase the collection of data from suppliers with green language in their contracts. Due to COVID-19 issues, the progress of the working group was slowed. However, evaluation of a standardized tool began and is anticipated to be implemented in FY 2021. Interdisciplinary teams also met to align requirements with updates to the Guiding Principles that govern design and construction for High Performance Sustainable Buildings.

3.4.3 Electronics Stewardship

Sandia procurement personnel are committed to purchasing electronic equipment that is registered in the Electronic Product Evaluation Assessment Tool (EPEAT). Products registered in EPEAT are considered to be green electronics. Registered equipment has been designed with the environment in mind. Green electronics are defined as equipment whose manufacture, operation, and end-of-life disposition have lower environmental impacts than electronics not registered in the EPEAT registry.

3.4.4 Recycling of Solid Waste

Materials suitable for reuse and/or recycling are diverted from landfills, thereby minimizing the economic and environmental impacts of waste disposal. Instead of paying to throw material away in a landfill, those avoided fees and any realized value are used to support diverse recycling and composting programs. This business model has created three permanent jobs and supported numerous positions at local and regional companies.

3.4.5 Awareness and Outreach

Materials Sustainability and Pollution Prevention Program personnel promote the use of green initiatives and available resources to decrease the environmental impact of existing operations. More than 100 additional compost bins were deployed in 2020, which brings the total to 217 compost bins.

Plans to expand the compost program into the limited areas are underway for FY 2021. Program personnel partner with a local business to process compost waste into a valuable commodity.

Various communication tools are used to increase awareness about and bolster participation in recycling, composting, and acquiring sustainable products. Major outreach efforts include the Zero Waste Challenge and the dedicated Zero Waste by 2025 website. Unfortunately, COVID-19 restrictions prevented Materials Sustainability and Pollution Prevention Program personnel from attending and hosting information tables during events like Earth Day and Pollution Prevention Week. Sandia continues to sponsor the New Mexico Recycling Coalition.

Additional information on Materials Sustainability and Pollution Prevention Programs initiatives, events, and accomplishments can be found at the following website:

http://p2.sandia.gov

3.5 Waste Management Program

Sandia personnel follow the waste management hierarchy dictated in the Pollution Prevention Act of 1990 and reinforced in amendments to RCRA. The objective is to reduce, reuse, or recycle waste (in that order), as appropriate, before any treatment or disposal. Waste management activities are conducted in accordance with applicable permits and regulations as discussed in Chapter 2.

Wastes are generated during daily activities that include research and testing, production, maintenance and support operations (construction, renovation, and decommissioning and demolition), environmental protection, and waste management. Wastes include the following:

- Commercial solid waste
- Construction and demolition waste
- Hazardous waste
- Mixed waste (including low-level radioactive mixed waste and mixed transuranic waste)
- Radioactive waste (including low-level radioactive waste and transuranic waste)
- Toxic Substances Control Act-regulated waste
- Other regulated wastes

Processes at waste management units vary according to the specific waste type, but general tasks are to collect, screen, sort, bale, repackage, treat, and/or store wastes in preparation for shipment to off-site facilities for recycling, storage, treatment, or disposal.

Types of waste handled and shipped in 2020 are summarized in Table 3-1. Wastes recycled in 2020 are summarized in Table 3-2.

Table 3-1. Waste shipped by waste management facilities, 2020

Waste Category	Waste Shipped (pounds)
Radioactive Waste	
Low-level radioactive waste	46,488
Transuranic waste	834
Subtotal	**47,322**

Waste Category	Waste Shipped (pounds)
Mixed Radioactive and Hazardous Waste	
Mixed low-level radioactive waste	54,504
Mixed transuranic waste	1,210
Subtotal	**55,714**
RCRA Waste	
Hazardous waste	195,024
Subtotal	**195,024**
Toxic Substances Control Act	
PCBs	961
PCBs and hazardous waste mixture	0
Subtotal	**961**
Other Regulated Wastes	
Infectious waste	6,142
Asbestos waste	336,960
Chemical waste (includes special waste and industrial solid waste)	652,196
Used oil (not recycled)	0
Subtotal	**995,298**
Solid Waste	
Solid waste collection and recycling center dry waste	1,014,100
Off-site office waste (Sandia Science and Technology Park)	42,240
Cafeteria wet waste	12,640
Construction and demolition waste	5,454,123
Other solid waste	86,896
Subtotal	**6,609,999**
Total Waste Shipped	**7,904,318**

Note: All wastes were shipped off-site for treatment and/or disposal. Wastes that were treated on-site and shipped off-site are included in the quantities of wastes shipped off-site. Waste treatment may increase waste quantity (e.g., adding inert material when treating waste through macroencapsulation within an outer container). Waste containers are included in the quantities of wastes shipped off-site, and some containers (e.g., containers with lead shielding for radiation protection) may increase the quantity significantly.

Table 3-2. Waste recycled, 2020

Recycle Category	Waste Recycled (pounds)
Regulated or Chemical Waste Recycled	
Batteries	48,421
Capacitors	5,638
Computer electronics	404,178
Lead	4,845
Light bulbs	10,414
Toner and ink cartridges	87,855
Used oil	38,558
Subtotal	**599,909**

Recycle Category	Waste Recycled (pounds)
Commercial, Construction, and Demolition Solid Waste Recycled	
Asphalt/concrete	15,641,740
Batteries	3,199
Cardboard	354,809
Carpet	8,000
Chairs	37,860
Compost (food, green waste, paper, and plywood)	227,051
Food grease	63,560
Metals	1,364,662
Nitrile gloves	1,921
Paper (mixed and white)	102,933
Plastics	80,257
Three-dimensional printer cartridges	10,560
Tires	0
Wood	238,731
Subtotal	**18,135,283**
Total Waste Recycled	**18,735,192**

3.5.1 Waste Management Activities in 2020

Waste management takes place at the following locations: the Auxiliary Hot Cell Unit, the Hazardous Waste Handling Unit, seven Manzano Storage Bunkers, the Radioactive and Mixed Waste Management Unit, the Solid Waste Collection and Recycling Center, and the Thermal Treatment Unit.

At each location, wastes are tracked, inspected, and managed at all times to protect human health and the environment. Wastes are not disposed of at SNL/NM. Waste management activities at individual units during 2020 are summarized as follows:

- At the Auxiliary Hot Cell Unit, mixed and radioactive wastes were generated and stored.
- At the Hazardous Waste Handling Unit, hazardous and other regulated wastes were screened, sorted, repackaged, and stored.
- At the Manzano Storage Bunkers, hazardous, mixed, radioactive, and solid wastes were stored and repackaged. Five of the seven bunkers are included in the RCRA Facility Operating Permit; hazardous and mixed waste management activities are limited to these five bunkers.
- At the Radioactive and Mixed Waste Management Unit, hazardous, mixed, and radioactive wastes were screened, sorted, repackaged, stored, and treated. Wastes were treated by one or more of the following methods: solidification and stabilization, chemical deactivation and neutralization, macroencapsulation, detonation inside a portable boom box, or physical treatment (volume reduction).
- At the Solid Waste Collection and Recycling Center, commercial waste was screened prior to shipment off-site for disposal. Other solid wastes and recyclable materials were collected and processed for shipment off site.
- At the Thermal Treatment Unit, small quantities of unique explosive hazardous waste generated by research and test activities at an adjacent facility were treated on-site.

3.5.2 Hazardous and Mixed Waste Permits in 2020

NMED has issued two permits for hazardous and mixed waste management activities, post-closure care, and long-term monitoring and maintenance at SNL/NM: the RCRA Facility Operating Permit and the Chemical Waste Landfill Post-Closure Care Permit.

RCRA Facility Operating Permit

The following units and activities are subject to this permit:

- Auxiliary Hot Cell Unit
- Corrective Action Management Unit (post-closure care)
- Hazardous Waste Handling Unit
- Manzano Storage Bunkers (five)
- Radioactive and Mixed Waste Management Unit
- Solid Waste Management Units and Areas of Concern for which Corrective Action is Complete (long-term monitoring and maintenance)
- Thermal Treatment Unit

The RCRA Facility Operating Permit was modified four times during 2020 as follows:

- The contingency plan for emergency response at each hazardous and mixed waste management unit was modified to update the names and contact information in the rosters of personnel who can serve as emergency coordinators. The change was effective April 6, 2020.
- The facility description was modified to add a waste treatment process: detonation of reactive wastes inside a portable boom box device at the Radioactive and Mixed Waste Management Unit. The change was effective May 19, 2020.
- The contingency plan was modified to update the names and contact information in the rosters of personnel who can serve as emergency coordinators. The change was effective June 12, 2020.
- Several permit sections were modified effective October 29, 2020:
  - The facility description and associated photographs were revised to reflect erosion control improvements at the Thermal Treatment Unit.
  - The contingency plan was modified to update the emergency response descriptions.

Chemical Waste Landfill Post-Closure Permit

The Chemical Waste Landfill post-closure care activities are subject to this permit. The Post-Closure Care Permit was modified to reflect changes in emergency response descriptions. The change was effective October 29, 2020.

3.5.3 Hazardous Waste

Hazardous waste generated at SNL/NM includes a wide variety of wastes from research and testing, together with larger quantities of wastes from decontamination and demolition, production, maintenance, and support operations, including waste management activities. Hazardous wastes that cannot be recycled or treated on-site are sent to off-site facilities for treatment, as needed, before disposal at permitted off-site facilities. Applicable regulations for hazardous waste handled at SNL/NM are listed in Chapter 10.

Certain types of explosives waste generated at SNL/NM are treated at the Radioactive and Mixed Waste Management Unit or the Thermal Treatment Unit. Explosives waste is generally managed at

the point of generation until it is shipped to an off-site facility for treatment in accordance with regulatory requirements.

In accordance with Section 2.5 of the RCRA Facility Operating Permit, DOE and Sandia personnel annually certify that there is a "program in place to reduce the volume and toxicity of hazardous waste generated by the facility's operation to the degree determined by the Permittee to be economically practicable" at SNL/NM. Many types of hazardous waste are recycled where feasible. Recycled hazardous waste includes various batteries, silver compounds, mercury compounds, lamps, capacitors, and toxic metals such as lead. Sandia personnel investigate and implement waste minimization efforts with support and technical assistance from Materials Sustainability and Pollution Prevention Program personnel (see Section 3.4). Hazardous and mixed waste minimization activities are described in an annual report to NMED (SNL/NM 2020d), which is available to the public in hard copy at the University of New Mexico's Zimmerman Library. An index of the RCRA-related documents that are available in the Information Repository can be found at:

http://www.sandia.gov/RCRA/

3.5.4 Radioactive Waste and Mixed Waste

DOE and Sandia personnel manage low-level radioactive waste and low-level radioactive mixed waste that is generated through a variety of processes, including production, research, decontamination and demolition, and waste management activities. DOE and Sandia personnel also manage transuranic and mixed transuranic wastes that have been generated through research and waste management activities. High-level radioactive waste is not generated at SNL/NM. During 2020, legacy wastes (wastes originally generated between 1990 and 1998) were also managed at SNL/NM.

Low-level radioactive waste generally consists of laboratory waste, debris from maintenance activities, debris from decontamination and demolition activities, and personal protective equipment. Low-level radioactive waste is contaminated primarily with one or more isotopes of americium, cesium, cobalt, plutonium, strontium, thorium, tritium, and/or uranium (plutonium and americium in low-level radioactive waste are below the activity level designated for transuranic waste).

Transuranic waste may derive from sealed instrument sources, research, decontamination and demolition waste, personal protective equipment, and/or laboratory waste. The radioactive components in transuranic waste are generally americium, curium, neptunium, and/or plutonium.

Low-level radioactive mixed waste and mixed transuranic waste generally consist of inorganic debris and radioactive metallic objects with hazardous waste constituents and include wastes that have been treated to meet hazardous waste treatment standards. The radioactive components of low-level radioactive mixed waste and mixed transuranic waste are similar to those in low-level radioactive waste or transuranic waste.

All radioactive waste and mixed waste generators are instructed to contact Radioactive Waste Program personnel to obtain approval before generating waste. This promotes waste minimization and allows a pathway to be developed for waste treatment and disposal before the waste is generated. Radioactive wastes typically are shipped to off-site facilities within one year but may remain on-site longer than one year, if necessary, to complete the process for acceptance at an off-site facility and/or to achieve full utilization of transport vehicles.

Sandia personnel manage mixed waste that is subject to the Federal Facility Compliance Order (NMED 1995). The compliance requirements include: (1) deadlines for processing and/or disposing of various types of waste as specified in the current Site Treatment Plan (SNL/NM 2020g) and (2) instructions for providing an annual update of activities and a current inventory of stored waste

still on-site. During 2020, DOE and Sandia personnel met all regulatory deadlines, requested a revision of the Site Treatment Plan to extend compliance deadlines to December 31, 2024, shipped 0.68 cubic meters of mixed transuranic waste to the Waste Isolation Pilot Plant for disposal, and provided an annual update of mixed waste activities during the previous year (SNL/NM 2020g). During 2020, Sandia personnel managed 2.32 cubic meters of mixed transuranic waste that was subject to the Federal Facility Compliance Order. Table 10-1 lists the quantities of mixed waste subject to the Federal Facility Compliance Order at the end of fiscal year 2020. These wastes are subject to a Site Treatment Plan compliance deadline of December 31, 2024.

3.5.5 Other Regulated Waste

Other regulated waste types at SNL/NM are managed in accordance with applicable regulatory requirements.

Screening solid waste is not a regulatory requirement, but it is a best management practice that Sandia personnel follow to prevent prohibited materials from inadvertently being sent to a landfill.

Industrial Solid and Special Wastes

Industrial solid waste and special waste include a wide variety of wastes generated from research and testing, production, maintenance and support, decontamination and demolition, and waste management activities. Wastes that cannot be recycled or treated on-site are sent to off-site facilities for treatment as needed before disposal at permitted off-site facilities. Many categories of nonhazardous waste are recycled, including alkaline batteries, fluorescent lamps, oils, and ballasts not containing PCBs. Waste minimization efforts are also applicable to nonhazardous waste, as discussed in Section 3.4 and Section 3.8.

Polychlorinated Biphenyl Wastes

PCBs are a class of organic chemicals that were used widely in the past in industrial applications due to their physical and chemical properties. PCBs were used in dielectric fluids (e.g., fluids in transformers or capacitors), hydraulic fluids, and other applications requiring stable, fire-retardant materials. The domestic production and distribution of PCBs was banned in 1979, and their use continues to be phased out.

Most PCBs and PCB-containing equipment at SNL/NM have been identified and replaced. There are currently no known PCB-containing items remaining in use that require tracking per regulations. Former locations of electrical transformers since removed from service will undergo future remediation. Electrical equipment (e.g., capacitors and light ballasts) are evaluated for PCBs when taken out of service. Table 3-1 summarizes the PCB waste shipped in 2020.

Asbestos Wastes

Asbestos-containing materials are present in older buildings, and abatement is ongoing. Asbestos-containing material is only removed when it presents an inhalation hazard or the building is slated to be torn down or renovated. Building materials containing asbestos are present in floors, ceilings, roofing tile, certain types of insulation, and other fire-retardant construction materials; these are typical asbestos wastes generated during abatement in buildings. Typical asbestos waste generated from equipment abatement is found in fume hoods, ovens, and cable insulation. In instances where laboratory equipment has asbestos-containing material in good condition and in a nonfriable form (which poses no inhalation risk), these items may remain in service or be redistributed through the Property Management and Reapplication Department. Table 3-1 summarizes the quantities of asbestos waste shipped in 2020.

3.5.6 Waste Management Program Results

Representatives of the NMED Hazardous Waste Bureau did not perform no-notice hazardous waste compliance evaluation inspections of the entire SNL/NM site during 2020. Findings from the December 2019 inspection were provided in February 2020.

- Fiscal Year 2020 inspection, December 2–5, 2019. A Notice of Violation was issued, which is a DOE reportable occurrence (Chapter 2).

3.6 Environmental Life-Cycle Management Program

Environmental Life-Cycle Management Program activities ensure long-term protection of human health and the environment. Using the NEPA process, program personnel review proposed projects and activities that have the potential to impact the environment. This review provides a process for minimizing adverse environmental impacts from ongoing and future activities. In 2020, environmental impacts of 157 projects were reviewed and documented.

Black-throated gray warbler (*Setophaga nigrescens*)

3.7 Environmental Restoration Operations

The Environmental Restoration Project (now Environmental Restoration Operations) was created under the DOE Office of Environmental Management to identify, assess, and remediate sites potentially contaminated by past spill, release, or disposal activities in accordance with RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984. Hazardous and Solid Waste Amendments requirements apply to environmental restoration sites that include solid waste management units or areas of concern. A solid waste management unit is any unit "from which hazardous constituents might migrate, irrespective of whether the units were intended for the management of solid and/or hazardous waste" (EPA 1993).

Areas of concern, which are not regulated as solid waste management units, were not identified in the initial list of sites at SNL/NM when the Hazardous and Solid Waste Amendments Module of Permit NM5890110518-1 was issued in 1993 (EPA 1985); however, NMED identified these areas as requiring investigation (SNL/NM 1996). Later modifications to Permit NM5890110518-1 included the addition of areas of concern and other revisions to the list of solid waste management units (e.g., newly identified sites). Permit NM5890110518-1 expired in August 2002 but remained in effect until NMED issued the RCRA Facility Operating Permit, which became effective February 2015 (NMED 2015). The current complete list of solid waste management units and areas of concern at SNL/NM is included in the RCRA Facility Operating Permit.

A Compliance Order on Consent, which became effective in 2004 (NMED 2004), governs investigation and corrective action requirements at SNL/NM. The Compliance Order on Consent will terminate upon completion of its requirements, and the current RCRA Facility Operating Permit will remain as the enforceable document.

3.7.1 Waste Cleanup and Site Closures

The initial identification of environmental restoration sites was completed in 1987. At that time, 117 sites were identified in the initial *Comprehensive Environmental Assessment and Response Program (CEARP) Phase I: Installation Assessment* (DOE/AL 1987); those sites were also identified in subsequent years and were incorporated into the list of sites that were subject to the RCRA corrective action requirements in the Hazardous and Solid Waste Amendments Module of Permit NM5890110581-1 (EPA 1993).

Since 1993, additional sites (including those certified in the *Comprehensive Environmental Assessment and Response Program*), potential sites, or individual historical activities have been identified for investigation. In 1992, the Environmental Restoration Project was officially launched to implement assessment and remediation activities for sites that had been contaminated or potentially contaminated because of past Sandia operations. In addition to the SNL/NM sites, other Sandia sites included in the original scope of Environmental Restoration Operations were SNL/CA; Kaua'i Test Facility, Hawai'i; and Tonopah Test Range, Nevada. There were also a few miscellaneous sites located in other areas nationally and internationally.

DOE and Sandia personnel propose environmental restoration sites to NMED for Corrective Action Complete status when the site investigations and, if necessary, remediations have been completed and the results indicate the site to be at acceptable levels of risk to human health and the environment. NMED determines whether to confer Corrective Action Complete status.

After NMED grants Corrective Action Complete status to an environmental restoration site, DOE and Sandia personnel submit a request for a Class 3 modification to the RCRA Facility Operating Permit to document the status through two steps: (1) remove the site from the list of solid waste management units and areas of concern requiring corrective action; and then (2) add the site to a list of solid waste management units and areas of concern for which corrective action is complete. Risk to human health and the environment is calculated for sites with residual contamination according to EPA and NMED guidelines. The remaining level of contamination and the appropriate land use category (i.e., industrial, residential, or recreational use) are combined with the available information and conceptual model for each site to determine the risk and whether site controls are needed. Solid waste management units and areas of concern requiring controls present a higher level of risk to human health and the environment.
All Corrective Action Complete proposals and Class 3 Permit modifications are available in hard copy for review at the University of New Mexico Zimmerman Library.

All Corrective Action Complete proposals and Class 3 Permit modifications are available for review at the University of New Mexico Zimmerman Library.

The RCRA Facility Operating Permit currently lists 317 solid waste management units and areas of concern at SNL/NM. Many of these include multiple smaller sites that may be renamed and tracked separately if warranted by risk and controls needed after corrective action is complete. The current status of the 317 solid waste management units and areas of concern are summarized as follows:

- Solid waste management units and areas of concern for which corrective action is complete and controls are not required (286 sites)

- Solid waste management units and areas of concern for which corrective action is complete and controls are required (25 sites)
- Solid waste management units and areas of concern for which corrective action is required (6 sites)

The solid waste management units and areas of concern that require corrective action are as follows:

- Three solid waste management units at active test facilities have potential soil contamination that will be evaluated at the end of their test operations: SWMU 83, SWMU 84, and SWMU 240.
- Three groundwater areas of concern require final remedies through public input and NMED process: TA-V Groundwater (TAVG), Tijeras Arroyo Groundwater (TAG), and Burn Site Groundwater (BSG).

3.7.2 Groundwater Monitoring at Areas of Concern

In 2020, routine groundwater samples were collected for the three groundwater areas of concern (TAVG, TAG, and BSG). A summary of activities and results follows. Additional information can be found in Appendix A, "Summary of Groundwater Monitoring in 2020." Details of all the groundwater monitoring conducted at SNL/NM can be found in the *Annual Groundwater Monitoring Report, Calendar Year 2020* (SNL/NM 2021a), which documents the results of all groundwater monitoring activities for 2020. The report is available at:

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

Groundwater samples were analyzed for the following parameters:

- TAVG wells—Target Analyte List metals (plus uranium), dissolved metals, inorganics (including nitrate plus nitrite and major anions), total alkalinity, volatile organic compounds, 1,4 dioxane, gross alpha, gross beta, and selected radionuclides
- TAG wells—Target Analyte List metals (plus uranium), inorganics (including nitrate plus nitrite and major anions), total alkalinity, volatile organic compounds, 1,4-dioxane, gross alpha, gross beta, and selected radionuclides
- BSG wells—Target Analyte List metals, inorganics (including nitrate plus nitrite, major anions, and perchlorate), total alkalinity, volatile organic compounds, diesel range organics, gasoline range organics, high explosive compounds, perchlorate, gross alpha, gross beta, and selected radionuclides
- Groundwater Monitoring Program wells—Target Analyte List metals (plus uranium), mercury, inorganics (including nitrate plus nitrite, major anions, and total cyanide), total phenols, total alkalinity, volatile organic compounds, total organic halogens, high explosive compounds (at select wells), gross alpha, gross beta, and selected radionuclides

For the TAVG area of concern, 17 monitoring wells were sampled in 2020. Several analytical results exceeded the maximum contaminant levels for trichloroethene and nitrite plus nitrate: trichloroethene exceeded the maximum contaminant level of 5 µg/L in five wells with a maximum concentration of 14.8 µg/L, and nitrite plus nitrate exceeded the maximum contaminant level of 10 mg/L in four wells with a maximum concentration of 14.6 mg/L.

For the TAG area of concern, 21 monitoring wells were sampled in 2020. For the perched groundwater system, the nitrate plus nitrite concentration exceeded the nitrate maximum contaminant level (10 mg/L) at five wells with the maximum being 22.7 mg/L. None of the wells screened in the regional aquifer exceeded the maximum contaminant level; the maximum nitrate plus nitrite concentration was 4.03 mg/L. There is one monitoring well that is screened in the groundwater merging zone between the perched aquifer and the regional aquifer; this well had a

maximum nitrate plus nitrite concentration of 31.9 mg/L. The maximum trichloroethene concentration in the perched groundwater system was 15.7 µg/L. Trichloroethene exceeded the maximum contaminant level (5 µg/L) at one well in the perched groundwater system. The maximum trichloroethene concentration in the regional aquifer exclusive of the merging zone well was 0.380 J µg/L (J-qualified data). In the merging zone above the regional aquifer, trichloroethene was not detected (< 0.300 µg/L).

A *perched aquifer* is a body of groundwater that is separated from an underlying body of groundwater by unsaturated earth materials.

For the BSG area of concern, 14 wells were sampled in 2020. Nitrate plus nitrite exceeded the maximum contaminant levels in eight wells, with a maximum concentration of 49.6 mg/L. All other analytical results for groundwater samples from the three areas of concern were below established maximum contaminant levels.

Field quality control samples associated with sampling events at the areas of concern included duplicate environmental, equipment blank, field blank, and trip blank samples.

3.8 Long-Term Stewardship Program

The Long-Term Stewardship Program is designed to protect human health and the environment from hazards associated with residual contamination at legacy sites and to minimize environmental liability by ensuring compliance with the environmental requirements in multiple NMED permits. Stewardship of legacy sites also protects natural and cultural resources from hazards associated with residual radioactivity and hazardous contamination.

Long-Term Stewardship Program personnel perform the following:

- Post-closure care for the Chemical Waste Landfill (including groundwater monitoring to satisfy Post-Closure Care Permit requirements)
- Post-closure care for the Corrective Action Management Unit (including leachate collection and vadose zone monitoring to satisfy RCRA Facility Operating Permit requirements)
- Long-term monitoring and maintenance for the Mixed Waste Landfill (including groundwater monitoring to satisfy RCRA Facility Operating Permit requirements)
- Long-term monitoring and maintenance for solid waste management units (other than Mixed Waste Landfill) with Corrective Action Complete with Controls status (to satisfy RCRA Facility Operating Permit requirements)
- Sampling for the Groundwater Monitoring Program (to satisfy the Compliance Order on Consent Section IV Background [NMED 2004] and DOE O 231.1B, *Environment, Safety and Health Reporting* [DOE O 231.1B, Admin Change 1] for groundwater surveillance)

Program personnel prepare annual reports for NMED on each of the post-closure care and long-term monitoring and maintenance sites.

Groundwater sampling results are compared with EPA maximum contaminant levels for drinking water supplies and NMED maximum allowable concentrations for human health standards of groundwater as promulgated by the New Mexico Water Quality Control Commission. Field quality control samples associated with sampling events included duplicate environmental, equipment blank, field blank, and trip blank samples.

Groundwater levels are measured in approximately 100 wells on a quarterly basis. Water-level data are used to generate a regional water table elevation contour map from which groundwater flow directions can be obtained. Groundwater elevation tables, hydrographs, and contour maps derived from the data are provided in the *Annual Groundwater Monitoring Report, Calendar Year 2020* (SNL/NM 2021a).

3.8.1 Chemical Waste Landfill Post-Closure Care

The Chemical Waste Landfill is a 1.9-acre remediated hazardous waste landfill in the southeastern corner of TA-III undergoing post-closure care. From 1962 until 1985, the Chemical Waste Landfill was used for the disposal of hazardous, radioactive, and mixed waste; from 1981 through 1989, it was used as a hazardous waste drum storage facility. From 1997 to 2003, the Chemical Waste Landfill was remediated through a voluntary corrective action program, including the extraction of organic soil vapor and the complete excavation of waste. An at-grade evapotranspirative cover was installed in September 2005. In June 2011, NMED approved closure of the Chemical Waste Landfill (NMED 2011), and the Chemical Waste Landfill Post-Closure Care Permit (NMED 2009) took effect. The Post-Closure Care Permit defines all post-closure requirements for the Chemical Waste Landfill, including groundwater monitoring.

The groundwater monitoring network at the Chemical Waste Landfill consists of four wells. In 2020, semiannual groundwater monitoring was performed in January and July in accordance with Post-Closure Care Permit requirements. Groundwater samples were analyzed for volatile organic compounds (including trichloroethene), nickel, and chromium. January and July results were consistent with previous years; trichloroethene was the only volatile organic compound detected. No analytes were detected at concentrations exceeding EPA maximum contaminant levels or Post-Closure Care Permit-defined hazardous concentration limits. Per a request from NMED (Kieling 2019), groundwater samples were collected and analyzed during both events for 1,4-dioxane in addition to Post-Closure Care Permit-required analyses. No 1,4-dioxane was detected above the laboratory method detection limit in any of the groundwater samples.

In addition to semiannual groundwater monitoring, the Post-Closure Care Permit requires other monitoring, inspection, maintenance, and repair activities. Inspections conducted in 2020 confirm that the Chemical Waste Landfill evapotranspirative cover was in good condition, evenly covered by native perennial grasses, and performing as designed. Volatile organic compound soil-vapor-monitoring continues to confirm that the residual volatile organic compound soil vapor plume is stable, slowly dissipating through diffusion, and not a threat to groundwater. All Post-Closure Care Permit-required activities for 2020 are documented in the *Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2020* (SNL/NM 2021b).

3.8.2 Corrective Action Management Unit Post-Closure Care

The Corrective Action Management Unit, a containment cell located near the Chemical Waste Landfill, holds treated soils generated from the Landfill Excavation Voluntary Corrective Measure of the Chemical Waste Landfill. Long-Term Stewardship Program personnel conduct post-closure care for the Corrective Action Management Unit in accordance with the RCRA Facility Operating Permit issued on January 27, 2015 (NMED 2015), having an effective date of February 26, 2015.

The Corrective Action Management Unit containment cell consists of engineered barriers, including a final cover system with a bottom liner system, a leachate collection system, and a vadose zone monitoring system. As a best practice to minimize further erosion and site maintenance, erosion control and drainage improvements were constructed at the Corrective Action Management Unit in 2020. The Corrective Action Management Unit monitoring system, which provides information on soil conditions under the containment cell for early detection of leaks, consists of three monitoring

subsystems: a primary subliner, a vertical sensor array, and the Chemical Waste Landfill sanitary sewer line. All three monitoring subsystems are monitored quarterly for soil moisture content. The vertical sensor array and Chemical Waste Landfill sanitary sewer monitoring subsystems are sampled annually for the composition of soil vapors.

The 2020 soil vapor monitoring results continue to show the edge of the residual soil vapor plume emanating from the nearby former Chemical Waste Landfill. This is consistent with the conceptual model of the Chemical Waste Landfill residual soil vapor plume (SNL/NM 2004). Volatile organic compound concentrations at the vertical sensor array monitoring subsystem locations continue to correlate with seasonal soil temperature variations, increasing when the soil temperature is warmer and decreasing when the soil temperature is cooler. The volatile organic compound concentrations are not attributed to the material in the Corrective Action Management Unit containment cell. Baseline data for soil vapor and soil moisture were established between October 2003 and September 2004.

The 2020 soil moisture monitoring results remained consistent with the baseline data for the primary subliner and vertical sensor array monitoring subsystems. Soil moisture values did not exceed the trigger level at any Chemical Waste landfill sanitary sewer monitoring locations. Slight increases at one Chemical Waste Landfill sanitary sewer monitoring subsystem location are related to the sanitary sewer line or the domestic water line. A camera was used to survey the sewer line in July 2020. Ongoing monitoring will be used to evaluate and determine any additional action if necessary.

Leachate is water that collects contaminants as it percolates through wastes, pesticides, or fertilizers. Leaching may occur in farming areas, feedlots, or landfills, and may result in hazardous substances entering surface water, groundwater, or soil.

In 2020, 232 gallons of leachate (a listed hazardous waste) were removed from the leachate collection system compared to 238 gallons of leachate removed in 2019. The evapotranspirative cover continues to meet successful revegetation criteria and is in excellent condition with even coverage of mature, native perennial grasses. Additional information on activities conducted—including inspection, monitoring, and sampling details—can be found in the *Corrective Action Management Unit Report of Post-Closure Care Activities Calendar Year 2020* (SNL/NM 2021c).

3.8.3 Mixed Waste Landfill Long-Term Monitoring and Maintenance

The Mixed Waste Landfill is a 2.6-acre solid waste management unit with Corrective Action Complete with Controls status. The Mixed Waste Landfill is in the north-central portion of TA-III and is undergoing long-term monitoring and maintenance. The site consists of two distinct disposal areas: the classified area (occupying 0.6 acres) and the unclassified area (occupying 2.0 acres). From March 1959 through December 1988, the Mixed Waste Landfill was used for the disposal of low-level radioactive, hazardous, and mixed waste. The Mixed Waste Landfill has undergone corrective action in accordance with two NMED orders (NMED 2004; NMED 2005) and 20.4.1.600 NMAC, *Hazardous Waste Management* (20.4.1 NMAC). The NMED Final Order for Corrective Action Complete with Controls (NMED 2016) became effective in March 2016, granting the Class 3 Permit Modification to reflect that the Mixed Waste Landfill is Corrective Action Complete with Controls. All controls are defined in the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan, which was implemented upon NMED approval (NMED 2014) and included in the RCRA Facility Operating Permit.

The groundwater monitoring network at the Mixed Waste Landfill consists of four compliance wells and three wells monitored for groundwater elevation only. In 2020, semiannual groundwater

monitoring was performed at the Mixed Waste Landfill in May and November in accordance with the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan. All groundwater samples were analyzed for volatile organic compounds; metals including cadmium, chromium, nickel, and uranium; specific radionuclides by gamma spectroscopy; gross alpha and gross beta; tritium; and radon-222. Results were consistent with previous years, and no analytes were detected at concentrations exceeding EPA maximum contaminant levels or Long-Term Monitoring and Maintenance Plan-defined trigger levels. Per a request from NMED (Kieling 2019), groundwater samples were collected and analyzed during both events for 1,4-dioxane in addition to Long-Term Monitoring and Maintenance Plan-required analyses. No 1,4-dioxane was detected above the laboratory method detection limit in any of the groundwater samples.

In addition to semiannual groundwater monitoring, the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan requires other monitoring, inspection, maintenance, and repair activities. Ongoing activities are documented comprehensively in a Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report submitted to NMED in June of each year. In 2020, the evapotranspirative cover was in excellent condition, evenly covered by mature native perennial grasses. Based on all monitoring, inspection, and maintenance results, the evapotranspirative cover and monitoring systems are functioning as designed, and site conditions remain protective of human health and the environment. Long-Term Monitoring and Maintenance Plan-required monitoring activities for 2020 are documented in the *Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report, April 2020 through March 2021* (SNL/NM 2021d).

3.8.4 Solid Waste Management Units Granted Corrective Action Complete with Controls for Long-Term Monitoring and Maintenance

The Long-Term Monitoring and Maintenance Plan addresses measures that provide protection for human health and the environment from constituents of concern that are present at solid waste management units that have been granted Corrective Action Complete with Controls status per the RCRA Facility Operating Permit. Measures include surveilling site conditions and maintaining institutional controls.

All RCRA Facility Operating Permit-required physical inspections were completed in 2020. Two damaged signs at two solid waste management units were replaced in 2020. The administrative and physical institutional controls in place at the 24 solid waste management units are effectively providing continued protection for human health and the environment. The *Solid Waste Management Unit and Areas of Concern Annual Long-Term Monitoring and Maintenance Report for Calendar Year 2020* (SNL/NM 2021f) was submitted to NMED.

3.8.5 Groundwater Monitoring Program

For the Groundwater Monitoring Program, 16 wells and one spring were sampled in 2020. Groundwater samples were analyzed for the following parameters: Target Analyte List metals (plus uranium), mercury, inorganics (including nitrate plus nitrite, major anions, and total cyanide), total phenols, total alkalinity, volatile organic compounds, total organic halogens, high explosive compounds (at select wells), gross alpha, gross beta, and selected radionuclides.

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

Fluoride was detected above the maximum allowable concentration in four groundwater wells and at Coyote Springs. Beryllium concentrations at Coyote Springs exceeded EPA maximum contaminant levels. The exceedance for each of these elements is attributable to the elevated natural concentrations associated with bedrock groundwater systems at the sampling locations. All other

analytical results for groundwater samples from the Groundwater Monitoring Program were below established maximum contaminant levels. The 2020 water quality results for this sampling were consistent with results from past years.

Field quality control samples associated with these groundwater sampling programs included duplicate environmental, equipment blank, field blank, and trip blank samples.

Chapter 4. Terrestrial Surveillance Program

Desert cottontail (*Sylvilagus audobonii*)

OVERVIEW ▪ Terrestrial Surveillance Program personnel collect soil, sediment, and vegetation samples, which are analyzed for radiological, metal, and other site-specific constituents. Environmental dosimeters are used to measure ambient external gamma radiation levels.

Terrestrial Surveillance Program personnel collect environmental media (soil, sediment, and vegetation) samples, which are analyzed for radiological constituents, as required. As a best management practice, samples are also collected to analyze metals and other site-specific constituents.

In addition to the environmental 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 DOE fee-owned areas, leased property, and KAFB.

Environmental radiological surveillance began at SNL/NM in 1959 (SNL/NM 1973). Nonradiological surveillance sampling began in 1993 with the implementation of the Terrestrial Surveillance Program and included the collection of samples for metal analyses.

4.1 Regulatory Criteria

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

The Terrestrial Surveillance Program is also designed to satisfy Sandia's EMS, which is certified to ISO 14001:2015. Reporting is done in accordance with DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*.

Soil is loose, unconsolidated minerals 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.

4.2 Sample Locations and Media

Terrestrial Surveillance Program personnel use three sample location classifications: on-site, perimeter, and off-site (the latter was previously referred to as community locations).

The on-site sampling locations (Figure 4-1) are in areas of known contamination (such as solid waste management units), areas of potential release (sites with current outdoor testing activities), and/or areas where concentrations may be naturally elevated due to geologic conditions. The perimeter sample locations are situated around the boundaries of KAFB (Figure 4-1). The off-site sample locations are within a 25-mile radius of KAFB (Figure 4-2).

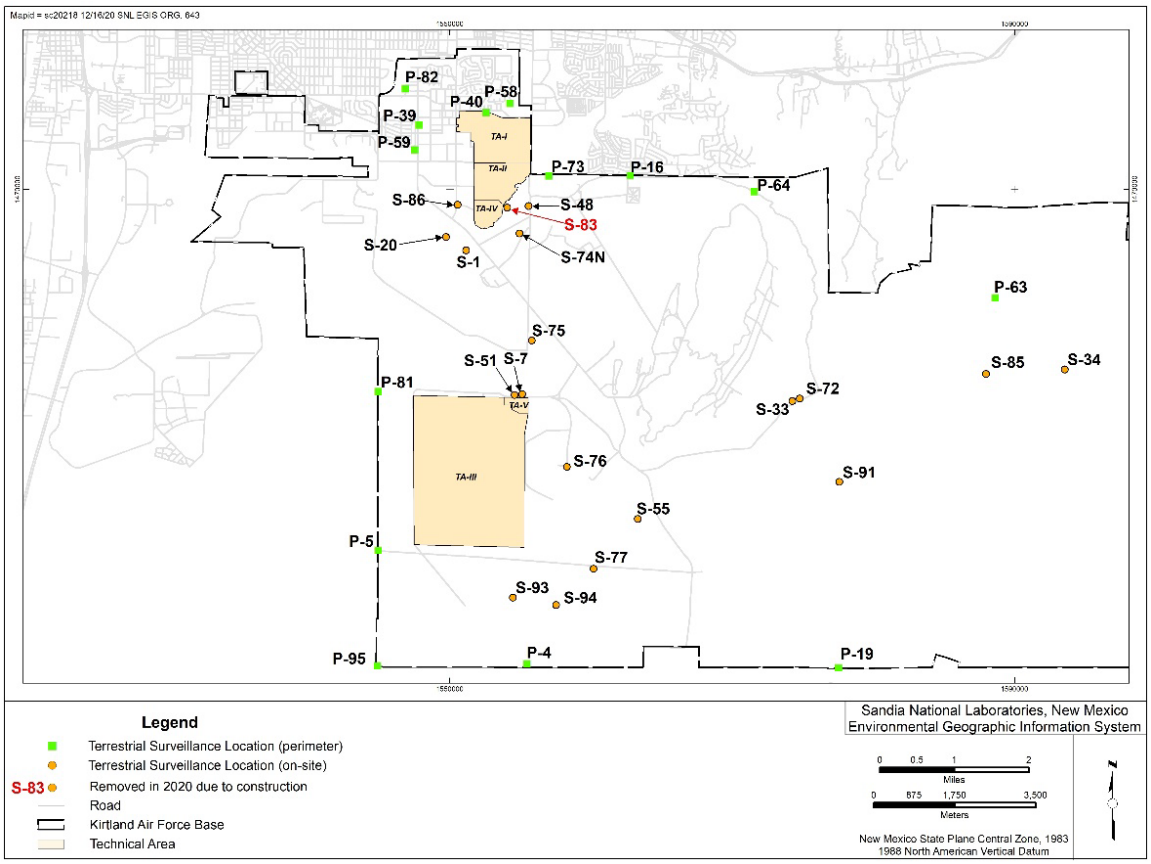

Figure 4-1. Terrestrial Surveillance Program on-site and perimeter sampling locations

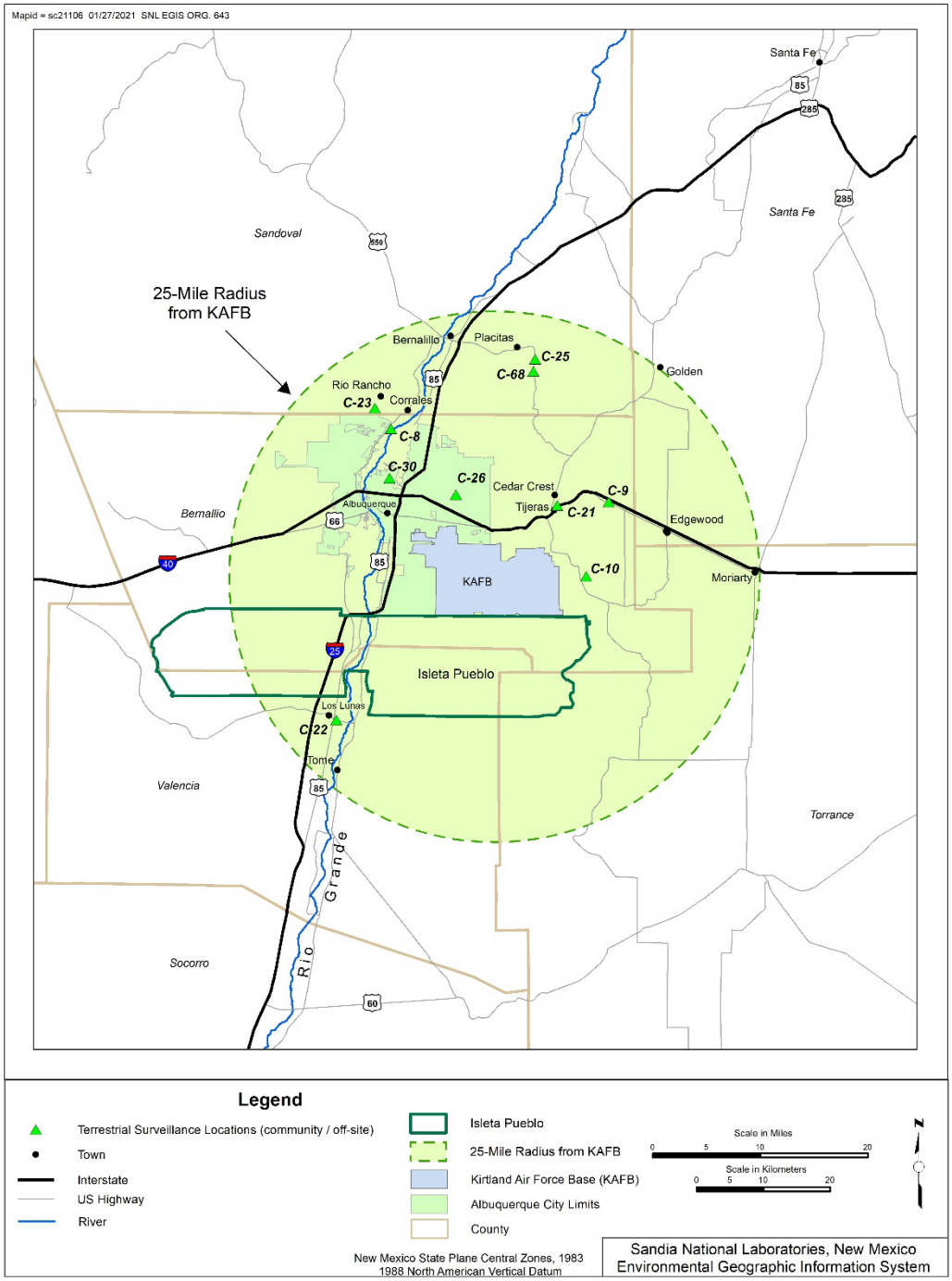

Figure 4-2. Terrestrial Surveillance Program off-site sampling locations

The various environmental sample media that are collected include surface soil (less than two inches deep), arroyo and river sediment samples, and vegetation. Vegetation samples, which are collected from native grasses and small leafy plants, are used to monitor the potential uptake of radioactive and nonradiological materials from the soil. 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 nonnatural sources. Table 4-1, Table 4-2, and Table 4-3 list the sampling locations, the type of media collected, and the analytical parameters sampled at the on-site, perimeter, and off-site locations, respectively.

Table 4-1. On-site terrestrial surveillance locations, sample media, and parameters

Location Number	Sampling Location	Soil[a]	Sediment[a]	Vegetation[b]	Dosimeter[c]
S-1	Pennsylvania Avenue	X			X
S-6	TA-III (east of the water tower)	X		X	X
S-7	Unnamed arroyo (north of TA-V)				X
S-20	TA-IV (southwest)				X
S-33	Coyote Springs	X		X	
S-34	Lurance Canyon Burn Site	X		X	
S-45	Radioactive and Mixed Waste Management Unit, TA-III (northwest corner)	X		X	X
S-46	TA-II (south corner)	X[d]		X	X
S-48	Tijeras Arroyo (east of TA-II)				X
S-49	Near the Explosives Components Facility	X[d]		X	
S-51	TA-V (north of a culvert)	X		X	
S-53	TA-III (south of the Long Sled Track)	X[e]			
S-55	Large Melt Facility, Building 9939	X		X	
S-57	TA-IV, Building 970 (northeast corner)	X			
S-72	Arroyo del Coyote (midstream)		X		
S-74N	TA-IV, Tijeras Arroyo (midstream)		X		
S-75	Arroyo del Coyote (downstream)		X		
S-76	Thunder Range (north)	X[d]			
S-77	Thunder Range (south)	X[d]			
S-83	Tijeras Arroyo Groundwater well		Removed in 2019		
S-85	Arroyo del Coyote Cable Site		X		
S-86	Corner of Wyoming Boulevard and S Street	X[d]		X[d]	
S-90	TA-III Land Mine Test Site	X[f]			
S-91	Background Arroyo near SWMU 87		X[d]		
S-92	TA-III Classified Waste Landfill	X			
S-93	Thunder Range Explosives Test Area	X[f,g]			
S-94	Thunder Range (southeast of Range 5)	X[f,g]			

[a] Soil and sediment samples are collected annually (except as noted) and analyzed for terrestrial surveillance metals and radionuclides (including tritium).
[b] Vegetation samples are collected annually (except as noted) and analyzed for terrestrial surveillance metals and radionuclides (including tritium).
[c] Dosimeters are analyzed to determine the dose from ambient gamma radiation.
[d] Terrestrial surveillance metals are not included in the sample analysis.
[e] Perchlorate is included in the sample analysis.
[f] High explosive compounds are included in the sample analysis.
[g] Radionuclides and metals are not included in the sample analysis.

Table 4-2. Perimeter terrestrial surveillance locations, sample media, and parameters

Location Number	Sampling Location	Soil[a]	Sediment[a]	Vegetation[b]	Dosimeter[c]
P-4	Isleta Reservation gate	X		X	X
P-5	McCormick gate	X		X	X
P-16	Four Hills	X		X	X
P-19	U.S. Geological Survey Seismic Center gate	X			X
P-39	Northwest DOE complex				X
P-40	TA-I (northeast)				X
P-58	North KAFB housing	X		X	
P-59	Zia Park (southeast)	X			
P-60	Tijeras Arroyo (downstream)		X		
P-61	Albuquerque International Sunport	X			
P-63	No Sweat Boulevard	X			
P-64	North Manzano base	X			
P-73	Tijeras Arroyo (upstream)		X		
P-81	KAFB (west fence)	X			X
P-82	Commissary	X		X	
P-95	Southwest corner of KAFB	X			

[a] Soil and sediment samples are collected annually and analyzed for terrestrial surveillance metals and radionuclides (including tritium).
[b] Vegetation samples are collected annually and analyzed for terrestrial surveillance metals and radionuclides (including tritium).
[c] Dosimeters are analyzed to determine the dose from ambient gamma radiation.

Table 4-3. Off-site terrestrial surveillance locations, sample media, and parameters

Location Number[a]	Sampling Location	Soil[b]	Sediment[b]	Vegetation[c]	Dosimeter[d]
C-8	Rio Grande, Corrales Bridge (upstream)		X		
C-9	Sedillo Hill, Interstate 40	X		X	
C-10	Oak Flats	X		X	
C-21	Bernalillo Fire Station 10, Tijeras				X
C-22	Los Lunas Fire Station				X
C-23	Rio Rancho Fire Station, 19th Avenue				X
C-25	Placitas Fire Station	X		X	X
C-26	Albuquerque Fire Station 9, Menaul Boulevard Northeast				X
C-30	Albuquerque Fire Station 6, Griegos Road Northwest				X
C-68	Las Huertas Creek		X		

[a] Off-site samples were previously called "community locations," thus the *C* label in the location number (maintained for the database).
[b] Soil and sediment samples are collected annually and analyzed for terrestrial surveillance metals and radionuclides (including tritium).
[c] Vegetation samples are collected annually and analyzed for terrestrial surveillance metals and radionuclides (including tritium).
[d] Dosimeters are analyzed to determine the dose from ambient gamma radiation.

4.3 Field Methods, Analytical Parameters, and Quality Control Procedures

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

Off-site laboratories analyzed all samples in accordance with applicable EPA analytical methods. All chemical data were reviewed and qualified in accordance with *Data Validation Procedure for Chemical and Radiochemical Data* (SNL/NM 2020b). Samples were analyzed for the following parameters: specific metals, high explosive compounds, perchlorate, and radionuclides (including tritium), as specified in Table 4-1, Table 4-2, and Table 4-3. The specific metals list is referred to as terrestrial surveillance metals and includes the following: aluminum, antimony, arsenic, beryllium, cadmium, chromium (total), copper, iron, lead, magnesium, nickel, selenium, silver, thallium, uranium (total), and zinc.

In 2020, the use of optically stimulated luminescent dosimeters was employed to measure ionizing radiation. The dosimeters are issued and analyzed by an accredited off-site laboratory.

The 2020 dosimeter data is presented here, but trend analyses will not be performed until several more years of data are available. Optically stimulated luminescent dosimeters have been used since 2018.

Field quality control samples were collected and included duplicate environmental samples and equipment blank samples. These samples were prepared in accordance with applicable field operating procedures. Laboratory quality control samples are prepared and analyzed as specified in Chapter 9.

4.4 Data Analysis and Methodology

The statistical analysis methodology performed on soil, sediment, and vegetation sample results is being revised. Therefore, general statistics, population comparisons, and trend analyses were not conducted this year. However, results for samples collected in 2020 were compared to available reference values.

There are no regulatory limits with which to compare concentrations of radiological constituents found in surface soils, sediment, or vegetation.

Environmental dosimeter data may be compared to established natural background (terrestrial and cosmic) radiation levels in the Albuquerque area. Levels in the Albuquerque area 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 local annual radiation dose from natural background sources (indoor radon not included) is 89 mrem (Mauro and Briggs 2005).

