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SANDIA NATIONAL LABORATORIES

ANNUAL SITE **ENVIRONMENTAL REPORT**

NEW MEXICO 2019

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U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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U.S. Department of Energy, National Nuclear Security Administration,
Sandia Field Office, Albuquerque, New Mexico

2019 Annual Site Environmental Report for Sandia National Laboratories, New Mexico

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for
United States 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 United States Department of Energy (DOE) 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.

DOE 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 2019. 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.

Acknowledgments

The following individuals provided their time and expertise to support production of this annual report for Sandia National Laboratories, New Mexico:

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Note to the Reader

The Sandia National Laboratories, New Mexico, *Annual Site Environmental Report* presents summary data regarding environmental performance and compliance with environmental standards and requirements. In addition, DOE views this document as a valuable tool for maintaining a dialogue with our community about the environmental health of this site and the commitment to protect our valuable resources. We continually strive to improve the quality of the contents of this annual report and to include information that is important to you. Please 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
CFR	Code of Federal Regulations
CFU	colony-forming unit
CGP	Construction General Permit
CINT	Center for Integrated Nanotechnologies
CO_2e	carbon dioxide equivalent
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

Term	Definition
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
MESA Fab	Microsystems, Engineering, and Sciences Applications fabrication facilities
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Permit
MTRU	mixed transuranic
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
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
NOTE	Non-occurrence Trackable Event
NPDES	National Pollutant Discharge Elimination System
NTESS	National Technology & Engineering Solutions of Sandia, LLC
NTU	nephelometric turbidity unit
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

Term	Definition
R	
RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine
RVR	Robotics Vehicle Range
S	
Sandia	Sandia National Laboratories
SARA	Superfund Amendments and Reauthorization Act
SF_6	sulfur hexafluoride
SFO	Sandia Field Office
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
sp.	unknown species
spp.	unknown species
ssp.	subspecies
SU	standard unit
SWMU	solid waste management unit
SWSP	stormwater sampling point

Term	Definition
T	
TA	technical area
TAG	Tijeras Arroyo Groundwater
TAVG	Technical Area V Groundwater
TCLP	toxicity characteristic leaching procedure
TG	treatability group
U	
U.S.	United States
USC	United States Code
W	
WIPP	Waste Isolation Pilot Plant
WTA3	west of Technical Area III

Units of Measure

Unit	Definition
°C	degree Celsius
°F	degrees Fahrenheit
mrem/year	any combination of beta- and/or gamma-emitting radionuclides (as dose rate)
CFU/100 mL	colony forming units per 100 milliliters
Ci/year	curies per year
cm	centimeter
k	thousand
kV	kilovolt
µ	micron
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µmhos/cm	micromhos per centimeter
m	meter
m^3	cubic meter

Unit	Definition
mb	millibar
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
pg/L	picograms per liter
ppm	parts per million
rem	roentgen equivalent man

Data Qualifiers

Laboratory Data Qualifier

Term	Definition
*	A replicate was outside limits.
B	The analyte was detected in the blank.
H	The analytical holding time was exceeded.
J	An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.
N	A spike was outside limits.
U	The analyte was absent or below the method detection limit.
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 value was an estimated quantity.
J+	The associated numerical value was an estimated quantity with a suspected positive 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.

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 DOE'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, Admin Change 1, *Environment, Safety, and Health Reporting*, and is approved for public release. The United States Department of Energy (DOE) and its management and operating contractor for Sandia are committed to safeguarding the environment, reassessing 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, during calendar year 2019.

Environmental Management System

Sandia management takes environmental stewardship seriously. A robust Environmental Management System (EMS) was established in 2005 as part of this commitment. The EMS 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 EMS is ISO 14001:2015 certified. This EMS is Sandia's primary platform for implementing the environmental management programs that help achieve annual site sustainability targets.

Site Sustainability

Sustainability practices and goals are defined in an annual Site Sustainability Plan. Sandia met or exceeded sustainability goals in several key areas in fiscal year 2019, including Scope 1 and Scope 2 greenhouse gas emissions and water use efficiency and management.

Environmental Performance

Environmental performance is tracked by DOE through measures and indicators and reported as part of an overall performance evaluation. During the most recent 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 2019, 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 were two DOE-reportable occurrences of sulfur hexafluoride releases.

Ambient Air Surveillance Program. Ambient air quality is measured at two locations for particulate matter, which is analyzed for metals and radiological constituents.

Chemical Information System. Chemical containers are tracked along with information about the chemical hazards.

Cultural Resource Program. Program personnel review and document potential impacts to archeologic sites and historic properties. In 2019, 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 and to support compliance with wildlife regulations and laws. Ecological data are collected to support documentation, land use decisions, and ecological and wildlife awareness campaigns to ensure safe work environments and sustainable decision-making strategies.

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 2019, 120 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 2019, one release to the environment was reported to the New Mexico Environment Department (NMED) and the United States Environmental Protection Agency (EPA) as a best management practice. This release did not meet the criteria of a DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, occurrence. In 2019, one release met the criteria for reporting to NMED, and three releases met the criteria for DOE reportable occurrences.

Environmental Restoration Operations. Personnel manage sites impacted by past spill, release, or disposal activities. In 2019, six sites remained that 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 2019, 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 2019, new recycling and composting avenues for certain waste streams were evaluated and additional collection bins were provided.

Meteorology Program. Decision support services, data, and analyses are provided to all programs and operations that require atmospheric information.

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 2019, 374 proposed projects were reviewed.

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 2019, the inventory of oil storage containers operating under the Spill Prevention, Control, and Countermeasure Plan included 50 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 occur 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 2019, 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 NMED regulations during the operations and maintenance of the drinking water system.

Stormwater Program. Three EPA National Pollutant Discharge Elimination System permits are maintained, and compliance activities are conducted. During 2019, monthly compliance inspections were conducted at approximately 30 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 2019, 23 individual discharge requests were approved and met applicable standards. Approved releases complied with NMED applicable requirements.

Terrestrial Surveillance Program. Surveillance activities are conducted at on-site and off-site locations; soil and vegetation are sampled for various parameters. In 2019, results of the sampling events were below comparison reference values. Environmental dosimeters used to measure 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 2019, two annual no-notice hazardous waste compliance evaluation inspections were conducted; one resulted in a notice of violation and was also a DOE reportable occurrence. Results of the other inspection are pending.

Wastewater Discharge Program. Wastewater is discharged from six permitted on-site outfalls. In 2019, wastewater was monitored continuously for total flow and potential of hydrogen compliance, and quarterly for other parameters via permit-mandated split sampling with the Albuquerque Bernalillo County Water Utility Authority. All routine monitoring and quarterly 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

Sandia sunset

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 United States 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) 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, 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 2019 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—providing 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 at Sandia can be found at the following website:

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

1.1.1 Operating Contract and DOE Directives

The Prime Contract for management and operations of Sandia defines the corporation's contractual obligations. The DOE directives that pertain to environmental protection and management are as follows:

- DOE O 231.1B, Admin Change 1, *Environment, Safety, and Health Reporting*, ensures that 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. This *Annual Site Environmental Report* is prepared in accordance with this directive.
- DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, requires timely notification to the DOE complex about events that could adversely affect the health and safety of the public or workers, the environment, DOE missions, or DOE credibility.
- DOE O 435.1 Change 1, *Radioactive Waste Management,* ensures that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety, and of the environment. Under this directive, contractors who manage and operate DOE facilities are required to plan, document, execute, and evaluate the management of DOE radioactive waste.
- DOE O 436.1, *Departmental Sustainability*, places environmental management systems and site sustainability at the forefront of environmental excellence. Sandia personnel implement this directive through an International Organization for Standardization (ISO) 14001-certified (ISO 14001:2004; ISO 14001:2015) Environmental Management System (EMS) at the primary operating locations of SNL/NM and Sandia National Laboratories, California (SNL/CA). All remaining locations follow the ISO 14001 management approach, as verified through internal assessments conducted every three years.
- DOE O 458.1 Admin Change 3, *Radiation Protection of the Public and the Environment*, establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities under the control of DOE pursuant to the Atomic Energy Act.

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 (Lockheed Martin Corporation). In May 2017, the management and operating contractor changed its name to National Technology & Engineering Solution of Sandia, LLC (NTESS), a wholly owned subsidiary of Honeywell International Inc.