Analytical results for metals in soil and sediment samples may also be compared to values in the following references (presented in Table 4-4):

- Local and regional soil concentrations (Dragun and Chekiri 2005)
- NMED soil screening levels (NMED 2019)
- Trace elements in soil (Kabata-Pendias 2000)

Table 4-4. Comparison reference values for metals in soil

Analyte	NM Soil Concentrations[a]		NMED Soil Screening Levels[b]		Trace Elements in Soil[c]	
	Lower Limit (mg/kg)	Upper Limit (mg/kg)	Residential, Noncancer (mg/kg)	Industrial, Noncancer (mg/kg)	Lower Limit (mg/kg)	Upper Limit (mg/kg)
Aluminum	5,000	100,000	78,000	1,290,000	4,500	100,000
Antimony	0.2	1.3	31.3	519	0.25	0.60
Arsenic	2.5	19	13.0	208	0.1	30
Beryllium	1.0	2.3	156	2,580	0.04	2.54
Cadmium	ND	11	70.5	1,110	0.08	0.47
Chromium (total)	7.6	42	45,200	314,000	7.0	1,500
Copper	2.1	30	3,130	51,900	1.0	70
Iron	1,000	100,000	54,800	908,000	5,000	45,000
Lead	7.8	21	—	—	10	70
Magnesium	300	100,000	15,600,000	5,680,000	—	—
Nickel	2.8	19	1,560	25,700	5.0	150
Selenium	0.2	0.8	391	6,490	0.1	4.0
Silver	0.5	5.0	391	6,490	0.2	3.2
Thallium	—	—	0.78	13.0	0.02	2.8
Uranium (total)	—	—	234[d]	3,880[d]	0.30	10.7
Zinc	18	84	23,500	389,000	5.0	164

[a] Source: Dragun and Chekiri 2005.
[b] Source: NMED 2019.
[c] Source: Kabata-Pendias 2000.
[d] Refers to uranium (soluble salts).
— = not available
ND = not detected

4.5 Terrestrial Surveillance Program Results in 2020

The following Terrestrial Surveillance Program activities occurred in 2020:

- The annual sampling of soil and sediment occurred in June 2020 at designated locations.
- The annual sampling of vegetation occurred in September 2020 at location C-25.
- The quarterly exchange (deployment and retrieval) of environmental dosimeters occurred at designated locations.

The analytical results for radiological parameters (including environmental dosimeters) and nonradiological parameters for the 2020 sampling events are provided in Appendix B, "Terrestrial Surveillance Analytical Results in 2020."

4.5.1 Radiological Results

Radiological analyses were performed on soil, sediment, and vegetation samples. In 2020, soil and sediment sample results for on-site locations were comparable to previous years.

4.5.2 Dosimeter Results

Analysis of dosimeter data was performed to determine the average dose rates for the three location classifications.

The average dose rate summary statistics for 2020 are shown in Table 4-5. The average annual dose rates are below the local estimated value of 89 mrem from natural background sources (Mauro and Briggs 2005). The difference may be attributed to a variety of elevations, the proximity to bedrock, and the statistical nature of radioactivity.

Table 4-5. Dosimeter dose rate summary statistics by location classification, 2020

Location Classification	Number of Observations	Average (mrem/year)	Median (mrem/year)	Standard Deviation (mrem/year)	Minimum (mrem/year)	Maximum (mrem/year)
On-site	7	68	67	4.6	61	76
Perimeter	7	66	64	10.5	58	88
Off-site	7	63	66	11.2	45	76

4.5.3 Nonradiological Results

Nonradiological parameters include terrestrial surveillance metals, high explosive compounds, and perchlorate.

Metals

All metal results were compared to values referenced in Section 4.4 and provided in Table 4-4. In 2020, no sample results (soil and sediment) exceeded NMED soil screening levels. No vegetation locations were sampled for metals.

High Explosive Compounds

Three on-site locations (S-90, S-93, and S-94; all soil samples) were analyzed for high explosive compounds (Figure 4-1). There were no detections above the method detection limit for any high explosive compounds.

Perchlorate

One on-site location (S-53; soil sample) was analyzed for perchlorate (Figure 4-1). The result was 0.0648 J mg/kg. The J-qualified data indicates the result is an estimated value due to the lack of matrix-specific accuracy data. The estimated result is below the NMED soil screening level of 54.8 mg/kg for residential use (NMED 2019). The sample was reanalyzed by another method, and the result was 0.0585 J mg/kg. The presence of perchlorate was estimated in both analyses.

4.6 Additional Activities and Variances

Terrestrial Surveillance Program sampling in 2020 was conducted with the following variances:

- Due to ongoing drought conditions, there was insufficient vegetation for collection at perimeter locations P-04, P-05, P-06, P-16, P-58, P-82 (Figure 4-1); on-site locations S-06, S-33, S-34, S-45, S-46, S-49, S-51, S-55, and S-86 (Figure 4-1); and off-site locations C-09 and C-10 (Figure 4-2). There was sufficient vegetation for sample collection at off-site location C-25.
- The vegetation samples collected at C-25 were analyzed for radiological constituents, and the results did not warrant further evaluation of biota.
- Location S-83 was removed during construction activities sometime in 2019, which was confirmed in 2020. No samples were collected at this location due to soil disturbance; the location will not be replaced.

Chapter 5. Air Quality Compliance and Related Programs

Honey bee (*Apis mellifera*) on evening primrose (*Oenothera pallida*)

OVERVIEW ■ Air quality, ambient air, meteorological, and radiological emissions program personnel monitor the air and atmosphere associated with Sandia facilities.

Air quality and meteorological monitoring and surveillance activities are conducted through the following programs:

- Air Quality Compliance Program
- Ambient Air Surveillance Program
- Meteorology Program
- Radionuclide NESHAP Program

5.1 Air Quality Compliance Program

In Bernalillo County, New Mexico, the City of Albuquerque Air Quality Program implements air quality regulations and standards established by EPA and the Albuquerque Bernalillo County Air Quality Control Board.

5.1.1 Stationary Sources

Stationary source registrations are required for sources that emit more than 2,000 pounds of any air contaminant per year or any amount of a hazardous air pollutant. Stationary source permits may be required for sources that have the potential to emit 10 pounds per hour or more or 25 tons per year or more of any single regulated air contaminant, 2 tons per year of a single hazardous air pollutant, or 5 tons per year of any combination of hazardous air pollutants. Permits may also be required for any

equipment or process that is subject to federal New Source Performance Standards or NESHAPs. Permits include requirements for monitoring source emissions and maintaining records of operations to ensure compliance with regulations, emission limits, and other conditions of the permit. Regulated air contaminants include criteria pollutants and hazardous air pollutants. Criteria pollutants include sulfur dioxide, nitrogen oxide, carbon monoxide, ozone, particulate matter, and lead. DOE air quality permits and registrations for SNL/NM stationary sources are presented in Table 10-1.

Most of the permitted stationary sources at SNL/NM are boilers used for comfort heat and emergency generators. Criteria pollutant emissions from combustion are monitored based on operation and/or fuel use. As required, *CY2020 Stationary Source Emissions Inventory Report for Sandia National Laboratories* (DOE/NNSA/SFO 2020a) was submitted to the City of Albuquerque Air Quality Program. In 2020, sources complied with permitted emission limits. Emissions data for permitted and registered sources are provided in Table 5-1.

Table 5-1. Permitted and registered stationary source emission data, 2020

Carbon Monoxide	Hazardous Air Pollutant	Nitrogen Oxide	Particulate Matter with a Diameter ≤ 10 µm	Sulfur Dioxide	Volatile Organic Compound
11.54	8.26	9.80	1.63	0.51	3.51

Note: All units are in tons per year.

Site-Wide Volatile Organic Compound and Hazardous Air Pollutant Emissions

Site-Wide Chemical Permit 1901-M1 includes all hazardous air pollutant and volatile organic compound emissions from general laboratory research and development uses. During 2020, potential emissions were 8.26 tons of hazardous air pollutants and 3.51 tons of volatile organic compounds. These emissions were within permitted limits.

Title V

DOE submitted a Title V Operating Permit application (DOE 2002) to the City of Albuquerque on March 1, 1996, since potential emissions from Sandia operations were greater than 100 tons per year of criteria pollutants annually. An application update was submitted in 2002. The City of Albuquerque has not issued the final permit, and a new updated application is currently being negotiated with the City of Albuquerque.

EPA defines a *greenhouse gas emission* as being 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.

Greenhouse Gas Emissions

On May 13, 2010, EPA issued a final rule that addressed greenhouse gas emissions from stationary sources under the Clean Air Act permitting programs. This final rule sets thresholds for greenhouse gases that define when permits under the New Source Review Prevention of Significant Deterioration and Title V Operating Permit programs are required for new and existing industrial facilities.

Major stationary sources that emit at least 100,000 tons per year of carbon dioxide equivalent will be required to include greenhouse gases in their Title V permit applications. The fugitive emissions are only included in the major source determination when the source belongs to a listed source category

in Section 302(j) of the Clean Air Act. Sandia is not a listed source category, and stack greenhouse gas emissions are much less than 100,000 tons per year of carbon dioxide equivalent.

During FY 2020, Sandia operations emitted a total of 160,444 tons of carbon dioxide equivalent (including fugitive greenhouse gas emissions). This total includes emissions from the sulfur hexafluoride release in April that was reportable under DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information* (see Chapter 2).

In 2009, EPA issued the Mandatory Greenhouse Gas Reporting Rule (codified in 40 CFR 98, *Mandatory Greenhouse Gas Reporting*), which requires reporting of greenhouse gas data from specific categories of large sources and from suppliers that meet designated emissions thresholds. Sandia activities resulting in greenhouse gas emissions were below reporting thresholds in 2020.

Sandia's annual Site Sustainability Plan documents greenhouse gas reductions, projected performance, and current status (see Chapter 2).

5.1.2 Stratospheric Ozone Protection

Title VI of the Clean Air Act Amendments of 1990 required EPA to establish regulations to phase out the production and consumption of ozone-depleting substances. Ozone-depleting substances are defined as chlorofluorocarbons, hydrochlorofluorocarbons, and other halogenated chemicals that have been found to contribute to the depletion of the stratospheric ozone layer. EPA has established regulations in 40 CFR 82, *Protection of Stratospheric Ozone*, which require the following: recycle ozone-depleting substances and other refrigerants when servicing equipment, establish requirements for recycling and recovering equipment, repair substantial leaks in refrigeration equipment containing more than 50 pounds of refrigerant, and establish safe disposal standards.

At SNL/NM, ozone-depleting substances are mainly used for comfort cooling for buildings, air conditioning units in vehicles, and water-cooling units in drinking fountains. Halon is contained in some fire-suppression systems and fire extinguishers.

5.1.3 Vehicles

As required by 20.11.100 NMAC, *Motor Vehicle Inspection—Decentralized*, an annual Vehicle Inventory and Inspection Plan was submitted to the City of Albuquerque for applicable vehicles owned by Sandia.

5.1.4 Open-Burn Permits

As required by 20.11.21 NMAC, *Open Burning*, open-burn permits are required for the following activities:

- Treating explosives waste by open burning (hazardous waste treatment)
- Open burning or detonating explosives related to research and development activities (no limit)
- Detonating explosives aboveground (more than 20 pounds)
- Disposing of explosives by burning to avoid transport or handling hazards (no limit)
- Igniting rocket motors (greater than 4,000 pounds of fuel)

A list of 2020 permits can be found in Chapter 10.

5.1.5 Fugitive Dust

As required by 20.11.20 NMAC, *Fugitive Dust Control*, DOE obtains fugitive dust permits for each applicable Sandia construction project that will disturb more than three-quarters of an acre of soil. A list of 2020 permits is included in Chapter 10.

5.2 Ambient Air Surveillance Program

Ambient air is surveilled through a network of air-monitoring stations located on or near Sandia property (Figure 5-1). In FY 2020, the stations monitored ambient air for particulate matter that has a diameter equal to or less than 2.5 micrometers ($PM_{2.5}$) and particulate matter that has a diameter equal to or less than 10 micrometers (PM_{10}).

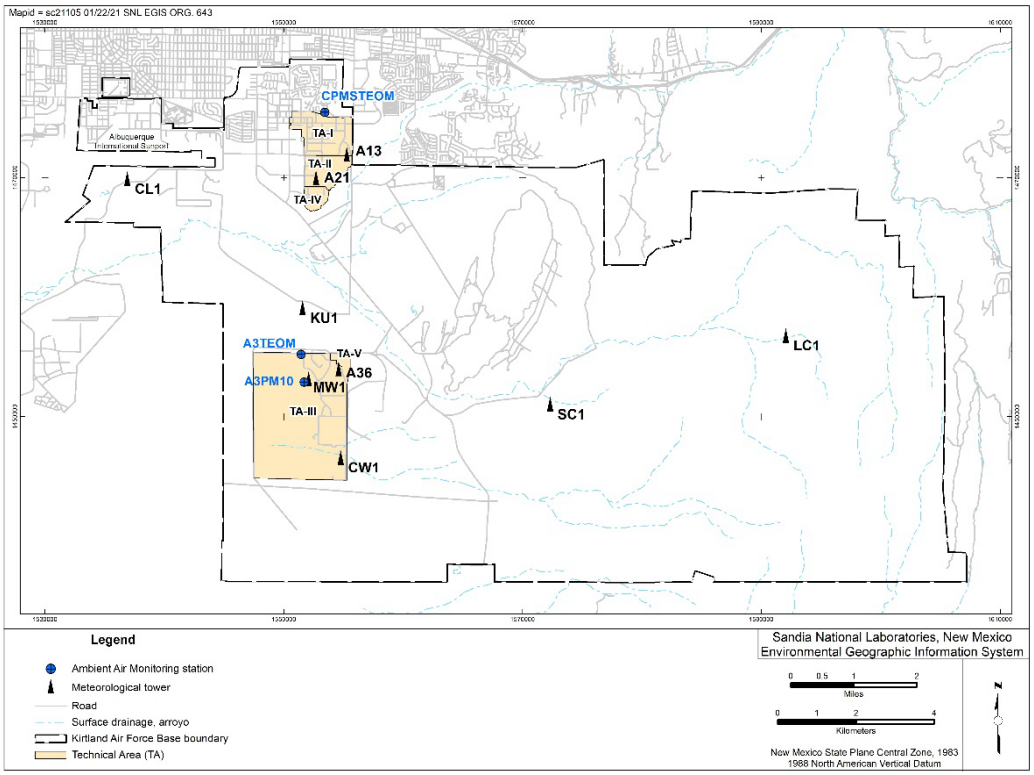

Figure 5-1. Clean air network of meteorological towers and ambient air-monitoring stations

Ambient means that portion of the atmosphere, external to buildings, to which the general public has access.

EPA has delegated authority to the City of Albuquerque to monitor the ambient air in Bernalillo County in order to determine compliance with the National Ambient Air Quality Standards and New Mexico Ambient Air Quality Standards. The ambient air-monitoring data is essential to the City of Albuquerque Environmental Health Department for regulating stationary source emissions, issuing air permits, and complying with the National Ambient Air Quality Standards.

Ambient air quality data collected by the City of Albuquerque is available at:

https://www.cabq.gov/airquality/air-quality-monitoring

5.2.1 Monitoring Stations

Ambient air-monitoring stations used in FY 2020 measured the following:

- $PM_{2.5}$ was measured at two monitoring locations (CPMSTEOM and A3TEOM). These particulates were measured continuously and recorded in hourly concentrations 24 hours a day, 365 days per year, contingent on equipment functionality.
- PM_{10} was measured at one monitoring location (A3PM10). The air was sampled for a 24-hour period every quarter, contingent on equipment functionality.

5.2.2 Ambient Air-Monitoring Results for Fiscal Year 2020

Ambient air-monitoring data are presented here for FY 2020. Laboratory data are available in Appendix C, "Ambient Air Surveillance Results in Fiscal Year 2020," and are summarized here.

Particulate Matter That Has a Diameter Equal to or Less than 2.5 Micrometers

The monthly and annual averages for one-hour $PM_{2.5}$ measurements in FY 2020 are listed in Table 5-2.

Table 5-2. Monthly and annual averages for one-hour $PM_{2.5}$ measurements, FY 2020

Sample Location	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Average FY 2020
A3TEOM[a]	5.82	5.59	4.77	4.58	4.52	5.09	5.62	5.42	7.01	7.51	6.61	5.37	**5.66**
CPMSTEOM[b]	9.52	8.55	6.98	6.24	6.71	7.38	8.11	10.07	15.15	14.52	11.28	8.64	**9.43**

Note: All units are in µg/m³.
[a]A3TEOM: Approximately 14 percent of all annual recorded data were negative values, and, therefore, were removed from monthly average calculations.
[b]CPMSTEOM equipment malfunction: data from approximately September 15 to September 30, 2020, were not included in this analysis. Approximately 25 percent of all annual recorded data were negative values, and, therefore, were removed from monthly average calculations.

Particulate Matter That Has a Diameter Equal to or Less than 10 Micrometers

The highest monthly average PM_{10} concentration in FY 2020 was 27.15 µg/m³, which occurred at the A3PM10 station in the second quarter of FY 2020. The quarterly and annual averages for PM_{10} are provided in Table 5-3.

Table 5-3. Quarterly and annual averages for PM_{10}, FY 2020

Sample Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Average FY 2020
A3PM10	2.26	27.15	6.63	6.33	**10.59**

Note: All units are in µg/m³.

The PM_{10} samples are also analyzed for metals and radiological constituents, and the FY 2020 averages are listed in Table 5-4.

Most of the radionuclides are either naturally occurring or are short-lived decay daughter products detected during analysis and are not emitted from Sandia sources.

Table 5-4. Average results of PM_{10} analysis, FY 2020

Analyte	Units	Station A3PM10	Threshold Limit Value [a]
Aluminum	µg/m³	3.36E-02	2,000
Antimony	µg/m³	DE	500
Arsenic	µg/m³	3.58E-04	10

Analyte	Units	Station A3PM10	Threshold Limit Value [a]
Barium	µg/m^3	9.46E-04	50
Beryllium	µg/m^3	DE	0.05
Cadmium	µg/m^3	DE	10
Calcium	µg/m^3	2.30E-01	2,000
Chromium	µg/m^3	3.64E-03	10
Cobalt	µg/m^3	DE	20
Copper	µg/m^3	2.88E-02	1,000
Iron	µg/m^3	6.34E-02	5,000
Lead	µg/m^3	5.31E-04	150
Magnesium	µg/m^3	2.27E-02	10,000
Manganese	µg/m^3	1.34E-03	200
Nickel	µg/m^3	4.92E-04	50
Potassium	µg/m^3	2.35E-02	2,000
Selenium	µg/m^3	9.76E-04	200
Silver	µg/m^3	3.36E-04	10
Sodium	µg/m^3	2.28E-02	5,000
Thallium	µg/m^3	DE	100
Uranium	µg/m^3	DE	200
Vanadium	µg/m^3	2.01E-04	50
Zinc	µg/m^3	1.08E-02	10
Actinium-228	pCi/m^3	DE	100
Alpha, gross	pCi/m^3	1.03E-03	0
Americium-241	pCi/m^3	DE	NE
Beryllium-7	pCi/m^3	1.32E-01	40,000
Beta, gross	pCi/m^3	1.04E-02	0
Bismuth-212	pCi/m^3	DE	700
Bismuth-214	pCi/m^3	DE	2,000
Cesium-137	pCi/m^3	DE	400
Cobalt-60	pCi/m^3	DE	80
Lead-212	pCi/m^3	DE	80
Lead-214	pCi/m^3	DE	2,000
Neptunium-237	pCi/m^3	DE	0
Potassium-40	pCi/m^3	DE	900
Radium-223	pCi/m^3	DE	NE
Radium-224	pCi/m^3	DE	4
Radium-226	pCi/m^3	DE	1
Radium-228	pCi/m^3	DE	3
Sodium-22	pCi/m^3	DE	NE
Thorium-227	pCi/m^3	DE	0.7
Thorium-231	pCi/m^3	DE	NE
Thorium-234	pCi/m^3	DE	400
Uranium-235	pCi/m^3	DE	0.1
Uranium-238	pCi/m^3	DE	0.1

[a] Threshold limit values are guidelines and not legal standards; these guidelines help to control occupational health hazards (American Conference of Governmental Hygienists 2011).
DE = data excluded due to undetected analyte or presumed false positives
NE = not established

5.3 Meteorology Program

Meteorology Program personnel provide decision support services, data, and analyses to all Sandia programs and operations that require atmospheric information. Program monitoring activities provide data that are used to assist with health and safety operations, emergency management and response, regulatory permitting and reporting processes, and general research and development activities. The DOE directives and regulations applicable to the Meteorology Program are listed in "References."

5.3.1 Meteorological Monitoring Network

Meteorological monitoring is conducted through a network of meteorological towers located throughout KAFB on or near Sandia property. The network includes seven 10-meter towers, one 30-meter tower, and one 60-meter tower. Meteorological tower locations are shown in Figure 5-1. All towers are instrumented to measure temperature and wind velocity at 3-meter and 10-meter levels above the surface. Temperature and wind velocity are also measured at the top of the two tallest towers (30 meters and 60 meters).

Relative humidity is measured at all locations, while rainfall is measured at the A36, A21, LC1, and SC1 towers. Barometric pressure is measured at towers A36, A21, and LC1. Routine instrument calibrations and a strong preventive maintenance field program are used to ensure data quality. Current weather information from the meteorological network can be found at the following website:

https://snlweather.sandia.gov

5.3.2 Meteorological Monitoring Results

New Mexico weather in 2020 was far warmer and drier than climatological means. The statewide temperature average was 59.2°F, which is 3.2 degrees above the normal of 56.0°F. This was tied for the second-warmest year on record (National Weather Service 2021). The statewide average precipitation was 8.42 inches, or 5.57 inches below the normal of 13.99 inches. This is the fourth-driest year on record (National Weather Service 2021).

Local conditions across SNL/NM were much in line with the statewide pattern, with drought conditions worsening as the year progressed. Tower A36 is a 60-meter tower used to describe general meteorology at SNL/NM due to its central geographic position and the availability of all network measurements at this one location. In 2020, Tower A36 observations showed significantly warmer and drier conditions than the 1995–2019 climatological averages for the site. Rainfall at Tower A36 totaled 6.42 inches, more than two inches below the 8.86-inch average at that site. The monsoon season (July through September) was a contributing factor, as season totals were an inch below average. Most of the remaining deficit occurred during October, November, and December, when only 0.40 inches of rain was measured. During November and December, there were multiple small snow events at SNL/NM, but Meteorological Program rain gauges do not have built-in heaters and can only measure snowfall when it melts. These measurements miss much of the actual snowfall total as the snow is blown off the top of the rain gauge.

The annual mean temperature at Tower A36 was 59.6°F; the 25-year average is 57.5°F. The months of April, May, July, and August were all particularly warmer than usual. February and December were the only months that were cooler than their climatological averages. Major forcing mechanisms for these precipitation and temperature deviations are likely climate change and the El Niño-Southern Oscillation pattern, which has been negative (La Niña) since mid-2020. La Niña events, even weak ones, historically have a warming and drying effect across New Mexico.

The 2020 annual summary for Tower A36 is shown in Table 5-5.

Table 5-5. Annual climatic summary from Tower A36, 2020

Measurement	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	2020 Annual
Temperature (°C)													
Average daily low	−3.98	−2.30	2.29	5.46	11.70	15.10	18.70	18.20	11.90	5.85	1.89	−6.17	6.55
Average daily high	9.30	11.30	17.30	22.10	28.90	33.00	34.30	34.50	27.90	23.90	16.30	8.57	22.28
Monthly mean	3.66	5.14	10.60	15.10	21.20	24.80	26.20	26.80	20.90	16.50	10.30	2.65	15.32
Extremes (°C)													
Low	−9.08	14.00	−3.29	−3.60	5.99	7.13	14.16	14.69	4.29	−7.66	−6.43	11.69	−14.00
High	15.40	18.92	23.77	30.71	33.77	37.11	39.67	37.62	35.56	30.44	24.67	15.03	39.67
Relative Humidity													
Humidity (percent)	51.90	51.20	43.20	27.60	22.50	24.80	37.70	31.90	34.00	28.40	39.00	43.70	36.33
Precipitation (cm)													
24-hour maximum	0.38	0.69	0.61	1.70	0.03	1.32	2.92	0.61	1.09	0.25	0.30	0.38	2.92
Monthly	0.76	1.52	0.89	1.80	0.03	1.63	5.72	1.40	1.55	0.33	0.30	0.38	16.31
Wind Speed (m/sec)													
Highest 24-hour average	5.80	8.97	8.33	5.92	8.17	7.61	5.71	5.31	10.69	11.38	7.55	6.57	11.38
Monthly mean	3.11	3.99	4.12	4.18	4.51	4.04	3.67	3.35	3.93	3.51	3.54	2.95	3.74
Maximum gust	17.98	25.10	21.18	23.70	21.14	23.86	29.25	27.53	27.29	21.34	21.58	18.94	29.25
Barometric (mb)													
Pressure	835.7	834.0	834.0	832.0	833.0	834.1	836.0	836.0	838.0	836.0	837.0	836.0	835.14

Note: Winter precipitation that falls as snow is underestimated.

In general, the annual statistics for each of the monitoring towers are similar. However, daily conditions vary considerably across the meteorological network. This real-time variability of meteorological conditions has implications for the transport and dispersion of pollutants, which are important in atmospheric emergency release scenarios and air dispersion modeling. Table 5-6 shows some of the variations and extremes from the meteorological measurements throughout the year.

Table 5-6. Variations and extremes in meteorological measurements across the tower network, 2020

Meteorological Measurement	Minimum	Maximum	Spread
Temperature	**°C**	**°C**	**°C**
Average daily temperature range	14.82 Tower A21	16.83 Tower CW1	2.01
Average daily minimum temperature	5.41 Tower CW1	7.47 Tower CL1	2.06
Average daily maximum temperature	21.19 Tower SC1	22.54 Tower CL1	1.35
Average annual temperature	13.02 Tower LC1	15.56 Tower KU1	2.54
Annual temperature extremes	−16.30 Tower CW1	39.91 Tower CL1	56.21
Precipitation	**cm**	**cm**	**cm**
Maximum daily precipitation	1.65 Tower A21	2.92 Tower A36	1.27
Greatest monthly precipitation variation	2.67 Tower LC1	6.43 Tower SC1	3.76 July
Annual precipitation extremes	15.27 Tower A21	19.86 Tower SC1	4.59

Meteorological Measurement	Minimum	Maximum	Spread
Wind Speed	m/sec	m/sec	m/sec
Average daily maximum wind speed	9.53 Tower LC1	14.16 Tower A13	4.63
Average annual wind speed	3.61 Tower KU1	3.86 Tower SC1	0.25
Maximum annual wind gust	25.45 Tower LC1	32.77 Tower A13	7.32

Note: Winter precipitation that falls as snow is underestimated.

5.3.3 Wind Analysis

The most important implication of meteorological variations is the wind impact on transport and dispersion of potential pollutants. Wind transport is a complex result of large-scale, synoptic-based weather systems and local or regional topographic influences. The local topography produces nocturnal drainage flows and can also channel the large-scale driven winds. Wind roses are diagrams used to present the distributions of wind speed and wind direction. It should be noted that wind direction is defined as the direction from which the wind originates. The wind roses for towers A36, CL1, and SC1 are shown in Figure 5-2. Typical diurnal variations and wind shifts cannot be seen in Figure 5-2. Figure 5-3 shows a much different wind pattern and nature, with the data divided into daytime and nighttime intervals at Tower A36. A similar diurnal pattern is seen at other locations within KAFB. The predominant wind direction at most locations is a product of local topographic features.

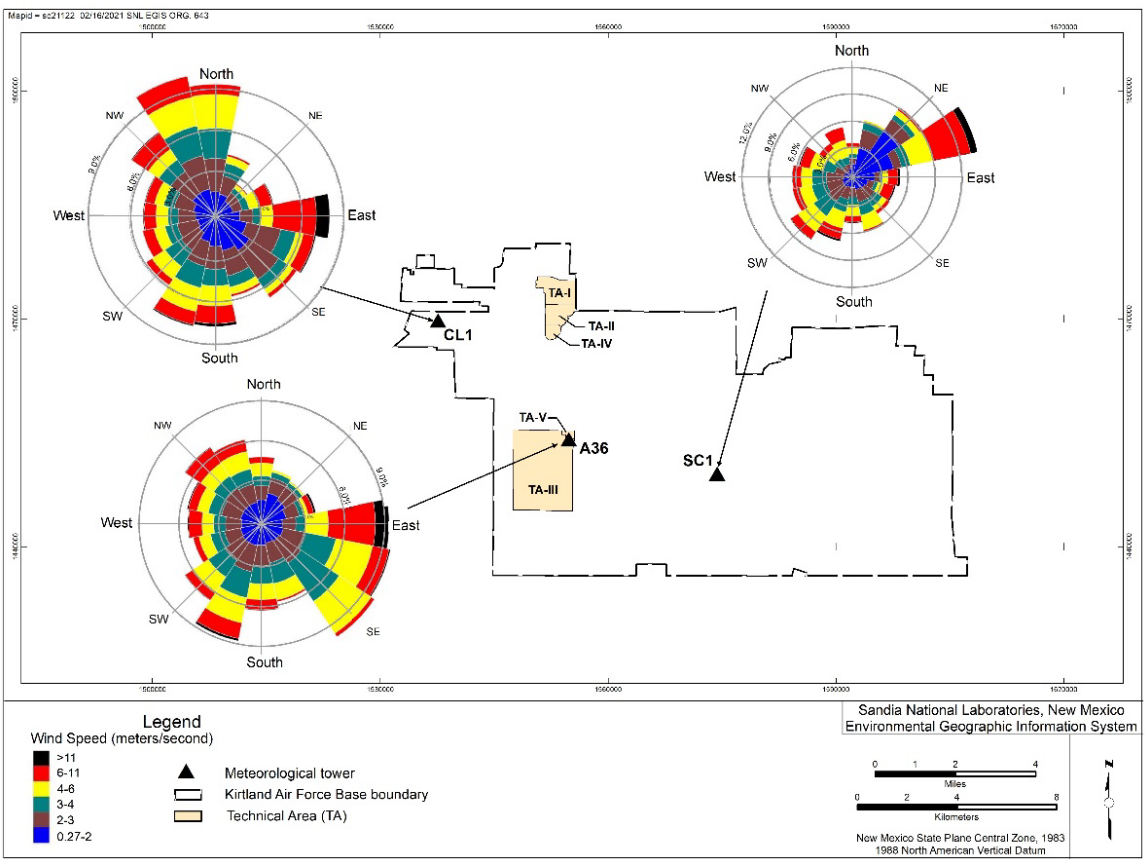

Figure 5-2. Annual wind roses at towers A36, CL1, and SC1

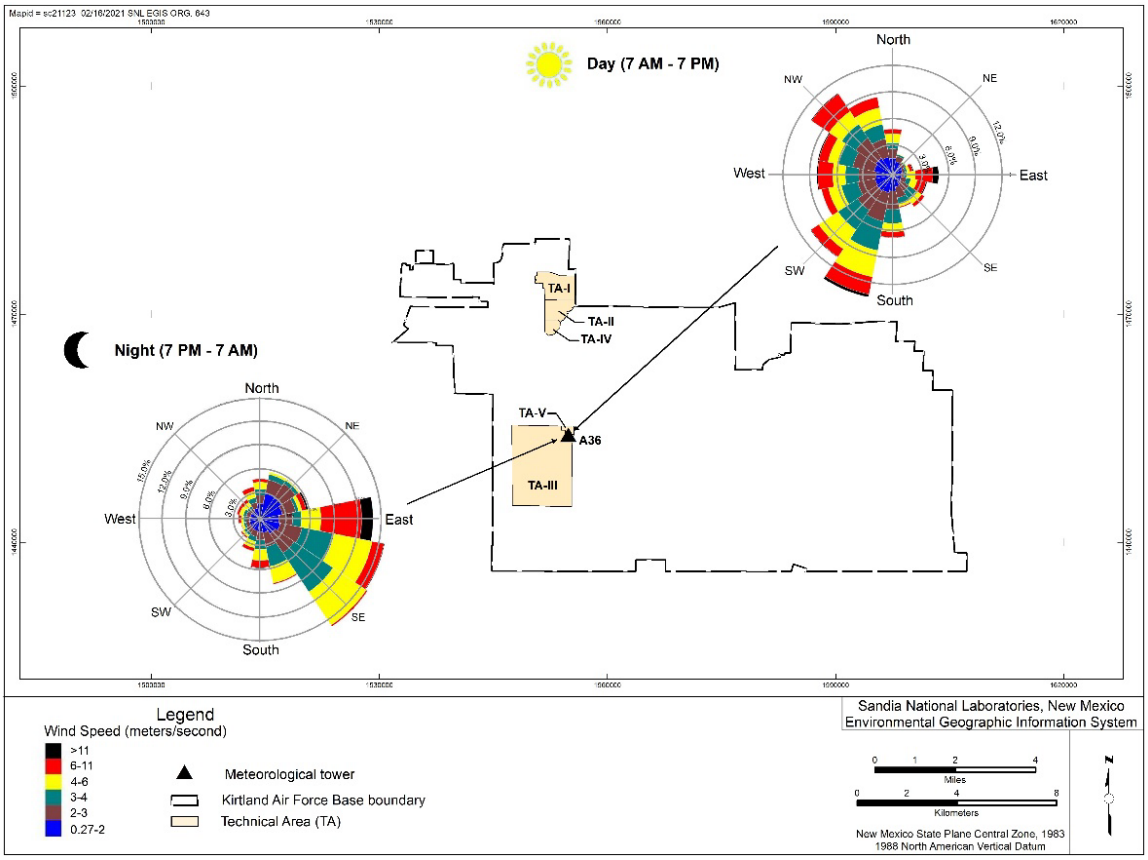

Figure 5-3. Annual wind roses for daytime and nighttime frequency at Tower A36

The relative location of a monitoring tower to local slopes and canyons identifies the exact direction of local topographic influences, which determines the predominant wind for the year, especially during nighttime hours.

Wind direction is the direction from which the wind originates.

Table 5-7 lists the predominant wind directions for daytime and nighttime periods for all towers in the network. Across the network, nighttime-predominant winds ranged from east-northeasterly to south-southeasterly. During the day, the predominant wind direction ranged from south-southwesterly to westerly.

Table 5-7. Predominant wind directions for day and night periods by tower, 2020

Tower	Day	Night
A13	West	East-northeast
A21	South-southwest	East-northeast
A36	South-southwest	Southeast
CL1	South-southwest	East
CW1	South-southwest	East
KU1	South-southwest	South-southeast
LC1	West	East-northeast
MW1	South-southwest	East-southeast
SC1	Southwest	East-northeast

5.4 Radionuclide National Emission Standards for Hazardous Air Pollutants Program

EPA regulates radionuclide air emissions in accordance with 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," and has established an effective dose equivalent limit of 10 mrem/year to any member of the public resulting from all radionuclide air emissions from a DOE facility. A summary of radionuclide releases and public doses resulting from Sandia operations in 2020 is provided in Table 5-8.

Table 5-8. Radiological dose and release reporting, 2020

Radiologic Doses			
Dose to On-Site Maximally Exposed Individual (mrem)	Dose to Off-Site Maximally Exposed Individual (mrem)	Estimated Population Dose in a 50-Mile Radius of KAFB (person-rem)	EPA and DOE Dose Limit for Air Pathway (mrem)
2.73E-04	9.91E-03	1.08E-02	10

Radiological Atmospheric Releases (in Curies)							
Tritium	Noble Gases (half-life < 40 days)	Fission and Activation Products (half-life < 3 hours)	Fission and Activation Products (half-life > 3 hours)	Total Radiostrontium	Total Uranium	Other Actinides	Other
4.20E+01	7.90E-01	6.58E-04	5.03E-06	5.04E-06	1.60E-06	2.06E-06	2.00E-08

5.4.1 Compliance Reporting

An annual radionuclide NESHAP report summarizes radionuclide air emission releases from Sandia facilities and presents the results of the annual dose assessment. DOE submits the annual report to EPA and the City of Albuquerque Environmental Health Department. Details can be found in the *Radionuclide NESHAP Annual Report CY 2020, SNL/NM* (SNL/NM 2021e).

5.4.2 Facilities

Point releases are emission sources that could potentially discharge material to the atmosphere through a facility's exhaust stack or rooftop vent (Figure 5-4). Table 5-9 lists the radionuclides and the total reported emissions from each of Sandia's radionuclide NESHAP sources in 2020.

TA-I Sources

The Ion Beam Laboratory accelerators are used to study and modify material systems. Some activities at the laboratory involve the use of tritium targets, which can off-gas elemental tritium during use. The off-gassed tritium exits the laboratory building through its ventilation exhaust.

The Neutron Generator Facility is the nation's principal production facility for neutron generators. This facility currently emits only tritium. The facility has two stacks, but only the main stack in the Tritium Envelope North Wing is used. Although anticipated tritium releases do not exceed the regulatory threshold requiring continuous monitoring, monitoring is performed voluntarily at the facility as a best management practice.

The Process Research and Development Laboratory is used to perform small-scale operations. Activities at the laboratory include handling and researching sealed and unsealed tritiated materials. Activities at the laboratory could result in the release of tritium.

TA-II Sources

The Explosives Components Facility is used to perform destructive testing on neutron generators. Activities at the facility could result in the release of trace amounts of tritium.

TA-III Sources

The Radioactive and Mixed Waste Management Unit is used for handling radioactive and mixed waste products. Activities could result in the release of trace amounts of radionuclides. Although anticipated releases do not exceed the regulatory threshold requiring continuous monitoring, monitoring is performed voluntarily at the Radioactive and Mixed Waste Management Unit as a best management practice.

TA-IV Sources

The High-Energy Radiation Megavolt Electron Source III accelerator is used to test the effects of prompt radiation on electronics and complete military systems. Activities at the accelerator produce air activation products, primarily nitrogen-13 and oxygen-15.

The Z Accelerator Facility is used for research on light-ion inertial confinement fusion. Large amounts of electrical energy are stored for several minutes and then released as an intense concentrated burst (shot) at a target. Some experiments could result in the release of trace amounts of radionuclides.

TA-V Sources

The Annular Core Research Reactor is used to subject test objects to a mixed photon and neutron irradiation environment. Activities at the reactor could result in the occasional release of trace amounts of radionuclides.

The Auxiliary Hot Cell Unit is used to identify, sort, characterize, and repackage legacy nuclear materials for permanent removal from SNL/NM. Legacy material may include accountable nuclear material, spent nuclear fuel, and radiological material. Activities at the Auxiliary Hot Cell Unit could result in the occasional release of trace amounts of radionuclides.

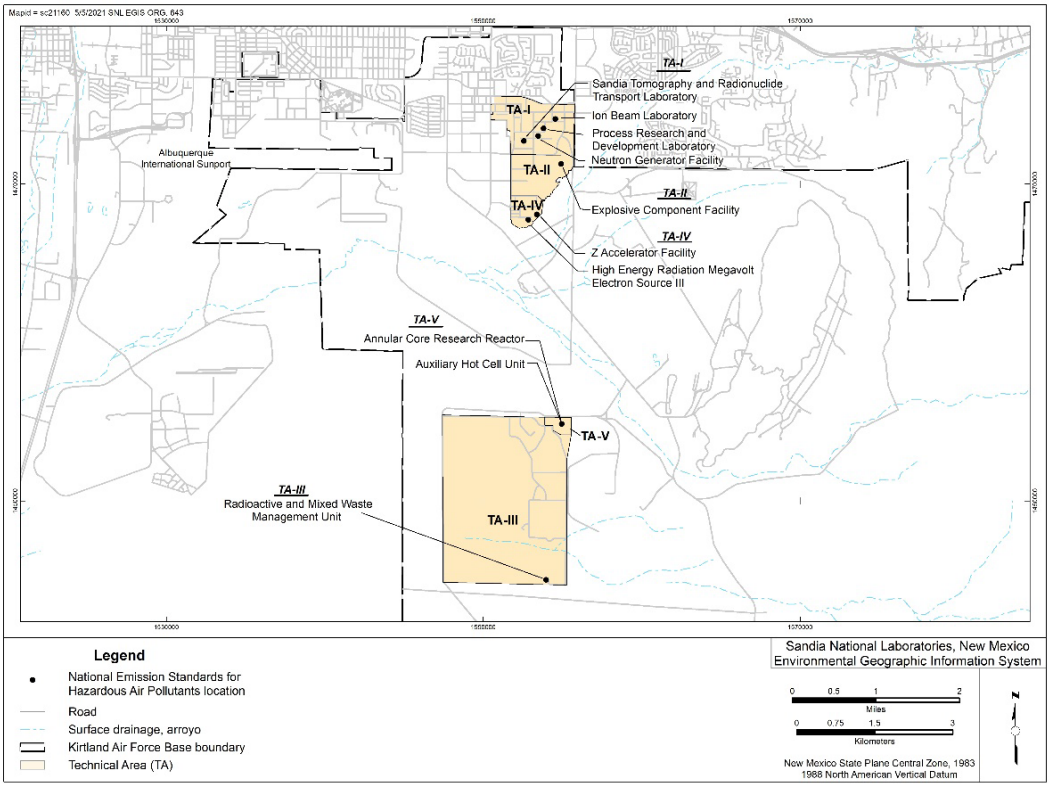

Figure 5-4. Locations of facilities that provided radionuclide inventories

Table 5-9. Summary of radionuclide releases from NESHAP sources, 2020

Source Name, Location	Description	Source Type	Monitoring Method	Radionuclide Emitted	Reported Release (Ci/year)
Annular Core Research Reactor, TA-V	Reactor used to perform in-pile experiments for severe reactor accident research projects	Point	Periodic	Argon-41	0.79
Auxiliary Hot Cell Unit, TA-V	Facility used to identify, sort, characterize, and repackage legacy nuclear materials for permanent removal; legacy material may include accountable nuclear material, spent nuclear fuel, and radiological material	Point	Periodic	Americium-241 Cesium-137 Krypton-85 Plutonium-238 Plutonium-239 Plutonium-241 Samarium-151 Strontium-90 Tritium Uranium-235m[a]	7.0E-11 1.0E-08 2.0E-08 2.8E-11 2.6E-11 2.1E-10 2.8E-10 1.5E-08 1.3E-09 2.6E-11
Explosives Components Facility, TA-II	Facility used to test neutron generator design and manufacturing	Point	Calculation	Tritium	2.53E-03
High-Energy Radiation Megavolt Electron Source III, TA-IV	Gamma simulator used primarily to simulate the effects of prompt radiation from a nuclear burst on electronics	Point	Periodic	Nitrogen-13 Oxygen-15	5.98E-04 6.00E-05
Ion Beam Laboratory, TA-I	Ion and electron accelerators used to study and modify materials systems	Point	Calculation	Tritium	20.2
Neutron Generator Facility, TA-I	Principal production facility for neutron generators	Point	Continuous	Tritium	21.84
Process Research and Development Laboratory, TA-I	Small-scale laboratory operation involved in handling and researching sealed and unsealed tritiated materials	Point	Calculation	Tritium	3.5E-05
Radioactive and Mixed Waste Management Unit, TA-III	Facility used to handle radioactive and mixed waste	Point	Continuous and calculation	Americium-241 Cesium-137 Plutonium-238 Plutonium-239 Plutonium-240 Plutonium-241 Plutonium-242 Strontium-90 Tritium (elemental) Tritium (oxide) Tritium (particulate) Uranium-234 Uranium-235 Uranium-238	3.11E-09 5.02E-06 6.91E-10 2.03E-06 7.50E-09 1.66E-08 4.34E-13 5.02E-06 5.78E-06 1.29E-05 1.10E-03 1.18E-06 4.64E-08 3.70E-07
Z Accelerator Facility, TA-IV	Experimental facility used to research light-ion inertial confinement fusion	Point	Calculation	Tritium	1.8E-03

Note: Monitoring methods include periodic, calculation, and continuous. Periodic is based on periodic measurements; calculation is based on known parameters; and continuous is based on continuous air-monitoring results.

[a] Uranium-235m is an excited nuclear isomer.

5.4.3 Assessment of Potential Dose to the Public

In general, the radiation dose a person receives is dependent on the person's distance from the source, the available pathways in the environment (food, air, or water), radionuclide quantities and properties, and meteorological conditions. Historically, radioactive releases from Sandia facilities have resulted in doses to the public that are several orders of magnitude below the EPA and DOE standard of 10 mrem/year. See Chapter 2 for DOE dose limits.

To assess compliance, all facilities with point releases must submit annual facility emission data. The emissions are modeled using version 4.1 of the EPA Clean Air Act Assessment Package-1988 (EPA 2020) to estimate the annual dose to each of the identified public receptors.

Emission Sources

Radionuclide NESHAP regulations require DOE to monitor continuously any radionuclide air emission source that has the potential to produce a dose of 0.1 mrem/year to the maximally exposed individual; no Sandia facilities exceed this criterion. However, as a best management practice, stacks are monitored continuously at some facilities. At other facilities, emission estimates are based on periodic confirmatory measurements or engineering calculations. In 2020, as with previous years, the highest emissions were from argon-41 and tritium. Historically, argon-41 and tritium have been the most significant contributors to the effective dose equivalent of the maximally exposed individual. Figure 5-5 shows the annual reported release of argon-41 and tritium for 2016 through 2020. The atmosphere contains 78.09 percent nitrogen, 20.95 percent oxygen, 0.93 percent argon, 0.03 percent carbon dioxide, and minor concentrations of neon, methane, hydrogen, helium, and krypton. Some of these constituents are susceptible to isotope transformations during high-energy processes, which result in air-activation products such as argon-41. Emissions vary from year to year, based on the operations conducted at the various facilities.

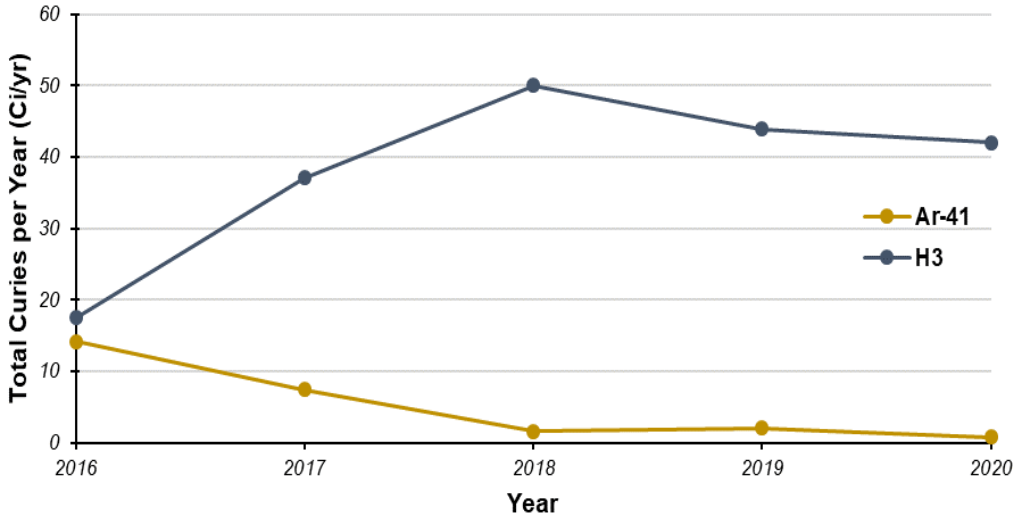

Figure 5-5. Atmospheric releases of argon-41 and tritium, 2016–2020

Demographic data include the resident population, the number of beef and dairy cattle, and the utilized food crop area fraction for a 50-mile radius study area. The densities for resident population, cattle, and food crops are calculated as the quotient of the most recent county data and the county land area (e.g., cows per acre). The radionuclide NESHAP calculation for the resident population was based on estimated urban and county population data and U.S. Census Bureau data (Census 2014). Although a census did take place in 2020, the data has not yet been made available. The beef and dairy cattle numbers and the food crop area fraction were calculated using 2007 agricultural statistics. The statistics were supplied by the New Mexico Department of Agriculture

(NMDOA 2013). Population data is expected to be updated with the next Clean Air Act Assessment Package-1988 revision (anticipated in 2021 to account for census data).

Off-Site and On-Site Public Receptors

Receptor locations in the vicinity of emission sources have been identified as potential locations of maximum exposure to a member of the public. Off-site receptor locations extend to the Isleta Resort Casino, the Four Hills subdivision north of KAFB, and areas near the Albuquerque International Sunport west of KAFB. On-site receptors include U.S. Air Force facilities, offices, and housing areas as well as other non-DOE and non-Unites States Department of Defense (DOD) facilities on KAFB.

Meteorology

Data from three meteorological towers (A21, A36, and CW1) in the proximity of emission sources were used in 2020. Data from each tower consisted of approximately 35,000 hourly observations of wind direction, wind speed, and stability class (inferred from wind and solar insulation data). The data were compiled into a normalized distribution from which all wind and stability frequency-of-occurrence data were derived.

5.4.4 Dose Assessment Results

The Clean Air Act Assessment Package-1988 uses a Gaussian plume equation to estimate air dispersion in both horizontal and vertical directions (EPA 2020). Individual effective dose equivalents to on-site and off-site receptors from emission sources are presented as dose assessment results, which are summarized in Table 5-10.

Table 5-10. Calculated dose assessment results for on-site and off-site receptors and for collective populations, 2020

Dose to Receptor	Location	Calculated Dose	EPA and DOE Dose Limit for Air Pathway
Individual Dose			
On-site receptor effective dose equivalent to the maximally exposed individual	Homeland Security Building	2.73E-04 mrem/year	10 mrem/year
Off-site receptor effective dose equivalent to the maximally exposed individual	Eubank Gate area	9.91E-03 mrem/year	10 mrem/year
Collective Dose			
Collective regional population	Fifty-mile radius of KAFB	1.08E-02 person-rem/ year	No standard available
Collective KAFB population	KAFB housing	4.95E-04 person-rem/ year	No standard available

The total dose at each receptor location is determined by summing the individual doses resulting from each source. The dose to the maximally exposed individual member of the public is then compared to the EPA NESHAP limit of 10 mrem/year.

In 2020, the primary radionuclides released from SNL/NM facilities were tritium and argon-41. In 2020, the on-site maximally exposed individual was located on KAFB at the Homeland Security Building. The on-site maximally exposed individual dose of 2.73E-04 mrem/year resulted primarily from tritium releases at the Ion Beam Laboratory and the Neutron Generator Facility and from argon-41 releases at the Annular Core Research Reactor. The off-site maximally exposed individual dose of 9.91E-03 mrem/year was located at the KAFB Eubank Gate area and primarily resulted

from tritium releases at the Ion Beam Laboratory and the Neutron Generator Facility. Both doses are well below the 10 mrem/year EPA NESHAP standard. By comparison, the average person in the United States receives 311 mrem/year from natural background radiation (NCRP 2009).

Collective Dose

The collective population dose resulting from all Sandia radiological emissions was calculated for both KAFB and the regional area (Table 5-10). Collective dose calculations are not required by NESHAP regulations; however, a collective calculation provides a useful numerical comparison with the public dose from year to year. Collective dose is calculated by multiplying a representative individual dose within a population by the total population. The collective population dose was calculated for both the KAFB housing areas and the general Albuquerque area population within a 50-mile radius of KAFB.

Regional

The Albuquerque regional collective population dose in 2020 was 1.08E-02 person-rem/year. This is comparable to the average over the past five years for regional collective population dose data. For the purpose of calculating the collective dose, all releases were assumed to occur at a location centered in TA-V.

Kirtland Air Force Base

A collective population dose for KAFB residents was calculated based on the main housing areas. The total population dose for the KAFB housing location was calculated by summing the total residential population. The 2020 calculation resulted in an estimated population dose of 4.95E-04 person-rem/year.

Chapter 6. Water Quality Programs

Standing water after a heavy rain

OVERVIEW ■ Water quality programs—which include the Environmental Release, Response, and Reporting Program; Oil Storage Program; Safe Drinking Water Protection Program; Stormwater Program; Surface Discharge Program; and Wastewater Discharge Program—collectively ensure compliance with requirements established by federal, state, and local agencies.

Sandia personnel ensure water quality through numerous programs. Operations comply with water quality requirements established by federal, state, and local agencies. Groundwater programs are summarized in Chapter 3. Additional water quality programs discussed in this chapter include the following:

- Environmental Release, Response, and Reporting Program
- Oil Storage Program
- Safe Drinking Water Protection Program
- Stormwater Program
- Surface Discharge Program
- Wastewater Discharge Program

NMED and the ABCWUA implement EPA standards at the state and local levels. Currently, EPA Region 6 implements stormwater regulations under NPDES permits. Sandia personnel adhere to these regulations and to the water quality guidelines in DOE O 458.1 Change 4 (LtdChg), *Radiation Protection of the Public and the Environment*.

6.1 Environmental Release, Response, and Reporting Program

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.

An *environmental release* is 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.

6.1.1 Events Reported to the New Mexico Environment Department

In 2020, no releases to the environment occurred that required reporting to NMED or EPA.

6.1.2 Events Categorized as a DOE Reportable Occurrence

In 2020, no releases to the environment were reported to outside agencies that met the criteria for DOE-reportable occurrences under DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information* (see Chapter 2).

6.1.3 Chemical Inventory and Toxic Release Inventory Reporting

The chemical inventory report and the toxic release inventory report for 2020 were submitted to EPA and support compliance with EPCRA. The chemical inventory report documents toxic chemicals in use and all chemical purchases. Chemical use at SNL/NM was above the reporting threshold for submitting a toxic release inventory report for lead and lead compounds.

6.2 Oil Storage Program

Oil Storage Program activities support regulatory compliance associated with the management, operation, and maintenance of oil storage containers and equipment. As required by 40 CFR 112, *Oil Pollution Prevention*, Oil Storage Program personnel maintain and implement a Spill Prevention, Control, and Countermeasure Plan (SNL/NM 2016), which describes the oil storage facilities at SNL/NM and the mitigation controls in place to prevent inadvertent discharges of oil.

The oil storage capacity at SNL/NM is approximately 2.2 million gallons. The inventory of oil storage containers operating under the Spill Prevention, Control, and Countermeasure Plan includes 47 stationary aboveground storage tanks and 2 underground storage tanks. Additional oil storage capacity in 55-gallon drums, mobile and portable containers, mobile refuelers, and oil-filled operational equipment (e.g., transformers and hydraulic elevators) is used throughout the site on an as-needed basis. All oil storage locations with regulated containers are equipped with secondary containment. Secondary containment structures include concrete-lined basins, retaining walls, containment reservoirs, double-wall tanks, sloped pads, trenches, and containment pallets.

Two 20,000-gallon underground oil storage tanks were operational in 2020. These underground tanks are registered with the NMED Petroleum Storage Tank Bureau. Although 47 stationary aboveground storage tanks were operational in 2020, only 7 are subject to NMED Petroleum Storage Tank Bureau regulation and registration. Registration numbers for the 2 underground storage tanks

and 7 aboveground storage tanks regulated by the Bureau are provided in Table 10-1. The NMED Petroleum Storage Tank Bureau owner identification number for SNL/NM-registered tanks is 14109, and the operator identification number is 13476.

6.2.1 Oil Storage Program Activities in 2020

In March 2020, a minimum site assessment was completed for the 10,000-gallon diesel fuel underground storage tank that was removed in February 2019 (SNL/NM 2020a) in accordance with 20.5.119 NMAC, *Corrective Action for Storage Tank Systems Containing Petroleum Products*. The site assessment determined that contamination was limited to the area immediately beneath the former underground tank. The *14-Day and Limited Minimum Site Assessment Report* (EA 2020) was submitted to the NMED Petroleum Storage Tank Bureau in March 2020 with a recommendation that no further correction actions were necessary. In November 2020, Sandia received correspondence from the NMED Petroleum Storage Tank Bureau accepting the assessment report and associated recommendation that no further actions are required.

In 2020, Sandia permanently closed three, stationary, aboveground storage tanks that were no longer in use or otherwise needed. In addition, the Spill Prevention, Control, and Countermeasure Plan was amended to include an oil storage container inventory management process with defined responsibilities.

In October 2020, the NMED Petroleum Storage Tank Bureau initiated a records review inspection at SNL/NM. No violations were identified as of year-end 2020.

6.3 Safe Drinking Water Protection Program

Safe Drinking Water Protection Program activities ensure the availability of safe drinking water for personnel at Sandia-operated facilities. Program personnel work in conjunction with Infrastructure Operations personnel to maintain compliance with applicable federal, state, local, and DOE requirements and coordinate operations that maintain, test, and inspect appropriate backflow-prevention activities.

KAFB supplies water to the DOE-owned drinking water distribution system at SNL/NM. The KAFB water system is registered with the NMED Drinking Water Bureau as a Community Public Water System. Because KAFB is identified as the sole registered party, the NMED Drinking Water Bureau regulates the distribution system on KAFB. The distribution system on DOE property is operated and maintained by Sandia personnel as a component of the KAFB Public Water System. Safe Drinking Water Protection Program personnel coordinate with KAFB to support compliance activities.

KAFB publishes an annual summary of drinking water quality, which can be found at the following website:

https://www.kirtland.af.mil/Home/Environment

6.4 Stormwater Program

Stormwater Program personnel are responsible for protecting surface water quality by minimizing the discharge of pollutants in stormwater. Program personnel maintain regulatory compliance with federal, state, tribal, and local stormwater requirements via NPDES permit coverage consisting of the Construction General Permit (CGP), the Middle Rio Grande Municipal Separate Storm Sewer System (MS4) Permit, and the Multi-Sector General Permit (MSGP). Activities include preparing Stormwater Pollution Prevention Plans and Stormwater Management Plans, conducting routine inspections, monitoring stormwater quality, and training personnel on stormwater pollution

prevention practices. Compliance with NPDES permits reduces the impact of construction, industrial, and municipal activities on the environment. EPA maintains administrative and enforcement authority for NPDES permits in New Mexico. The NMED assists EPA with inspections but has no enforcement authority.

6.4.1 Regulatory Criteria

Stormwater is regulated because it can potentially discharge to "waters of the United States" as defined under the Clean Water Act. In addition, the State of New Mexico regulates "surface water(s) of the state," which are defined as: "all surface waters situated wholly or partly within or bordering upon the state, including lakes, rivers, streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, reservoirs, or natural ponds." Surface water discharged from SNL/NM is required to meet the State of New Mexico requirements listed in 20.6.4 NMAC, *Standards for Interstate and Intrastate Surface Waters*, in addition to federal requirements specific to individual stormwater permits.

6.4.2 Surface Waters and Stormwater Drainage

The major drainage features within KAFB are the Tijeras Arroyo and its named tributary, Arroyo del Coyote. Both are designated as "waters of the United States" and are ephemeral, flowing for short durations in response to direct precipitation. Tijeras Arroyo is a significant topographic feature of KAFB, where erosion of unconsolidated basin sediment has resulted in a flood plain width of more than one-half mile in some areas. As shown in Figure 6-1, Tijeras Arroyo enters KAFB from the northeast, flows generally southwest, exits at the west boundary of KAFB, and continues approximately six miles to its outfall at the Rio Grande.

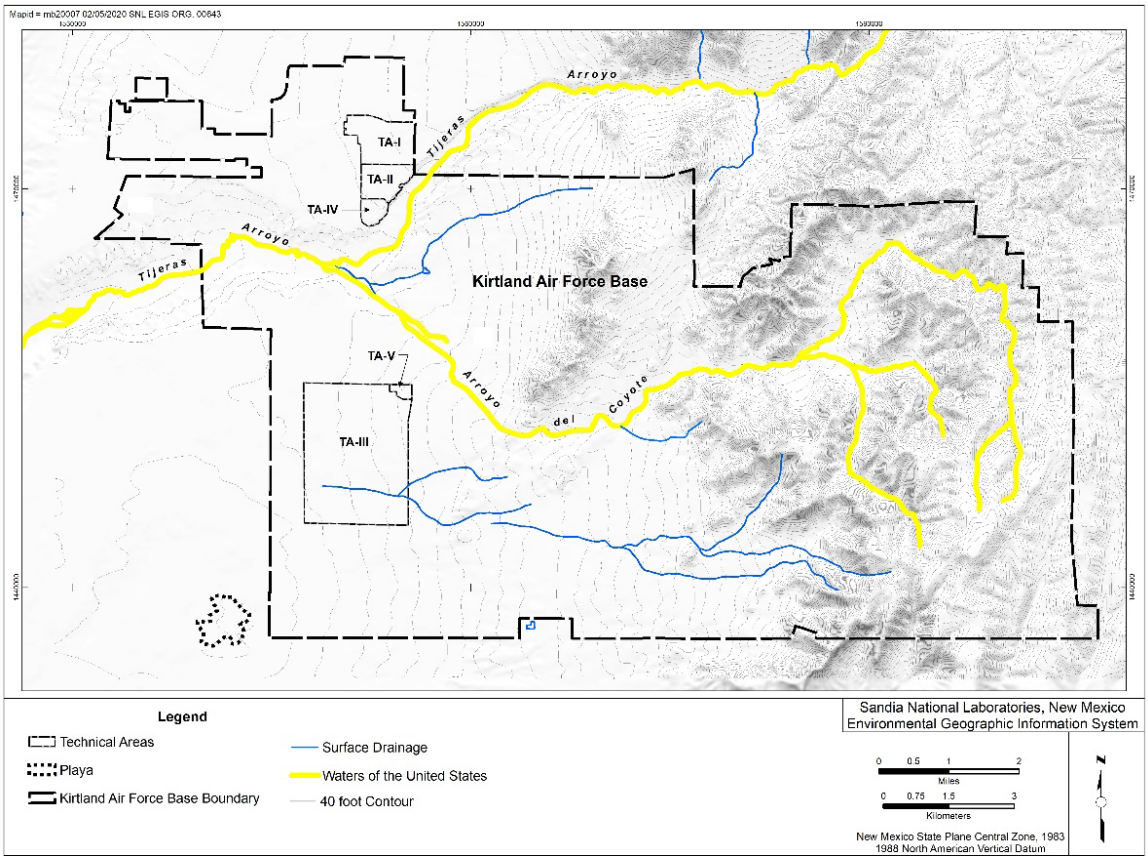

Figure 6-1. Location of SNL/NM technical areas and waters of the United States within KAFB

6.4.3 Construction General Permit

The CGP regulates stormwater discharges associated with construction activities. Notices of Intent are submitted to EPA for coverage under the CGP every time it is anticipated that a construction project will disturb one or more acres of land. A site-specific Stormwater Pollution Prevention Plan is developed for each construction site, including details about installing best management practices, implementing pollution prevention measures, conducting site inspections on a routine basis and after storm events, and stabilizing all disturbed areas of a site upon completion of a project. During 2020, Sandia held active permit coverage for 25 construction sites (see Chapter 10); DOE and its management and operating contractor for Sandia held joint CGP coverage for four of these sites.

Stormwater Quality Monitoring

No water quality monitoring is conducted under the CGP.

6.4.4 Middle Rio Grande Municipal Separate Storm Sewer System Permit

The MS4 Permit covers the entire centralized storm drainage system within TA-I, TA-II, and TA-IV, approximately 1.16 square miles. The permit establishes requirements to reduce non-point source municipal stormwater pollutants discharged to the Rio Grande. In effect since 2014, the permit entered administrative continuance on December 22, 2019, which remains in effect until EPA issues a new permit.

The Rio Grande provides a critical habitat for threatened and endangered species of birds and fish and serves as a municipal, agricultural, and recreational water resource for Albuquerque and surrounding communities.

Compliance with the MS4 Permit is maintained by developing and updating a Stormwater Management Plan, implementing control measures, conducting inspections, sampling stormwater, submitting discharge monitoring reports, and submitting annual reports. The MS4 Stormwater Management Plan and other associated documents are available to the public in the digital repository at the University of New Mexico Zimmerman Library online database:

https://digitalrepository.unm.edu/snl_ms4/

Stormwater Quality Monitoring and Results

The stormwater sampling points established for compliance with the MS4 Permit are located at the MS4 inflow (SWSP-02) and four MS4 outflows (SWSP-05, SWSP-24, SWSP-35, and SWSP-36) as indicated in Figure 6-2. MS4 Permit sampling can be conducted when a qualifying event occurs, which is specified as rainfall in excess of 0.25 inches during a 24-hour period. Required monitoring is to be conducted for a minimum of eight events during the permit term; at least four monitoring events must be conducted during the wet season (July 1 through October 31), and at least two events must be conducted during the dry season (November 1 through June 30). The monitoring constituents required by the MS4 Permit and associated water quality standards are listed in Appendix D.

Automatic samplers are installed at each sampling point and are programmed to collect four subsamples 15 minutes apart during the first hour of a discharge event. Field measurements of temperature, potential of hydrogen (pH), specific conductance, and dissolved oxygen are made for each subsample, and the subsamples are composited for laboratory analyses.

Only one complete sample was collected during the monitoring period (at SWSP-35) due to sample volume limitations and permit requirements. The sample from SWSP-35 met applicable water quality standards for all constituents except for PCBs and Escherichia coli (*E. coli*). In addition to the full

sample collected at SWSP-35, multiple *E. coli* samples were collected from each of the five monitoring locations as part of a microbial source tracking investigation.

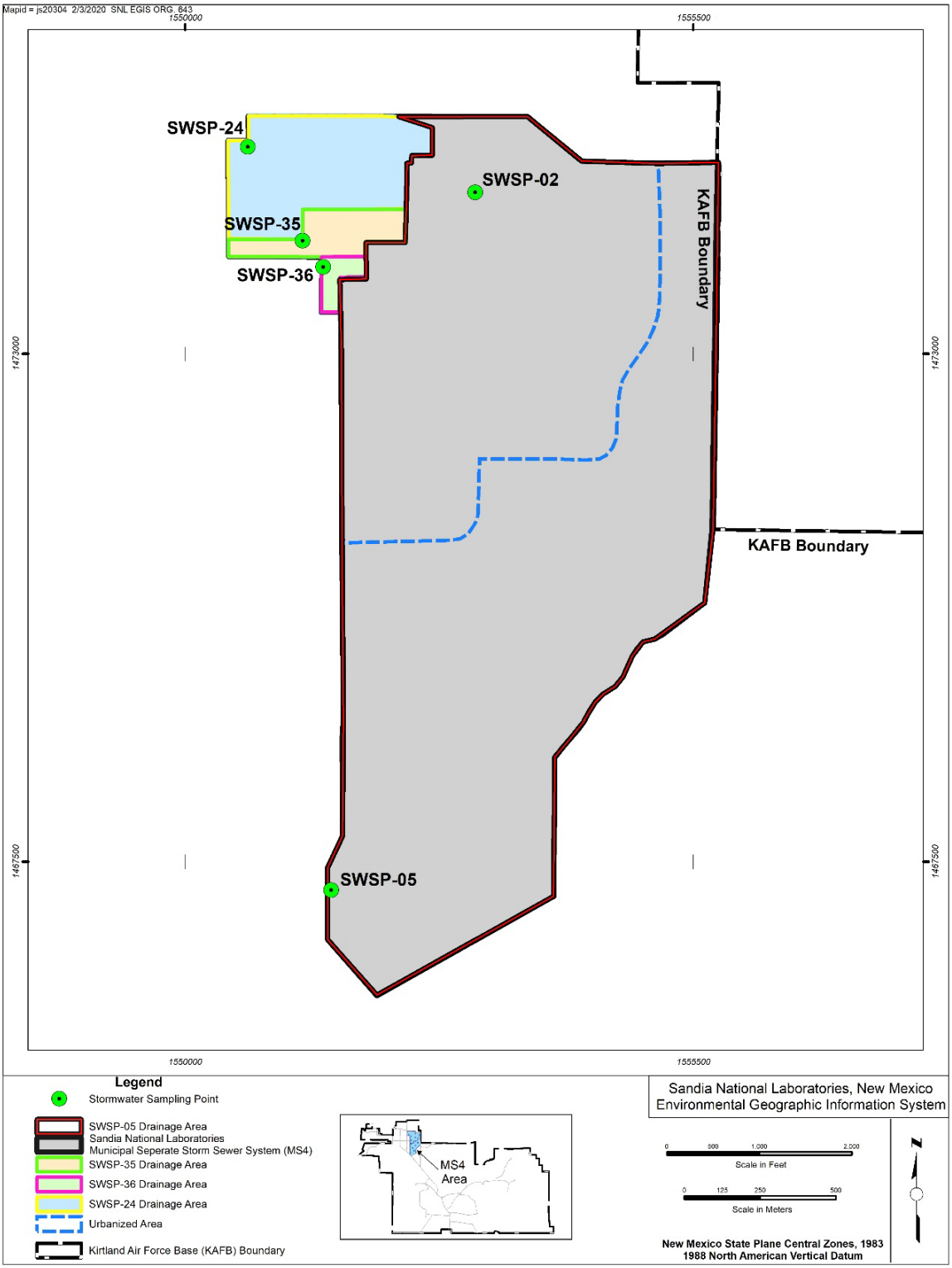

Figure 6-2. Municipal Separate Storm Sewer System drainage areas and monitoring locations

PCBs and *E. coli* regularly exceed applicable water quality standards in stormwater at SNL/NM. Data collected since the inception of the MS4 Permit were used to evaluate potential sources of PCBs and *E. coli*. The investigation reports are in the 2020 MS4 Stormwater Management Plan and are available to the public in the digital repository at the University of New Mexico Zimmerman Library online database:

https://digitalrepository.unm.edu/snl_ms4/

The concentration of *E. coli* in samples varies substantially with both location and individual rain event as reported in *White Paper: The Occurrence of E. coli in Stormwater at SNL/NM* (SNL/NM 2020h). The median concentration at SNL/NM is below median concentrations reported for other stormwater drains throughout the Albuquerque area (Storms et al. 2015). The microbial source tracking investigation determined that there are essentially no human, avian, or canine sources of *E. coli* at SNL/NM. By process of elimination, the source of *E. coli* is likely wildlife (e.g., skunks, racoons, and rodents) that are known to exist within the vicinity of the storm drain system. Several measures being pursued to reduce *E. coli* at SNL/NM include precluding wildlife, reducing sediment, and decentralizing the storm drainage system.

The concentration of PCBs in samples also varies substantially with both location and individual rain event as reported in *White Paper: The Occurrence of Polychlorinated Biphenyls in Stormwater at SNL/NM* (SNL/NM 2020i). The median concentration of PCBs at SNL/NM is below median concentrations reported for other stormwater drains throughout the Albuquerque area (Shephard et al. 2019). The sources of PCBs in stormwater at SNL/NM are likely direct precipitation and diffuse deposition in soil and sediment from historic on-site and off-site activities. There are no known discrete sources of PCBs at SNL/NM. Recommendations for methods to decrease PCBs in stormwater at SNL/NM include increasing monitoring to characterize potential sources, reducing sediment in stormwater, and reducing flow to the storm drains through green stormwater infrastructure.

Stormwater drainage channel to Tijeras Arroyo

6.4.5 Multi-Sector General Permit

The MSGP regulates stormwater discharges associated with industrial activities that meet the criteria for one or more specific industrial sector as defined in the permit. A total of 18 facilities (also referred to as sites) at SNL/NM operated under the MSGP in 2020. The sites and the associated stormwater sampling points (SWSPs), located at the outfalls, are listed in Table 6-1 and shown in Figure 6-3.

The MSGP was issued in 2015 and expired in June 2020. The permit has entered administrative continuance, which remains in effect until EPA issues a new permit.

Compliance with the MSGP is maintained by developing and updating a Stormwater Pollution Prevention Plan that covers all eligible industrial activities at SNL/NM and documents permit requirements applicable to these activities. The Stormwater Pollution Prevention Plan and other MSGP associated documents are available to the public in the digital repository at the University of New Mexico Zimmerman Library online database:

https://digitalrepository.unm.edu/snl_msgp/

Table 6-1. Sites with coverage under the MSGP and associated stormwater sampling points

Sector Title	Sector	Permitted Sites	Stormwater Sampling Point
Electronic and Electrical Equipment and Components, Photographic and Optical Goods	AC1	Advanced Manufacturing Process Laboratory	SWSP-05 (No analytical requirement)
Hazardous Waste Treatment, Storage, or Disposal Facilities	K1	Auxiliary Hot Cell Unit	SWSP-52
		Gun Facility (SWMU 84)	SWSP-46
		Hazardous Waste Handling Unit	SWSP-40
		Long Sled Track (SWMU 83)	SWSP-17
		Manzano Storage Bunkers	SWSP-51
		Radioactive and Mixed Waste Management Unit	SWSP-49
		Short Sled Track (SWMU 240)	SWSP-47
		TA-V Sandlot	SWSP-52
		Thermal Treatment Unit	SWSP-48
		Thunder Range 6 Detonation Site	No sampling point (Emergency use only)
		Center for Integrated Nanotechnologies	SWSP-50 (No analytical requirement)
Landfills	L1 and L2	Classified Waste Landfill	SWSP-08
Local and Highway Passenger Transportation	P1	Fleet Services	SWSP-05 (No analytical requirement)
Nonmetallic Mineral and Mining Dressing; Construction Sand and Gravel	J1	TA-III Borrow Pit	No outfall
Scrap and Waste Recycling, Except Source-Separated Recycling	N1	TA-III Borrow Pit	No outfall
Source-Separated Recycling	N2	Reapplication Yard	SWSP-41 (No analytical requirement)
		Solid Waste Collection and Recycling Center	SWSP-42 (No analytical requirement)
		Sprung Tent 11 (Material Sustainability and Pollution Prevention)	SWSP-57 (No analytical requirement)

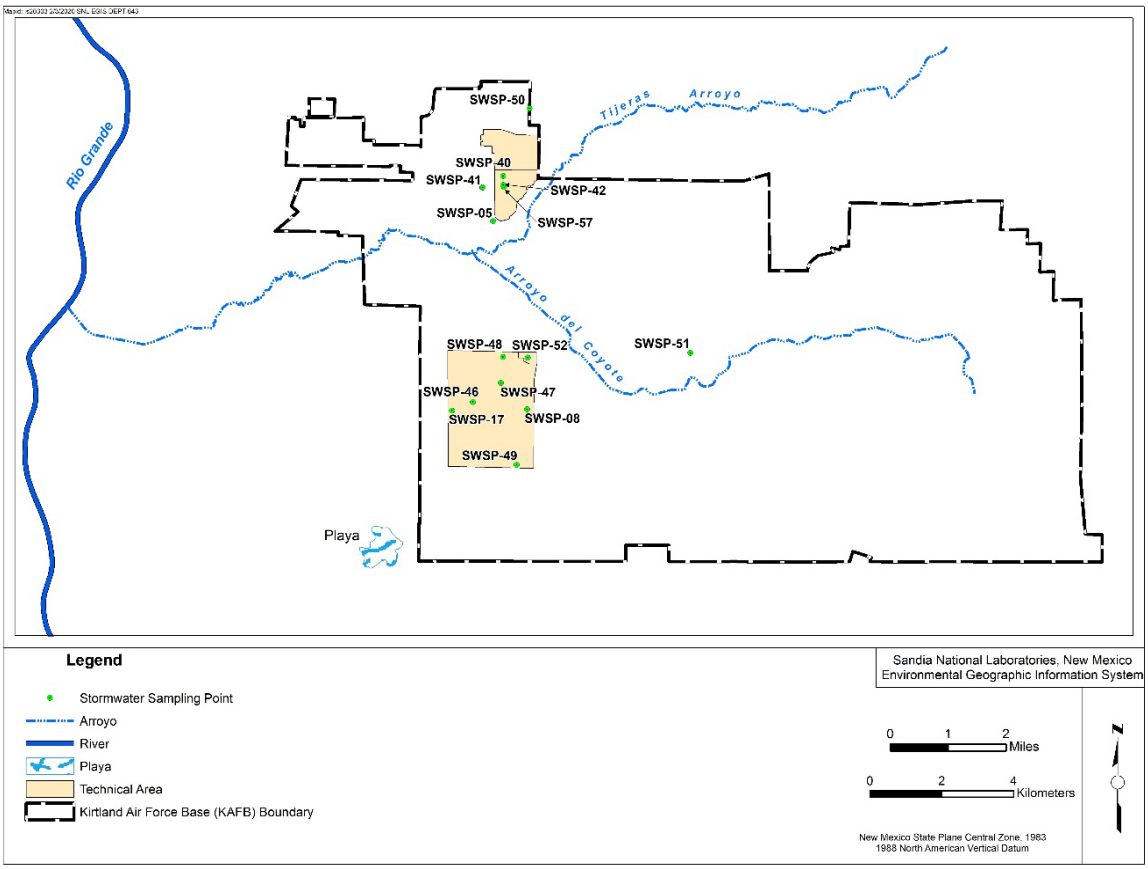

Figure 6-3. MSGP stormwater sampling point locations

Stormwater Quality Monitoring and Results

Quarterly sampling is required at the outfall of each facility or site permitted under the MSGP. The permit allows a monitoring quarter to be defined as one of the four months during the wet season; therefore, at SNL/NM, the four monitoring quarters are the months of July, August, September, and October. Monitoring is not required during the rest of the year (November through June). If the average of four consecutive samples is below the monitoring benchmark value, then monitoring of that constituent at that location is not required for the remainder of the permit term. For the 2020 wet season (the fifth year in the five-year permit term), monitoring was required at only 2 of the 18 permitted sites: the Classified Waste Landfill (SWSP-08) and the Gun Facility (SWSP-46).

The water quality constituents sampled for laboratory analysis for each applicable industry sector and the applicable New Mexico benchmark values are provided in Appendix D, "Stormwater Sampling Requirements and Results in 2020." In addition to collecting stormwater samples for laboratory analysis, visual assessments are performed at the outfalls to document observable pollutants, such as odor, clarity, solids, oils, and foam.

The analytical results for 2020, as submitted to EPA, are provided in Appendix D. Samples were collected from only one site, SWSP-46. Samples at SWSP-08 were not collected because of insufficient precipitation to cause runoff from the site. There were no benchmark exceedances in 2020.

6.4.6 Stormwater Data Quality Assurance

Quality assurance, control, and assessment processes ensure that stormwater sampling produces reliable data to meet permit requirements and verify the effectiveness of implemented pollution control measures. Due to the heterogeneous nature of stormwater, there is a low expectation of reproducibility from one sample to the next; therefore, field duplicates are not collected. See Chapter 8 for more information on quality assurance.

6.5 Surface Discharge Program

Surface Discharge Program personnel evaluate all water and water-based compounds that discharge to the ground surface at SNL/NM for compliance with New Mexico Water Quality Control Commission regulations (20.6.2 NMAC, *Ground and Surface Water Protection*) as implemented by the NMED Ground Water Quality Bureau. These regulations are designed to protect the state's groundwater and surface water.

6.5.1 Surface Discharge Approvals

Surface discharges are releases of water and water-based compounds to roads, open areas, or impoundments. Surface discharges are only made following approval by Surface Discharge Program personnel. Proposed discharges are evaluated for potential contaminants to determine whether the discharge complies with applicable requirements for surface releases. If any discharges do not meet surface water quality standards, alternative methods of disposal are found.

Surface discharge requests are made when access to a sanitary sewer line is not available, such as in remote locations on KAFB where no sewer lines exist. Typical surface discharges are requested as a result of fire-training activities, to control dust, and after cleaning building exteriors.

Surface discharges are releases of water and water-based compounds to roads, open areas, or confined areas such as reservoirs.

In 2020, 26 individual surface discharge requests were approved. Approved releases complied with NMED applicable requirements.

6.5.2 Activities at Evaporation Lagoons

Surface Discharge Program personnel report on water quality results from routine sampling events conducted at two evaporation lagoons in TA-IV. Both lagoons are permitted through NMED in Discharge Permit (DP) 530. The two evaporation lagoons (Lagoon 1 and Lagoon 2) are used to contain and evaporate water that collects in the secondary containments around seven outdoor oil storage tanks used to store dielectric oil. The secondary containments are designed to hold the entire content of the tanks in the event of an accidental release. Significant volumes of precipitation can collect in the containments during storm events. The water that has collected within the containments is inspected visually for oil contamination, and any oil present is removed prior to discharge to the TA-IV lagoons.

The original DP-530 was issued on March 8, 1988, for discharges from the pulsed power facilities located in TA-IV to Lagoon 1 and Lagoon 2. DP-530 was submitted pursuant to 20.6.2.3106 NMAC, *Application for Discharge Permits, Renewals, and Modifications*, and was approved pursuant to 20.6.2.3109 NMAC, *Secretary Approval, Disapproval, Modification or Termination of Discharge Permits, and Requirement for Abatement Plans*. On September 5, 2014, a new DP-530 was issued, which expired on September 5, 2019. Sandia personnel submitted renewal for DP-530 to DOE for transmittal to NMED on February 21, 2019, in compliance with a request from NMED dated September 5, 2014. Additional information was submitted at the request of NMED on May 24, 2019. NMED issued a

public notice of the application renewal on August 23, 2019. A renewed permit for DP-530 has not yet been issued. The expired permit has been administratively extended until a new permit is issued. The monitoring and reporting requirements associated with DP-530 are listed in Table 6-2.

Table 6-2. DP-530 monitoring and reporting requirements

Action	Frequency	Reporting
Inspection of lagoons	Monthly	Documented in checklists
Inspection of sump pump stations	Quarterly	Annually
Lagoon water samples	Annually	Annually
Volume of wastewater discharged	Monthly	Annually

Samples were collected from Lagoon 1 and Lagoon 2 on November 9, 2020. Sample fractions were collected for major ions, total dissolved solids, and purgeable and extractable organics as specified in DP-530. All samples were transported with sample custody documentation to the analytical laboratory. The analytical laboratory prepares and analyzes quality control samples as described in Section 6.4.4. See Chapter 8 for more information on quality assurance and quality control.

An *ion* is an atom or molecule with a net electric charge due to the loss or gain of one or more electrons.

Although there were no discharges to Lagoon 2 in 2020, it was sampled to ensure that no residual or outside contamination had occurred. Laboratory analysis results indicated that all detected constituents met the standards in 20.6.2 NMAC, *Ground and Surface Water Protection*. In addition, both lagoons are inspected monthly to verify water levels and ensure that no damage to the lagoons exists.

6.6 Wastewater Discharge Program

Wastewater that is discharged to the public sewer system is divided into two categories: sanitary discharges and industrial discharges. Sanitary discharges include wastewater from restrooms and showers, food preparation activities, and other domestic-type activities. Industrial discharges are produced from general laboratory research operations, including electroplating, metal finishing, microelectronic development, and photographic processes.

Sanitary discharges include wastewater from restrooms and showers, food preparation activities, and other domestic-type activities. *Industrial discharges* are produced from general laboratory research operations.

Federal and local regulations establish the standards for sanitary sewer releases. Discharged wastewater effluent must meet the ABCWUA Sewer Use and Wastewater Control Ordinance requirements. Information on the ABCWUA Sewer Use and Wastewater Control Ordinance can be found at the following website:

https://www.abcwua.org/sewer-system-industrial-pretreatment-overview/

Sanitary sewer releases must also meet requirements in DOE O 435.1 Change 1, *Radioactive Waste Management*, and DOE O 458.1 Change 4 (LtdChg), *Radiation Protection of the Public and the Environment*.

All wastewater discharges are monitored to meet regulatory compliance. Toxic discharges are further reduced by implementing toxic organic management plans, general good housekeeping, and engineering practices.

6.6.1 Requirements for Septic Tank System Discharges

Three active septic tank systems and one holding tank are maintained in remote areas on KAFB and are used only for domestic sanitary sewage collection. Since these tanks receive only domestic sewage and no industrial discharges, they do not require sampling prior to pumping or discharge to the public sewer. Septic holding tank pumping records are sent to NMED every six months.

6.6.2 Requirements for Technical Area V Wastewater Discharges

Research and engineering reactors are maintained in TA-V. These reactors and support facilities have the potential to produce radioactive process wastewater that includes liquids from floor drains, laboratory sinks, and other drains located in buildings that use, process, or store radioactive materials. To ensure that all wastewater from these facilities meets regulatory standards, liquid effluent is separated into two process streams: reactor and nonreactor wastewater. Nonreactor wastewater is water from restrooms and nonradioactive laboratory activities. Reactor wastewater is water from areas that use, process, or store radioactive materials and is channeled to holding tanks where it can be screened within the TA-V Liquid Effluent Control System for radiological constituents. The Liquid Effluent Control System was developed to maintain the integrity of the ABCWUA sanitary sewer system by collecting, analyzing, and handling reactor process wastewater from TA-V reactor activities. The system consists of three 5,000-gallon holding tanks with liquid level alarm systems, a sample processing area, and a data acquisition system that can be monitored remotely. Radiation Protection personnel survey the building for contamination annually. The Liquid Effluent Control System is an engineered facility operating within an established safety envelope.

TA-V wastewater samples are analyzed voluntarily for tritium, gross alpha, gross beta, and gamma spectroscopy to ensure that radionuclide levels meet regulatory standards established in the ABCWUA Sewer Use and Wastewater Control Ordinance. These analytical results are also provided to ABCWUA semiannually as part of the report for Permit 2069K (Table 6-3). If radionuclides are detected above regulatory limits, the water will not be released to the sanitary sewer system; an alternative disposal path will be found, or the radionuclides will be allowed to decay in place over a matter of days or weeks if determined to be appropriate. If the radioactivity level is determined to be at or below regulatory limits, the ABCWUA is notified at least 24 hours prior to the proposed discharge, and the batch is held until authorization to discharge is given. The ABCWUA may at its discretion request that the batch be held in order to conduct independent sampling of the tank. Once the ABCWUA has granted final approval, the water can be discharged safely to the public sewer system. Discharges to the sanitary sewer system from the Liquid Effluent Control System and all other TA-V activities did not exceed standards for radionuclides at any of the wastewater monitoring stations in 2020.

Table 6-3. Wastewater discharge permits and monitoring station characteristics

Permit	Station	Waste Stream Process
General Outfall		
2069A	WW001	All waste streams (includes effluent from Permit 2069G)
2069F	WW006	All waste streams (includes effluent from Permit 2238A)
2069I	WW008	All waste streams
2069K	WW011	All waste streams and radiological screening of TA-V process water at the Liquid Effluent Control System

Permit	Station	Waste Stream Process
		Categorical
2069G	WW007	Laboratory industrial process acid wastewater from Microsystems and Engineering Sciences Applications activities
2238A	Center for Integrated Nanotechnologies	Laboratory industrial process acid wastewater from Center for Integrated Nanotechnologies activities

Note: "All waste streams" includes both domestic and industrial discharges.

6.6.3 Albuquerque Bernalillo County Water Utility Authority Permitting and Reporting

The ABCWUA operates a publicly owned treatment works that discharges to the Rio Grande. The Sandia sewer system connects to the ABCWUA sanitary sewer system and eventually to the publicly owned treatment works through six permitted outfalls (Figure 6-4). Wastewater effluent discharged from any of the six outfalls must meet the permit-specific ABCWUA Sewer Use and Wastewater Control Ordinance requirements (Table 6-3).

DOE and Sandia personnel are required to report exceedances to the ABCWUA immediately in the event of accidental releases or slug discharges to the sanitary sewer (having the potential to violate publicly owned treatment works). In addition, Sandia personnel submit semiannual wastewater reports to the ABCWUA.

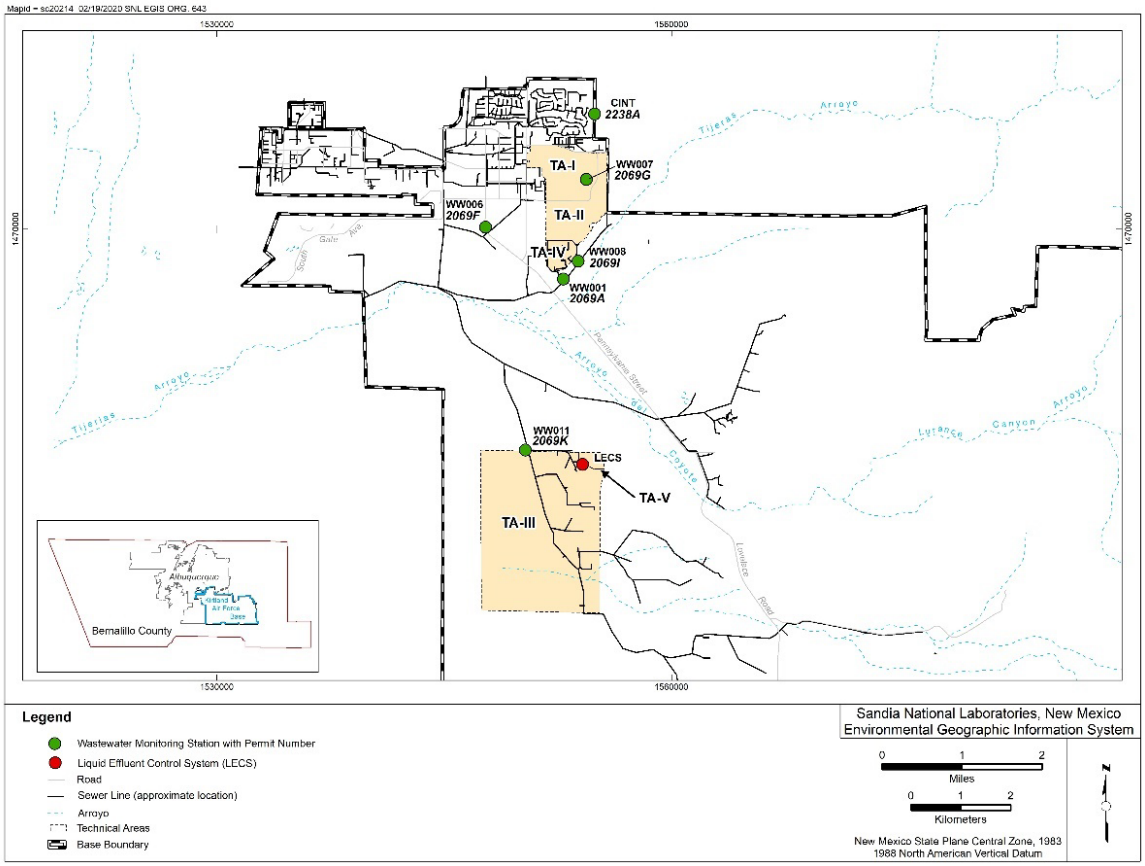

Figure 6-4. Wastewater monitoring station locations

Wastewater discharges resulting from ongoing chemical, manufacturing, and industrial processes conducted at Sandia facilities are tracked through the Wastewater Discharge Approval System before being discharged to the ABCWUA sanitary system. Facility processes are reviewed for contaminants, concentrations, and discharge frequencies to determine whether the effluent will meet regulatory criteria. Once approved, a facility is issued an internal permit, which is reviewed annually. Generally, processes are well characterized, and any constituents detected as being above the permit-specific limits at a wastewater monitoring station can be tracked back to the source facility. Corrective actions to mitigate further releases are implemented as necessary. One-time releases are approved on a case-by-case basis. In 2020, 317 wastewater discharge requests were approved. Wastewater discharge approvals are not required for buildings that only produce domestic sewage from restrooms, showers, sinks, and fountains.

6.6.4 Wastewater Monitoring Stations and Sampling Parameters

There are six on-site wastewater monitoring stations permitted by the ABCWUA at SNL/NM (Figure 6-4). Wastewater monitoring station characteristics are listed in Table 6-3. Wastewater from the four permitted general outfall monitoring stations (WW001, WW006, WW008, and WW011) contains a mixture of sanitary and industrial wastewater, which discharges into the ABCWUA sanitary sewer system through the Tijeras Arroyo Intercept.

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

EPA has established categorical pretreatment standards for specified classes of industrial discharges. Categorical monitoring station WW007 monitors the wastewater discharged from the acid waste neutralization system within the Microelectronics Development Laboratory in TA-I. Laboratory discharges from the Microsystems and Engineering Sciences Applications Complex may also be configured to discharge to this acid waste neutralization system. An acid waste neutralization system is used to pretreat process wastewater at the Center for Integrated Nanotechnologies categorical monitoring station.

All general outfall monitoring stations are equipped with flow meters and pH sensors that continuously monitor wastewater discharges. The flow meters and pH sensors are connected to a central server system that has alarm processing, remote real-time display of data, and report-generating capabilities. If the wastewater pH approaches a set limit, an automated email protocol system notifies Sandia personnel before a pH regulatory limit is reached. Sandia personnel notify DOE when a pH limit is exceeded. Sandia or DOE personnel are required to report an exceedance limit to the ABCWUA as soon as possible.

ABCWUA personnel sample wastewater from Sandia-permitted outfalls on a regular basis (usually quarterly) to determine compliance with permit requirements. All samples are obtained as 24-hour flow proportional or time-weighted composites. In addition, Sandia personnel collect split samples during ABCWUA sampling events, which are sent to an EPA-approved laboratory for analysis. The NMED DOE Oversight Bureau is also notified when sampling is scheduled to occur and is offered the opportunity to obtain split samples for analysis. The ABCWUA ultimately determines which parameters it plans to analyze, and Sandia personnel collect split samples for those same analytes as well as for any others requested by DOE. Wastewater was collected in 2020 to monitor the following parameters:

- Total metals—aluminum, arsenic, boron, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc
- Radiological constituents (collected for the Sandia samples only)—gamma spectroscopy, gross alpha, gross beta, and tritium

- General chemistry—ammonia, chemical oxygen demand, cyanide (for permits 2069F, 2069G, and 2238A only), fluoride, phosphorus, and total suspended solids

A *split sample* is a single sample that is separated into at least two parts such that each part is representative of the original sample.

Wastewater monitoring stations WW001, WW006, WW008, and WW011 are manhole-type installations with permanently installed continuous-flow measuring and pH-recording instrumentation. Wastewater monitoring station WW007 (Permit 2069G) and the Center for Integrated Nanotechnologies (Permit 2238A) are located within buildings and are also equipped with installed continuous-flow measuring and pH-recording instrumentation.

6.6.5 Wastewater Monitoring Results and Inspection Activities in 2020

During 2020, only one ABCWUA sampling event was conducted; other sampling events did not occur at the request of ABCWUA. Sandia personnel collected wastewater split samples in October with ABCWUA and the NMED DOE Oversight Bureau. Laboratory analytical results for these split samples confirmed that Sandia operations were in compliance with ABCWUA requirements for permits 2069A, 2069F, 2069G, 2069I, 2069K, and 2238A (Table 6-3). All water discharged from the Liquid Effluent Control System in 2020 met requirements for radiological levels in wastewater. All analytical results from sampling conducted in 2020 met ABCWUA Sewer Use and Wastewater Control Ordinance discharge requirements. Analytical results are provided in Appendix E, "Sanitary Outfalls Monitoring Results in 2020."

In February 2020, the ABCWUA performed annual inspections of facilities that discharge within permitted flow basins 2069G and 2069I; in June 2020, the ABCWUA performed annual inspections of flow basins 2069A, 2069F, 2069K, and 2238A. In addition, the ABCWUA performed a permit renewal inspection of industrial permit 2069G in February 2020. No issues or findings were identified during any of these inspections.

6.6.6 Sanitary Sewer System Releases in 2020

In 2020, one event related to equipment failure that led to a monitoring disruption was reported to the ABCWUA and DOE; backup data were available during the disruption, and the ABCWUA did not consider this to be a violation. One sanitary sewer system release that was below regulatory limits was reported to the ABCWUA and DOE, which did not result in a notice of violation.

6.6.7 Pretreatment Gold Awards

The ABCWUA presented DOE and NTESS with five Pretreatment Gold Awards. Gold awards are given for 100 percent compliance with wastewater discharge permit reporting requirements, zero notices of violation, and an exceptional level of permit compliance. Wastewater discharge permits 2238A, 2069A, 2069G, 2069I, and 2069K were included in the awards.

Chapter 7. Ecology Program

Loggerhead shrike *(Lanius ludovicianus)*

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

Ecology Program personnel monitor and surveil flora and fauna to support operations. Activities are conducted on DOE-permitted or fee-owned land as follows:

- Collect biological inventory data to support site activities and maintain regulatory compliance while preserving ecological resources. Data are collected on plant, mammal, reptile, amphibian, bird, and insect species that currently inhabit DOE-controlled land. Data collected include information on species diversity, abundance, and land use patterns. These data are used to support NEPA documentation, land use decisions, and ecological and wildlife awareness campaigns, and to ensure safe work environments and sustainable decision-making strategies. Table 1-1 lists some of the more common plant and animal species identified at SNL/NM and KAFB.
- Collect data on plant and animal species to advance the understanding of on-site ecological processes.
- Collect biota contaminant data on an as-needed basis in support of site projects and regulatory compliance. No data on wildlife has been collected with respect to contaminant radionuclides and metals since 2001, as no significantly elevated levels of radionuclides or metals have been observed in soil, sediment, or vegetation samples collected by Terrestrial Surveillance Program personnel (see Chapter 4 for details) during that time.
- Educate the Sandia community regarding ecological conservation.

- Provide support when biological issues arise, i.e., injured wildlife, nesting birds, snake relocation, and/or other wildlife encounter concerns.

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

Biota monitoring was added to environmental monitoring in 1996 and includes annual monitoring and surveillance of vegetation, insects, herpetofauna (reptiles and amphibians), mammals, and birds. Ecological monitoring and surveillance is conducted throughout the year for routine and nonroutine activities. Sampling locations and vegetation types or habitat descriptions are provided in Table 7-1.

Table 7-1. Sampling locations with vegetation type or habitat description

Sampling Site Name	Vegetation Type or Habitat Description
Grasslands	
Coyote Springs	Wetland
Golf Course	Urban area, ornamental landscaping
Robotics Vehicle Range	Grassland with sparse dwarf shrub
SC Dome	Shrub, open woodland, and grassland
West of TA-III	Large shrub grassland
Woodlands	
Madera Canyon Guzzler	Open woodland, shrub, and grassland
Range Wildlife Guzzler	Open woodland, shrub, and grassland

SC Dome = Scale Compatibility Dome

7.1 Vegetation Surveillance

Vegetation is a key ecosystem component. It is involved in essential processes, including: cycling and regulating water, carbon, and nitrogen; converting solar energy into biomass to form the base of all food chains; and releasing oxygen while sequestering carbon. Vegetation also serves the critical roles of providing habitat and food for wildlife and mitigating local climate extremes by influencing the earth's surface energy balance and the lower atmosphere. Humans derive indirect socioeconomic services, such as soil and watershed protection, and direct socioeconomic products, such as timber and food, from vegetation. Vegetation affects soil development over time, generally contributing to a more productive soil (CNVC 2013).

Ecosystem services are the natural resources and processes that occur in a well-functioning environment, which benefit humans at no cost.

Vegetation monitoring provides data to enhance understanding about an ecosystem and allow correlations to be examined between transformations in a vegetation habitat and other ecosystem changes. Long-term monitoring can be used to observe changes in vegetation cover, composition, and structure due to natural or human-influenced events. Vegetation data collection across many years also enables improved planning for and management of natural areas and facilitates goals for conservation, habitat management, and reclamation (Hockings 1998).

Vegetation type is a broad structural category of vegetation that dominates an area such as a grassland, woodland, desert, scrubland, or forest. Ecologists subdivide vegetation types, using specific definitions or descriptions appropriate to the land area of interest. For example, grasslands are primarily divided into temperate or tropical categories and then each of these categories is

repeatedly subdivided to characterize the type of grassland. The two main vegetation types at SNL/NM are grassland and woodland (Table 7-1). SNL/NM grasslands can have a shrub and/or scattered tree component to them and may be described in a variety of ways, such as a dwarf shrub grassland, a shrub-dominated grassland, a grassland containing shrubs and a scattered woodland component, or a meadow where a grassland area occurs as an opening within a woodland. Similarly, woodlands may be composed of tightly clustered trees dominated by piñon and juniper and described as closed piñon-juniper woodland, or the main structural vegetation type may be scattered piñon and juniper trees and described as a scattered piñon-juniper woodland.

Habitat is the place or environment where a plant or animal naturally or normally lives and grows.

Habitat is the environment that a plant or animal has adapted to and where it is normally found. The word *habitat* is taken from the Latin *habitare* meaning "to live or dwell." The habitat for a species may be very broad, such as temperate North American grasslands, or the habitat for a species can be very narrow, such as a highly specific biotic composition with short, medium, or tall grassland that is composed of certain grass species with or without specific shrub components. Species most often have habitat requirements somewhere within this spectrum. For a rare species, the habitat typically is extremely specific, whereas for a common species, the habitat typically is quite broad.

Detecting invasive plant species is an important aspect of long-term monitoring across a variety of vegetation types. An invasive species is an organism that is not indigenous, or native, to an area. Vegetation monitoring is valuable in upholding compliance with Executive Order 13751, *Safeguarding the Nation from the Impacts of Invasive Species*, and Executive Order 13112, *Invasive Species*. Of biota occurring at Sandia, invasive plants pose the greatest risk to the local ecology. Invasive plant species are a leading cause of native plant biodiversity loss. They can cause ecosystem-level changes by displacing native plants, reducing the amount of native plant cover, and reducing the number of native species present in an ecosystem. This plant diversity decline then reverberates up the food web, causing, for example, losses in insect and songbird diversity.

The invasive plant of greatest concern at SNL/NM is cheatgrass (*Bromus tectorum*). Cheatgrass has been referred to as "the invader that won the West" due to its invasion across all the intermountain states and domination of more than 100 million acres in the western United States. Under the right conditions, cheatgrass can spread rapidly across vast areas of land, displacing the native vegetation communities. It is then able to maintain superiority over native plants through prolific seed production and the ability to germinate in autumn or spring, which gives it a competitive advantage over native warm season perennials. A hazardous aspect of cheatgrass is its ability to alter the local fire regime; wildfires occur more frequently—cheatgrass burns nearly four times more often than native vegetation types—and larger areas burn when cheatgrass is present. Cheatgrass was associated with 24 percent of the land area burned in the 50 largest fires in the 2000s in the western United States (Balch, Bradley, and Gómez-Dans 2013).

7.1.1 Vegetation Monitoring Strategy

In 2017, Ecology Program personnel began adoption of the national Assessment, Inventory, and Monitoring (AIM) vegetation strategy. This long-term monitoring strategy provides a landscape-level, data-driven method for understanding ecosystem conditions that better supports management decisions, natural resources, and reporting.

Developed to help land managers gather data in a consistent and efficient manner, AIM is a comprehensive and rigorous strategy that can serve many monitoring objectives and can also be aggregated for use across multiple scales of management. The AIM framework includes methods,

protocols, and principles for quantitative assessments of the condition, trend, amount, location, and spatial pattern of natural resources on the nation's public lands. The AIM approach is built on five key elements: a standardized set of core and contingent indicators for both terrestrial and aquatic ecosystems, a statistically valid sampling design, a structured implementation process, electronic data capture, and integration with remote sensing (BLM 2011).

By using standardized monitoring indicators and methods to collect AIM data, land managers have a basis from which to (1) adaptively manage resources to achieve management goals and objectives, (2) improve understanding of the ecosystem, and (3) adjust monitoring efforts as necessary by using a well-documented and consistent approach (BLM 2011).

7.1.2 Vegetation Monitoring

Vegetation monitoring was not conducted in 2020 because of COVID-19 site restrictions.

7.2 Herpetofauna Surveillance

Snakes and lizards play principal roles in maintaining well-functioning natural ecosystems. Lizards, which are important prey species across all habitats at SNL/NM, are easily seen by predators due to diurnal activity patterns, are defenseless when captured, and are available in abundant numbers. Snakes are also important prey species, supporting medium- to large-sized mammal and bird populations. Lizards prey on insects, thus moderating ant, grasshopper, termite, beetle, and spider populations. Snakes regulate small mammal populations, which helps to control Hantavirus, a potentially lethal virus that is transmitted to humans through mouse excrement. Hantavirus control by snakes is a valuable ecosystem service for humans.

Herpetology is the study of reptiles and amphibians. *Herpetofauna* are the reptiles and amphibians of a particular region, habitat, or geological period.

Amphibians largely eat invertebrates and play an important role in controlling insect populations. Tadpoles are often prey and are a significant part of nutrient cycling. Amphibians are very sensitive to changes in their environment and are widely regarded as ecological indicators.

7.2.1 Drift Fence Trapping

Many different techniques are available to detect the presence of reptiles and amphibians in the environment. In 2012, funnel traps and pitfall traps were installed along drift fence arrays at SNL/NM to detect both reptiles and amphibians. A funnel trap consists of wire mesh boxes placed on either side of a 100-foot drift fence. The boxes have one-way entrances, whereby animals can passively enter the trap but not exit. Funnel traps have proven successful in multiple habitats and continue to be used.

From 2012 to 2014, field trapping was conducted once annually in a three-consecutive-week session from the end of June through the start of July. To gather additional information on seasonal activity and life history data, the trapping schedule was changed in 2015 to include three separate sessions, each being two weeks long. These sessions were conducted in late May, the end of June to the start of July, and late August. The traps were checked twice daily during each session, and all animals were released. Not all trap locations were used during a given calendar year.

7.2.2 Herpetofauna Survey Results

Herpetofaunal monitoring did not occur in 2020 because of COVID-19 restrictions. Summaries of herpetofaunal distribution, diversity, and relative abundance from 2012 to 2019—including 890 individual reptiles and amphibians from 25 species that have been caught and identified—are presented for the Robotics Vehicle Range, West of TA-III, and Scale Compatibility (SC Dome) monitoring sites. Each location monitored represents a distinct habitat found on-site.

Herpetofauna monitoring information for the Robotics Vehicle Range is presented in Figure 7-1. A distinctly colored prairie rattlesnake (*Crotalus viridis*) (Figure 7-2) was photographed after being recorded and released at this site. This individual was captured multiple times in one year. Greater short-horned lizards (*Phynosoma hernandesi*) (Figure 7-2) are frequently encountered in desert grassland locations. The adult was photographed eating harvester ants at the entrance of a funnel trap. Both individuals were found at the Robotics Vehicle Range monitoring site.

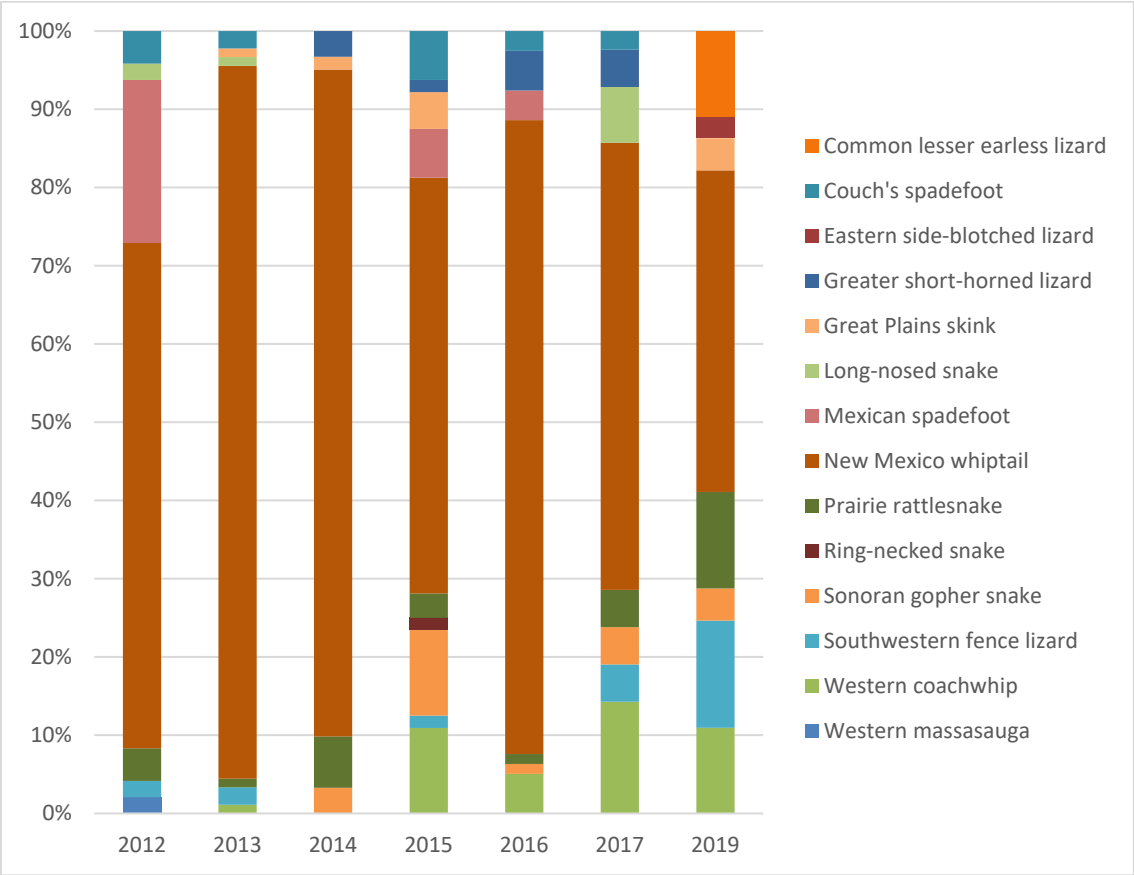

Figure 7-1. Relative abundance of herpetofauna during different monitoring years at the Robotics Vehicle Range monitoring site

Figure 7-2. Prairie rattlesnake (*Crotalus viridis*) (left) and greater short-horned lizard (*Phynosoma hernandesi*) (right) at the Robotics Vehicle Range monitoring site

Herpetofauna monitoring information for the West of TA-III site is presented in Figure 7-3. Although not currently listed as threatened or endangered, the western massasauga (*Sistrurus tergeminus*) (Figure 7-4) is a regional species of interest that has been detected at the West of TA-III site using funnel-trapping techniques.

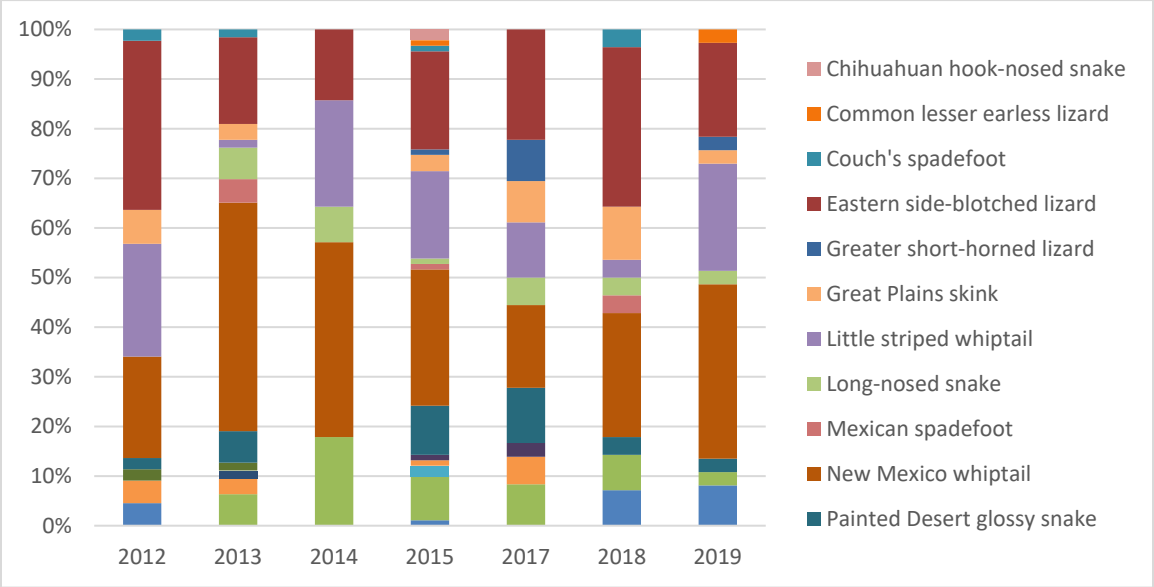

Figure 7-3. Relative abundance of herpetofauna during different monitoring years at the West of TA-III monitoring site

Figure 7-4. Two adult western massasaugas (*Sistrurus tergeminus*) at the West of TA-III monitoring site

Herpetofauna monitoring information for the SC Dome is presented in Figure 7-5. The eastern collared lizard (*Crotaphytus collaris*) and the Chihuahuan spotted whiptail (*Aspidoscelis exsanguis*) have only been captured in the juniper savanna habitat surrounding the SC Dome monitoring site (Figure 7-6).

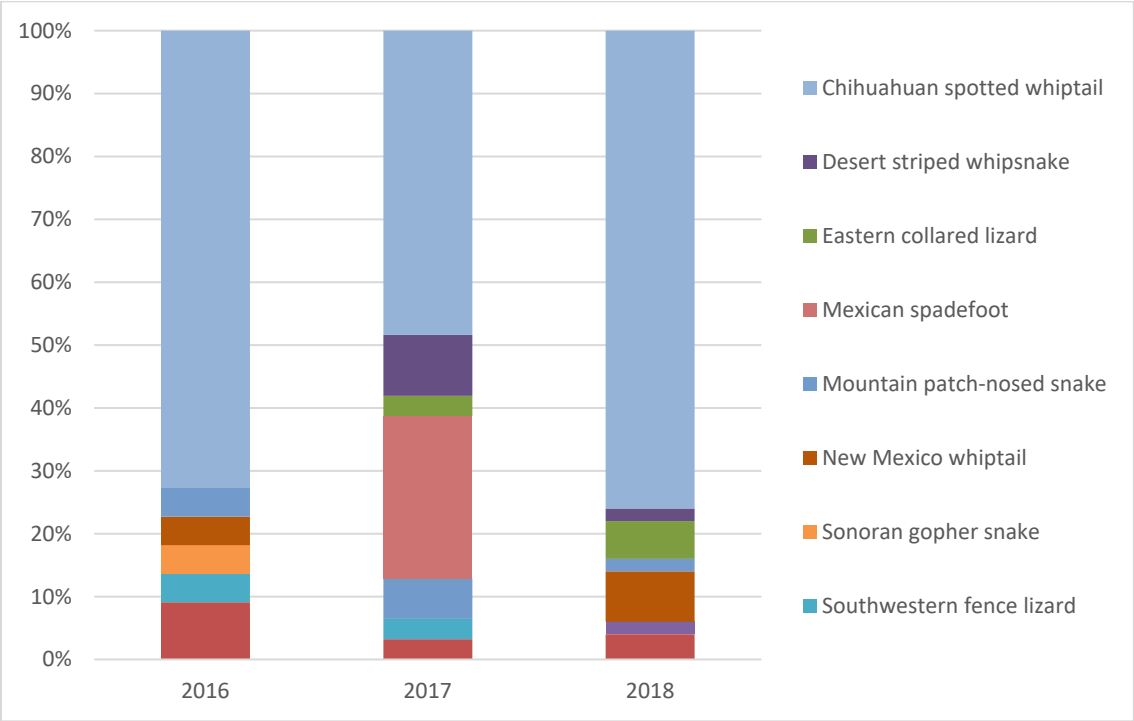

Figure 7-5. Relative abundance of herpetofauna during different monitoring years at the SC Dome monitoring site

Figure 7-6. Eastern collared lizard (*Crotaphytus collaris*) (left) and Chihuahuan spotted whiptail (*Aspidoscelis exsanguis*) (right) at the SC Dome monitoring site

7.3 Bat Surveillance

In 2020, 20 species of bats were documented at SNL/NM, of which only one species (the spotted bat, *Euderma maculatum*) is state-listed as threatened (NMDGF 2018).

There are many threats to bats across the United States, most notably wind energy operations and white-nose syndrome, a fungal disease. A study of population projection models showed that under even conservative estimates, the entire North America population of hoary bats (*Lasiurus cinereus*) could decline up to 90 percent in the next 50 years (Frick et al. 2017). Deaths due to white-nose syndrome were reported at 5 to 6 million bats in 2015 (Leopardi, Blake, and Puechmaille 2015), and the fungus that causes white-nose syndrome was recently detected in New Mexico caves (NPS 2018). Given these serious threats, it is imperative that bat populations be monitored at SNL/NM so potential threats to their survival can be mitigated.

7.3.1 Passive Bat Monitoring

Passive bioacoustic recordings were used to monitor bats from January 2020 through December 2020, although occasional equipment failure resulted in some data gaps. Ultrasonic recorders are located at Coyote Springs and at the large pond at the KAFB Golf Course, both with the KAFB Natural Resources program manager's permission.

Once the digital cards were retrieved from the recorders, the data were processed using bioacoustic analysis software. The software suggests the species most likely to have been recorded according to the call amplitude, shape, and frequency. Calls are assigned a match ratio, which is the number of pulses in an individual call that match calls from the classifier library. For instance, if 10 out of 10 pulses from an individual call match silver-haired bat (*Lasionycteris noctivagans*) calls in the classifier library, that call is given a match ratio of 1.0. Only calls that had a match ratio of 0.8 and above were included in species results.

7.3.2 Bat Monitoring Results

Twenty-one species from two families were detected using ultrasonic recorders in 2020 (Table 7-2). Twelve of these species were not detected in 2019, although the detectors were not deployed in 2019 until November. Detections at Coyote Springs and the KAFB Golf Course are shown in Figure 7-7 and Figure 7-8, respectively.

Table 7-2. Bat species detected using ultrasonic recorders, 2020

Common Name	Scientific Name
Family Vespertilionidae	
Arizona myotis	*Myotis occultus*
Big brown bat	*Eptesicus fuscus*
California myotis	*Myotis californicus*
Canyon bat	*Parastrellus hesperus*
Desert pallid bat	*Antrozous pallidus*
Eastern red bat	*Lasiurus borealis*
Evening bat	*Nycticeius humeralis*
Fringed myotis	*Myotis thysanodes*
Hoary bat	*Aeorestes cinereus*
Long-legged myotis	*Myotis volans*
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*
Silver-haired bat	*Lasionycteris noctivagans*
Spotted bat	*Euderma maculatum*

Common Name	Scientific Name
Tricolored bat	*Perimyotis subflavus*
Western red bat	*Lasiurus blossevillii*
Western small-footed bat	*Myotis ciliolabrum*
Western yellow bat	*Lasiurus xanthinus*
Yuma myotis	*Myotis yumanensis*
Family Molossidae	
Big free-tailed bat	*Nyctinomops macrotis*
Mexican free-tailed bat	*Tadarida brasiliensis*
Pocketed free-tailed bat	*Nyctinomops femorosaccus*

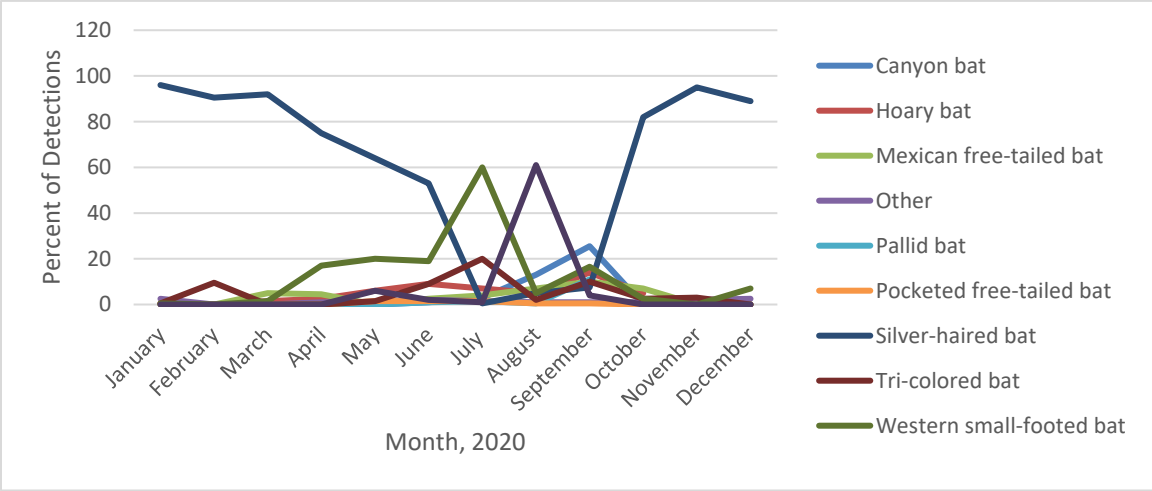

Figure 7-7. Bat species detections at Coyote Springs by month, 2020

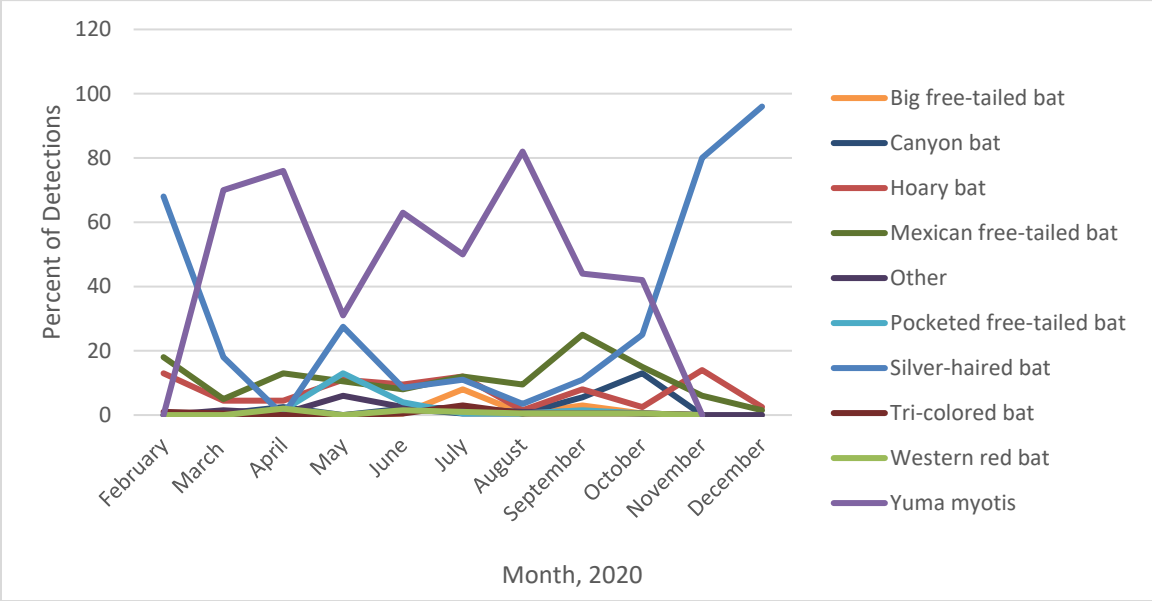

Figure 7-8. Bat species detections at the KAFB Golf Course by month, 2020

The low number of silver-haired bats detected in the summer indicates that this bat is a winter resident that likely migrates north during the summer months. Conversely, many of the *Myotis* species are primarily present in summer months and may migrate to southern parts of the state or out of state in the winter.

7.4 Avian Surveillance

Long-term monitoring of breeding and wintering birds can reveal population trends and dynamics. Collecting data aids land use decisions and provides documentation regarding bird population trends regionally and continentally. The two main monitoring methods used at SNL/NM are bird surveys, which is the process of counting birds visually and audibly, and bird banding, which involves capturing a bird, adding a leg band, and then releasing the bird unharmed.

7.4.1 Bird Surveys Using Transects

In 2020, bird surveys were not conducted during the breeding or winter seasons due to COVID-19 site restrictions.

A *bird survey* is the process of counting birds visually and audibly; *bird banding* involves capturing a bird, adding a leg band, and then releasing the bird unharmed.

7.4.2 Bird Banding and Monitoring

In 2003, Ecology Program personnel implemented two projects that use bird banding to monitor bird diversity and abundance: the Monitoring Avian Productivity and Survivorship (MAPS) protocol and fall migration. Ecology Program personnel maintain a banding permit through the U.S. Geological Survey Bird Banding Laboratory.

In order to make comparisons among seasons, days, and net sites, personnel calculate birds captured per net hour (one standard mist net operated for one hour) using marked or banded birds. For this computation, the number of birds captured in a day or season is divided by the number of total net hours in that period.

Monitoring Avian Productivity and Survivorship Banding: Results

MAPS banding sessions have been conducted annually since 2003 at SNL/NM. The MAPS method for banding birds was developed by the Institute for Bird Populations (DeSante et al. 2010). In addition, the MAPS organization hosts a collaborative effort among public agencies in North America that seeks to derive population and productivity trends for nesting birds through mist netting (stringing mesh nets between two poles) during the breeding season (May through mid-August). This data, collected all over North America since 1989, has helped ornithologists better understand population trends, dynamics, gender ratios, and productivity for more than 200 species of breeding birds.

In 2020, MAPS banding sessions were not run at SNL/NM because of COVID-19 site restrictions.

Fall Migration Banding: Results

Fall migration monitoring has been conducted annually since 2003 at SNL/NM. Ecology Program personnel monitor birds weekly from early August through early November. These annual monitoring activities are an effort to document breeding bird productivity and investigate fall migration patterns of songbirds in shrub, open woodland, and grassland habitats.

In 2020, fall migration banding was not attempted at SNL/NM because of COVID-19 site restrictions.

Fall migration monitoring continued to show a downward trend for total birds per 100 net hours from 2003 through 2019 (Figure 7-9) even though the previous several seasons' capture rates were above average.

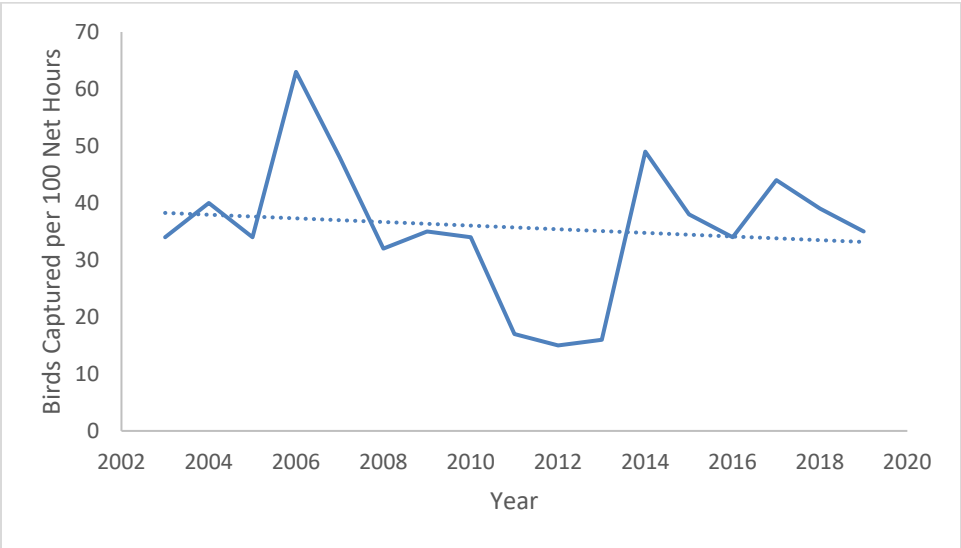

Figure 7-9. Linear trend of all birds captured during fall migration monitoring, 2003–2019

7.5 Remote Camera Surveillance

Ecology Program personnel have conducted passive surveillance with remote-sensor cameras for a diversity of wildlife in various habitats since 2005.

Remote-sensor camera *trapping* refers to the use of motion-activated cameras to document the occurrence and behaviors of wildlife in a particular habitat or study area. The cameras work by detecting moving objects that have a differing temperature (i.e., hotter) from the surrounding ambient environment. There is a *detection* each time the camera is triggered and an *observation* each separate time an individual is present and recorded within a frame.

Overall, the main goal of remote-sensor camera monitoring at SNL/NM is to document small-, medium-, and large-sized mammals while minimizing incidental observations of other species, such as birds, amphibians, reptiles, and insects. Although mammals are the targeted wildlife, when birds, reptiles, and amphibians are captured in camera images, those observations are also recorded.

Remote-sensor camera traps have become an increasingly popular tool, especially during the last several decades, to inventory and monitor wildlife populations around the world (Rovero, Tobler, and Sanderson 2010). With major technological advances in remote-sensor cameras, including digital photography and infrared sensors, there has been increased reliability in the detection of both commonplace and elusive wildlife (Kucera and Barrett 2011). These cameras provide a noninvasive, cost-effective method for developing estimates of common population-level and community-level indices, including the richness, composition, and structure of mammal communities (Cusack et al. 2015).

Ecology Program personnel maintain two wildlife water guzzlers on DOE-permitted or fee-owned land: the Madera Canyon Guzzler and the Range Guzzler. The Madera Canyon Camera Station is

set up at the Madera Canyon Guzzler, and the Range Camera Station is set up at the Range Guzzler. Because many mammal species use artificial water sources, remote-sensor cameras provide an excellent means of documenting the diversity and abundance of mammals at these locations.

7.5.1 Madera Canyon Camera Station Results

COVID-19 site restrictions impacted the Ecology Program team's ability to check consistently and maintain the remote-sensor cameras throughout the year. These restrictions affected trail-camera functionality, battery deficits and resultant functionality issues, and follow-up after extended weather impacts, among other issues. These circumstances resulted in some gaps in the data collected in 2020. Data collected at the Madera Canyon Camera Station is missing for the following time periods: June 14, 2020, through July 8, 2020; August 18, 2020, through August 26, 2020; October 11, 2020, through November 8, 2020; and November 26, 2020, through December 20, 2020.

In 2020, 43 different species were observed at the Madera Canyon Camera Station (Table 7-3), including 8 different mammal species, 32 different bird species, and 3 different invertebrate species. No amphibians or reptiles were observed at the Madera Canyon Camera Station during 2020.

Since June 2005, 70 species have been recorded and identified at the Madera Canyon Guzzler. Seven of these species have been documented in each calendar year since monitoring with remote-sensor cameras began, including the American black bear (*Ursus americanus*), common raven (*Corvus corax*), coyote (*Canis latrans*), gray fox (*Urocyon cineroargentus*), mourning dove (*Zenaida macroura*), mule deer (*Odocoileus hemionus*), and northern flicker (*Colaptes auratus*).

An additional 14 species have been documented at the Madera Canyon Guzzler that have not been documented at the Range Guzzler. The species are: Audubon's warbler (*Setophaga coronata auduboni*), brown-headed cowbird (*Molothrus ater*), brown thrasher (*Toxostoma rufum*), Clark's nutcracker (*Nucifraga columbiana*), curve-billed thrasher (*Toxostoma curvirostre*), eastern bluebird (*Sialia sialis*), Eurasian-collared dove (*Stretopelia decaocto*), hepatic tanager (*Piranga flava*), javelina (*Pecari tajacu*), Steller's jay (*Cyanocitta stelleri*), turkey vulture (*Cathartes aura*), white-tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*).

Table 7-3. Wildlife species observed at the Madera Canyon Camera Station, 2020

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mammals													
American black bear	*Ursus americanus*				✓	✓		✓	✓				
Coyote	*Canis latrans*	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gray fox	*Urocyon cinereoargenteus*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Javelina	*Pecari tajacu*								✓	✓	✓	✓	✓
Mountain lion	*Puma concolor*					✓	✓		✓	✓	✓	✓	
Mule deer	*Odocoileus hemionus*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Striped skunk	*Mephitis mephitis*			✓	✓	✓	✓	✓	✓	✓	✓		
Birds													
American robin	*Turdus migratorius*	✓	✓	✓	✓			✓		✓	✓	✓	✓
Black-headed grosbeak	*Pheucticus melanocephalus*				✓	✓	✓	✓					
Brown-headed cowbird	*Molothrus ater*						✓						
Canyon towhee	*Melozone fusca*		✓										✓
Clark's nutcracker	*Nucifraga columbiana*										✓		
Common raven	*Corvus corax*			✓	✓	✓	✓	✓		✓	✓	✓	

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Cooper's hawk	*Accipiter cooperii*						✓				✓		
Crissal thrasher	*Toxostoma crissale*										✓		
Curve-billed thrasher	*Toxostoma curvirostre*		✓										
Dark-eyed junco	*Junco hyemalis*		✓								✓	✓	✓
Eastern bluebird	*Sialia sialis*		✓	✓									
Evening grosbeak	*Coccothraustes vespertinus*										✓		
Great horned owl	*Bubo virginianus*		✓	✓	✓	✓	✓		✓	✓	✓	✓	
Hepatic tanager	*Piranga flava*					✓							
House finch	*Haemorhous mexicanus*		✓	✓	✓	✓	✓	✓					✓
Juniper titmouse	*Baeolophus ridgwayi*									✓	✓		
Lesser goldfinch	*Spinus psaltria*									✓			
Mountain bluebird	*Sialia currucoides*			✓	✓								✓
Mourning dove	*Zenaida macroura*				✓	✓	✓	✓	✓				✓
Northern flicker	*Colaptes auratus*		✓	✓	✓					✓	✓	✓	✓
Northern mockingbird	*Mimus polyglottos*					✓	✓	✓					
Pinyon jay	*Gymnorhinus cyanocephalus*				✓		✓	✓		✓	✓		
Red-tailed hawk	*Buteo jamaicensis*					✓				✓		✓	
Say's phoebe	*Sayornis saya*												✓
Spotted towhee	*Pipilo maculatus*					✓							✓
Steller's jay	*Cyanocitta stelleri*										✓		
Townsend's solitaire	*Myadestes townsendi*			✓						✓	✓	✓	✓
Turkey vulture	*Cathartes aura*				✓	✓		✓					
Western bluebird	*Sialia mexicana*	✓	✓	✓	✓					✓		✓	✓
Western tanager	*Piranga ludoviciana*					✓	✓						
White-crowned sparrow	*Zonotrichia leucophrys*			✓							✓		
White-winged dove	*Zenaida asiatica*					✓	✓	✓	✓				
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*		✓	✓	✓	✓	✓			✓	✓	✓	
Reptiles													
None													
Amphibians													
None													
Invertebrates													
Arizona sister	*Adelpha eulalia*					✓				✓			
Cabbage white	*Pieris rapae*					✓				✓			
Unknown dragonfly										✓			

On May 18, 2019, a single javelina was documented at the Madera Canyon Camera Station. No subsequent observations of this species were made from June 2019 to July 2020. From August 2020 through December 2020 the species was detected again, and 40 separate sets of observations were made during that time (Figure 7-10). It is presumed that the new observations were of the same individual originally observed in May 2019; however, that has not been confirmed. The solitary nature of this individual is somewhat anomalous, as javelinas normally exist within larger family groups; common herd sizes can range from 6 to 20 individuals. It is possible that this individual is a solitary male attempting to establish a new territory or is an injured, ill, or aging adult seeking solitude. The former supposition seems more likely as there are no obvious injuries observable in the captured images, and the individual seemed to be behaving normally.

Figure 7-10. An individual javelina visiting the Madera Guzzler in 2020

American black bears have been documented at the Madera Canyon Guzzler each year since monitoring began in 2005. In 2020, bears appeared to be most active during the months of April through August. However, no observations were made in June. At least three different bears visited the guzzler as identified in camera images. One of the bears was large and black with a yellow tag on the right ear. Another one was a large, brown-colored bear with a light brown muzzle; this bear did not have any ear tags. The third bear was small relative to the other two bears, had long, blonde guard hairs, and had two ear tags (the left ear tag was red, and the right ear tag was yellow). Figure 7-11, Figure 7-12, and Figure 7-13 show the individual bears that frequented the guzzler in 2020. No cubs were recorded visiting the guzzler in 2020.

Figure 7-11. A large brown-colored American black bear (*Ursus americanus*) facing the camera at the Madera Canyon Guzzler

Figure 7-12. An ear-tagged American black bear (*Ursus americanus*) preparing to bathe in the Madera Canyon Guzzler

Figure 7-13. A blonde American black bear (*Ursus americanus*) visiting the Madera Canyon Guzzler

During the 2020 monitoring season, numerous observations were made of striped skunks (*Mephitis mephitis*) seemingly following gray foxes to the Madera Canyon Guzzler. Foxes and skunks were observed visiting this guzzler simultaneously on 14 occasions (Figure 7-14). These observations were made from March through August, with no concurrent observations made in July. Given the number of simultaneous and consecutive observations, as well as the time between visits by the two species, there is a possibility that these interactions were not random. These interactions might be taking place due to some sort of antipredator benefit or for foraging advantages (Stensland, Angerbjorn, and Berggren 2003). A recent study in Mexico showed a similar overlap in activity patterns among foxes and skunks, mainly during nocturnal hours (Pérez-Irineo, Mandujano, and López-Tello 2020). In this study, researchers found that the encounters between the southern spotted skunk (*Spilogale*

angustifrons) and gray fox were indeed not random; there was a significance in overlapping activity patterns as well as differences in daily activity patterns.

Figure 7-14. A striped skunk (*Mephitis mephitis*) and a gray fox (*Urocyon cinereoargenteus*) observed together at the Madera Canyon Guzzler throughout 2020

7.5.2 Range Camera Station Results

COVID-19 site restrictions impacted the Ecology Program team's ability to check and maintain the remote-sensor cameras consistently throughout the year. This affected trail-camera functionality, battery deficits and resultant functionality issues, and follow-up after extended weather impacts, among other issues. These circumstances resulted in some gaps in the data collected in 2020. Data collected at the Range Camera Station is missing for the following time period: April 22, 2020, through April 30, 2020.

In 2020, 31 different species were observed at the Range Camera Station (Table 7-4), including 11 different mammal species, 18 different bird species, 1 reptile species, and 1 amphibian species. No reptiles or invertebrates were observed at the Range Guzzler during 2020.

Table 7-4. Wildlife species observed at the Range Camera Station, 2020

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mammals													
American badger	*Taxidea taxus*				✓	✓							
Black-tailed jackrabbit	*Lepus californicus*		✓										
Bobcat	*Lynx rufus*								✓	✓	✓		
Coyote	*Canis latrans*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Desert cottontail	*Sylvilagus audubonii*											✓	
Gray fox	*Urocyon cinereoargenteus*			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mountain lion	*Puma concolor*	✓					✓		✓				✓
Mule deer	*Odocoileus hemionus*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Raccoon	*Procyon lotor*					✓							
Rock squirrel	*Otospermophilus variegatus*							✓	✓	✓	✓	✓	
Striped skunk	*Mephitis mephitis*			✓									
Birds													
American robin	*Turdus migratorius*			✓		✓					✓	✓	✓
Cassin's finch	*Haemorhous cassinii*					✓							
Common raven	*Corvus corax*					✓					✓		
Cooper's hawk	*Accipiter cooperii*											✓	
Golden eagle	*Aquila chrysaetos*					✓			✓		✓	✓	✓
Greater roadrunner	*Geococcyx californianus*					✓			✓				
Great horned owl	*Bubo virginianus*										✓	✓	
House finch	*Haemorhous mexicanus*												
Mountain bluebird	*Sialia currucoides*					✓							
Mourning dove	*Zenaida macroura*					✓	✓	✓	✓				
Northern flicker	*Colaptes auratus*					✓					✓	✓	
Northern mockingbird	*Mimus polyglottos*					✓					✓		
Pinyon jay	*Gymnorhinus cyanocephalus*										✓		
Red-tailed hawk	*Buteo jamaicensis*												
Townsend's solitaire	*Myadestes townsendi*										✓		
Western bluebird	*Sialia mexicana*			✓							✓	✓	
White-winged dove	*Zenaida asiatica*								✓	✓			
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*					✓			✓		✓		
Reptiles													
Unidentified snake										✓			
Amphibians													
Spadefoot ssp.							✓	✓	✓	✓			
Invertebrates													
None													

ssp. = subspecies

Since monitoring began, remote-sensor cameras have captured images of 73 species at the Range Camera Station. In addition, toads, bats, and other small mammals have been observed but were not identified to the species level.

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.

Two species have been observed in images at the Range Guzzler in every year of monitoring: gray fox and mule deer. At most, 31 species have been documented in a single calendar year. In addition, 16 species have been documented at the Range Guzzler that have not been documented at the Madera Canyon Guzzler. These include American badger (*Taxidea taxus*), ash-throated flycatcher (*Myiarchus cinerascens*), European starling (*Sturnus vulgaris*), gopher snake (*Pituophis catenifer*), greater roadrunner (*Geococcyx californianus*), hog-nosed skunk (*Conepatus leuconotus*), ladder-backed woodpecker (*Dryobates scalaris*), mountain chickadee (*Poecile gambeli*), ringtail (*Bassariscus astutus*), rock wren (*Salpinctes obsoletus*), rufous-crowned sparrow (*Aimophila ruficeps*), scaled quail (*Callipepla squamata*), Texas

antelope squirrel (*Ammospermophilus interpres),* western spotted skunk (*Spilogale gracilis)*, Williamson's sapsucker (*Sphyrapicus thyroideus*), and woodrat (*Neotoma* spp.).

Mule deer were documented at the Range Guzzler every month during 2020 (Figure 7-15). As with the Madera Canyon Guzzler, mule deer were detected and observed more than any other species at the Range Guzzler. Observations of this species indicate that they were most active at the Range Guzzler during November, followed by August, and then October. Overall, there was a higher number of observations of does (1,730) than bucks (809) throughout the year.

Figure 7-15. A mule deer (*Odocoileus hemionus*) buck in velvet visiting the Range Guzzler

Coyotes (*Canis latrans*) were documented at the Range Guzzler every month during 2020 (Figure 7-16), with 396 separate observations of coyotes. There were two peaks in activity for this species in 2020; the first peak was during May, June, and July, and the second peak was during October and November. It is unclear how many unique individuals visited the Range Guzzler during this period of time.

Figure 7-16. A pair of coyotes (*Canis latrans*) visiting the Range Guzzler at night

There were only four observations of an American badger at the Range Guzzler in 2020, once in April and three separate observations in May (Figure 7-17). All four visits were short, lasting only two

seconds at most during one of the May visits. As is normal behavior for this crepuscular species, each visit took place in the twilight hours of early morning and late evening.

Figure 7-17. Two separate observations of an American badger (*Taxidea taxus*) at the Range Guzzler

7.6 Federally Listed and State-Listed Endangered, Threatened, and Other Species of Concern

As stated in Chapter 2, the Endangered Species Act is intended to protect all animal, plant, and insect species that are federally listed as endangered or threatened. Currently, no known federally listed endangered or threatened species breed or reside within KAFB boundaries. Several federally listed species are found within Bernalillo County, New Mexico (Table 7-5).

A few mammal species protected by the State of New Mexico have been encountered within KAFB boundaries (Table 7-5). One species in particular, the gray vireo (*Vireo vicinior*), listed as threatened by the New Mexico Department of Game and Fish, is well known as a breeding bird on both KAFB property and on DOE-permitted and fee-owned areas. The gray vireo's primary breeding habitat is open piñon-juniper woodlands within the foothills of the Manzano Mountains.

Table 7-5. Federally listed and state-listed endangered, threatened, and other species of concern potentially occurring in Bernalillo County, New Mexico

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed at KAFB
Common Name	Scientific Name			
Mammals				
Arizona myotis	*Myotis occultus*	—	Sensitive	✓
Big free-tailed bat	*Nyctinomops macrotis*	—	Sensitive	
Common hog-nosed skunk	*Conepatus leuconotus*	—	Sensitive	✓
Fringed myotis	*Myotis thysanodes*	—	Sensitive	
Gunnison's prairie dog	*Cynomys gunnisoni zuniensis*	—	Sensitive	✓
Long-legged myotis	*Myotis volans*	—	Sensitive	
Meadow jumping mouse	*Zapus luteus luteus*	Endangered and critical habitat	Endangered	

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed at KAFB
Common Name	Scientific Name			
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	Species of concern	SGCN	✓
Red fox	*Vulpes vulpes*	—	Sensitive	
Ringtail	*Bassariscus astutus*	—	Sensitive	✓
Spotted bat	*Euderma maculatum*	—	Threatened	
Western small-footed myotis	*Myotis ciliolabrum*	—	Sensitive	
Western spotted skunk	*Spilogale gracilis*	—	Sensitive	✓
Yuma myotis	*Myotis yumanensis*	—	Sensitive	
Birds				
Baird's sparrow	*Ammodramus bairdii*	Species of concern	Threatened	
Bald eagle	*Haliaeetus leucocephalus*	—	Threatened	✓
Bell's vireo	*Vireo bellii*	Species of concern	Threatened	✓
Burrowing owl	*Athene cunicularia*	Species of concern	SGCN	✓
Common black hawk	*Buteogallus anthracinus*	Species of concern	Threatened	
Gray vireo	*Vireo vicinior*	—	Threatened	✓
Least tern	*Sternula antillarum*	—	Threatened	
Loggerhead shrike	*Lanius ludovicianus*	—	SGCN	✓
Mexican spotted owl	*Strix occidentalis lucida*	Threatened and critical habitat	SGCN	
Mountain plover	*Charadrius montanus*	—	SGCN	
Neotropic cormorant	*Phalacrocorax brasilianus*	—	Threatened	
Northern goshawk	*Accipiter gentilis*	Species of concern	Sensitive	
Peregrine falcon	*Falco peregrinus*	Species of concern	Threatened	✓
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered and critical habitat	Endangered	✓
Sprague's pipit	*Anthus spragueii*	—	SGCN	✓
Western yellow-billed cuckoo	*Coccyzus americanus*	Threatened	SGCN	
Reptiles				
Desert massasauga	*Sistrurus catenatus dewardsii*	Under review	SGCN	✓
Southwestern fence lizard	*Sceloporus cowlesi*	—	Sensitive	✓
Fish				
Rio Grande chub	*Gila pandora*	—	SGCN	
Rio Grande silvery minnow	*Hybognathus amarus*	Endangered and critical habitat	Threatened	
Invertebrates				
Monarch butterfly	*Danaus plexippus*	Candidate	—	
Socorro mountain snail	*Oreohelix neomexicana*	—	Sensitive	

Source: Biota Information System of New Mexico. Accessed February 2020. http://www.bison-m.org.
— = no designation
SGCN = Species of Greatest Conservation Need

7.7 Eco Ticket Request System

In 2013, Ecology Program personnel launched a web-based ticketing system. This system, named Eco Ticket, is used to report wildlife issues or concerns and to request biological surveys. Prior to using Eco Ticket, individuals contacted Ecology Program personnel via numeric pagers, phone calls, and/or emails. This outdated system led to delays in response time, difficulty coordinating support for an increasing workforce and growing workload, and the inability to track trends effectively.

Using Eco Ticket, individuals can easily place a request that is sent to all Ecology Program personnel instantaneously. Requests are prioritized in a queue and then responded to accordingly. Once an action is completed, a biologist will close out the ticket, moving the request and associated data from the queue to a searchable database. The request database is used to track wildlife encounters and ultimately to inform decisions and practices aimed at effectively managing human-wildlife interactions. Ongoing outreach campaigns have increased awareness of the Eco Ticket tool since its inception. Infrastructure Operations personnel use the system most frequently, requesting biological surveys to support work orders. Requests have been split nearly evenly between biological survey requests and animal service calls since the first full year of Eco Ticket use (Figure 7-18). Sorting and analyzing ticket types aids understanding of the dynamics of wildlife issues at SNL/NM.

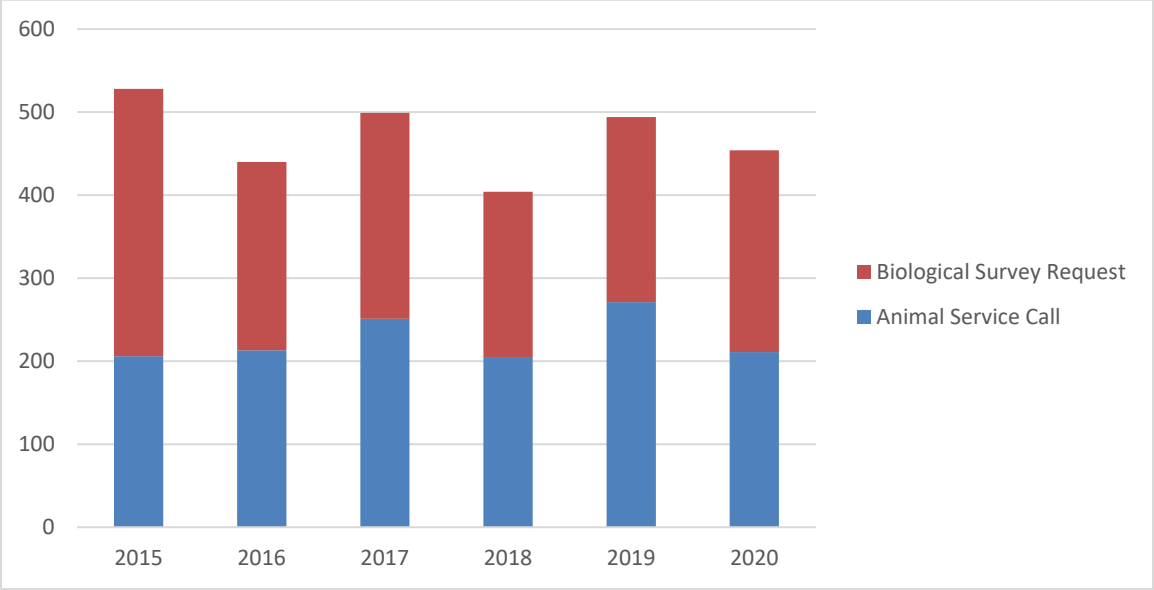

Figure 7-18. Two major categories of Eco Ticket requests, 2015–2020

7.7.1 Eco Ticket Results

Wildlife Response

Eco Ticket is used to report wildlife issues or concerns, which may include snakes, bird nests, injured wildlife, trapped wildlife, and dead wildlife. Wildlife reported include mammals, reptiles, amphibians, birds, and some insects, all of which are monitored through the Eco Ticket system.

For Eco Tickets pertaining to a wildlife issue, Ecology Program personnel call the individual who placed the ticket to gather information. Requested information may include the type of animal, the location, the time last seen, and any pertinent safety information. For nonvenomous wildlife outside buildings, Ecology Program personnel typically leave the animal alone unless it is trapped, sick, or injured. Venomous snakes are always relocated due to the risk they pose to personnel. If an animal is

injured, it is taken to wildlife rescue. Wildlife trapped inside a building are captured and then released in appropriate habitats.

Two hundred and eleven animal requests were received through Eco Ticket in 2020. The "Other" category of animal service was requested most often with 52 tickets. Insects and non-urgent wildlife sightings made up a large portion of this category. Insect requests were rerouted through the Integrated Pest Management system when applicable, and all wildlife sightings were documented.

If an animal is injured, it is taken to wildlife rescue. Wildlife trapped inside a building are captured and then released in appropriate habitats.

There were 51 snake removal tickets in 2020, a small increase from 2019. Of the 51 tickets, 27 were for venomous snakes. Prairie rattlesnakes (*Crotalus viridis*) continue to be the most common venomous snakes encountered; however, one diamond-backed rattlesnake (*Crotalus atrox*), one plains hog-nosed snake (*Heterodon nasicus*), and two plains black-headed snakes (*Tantilla nigriceps*) were encountered in 2020 (Figure 7-19). While venomous, both plains hog-nosed snakes and plains black-headed snakes are not considered dangerous to humans due to their small mouths, rear fangs, and mild venom.

In 2020, raccoons (*Procyon lotor*) were a commonly reported sight across TA-I. Lower levels of human traffic (with increased telecommuting in response to COVID-19 restrictions) likely drove this increase as animals appeared more comfortable foraging through outdoor trash receptacles during normal working hours. In response to this uptick, the old-style trash receptacles will be replaced with new wildlife-proof bins. Proactively removing attractants is the best way to reduce unwanted human interactions with urban wildlife.

A barn owl (*Tyto alba*) was reported as injured near a remote facility (Figure 7-19). After close observation, the owl was determined to be a healthy fledgling from a nearby nest box. The young bird eventually took cover without the need for biologist intervention.

Figure 7-19. A plains hog-nosed snake (*Heterodon nasicus*) captured and relocated near the Sled Track (left) and a barn owl (*Tyto alba*) reported as injured near a remote facility seen perched on a fence (right)

Work Orders and Projects

Before certain outdoor work is initiated, Ecology Program personnel survey the work site. These biological surveys are performed to conserve protected species, most often birds and their nests, which are protected under the Migratory Bird Treaty Act.

In 2020, Ecology Program personnel received 243 Eco Ticket requests for biological surveys (Figure 7-20). Of these 243 tickets, 165 came in as "Facilities Work Orders." These are routine, small-scope requests generated by Infrastructure Operations personnel. Campus maintenance activities—such as tree trimming; building, walkway, and waterline repairs; and mowing—are included in this work order category. The remaining 78 requests came in as "NEPA ID" requests or as projects that didn't fall under routine maintenance activities. Outdoor testing and large-scale construction activities made up the majority of the NEPA ID requests for biological surveys.

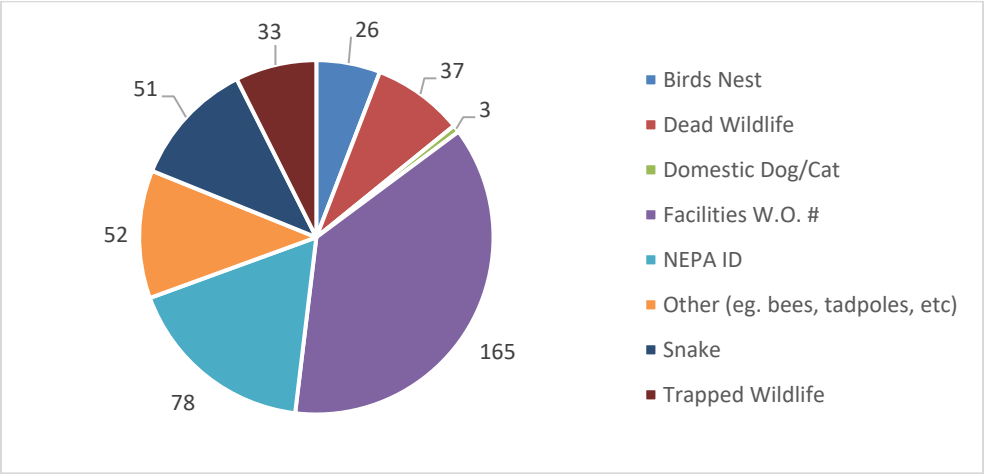

Figure 7-20. Eco Ticket requests by type, 2020

7.8 Ecological Restoration

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed; it is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity, and sustainability (SER 2004).

Ecology Program personnel have been providing ecological restoration guidance and support to a variety of projects since 2009. The successful recovery of degraded lands in central New Mexico is extremely challenging. SNL/NM resides in an arid climate that receives less than nine inches of precipitation per year, experiences drying winds in the spring, and has hot summers and cold winters. Prior to Ecology Program personnel becoming involved with the restoration of degraded sites, reseeding efforts generally were unsuccessful. The Ecology Program approach has since shifted, recognizing that all biotic components need to be assessed and addressed in order to reestablish the historic native community of each site successfully.

The reestablishment of native vegetation is the first step in the restoration process. Biotic characteristics such as the absence or presence of healthy, living soils capable of supporting a native plant community determines the next steps in the restoration process. The process includes selecting the appropriate plant species and density, using proper implementation methods, providing seed protection, and eliminating or significantly reducing site competition from weeds and their seeds in the soil bank. Identifying appropriate project goals and applying approaches best suited to the degree of site impairment are part of the essential framework for each restoration project.

7.8.1 Ecological Restoration Support Role

Ecological restoration projects are most often related to construction activities, commonly in support of the Stormwater Pollution Prevention Plan development process and, more specifically, the CGP, according to EPA guidelines. When possible, an area is evaluated to identify and document the native

biological community prior to beginning activities that will disturb the earth. If an area cannot be evaluated prior to disturbance or if the area has existing disturbance, a reference ecosystem serves as a guide for planning the restoration work. The full scope of disturbance effects, either existing or planned, the anticipated final state of the site, and any other relevant factors are also assessed before planning the restoration work. Ecology Program personnel develop a detailed written restoration plan, or specification, for the project. This is provided to Infrastructure Operations personnel, who oversee work contracts. Ecology Program personnel continue to provide support and guidance throughout the restoration project, including conducting post-restoration site monitoring and biological evaluations of the recovery.

A Certified Ecological Restoration Practitioner provides ecological restoration support at SNL/NM. This certification is awarded by the Society for Ecological Restoration to practitioners who have met the society's rigorous standards of knowledge and experience.

In 2020, Ecology Program personnel supported the following ecological restoration projects:

- **Building 905.** Building 905 was evaluated for native plant community establishment and growth across the project area. Vegetative cover exceeded the Stormwater Pollution Prevention Plan CGP criteria for permanent soil stabilization. The formal vegetation survey triggered Stormwater Pollution Prevention Plan CGP termination for this project.
- **Old Centrifuge Site and Escarpment Stabilization.** Seeding and wattle were installed at the Old Centrifuge Site and Escarpment Stabilization project area.
- **Site 9940X.** The existing Site 9940X and estimated project area were evaluated in 2020. A restoration plan was developed and sent to the Infrastructure Operations project manager.
- **Substation 5 Loop.** The Substation 5 Loop project is in the Coyote Test Field area between Building 9960 and Building 9930. The seeding work occurred on this project in 2018. In 2020, vegetation establishment within the project area was evaluated and exceeded the CGP criteria for permanent soil stabilization.

Note: In arid and semiarid environments, vegetative cover in the project area must meet or exceed 70 percent of the native background vegetative cover to meet the requirement for permit termination.

Additional 2020 activities included monitoring restoration projects that were installed in previous years and instituting recommendations as necessary to improve their ecological recovery trajectories. These projects were evaluated during prime vegetation growth periods for the best evaluation of native plant cover and weed presence and to observe any potential issues present during the warm growing season.

Chapter 8. Cultural Resource Management Program

Exterior light set in a brick sunburst design on historic Building 840, one of the early buildings designed by New Mexico architect W. C Kruger's firm

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

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

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

Between 1977 and 2020, 42 archaeological surveys—covering more than 6,000 acres of land—have been conducted at KAFB, including on Sandia-controlled property. Currently, 2,150 historical sites (sites having cultural heritage value) at KAFB have been recommended as eligible for inclusion in the National Register of Historic Places; approximately 70 percent of those sites are on Sandia-controlled property.

8.1 Culture History

The prehistoric and historic time periods in the Albuquerque area consist of four major cultural and temporal periods: Paleoindian Period, Archaic Period, Ancestral Puebloan Period, and current Historic Period (AD 1540 to present) (Cordell 1997).

The earliest well-documented human occupation in New Mexico—the Paleoindian period (10,000–5500 BC)—was developed when the climate was cool and precipitation was high, and it is characterized by stylistically distinct, large, often fluted, lanceolate projectile points (arrowheads). The Archaic period (5500 BC to AD 400) is best defined as the continued adaptation of Paleoindian groups to the changing climatic conditions. The Ancestral Puebloan period (AD 400–1540) was an era of change and an increasing dependence on cultigens (cultivated plants), such as maize, beans, and squash. It was marked by population growth, greater residential sedentism (staying in one place), the appearance of the bow and arrow, the appearance of pottery, increasing dependence on storing foods, and developments in architecture and sociopolitical organization. The 1540–1542 *entrada* of Francisco Vasquez de Coronado was the first official European entry into the present Albuquerque area and denotes the beginning of the historic period. The expedition found 12 large pueblos clustered along the Rio Grande between present-day Bernalillo and Isleta and several smaller villages to the south.

Although Spanish settlement of the Rio Grande Valley and adjacent areas increased steadily between 1610 and 1680, life was far from peaceful. Quarreling between religious and civil leaders was common. The Apaches and the Comanches often used Tijeras Canyon and the Sandia and Manzano mountains to stage raids on Spanish and Pueblo communities. Due to the high frequency of these raids, the Spanish governor authorized the settlement of San Miguel del Laredo (San Miguel) at the western end of Tijeras Canyon for protection. Some families who settled at San Miguel in 1817 settled along San Antonio Creek, which is a tributary of Tijeras Creek.

Obsidian projectile point (arrowhead)

8.2 Historical Context

By the nineteenth century, the area along the Rio Grande between present-day Bernalillo and Isleta and including the east side of the Sandia Mountains was primarily occupied by ranchers and miners; however, a small community, Coyote Springs, was established in the vicinity of a natural spring along the Arroyo del Coyote. Mining began in the nineteenth century and extended well into the twentieth century. The Tijeras Mining District extended southward into the northern portion of what is now KAFB, the Coyote Canyon District was situated within the U.S. Forest withdrawn land in the eastern portion of KAFB (Fulp et al. 1982), and the Hell Canyon District was located within the southern

edge of KAFB (Lintz et al. 1988). Between 1910 and 1923 and again during World War II, lead and fluorspar were mined in Coyote Canyon (Elston 1967); Tijeras Canyon was mined for gold into the 1930s (Northrop 1975); and gold, silver, and copper were mined from Hell Canyon from about 1880 to 1910 and again in 1975 through 1976 (Fulp et al. 1982). Most of the mining at KAFB ended in the early 1930s (Lintz et al. 1988).

In 1928, Oxnard Field was built on the East Mesa, to the southeast of Albuquerque. It served as an airport for the next few years, until the West Mesa Airport was built further to the west and Oxnard Field became a private airfield. By 1939, Oxnard Field was seeing frequent use by military flights for refueling. Two years later, the U.S. Army acquired the site and the land around it, eventually renaming it Albuquerque Army Air Field and using it as a training depot for aircraft mechanics. By 1943, the training program concluded, and the area was converted to a convalescent center.

By June 1942, the U.S. Army had acquired additional land slightly to the west of Oxnard Field to be used as an Army Air Forces air depot training station. New runways were built at what became Kirtland Army Air Field. When the U.S. Air Force was created in 1947, Kirtland became an Air Force base (TLI Solutions 2006).

Beginning in 1941 and continuing until 1954, land south of that acquired by the U.S. Army and north of Isleta Pueblo was used as the New Mexico Proving Ground/New Mexico Experimental Range as a test site for developing the proximity fuze, the research and technical design of which was based at Johns Hopkins University. E. J. Workman, a physicist at the University of New Mexico, took on the assignment and the contracts for testing the fuze. He arranged for acquisition of the land, increasing the size of the test site over time with a series of leases and purchases. When the New Mexico Proving Ground closed, the federal government kept the land, which is now part of KAFB.

A *proximity fuze* (or *fuse*) is an explosive ignition device used in bombs, artillery shells, and mines that detonates automatically when the distance to the target becomes smaller than a predetermined value.

In July 1945, Los Alamos Scientific Laboratory, part of the Manhattan Engineer District, created Z Division as part of a lab-wide reorganization. Z Division included the ordnance engineering activities involved in turning the nuclear physics package developed by Los Alamos into a deliverable nuclear weapon. Expected to grow, Z Division was moved to a site within the Albuquerque Army Air Field, which was selected because it was not too far from Los Alamos, was near an airfield to support testing, and was sited with the military to facilitate training. The Air Field was renamed Sandia Base (Furman 1990).

When the Manhattan Engineer District was dissolved and the Atomic Energy Commission took over all nuclear energy and related research and development, Los Alamos and Z Division became civilian enterprises. The land and all other property owned by the Manhattan Engineer District transferred to the new Atomic Energy Commission, including the land on which Z Division sat (Furman 1990). However, Sandia Base itself remained a military base. In 1971, Sandia Base was merged into KAFB. Today, DOE owns the Sandia technical areas and the built environment on land permitted by the U.S. Air Force and land withdrawn for its use from Cibola National Forest.

In 1948, Z Division was renamed Sandia Laboratory. In 1949, it was separated from its parent lab and placed under the management of Sandia Corporation, a wholly owned subsidiary of Western Electric. The management and operating contract has changed hands twice since then, with NTESS, a Honeywell company, currently managing Sandia.

Over time, Sandia operations grew from one main technical area (TA-I) to five technical areas. TA-II, established as part of Z Division's weapon assembly assignment, opened in 1948. TA-III, established in 1954 for environmental and developmental testing, houses large environmental test facilities. TA-IV was created in the 1980s to house pulsed power machines. TA-V contains reactor research and testing facilities.

DOE owns the land occupied by all five technical areas. Sandia also has facilities on land within the Coyote Test Field (formerly the location of Workman's proximity fuze testing) mostly via land permits with the U.S. Air Force and on some land withdrawn from the U.S. Forest Service to DOE.

8.3 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 New Mexico Historic Preservation Division. See Chapter 2.

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

8.4 Archaeological Resources

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

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

8.4.1 Field Methods

Archaeological personnel conduct pedestrian surveys (walking the natural landscape on foot) and record prehistoric and historic sites in accordance with New Mexico Archaeological Council guidelines (4.10.8 NMAC, *Permits to Conduct Archaeological Investigations on State Land*; 4.10.15 NMAC, *Standards for Survey and Inventory*). In addition, the archaeologist provides recommendations regarding the potential effect of proposed undertakings on prehistoric and historic properties. These include recommendations regarding a site's eligibility for nomination to the National Register of Historic Places for Cultural Properties and Historic Preservation and project mitigation.

A pedestrian survey lightly impacts surface soils. Survey transects are spaced 50 ft apart, with no more than 40 acres surveyed per person per day. All cultural resources that are at least 50 years old are recorded on field forms. Archaeological sites are defined by the presence of either a cultural feature or 10 or more artifacts that are at least 50 years old and are separated by no more than 66 ft. Areas where cultural materials are sparse (fewer than 10 items) and are at least 50 years old are recorded as isolated occurrences. The archaeologist generates a New Mexico Laboratory of Anthropology Inventory Form for archaeological sites in New Mexico. Archaeological sites are mapped both manually on graph paper and digitally. Digital maps are created using a global positioning system unit with sub-meter accuracy. Each map includes the site boundary and the locations of the datum, any features identified, artifact concentrations, important or diagnostic

artifacts, drainages or other landscape features, and topographic contours. Each site, including any cultural features or tools, is photographed. All artifacts are analyzed in the field unless more than 50 artifacts of a given class (e.g., lithic [stone], prehistoric ceramic, or historic) are present, in which case a sample of at least 50 are analyzed. Lithic and prehistoric ceramic artifacts are analyzed using standard in-field techniques. Ceramics, projectile points, and other diagnostic artifacts are identified by type and cultural affiliation when sufficient attributes for a reliable determination are present. Isolated occurrences and their location coordinates are recorded and analyzed. The archaeologist writes all reports of findings and associated documentation.

8.4.2 Archaeological Assessments and Analysis in 2020

In 2020, the archaeologist completed two pedestrian surveys, reviewing more than 200 outdoor projects and surveying more than six acres. Projects included utility work, road grading, and ongoing operational activities. Seven archaeological reviews were conducted on DOE land in the Cibola National Forest in the U.S. Forest Service withdrawn area, as well as on and near DOE-permitted property and environmental restoration sites. This resulted in two memos to DOE that identified cultural resource concerns. The memos identified archaeological resources that had been noted during pedestrian surveys. In addition, 15 conceptual analyses were completed to support site planning. These reviews included research that identified any potential effects that might result from the proposed site plans.

8.5 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/NM, whether the properties sit on land owned by DOE or are permitted to it. 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 1945.

8.5.1 Methods

Although the historian does provide input on proposed projects as requested, most historic building assessments of project impacts are triggered by the NEPA process. While a NEPA checklist is in subject matter expert review, the historian reviews the project details, visits the work site, reviews existing photographs of and documents about the facilities involved, conducts research in the archival and building drawing collections, and obtains new photographs, if needed. The properties potentially affected by the proposed project are evaluated within the established Cold War themes (weapon design, field testing, environmental testing, weapon assembly, military liaison, stockpile surveillance, non-weapons research, and administration/community) defined by the 2010 context statement (Section 8.5.2), which provides the framework for evaluating a property for historical significance (SNL/NM 2010). Note is made of any previous surveys and resulting determinations as to the property's eligibility for the National Register of Historic Places.

If there are any questions regarding proposed work and its potential impact on a building or buildings, 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 any adverse effects on the property.

Once a property is understood in context, the historian makes a recommendation as to whether it is eligible for inclusion in the National Register of Historic Places, summarizing past determinations and any subsequent changes to the property. The historian also makes a recommendation as to whether proposed work will have an adverse effect on any historic properties or districts, including

the property where the work is occurring. Information regarding the property, photographs, a description of the proposed work, any impacts, and the overall recommendation on eligibility as a historic property are captured on a New Mexico Historic Cultural Properties Inventory form. The Historic Cultural Properties Inventory form is submitted as an attachment to the NEPA checklist for DOE review and use in consultation with the New Mexico State Historic Preservation Office.

8.5.2 Previous Building Surveys, Assessments, and Determinations

The Cold War arms race provides the primary historic context for Sandia's built environment through 1989. Sandia drafted a Cold War Context Statement for the New Mexico site in 2002 and updated it in 2007. This document was used to support property evaluations and historic building recommendations in support of the National Historic Preservation Act, Section 106, during DOE consultation with the State Historic Preservation Office.

In 2010, the context statement was updated and extended to reflect the site and its built environment in the post-Cold War period. That same year, Sandia personnel performed a site-wide survey and assessment to identify properties that might be eligible for the National Register of Historic Places. The final recommendation to DOE identified eight historic districts and three individually eligible buildings. DOE did not consult with the State Historic Preservation Office regarding the 2010 recommendation; however, the assessments have been used by DOE in National Historic Preservation Act, Section 106, consultation with the State Historic Preservation Office regarding proposed undertakings to individual properties. The site survey and assessment will be revised prior to any future DOE consultations with the State Historic Preservation Office regarding the SNL/NM site as a whole. Table 8-1 provides a list of SNL/NM properties determined to be historic and their current status.

If a historic property faces adverse effects from a proposed project, DOE and the State Historic Preservation Office agree on what type of mitigation will occur. Often, the design of new or replaced building elements (e.g., doors, windows, or entrances) are in keeping with the building's original design and no further mitigation is required. If the adverse effect will harm the building's historic status—if the building will be torn down or significantly modified—DOE and the State Historic Preservation Office establish a memorandum of agreement specifying the documentation needed to ensure that the building will be preserved. In most instances, the historian prepares Historic American Building Survey/Historic American Engineering Record documentation, including large- and medium-format photographs, photographic descriptions, and a written historical and architectural summary of a property. All photography is completed prior to any demolition or other undertaking that threatens the property's integrity. Completed documentation is held in the Sandia Corporate Archives and the New Mexico State Historic Preservation Office.

Table 8-1. Properties previously determined to be historic and their current status

Property	Historic District?	Facilities That Were Contributing Elements to the Historic Property Determination	State Historic Preservation Office Concurrence	Still Extant?	Still Considered Historic?	Documentation Needed?[a]
300-Foot Drop Tower (S6510)	Yes	S6510, 6510E, 6523B, S6510C (impact pool)	01/12/2004	Yes	Yes	No
10,000-Foot Sled Track	Yes	S6740, 6741, 6742, 6743, 6744, 6745, 6746, 6751	12/17/2003	Yes	Yes	No
Aerial Cable Facility	Yes	9831, 9832, 9834	12/17/2003	Yes	No	Yes
Building 800	No		12/21/2000	Yes	Yes	No

Property	Historic District?	Facilities That Were Contributing Elements to the Historic Property Determination	State Historic Preservation Office Concurrence	Still Extant?	Still Considered Historic?	Documentation Needed?[a]
Building 801	No		12/21/2000	Yes	Yes	No
Building 802	No		12/21/2000	Yes	Yes	No
Building 804	No		11/02/2006	Yes	Yes	No
Building 808	No		12/21/2000	Yes	Yes	No
Building 809	No		05/18/2017	Yes	Yes	No
Building 835	No		12/21/2000	Yes	Yes	No
Building 840	No		12/21/2000	Yes	Yes	No
Building 852	No		2002	No	No	Yes
Building 860	No		12/21/2000	Yes	Yes	No
Building 864	No		11/07/2017	Yes	Yes	No
Building 871	No		11/02/2006	Yes	Yes	No
Building 884	No		2005	No	No	Yes
Building 892	No		11/02/2006	Yes	Yes	No
Building 981	No		11/07/2017	Yes	Yes	No
Building 983	No		2012	Yes	Yes	No
Building 986	No		11/07/2017	Yes	Yes	No
Building 6523	Yes	6523B	12/17/2003	Yes	Yes	No
Building 6560	No		12/17/2003	Yes	Yes	No
Building 6570	No		12/17/2003	Yes	Yes	No
Building 6588	Yes	6593, 6594	11/30/2017	Yes	Yes	No
Building 6610	No		12/17/2003	Yes	Yes	No
Building 6620	Yes	6620	11/7/2017	Yes	Yes	No
Building 8895	No		07/29/2008	No	No	Yes
Building 9920	No		06/03/2017	Yes	Yes	No
Building 9939	Yes	9939	11/07/2017	Yes	Yes	No
Building 9990	Yes	9990, 9991, 9992, 9993, 9994	12/12/2005	Yes	No	Yes
Coronado Club	No		2011	No	No	Yes
Gun Site	Yes	S6624, 6625	2017	Yes	Yes	Yes
Hydraulic Centrifuge Facility	Yes	6520, 6526, 6527	12/17/2003			
Old Centrifuge	Yes	Centrifuge and control shelter	2011	No	No	Yes
S9800B	No		2001			Yes
Technical Area II	Yes		1988	No	No	Complete
Telescope Facility—Laser Applications Facility	Yes	952, 952A, 952G, 952L	03/22/2017	Yes	Yes	No

[a] Historic American Building Survey/Historic American Engineering Record documentation, including large- and medium-format photographs, photographic descriptions, and a written historical and architectural summary of a property.

8.5.3 Historic Building Assessments in 2020

In 2020, the historian completed historic building assessments in response to 70 proposed actions at 65 properties. This was an increase over previous years, largely due to three projects that involved multiple buildings. A DOE-sponsored Roof Asset Management Project resulted in proposals to reroof 26 buildings and repair the roofs on 6 buildings. Consultation is ongoing for some of these actions, although none are anticipated to have an adverse effect on any historic properties. The roof work generally involves replacement in kind and does not affect the design, appearance, or operation of any historic property.

In the other two projects involving multiple facilities, communications equipment will be added to the exteriors of 14 buildings. The historian's assessment of the impact of this work resulted in the recommendation that there would be no adverse effects to any historic properties. The equipment will not damage the building exteriors. One project remains with DOE for review.

Other projects included minor laboratory and room upgrades, replacement and upgrade of utilities, and the addition of transportainers for equipment storage. A proposal to add a ramp that is compliant with the Americans with Disabilities Act to the front of Building 809 will have an adverse effect on the building's design, but the design of the new ramp and entrance is expected to mitigate the adverse effect, maintaining the building's historic condition. DOE consultation with the State Historic Preservation Officer on this matter is not complete yet.

In 2015, Sandia personnel proposed the removal of test structures at 15 environmental restoration sites where Sandia had conducted activities on KAFB property. The historian provided historic property assessments of the sites to DOE in 2016. DOE provided the information to KAFB, which consulted with the State Historic Preservation Office in 2016. One of the sites—identified as environmental restoration Site 57A and part of the area known as the Workman Site where proximity fuze testing was conducted during World War II—included historic properties, which Sandia personnel are documenting with large-format photography and a written historical and architectural summary. KAFB will review the documentation and consult with the State Historic Preservation Office before the properties are demolished.

8.6 Quality Check and Validation of Process

Each fiscal year, Cultural Resource Management Program personnel validate 20 NEPA checklists from the previous fiscal year. The review focuses on archaeological concerns for 10 checklists and on historic building issues for the other 10 checklists. The validation activity verifies that cultural resources were addressed in each checklist, that the projects did not include an activity that should have but did not receive cultural resources review, and that projects that did receive cultural resources review were carried out as expected. The goal is to ensure that all projects needing cultural resources review are identified during the NEPA checklist review and that reviewed projects are keeping to their agreed-upon scope and impact. This is also an opportunity to verify that any mitigating actions were taken and/or are on schedule for completion.

8.7 Additional Activities

To provide information to the public about cultural resources, a website (Sandia's Cultural Resources in New Mexico) was created to provide historical information about and photographs of properties determined to be historic that have been demolished. Building on the mitigation documentation prepared for the demolished sites, the website provides details regarding the origin, purpose, evolution, and reasons for disuse of five properties and one district that were eligible for the National Register of Historic Places. Sandia personnel plan to continue adding properties to the site:

https://www.sandia.gov/about/history/hb/index.html

Chapter 9. Quality Assurance

Blue grama (*Bouteloua gracilis*)

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

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

9.1 Environmental Monitoring for Quality Assurance

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

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

9.1.1 Sample Management Office

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

9.1.2 Contract Laboratory Selection

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

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

9.1.3 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 Sample Management Office Statement of Work for Analytical Laboratories (SNL/NM 2020f). 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.

9.1.4 Data Validation and Records Management

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

The data are validated at a minimum of three levels:

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

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

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

9.2 Sample Management Office Activities

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

In 2020, Sample Management Office personnel processed 3,934 samples in support of programs and projects at SNL/NM.

9.2.1 Sample Handling and Analyses

In 2020, Sample Management Office personnel processed 3,934 samples in support of programs and projects at SNL/NM. Of the 3,934 samples, 1,153 were submitted as field and analytical quality control samples to assist with data validation and decision-making. The following programs and projects were supported by Sample Management Office services in 2020:

- Air Quality Compliance
- Decontamination and Demolition
- Environmental Restoration Operation

- Long-Term Stewardship
- Terrestrial Surveillance
- Waste Management
- Water Quality

During 2020, the following contract laboratories were employed to analyze samples:

- ALS Environmental in Salt Lake City, Utah, and Cincinnati, Ohio
- Cape Fear Analytical, LLC, in Wilmington, North Carolina
- Eurofins Test America in multiple locations
- General Engineering Laboratories in Charleston, South Carolina
- Hall Environmental Analysis Laboratory in Albuquerque, New Mexico
- Landauer, Inc., in Glenwood, Illinois
- New Mexico Department of Health in Albuquerque, New Mexico
- Pace Analytical Gulf Coast Laboratory, in Baton Rouge, Louisiana
- Radonova Laboratories in Westmont, Illinois
- SiREM in Knoxville, Tennessee
- Southwest Research Institute in San Antonio, Texas
- Trace Analytics LLC in Austin, Texas

9.2.2 Laboratory Quality Assurance Assessments and Validation

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

9.2.3 Quality Assurance Audits

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

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

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

Chapter 10. Environmental Permits and Mixed Waste History

Young barn owls (*Tito alba*) in a nest box

OVERVIEW ■ Sandia personnel maintain current environmental-related permits and information on the history and quantities of mixed waste at SNL/NM.

Table 10-1 presents environmental-related permits. Table 10-2 summarizes the compliance history of mixed waste at SNL/NM, and Table 10-3 lists the quantity of mixed waste subject to the Federal Facility Compliance Order at the end FY 2020.

Table 10-1. Summary of environmental permits and registrations in effect, 2020

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Sewer Wastewater					
General	WW001 Station Manhole, south of TA-IV at Tijeras Arroyo	2069A	2/28/2018	1/31/2023	ABCWUA
General	WW006 Station Manhole, at Pennsylvania Avenue	2069F	8/12/2019	7/1/2024	ABCWUA
Microsystems and Engineering Sciences Applications Complex	WW007 Station Manhole, TA-I	2069G	2/19/2020	12/31/2024	ABCWUA
General	WW008 Station Manhole, south of TA-II at Tijeras Arroyo	2069I	8/12/2019	7/1/2024	ABCWUA
General	WW011 Station Manhole, north of TA-III (includes TA-III and TA-V sewer lines and Coyote Test Field sewer lines)	2069K	9/27/2019	8/31/2024	ABCWUA

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Center for Integrated Nanotechnologies	Center for Integrated Nanotechnologies	2238A	5/1/2016	4/30/2021	ABCWUA
Surface Discharge					
Pulsed Power Development Facilities (Discharge Permit)	TA-IV, Lagoon I and Lagoon II	DP-530	9/5/2014	9/5/2019[a]	NMED
Ground Water (Discharge Permit)	TA-V	DP-1845	5/20/2017	5/29/2022	NMED
Underground Storage Tanks					
Underground Storage Tank (20,000 gallons)	TA-I	1554	7/1/2020	6/30/2021	NMED
Underground Storage Tank (20,000 gallons)	TA-I	1555	7/1/2020	6/30/2021	NMED
Aboveground Storage Tanks					
Aboveground Storage Tank (3,020 gallons)	TA-I	1551	7/1/2020	6/30/2021	NMED
Aboveground Storage Tank (2,119 gallons)	TA-I	1552	7/1/2020	6/30/2021	NMED
Aboveground Storage Tank (2,000 gallons)	TA-I	1553	7/1/2020	6/30/2021	NMED
Aboveground Storage Tank (5,000 gallons)	TA-III	1556	7/1/2020	6/30/2021	NMED
Aboveground Storage Tank (5,500 gallons)	Coyote Test Field	1557	7/1/2020	6/30/2021	NMED
Aboveground Storage Tank (4,500 gallons)	TA-IV	1558	7/1/2020	6/30/2021	NMED
Aboveground Storage Tank (1,500 gallons)	TA-I	1559	7/1/2020	6/30/2021	NMED
NPDES Rio Grande Watershed-Based Municipal Separate Storm Sewer System Permit					
NPDES Municipal Separate Storm Sewer System Permit	TA-I, TA-II, and TA-IV	NTESS: NMR04A012 DOE: NMR04A011	12/22/2015 11/18/2015	12/19/2019 (the permit has entered into administrative continuance and remains in effect until EPA issues a new permit)	EPA
NPDES Multi-Sector General Permit					
NPDES Multi-Sector General Permit	SNL/NM industrial discharge locations	NTESS: NMR04A012 DOE: NMR04A011	9/30/2015	6/4/2020 (the permit has entered into administrative continuance and remains in effect until EPA issues a new permit)	EPA
Dynamic Explosives Test Site North	Thunder Range	NTESS: NMR1000FE DOE: NMR1000F1	5/30/2017 5/16/2017	Construction General Permit expires 2/16/2022	EPA
Building 905 Addition	TA-II	NTESS: NMR1000FF	5/30/2017	Construction General Permit expires 2/16/2022	EPA
Brayton Cycle Gas Line	TA-III	NTESS: NMR1000FG	5/30/2017	Construction General Permit expires 2/16/2022	EPA

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Long Sled Track Clearing	TA-III	NTESS: NMR1000FH	5/30/2017	Construction General Permit expires 2/16/2022	EPA
6000 Igloos	6000 Igloos	NTESS: NMR1000FJ	5/30/2017	Construction General Permit expires 2/16/2022	EPA
Battery Test Facility	TA-II	NTESS: NMR1000XA	11/27/2017	Construction General Permit expires 2/16/2022	EPA
TA-III to TA-V Waterline Replacement	TA-III and TA-V	NTESS: NMR1001BR	5/16/2018	Construction General Permit expires 2/16/2022	EPA
Coyote Test Field Volt Feeder	Coyote Test Field	NTESS: NMR1001GL	7/18/2018	Construction General Permit expires 2/16/2022	EPA
Substation 5 Loop	TA-III	NTESS: NMR1001R7	11/28/2018	Construction General Permit expires 2/16/2022	EPA
TA-IV Escarpment	TA-IV	NTESS: NMR1001X4	2/27/2019	Construction General Permit expires 2/16/2022	EPA
Building 812	TA-I	NTESS: NMR1002DJ	9/12/2019	Construction General Permit expires 2/16/2022	EPA
Groundwater Well Installation	Coyote Test Field	NTESS: NMR1002F4	9/26/2019	Notice of Intent terminated 3/6/2020	EPA
Building 972	TA-IV	NTESS: NMR10020U	3/29/2019	Construction General Permit expires 32/16/2022	EPA
Building 996 Drainage	TA-II	NTESS: NMR1002P9 DOE: NMR1002PH	1/15/2020 1/17/2020	Notice of Intent terminated 9/14/2020	EPA
Building 6639 Drainage	TA-III	NTESS: NMR1002QV	2/4/2020	Notice of Intent terminated 9/14/2020	EPA
Thunder Range 5K Overhead Feeder	TA-III, Coyote Test Field	NTESS: NMR1002XE DOE: NMR1002YL	6/25/2020 5/1/2020	Construction General Permit expires 2/16/2022	EPA
700K Water Tank Feeder	Coyote Test Field	NTESS: NMR1002XF DOE: NMR1002YK	4/17/2020 5/1/2020	Construction General Permit expires 2/16/2022	EPA
Corrective Action Management Unit Drainage	TA-III	NTESS: NMR1002XH	4/17/2020	Notice of Intent terminated 9/14/2020	EPA
TA-IV Temporary Structure	TA-IV	NTESS: NMR10026L	6/18/2019	Notice of Intent terminated 3/6/2020	EPA
Natural Gas Pipeline	TA-I, TA-II, TA-IV	NTESS: NMR10026M	6/18/2019	Notice of Intent terminated 3/6/2020	EPA
Contractor Laydown Yard	TA-II	NTESS: NMR10027B	6/26/2019	Notice of Intent terminated 9/14/2020	EPA
Building 706 (High Bay)	TA-I	NTESS: NMR10027C	6/26/2019	Construction General Permit expires 2/16/2022	EPA

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
TA-II Escarpment	TA-II	NTESS: NMR1002LR	12/9/2019	Construction General Permit expires 2/16/2022	EPA
Contractor Laydown Yards	TA-I and TA-II	NTESS: NMR1003CF	9/12/2020	Construction General Permit expires 2/16/2022	EPA
Ecological					
New Mexico Department of Game and Fish Nuisance Permit	Site-wide ecological monitoring activity	119	1/12/2021	12/31/2021	New Mexico Department of Game and Fish
New Mexico Department of Game and Fish for Scientific/Educational Purposes Authorization for Taking of Protected Wildlife	Site-wide ecological monitoring activity	3757	1/16/2020	12/31/2022	New Mexico Department of Game and Fish
Resource Conservation and Recovery Act					
Hazardous Waste Permit (Post-Closure Care)	Chemical Waste Landfill	NM5890110518	Issued 10/15/2009; effective 6/2/2011	6/2/2021	NMED
RCRA Facility Operating Permit	• Hazardous Waste Handling Unit • Thermal Treatment Unit • Radioactive and Mixed Waste Management Unit • Auxiliary Hot Cell Unit • Manzano Storage Bunkers (5) • Corrective Action Management Unit	NM5890110518	Issued 1/27/2015; effective 2/26/2015	2/26/2025	NMED
Open Burning and/or Detonation					
Multiple Event Open Burn Permit	9920 Test Site	20-0004	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	9930 Test Site	20-0005	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	9939 Test Site	20-0006	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Dynamic Explosive Training Site Complex	20-0007	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Rocket Sled Track	20-0008	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	National Solar Thermal Test Facility	20-0009	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Thermal Treatment Unit	20-0010	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Thunder Range Test Site	20-0011	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	20-0012	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	20-0013	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	20-0014	1/1/2020	12/31/2020	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	20-0015	1/1/2020	12/31/2020	City of Albuquerque

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Stationary Source (Air)					
Document Disintegrator	TA-III	Permit 144-M1	9/28/2006	N/A	City of Albuquerque
Neutron Generator Facility	TA-I	Permit 374-M2-1TR	9/25/2017	N/A	City of Albuquerque
Standby Diesel Generators at Substation 41	TA-I	Permit 402-M1	10/27/2017	N/A	City of Albuquerque
Radioactive and Mixed Waste Management Unit	TA-III	Permit 415-M2-RV1	9/23/2011	N/A	City of Albuquerque
Title V Operating Permit	Site-wide	Permit 515 (pending)	Submitted 3/1/1996	N/A	City of Albuquerque
Emergency Generator at Building 702	TA-I	Permit 924-RV1	2/8/2012	N/A	City of Albuquerque
Processing and Environmental Technology Laboratory Emergency Generator	TA-I	Permit 925-M2	4/11/2012	N/A	City of Albuquerque
Thermal Test Complex	TA-III	Permit 1712-RV2	5/20/2016	N/A	City of Albuquerque
Center for Integrated Nanotechnologies	Sandia Science and Technology Park	Permit 1725-M1	4/12/2012	N/A	City of Albuquerque
Microsystems and Engineering Sciences Applications Facility Boilers and Generators	TA-I	Permit 1820-M1-RV1	9/16/2015	N/A	City of Albuquerque
Southeast TA-I Generator	TA-I	Permit 1828	9/28/2006	N/A	City of Albuquerque
Strategic Defense Facility, Building 963	TA-IV	Permit 1900	1/11/2008	N/A	City of Albuquerque
Site-Wide Chemical Use	Site-wide	Permit 1901-M1	10/10/2016	N/A	City of Albuquerque
Building 962 Generator	TA-IV	Permit 1930-RV1	2/3/2012	N/A	City of Albuquerque
Building 833 Generator	TA-I	Permit 2097-M3	12/4/2019	N/A	City of Albuquerque
Building 880 Boiler and Generator	TA-I	Permit 2116-M1	9/10/2015	N/A	City of Albuquerque
Lurance Canyon Burn Site Igloo and Fire Laboratory for Accreditation of Modeling by Experiment	Remote	Permit 3216-M1	7/1/2016	N/A	City of Albuquerque
Explosives Components Facility	TA-II	Registration 547-RV1	9/27/2011	N/A	City of Albuquerque
Advanced Manufacturing Prototype Facility	TA-I	Registration 1406-M1-RV1	10/4/2011	N/A	City of Albuquerque
Building 899A Boiler	TA-I	Registration 1823-RV1	9/30/2011	N/A	City of Albuquerque
Building 878 Boiler	TA-I	Registration 1888-RV1	5/11/2011	N/A	City of Albuquerque
Building 865 Boiler	TA-I	Registration 1902-RV1	11/30/2010	N/A	City of Albuquerque
Building 802 Boiler	TA-I	Registration 2109	10/28/2010	N/A	City of Albuquerque
Building 804 Boiler	TA-I	Registration 2110	11/8/2010	N/A	City of Albuquerque

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Building 810 Boiler	TA-I	Registration 2111	11/8/2010	N/A	City of Albuquerque
Building 823 Boiler	TA-I	Registration 2112	11/8/2010	N/A	City of Albuquerque
Building 840 Boiler	TA-I	Registration 2113	11/8/2010	N/A	City of Albuquerque
Building 857 Boiler	TA-I	Registration 2114	11/8/2010	N/A	City of Albuquerque
Building 860 Boiler	TA-I	Registration 2115	11/8/2010	N/A	City of Albuquerque
Building 890 Boiler	TA-I	Registration 2117	11/29/2010	N/A	City of Albuquerque
Building 887 Boiler	TA-I	Registration 2118	11/29/2010	N/A	City of Albuquerque
Building 891 Boiler	TA-I	Registration 2119	11/29/2010	N/A	City of Albuquerque
Building 892 Boiler	TA-I	Registration 2120	11/30/2010	N/A	City of Albuquerque
Building 894 Boiler	TA-I	Registration 2121	11/30/2010	N/A	City of Albuquerque
Building 897 Boiler	TA-I	Registration 2122	11/30/2010	N/A	City of Albuquerque
Building 960 Boiler	TA-IV	Registration 2169	9/27/2011	N/A	City of Albuquerque
Building 895 Boiler	TA-I	Registration 2170	9/27/2011	N/A	City of Albuquerque
Building 800 Boiler	TA-I	Registration 2171	9/27/2011	N/A	City of Albuquerque
Building 6585 Boiler	TA-V	Registration 2172-RV1	1/26/2012	N/A	City of Albuquerque
Building 6597 Boiler	TA-V	Registration 2173	2/10/2012	N/A	City of Albuquerque
Building 6580 Boiler	TA-V	Registration 2174-RV1	2/26/2012	N/A	City of Albuquerque
Building 981 Boiler	TA-IV	Registration 2175	9/22/2011	N/A	City of Albuquerque
Building 983 Boiler	TA-IV	Registration 3111	9/13/2013	N/A	City of Albuquerque
Building 963 Boiler	TA-IV	Registration 3211	2/15/2015	N/A	City of Albuquerque
Building 970 Boiler	TA-IV	Registration 3302	12/29/2016	N/A	City of Albuquerque
Fugitive Dust Control Construction, Demolition, and Programmatic, as of 12/31/2020					
Fugitive Dust Control Programmatic Permit	Site-wide	8683-P	6/12/2017	6/12/2022	City of Albuquerque
Replace 5 kV Feeder	Remote	9417-C	7/17/2018	7/17/2020	City of Albuquerque
Substation 5 Loop	TA-III	9669-C	11/29/2018	11/29/2020	City of Albuquerque
2K Sled Track Paving Project	TA-III	9700-C	1/7/2019	1/7/2021	City of Albuquerque
TA-IV Escarpment	TA-IV	9815-C	3/18/2019	3/18/2021	City of Albuquerque
Building 972	TA-II	9831-C	4/4/2019	4/4/2021	City of Albuquerque

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
20th Street Parking Lot	TA-II	9842-C	4/4/2019	4/4/2021	City of Albuquerque
TA-IV Temporary Building	TA-IV	9956-C	6/27/2019	6/27/2021	City of Albuquerque
Building 9940H	Coyote Test Field	9917-C	6/6/2019	6/6/2022	City of Albuquerque
Building 706	TA-I	9987-C	7/5/2019	7/5/2021	City of Albuquerque
Contractor Laydown Yard	TA-II	0001-C	7/11/2019	7/11/2021	City of Albuquerque
Atmospheric Research Instrumentation and Systems Relocation	TA-II	0018-C	8/19/2019	8/12/2020	City of Albuquerque
Groundwater Well Installation	Coyote Test Field	0050-C	9/9/2019	9/9/2021	City of Albuquerque
Building 812	TA-I	0059-C	9/18/2019	9/18/2023	City of Albuquerque
TA-IV Modular Building	TA-IV	0061-C	9/20/2019	9/20/2023	City of Albuquerque
20th and G Realignment	TA-I	0066-C	10/2/2019	10/2/2023	City of Albuquerque
9940X	Coyote Test Field	0428-C	3/1/2020	5/8/2022	City of Albuquerque
5 kV Overhead Feeder	Remote	0460-C	6/15/2020	6/15/2022	City of Albuquerque
Sled Track Monuments	TA III	0634-C	9/3/2020	9/3/2022	City of Albuquerque
700K Water Tank Feed	Coyote Test Field	0646-C	9/22/2020	9/22/2022	City of Albuquerque

[a] Renewal for Surface Discharge Permit DP-530 was submitted to DOE for transmittal to NMED on February 21, 2019, in compliance with a request from NMED dated September 5, 2014. Additional information was submitted at the request of NMED on May 24, 2019. NMED issued a public notice of the application renewal on August 23, 2019. A new permit for DP-530 has not yet been issued. The expired permit has been administratively extended until a new permit is issued.
N/A = not applicable

Table 10-2. Summary of compliance history with regard to mixed waste

Date	Milestone	Comment
Nov 1984	1984 HSWA to RCRA	Experienced an issue with extended storage after HSWA established land disposal restrictions and a prohibition on storage of wastes for more than one year.
Aug 1990	RCRA Part A interim status permit application submitted	Submitted the RCRA Part A interim status permit application to NMED for mixed waste storage. Later revisions to the interim status application were added to include proposed mixed waste treatment processes.
Oct 1992	FFCA passed	The FFCA allows storage of mixed waste that does not meet the applicable treatment standard beyond the one-year RCRA time limit. This required DOE to submit a site treatment plan for mixed waste.
Dec 1992	Notice of Noncompliance issued	EPA issued a Notice of Noncompliance for storage of RCRA-regulated mixed waste over the one-year maximum period.
Oct 1993	Conceptual site treatment plan submitted	DOE submitted a conceptual site treatment plan for mixed waste to NMED; subsequent drafts followed.
Mar 1995	Final site treatment plan submitted	DOE submitted a final site treatment plan for mixed waste to NMED.
Jun 1995	HDRV Project initiated	The HDRV Project was initiated to characterize and sort legacy mixed waste. The project continued into 1997, when it was replaced with new sorting procedures.
Oct 1995	FFCO signed	The FFCO, an agreement between NMED, DOE, and Sandia personnel, detailed specific actions required with regard to mixed waste management, including the requirement to develop a site treatment plan, to be updated annually.
Mar 1996	Site treatment plan milestones met	Updated the site treatment plan to reflect FY 1995 activities.
Sep 1996	First mixed waste shipment made FFCO Amendment No. 1	The first mixed waste shipment was made; mixed waste was sent to Perma-Fix/ Diversified Scientific Services, Inc., for treatment. The FFCO was amended.
Dec 1996	N/A	DOE and Sandia personnel resubmitted the RCRA Part A and Part B permit application to reflect revisions to proposed on-site treatment methods.
May 1997	FFCO Amendment No. 2	The FFCO was amended.
Dec 1997	On-site mixed waste treatment	On-site treatment of mixed waste began at the Radioactive and Mixed Waste Management Unit in compliance with regulatory requirements.
1997–2001	Site treatment plan milestones met	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones. Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies. NMED approved revisions 1 through 5 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
May 2001	FFCO Amendment No. 3	The FFCO was amended.
Feb 2002	N/A	DOE and Sandia personnel submitted the updated RCRA Part A and Part B permit application to NMED to reflect revisions to on-site waste management operations. Permit application for mixed waste management units was combined with permit renewal requests for hazardous waste management units.

Date	Milestone	Comment
2002–2003	Site treatment plan milestones met	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones. Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies. NMED approved revisions 6 and 7 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
Apr 2003, Nov 2003	N/A	DOE and Sandia personnel revised the RCRA Part A and Part B permit application in response to NMED comments.
Apr 2004	FFCO Amendment No. 4	The FFCO was amended.
Nov 2004	N/A	DOE and Sandia personnel revised the RCRA Part A and Part B permit application in response to NMED comments.
2004–2007	Site treatment plan milestones met	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones. Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies. NMED approved revisions 8 through 11 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
Jun 2005, Oct 2005, May 2006, Mar 2007	N/A	DOE and Sandia personnel revised the RCRA Part A and Part B permit application to reflect changes in waste management operations.
Aug 2007	N/A	NMED issued a draft RCRA permit to DOE and Sandia personnel and made it available for public comment.
Jan 2008	N/A	DOE and Sandia personnel submitted extensive comments on the draft permit to NMED and requested resolution of comments.
2008–2010	Site treatment plan milestones met	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones. Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies. NMED approved Revision 12 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
Oct 2009, Nov 2010	N/A	DOE and Sandia personnel revised the RCRA Part B permit application to reflect changes in waste management operations.
Dec 2010	FFCO Amendment No. 5	The FFCO was amended to extend certain compliance deadlines.
2011	Site treatment plan milestones met	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones. Completed disposition of all mixed wastes subject to the site treatment plan in compliance with applicable deadlines. Updated the site treatment plan to reflect FY 2010 activities.
Oct 2011, May 2012	N/A	DOE and Sandia personnel revised the RCRA Part A and Part B permit application to reflect changes in waste management operations.
Sep 2012	N/A	NMED issued a draft RCRA permit to DOE and Sandia personnel and made it available for public comment.
Nov 2012	N/A	DOE and Sandia personnel submitted comments on the draft permit to NMED and requested resolution of comments.

Date	Milestone	Comment
2012–2014	N/A	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements. Updated the site treatment plan annually to reflect waste management activities and waste volumes. Requested approval of Revision 14 to the site treatment plan to revise waste volumes, establish new deadlines, and provide continuity.
Dec 2014	N/A	NMED approved Revision 14 to the site treatment plan, which revised waste volumes and established new deadlines.
Jan 2015	N/A	NMED issued the RCRA Facility Operating Permit for SNL/NM. The permit includes mixed waste storage and treatment units.
2015–2016	N/A	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements. Updated the site treatment plan annually to reflect waste management activities and waste volumes. Requested approval of Revision 15 to the site treatment plan to establish new deadlines, update waste management technologies, and provide continuity.
Oct 2016	N/A	NMED approved Revision 15 to the site treatment plan, which revised waste volumes and technologies, and established new deadlines.
2017–2020	N/A	Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements. Updated the site treatment plan to reflect waste management activities and waste volumes. Requested approval of Revision 16 to the site treatment plan to revise waste volumes, update waste management technologies, establish new deadlines, and provide continuity.

FFCA = Federal Facility Compliance Act
FFCO = Federal Facility Compliance Order
HDRV = Historical Disposal Requests Validation
HSWA = Hazardous and Solid Waste Amendment
N/A = not applicable

Table 10-3. Quantity of mixed waste subject to the Federal Facility Compliance Order, end of FY 2020

Waste Category	Volume (m^3)	Description	Status and Plans
TG 1	0	Inorganic debris with an explosives component	No waste currently in inventory
TG 2	0	Inorganic debris with a water-reactive component	No waste currently in inventory
TG 3	0	Reactive metals	No waste currently in inventory
TG 4	0	Elemental lead	No waste currently in inventory
TG 5	0	Aqueous liquids (corrosive)	No waste currently in inventory
TG 6	0	Elemental mercury	No waste currently in inventory
TG 7	0	Organic liquids I	No waste currently in inventory
TG 8	0	Organic debris with organic contaminants	No waste currently in inventory
TG 9	0	Inorganic debris with TCLP metals	No waste currently in inventory
TG 10	0	Heterogeneous debris	No waste currently in inventory
TG 11	0	Organic liquids II	No waste currently in inventory
TG 12	0	Organic debris with TCLP metals	No waste currently in inventory
TG 13	0	Oxidizers	No waste currently in inventory
TG 14	0	Aqueous liquids with organic contaminants	No waste currently in inventory
TG 15	0	Soils < 50 percent debris and particulates with TCLP metals	No waste currently in inventory
TG 16	0	Cyanide waste	No waste currently in inventory
TG 17	0	Liquid or solid with organic and/or metal contaminants	No waste currently in inventory
TG 18	0	Particulates with organic contaminants	No waste currently in inventory
TG 19	0	Liquids with metals	No waste currently in inventory
TG 20	0	Propellant with TCLP metals	No waste currently in inventory
TG 21	0	Sealed sources with TCLP metals	No waste currently in inventory
TG 22	0	Reserved	N/A
TG 23	0	Thermal batteries	No waste currently in inventory
TG 24	0	Spark gap tubes with TCLP metals	No waste currently in inventory
TG 25	0	Classified items with TCLP metals	No waste currently in inventory
TG 26	0	Debris items with reactive compounds and TCLP metals	No waste currently in inventory
TG 27	0	High mercury solids and liquids	No waste currently in inventory
MTRU	1.64	Mixed transuranic waste	Stored at SNL/NM; awaiting shipment to the Waste Isolation Pilot Project

N/A = not applicable
TCLP = toxicity characteristic leaching procedure

Appendix A. Summary of Groundwater Monitoring in 2020

Tarantula hawk wasp (*Pepsis formosa*), the official state insect of New Mexico

Table A-1. Sample collection events for groundwater quality monitoring at SNL/NM, 2020

Sampling Event	Groundwater Monitoring Program (16 wells plus 1 spring)	Chemical Waste Landfill (4 wells)	Mixed Waste Landfill (4 wells)	TA-V Groundwater Area of Concern (17 wells)	Tijeras Arroyo Groundwater Area of Concern (21 wells)	Burn Site Groundwater Area of Concern (14 wells)
January		√				√
February				√	√	
March	√				√	
April	√					√
May			√	√		
June				√	√	
July		√				√
August				√	√	
September				√	√	
October						√
November			√	√		√
December				√	√	

Note: Number of active wells sampled was 77, number of analyses performed was 14,375, and percent of non-detected results was 84 percent.

Table A-2. SNL/NM groundwater monitoring analytical results, 2020

Analyte	Number of Detects	Number of Non-Detects	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Summary of Field Water Quality Parameters Prior to Sample Collection (units as indicated below)						
pH in standard units	166	0	6.10	7.83	7.40	NE
Specific conductivity in µmhos/cm	166	0	320.6	4,139.9	715.7	NE
Temperature in °C	166	0	12.57	26.54	19.13	NE
Turbidity in nephelometric turbidity units	166	0	0.13	76.3	2.24	NE
Detected Inorganic Parameters in mg/L						
Nitrate plus nitrite	191	0	0.125	49.6	8.217	10.0
Bromide	89	1	0.144	2.71	0.539	NE
Chloride	90	0	10.4	470	50.6	NE
Fluoride	88	2	0.228	2.70	1.024	4.0
Sulfate	90	0	16.2	2,110	117.5	NE
Total organic halogens	7	14	0.00386	0.0142	0.00835	NE
Alkalinity as $CaCO_3$	82	0	83.2	1,050	211.6	NE
Detected Metals in mg/L						
Aluminum	20	76	0.0241	0.574	0.1460	NE
Antimony	1	95	0.00104	0.00104	0.00104	0.006
Arsenic	116	45	0.00202	0.00957	0.00325	0.010
Barium	96	0	0.00941	0.230	0.07053	2.0
Beryllium	6	96	0.00219	0.00721	0.00315	0.004
Cadmium	2	104	0.000362	0.000370	0.000366	0.005
Calcium	96	0	40.0	343	90.3	NE
Chromium	14	102	0.00320	0.122	0.0294	0.100
Cobalt	8	86	0.000310	0.00967	0.00195	NE
Copper	31	65	0.000305	0.00333	0.000630	NE
Iron	40	121	0.0335	0.696	0.1621	NE
Magnesium	96	0	3.44	66.1	20.50	NE
Manganese	49	105	0.0010	1.57	0.0757	NE
Mercury	2	115	0.000101	0.000106	0.000103	0.002
Molybdenum	16	0	0.00312	0.00679	0.00444	NE
Nickel	36	80	0.000636	0.0236	0.002577	NE
Potassium	96	0	1.40	30.2	3.32	NE
Selenium	67	29	0.00203	0.0282	0.00518	0.050
Silver	2	94	0.000449	0.00120	0.000824	NE
Sodium	96	0	14.1	1,120	57.1	NE
Thallium	1	95	0.00131	0.00131	0.00131	0.002
Uranium	76	0	0.000246	0.0173	0.004582	0.030
Vanadium	47	49	0.00397	0.0127	0.00677	NE
Zinc	33	63	0.00340	0.0396	0.00748	NE
Detected Organic Compounds in µg/L						
Chloroform	9	177	0.330	1.01	0.803	80.0[a]
Dichlorobenzene, 1,3-	1	170	0.830	0.830	0.830	NE
Dichloroethane, 1,1-	10	171	0.370	5.06	1.793	NE

Analyte	Number of Detects	Number of Non-Detects	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Dichloroethene, 1,1-	6	180	0.360	2.26	1.398	7.0
Dichloroethene, cis-1,2-	39	142	0.370	6.76	1.577	70.0
Dichloropropene, trans-1,3-	1	180	0.670	0.670	0.670	NE
Tetrachloroethene	10	176	0.350	7.88	2.764	5.0
Toluene	3	178	0.390	0.640	0.477	1,000
Trichloroethene	76	115	0.320	15.9	4.831	5.0
Dioxane, 1,4-	21	79	0.108	1.34	0.576	NE
Diesel Range Organics	2	44	109	373	241	NE
Detected Radiological Parameters in pCi/L						
Alpha, gross (corrected)	100	0	-5.39	12.90	2.84	15.0[b]
Beta, gross	93	7	1.72	31.0	4.83	4 mrem/yr
Potassium-40	3	91	39.6	89.7	61.4	NE
Radium-226	9	12	0.235	0.913	0.582	5.0[c]
Radium-228	3	18	0.564	1.59	0.941	5.0[c]
Radon-222	10	0	81.1	559	293.2	4,000
Tritium	3	76	−44.0	497	153	NE
Uranium-233/234	38	0	0.43	34.8	10.8	NE
Uranium-235/236	34	4	0.0847	0.484	0.1994	NE
Uranium-238	38	0	0.095	6.04	2.255	NE

[a] The 80.0 µg/L MCL is for combined trihalomethanes.
[b] The 15.0 pCi/L MCL is for corrected gross alpha activity.
[c] The 5.0 pCi/L MCL is for combined Ra-226 and Ra-228.
$CaCO_3$ = calcium as carbon carbonate
corrected = gross alpha results reported as corrected values (uranium activities subtracted out)
MCL = maximum contaminant level
NE = not established

Table A-3. Exceedances for SNL/NM groundwater monitoring wells and springs sampled, 2020

Analyte	Well	Exceedance	Date
Beryllium MCL = 0.004 mg/L	Coyote Springs	0.00721 mg/L[a]	April 2020
Chromium MCL = 0.100 mg/L	AVN-1	0.112 mg/L	May 2020
		0.122 mg/L	September 2020
	AVN-1 (duplicate)	0.115 mg/L	May 2020
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	AVN-1	10.1 mg/L	May 2020
	CYN-MW9	49.6 mg/L	April 2020
		36.6 mg/L	November 2020
	CYN-MW11	11.5 mg/L	April 2020
	CYN-MW12	19.6 mg/L	April 2020
		15.6 mg/L	November 2020
	CYN-MW13	38.4 mg/L	April 2020
		30.2 mg/L	November 2020
	CYN-MW13 (duplicate)	40.0 mg/L	April 2020
	CYN-MW14A	14.5 mg/L	April 2020
		12.4 mg/L	October 2020
	CYN-MW14A (duplicate)	12.2 mg/L	October 2020
	CYN-MW15	24.3 mg/L	April 2020
		21.6 mg/L	November 2020
	CYN-MW15 (duplicate)	25.9 mg/L	April 2020
	CYN-MW16	11.7 mg/L	January 2020
	LWDS-MW1	13.7 mg/L	February 2020
		12.8 mg/L	June 2020
		14.6 mg/L	August 2020
		12.2 mg/L	December 2020
	LWDS-MW1 (duplicate)	12.7 mg/L	February 2020
		12.1 mg/L	December 2020
	TA2-W-19	12.1 mg/L	March 2020
		12.0 mg/L	June 2020
		11.5 mg/L	September 2020
		11.8 mg/L	December 2020
	TA2-W-28	16.8 mg/L	March 2020
		17.8 mg/L	June 2020
		17.1 mg/L	September 2020
		17.6 mg/L	December 2020
	TA2-W-28 (duplicate)	17.3 mg/L	March 2020
		16.8 mg/L	September 2020
	TAV-MW10	11.4 mg/L	February 2020
		11.0 mg/L	June 2020
		11.6 mg/L	August 2020
		12.0 mg/L	December 2020
	TAV-MW10 (duplicate)	11.8 mg/L	August 2020
	TJA-2	12.0 mg/L	March 2020
		11.8 mg/L	June 2020
		10.7 mg/L	September 2020

Analyte	Well	Exceedance	Date
		11.6 mg/L	December 2020
	TJA-2 (duplicate)	11.8 mg/L	June 2020
	TJA-4	31.3 mg/L	March 2020
		31.0 mg/L	June 2020
		29.2 mg/L	September 2020
		31.9 mg/L	December 2020
	TJA-4 (duplicate)	30.6 mg/L	December 2020
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	TJA-5	16.7 mg/L	September 2020
	TJA-7	22.7 mg/L	March 2020
		22.0 mg/L	June 2020
		20.7 mg/L	September 2020
		22.2 mg/L	December 2020
	TJA-7 (duplicate)	22.1 mg/L	June 2020
Tetrachloroethene MCL = 5.0 µg/L	TA2-W-26	7.59 µg/L	December 2020
	TA2-W-26 (duplicate)	7.88 µg/L	December 2020
Trichloroethene MCL = 5.0 µg/L	LWDS-MW1	11.2 µg/L	February 2020
		13.6 µg/L	June 2020
		13.2 µg/L	August 2020
		14.1 µg/L	December 2020
	LWDS-MW1 (duplicate)	14.8 µg/L	February 2020
		13.3 µg/L	December 2020
	TA2-W-26	11.6 µg/L	September 2020
		15.7 µg/L	December 2020
	TA2-W-26 (duplicate)	15.9 µg/L	December 2020
	TAV-MW4	5.18 µg/L	August 2020
		5.08 µg/L	November 2020
	TAV-MW4 (duplicate)	5.03 µg/L	February 2020
	TAV-MW8	5.37 µg/L	November 2020
	TAV-MW10	12.4 µg/L	February 2020
		9.32 µg/L	June 2020
		13.1 µg/L	August 2020
		13.1 µg/L	December 2020
	TAV-MW10 (duplicate)	12.5 µg/L	August 2020
	TAV-MW14	5.31 µg/L	August 2020
		5.35 µg/L	December 2020
	TAV-MW14 (duplicate)	5.22 µg/L	December 2020

[a] Analytical result for filtered groundwater sample. All other analytical results are for unfiltered groundwater samples.

Appendix B. Terrestrial Surveillance Analytical Results in 2020

Short-horned lizard (*Phrynosoma hernandesi*)

Table B-1. Radiological results in soil, 2020

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-9	0.00569 ± 0.0119	0.021	U	BD	HASL 300
		pCi/g	C-10	0.0583 ± 0.0845	0.129	U	BD	HASL 300
		pCi/g	C-25	−0.0315 ± 0.0584	0.0925	U	BD	HASL 300
	Cesium-137	pCi/g	C-9	0.129 ± 0.00207	0.0156		None	HASL 300
		pCi/g	C-10	0.405 ± 0.0508	0.024		None	HASL 300
		pCi/g	C-25	0.0741 ± 0.0168	0.0139		None	HASL 300
	Tritium	pCi/L	C-9	20.9 ± 95.4	178	U	BD	GL-RAD-A-002
		pCi/L	C-10	52.1 ± 107	190	U	BD	GL-RAD-A-002
		pCi/L	C-25	120 ± 114	185	U	BD	GL-RAD-A-002
On-Site	Americium-241	pCi/g	S-1	0.00804 ± 0.11	0.181	U	BD	HASL 300
		pCi/g	S-6	0.0155 ± 0.0378	0.0657	U	BD	HASL 300
		pCi/g	S-33	0.0435 ± 0.0706	0.0788	U	BD	HASL 300
		pCi/g	S-34	0.00643 ± 0.0433	0.0758	U	BD	HASL 300
		pCi/g	S-45	−0.0355 ± 0.0532	0.086	U	BD	HASL 300
		pCi/g	S-46	0.0212 ± 0.0487	0.0905	U	BD	HASL 300
		pCi/g	S-49	0.00795 ± 0.0475	0.0803	U	BD	HASL 300
		pCi/g	S-51	0.0197 ± 0.0287	0.0472	U	BD	HASL 300
		pCi/g	S-53	−0.0326 ± 0.0352	0.0618	U	BD	HASL 300
		pCi/g	S-55	−0.026 ± 0.0845	0.144	U	BD	HASL 300
		pCi/g	S-57	0.0288 ± 0.0343	0.0532	U	BD	HASL 300
		pCi/g	S-76	0.0101 ± 0.0135	0.0228	U	BD	HASL 300
		pCi/g	S-77	−0.00335 ± 0.0896	0.155	U	BD	HASL 300
		pCi/g	S-86	0.0203 ± 0.0993	0.167	U	BD	HASL 300
		pCi/g	S-90	0.000166 ± 0.0303	0.0533	U	BD	HASL 300
		pCi/g	S-92	0.00365 ± 0.0711	0.135	U	BD	HASL 300
	Cesium-137	pCi/g	S-1	0.109 ± 0.0358	0.0281		None	HASL 300
		pCi/g	S-6	0.0195 ± 0.0181	0.0314	U	BD	HASL 300
		pCi/g	S-33	0.227 ± 0.0287	0.0169		None	HASL 300
		pCi/g	S-34	0.0345 ± 0.0132	0.0172		J	HASL 300
		pCi/g	S-45	0.0429 ± 0.0195	0.0236		J	HASL 300

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Cesium-137	pCi/g	S-46	0.147 ± 0.0238	0.0183		None	HASL 300
		pCi/g	S-49	0.235 ± 0.0339	0.0216		None	HASL 300
		pCi/g	S-51	0.0532 ± 0.0272	0.0196		J	HASL 300
		pCi/g	S-53	0.0292 ± 0.0212	0.0176		J	HASL 300
		pCi/g	S-55	0.125 ± 0.0346	0.025		None	HASL 300
		pCi/g	S-57	0.0258 ± 0.0182	0.0183		J	HASL 300
		pCi/g	S-76	0.0319 ± 0.0236	0.0236		J	HASL 300
		pCi/g	S-77	0.305 ± 0.042	0.025		None	HASL 300
		pCi/g	S-86	0.0227 ± 0.0189	0.0239	U	BD	HASL 300
		pCi/g	S-90	0.107 ± 0.0246	0.0211		None	HASL 300
		pCi/g	S-92	0.088 ± 0.0292	0.0196		None	HASL 300
	Tritium	pCi/L	S-1	92 ± 109	182	U	BD	GL-RAD-A-002
		pCi/L	S-6	59.8 ± 90.5	157	U	BD	GL-RAD-A-002
		pCi/L	S-33	60.8 ± 110	193	U	BD	GL-RAD-A-002
		pCi/L	S-45	51.8 ± 101	180	U	BD	GL-RAD-A-002
		pCi/L	S-46	72.9 ± 138	235	U	BD	GL-RAD-A-002
		pCi/L	S-49	179 ± 148	242	U	BD	GL-RAD-A-002
		pCi/L	S-53	93 ± 108	181	U	BD	GL-RAD-A-002
		pCi/L	S-55	−16.1 ± 88.4	177	U	BD	GL-RAD-A-002
		pCi/L	S-57	−3.57 ± 136	237	U	BD	GL-RAD-A-002
		pCi/L	S-76	45.8 ± 100	179	U	BD	GL-RAD-A-002
		pCi/L	S-77	19.4 ± 126	225	U	BD	GL-RAD-A-002
		pCi/L	S-86	145 ± 147	244	U	BD	GL-RAD-A-002
Perimeter	Americium-241	pCi/g	P-4	−0.0189 ± 0.0922	0.163	U	BD	HASL 300
		pCi/g	P-5	0.0367 ± 0.0955	0.167	U	BD	HASL 300
		pCi/g	P-16	0.000582 ± 0.0614	0.103	U	BD	HASL 300
		pCi/g	P-19	−0.0291 ± 0.0699	0.106	U	BD	HASL 300
		pCi/g	P-58	0.0283 ± 0.0399	0.0673	U	BD	HASL 300
		pCi/g	P-59	−0.0105 ± 0.033	0.0545	U	BD	HASL 300
		pCi/g	P-61	0.00284 ± 0.0321	0.0608	U	BD	HASL 300
		pCi/g	P-63	0.0387 ± 0.088	0.142	U	BD	HASL 300

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Americium-241	pCi/g	P-64	0.0191 ± 0.0285	0.0472	U	BD	HASL 300
		pCi/g	P-81	−0.00869 ± 0.0314	0.0539	U	BD	HASL 300
		pCi/g	P-82	−0.0238 ± 0.0458	0.0757	U	BD	HASL 300
		pCi/g	P-95	−0.0276 ± 0.0799	0.149	U	BD	HASL 300
	Cesium-137	pCi/g	P-4	0.124 ± 0.036	0.0259		None	HASL 300
		pCi/g	P-5	0.123 ± 0.032	0.0249		None	HASL 300
		pCi/g	P-16	0.0795 ± 0.0195	0.0164		None	HASL 300
		pCi/g	P-19	0.1 ± 0.021	0.0183		None	HASL 300
		pCi/g	P-58	0.0611 ± 0.0201	0.0176		None	HASL 300
		pCi/g	P-59	0.18 ± 0.0272	0.0173		None	HASL 300
		pCi/g	P-61	0.0116 ± 0.00979	0.0157	U	BD	HASL 300
		pCi/g	P-63	0.212 ± 0.0325	0.0242		None	HASL 300
		pCi/g	P-64	0.137 ± 0.022	0.0171		None	HASL 300
		pCi/g	P-81	0.0642 ± 0.0304	0.021		None	HASL 300
		pCi/g	P-82	0.0608 ± 0.0206	0.0229		J	HASL 300
		pCi/g	P-95	0.183 ± 0.0324	0.0214		None	HASL 300
	Tritium	pCi/L	P-4	97.6 ± 106	175	U	BD	GL-RAD-A-002
		pCi/L	P-5	32.6 ± 99.7	183	U	BD	GL-RAD-A-002
		pCi/L	P-58	157 ± 152	251	U	BD	GL-RAD-A-002
		pCi/L	P-61	14.3 ± 100	189	U	BD	GL-RAD-A-002
		pCi/L	P-63	150 ± 146	241	U	BD	GL-RAD-A-002
		pCi/L	P-81	120 ± 112	179	U	BD	GL-RAD-A-002
		pCi/L	P-82	46.1 ± 99.9	179	U	BD	GL-RAD-A-002
		pCi/L	P-95	118 ± 107	170	U	BD	GL-RAD-A-002

[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 Qualifiers
U = The analyte was absent or below the method detection limit.

Data Validation Qualifiers
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 value was an estimated quantity.
None = There was no data validation for corrected gross alpha activity.

Table B-2. Radiological results in sediment, 2020

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-8	−0.00558 ± 0.0491	0.0858	U	BD	HASL 300
		pCi/g	C-68	−0.00276 ± 0.0105	0.0178	U	BD	HASL 300
	Cesium-137	pCi/g	C-8	0.0476 ± 0.0184	0.0171		J	HASL 300
	Tritium	pCi/L	C-8	18.1 ± 93.1	175	U	BD	GL-RAD-A-002
		pCi/L	C-68	36.8 ± 105	191	U	BD	GL-RAD-A-002
On-Site	Americium-241	pCi/g	S-72	−0.00196 ± 0.0291	0.0511	U	BD	HASL 300
		pCi/g	S-74	−0.0092 ± 0.0467	0.0823	U	BD	HASL 300
		pCi/g	S-75	−0.0146 ± 0.0441	0.0782	U	BD	HASL 300
		pCi/g	S-85	0.0453 ± 0.074	0.126	U	BD	HASL 300
	Cesium-137	pCi/g	S-72	0.0286 ± 0.0171	0.0154		J	HASL 300
		pCi/g	S-74	0.00553 ± 0.0142	0.0221	U	BD	HASL 300
		pCi/g	S-75	0.0856 ± 0.0345	0.0269		None	HASL 300
		pCi/g	S-85	0.00906 ± 0.0111	0.0178	U	BD	HASL 300
		pCi/g	S-91	0.138 ± 0.0324	0.0234		None	HASL 300
	Tritium	pCi/L	S-75	44.2 ± 112	201	U	BD	GL-RAD-A-002
Perimeter	Americium-241	pCi/g	P-60	−0.00662 ± 0.0354	0.068	U	BD	HASL 300
	Cesium-137	pCi/g	P-60	0.0054 ± 0.00963	0.0153	U	BD	HASL 300
		pCi/g	P-73	0.0054 ± 0.0111	0.0204	U	BD	HASL 300
	Tritium	pCi/L	P-60	42.9 ± 107	193	U	BD	GL-RAD-A-002

[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 Qualifiers
U = The analyte was absent or below the method detection limit.

Data Validation Qualifiers
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 value was an estimated quantity.
None = There was no data validation for corrected gross alpha activity.

Table B-3. Radiological results in vegetation, 2020

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-25	−0.00204 ± 0.114	0.159	U	BD	HASL 300
	Cesium-137	pCi/g	C-25	0.00762 ± 0.0176	0.0293	U	BD	HASL 300
	Tritium	pCi/L	C-25	797 ± 187	217		None	GL-RAD-A-002

[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 Qualifiers
U = The analyte was absent or below the method detection limit.

Data Validation Qualifiers
BD = The associated value was below the detection limit as used in radiochemistry to identify results that are not statistically different from zero.
None = There was no data validation for corrected gross alpha activity.

Table B-4. Dosimeter measurements, 2020

Location Classification	Location Number	1st Quarter (89 Days)		2nd Quarter (93 Days)		3rd Quarter (82 Days)		4th Quarter (99 Days)	
		Gross Exposure (mrem)	Net Exposure (mrem)	Gross Exposure (mrem)	Net Exposure (mrem)	Gross Exposure (mrem)	Net Exposure (mrem)	Gross Exposure (mrem)	Net Exposure (mrem)
Community	C-10	40	17	44.7	19	39.5	17.9	43.7	20.2
	C-21	40.4	17.3	44.8	19.2	39.3	17.7	44.8	21.3
	C-22	36.3	13.2	40.5	14.9	36.1	14.5	41.7	18.2
	C-23	34.6	11.6	34.5	8.9	33.1	11.5	36.2	12.7
	C-25	35.3	12.2	39	13.3	32.8	11.2	39.8	16.3
	C-26	39.7	16.7	43.1	17.5	36.8	15.2	42.3	18.7
	C-30	39.9	16.9	41.6	15.9	34.1	12.6	43.6	20.1
On-Site	S-1	39.2	16.1	42	16.3	35.2	13.6	43.2	19.7
	S-6	36	13	41.3	15.7	37.1	15.5	40.6	17.1
	S-7	38.4	15.4	42.9	17.2	37.5	15.9	42.4	18.8
	S-20	40.4	17.3	42.6	16.9	38.1	16.5	38.3	14.8
	S-45	39	16	41	15.3	37.3	15.7	43.9	20.4
	S-46	39.7	16.7	45.9	20.3	36.9	15.3	42.4	18.8
	S-48	40	17	45.4	19.7	37.9	16.3	46.4	22.9
Perimeter	P-4	36.5	13.4	42.4	16.8	37.4	15.8	41.5	18
	P-5	37.3	14.3	38.8	13.1	35.8	14.2	39.8	16.3
	P-16	43.6	20.6	47.9	22.3	42.6	21	47.6	24.1
	P-19	40.6	17.6	44.1	18.4	26	12.1	41.6	18
	P-39	37.8	14.8	41.3	15.6	25.9	11.9	40.2	16.7
	P-40	36.1	13	39.2	13.6	36.9	15.3	40.1	16.5
	P-81	40.1	17.1	43.4	17.7	37.2	15.6	40.7	17.1

Table B-5. Nonradiological results in soil, 2020

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Community	Aluminum	C-9	14,900	21.9	48.1		J	SW846 3050B/6020B
	Antimony	C-9	0.327	0.327	1.98	U	1.98UJ	SW846 3050B/6010D
	Arsenic	C-9	3.33	0.325	0.962		None	SW846 3050B/6020B
	Beryllium	C-9	0.568	0.0192	0.0962		None	SW846 3050B/6020B
	Cadmium	C-9	0.205	0.0192	0.192		J+	SW846 3050B/6020B
	Chromium	C-9	14.9	0.192	0.577		None	SW846 3050B/6020B
	Copper	C-9	10.4	0.0635	0.385	N	J	SW846 3050B/6020B
	Iron	C-9	13,900	31.7	96.2		J	SW846 3050B/6020B
	Lead	C-9	13.4	0.0962	0.385		None	SW846 3050B/6020B
	Magnesium	C-9	4,550	1.92	5.77		None	SW846 3050B/6020B
	Nickel	C-9	11.8	0.0962	0.385		None	SW846 3050B/6020B
	Selenium	C-9	0.772	0.346	0.962	JN	J	SW846 3050B/6020B
	Silver	C-9	0.119	0.0992	0.496	JB	0.496U	SW846 3050B/6010D
	Thallium	C-9	0.135	0.135	0.385	U	None	SW846 3050B/6020B
	Uranium	C-9	0.482	0.0127	0.0385		None	SW846 3050B/6020B
	Zinc	C-9	37.3	0.769	3.85	B	None	SW846 3050B/6020B
On-Site	Aluminum	S-1	14,200	22.1	48.6		J	SW846 3050B/6020B
	Antimony	S-1	0.307	0.307	1.86	U	1.86UJ	SW846 3050B/6010D
	Arsenic	S-1	2.68	0.329	0.973		None	SW846 3050B/6020B
	Beryllium	S-1	0.566	0.0195	0.0973		None	SW846 3050B/6020B
	Cadmium	S-1	0.239	0.0195	0.195		J-	SW846 3050B/6020B
	Chromium	S-1	12.3	0.195	0.584		None	SW846 3050B/6020B
	Copper	S-1	12	0.0642	0.389		J	SW846 3050B/6020B
	Iron	S-1	15,500	32.1	97.3		J	SW846 3050B/6020B
	Lead	S-1	12.8	0.0973	0.389		None	SW846 3050B/6020B
	Magnesium	S-1	5,430	1.95	5.84	*	None	SW846 3050B/6020B
	Nickel	S-1	11.3	0.0973	0.389		None	SW846 3050B/6020B
	Selenium	S-1	1.63	0.35	0.973		None	SW846 3050B/6020B
	Silver	S-1	0.179	0.0931	0.466	J	0.466U	SW846 3050B/6010D
	Thallium	S-1	0.18	0.136	0.389	J	None	SW846 3050B/6020B
	Uranium	S-1	0.706	0.013	0.039		None	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Zinc	S-1	46.7	0.778	3.89		J	SW846 3050B/6020B
	Aluminum	S-6	10,400	21.6	47.4		J	SW846 3050B/6020B
	Arsenic	S-6	3.54	0.321	0.949		None	SW846 3050B/6020B
	Beryllium	S-6	0.396	0.019	0.0949		None	SW846 3050B/6020B
	Cadmium	S-6	0.124	0.019	0.19	J	J-	SW846 3050B/6020B
	Chromium	S-6	8.55	0.19	0.569		None	SW846 3050B/6020B
	Copper	S-6	11.6	0.0626	0.38		J	SW846 3050B/6020B
	Iron	S-6	8,760	6.26	19		J	SW846 3050B/6020B
	Lead	S-6	6.12	0.0949	0.38		None	SW846 3050B/6020B
	Magnesium	S-6	2,990	1.9	5.69	*	None	SW846 3050B/6020B
	Nickel	S-6	6.86	0.0949	0.38		None	SW846 3050B/6020B
	Selenium	S-6	0.538	0.342	0.949	J	None	SW846 3050B/6020B
	Silver	S-6	0.474	0.474	2.37	U	None	SW846 3050B/6010D
	Uranium	S-6	0.635	0.013	0.038		None	SW846 3050B/6020B
	Thallium	S-6	0.133	0.133	0.38	U	None	SW846 3050B/6020B
	Zinc	S-6	26.1	0.759	3.8		J	SW846 3050B/6020B
	Aluminum	S-33	12,300	22.2	48.8		J	SW846 3050B/6020B
	Arsenic	S-33	7.04	0.33	0.977		None	SW846 3050B/6020B
	Beryllium	S-33	1.03	0.0195	0.0977		None	SW846 3050B/6020B
	Cadmium	S-33	0.313	0.0195	0.195		J+	SW846 3050B/6020B
	Chromium	S-33	11.4	0.195	0.586		None	SW846 3050B/6020B
	Copper	S-33	10.9	0.0645	0.391	N	J	SW846 3050B/6020B
	Iron	S-33	12,800	32.2	97.7		J	SW846 3050B/6020B
	Lead	S-33	12.8	0.0977	0.391		None	SW846 3050B/6020B
	Magnesium	S-33	5,470	1.95	5.86		None	SW846 3050B/6020B
	Nickel	S-33	13.4	0.0977	0.391		None	SW846 3050B/6020B
	Selenium	S-33	1.2	0.352	0.977	N	J	SW846 3050B/6020B
	Silver	S-33	0.55	0.485	2.43	JB	2.43U	SW846 3050B/6010D
	Uranium	S-33	1.16	0.013	0.039		None	SW846 3050B/6020B
	Thallium	S-33	0.165	0.137	0.391	J	None	SW846 3050B/6020B
	Zinc	S-33	52.2	0.781	3.91	B	None	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Aluminum	S-34	15,300	21.5	47.3		J	SW846 3050B/6020B
	Antimony	S-34	0.319	0.319	1.93	U	1.93UJ	SW846 3050B/6010D
	Arsenic	S-34	4.11	0.319	0.945		None	SW846 3050B/6020B
	Beryllium	S-34	0.674	0.0189	0.0945		None	SW846 3050B/6020B
	Cadmium	S-34	0.152	0.0189	0.189	J	None	SW846 3050B/6020B
	Chromium	S-34	14.1	0.189	0.567		None	SW846 3050B/6020B
	Copper	S-34	8.81	0.0624	0.378	N	J	SW846 3050B/6020B
	Iron	S-34	14,000	31.2	94.5		J	SW846 3050B/6020B
	Lead	S-34	10.5	0.0945	0.378		None	SW846 3050B/6020B
	Magnesium	S-34	4,030	1.89	5.67		None	SW846 3050B/6020B
	Nickel	S-34	12.6	0.0945	0.378		None	SW846 3050B/6020B
	Selenium	S-34	0.856	0.34	0.945	JN	J	SW846 3050B/6020B
	Silver	S-34	0.0965	0.0965	0.483	U	None	SW846 3050B/6010D
	Thallium	S-34	0.154	0.132	0.378	J	None	SW846 3050B/6020B
	Uranium	S-34	0.491	0.013	0.038		None	SW846 3050B/6020B
	Zinc	S-34	37.6	0.756	3.78	B	None	SW846 3050B/6020B
	Aluminum	S-45	10,900	21.9	48.2		J	SW846 3050B/6020B
	Antimony	S-45	0.515	0.307	1.86	J	J	SW846 3050B/6010D
	Arsenic	S-45	2.8	0.326	0.963		None	SW846 3050B/6020B
	Beryllium	S-45	0.415	0.0193	0.0963		None	SW846 3050B/6020B
	Cadmium	S-45	0.105	0.0193	0.193	J	None	SW846 3050B/6020B
	Chromium	S-45	9.32	0.193	0.578		None	SW846 3050B/6020B
	Copper	S-45	6.32	0.0636	0.385		J	SW846 3050B/6020B
	Iron	S-45	8,990	6.36	19.3		J	SW846 3050B/6020B
	Lead	S-45	7.64	0.0963	0.385		None	SW846 3050B/6020B
	Magnesium	S-45	3,440	1.93	5.78	*	None	SW846 3050B/6020B
	Nickel	S-45	6.99	0.0963	0.385		None	SW846 3050B/6020B
	Selenium	S-45	0.423	0.347	0.963	J	None	SW846 3050B/6020B
	Silver	S-45	0.0931	0.0931	0.466	U	None	SW846 3050B/6010D
	Thallium	S-45	0.135	0.135	0.385	U	None	SW846 3050B/6020B
	Uranium	S-45	0.385	0.013	0.039		None	SW846 3050B/6020B
	Zinc	S-45	27.1	0.771	3.85		J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Aluminum	S-51	12,500	42.1	92.4		J	SW846 3050B/6020B
	Antimony	S-51	0.323	0.323	1.96	U	UJ	SW846 3050B/6010D
	Arsenic	S-51	2.22	0.312	0.924		None	SW846 3050B/6020B
	Beryllium	S-51	0.499	0.0185	0.0924		None	SW846 3050B/6020B
	Cadmium	S-51	0.125	0.0185	0.185	J	None	SW846 3050B/6020B
	Chromium	S-51	28.4	0.185	0.555		None	SW846 3050B/6020B
	Copper	S-51	9.52	0.061	0.37		None	SW846 3050B/6020B
	Iron	S-51	11,000	61	185		J	SW846 3050B/6020B
	Lead	S-51	8.81	0.0924	0.37		None	SW846 3050B/6020B
	Magnesium	S-51	3,500	1.85	5.55		None	SW846 3050B/6020B
	Nickel	S-51	9.03	0.0924	0.37		None	SW846 3050B/6020B
	Selenium	S-51	0.333	0.333	0.924	U	None	SW846 3050B/6020B
	Silver	S-51	0.0978	0.0978	0.489	U	None	SW846 3050B/6010D
	Thallium	S-51	0.129	0.129	0.37	U	None	SW846 3050B/6020B
	Uranium	S-51	0.469	0.012	0.037		None	SW846 3050B/6020B
	Zinc	S-51	42.9	0.739	3.7	*B	J	SW846 3050B/6020B
	Aluminum	S-53	8,510	4.32	9.49		J	SW846 3050B/6020B
	Antimony	S-53	0.311	0.311	1.88	U	1.88UJ	SW846 3050B/6010D
	Arsenic	S-53	1.56	0.321	0.949		None	SW846 3050B/6020B
	Beryllium	S-53	0.299	0.019	0.0949		None	SW846 3050B/6020B
	Cadmium	S-53	0.109	0.019	0.19	J	None	SW846 3050B/6020B
	Chromium	S-53	6.57	0.19	0.569		None	SW846 3050B/6020B
	Copper	S-53	5.31	0.0626	0.38		J	SW846 3050B/6020B
	Iron	S-53	6,760	6.26	19		J	SW846 3050B/6020B
	Lead	S-53	7.19	0.0949	0.38		None	SW846 3050B/6020B
	Magnesium	S-53	1,920	1.9	5.69	*	None	SW846 3050B/6020B
	Nickel	S-53	5.18	0.0949	0.38		None	SW846 3050B/6020B
	Selenium	S-53	0.358	0.342	0.949	J	None	SW846 3050B/6020B
	Silver	S-53	0.136	0.0942	0.471	J	None	SW846 3050B/6010D
	Thallium	S-53	0.133	0.133	0.38	U	None	SW846 3050B/6020B
	Uranium	S-53	0.571	0.013	0.038		None	SW846 3050B/6020B
	Zinc	S-53	19.6	0.759	3.8		J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Aluminum	S-55	11,300	20.2	44.4		J	SW846 3050B/6020B
	Antimony	S-55	0.304	0.304	1.84	U	1.84UJ	SW846 3050B/6010D
	Arsenic	S-55	2.49	0.3	0.888		None	SW846 3050B/6020B
	Beryllium	S-55	0.432	0.0178	0.0888		None	SW846 3050B/6020B
	Cadmium	S-55	0.142	0.0178	0.178	J	None	SW846 3050B/6020B
	Chromium	S-55	9.47	0.178	0.533		None	SW846 3050B/6020B
	Copper	S-55	6.07	0.0586	0.355		J	SW846 3050B/6020B
	Iron	S-55	9,590	29.3	88.8		J	SW846 3050B/6020B
	Lead	S-55	7.97	0.0888	0.355		None	SW846 3050B/6020B
	Magnesium	S-55	3,520	1.78	5.33	*	None	SW846 3050B/6020B
	Nickel	S-55	7.32	0.0888	0.355		None	SW846 3050B/6020B
	Selenium	S-55	0.698	0.32	0.888	J	None	SW846 3050B/6020B
	Silver	S-55	0.0921	0.0921	0.46	U	None	SW846 3050B/6010D
	Thallium	S-55	0.124	0.124	0.355	U	None	SW846 3050B/6020B
	Uranium	S-55	0.356	0.012	0.036		None	SW846 3050B/6020B
	Zinc	S-55	27.5	0.71	3.55		J	SW846 3050B/6020B
	Aluminum	S-57	7,880	4.35	9.56		J	SW846 3050B/6020B
	Antimony	S-57	0.311	0.311	1.89	U	UJ	SW846 3050B/6010D
	Arsenic	S-57	2.78	0.323	0.956		None	SW846 3050B/6020B
	Beryllium	S-57	0.331	0.0191	0.0956		None	SW846 3050B/6020B
	Cadmium	S-57	0.224	0.0191	0.191		None	SW846 3050B/6020B
	Chromium	S-57	7.42	0.191	0.574		None	SW846 3050B/6020B
	Copper	S-57	7.34	0.0631	0.382		None	SW846 3050B/6020B
	Iron	S-57	8,530	6.31	19.1		J	SW846 3050B/6020B
	Lead	S-57	7.01	0.0956	0.382		None	SW846 3050B/6020B
	Magnesium	S-57	4,250	1.91	5.74		None	SW846 3050B/6020B
	Nickel	S-57	7.25	0.0956	0.382		None	SW846 3050B/6020B
	Selenium	S-57	0.344	0.344	0.956	U	None	SW846 3050B/6020B
	Silver	S-57	0.0943	0.0943	0.472	U	None	SW846 3050B/6010D
	Uranium	S-57	0.95	0.013	0.038		None	SW846 3050B/6020B
	Thallium	S-57	0.134	0.134	0.382	U	None	SW846 3050B/6020B
	Zinc	S-57	64.1	0.765	3.82	*B	J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Aluminum	S-90	7,740	4.38	9.63		J	SW846 3050B/6020B
	Antimony	S-90	0.308	0.308	1.87	U	1.87UJ	SW846 3050B/6010D
	Arsenic	S-90	1.22	0.326	0.963		None	SW846 3050B/6020B
	Beryllium	S-90	0.306	0.0193	0.0963		None	SW846 3050B/6020B
	Cadmium	S-90	0.118	0.0193	0.193	J	None	SW846 3050B/6020B
	Chromium	S-90	7.04	0.193	0.578		None	SW846 3050B/6020B
	Copper	S-90	5.36	0.0636	0.385		None	SW846 3050B/6020B
	Iron	S-90	7,630	6.36	19.3		J	SW846 3050B/6020B
	Lead	S-90	7.64	0.0963	0.385		None	SW846 3050B/6020B
	Magnesium	S-90	1,770	1.93	5.78		None	SW846 3050B/6020B
	Nickel	S-90	5.88	0.0963	0.385		None	SW846 3050B/6020B
	Selenium	S-90	0.347	0.347	0.963	U	None	SW846 3050B/6020B
	Silver	S-90	0.0933	0.0933	0.466	U	None	SW846 3050B/6010D
	Thallium	S-90	0.135	0.135	0.385	U	None	SW846 3050B/6020B
	Uranium	S-90	0.361	0.013	0.039		None	SW846 3050B/6020B
	Zinc	S-90	25.1	0.771	3.85	*B	J	SW846 3050B/6020B
	Aluminum	S-92	7,210	4.33	9.51		J	SW846 3050B/6020B
	Antimony	S-92	0.324	0.324	1.96	U	UJ	SW846 3050B/6010D
	Arsenic	S-92	1.06	0.321	0.951		None	SW846 3050B/6020B
	Beryllium	S-92	0.304	0.019	0.0951		None	SW846 3050B/6020B
	Cadmium	S-92	0.109	0.019	0.19	J	None	SW846 3050B/6020B
	Chromium	S-92	6.71	0.19	0.57		None	SW846 3050B/6020B
	Copper	S-92	5.21	0.0627	0.38		None	SW846 3050B/6020B
	Iron	S-92	6,230	6.27	19		J	SW846 3050B/6020B
	Lead	S-92	6.27	0.0951	0.38		None	SW846 3050B/6020B
	Magnesium	S-92	1,650	1.9	5.7		None	SW846 3050B/6020B
	Nickel	S-92	5.22	0.0951	0.38		None	SW846 3050B/6020B
	Selenium	S-92	0.342	0.342	0.951	U	None	SW846 3050B/6020B
	Silver	S-92	0.14	0.098	0.49	JB	0.490U	SW846 3050B/6010D
	Uranium	S-92	0.291	0.013	0.038		None	SW846 3050B/6020B
	Thallium	S-92	0.278	0.133	0.38	J	None	SW846 3050B/6020B
	Zinc	S-92	17.8	0.76	3.8	*B	J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-4	9,930	21.6	47.4		J	SW846 3050B/6020B
	Antimony	P-4	0.324	0.324	1.96	U	1.96UJ	SW846 3050B/6010D
	Arsenic	P-4	2.25	0.321	0.949		None	SW846 3050B/6020B
	Beryllium	P-4	0.358	0.019	0.0949		None	SW846 3050B/6020B
	Cadmium	P-4	0.132	0.019	0.19	J	None	SW846 3050B/6020B
	Chromium	P-4	8.63	0.19	0.569		None	SW846 3050B/6020B
	Copper	P-4	5.89	0.0626	0.38		J	SW846 3050B/6020B
	Iron	P-4	8,450	6.26	19		J	SW846 3050B/6020B
	Lead	P-4	8.32	0.0949	0.38		None	SW846 3050B/6020B
	Magnesium	P-4	3,140	1.9	5.69	*	None	SW846 3050B/6020B
	Nickel	P-4	6.55	0.0949	0.38		None	SW846 3050B/6020B
	Selenium	P-4	0.483	0.342	0.949	J	None	SW846 3050B/6020B
	Silver	P-4	0.116	0.0982	0.491	J	0.491U	SW846 3050B/6010D
	Thallium	P-4	0.133	0.133	0.38	U	None	SW846 3050B/6020B
	Uranium	P-4	0.329	0.013	0.038		None	SW846 3050B/6020B
	Zinc	P-4	24.6	0.759	3.8		J	SW846 3050B/6020B
	Aluminum	P-5	7,090	4.28	9.4		J	SW846 3050B/6020B
	Antimony	P-5	0.326	0.326	1.98	U	1.98UJ	SW846 3050B/6010D
	Arsenic	P-5	1.28	0.318	0.94		None	SW846 3050B/6020B
	Beryllium	P-5	0.308	0.0188	0.094		None	SW846 3050B/6020B
	Cadmium	P-5	0.0904	0.0188	0.188	J	None	SW846 3050B/6020B
	Chromium	P-5	6.41	0.188	0.564		None	SW846 3050B/6020B
	Copper	P-5	4.77	0.062	0.376		J	SW846 3050B/6020B
	Iron	P-5	6,570	6.2	18.8		J	SW846 3050B/6020B
	Lead	P-5	6.57	0.094	0.376		None	SW846 3050B/6020B
	Magnesium	P-5	1,560	1.88	5.64	*	None	SW846 3050B/6020B
	Nickel	P-5	4.64	0.094	0.376		None	SW846 3050B/6020B
	Selenium	P-5	0.383	0.338	0.94	J	None	SW846 3050B/6020B
	Silver	P-5	0.136	0.0988	0.494	J	0.494U	SW846 3050B/6010D
	Thallium	P-5	0.132	0.132	0.376	U	None	SW846 3050B/6020B
	Uranium	P-5	0.233	0.012	0.038		None	SW846 3050B/6020B
	Zinc	P-5	18.8	0.752	3.76		J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-16	13,400	21.7	47.8		J	SW846 3050B/6020B
	Antimony	P-16	0.325	0.325	1.97	U	1.97UJ	SW846 3050B/6010D
	Arsenic	P-16	2.46	0.323	0.956		None	SW846 3050B/6020B
	Beryllium	P-16	0.556	0.0191	0.0956		None	SW846 3050B/6020B
	Cadmium	P-16	0.154	0.0191	0.191	J	None	SW846 3050B/6020B
	Chromium	P-16	9.24	0.191	0.574		None	SW846 3050B/6020B
	Copper	P-16	11	0.0631	0.382	N	J	SW846 3050B/6020B
	Iron	P-16	15,800	31.5	95.6		J	SW846 3050B/6020B
	Lead	P-16	11.9	0.0956	0.382		None	SW846 3050B/6020B
	Magnesium	P-16	5,570	1.91	5.74		None	SW846 3050B/6020B
	Nickel	P-16	9.8	0.0956	0.382		None	SW846 3050B/6020B
	Selenium	P-16	1.28	0.344	0.956	N	J	SW846 3050B/6020B
	Silver	P-16	0.0984	0.0984	0.492	U	None	SW846 3050B/6010D
	Thallium	P-16	0.179	0.134	0.382	J	None	SW846 3050B/6020B
	Uranium	P-16	0.808	0.013	0.038		None	SW846 3050B/6020B
	Zinc	P-16	50.4	0.765	3.82	B	None	SW846 3050B/6020B
	Aluminum	P-19	14,100	45	98.8		J	SW846 3050B/6020B
	Antimony	P-19	0.306	0.306	1.86	U	UJ	SW846 3050B/6010D
	Arsenic	P-19	2.57	0.334	0.988		None	SW846 3050B/6020B
	Beryllium	P-19	0.495	0.0198	0.0988		None	SW846 3050B/6020B
	Cadmium	P-19	0.174	0.0198	0.198	J	None	SW846 3050B/6020B
	Chromium	P-19	16.7	0.198	0.593		None	SW846 3050B/6020B
	Copper	P-19	15.3	0.0652	0.395		None	SW846 3050B/6020B
	Iron	P-19	14,600	65.2	198		J	SW846 3050B/6020B
	Lead	P-19	18.1	0.0988	0.395		None	SW846 3050B/6020B
	Magnesium	P-19	4,510	1.98	5.93		None	SW846 3050B/6020B
	Nickel	P-19	15	0.0988	0.395		None	SW846 3050B/6020B
	Selenium	P-19	0.356	0.356	0.988	U	None	SW846 3050B/6020B
	Silver	P-19	0.0928	0.0928	0.464	U	None	SW846 3050B/6010D
	Thallium	P-19	0.177	0.138	0.395	J	None	SW846 3050B/6020B
	Uranium	P-19	0.439	0.013	0.04		None	SW846 3050B/6020B
	Zinc	P-19	51.8	0.791	3.95	*B	J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-58	11,300	44.5	97.8		J	SW846 3050B/6020B
	Antimony	P-58	0.7	0.295	1.79	J	J-	SW846 3050B/6010D
	Arsenic	P-58	2.58	0.331	0.978		None	SW846 3050B/6020B
	Beryllium	P-58	0.457	0.0196	0.0978		None	SW846 3050B/6020B
	Cadmium	P-58	0.184	0.0196	0.196	J	None	SW846 3050B/6020B
	Chromium	P-58	9.29	0.196	0.587		None	SW846 3050B/6020B
	Copper	P-58	11.6	0.0646	0.391		None	SW846 3050B/6020B
	Iron	P-58	11,500	64.6	196		J	SW846 3050B/6020B
	Lead	P-58	16.6	0.0978	0.391		None	SW846 3050B/6020B
	Magnesium	P-58	4,340	1.96	5.87		None	SW846 3050B/6020B
	Nickel	P-58	8.59	0.0978	0.391		None	SW846 3050B/6020B
	Selenium	P-58	0.352	0.352	0.978	U	None	SW846 3050B/6020B
	Silver	P-58	0.0894	0.0894	0.447	U	None	SW846 3050B/6010D
	Thallium	P-58	0.137	0.137	0.391	U	None	SW846 3050B/6020B
	Uranium	P-58	0.597	0.013	0.039		None	SW846 3050B/6020B
	Zinc	P-58	37.5	0.783	3.91	*B	J	SW846 3050B/6020B
	Aluminum	P-61	6,880	4.24	9.33		J	SW846 3050B/6020B
	Antimony	P-61	0.314	0.314	1.9	U	1.90UJ	SW846 3050B/6010D
	Arsenic	P-61	3.22	0.315	0.933		None	SW846 3050B/6020B
	Beryllium	P-61	0.308	0.0187	0.0933		None	SW846 3050B/6020B
	Cadmium	P-61	0.18	0.0187	0.187	J	J+	SW846 3050B/6020B
	Chromium	P-61	6.09	0.187	0.56		None	SW846 3050B/6020B
	Copper	P-61	7.54	0.0616	0.373	N	J	SW846 3050B/6020B
	Iron	P-61	6,830	6.16	18.7		J	SW846 3050B/6020B
	Lead	P-61	7.98	0.0933	0.373		None	SW846 3050B/6020B
	Magnesium	P-61	3,250	1.87	5.6		None	SW846 3050B/6020B
	Nickel	P-61	5.5	0.0933	0.373		None	SW846 3050B/6020B
	Selenium	P-61	0.51	0.336	0.933	JN	J	SW846 3050B/6020B
	Silver	P-61	0.0952	0.0952	0.476	U	None	SW846 3050B/6010D
	Thallium	P-61	0.131	0.131	0.373	U	None	SW846 3050B/6020B
	Uranium	P-61	0.57	0.012	0.037		None	SW846 3050B/6020B
	Zinc	P-61	26	0.746	3.73	B	None	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-63	14,800	45.2	99.4		J	SW846 3050B/6020B
	Antimony	P-63	0.308	0.308	1.87	U	UJ	SW846 3050B/6010D
	Arsenic	P-63	2.4	0.336	0.994		None	SW846 3050B/6020B
	Beryllium	P-63	0.592	0.0199	0.0994		None	SW846 3050B/6020B
	Cadmium	P-63	0.222	0.0199	0.199		None	SW846 3050B/6020B
	Chromium	P-63	14.5	0.199	0.596		None	SW846 3050B/6020B
	Copper	P-63	10.3	0.0656	0.398		None	SW846 3050B/6020B
	Iron	P-63	13,400	65.6	199		J	SW846 3050B/6020B
	Lead	P-63	12	0.0994	0.398		None	SW846 3050B/6020B
	Magnesium	P-63	4,050	1.99	5.96		None	SW846 3050B/6020B
	Nickel	P-63	12.3	0.0994	0.398		None	SW846 3050B/6020B
	Selenium	P-63	0.358	0.358	0.994	U	None	SW846 3050B/6020B
	Silver	P-63	0.0939	0.0935	0.467	JB	0.467U	SW846 3050B/6010D
	Thallium	P-63	0.139	0.139	0.398	U	None	SW846 3050B/6020B
	Uranium	P-63	0.516	0.013	0.04		None	SW846 3050B/6020B
	Zinc	P-63	33.6	0.795	3.98	*B	J	SW846 3050B/6020B
	Aluminum	P-64	10,100	21.4	47.1		J	SW846 3050B/6020B
	Arsenic	P-64	2.63	0.318	0.942		None	SW846 3050B/6020B
	Beryllium	P-64	0.877	0.0188	0.0942		None	SW846 3050B/6020B
	Cadmium	P-64	0.0976	0.0188	0.188	J	J+	SW846 3050B/6020B
	Chromium	P-64	5.68	0.188	0.565		None	SW846 3050B/6020B
	Copper	P-64	9.43	0.0621	0.377	N	J	SW846 3050B/6020B
	Iron	P-64	18,800	31.1	94.2		J	SW846 3050B/6020B
	Lead	P-64	6.56	0.0942	0.377		None	SW846 3050B/6020B
	Magnesium	P-64	6,970	1.88	5.65		None	SW846 3050B/6020B
	Nickel	P-64	7.81	0.0942	0.377		None	SW846 3050B/6020B
	Selenium	P-64	2.75	0.339	0.942	N	J	SW846 3050B/6020B
	Silver	P-64	0.0911	0.0911	0.455	U	None	SW846 3050B/6010D
	Thallium	P-64	0.132	0.132	0.377	U	None	SW846 3050B/6020B
	Uranium	P-64	1.56	0.012	0.038		None	SW846 3050B/6020B
	Zinc	P-64	54.3	0.753	3.77	B	None	SW846 3050B/6020B
	Aluminum	P-81	14,800	22.7	49.8		J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Antimony	P-81	0.33	0.33	2	U	2.00UJ	SW846 3050B/6010D
	Arsenic	P-81	2.22	0.337	0.996		None	SW846 3050B/6020B
	Beryllium	P-81	0.575	0.0199	0.0996		None	SW846 3050B/6020B
	Cadmium	P-81	0.154	0.0199	0.199	J	None	SW846 3050B/6020B
	Chromium	P-81	11.1	0.199	0.598		None	SW846 3050B/6020B
	Copper	P-81	8.63	0.0657	0.398		J	SW846 3050B/6020B
	Iron	P-81	11,300	32.9	99.6		J	SW846 3050B/6020B
	Lead	P-81	8.67	0.0996	0.398		None	SW846 3050B/6020B
	Magnesium	P-81	3,260	1.99	5.98	*	None	SW846 3050B/6020B
	Nickel	P-81	9.12	0.0996	0.398		None	SW846 3050B/6020B
	Selenium	P-81	0.604	0.359	0.996	J	None	SW846 3050B/6020B
	Silver	P-81	0.1	0.1	0.5	U	None	SW846 3050B/6010D
	Thallium	P-81	0.139	0.139	0.398	U	None	SW846 3050B/6020B
	Uranium	P-81	0.39	0.013	0.04		None	SW846 3050B/6020B
	Zinc	P-81	29.1	0.797	3.98		J	SW846 3050B/6020B
	Aluminum	P-82	8,710	4.14	9.09		J	SW846 3050B/6020B
	Antimony	P-82	0.452	0.311	1.88	J	J	SW846 3050B/6010D
	Arsenic	P-82	2.85	0.307	0.909		None	SW846 3050B/6020B
	Beryllium	P-82	0.391	0.0182	0.0909		None	SW846 3050B/6020B
	Cadmium	P-82	0.137	0.0182	0.182	J	J-	SW846 3050B/6020B
	Chromium	P-82	7.2	0.182	0.545		None	SW846 3050B/6020B
	Copper	P-82	7.74	0.06	0.364		J	SW846 3050B/6020B
	Iron	P-82	7,710	6	18.2		J	SW846 3050B/6020B
	Lead	P-82	26	0.0909	0.364		None	SW846 3050B/6020B
	Magnesium	P-82	3,680	1.82	5.45	*	None	SW846 3050B/6020B
	Nickel	P-82	6.53	0.0909	0.364		None	SW846 3050B/6020B
	Selenium	P-82	0.652	0.327	0.909	J	None	SW846 3050B/6020B
	Silver	P-82	0.11	0.0942	0.471	J	0.471U	SW846 3050B/6010D
	Thallium	P-82	0.127	0.127	0.364	U	None	SW846 3050B/6020B
	Uranium	P-82	0.754	0.012	0.036		None	SW846 3050B/6020B
	Zinc	P-82	29.1	0.727	3.64		J	SW846 3050B/6020B
	Aluminum	P-95	10,800	22.8	50		J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Antimony	P-95	0.322	0.322	1.95	U	1.95UJ	SW846 3050B/6010D
	Arsenic	P-95	1.77	0.338	1		None	SW846 3050B/6020B
	Beryllium	P-95	0.35	0.02	0.1		None	SW846 3050B/6020B
	Cadmium	P-95	0.14	0.02	0.2	J	0.20U	SW846 3050B/6020B
	Chromium	P-95	9.42	0.2	0.6		None	SW846 3050B/6020B
	Copper	P-95	6.5	0.066	0.4		J	SW846 3050B/6020B
	Iron	P-95	8,760	6.6	20		J	SW846 3050B/6020B
	Lead	P-95	9.48	0.1	0.4		None	SW846 3050B/6020B
	Magnesium	P-95	3,010	2	6	*	None	SW846 3050B/6020B
	Nickel	P-95	7.22	0.1	0.4		None	SW846 3050B/6020B
	Selenium	P-95	0.962	0.36	1	J	None	SW846 3050B/6020B
	Silver	P-95	0.102	0.0977	0.488	J	0.488U	SW846 3050B/6010D
	Thallium	P-95	0.14	0.14	0.4	U	None	SW846 3050B/6020B
	Uranium	P-95	0.298	0.013	0.04		None	SW846 3050B/6020B
	Zinc	P-95	24.9	0.8	4		J	SW846 3050B/6020B

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

Laboratory Data Qualifiers
* = A replicate was outside limits.
B = The analyte was detected in the blank.
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.

Data Validation Qualifiers
J = The associated value was an estimated quantity.
J+ = The associated numerical value was an estimated quantity with a suspected positive base.
J- = The associated numerical value is an estimated quantity with a suspected negative base.
None = There was no data validation for corrected gross alpha activity.
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.

Table B-6. Nonradiological results in sediment, 2020

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Community	Aluminum	C-68	10,200	21.4	47.1		J	SW846 3050B/6020B
	Antimony	C-68	0.516	0.297	1.8	J	J-	SW846 3050B/6010D
	Arsenic	C-68	5.59	0.318	0.942		None	SW846 3050B/6020B
	Beryllium	C-68	0.457	0.0188	0.0942		None	SW846 3050B/6020B
	Cadmium	C-68	0.212	0.0188	0.188		J+	SW846 3050B/6020B
	Chromium	C-68	10.6	0.188	0.565		None	SW846 3050B/6020B
	Copper	C-68	6.72	0.0621	0.377	N	J	SW846 3050B/6020B
	Iron	C-68	8,880	6.21	18.8		J	SW846 3050B/6020B
	Lead	C-68	9.27	0.0942	0.377		None	SW846 3050B/6020B
	Magnesium	C-68	4,060	1.88	5.65		None	SW846 3050B/6020B
	Nickel	C-68	10.1	0.0942	0.377		None	SW846 3050B/6020B
	Selenium	C-68	0.737	0.339	0.942	JN	J	SW846 3050B/6020B
	Silver	C-68	0.45	0.45	2.25	U	None	SW846 3050B/6010D
	Thallium	C-68	0.132	0.132	0.377	U	None	SW846 3050B/6020B
	Uranium	C-68	0.898	0.0124	0.0377		None	SW846 3050B/6020B
	Zinc	C-68	26.2	0.753	3.77	B	None	SW846 3050B/6020B
On-Site	Aluminum	S-72	13,800	21.3	46.7		J	SW846 3050B/6020B
	Antimony	S-72	0.306	0.306	1.86	U	1.86UJ	SW846 3050B/6010D
	Arsenic	S-72	3.57	0.316	0.935		None	SW846 3050B/6020B
	Beryllium	S-72	0.544	0.0187	0.0935		None	SW846 3050B/6020B
	Cadmium	S-72	0.228	0.0187	0.187		J+	SW846 3050B/6020B
	Chromium	S-72	13.4	0.187	0.561		None	SW846 3050B/6020B
	Copper	S-72	10.5	0.0617	0.374	N	J	SW846 3050B/6020B
	Iron	S-72	13,000	30.8	93.5		J	SW846 3050B/6020B
	Lead	S-72	16.2	0.0935	0.374		None	SW846 3050B/6020B
	Magnesium	S-72	5,200	1.87	5.61		None	SW846 3050B/6020B
	Nickel	S-72	12.1	0.0935	0.374		None	SW846 3050B/6020B
	Selenium	S-72	0.863	0.336	0.935	JN	J	SW846 3050B/6020B
	Silver	S-72	0.0928	0.0928	0.464	U	None	SW846 3050B/6010D
	Thallium	S-72	0.143	0.131	0.374	J	None	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Ste	Uranium	S-72	0.72	0.0123	0.0374		None	SW846 3050B/6020B
	Zinc	S-72	34.6	0.748	3.74	B	None	SW846 3050B/6020B
	Aluminum	S-74	1,850	4.21	9.24		J	SW846 3050B/6020B
	Antimony	S-74	0.428	0.308	1.87	J	J	SW846 3050B/6010D
	Arsenic	S-74	0.653	0.312	0.924	J	None	SW846 3050B/6020B
	Beryllium	S-74	0.142	0.0185	0.0924		None	SW846 3050B/6020B
	Cadmium	S-74	0.0482	0.0185	0.185	J	None	SW846 3050B/6020B
	Chromium	S-74	1.82	0.185	0.555		None	SW846 3050B/6020B
	Copper	S-74	2.59	0.061	0.37		J	SW846 3050B/6020B
	Iron	S-74	3,030	6.1	18.5		J	SW846 3050B/6020B
	Lead	S-74	3.54	0.0924	0.37		None	SW846 3050B/6020B
	Magnesium	S-74	928	1.85	5.55	*	None	SW846 3050B/6020B
	Nickel	S-74	1.8	0.0924	0.37		None	SW846 3050B/6020B
	Selenium	S-74	0.697	0.333	0.924	J	None	SW846 3050B/6020B
	Silver	S-74	0.0935	0.0935	0.467	U	None	SW846 3050B/6010D
	Thallium	S-74	0.129	0.129	0.37	U	None	SW846 3050B/6020B
	Uranium	S-74	0.532	0.0122	0.037		None	SW846 3050B/6020B
	Zinc	S-74	10.5	0.739	3.7		J	SW846 3050B/6020B
	Aluminum	S-75	5,100	4.35	9.56		J	SW846 3050B/6020B
	Antimony	S-75	0.317	0.312	1.89	J	J-	SW846 3050B/6010D
	Arsenic	S-75	1.46	0.323	0.956		None	SW846 3050B/6020B
	Beryllium	S-75	0.33	0.0191	0.0956		None	SW846 3050B/6020B
	Cadmium	S-75	0.124	0.0191	0.191	J	J+	SW846 3050B/6020B
	Chromium	S-75	4.77	0.191	0.574		None	SW846 3050B/6020B
	Copper	S-75	5.42	0.0631	0.382	N	J	SW846 3050B/6020B
	Iron	S-75	5,210	6.31	19.1		J	SW846 3050B/6020B
	Lead	S-75	3.74	0.0956	0.382		None	SW846 3050B/6020B
	Magnesium	S-75	2,560	1.91	5.74		None	SW846 3050B/6020B
	Nickel	S-75	5.55	0.0956	0.382		None	SW846 3050B/6020B
	Selenium	S-75	0.706	0.344	0.956	JN	J	SW846 3050B/6020B
	Silver	S-75	0.0945	0.0945	0.473	U	None	SW846 3050B/6010D

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Thallium	S-75	0.134	0.134	0.382	U	None	SW846 3050B/6020B
	Uranium	S-75	0.742	0.0126	0.0382		None	SW846 3050B/6020B
	Zinc	S-75	16.1	0.765	3.82	B	None	SW846 3050B/6020B
	Aluminum	S-85	6,340	4.29	9.43		J	SW846 3050B/6020B
	Antimony	S-85	0.349	0.319	1.93	J	J-	SW846 3050B/6010D
	Arsenic	S-85	2.33	0.319	0.943		None	SW846 3050B/6020B
	Beryllium	S-85	0.29	0.0189	0.0943		None	SW846 3050B/6020B
	Cadmium	S-85	0.101	0.0189	0.189	J	J+	SW846 3050B/6020B
	Chromium	S-85	6.9	0.189	0.566		None	SW846 3050B/6020B
	Copper	S-85	4.44	0.0623	0.377	N	J	SW846 3050B/6020B
	Iron	S-85	7,110	6.23	18.9		J	SW846 3050B/6020B
	Lead	S-85	5.61	0.0943	0.377		None	SW846 3050B/6020B
	Magnesium	S-85	2,210	1.89	5.66		None	SW846 3050B/6020B
	Nickel	S-85	6.21	0.0943	0.377		None	SW846 3050B/6020B
	Selenium	S-85	0.569	0.34	0.943	JN	J	SW846 3050B/6020B
	Silver	S-85	0.0965	0.0965	0.483	U	None	SW846 3050B/6010D
	Thallium	S-85	0.132	0.132	0.377	U	None	SW846 3050B/6020B
	Uranium	S-85	0.485	0.013	0.038		None	SW846 3050B/6020B
	Zinc	S-85	19.3	0.755	3.77	B	None	SW846 3050B/6020B
	Aluminum	S-91	7,320	4.44	9.77		J	SW846 3050B/6020B
	Antimony	S-91	0.319	0.319	1.93	U	1.93UJ	SW846 3050B/6010D
	Arsenic	S-91	7.84	0.33	0.977		None	SW846 3050B/6020B
	Beryllium	S-91	0.455	0.0195	0.0977		None	SW846 3050B/6020B
	Cadmium	S-91	0.147	0.0195	0.195	J	J+	SW846 3050B/6020B
	Chromium	S-91	7.86	0.195	0.586		None	SW846 3050B/6020B
	Copper	S-91	7.02	0.0645	0.391	N	J	SW846 3050B/6020B
	Iron	S-91	14,400	32.2	97.7		J	SW846 3050B/6020B
	Lead	S-91	10.7	0.0977	0.391		None	SW846 3050B/6020B
	Magnesium	S-91	3,140	1.95	5.86		None	SW846 3050B/6020B
	Nickel	S-91	9.77	0.0977	0.391		None	SW846 3050B/6020B
	Selenium	S-91	1.37	0.352	0.977	N	J	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Silver	S-91	0.0967	0.0967	0.484	U	None	SW846 3050B/6010D
	Thallium	S-91	0.176	0.137	0.391	J	None	SW846 3050B/6020B
	Uranium	S-91	0.492	0.013	0.039		None	SW846 3050B/6020B
	Zinc	S-91	37	0.781	3.91	B	None	SW846 3050B/6020B
	Aluminum	P-60	3,530	4.31	9.47		J	SW846 3050B/6020B
	Antimony	P-60	0.304	0.304	1.85	U	1.85UJ	SW846 3050B/6010D
	Arsenic	P-60	1.14	0.32	0.947		None	SW846 3050B/6020B
	Beryllium	P-60	0.192	0.0189	0.0947		None	SW846 3050B/6020B
	Cadmium	P-60	0.137	0.0189	0.189	J	None	SW846 3050B/6020B
	Chromium	P-60	3.41	0.189	0.568		None	SW846 3050B/6020B
	Copper	P-60	3.54	0.0625	0.379	N	J	SW846 3050B/6020B
	Iron	P-60	5,370	6.25	18.9		J	SW846 3050B/6020B
	Lead	P-60	4.08	0.0947	0.379		None	SW846 3050B/6020B
	Magnesium	P-60	1,660	1.89	5.68		None	SW846 3050B/6020B
	Nickel	P-60	3.87	0.0947	0.379		None	SW846 3050B/6020B
	Selenium	P-60	0.41	0.341	0.947	JN	J	SW846 3050B/6020B
	Silver	P-60	0.0979	0.0923	0.461	JB	0.461U	SW846 3050B/6010D
	Thallium	P-60	0.133	0.133	0.379	U	None	SW846 3050B/6020B
	Uranium	P-60	0.473	0.013	0.038		None	SW846 3050B/6020B
	Zinc	P-60	14.8	0.758	3.79	B	None	SW846 3050B/6020B
	Aluminum	P-73	4,820	4.5	9.88		J	SW846 3050B/6020B
	Antimony	P-73	0.32	0.32	1.94	U	1.94UJ	SW846 3050B/6010D
	Arsenic	P-73	1.13	0.334	0.988		None	SW846 3050B/6020B
	Beryllium	P-73	0.263	0.0198	0.0988		None	SW846 3050B/6020B
	Cadmium	P-73	0.0603	0.0198	0.198	J	None	SW846 3050B/6020B
	Chromium	P-73	3.93	0.198	0.593		None	SW846 3050B/6020B
	Copper	P-73	5.42	0.0652	0.395	N	J	SW846 3050B/6020B
	Iron	P-73	6,200	6.52	19.8		J	SW846 3050B/6020B
	Lead	P-73	3.08	0.0988	0.395		None	SW846 3050B/6020B
	Magnesium	P-73	2,790	1.98	5.93		None	SW846 3050B/6020B
	Nickel	P-73	4.22	0.0988	0.395		None	SW846 3050B/6020B

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
Perimeter	Selenium	P-73	0.548	0.356	0.988	JN	J	SW846 3050B/6020B
	Silver	P-73	0.0971	0.0971	0.485	U	None	SW846 3050B/6010D
	Thallium	P-73	0.138	0.138	0.395	U	None	SW846 3050B/6020B
	Uranium	P-73	0.505	0.013	0.04		None	SW846 3050B/6020B
	Zinc	P-73	18.9	0.791	3.95	B	None	SW846 3050B/6020B

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

Laboratory Data Qualifier
* = A replicate was outside limits.
B = The analyte was detected in the blank.
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.

Data Validation Qualifier
J = The associated value was an estimated quantity.
J+ = The associated numerical value was an estimated quantity with a suspected positive base.
J- = The associated numerical value is an estimated quantity with a suspected negative base.
None = There was no data validation for corrected gross alpha activity.
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.

Table B-7. Perchlorate results in soil, 2020

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers[a]	Data Validation Qualifiers	Analytical Method
On-Site	Perchlorate	S-53	0.0584	0.0248	0.099		J	SW846 6850 Modified
		S-53	0.0648	0.0386	0.116	J	None	EPA 314.0 DOE-AL

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

Laboratory Data Qualifier
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.

Data Validation Qualifier
J = The associated value was an estimated quantity.

Table B-8. High explosive compound results in soil, 2020

Location Classification	Analyte	Location	Result (µg/kg)	MDL (µg/kg)	PQL (µg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Amino-2,6-dinitrotoluene, 4-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Amino-4,6-dinitrotoluene, 2-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Dinitrobenzene, 1,3-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Dinitrotoluene, 2,4-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Dinitrotoluene, 2,6-	S-90	44.6	44.6	134	U	None	SW846 8330A
	HMX	S-90	44.6	44.6	134	U	None	SW846 8330A
	Nitro-benzene	S-90	44.6	44.6	134	U	None	SW846 8330A
	Nitrotoluene, 2-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Nitrotoluene, 3-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Nitrotoluene, 4-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Pentaerythritol tetranitrate	S-90	73.7	73.7	446	U	None	SW846 8330A
	RDX	S-90	44.6	44.6	134	U	None	SW846 8330A
	Tetryl	S-90	44.6	44.6	134	U	None	SW846 8330A
	Trinitrobenzene, 1,3,5-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Trinitrotoluene, 2,4,6-	S-90	44.6	44.6	134	U	None	SW846 8330A
	Amino-2,6-dinitrotoluene, 4-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Amino-4,6-dinitrotoluene, 2-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Dinitrobenzene, 1,3-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Dinitrotoluene, 2,4-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Dinitrotoluene, 2,6-	S-93	49.3	49.3	148	U	None	SW846 8330A
	HMX	S-93	49.3	49.3	148	U	None	SW846 8330A
	Nitro-benzene	S-93	49.3	49.3	148	U	None	SW846 8330A
	Nitrotoluene, 2-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Nitrotoluene, 3-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Nitrotoluene, 4-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Pentaerythritol tetranitrate	S-93	81.3	81.3	493	U	None	SW846 8330A
	RDX	S-93	49.3	49.3	148	U	None	SW846 8330A
	Tetryl	S-93	49.3	49.3	148	U	None	SW846 8330A
	Trinitrobenzene, 1,3,5-	S-93	49.3	49.3	148	U	None	SW846 8330A
	Trinitrotoluene, 2,4,6-	S-93	49.3	49.3	148	U	None	SW846 8330A

Location Classification	Analyte	Location	Result (µg/kg)	MDL (µg/kg)	PQL (µg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Amino-2,6-dinitrotoluene, 4-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Amino-4,6-dinitrotoluene, 2-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Dinitrobenzene, 1,3-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Dinitrotoluene, 2,4-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Dinitrotoluene, 2,6-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	HMX	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Nitro-benzene	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Nitrotoluene, 2-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Nitrotoluene, 3-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Nitrotoluene, 4-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Pentaerythritol tetranitrate	S-94	76	76	461	Uh	UJ	SW846 8330A
	RDX	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Tetryl	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Trinitrobenzene, 1,3,5-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A
	Trinitrotoluene, 2,4,6-	S-94	46.1	46.1	138	Uh	UJ	SW846 8330A

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

Laboratory Data Qualifier
U = The analyte was absent or below the method detection limit.
Uh = The analyte was absent or below the method detection limit. Laboratory preparation holding time was exceeded.

Data Validation Qualifier
None = There was no data validation for corrected gross alpha activity.
UJ = The analyte was analyzed for but was not detected. The associated value was an estimate and might be inaccurate or imprecise.

Appendix C. Ambient Air Surveillance Results in Fiscal Year 2020

Redbud (*Cercis* spp.)

Table C-1. Ambient air metals analysis, FY 2020

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
A3PM	22-Nov-2019	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.000669	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.365	0.1	0.032	
		Chromium	0.0023	0.004	0.0006	J
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.00872	0.008	0.0012	
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.008	0.00132	U
		Magnesium	0.0484	0.12	0.034	J
		Manganese	<0.0008	0.004	0.0008	U
		Nickel	0.000883	0.002	0.0006	J
		Potassium	0.0557	0.1	0.0256	J
		Selenium	0.00273	0.012	0.002	J
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.628	0.1	0.028	B
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U
		Vanadium	<0.0004	0.002	0.0004	U
		Zinc	0.0311	0.008	0.0016	
AREA 3 PM	26-Mar-2020	Aluminum	0.0658	0.08	0.0272	J
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00145	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.534	0.1	0.032	
		Chromium	0.00319	0.004	0.0006	J

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
AREA 3 PM	26-Mar-2020	Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.0113	0.008	0.0012	
		Iron	0.0786	0.1	0.032	J
		Lead	0.00142	0.008	0.00132	J
		Magnesium	0.0673	0.12	0.034	J
		Manganese	0.00186	0.004	0.0008	J
		Nickel	<0.0006	0.002	0.0006	U
		Potassium	0.0529	0.1	0.0256	JB
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.73	0.1	0.028	
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U
		Vanadium	<0.0004	0.002	0.0004	U
		Zinc	0.0729	0.008	0.0016	
Area 3 PM	3-Jun-2020	Aluminum	0.0576	0.08	0.0272	J
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00246	0.002	0.0004	
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.42	0.1	0.032	
		Chromium	0.00352	0.004	0.0006	J
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.0946	0.008	0.0012	
		Iron	0.0679	0.1	0.032	J
		Lead	0.00199	0.008	0.00132	J
		Magnesium	0.0853	0.12	0.034	J
		Manganese	0.00188	0.004	0.0008	J
		Nickel	0.000722	0.002	0.0006	J
		Potassium	0.0578	0.1	0.0256	JB
		Selenium	0.00322	0.012	0.002	JB

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
Area 3 PM	3-Jun-2020	Silver	0.00217	0.002	0.0004	
		Sodium	0.814	0.1	0.028	B
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U
		Vanadium	<0.0004	0.002	0.0004	U
		Zinc	0.0482	0.008	0.0016	
Area 3 PM 10	16-Sep-2020	Aluminum	0.0915	0.08	0.0272	
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	0.00228	0.012	0.002	J
		Barium	0.00385	0.002	0.0004	
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.776	0.1	0.032	
		Chromium	0.0217	0.004	0.0006	
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.0717	0.008	0.0012	
		Iron	0.258	0.1	0.032	
		Lead	<0.00132	0.008	0.00132	U
		Magnesium	0.0934	0.12	0.034	J
		Manganese	0.00481	0.004	0.0008	
		Nickel	0.00154	0.002	0.0006	J
		Potassium	0.0728	0.1	0.0256	J
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.565	0.1	0.028	
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U
		Vanadium	0.00128	0.002	0.0004	J
		Zinc	0.0195	0.008	0.0016	B
BKPM	22-Nov-2019	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	<0.002	0.012	0.002	U

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
BKPM	22-Nov-2019	Barium	0.00051	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.231	0.1	0.032	
		Chromium	0.00204	0.004	0.0006	J
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	<0.0012	0.008	0.0012	U
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.008	0.00132	U
		Magnesium	0.0366	0.12	0.034	J
		Manganese	<0.0008	0.004	0.0008	U
		Nickel	<0.0006	0.002	0.0006	U
		Potassium	<0.0256	0.1	0.0256	U
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.528	0.1	0.028	B
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U
		Vanadium	<0.0004	0.002	0.0004	U
		Zinc	0.0271	0.008	0.0016	
BKPM	26-Mar-2020	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.000649	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.341	0.1	0.032	
		Chromium	0.0132	0.004	0.0006	
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	<0.0012	0.008	0.0012	U
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.008	0.00132	U

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
BKPM	26-Mar-2020	Magnesium	0.0611	0.12	0.034	J
		Manganese	<0.0008	0.004	0.0008	U
		Nickel	<0.0006	0.002	0.0006	U
		Potassium	0.0473	0.1	0.0256	JB
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.712	0.1	0.028	
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U
		Vanadium	<0.0004	0.002	0.0004	U
		Zinc	0.0688	0.008	0.0016	
BKPM	3-Jun-2020	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.000568	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.28	0.1	0.032	
		Chromium	0.00308	0.004	0.0006	J
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	<0.0012	0.008	0.0012	U
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.008	0.00132	U
		Magnesium	0.0682	0.12	0.034	J
		Manganese	<0.0008	0.004	0.0008	U
		Nickel	<0.0006	0.002	0.0006	U
		Potassium	0.0419	0.1	0.0256	JB
		Selenium	0.00287	0.012	0.002	JB
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.808	0.1	0.028	B
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
BKPM	3-Jun-2020	Vanadium	<0.0004	0.002	0.0004	U
		Zinc	0.0703	0.008	0.0016	
BKPM 10	16-Sep-2020	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	<0.00132	0.008	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00065	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.324	0.1	0.032	
		Chromium	0.00239	0.004	0.0006	J
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.00153	0.008	0.0012	J
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.008	0.00132	U
		Magnesium	0.0529	0.12	0.034	J
		Manganese	<0.0008	0.004	0.0008	U
		Nickel	<0.0006	0.002	0.0006	U
		Potassium	<0.0256	0.1	0.0256	U
		Selenium	0.00314	0.012	0.002	JB
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.544	0.1	0.028	
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U
		Vanadium	<0.0004	0.002	0.0004	U
		Zinc	0.00638	0.008	0.0016	JB

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

Laboratory Data Qualifier
B = The analyte was detected in the blank.
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.
U = The analyte was absent or below the method detection limit.

Table C-2. Ambient air radiological analysis, FY 2020

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers[a]
A3PM	22-Nov-2019	Actinium-228	24	53.9	70.4	32.1	U
		Alpha, gross	2.29	1.3	1.86	0.795	
		Americium-241	3.72	8.24	14.8	6.95	U
		Beryllium-7	117	142	110	49.9	X
		Beta, gross	9.58	2.16	3.22	1.56	
		Bismuth-212	129	121	212	96.2	U
		Bismuth-214	20.8	33.6	26.7	12.1	U
		Cesium-137	−4.38	7.43	12.3	5.46	U
		Cobalt-60	−2.36	8.58	13.9	5.82	U
		Lead-212	−7.9	16.5	23.6	11.2	U
		Lead-214	6.9	34.9	26.2	12.1	U
		Neptunium-237	3.04	12.8	22.8	10.5	U
		Potassium-40	−115	126	177	77.5	U
		Radium-223	121	154	215	99.2	U
		Radium-224	−153	160	214	100	U
		Radium-226	−223	207	270	128	U
		Radium-228	24	53.9	70.4	32.1	U
		Sodium-22	0.176	7.32	14.7	6.26	U
		Thorium-227	1.31	50.3	88.2	41.1	U
		Thorium-231	−10.1	66.8	91.9	43.3	U
		Thorium-234	20.8	189	141	65.7	U
		Uranium-235	17.7	66	69.2	32.7	U
		Uranium-238	20.8	189	141	65.7	U
AREA 3 PM	26-Mar-2020	Actinium-228	9.57	41.3	35.7	17	U
		Alpha, gross	6.03	2.25	3.22	1.49	
		Americium-241	11.3	24	38.7	18.8	U
		Beryllium-7	505	120	100	48.1	
		Beta, gross	20.6	2.98	4.21	2.06	
		Bismuth-212	70.2	69.3	115	54.7	U
		Bismuth-214	19.4	24.9	15.1	7.21	X
		Cesium-137	−2.09	4.81	8.01	3.81	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers[a]
AREA 3 PM	26-Mar-2020	Cobalt-60	3.2	6.45	7.34	3.36	U
		Lead-212	6.63	18.5	12.8	6.22	U
		Lead-214	3.5	24	15.9	7.64	U
		Neptunium-237	2.46	8.26	14.5	7.03	U
		Potassium-40	15.4	151	71.6	32.7	U
		Radium-223	11.7	77.4	137	66	U
		Radium-224	−7.18	86.5	136	66.1	U
		Radium-226	16.2	227	134	65.2	U
		Radium-228	9.57	41.3	35.7	17	U
		Sodium-22	−2.32	4.67	7.55	3.47	U
		Thorium-227	−0.386	31.6	55.6	27	U
		Thorium-231	5.01	92	103	50.5	U
		Thorium-234	318	472	423	208	U
		Uranium-235	12.1	50.6	42.7	20.8	U
		Uranium-238	318	472	423	208	U
Area 3 PM	3-Jun-2020	Actinium-228	−29.9	37.4	37	17.6	U
		Alpha, gross	−0.292	2	3.67	1.69	U
		Americium-241	−3.9	17	30.2	14.6	U
		Beryllium-7	251	74.5	55.3	26.3	
		Beta, gross	28	2.99	3.79	1.85	
		Bismuth-212	38.2	66.5	104	49.3	U
		Bismuth-214	6.45	21.6	18.6	8.95	U
		Cesium-137	−0.666	4.42	7.56	3.58	U
		Cobalt-60	0.104	4.82	8.65	4.02	U
		Lead-212	−6.13	13.7	13.4	6.52	U
		Lead-214	−16.4	17.8	15.1	7.27	U
		Neptunium-237	−1.56	7.15	12.8	6.14	U
		Potassium-40	4.64	125	72.9	33.3	U
		Radium-223	101	97.6	125	59.9	U
		Radium-224	−225	137	119	57.5	U
		Radium-226	−167	194	168	81.9	U
		Radium-228	−29.9	37.4	37	17.6	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers[a]
Area 3 PM	3-Jun-2020	Sodium-22	−0.561	4.8	8.52	3.96	U
		Thorium-227	6.18	30.3	50.2	24.3	U
		Thorium-231	−55.4	88.7	77.9	37.8	U
		Thorium-234	66.8	379	248	120	U
		Uranium-235	3.52	41	36.8	17.8	U
		Uranium-238	66.8	379	248	120	U
Area 3 PM 10	16-Sep-2020	Actinium-228	−4.77	8.71	8.02	3.77	U
		Alpha, gross	1.23	0.45	0.594	0.266	
		Americium-241	0.358	1.1	1.9	0.912	U
		Beryllium-7	88.5	20.1	14.5	6.85	
		Beta, gross	8.32	1.15	0.99	0.448	
		Bismuth-212	3.51	14.2	25.3	11.9	U
		Bismuth-214	−4.03	5.24	4.46	2.14	U
		Cesium-137	0.108	0.989	1.78	0.834	U
		Cobalt-60	0.982	1.23	2.26	1.05	U
		Lead-212	1.9	3.51	3.13	1.52	U
		Lead-214	1.93	5.35	4.02	1.94	U
		Neptunium-237	1.48	2.44	2.96	1.42	U
		Potassium-40	20.9	24.4	18.3	8.28	X
		Radium-223	−11.6	29.8	30.9	14.8	U
		Radium-224	2.74	17.3	27.4	13.2	U
		Radium-226	−31.3	37.9	37.7	18.4	U
		Radium-228	−4.77	8.71	8.02	3.77	U
		Sodium-22	−0.493	1.02	1.76	0.799	U
		Thorium-227	1.25	6.72	11.5	5.5	U
		Thorium-231	−5.78	11.6	12.6	6.08	U
		Thorium-234	2.42	31.3	19.2	9.25	U
		Uranium-235	8.39	10.8	8.79	4.25	U
		Uranium-238	2.42	31.3	19.2	9.25	U
BKPM	22-Nov-2019	Actinium-228	35	55.9	40.5	19.1	U
		Alpha, gross	2.99	1.58	2.28	0.998	
		Americium-241	8.46	11.3	19.1	9.41	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers[a]
BKPM	22-Nov-2019	Beryllium-7	−23	51.5	88.2	42.2	U
		Beta, gross	2.43	1.53	2.46	1.18	U
		Bismuth-212	−158	170	167	79.6	U
		Bismuth-214	3.14	38.3	20.5	9.78	U
		Cesium-137	0.332	6.62	11.6	5.54	U
		Cobalt-60	−11.4	12.4	10.7	4.92	U
		Lead-212	−3.48	19.7	20.3	9.91	U
		Lead-214	−24.2	26.9	25.4	12.3	U
		Neptunium-237	22.5	16.8	22.5	8.67	U
		Potassium-40	−148	144	159	75.1	U
		Radium-223	−12.4	108	177	85.2	U
		Radium-224	−359	199	164	79.7	U
		Radium-226	374	363	374	118	U
		Radium-228	35	55.9	40.5	19.1	U
		Sodium-22	−0.371	6.32	11.5	5.34	U
		Thorium-227	−5.38	41.3	68.5	33.1	U
		Thorium-231	−47.8	73.8	70.7	34.5	U
		Thorium-234	−232	262	224	111	U
		Uranium-235	42.3	61.7	45.9	22.3	U
		Uranium-238	−232	262	224	111	U
BKPM	26-Mar-2020	Actinium-228	−15.7	34.1	31.3	14.9	U
		Alpha, gross	2.01	2.14	3.51	1.64	U
		Americium-241	0.879	4.27	7.02	3.4	U
		Beryllium-7	5.73	48.2	85.6	41	U
		Beta, gross	2.73	1.84	3.02	1.47	U
		Bismuth-212	10.4	58.6	102	48.5	U
		Bismuth-214	3.67	21.5	16.7	8.06	U
		Cesium-137	1.19	3.78	6.65	3.16	U
		Cobalt-60	2.26	3.78	7.01	3.25	U
		Lead-212	0.782	12.3	11.9	5.79	U
		Lead-214	6.75	14	14.6	7.06	U
		Neptunium-237	−7.92	6.95	10.1	4.85	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers[a]
BKPM	26-Mar-2020	Potassium-40	21.4	130	69.5	32.1	U
		Radium-223	3.32	60.9	110	52.9	U
		Radium-224	−132	89.6	98.9	47.8	U
		Radium-226	35.9	159	94.4	45.7	U
		Radium-228	−15.7	34.1	31.3	14.9	U
		Sodium-22	2.07	3.93	7.27	3.38	U
		Thorium-227	−8.63	25.7	40.9	19.8	U
		Thorium-231	7.23	48.9	48.6	23.7	U
		Thorium-234	56.6	137	68.2	33.1	U
		Uranium-235	12.9	52.3	27.6	13.4	U
		Uranium-238	56.6	137	68.2	33.1	U
BKPM	3-Jun-2020	Actinium-228	1.06	40.2	30.2	14.3	U
		Alpha, gross	1.01	1.27	2.15	0.955	U
		Americium-241	6.36	16.6	26.7	12.9	U
		Beryllium-7	4.16	30.7	54.7	26.1	U
		Beta, gross	1.15	1.49	2.51	1.21	U
		Bismuth-212	−161	136	106	50.4	U
		Bismuth-214	6.89	23	17	8.17	U
		Cesium-137	0.507	3.5	6.21	2.93	U
		Cobalt-60	2.78	4.13	7.67	3.56	U
		Lead-212	−14.8	16	19.9	9.77	U
		Lead-214	8.41	20.2	15.2	7.33	U
		Neptunium-237	4.13	6.68	11.9	5.71	U
		Potassium-40	31	110	55.1	24.8	U
		Radium-223	−36.3	68.3	116	55.9	U
		Radium-224	13.5	121	108	52.1	U
		Radium-226	35.4	178	110	53.4	U
		Radium-228	1.06	40.2	30.2	14.3	U
		Sodium-22	0.597	3.68	6.88	3.17	U
		Thorium-227	15.7	25.7	45.7	22.1	U
		Thorium-231	−47.8	83.5	84.7	41.3	U
		Thorium-234	10.5	284	211	102	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers[a]
BKPM	3-Jun-2020	Uranium-235	45.5	33.4	31.2	15.1	X
		Uranium-238	10.5	284	211	102	U
BKPM 10	16-Sep-2020	Actinium-228	−1.65	6.94	6.66	3.1	U
		Alpha, gross	0.266	0.537	0.93	0.43	U
		Americium-241	0.189	1.16	1.95	0.94	U
		Beryllium-7	3.41	8.13	14.8	7.04	U
		Beta, gross	0.254	0.563	0.982	0.453	U
		Bismuth-212	3.65	25.3	23.2	10.9	U
		Bismuth-214	2.83	5.46	4.57	2.19	U
		Cesium-137	0.518	1	1.66	0.776	U
		Cobalt-60	−0.0525	0.987	1.84	0.839	U
		Lead-212	−2.02	3.19	4.79	2.35	U
		Lead-214	0.21	4.4	3.7	1.78	U
		Neptunium-237	−0.282	1.74	2.86	1.37	U
		Potassium-40	0.0591	20.8	18.9	8.66	U
		Radium-223	8.34	16.6	27.7	13.2	U
		Radium-224	−0.258	29.4	28.4	13.7	U
		Radium-226	6.32	29.9	37.7	18.4	U
		Radium-228	−1.65	6.94	6.66	3.1	U
		Sodium-22	−0.554	1.04	1.78	0.812	U
		Thorium-227	−2.71	6.62	10.7	5.12	U
		Thorium-231	−3.01	11.4	12.8	6.2	U
		Thorium-234	1.41	31.7	26.3	12.8	U
		Uranium-235	1.82	4.83	7.78	3.75	U
		Uranium-238	1.41	31.7	26.3	12.8	U

[a] Blank cells indicate that the data did not require a data qualifier.
Lc = critical level
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.

Appendix D. Stormwater Sampling Requirements and Results in 2020

Flame skimmer (*Libellula saturata*)

Table D-1. MSGP stormwater sampling requirements and benchmark values

Pollutant	MSGP Sector, Subsector	EPA Benchmark Total (mg/L)	New Mexico Benchmark Total (mg/L)	New Mexico Benchmark, Dissolved (mg/L)
Aluminum[a]	N1	N/A	N/A	8.838[a] (total recoverable[b])
Ammonia	K1	2.14	N/A	N/A
Arsenic	K1	N/A	0.01	N/A
Cadmium[a]	K1	N/A	N/A	0.00298[a]
Chemical oxygen demand	K1, N1	120	N/A	N/A
Copper[a]	N1	N/A	N/A	0.026[a]
Cyanide	K1	N/A	0.0052	N/A
Iron	N1, L2	1.0	N/A	N/A
Lead[a]	K1, N1	N/A	N/A	0.14[a]
Magnesium	K1	0.064	N/A	N/A
Mercury	K1	N/A	0.00077	N/A
Selenium	K1	0.005	N/A	N/A
Silver[a]	K1	N/A	N/A	0.011[a]
Total nitrogen (nitrate + nitrite)	J1	N/A	132	N/A
Total suspended solids	J1, L1, N1	100	N/A	N/A
Zinc[a]	N1	N/A	N/A	0.301[a]

[a] Hardness-dependent benchmark. Value calculated using a hardness value of 125 mg/L, determined for the Middle Rio Grande from U.S. Geological Survey sampling data.
[b] The modified benchmark concentration value for aluminum specified in the New Mexico water quality hardness-based values table in Multi-Sector General Permit Part 9.6.2.1 is 8.838 mg/L as total recoverable.
N/A = not applicable

Table D-2. MS4 Permit sampling requirements and water quality standards

Parameter	Water Quality Standard[a]
Chemical oxygen demand	—
Conductivity	—
Dissolved oxygen	Greater than 5.0 mg/L
Dissolved phosphorous	—
E. coli	47 CFU/100 mL
Five-day biological oxygen demand	—
Gross alpha	15 pCi/L
Oil and grease	15 mg/L
Nitrate plus nitrite	132 mg/L
pH	6.6–9.0
Polychlorinated biphenyl	0.00017 µg/L
Temperature	Less than 32.0 °C
Total dissolved solids	1,500 mg/L
Total Kjeldahl nitrogen	8.5 mg/L
Total phosphorous	—
Total suspended solids	—

[a] As specified by the Municipal Separate Storm Sewer System Permit or 20.6.4 NMAC.
— = no water quality standard specified
CFU = colony-forming unit

Table D-3. MSGP stormwater sampling results, 2020

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-46	27-Jul-20	Cadmium	<0.0003	0.0003	0.001	Filtered
		Lead	<0.0005	0.0005	0.002	Filtered
		Silver	<0.0003	0.0003	0.001	Filtered

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

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

Table D-4. MS4 Permit sampling results, July 1, 2019, through June 30, 2020

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Sample Preparation	Units
SWSP-02	4-Oct-2019	*E. Coli*	1162		10	Unfiltered	MPN/100
	13-Apr-2020	*E. Coli*	224.7		1	Unfiltered	MPN/100
SWSP-05	4-Oct-2019	*E. Coli*	201		10	Unfiltered	MPN/100
	20-Nov-2019	*E. Coli*	24196		10	Unfiltered	MPN/100
	13-Apr-2020	*E. Coli*	10		10	Unfiltered	MPN/100
SWSP-24	4-Oct-2019	*E. Coli*	17329		10	Unfiltered	MPN/100
	20-Nov-2019	*E. Coli*	19863		10	Unfiltered	MPN/100
	13-Apr-2020	*E. Coli*	670		10	Unfiltered	MPN/100
SWSP-35	26-Jul-2019	Alpha, gross	3.62	0.36	0.779	Unfiltered	pCi/L
	26-Jul-2019	Biochemical oxygen demand	30		2	Unfiltered	mg/L
	26-Jul-2019	Beta, gross	21.3	0.435	0.968	Unfiltered	pCi/L
	26-Jul-2019	Chemical oxygen demand	112	8.95	20	Unfiltered	mg/L
	26-Jul-2019	*E. Coli*	24196		10	Unfiltered	MPN/100
	26-Jul-2019	Grease and oil	3.15	1.52	5.43	Unfiltered	mg/L
	26-Jul-2019	Nitrate plus nitrite as N	1.47	0.085	0.25	Unfiltered	mg/L
	26-Jul-2019	Nitrogen, Kjeldahl	4.38	0.033	0.1	Unfiltered	mg/L
	26-Jul-2019	Phosphorus, total as P	0.421	0.02	0.05	Unfiltered	mg/L
	26-Jul-2019	Phosphorus, total as P	0.491	0.02	0.05	Unfiltered	mg/L
	26-Jul-2019	Solids, total dissolved	120	3.4	14.3	Unfiltered	mg/L
	26-Jul-2019	Solids, total suspended	56	5.7	25	Unfiltered	mg/L
	26-Jul-2019	Total PCB Congeners	0.0523		111	Unfiltered	ug/L
	9-Aug-2019	Biochemical oxygen demand	11		2	Unfiltered	mg/L
	9-Aug-2019	*E. Coli*	12.1		1	Unfiltered	MPN/100
	9-Aug-2019	Phosphorus, total as P	0.113	0.02	0.05	Filtered	mg/L
	20-Nov-2019	*E. Coli*	2419.6		1	Unfiltered	MPN/100
	13-Apr-2020	*E. Coli*	1860		10	Unfiltered	MPN/100

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Sample Preparation	Units
SWSP-36	26-Jul-2019	Phosphorus, total as P	0.366	0.02	0.05	Unfiltered	mg/L
	26-Jul-2019	Solids, total suspended	7.4	1.14	5	Unfiltered	mg/L
	4-Oct-2019	*E. Coli*	< 10		10	Unfiltered	MPN/100
	20-Nov-2019	*E. Coli*	118.7		1	Unfiltered	MPN/100
	13-Apr-2020	*E. Coli*	10.8		1	Unfiltered	MPN/100

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

Appendix E. Sanitary Outfalls Monitoring Results in 2020

Black-chinned hummingbird (*Archilochus alexandri*)

Table E-1. Inorganic results for permitted sanitary outfalls, October 2020

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	5-Oct-2020	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		6-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	1.04	0.085	B	EPA 350.1
			Arsenic	0.00248	0.002	J	EPA 200.8
			Boron	0.294	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00347	0.003	J	EPA 200.8
			Copper	0.00391	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	2.54	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00783	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Selenium	0.00258	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.00506	0.0033	JB	EPA 200.8
		7-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.355	0.017	B	EPA 350.1
			Arsenic	0.00215	0.002	J	EPA 200.8
			Boron	0.0615	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00308	0.003	J	EPA 200.8
			Copper	0.0103	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	1.12	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	7-Oct-2020	Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00334	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Selenium	0.00325	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.00346	0.0033	J	EPA 200.8
		8-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.425	0.017	B	EPA 350.1
			Arsenic	0.00227	0.002	J	EPA 200.8
			Boron	0.0741	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00582	0.0003		EPA 200.8
			Fluoride	0.987	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00318	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0443	0.0033		EPA 200.8
		9-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.442	0.017	B	EPA 350.1
			Arsenic	0.00323	0.002	J	EPA 200.8
			Boron	0.16	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00805	0.0003		EPA 200.8
			Fluoride	1.49	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	9-Oct-2020	Molybdenum	0.0041	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0789	0.0033		EPA 200.8
WW001	2069A	6-Oct-2020	Aluminum	0.0345	0.0193	J	EPA 200.8
			Ammonia	6.35	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0663	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00405	0.003	J	EPA 200.8
			Copper	0.0165	0.0003		EPA 200.8
			Fluoride	1.95	0.033		EPA 300.0
			Lead	0.000787	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00853	0.0002		EPA 200.8
			Nickel	0.00141	0.0006	J	EPA 200.8
			Selenium	0.00266	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0325	0.0033	B	EPA 200.8
		7-Oct-2020	Aluminum	0.031	0.0193	J	EPA 200.8
			Ammonia	6.75	0.085	B	EPA 350.1
			Arsenic	0.00255	0.002	J	EPA 200.8
			Boron	0.198	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.0043	0.003	J	EPA 200.8
			Copper	0.0156	0.0003		EPA 200.8
			Fluoride	1.39	0.033		EPA 300.0
			Lead	0.000695	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00978	0.0002		EPA 200.8
			Nickel	0.00285	0.0006		EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	7-Oct-2020	Selenium	0.00299	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0252	0.0033		EPA 200.8
		8-Oct-2020	Aluminum	0.0253	0.0193	J	EPA 200.8
			Ammonia	7.5	0.085	B	EPA 350.1
			Arsenic	0.00318	0.002	J	EPA 200.8
			Boron	0.0818	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00388	0.003	J	EPA 200.8
			Copper	0.0163	0.0003		EPA 200.8
			Fluoride	1.51	0.033		EPA 300.0
			Lead	0.000563	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0112	0.0002		EPA 200.8
			Nickel	0.00125	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0401	0.0033		EPA 200.8
		9-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	6.6	0.085	B	EPA 350.1
			Arsenic	0.00274	0.002	J	EPA 200.8
			Boron	0.0526	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00339	0.003	J	EPA 200.8
			Copper	0.0136	0.0003		EPA 200.8
			Fluoride	1.82	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00905	0.0002		EPA 200.8
			Nickel	0.00114	0.0006	J	EPA 200.8
			Selenium	0.00228	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	9-Oct-2020	Zinc	0.0376	0.0033		EPA 200.8
WW006	2069F	5-Oct-2020	Cyanide, total	0.00409	0.00167	J	EPA 335.4
			Cyanide, total	0.00296	0.00167	J	EPA 335.4
			Cyanide, total	0.00343	0.00167	J	EPA 335.4
		6-Oct-2020	Aluminum	0.0594	0.0193		EPA 200.8
			Ammonia	26	0.425	B	EPA 350.1
			Arsenic	0.00262	0.002	J	EPA 200.8
			Boron	2.08	0.104		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0204	0.0003		EPA 200.8
			Cyanide, total	0.00277	0.00167	J	EPA 335.4
			Cyanide, total	0.0034	0.00167	J	EPA 335.4
			Cyanide, total	0.00278	0.00167	J	EPA 335.4
			Cyanide, total	0.00551	0.00167		EPA 335.4
			Fluoride	0.994	0.033		EPA 300.0
			Lead	0.00116	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0188	0.0002		EPA 200.8
			Nickel	0.00152	0.0006	J	EPA 200.8
			Selenium	0.00225	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0737	0.0033	B	EPA 200.8
		7-Oct-2020	Aluminum	0.0575	0.0193		EPA 200.8
			Ammonia	43.8	0.85	B	EPA 350.1
			Arsenic	0.00276	0.002	J	EPA 200.8
			Boron	2.07	0.104		EPA 200.8
			Cadmium	0.000308	0.0003	J	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0223	0.0003		EPA 200.8
			Cyanide, total	0.00538	0.00167		EPA 335.4
			Fluoride	1.05	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	7-Oct-2020	Lead	0.00112	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0194	0.0002		EPA 200.8
			Nickel	0.00176	0.0006	J	EPA 200.8
			Selenium	0.00289	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0842	0.0033		EPA 200.8
		8-Oct-2020	Aluminum	0.0527	0.0193		EPA 200.8
			Ammonia	43.6	0.85	B	EPA 350.1
			Arsenic	0.00301	0.002	J	EPA 200.8
			Boron	1.92	0.104		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0257	0.0003		EPA 200.8
			Fluoride	1.03	0.033		EPA 300.0
			Lead	0.000792	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0268	0.0002		EPA 200.8
			Nickel	0.00202	0.0006		EPA 200.8
			Selenium	0.00217	0.002	J	EPA 200.8
			Silver	0.00036	0.0003	J	EPA 200.8
			Zinc	0.063	0.0033		EPA 200.8
		9-Oct-2020	Aluminum	0.0681	0.0193		EPA 200.8
			Ammonia	31.5	0.85	B	EPA 350.1
			Arsenic	0.00276	0.002	J	EPA 200.8
			Boron	1.84	0.104		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00804	0.003	J	EPA 200.8
			Copper	0.0274	0.0003		EPA 200.8
			Fluoride	0.997	0.033		EPA 300.0
			Lead	0.000932	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	9-Oct-2020	Molybdenum	0.0233	0.0002		EPA 200.8
			Nickel	0.00539	0.0006		EPA 200.8
			Selenium	0.00208	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0864	0.0033		EPA 200.8
WW007	2069G	5-Oct-2020	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		6-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	1.89	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0223	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00149	0.0003	J	EPA 200.8
			Cyanide, total	0.00259	0.00167	J	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	2.01	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0129	0.0002		EPA 200.8
			Nickel	0.00206	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc		0.0033	U	EPA 200.8
		7-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	1.27	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0243	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	7-Oct-2020	Chromium		0.003	U	EPA 200.8
			Copper	0.00305	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	1.41	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.012	0.0002		EPA 200.8
			Nickel	0.000844	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.00372	0.0033	J	EPA 200.8
		8-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	3.44	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0242	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00151	0.0003	J	EPA 200.8
			Fluoride	1.55	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0102	0.0002		EPA 200.8
			Nickel	0.000922	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc		0.0033	U	EPA 200.8
		9-Oct-2020	Aluminum		0.0193	U	EPA 200.8
			Ammonia	2.26	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0202	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	9-Oct-2020	Copper	0.000841	0.0003	J	EPA 200.8
			Fluoride	2.19	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0105	0.0002		EPA 200.8
			Nickel	0.000886	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc		0.0033	U	EPA 200.8
WW008	2069I	6-Oct-2020	Aluminum	0.0495	0.0193	J	EPA 200.8
			Ammonia	9.85	0.085	B	EPA 350.1
			Arsenic	0.0021	0.002	J	EPA 200.8
			Boron	0.0933	0.0052		EPA 200.8
			Cadmium	0.000349	0.0003	J	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0251	0.0003		EPA 200.8
			Fluoride	0.795	0.033		EPA 300.0
			Lead	0.000993	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0173	0.0002		EPA 200.8
			Nickel	0.00351	0.0006		EPA 200.8
			Selenium	0.00253	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.545	0.0033	B	EPA 200.8
		7-Oct-2020	Aluminum	0.121	0.0193		EPA 200.8
			Ammonia	10.6	0.425	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.101	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00424	0.003	J	EPA 200.8
			Copper	0.0346	0.0003		EPA 200.8
			Fluoride	0.677	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	7-Oct-2020	Lead	0.00149	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0432	0.0002		EPA 200.8
			Nickel	0.00276	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver	0.00054	0.0003	J	EPA 200.8
			Zinc	0.103	0.0033		EPA 200.8
		8-Oct-2020	Aluminum	0.0814	0.0193		EPA 200.8
			Ammonia	18.2	0.85	B	EPA 350.1
			Arsenic	0.0029	0.002	J	EPA 200.8
			Boron	0.0765	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00458	0.003	J	EPA 200.8
			Copper	0.0341	0.0003		EPA 200.8
			Fluoride	0.765	0.033		EPA 300.0
			Lead	0.000507	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.006	0.0002		EPA 200.8
			Nickel	0.00604	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver	0.000329	0.0003	J	EPA 200.8
			Zinc	0.184	0.0033		EPA 200.8
		9-Oct-2020	Aluminum	0.0208	0.0193	J	EPA 200.8
			Ammonia	17	0.85	B	EPA 350.1
			Arsenic	0.0026	0.002	J	EPA 200.8
			Boron	0.164	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0208	0.0003		EPA 200.8
			Fluoride	0.753	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	9-Oct-2020	Molybdenum	0.00651	0.0002		EPA 200.8
			Nickel	0.00423	0.0006		EPA 200.8
			Selenium	0.00221	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0418	0.0033		EPA 200.8
WW011	2069K	6-Oct-2020	Aluminum	0.0383	0.0193	J	EPA 200.8
			Ammonia	17.8	0.425	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.121	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00596	0.003	J	EPA 200.8
			Copper	0.014	0.0003		EPA 200.8
			Fluoride	0.714	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.047	0.0002		EPA 200.8
			Nickel	0.00228	0.0006		EPA 200.8
			Selenium	0.00204	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0399	0.0033	B	EPA 200.8
		7-Oct-2020	Aluminum	0.05	0.0193		EPA 200.8
			Ammonia	22.1	0.85	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.059	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0219	0.0003		EPA 200.8
			Fluoride	0.658	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00484	0.0002		EPA 200.8
			Nickel	0.00297	0.0006		EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	7-Oct-2020	Selenium	0.0022	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.112	0.0033		EPA 200.8
		8-Oct-2020	Aluminum	0.0712	0.0193		EPA 200.8
			Ammonia	18.7	0.85	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0923	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00327	0.003	J	EPA 200.8
			Copper	0.0259	0.0003		EPA 200.8
			Fluoride	0.687	0.033		EPA 300.0
			Lead	0.000714	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0477	0.0002		EPA 200.8
			Nickel	0.00197	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.071	0.0033		EPA 200.8
		9-Oct-2020	Aluminum	0.0234	0.0193	J	EPA 200.8
			Ammonia	18.8	0.85	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.101	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0135	0.0003		EPA 200.8
			Fluoride	0.751	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0436	0.0002		EPA 200.8
			Nickel	0.00182	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	9-Oct-2020	Zinc	0.0419	0.0033		EPA 200.8

[a] Blank cells indicate that the data did not require a data qualifier.
CINT = Center for Integrated Nanotechnologies
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
PQL = practical quantitation limit; the lowest concentration of analytes in a sample that can be determined reliably within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions

Laboratory Data Qualifier
B = The analyte was detected in the blank.
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.
U = The analyte was absent or below the method detection limit.

Table E-2. Radiological results for permitted sanitary outfalls, October 2020

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	6-Oct-2020	Actinium-228	9.65 + 26.1	17.3	U	EPA 901.1
			Alpha, gross	3.93 + 1.48	2.15		EPA 900.0/SW846 9310
			Americium-241	−2.85 + 11.3	20.3	U	EPA 901.1
			Beryllium-7	−2.93 + 20.7	33.6	U	EPA 901.1
			Beta, gross	2.7 + 0.917	1.44		EPA 900.0/SW846 9310
			Bismuth-212	58.2 + 43.8	71.5	U	EPA 901.1
			Bismuth-214	−2.95 + 11.9	13.2	U	EPA 901.1
			Cesium-137	28 + 5.49	5.01		EPA 901.1
			Cobalt-60	0.89 + 2.74	5.36	U	EPA 901.1
			Lead-212	1.4 + 7.66	9.25	U	EPA 901.1
			Lead-214	0.0813 + 14.1	9.37	U	EPA 901.1
			Neptunium-237	−0.62 + 4.82	8.02	U	EPA 901.1
			Potassium-40	−37 + 59.7	83.5	U	EPA 901.1
			Radium-223	−19.6 + 49.2	79	U	EPA 901.1
			Radium-224	−73.8 + 62.2	82.5	U	EPA 901.1
			Radium-226	34.7 + 142	79.6	U	EPA 901.1
			Radium-228	9.65 + 26.1	17.3	U	EPA 901.1
			Sodium-22	−4.23 + 4.47	5.09	U	EPA 901.1
			Thorium-227	12.4 + 20.1	33.7	U	EPA 901.1
			Thorium-231	7.37 + 59.4	49.9	U	EPA 901.1
			Thorium-234	−104 + 173	202	U	EPA 901.1
			Tritium	33.1 + 76.1	136	U	EPA 906.0 Modified
			Uranium-235	−19.2 + 23.1	24.8	U	EPA 901.1
			Uranium-238	−104 + 173	202	U	EPA 901.1
		7-Oct-2020	Actinium-228	20.3 + 26.9	26.7	U	EPA 901.1
			Alpha, gross	−0.307 + 2.96	5.32	U	EPA 900.0/SW846 9310
			Americium-241	1.55 + 11.1	20.3	U	EPA 901.1
			Beryllium-7	7.87 + 19.2	35.4	U	EPA 901.1
			Beta, gross	1.67 + 2.79	4.71	U	EPA 900.0/SW846 9310
			Bismuth-212	29.4 + 38.7	68.9	U	EPA 901.1
			Bismuth-214	6.09 + 14.5	9.17	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	7-Oct-2020	Cesium-137	1.51 + 2.64	4.8	U	EPA 901.1
			Cobalt-60	1.68 + 2.96	5.71	U	EPA 901.1
			Lead-212	6.77 + 9.72	6.95	U	EPA 901.1
			Lead-214	11.5 + 13.1	12.2	U	EPA 901.1
			Neptunium-237	−0.629 + 5.21	7.96	U	EPA 901.1
			Potassium-40	23.9 + 76.3	47.9	U	EPA 901.1
			Radium-223	−16.9 + 50.1	81	U	EPA 901.1
			Radium-224	36.5 + 49.2	75.6	U	EPA 901.1
			Radium-226	38.4 + 112	74.6	U	EPA 901.1
			Radium-228	20.3 + 26.9	26.7	U	EPA 901.1
			Sodium-22	−1.88 + 2.75	4.52	U	EPA 901.1
			Thorium-227	−3.34 + 18	30	U	EPA 901.1
			Thorium-231	46.8 + 39.5	46	X	EPA 901.1
			Thorium-234	119 + 220	161	U	EPA 901.1
			Tritium	129 + 91	134	U	EPA 906.0 Modified
			Uranium-235	−3.84 + 20.1	24.1	U	EPA 901.1
			Uranium-238	119 + 220	161	U	EPA 901.1
		8-Oct-2020	Actinium-228	5.32 + 14.5	9.14	U	EPA 901.1
			Alpha, gross	0.164 + .952	1.71	U	EPA 900.0/SW846 9310
			Americium-241	1.56 + 5.33	8.1	U	EPA 901.1
			Beryllium-7	−5.89 + 12	19.3	U	EPA 901.1
			Beta, gross	1.6 + .959	1.57		EPA 900.0/SW846 9310
			Bismuth-212	0.589 + 19.7	35.2	U	EPA 901.1
			Bismuth-214	6.51 + 7.74	4.88	X	EPA 901.1
			Cesium-137	0.288 + 1.5	2.69	U	EPA 901.1
			Cobalt-60	−0.499 + 1.55	2.51	U	EPA 901.1
			Lead-212	0.405 + 5.58	4.65	U	EPA 901.1
			Lead-214	2.02 + 5.96	5.34	U	EPA 901.1
			Neptunium-237	4.33 + 5.34	4.62	U	EPA 901.1
			Potassium-40	30.9 + 43.2	24.3	X	EPA 901.1
			Radium-223	−22.7 + 27.8	42.8	U	EPA 901.1
			Radium-224	0.348 + 26.7	41.5	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	8-Oct-2020	Radium-226	−6.56 + 57.4	57.9	U	EPA 901.1
			Radium-228	5.32 + 14.5	9.14	U	EPA 901.1
			Sodium-22	−1.07 + 1.71	2.31	U	EPA 901.1
			Thorium-227	−1.38 + 10.3	17.6	U	EPA 901.1
			Thorium-231	−3.99 + 25.8	28.6	U	EPA 901.1
			Thorium-234	79.8 + 102	68.9	X	EPA 901.1
			Tritium	44.9 + 112	199	U	EPA 906.0 Modified
			Uranium-235	−13.9 + 13.6	13.9	U	EPA 901.1
			Uranium-238	79.8 + 102	68.9	X	EPA 901.1
		9-Oct-2020	Actinium-228	11.5 + 15.3	12.5	U	EPA 901.1
			Alpha, gross	0.0511 + 0.891	1.65	U	EPA 900.0/SW846 9310
			Americium-241	−1.74 + 2.48	3.55	U	EPA 901.1
			Beryllium-7	-12.5 + 15.2	20.5	U	EPA 901.1
			Beta, gross	1.32 + 0.62	0.986		EPA 900.0/SW846 9310
			Bismuth-212	9.98 + 22.1	37.9	U	EPA 901.1
			Bismuth-214	4.49 + 6.73	5.44	U	EPA 901.1
			Cesium-137	−0.608 + 1.77	2.59	U	EPA 901.1
			Cobalt-60	1.27 + 1.8	3.23	U	EPA 901.1
			Lead-212	−4.01 + 5.36	4.49	U	EPA 901.1
			Lead-214	2.54 + 7.69	4.96	U	EPA 901.1
			Neptunium-237	−1.21 + 2.6	4.4	U	EPA 901.1
			Potassium-40	34.1 + 41.2	28.7	X	EPA 901.1
			Radium-223	18.8 + 29.4	44.8	U	EPA 901.1
			Radium-224	28.7 + 31.1	50.1	U	EPA 901.1
			Radium-226	−60.8 + 66.4	63.8	U	EPA 901.1
			Radium-228	11.5 + 15.3	12.5	U	EPA 901.1
			Sodium-22	−0.0634 + 1.44	2.6	U	EPA 901.1
			Thorium-227	−7.13 + 9.9	16.1	U	EPA 901.1
			Thorium-231	-7.74 + 20.2	21.7	U	EPA 901.1
			Thorium-234	16.9 + 62.8	61.8	U	EPA 901.1
			Tritium	53.2 + 105	184	U	EPA 906.0 Modified
			Uranium-235	4.52 + 13.2	13.8	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	9-Oct-2020	Uranium-238	16.9 + 62.8	61.8	U	EPA 901.1
WW001	2069A	6-Oct-2020	Actinium-228	−0.0101 + 11.6	12.2	U	EPA 901.1
			Alpha, gross	1.8 + 1.38	2.17	U	EPA 900.0/SW846 9310
			Americium-241	0.0112 + 8.85	14.6	U	EPA 901.1
			Beryllium-7	3.15 + 11	19.9	U	EPA 901.1
			Beta, gross	6.11 + 1.4	2.09		EPA 900.0/SW846 9310
			Bismuth-212	10.8 + 21.4	38	U	EPA 901.1
			Bismuth-214	0.181 + 7.37	6.35	U	EPA 901.1
			Cesium-137	−0.554 + 1.58	2.69	U	EPA 901.1
			Cobalt-60	−0.224 + 1.6	2.91	U	EPA 901.1
			Lead-212	6.73 + 6.75	6.74	U	EPA 901.1
			Lead-214	2.96 + 7.12	6.31	U	EPA 901.1
			Neptunium-237	−0.799 + 2.72	4.84	U	EPA 901.1
			Potassium-40	25.5 + 49.1	25.5	X	EPA 901.1
			Radium-223	−3.29 + 26.5	47.9	U	EPA 901.1
			Radium-224	−27.8 + 44.4	44	U	EPA 901.1
			Radium-226	−66.8 + 66	73.8	U	EPA 901.1
			Radium-228	-0.0101 + 11.6	12.2	U	EPA 901.1
			Sodium-22	−0.329 + 1.61	2.91	U	EPA 901.1
			Thorium-227	0.0684 + 11.8	18.1	U	EPA 901.1
			Thorium-231	21.5 + 41.9	31.6	U	EPA 901.1
			Thorium-234	345 + 214	111	X	EPA 901.1
			Tritium	−6.78 + 92.6	174	U	EPA 906.0 Modified
			Uranium-235	−5.04 + 16.7	17.9	U	EPA 901.1
			Uranium-238	345 + 214	111	X	EPA 901.1
		7-Oct-2020	Actinium-228	4.91 + 9.88	12.6	U	EPA 901.1
			Alpha, gross	1.73 + 1.66	2.66	U	EPA 900.0/SW846 9310
			Americium-241	−2.74 + 8	12.8	U	EPA 901.1
			Beryllium-7	−3.58 + 11.6	20.2	U	EPA 901.1
			Beta, gross	6.41 + 1.33	1.98		EPA 900.0/SW846 9310
			Bismuth-212	13.6 + 20.8	36.4	U	EPA 901.1
			Bismuth-214	0.321 + 6.51	5.26	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	7-Oct-2020	Cesium-137	3.31 + 2.64	2.52		EPA 901.1
			Cobalt-60	0.1 + 1.64	2.7	U	EPA 901.1
			Lead-212	−0.0196 + 4.67	5.28	U	EPA 901.1
			Lead-214	0.389 + 6.06	5.66	U	EPA 901.1
			Neptunium-237	−1.64 + 2.68	4.55	U	EPA 901.1
			Potassium-40	31.7 + 46.5	27	X	EPA 901.1
			Radium-223	1.28 + 27	48.9	U	EPA 901.1
			Radium-224	−37.1 + 33.5	44.9	U	EPA 901.1
			Radium-226	−55.2 + 69.3	73	U	EPA 901.1
			Radium-228	4.91 + 9.88	12.6	U	EPA 901.1
			Sodium-22	−0.181 + 1.47	2.68	U	EPA 901.1
			Thorium-227	−0.828 + 11.1	18.3	U	EPA 901.1
			Thorium-231	−17.5 + 38.4	34.2	U	EPA 901.1
			Thorium-234	55.5 + 149	144	U	EPA 901.1
			Tritium	17.2 + 78.5	145	U	EPA 906.0 Modified
			Uranium-235	3.46 + 17.2	16.5	U	EPA 901.1
			Uranium-238	55.5 + 149	144	U	EPA 901.1
		8-Oct-2020	Actinium-228	−7.85 + 13.7	12.8	U	EPA 901.1
			Alpha, gross	2.31 + 1.53	2.4	U	EPA 900.0/SW846 9310
			Americium-241	12.3 + 16.6	18.7	U	EPA 901.1
			Beryllium-7	1.71 + 14.1	25	U	EPA 901.1
			Beta, gross	3.86 + 1.53	2.45		EPA 900.0/SW846 9310
			Bismuth-212	24.2 + 28.1	46.9	U	EPA 901.1
			Bismuth-214	1.18 + 10	6.09	U	EPA 901.1
			Cesium-137	−0.597 + 1.84	3.08	U	EPA 901.1
			Cobalt-60	1.74 + 2.11	3.77	U	EPA 901.1
			Lead-212	1.32 + 6.71	5.67	U	EPA 901.1
			Lead-214	0.428 + 10.3	6.98	U	EPA 901.1
			Neptunium-237	−0.135 + 2.88	5.19	U	EPA 901.1
			Potassium-40	28 + 58.7	34.2	U	EPA 901.1
			Radium-223	−14.2 + 33.1	51.2	U	EPA 901.1
			Radium-224	26.4 + 35.5	52.6	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	8-Oct-2020	Radium-226	−6.31 + 65.7	65.6	U	EPA 901.1
			Radium-228	−7.85 + 13.7	12.8	U	EPA 901.1
			Sodium-22	0.701 + 1.93	3.53	U	EPA 901.1
			Thorium-227	−8.64 + 13	19.6	U	EPA 901.1
			Thorium-231	11.5 + 22.1	38.1	U	EPA 901.1
			Thorium-234	−39 + 169	168	U	EPA 901.1
			Tritium	13 + 106	196	U	EPA 906.0 Modified
			Uranium-235	10.6 + 14.5	16.6	U	EPA 901.1
			Uranium-238	−39 + 169	168	U	EPA 901.1
		9-Oct-2020	Actinium-228	2.23 + 15.7	12.2	U	EPA 901.1
			Alpha, gross	1.8 + 1.24	1.89	U	EPA 900.0/SW846 9310
			Americium-241	1.21 + 4.46	7.16	U	EPA 901.1
			Beryllium-7	−1.23 + 11.8	20	U	EPA 901.1
			Beta, gross	6.45 + 1.51	2.25		EPA 900.0/SW846 9310
			Bismuth-212	11.1 + 19.7	34.9	U	EPA 901.1
			Bismuth-214	1.49 + 5.63	6.27	U	EPA 901.1
			Cesium-137	−0.945 + 1.48	2.47	U	EPA 901.1
			Cobalt-60	0.637 + 1.51	2.78	U	EPA 901.1
			Lead-212	1.99 + 5.08	4.68	U	EPA 901.1
			Lead-214	2.67 + 7.2	5.65	U	EPA 901.1
			Neptunium-237	0.915 + 2.52	4.42	U	EPA 901.1
			Potassium-40	−23.5 + 36.4	41.4	U	EPA 901.1
			Radium-223	−8.03 + 24.4	41.8	U	EPA 901.1
			Radium-224	10.3 + 24.9	39.8	U	EPA 901.1
			Radium-226	−17.2 + 57.9	62	U	EPA 901.1
			Radium-228	2.23 + 15.7	12.2	U	EPA 901.1
			Sodium-22	2 + 1.8	2.94	U	EPA 901.1
			Thorium-227	−4.65 + 9.74	16.6	U	EPA 901.1
			Thorium-231	6.11 + 34	23.6	U	EPA 901.1
			Thorium-234	12.6 + 91.3	88.5	U	EPA 901.1
			Tritium	65.7 + 120	209	U	EPA 906.0 Modified
			Uranium-235	−10.8 + 17.1	14.3	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	9-Oct-2020	Uranium-238	12.6 + 91.3	88.5	U	EPA 901.1
WW006	2069F	6-Oct-2020	Actinium-228	5.64 + 12.2	10.7	U	EPA 901.1
			Alpha, gross	0.437 + 1.76	3.08	U	EPA 900.0/SW846 9310
			Americium-241	3.12 + 8.72	14	U	EPA 901.1
			Beryllium-7	5.23 + 12.6	22.7	U	EPA 901.1
			Beta, gross	14.8 + 1.79	2.2		EPA 900.0/SW846 9310
			Bismuth-212	17 + 44.7	36.2	U	EPA 901.1
			Bismuth-214	.895 + 8.31	5.26	U	EPA 901.1
			Cesium-137	3.94 + 4.38	2.65	X	EPA 901.1
			Cobalt-60	−0.331 + 1.61	2.95	U	EPA 901.1
			Lead-212	0.652 + 5.44	5.47	U	EPA 901.1
			Lead-214	2.19 + 8.11	6.84	U	EPA 901.1
			Neptunium-237	0.404 + 2.83	5.15	U	EPA 901.1
			Potassium-40	37.4 + 46.7	27.9	X	EPA 901.1
			Radium-223	−6.69 + 28.8	51.3	U	EPA 901.1
			Radium-224	9.94 + 32.4	49.4	U	EPA 901.1
			Radium-226	8.46 + 72.3	53.5	U	EPA 901.1
			Radium-228	5.64 + 12.2	10.7	U	EPA 901.1
			Sodium-22	1.09 + 1.7	3.2	U	EPA 901.1
			Thorium-227	−12.1 + 13.5	19.1	U	EPA 901.1
			Thorium-231	6.26 + 34.3	39.4	U	EPA 901.1
			Thorium-234	7.86 + 168	115	U	EPA 901.1
			Tritium	51.2 + 65.4	110	U	EPA 906.0 Modified
			Uranium-235	4.09 + 19.2	15.5	U	EPA 901.1
			Uranium-238	7.86 + 168	115	U	EPA 901.1
		7-Oct-2020	Actinium-228	20.5 + 11.4	8.88	X	EPA 901.1
			Alpha, gross	4.1 + 2.5	3.94		EPA 900.0/SW846 9310
			Americium-241	−5.96 + 6.33	8.41	U	EPA 901.1
			Beryllium-7	−1.56 + 11.8	20.4	U	EPA 901.1
			Beta, gross	14.2 + 2.12	3.06		EPA 900.0/SW846 9310
			Bismuth-212	0-36 + 35.2	34.8	U	EPA 901.1
			Bismuth-214	0.061 + 6.62	5.4	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	7-Oct-2020	Cesium-137	1.94 + 1.76	2.87	U	EPA 901.1
			Cobalt-60	0.49 + 1.75	3.23	U	EPA 901.1
			Lead-212	5.28 + 6.77	3.93	X	EPA 901.1
			Lead-214	0.285 + 7.06	6.11	U	EPA 901.1
			Neptunium-237	−1.04 + 2.71	4.64	U	EPA 901.1
			Potassium-40	2.41 + 44.4	32.2	U	EPA 901.1
			Radium-223	4.49 + 27.2	48.3	U	EPA 901.1
			Radium-224	29.6 + 28.3	46.2	U	EPA 901.1
			Radium-226	5.55 + 67.1	44.7	U	EPA 901.1
			Radium-228	20.5 + 11.4	8.88	X	EPA 901.1
			Sodium-22	1.07 + 1.54	2.87	U	EPA 901.1
			Thorium-227	−4.7 + 10.6	18.1	U	EPA 901.1
			Thorium-231	−7.73 + 28.4	29.7	U	EPA 901.1
			Thorium-234	77.6 + 107	110	U	EPA 901.1
			Tritium	24.1 + 73.5	134	U	EPA 906.0 Modified
			Uranium-235	13.5 + 18.6	13.4	X	EPA 901.1
			Uranium-238	77.6 + 107	110	U	EPA 901.1
		8-Oct-2020	Actinium-228	11.1 + 15.6	11.1	U	EPA 901.1
			Alpha, gross	2.94 + 2.15	3.4	U	EPA 900.0/SW846 9310
			Americium-241	2.4 + 3.16	5.08	U	EPA 901.1
			Beryllium-7	13.5 + 11.9	19.5	U	EPA 901.1
			Beta, gross	17.7 + 2.92	4.15		EPA 900.0/SW846 9310
			Bismuth-212	−61.5 + 55.9	37.1	U	EPA 901.1
			Bismuth-214	5.13 + 7.03	4.57	X	EPA 901.1
			Cesium-137	−1.26 + 2.42	2.15	U	EPA 901.1
			Cobalt-60	0.271 + 1.38	2.58	U	EPA 901.1
			Lead-212	−1.39 + 4.52	6.56	U	EPA 901.1
			Lead-214	−3.03 + 6.87	5.06	U	EPA 901.1
			Neptunium-237	-.658 + 2.34	3.78	U	EPA 901.1
			Potassium-40	14.4 + 41.4	26.2	U	EPA 901.1
			Radium-223	−3.67 + 24.5	39.9	U	EPA 901.1
			Radium-224	−41.4 + 44.1	37.1	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	8-Oct-2020	Radium-226	23.2 + 56.2	35.5	U	EPA 901.1
			Radium-228	11.1 + 15.6	11.1	U	EPA 901.1
			Sodium-22	−0.746 + 1.39	2.05	U	EPA 901.1
			Thorium-227	5.11 + 8.97	14.9	U	EPA 901.1
			Thorium-231	−13.4 + 21.9	22.5	U	EPA 901.1
			Thorium-234	27.2 + 63.8	44.1	U	EPA 901.1
			Tritium	141 + 136	220	U	EPA 906.0 Modified
			Uranium-235	0.924 + 16.7	10.8	U	EPA 901.1
			Uranium-238	27.2 + 63.8	44.1	U	EPA 901.1
		9-Oct-2020	Actinium-228	8.17 + 11.6	7.76	X	EPA 901.1
			Alpha, gross	3.16 + 2.52	4.08	U	EPA 900.0/SW846 9310
			Americium-241	1.86 + 7.3	12	U	EPA 901.1
			Beryllium-7	−7.05 + 10.9	17.8	U	EPA 901.1
			Beta, gross	16.6 + 2.04	2.61		EPA 900.0/SW846 9310
			Bismuth-212	2.58 + 17.9	31.3	U	EPA 901.1
			Bismuth-214	1.1 + 7.51	5.6	U	EPA 901.1
			Cesium-137	0.312 + 1.3	2.29	U	EPA 901.1
			Cobalt-60	0.211 + 1.34	2.47	U	EPA 901.1
			Lead-212	0.926 + 4.92	4.68	U	EPA 901.1
			Lead-214	0.607 + 5.98	5.27	U	EPA 901.1
			Neptunium-237	-0.987 + 2.42	4.23	U	EPA 901.1
			Potassium-40	73 + 46.9	22.5		EPA 901.1
			Radium-223	−25.4 + 25.1	38.2	U	EPA 901.1
			Radium-224	22.3 + 27.2	40.1	U	EPA 901.1
			Radium-226	−48.1 + 66	64.5	U	EPA 901.1
			Radium-228	8.17 + 11.6	7.76	X	EPA 901.1
			Sodium-22	−0.344 + 1.63	2.54	U	EPA 901.1
			Thorium-227	−10.7 + 11.4	15.9	U	EPA 901.1
			Thorium-231	0.576 + 41.5	29.4	U	EPA 901.1
			Thorium-234	9.48 + 132	96	U	EPA 901.1
			Tritium	129 + 140	230	U	EPA 906.0 Modified
			Uranium-235	1.56 + 15.6	14.2	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	9-Oct-2020	Uranium-238	9.48 + 132	96	U	EPA 901.1
WW007	2069G	6-Oct-2020	Actinium-228	6.98 + 16.8	10.3	U	EPA 901.1
			Alpha, gross	4.41 + 1.82	2.72		EPA 900.0/SW846 9310
			Americium-241	10.8 + 14.7	18.2	U	EPA 901.1
			Beryllium-7	15.8 + 15.3	18.4	U	EPA 901.1
			Beta, gross	1.93 + .992	1.61		EPA 900.0/SW846 9310
			Bismuth-212	−42 + 48.8	36.5	U	EPA 901.1
			Bismuth-214	5.12 + 12.5	5.08	X	EPA 901.1
			Cesium-137	−0.167 + 1.59	2.69	U	EPA 901.1
			Cobalt-60	0.292 + 1.54	2.94	U	EPA 901.1
			Lead-212	1.37 + 5.71	6.24	U	EPA 901.1
			Lead-214	−8.01 + 9.26	6.48	U	EPA 901.1
			Neptunium-237	−0.898 + 2.97	5.06	U	EPA 901.1
			Potassium-40	11.8 + 47.7	28.7	U	EPA 901.1
			Radium-223	3.6 + 26.8	47.2	U	EPA 901.1
			Radium-224	−44.4 + 34.8	46	U	EPA 901.1
			Radium-226	−99.6 + 84.7	92.1	U	EPA 901.1
			Radium-228	6.98 + 16.8	10.3	U	EPA 901.1
			Sodium-22	0.562 + 1.6	3.06	U	EPA 901.1
			Thorium-227	−10.3 + 13.1	18.7	U	EPA 901.1
			Thorium-231	−16.9 + 37.8	40.7	U	EPA 901.1
			Thorium-234	−274 + 217	205	U	EPA 901.1
			Tritium	46.2 + 80.1	140	U	EPA 906.0 Modified
			Uranium-235	5.74 + 21.9	18.8	U	EPA 901.1
			Uranium-238	−274 + 217	205	U	EPA 901.1
		7-Oct-2020	Actinium-228	−9.35 + 13.5	14.2	U	EPA 901.1
			Alpha, gross	1.27 + 0.88	1.39	U	EPA 900.0/SW846 9310
			Americium-241	10.8 + 13.2	20.3	U	EPA 901.1
			Beryllium-7	1.88 + 13.2	23.4	U	EPA 901.1
			Beta, gross	2.1 + 0.903	1.46		EPA 900.0/SW846 9310
			Bismuth-212	−34.4 + 42	39.9	U	EPA 901.1
			Bismuth-214	0.0845 + 9.43	6.36	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	7-Oct-2020	Cesium-137	3.87 + 2.44	3		EPA 901.1
			Cobalt-60	0.308 + 1.62	3.04	U	EPA 901.1
			Lead-212	5.13 + 5.63	4.68	X	EPA 901.1
			Lead-214	1.48 + 8.7	7.07	U	EPA 901.1
			Neptunium-237	−1.24 + 3.16	5.46	U	EPA 901.1
			Potassium-40	−23.1 + 45.2	51	U	EPA 901.1
			Radium-223	−38.8 + 34.2	48.8	U	EPA 901.1
			Radium-224	36.7 + 40.3	50.1	U	EPA 901.1
			Radium-226	−95.9 + 85.9	93.7	U	EPA 901.1
			Radium-228	−9.35 + 13.5	14.2	U	EPA 901.1
			Sodium-22	0.0921 + 1.7	3.14	U	EPA 901.1
			Thorium-227	−1.76 + 12.1	21.7	U	EPA 901.1
			Thorium-231	39.5 + 61.8	38.6	X	EPA 901.1
			Thorium-234	224 + 217	159	X	EPA 901.1
			Tritium	21.8 + 79.7	146	U	EPA 906.0 Modified
			Uranium-235	−13.7 + 19.4	19.6	U	EPA 901.1
			Uranium-238	224 + 217	159	X	EPA 901.1
		8-Oct-2020	Actinium-228	2.45 + 17.5	10.8	U	EPA 901.1
			Alpha, gross	1.96 + 1.3	2.06	U	EPA 900.0/SW846 9310
			Americium-241	3.69 + 13.7	21.6	U	EPA 901.1
			Beryllium-7	6.5 + 14.3	24.2	U	EPA 901.1
			Beta, gross	0.377 + 0.677	1.15	U	EPA 900.0/SW846 9310
			Bismuth-212	15.1 + 22.4	40	U	EPA 901.1
			Bismuth-214	3.38 + 8.27	6.86	U	EPA 901.1
			Cesium-137	−0.0301 + 1.58	2.85	U	EPA 901.1
			Cobalt-60	0.41 + 1.73	3.16	U	EPA 901.1
			Lead-212	−2 + 5.04	5.36	U	EPA 901.1
			Lead-214	0.532 + 7.14	6.09	U	EPA 901.1
			Neptunium-237	−2.27 + 3.15	4.91	U	EPA 901.1
			Potassium-40	78 + 35.8	28.5		EPA 901.1
			Radium-223	1.26 + 52	52.2	U	EPA 901.1
			Radium-224	−85 + 49.7	47.7	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	8-Oct-2020	Radium-226	29.8 + 93.4	48.1	U	EPA 901.1
			Radium-228	2.45 + 17.5	10.8	U	EPA 901.1
			Sodium-22	0.379 + 1.72	3.12	U	EPA 901.1
			Thorium-227	−3.88 + 11.3	18.8	U	EPA 901.1
			Thorium-231	10 + 39.6	45.1	U	EPA 901.1
			Thorium-234	−95.5 + 193	207	U	EPA 901.1
			Tritium	66.5 + 99.3	170	U	EPA 906.0 Modified
			Uranium-235	−2.95 + 17.5	17.6	U	EPA 901.1
			Uranium-238	−95.5 + 193	207	U	EPA 901.1
		9-Oct-2020	Actinium-228	3.15 + 13.3	11.3	U	EPA 901.1
			Alpha, gross	1.08 + 1.31	2.2	U	EPA 900.0/SW846 9310
			Americium-241	4 + 7.93	12.5	U	EPA 901.1
			Beryllium-7	3.8 + 11.2	19.9	U	EPA 901.1
			Beta, gross	2.03 + 0.819	1.29		EPA 900.0/SW846 9310
			Bismuth-212	19.8 + 24.9	30.7	U	EPA 901.1
			Bismuth-214	−6.03 + 7.53	6.01	U	EPA 901.1
			Cesium-137	0.431 + 1.35	2.39	U	EPA 901.1
			Cobalt-60	−0.746 + 2.34	2.58	U	EPA 901.1
			Lead-212	6.43 + 6.89	6.43	U	EPA 901.1
			Lead-214	−0.0321 + 5.6	5.67	U	EPA 901.1
			Neptunium-237	0.91 + 2.44	4.38	U	EPA 901.1
			Potassium-40	−43.9 + 42.4	40.6	U	EPA 901.1
			Radium-223	−7.51 + 25.2	44.5	U	EPA 901.1
			Radium-224	8.21 + 27.2	41.2	U	EPA 901.1
			Radium-226	−56.8 + 70	64	U	EPA 901.1
			Radium-228	3.15 + 13.3	11.3	U	EPA 901.1
			Sodium-22	0.695 + 1.35	2.53	U	EPA 901.1
			Thorium-227	−2.41 + 10.7	17.2	U	EPA 901.1
			Thorium-231	0.661 + 36.7	29.9	U	EPA 901.1
			Thorium-234	59.7 + 158	129	U	EPA 901.1
			Tritium	43.2 + 97.3	173	U	EPA 906.0 Modified
			Uranium-235	3.18 + 20.5	15.7	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	9-Oct-2020	Uranium-238	59.7 + 158	129	U	EPA 901.1
WW008	2069I	6-Oct-2020	Actinium-228	5.77 + 15.7	13.8	U	EPA 901.1
			Alpha, gross	3.26 + 1.13	1.56		EPA 900.0/SW846 9310
			Americium-241	1.19 + 6.06	9.28	U	EPA 901.1
			Beryllium-7	6.3 + 13.6	23.3	U	EPA 901.1
			Beta, gross	8.42 + .98	1.26		EPA 900.0/SW846 9310
			Bismuth-212	19.8 + 23.5	41.2	U	EPA 901.1
			Bismuth-214	−2.55 + 7.37	7.07	U	EPA 901.1
			Cesium-137	0.475 + 1.64	3	U	EPA 901.1
			Cobalt-60	0.578 + 1.67	3.03	U	EPA 901.1
			Lead-212	5.44 + 6.87	5.68	U	EPA 901.1
			Lead-214	3.82 + 8.17	6.93	U	EPA 901.1
			Neptunium-237	−1.87 + 3.18	5.16	U	EPA 901.1
			Potassium-40	1.72 + 49.3	26.6	U	EPA 901.1
			Radium-223	−6.4 + 30.6	52.2	U	EPA 901.1
			Radium-224	−3.41 + 45.5	51.1	U	EPA 901.1
			Radium-226	−59.6 + 73.4	68.5	U	EPA 901.1
			Radium-228	5.77 + 15.7	13.8	U	EPA 901.1
			Sodium-22	1.16 + 1.84	3.01	U	EPA 901.1
			Thorium-227	−6.81 + 12.8	21.1	U	EPA 901.1
			Thorium-231	−13 + 30.2	32.8	U	EPA 901.1
			Thorium-234	5.45 + 107	83.1	U	EPA 901.1
			Tritium	39.7 + 74	130	U	EPA 906.0 Modified
			Uranium-235	12.4 + 19.4	17.2	U	EPA 901.1
			Uranium-238	5.45 + 107	83.1	U	EPA 901.1
		7-Oct-2020	Actinium-228	4.73 + 13.9	17.4	U	EPA 901.1
			Alpha, gross	1.31 + 0.514	0.713		EPA 900.0/SW846 9310
			Americium-241	7.59 + 13.2	23.2	U	EPA 901.1
			Beryllium-7	5.54 + 15.9	28.3	U	EPA 901.1
			Beta, gross	6.77 + .673	0.822		EPA 900.0/SW846 9310
			Bismuth-212	−13.7 + 29.3	47.6	U	EPA 901.1
			Bismuth-214	0.576 + 9.62	7.84	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	7-Oct-2020	Cesium-137	1.49 + 2.04	3.57	U	EPA 901.1
			Cobalt-60	−0.169 + 2.42	4.32	U	EPA 901.1
			Lead-212	1.39 + 8.95	6.34	U	EPA 901.1
			Lead-214	−7.91 + 9.29	7.82	U	EPA 901.1
			Neptunium-237	1.79 + 3.58	6.44	U	EPA 901.1
			Potassium-40	19.2 + 67.3	41.2	U	EPA 901.1
			Radium-223	−38 + 37.4	56.6	U	EPA 901.1
			Radium-224	28.3 + 37.6	56.4	U	EPA 901.1
			Radium-226	59.2 + 88.2	60.3	U	EPA 901.1
			Radium-228	4.73 + 13.9	17.4	U	EPA 901.1
			Sodium-22	0.489 + 2.26	4.15	U	EPA 901.1
			Thorium-227	−3.34 + 13.8	22.3	U	EPA 901.1
			Thorium-231	33.8 + 30.7	44.7	U	EPA 901.1
			Thorium-234	82.8 + 216	200	U	EPA 901.1
			Tritium	53.5 + 77.8	133	U	EPA 906.0 Modified
			Uranium-235	17.1 + 15.3	17.5	U	EPA 901.1
			Uranium-238	82.8 + 216	200	U	EPA 901.1
		8-Oct-2020	Actinium-228	0.884 + 14.4	9.42	U	EPA 901.1
			Alpha, gross	6.35 + 2.29	3.36		EPA 900.0/SW846 9310
			Americium-241	−4.65 + 7.31	12.1	U	EPA 901.1
			Beryllium-7	2.19 + 11.9	21	U	EPA 901.1
			Beta, gross	10.9 + 1.27	1.5		EPA 900.0/SW846 9310
			Bismuth-212	22.3 + 36.3	33.1	U	EPA 901.1
			Bismuth-214	−2.5 + 6.58	5.89	U	EPA 901.1
			Cesium-137	0.381 + 1.48	2.57	U	EPA 901.1
			Cobalt-60	−0.175 + 1.49	2.65	U	EPA 901.1
			Lead-212	−5.23 + 5.34	4.77	U	EPA 901.1
			Lead-214	2.57 + 7.28	5.89	U	EPA 901.1
			Neptunium-237	−0.341 + 2.51	4.47	U	EPA 901.1
			Potassium-40	14.4 + 44.5	24.8	U	EPA 901.1
			Radium-223	9.27 + 25.8	46.2	U	EPA 901.1
			Radium-224	−42.9 + 35	44.6	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	8-Oct-2020	Radium-226	−6.11 + 64.1	63.7	U	EPA 901.1
			Radium-228	0.884 + 14.4	9.42	U	EPA 901.1
			Sodium-22	0.514 + 1.53	2.79	U	EPA 901.1
			Thorium-227	−0.518 + 11.6	17.4	U	EPA 901.1
			Thorium-231	−3.81 + 36.5	30	U	EPA 901.1
			Thorium-234	43.8 + 127	132	U	EPA 901.1
			Tritium	−54.2 + 111	220	U	EPA 906.0 Modified
			Uranium-235	3.26 + 16.1	15.2	U	EPA 901.1
			Uranium-238	43.8 + 127	132	U	EPA 901.1
		9-Oct-2020	Actinium-228	−3.01 + 12.6	13.4	U	EPA 901.1
			Alpha, gross	0.952 + 1.85	3.19	U	EPA 900.0/SW846 9310
			Americium-241	12.3 + 12.4	18.3	U	EPA 901.1
			Beryllium-7	3.34 + 12.4	21.9	U	EPA 901.1
			Beta, gross	12.2 + 1.41	1.76		EPA 900.0/SW846 9310
			Bismuth-212	−10.5 + 37.7	37.4	U	EPA 901.1
			Bismuth-214	−1.56 + 7.31	6.59	U	EPA 901.1
			Cesium-137	3.36 + 2.23	2.43	X	EPA 901.1
			Cobalt-60	1.14 + 1.6	2.93	U	EPA 901.1
			Lead-212	−0.832 + 4.8	5.59	U	EPA 901.1
			Lead-214	4.26 + 7.07	5.28	U	EPA 901.1
			Neptunium-237	0.443 + 2.74	4.89	U	EPA 901.1
			Potassium-40	−33.3 + 45.6	44.7	U	EPA 901.1
			Radium-223	5.51 + 26.3	46.9	U	EPA 901.1
			Radium-224	−60.5 + 40.2	48.7	U	EPA 901.1
			Radium-226	−63.9 + 76	82.9	U	EPA 901.1
			Radium-228	−3.01 + 12.6	13.4	U	EPA 901.1
			Sodium-22	−2.67 + 1.98	2.39	U	EPA 901.1
			Thorium-227	−9.74 + 11.4	18	U	EPA 901.1
			Thorium-231	8.61 + 45	35.9	U	EPA 901.1
			Thorium-234	108 + 203	136	U	EPA 901.1
			Tritium	44.3 + 118	211	U	EPA 906.0 Modified
			Uranium-235	−11.4 + 18.1	17	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	9-Oct-2020	Uranium-238	108 + 203	136	U	EPA 901.1
WW011	2069K	6-Oct-2020	Actinium-228	−4.35 + 11.8	14.9	U	EPA 901.1
			Alpha, gross	−2.05 + 1.61	3.32	U	EPA 900.0/SW846 9310
			Americium-241	−0.346 + 5.07	8.13	U	EPA 901.1
			Beryllium-7	3.91 + 13.1	22.7	U	EPA 901.1
			Beta, gross	15.9 + 3.74	5.79		EPA 900.0/SW846 9310
			Bismuth-212	16.3 + 23.2	41.3	U	EPA 901.1
			Bismuth-214	−4.84 + 6.94	7.03	U	EPA 901.1
			Cesium-137	−0.142 + 1.54	2.79	U	EPA 901.1
			Cobalt-60	−0.284 + 1.71	3.12	U	EPA 901.1
			Lead-212	1.72 + 4.94	5.4	U	EPA 901.1
			Lead-214	−1.23 + 5.73	6.47	U	EPA 901.1
			Neptunium-237	0.394 + 2.93	5.18	U	EPA 901.1
			Potassium-40	22.5 + 45.2	29.6	U	EPA 901.1
			Radium-223	8.83 + 30.1	52.9	U	EPA 901.1
			Radium-224	−47.5 + 36.3	49	U	EPA 901.1
			Radium-226	41.5 + 79.6	47.2	U	EPA 901.1
			Radium-228	−4.35 + 11.8	14.9	U	EPA 901.1
			Sodium-22	−1.16 + 1.92	3.05	U	EPA 901.1
			Thorium-227	−4.59 + 11.5	19.7	U	EPA 901.1
			Thorium-231	6.61 + 38.4	27.9	U	EPA 901.1
			Thorium-234	76.4 + 101	69.9	X	EPA 901.1
			Tritium	66.9 + 84.6	142	U	EPA 906.0 Modified
			Uranium-235	15.9 + 18.4	15	X	EPA 901.1
			Uranium-238	76.4 + 101	69.9	X	EPA 901.1
		7-Oct-2020	Actinium-228	15.3 + 16.2	15.3	U	EPA 901.1
			Alpha, gross	1.11 + 1.43	2.41	U	EPA 900.0/SW846 9310
			Americium-241	−9.47 + 8.88	13.2	U	EPA 901.1
			Beryllium-7	1.92 + 13.6	24.2	U	EPA 901.1
			Beta, gross	21.5 + 2.49	3.15		EPA 900.0/SW846 9310
			Bismuth-212	24.4 + 31.8	37.7	U	EPA 901.1
			Bismuth-214	2.41 + 9.24	5.36	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	7-Oct-2020	Cesium-137	0.561 + 1.53	2.7	U	EPA 901.1
			Cobalt-60	0.103 + 1.78	3.22	U	EPA 901.1
			Lead-212	−1.78 + 4.29	5.21	U	EPA 901.1
			Lead-214	3.14 + 8.66	6.21	U	EPA 901.1
			Neptunium-237	0.202 + 2.75	4.98	U	EPA 901.1
			Potassium-40	−15.2 + 39.9	46.9	U	EPA 901.1
			Radium-223	−16.5 + 28.7	48.7	U	EPA 901.1
			Radium-224	−80.8 + 56.8	44.7	U	EPA 901.1
			Radium-226	4.06 + 68.9	47.6	U	EPA 901.1
			Radium-228	15.3 + 16.2	15.3	U	EPA 901.1
			Sodium-22	−0.0903 + 1.63	2.94	U	EPA 901.1
			Thorium-227	0.405 + 11.7	19.3	U	EPA 901.1
			Thorium-231	−32 + 37.3	33.5	U	EPA 901.1
			Thorium-234	106 + 163	132	U	EPA 901.1
			Tritium	45.2 + 83.3	146	U	EPA 906.0 Modified
			Uranium-235	4.86 + 18.1	13.5	U	EPA 901.1
			Uranium-238	106 + 163	132	U	EPA 901.1
		8-Oct-2020	Actinium-228	10.9 + 7.49	11.1	U	EPA 901.1
			Alpha, gross	5.68 + 3.8	5.75	U	EPA 900.0/SW846 9310
			Americium-241	0.35 + 4.84	7.55	U	EPA 901.1
			Beryllium-7	6.48 + 11.2	19.4	U	EPA 901.1
			Beta, gross	18.6 + 3.07	4.1		EPA 900.0/SW846 9310
			Bismuth-212	−30.1 + 32.7	31.3	U	EPA 901.1
			Bismuth-214	0.995 + 6.31	4.57	U	EPA 901.1
			Cesium-137	0.292 + 1.31	2.27	U	EPA 901.1
			Cobalt-60	−0.0752 + 1.33	2.4	U	EPA 901.1
			Lead-212	1.66 + 5.61	4.64	U	EPA 901.1
			Lead-214	4.36 + 6.3	5.31	U	EPA 901.1
			Neptunium-237	−1.52 + 2.42	3.98	U	EPA 901.1
			Potassium-40	38.4 + 42.6	24.4	X	EPA 901.1
			Radium-223	11 + 23.5	41.3	U	EPA 901.1
			Radium-224	11.4 + 25	39.9	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	8-Oct-2020	Radium-226	−18.5 + 50.4	60.7	U	EPA 901.1
			Radium-228	10.9 + 7.49	11.1	U	EPA 901.1
			Sodium-22	0.662 + 1.42	2.61	U	EPA 901.1
			Thorium-227	−1.06 + 9.38	16.6	U	EPA 901.1
			Thorium-231	−6.58 + 27.2	26.1	U	EPA 901.1
			Thorium-234	72.6 + 93.1	67.2	X	EPA 901.1
			Tritium	39.8 + 111	198	U	EPA 906.0 Modified
			Uranium-235	1.08 + 17.7	13.8	U	EPA 901.1
			Uranium-238	72.6 + 93.1	67.2	X	EPA 901.1
		9-Oct-2020	Actinium-228	6.32 + 26.8	21.2	U	EPA 901.1
			Alpha, gross	1.04 + 1.58	2.7	U	EPA 900.0/SW846 9310
			Americium-241	−6.34 + 10	17	U	EPA 901.1
			Beryllium-7	13.7 + 19.5	34.7	U	EPA 901.1
			Beta, gross	17.3 + 1.68	1.48		EPA 900.0/SW846 9310
			Bismuth-212	34.8 + 44.5	49.2	U	EPA 901.1
			Bismuth-214	−8.33 + 11.5	10.8	U	EPA 901.1
			Cesium-137	0.604 + 2.22	4.02	U	EPA 901.1
			Cobalt-60	−1.33 + 2.58	4.41	U	EPA 901.1
			Lead-212	4.07 + 8.77	7.88	U	EPA 901.1
			Lead-214	0.783 + 11.3	9.91	U	EPA 901.1
			Neptunium-237	−1.39 + 4.12	6.67	U	EPA 901.1
			Potassium-40	46.8 + 69.1	41.4	X	EPA 901.1
			Radium-223	−20.3 + 43.4	68.6	U	EPA 901.1
			Radium-224	6.77 + 40.9	64.1	U	EPA 901.1
			Radium-226	−21.5 + 85.7	87.4	U	EPA 901.1
			Radium-228	6.32 + 26.8	21.2	U	EPA 901.1
			Sodium-22	−0.563 + 2.27	4.12	U	EPA 901.1
			Thorium-227	6.2 + 15.5	26.2	U	EPA 901.1
			Thorium-231	26.7 + 34.5	40.9	U	EPA 901.1
			Thorium-234	23.6 + 214	166	U	EPA 901.1
			Tritium	−82.7 + 106	219	U	EPA 906.0 Modified
			Uranium-235	−1.76 + 19.3	22	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	9-Oct-2020	Uranium-238	23.6 + 214	166	U	EPA 901.1

[a] Blank cells indicate that the data did not require a data qualifier.
CINT = Center for Integrated Nanotechnologies
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.

Glossary

Greater roadrunner (*Geococcyx californianus*)

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).

alluvial Relating to and/or sand deposited by flowing water.

ambient That portion of the atmosphere, external to buildings, to which the general public has access.

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

analyte A substance or chemical constituent undergoing analysis.

anthropogenic Of, relating to, or resulting from the influence of human beings on nature.

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

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

arroyo A deep gully cut by an intermittent stream; a dry gulch.

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.

biological niche A role played by a species in the environment.

biota The animal and plant life of a given region.

biotic Relating to or resulting from living organisms.

bird banding The process of capturing a bird, adding a leg band, and then releasing the bird unharmed.

bird survey The process of counting birds visually and audibly.

C

catchment basin The geographical area draining into a river or reservoir.

containment An enclosed space or facility designed to contain and prevent the escape of hazardous material.

containment cell An engineered structure designed to contain and prevent the migration of hazardous waste.

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

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

D

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

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

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

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

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

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

E

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

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

ecosystem services The natural resources and processes that occur in a well-functioning environment, which benefit humans at no cost.

effective dose equivalent The weighted average of the estimated biological effect of a dose of ionizing radiation in certain human organs or tissues; can be used to estimate the health-effects risk for an exposed individual.

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

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

electroplating The act of coating or covering a substrate with a thin layer of metal.

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

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

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

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

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

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

environmental release Any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of material into the environment, which may include (but is not limited to) soil, air, and drain systems.

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

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

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

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

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

exceedance Violation of the regulatory limits for pollutants permitted by environmental protection standards.

explosives waste Any explosive substance, article, or explosive-contaminated item that cannot be used for its intended purpose and does not have a legitimate investigative or research use.

F

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

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

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

fungicide An agent that destroys fungi or inhibits their growth.

G

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

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

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

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

H

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

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

hazardous waste site Any facility or location at which hazardous waste operations take place.

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

herpetofauna The reptiles and amphibians of a particular region, habitat, or geological period.

herpetology The study of reptiles and amphibians.

high-level radioactive waste Materials produced as a byproduct of the reactions that occur inside nuclear reactors and determined to be waste.

I

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

industrial discharge Wastewater emitting from general laboratory research operations that may contain pollutants at levels that could affect the quality of receiving waters or interfere with publicly owned treatment works.

inertial confinement fusion A type of energy research that attempts to initiate nuclear fusion reactions.

inhalation hazard Risk from materials or chemicals that present a hazard if respired (inhaled) into the lungs.

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

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

ion An atom or molecule with a net electric charge due to the loss or gain of one or more electrons.

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.

leachate Water that collects contaminants as it percolates through wastes, pesticides, or fertilizers. Leaching may occur in farming areas, feedlots, or landfills and may result in hazardous substances entering surface water, groundwater, or soil.

legacy site A former Environmental Restoration site.

legacy waste Waste originally generated between 1990 and 1998.

low-level radioactive waste Items that have become contaminated with radioactive material or have become radioactive through exposure to neutron radiation and determined to be waste.

M

Materials Sustainability and Pollution Prevention Program A program to facilitate the use and reuse of materials in the most productive and sustainable manner across their entire life cycle.

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

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

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

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

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.

nonradiological contaminant A source of contamination that has no radiological components.

nuclear particle acceleration A method for imparting large kinetic energy to electrically charged subatomic nuclear particles by applying electrical potential differences for the purpose of physics experiments.

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.

ozone (O_3) A colorless gas soluble in alkalis and cold water; a strong oxidizing agent; can be produced by electric discharge in oxygen or by the action of ultraviolet radiation on oxygen in the stratosphere (where it acts as a screen for ultraviolet radiation).

P

perched aquifer A body of groundwater that is separated from an underlying body of groundwater by unsaturated earth materials.

perennial spring A source of water issuing from the ground that flows continuously, as opposed to an intermittent spring or a periodic spring.

$PM_{2.5}$ Respirable particulate matter that has a diameter equal to or less than 2.5 microns.

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

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

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

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

proximity fuze (or fuse) An explosive ignition device used in bombs, artillery shells, and mines that detonates automatically when the distance to the target becomes smaller than a predetermined value.

pulsed power Technology used to generate and apply energetic beams and high-power energy pulses.

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.

sanitary discharge Liquid effluent that is exclusive of industrial wastewater and stormwater. It includes the liquid discharges from restrooms and showers, food preparation activities, and other domestic-type activities.

secondary containment Any structure or device that has been installed to prevent leaks, spills, or other discharges of stored chemicals, waste, oil, or fuel from storage, transfer, or end-use equipment from being released to the environment. Examples of secondary containment include pans, basins, sumps, dikes, berms, or curbs.

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.

split sample A single sample that is separated into at least two parts such that each part is representative of the original sample.

statement of work A comprehensive description of the goods, services, or combination of goods and services for which Sandia contracts.

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

surface discharge A release of water and water-based compounds to roads, open areas, or confined areas such as reservoirs.

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.

time-weighted composite A sample consisting of several portions of the discharge collected during a 24-hour period in which each portion of the sample is collected within a specific time frame that is irrespective of flow.

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.

transuranic waste Radioactive waste containing alpha-emitting radionuclides having an atomic number greater than 92 and a half-life greater than 20 years in concentrations greater than 100 nanocuries per gram.

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

unconsolidated basin sediment (1) A sediment that is loosely arranged or unstratified, or whose particles are not cemented together, occurring either at the surface or at depth. (2) Soil material that is in a loosely aggregated form.

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).

upstream (1) In the direction opposite the flow of a stream. (2) In or to a position within the production stream closer to manufacturing processes.

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

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

V

vadose zone The part of the Earth between land surface and the water table.

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

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

W

waste characterization The identification of a waste material's chemical and microbiological constituents.

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

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

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

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

water table The level of groundwater.

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.

wind direction The direction from which the wind originates.

wind rose A graphical presentation of wind speed and wind direction frequency distribution.

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