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 United States (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.

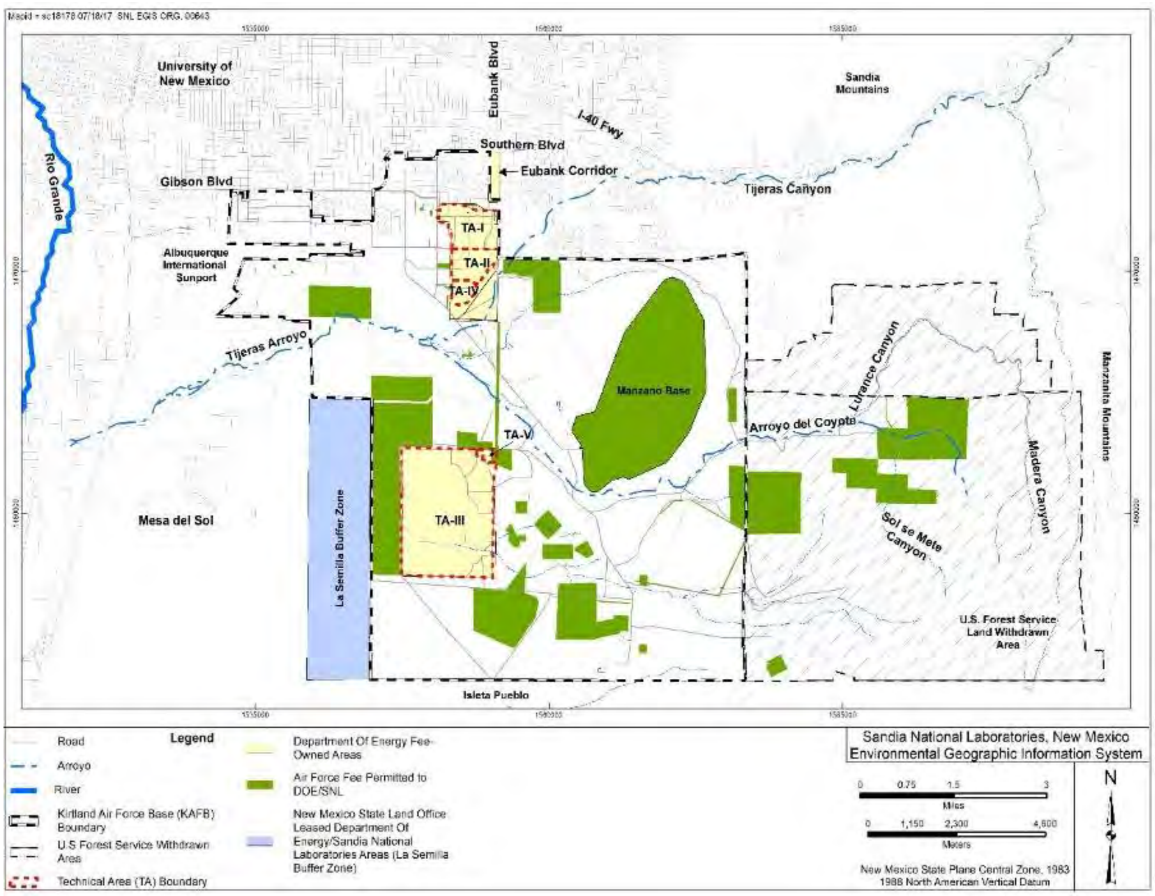


Figure 1-1. SNL/NM, including technical areas and permitted areas

Sandia conducts operations on DOE-owned property, non-DOE-owned property contracted from other federal agencies, and privately owned leased property. Sandia sites located on DOE-owned property comprise 2,938 acres and include five technical areas (TAs) (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. At the end of fiscal year 2019, the Sandia workforce (for all sites) comprised approximately 14,014 employees and contractors. There are approximately 6.54 million gross square feet of existing facilities at SNL/NM (SNL/NM 2019a).

1.4 Demographics

New Mexico is the fifth-largest state in the United States, encompassing approximately 121,000 square miles. Based on recent projections, New Mexico's estimated 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 population within a 50-mile radius (Figure 1-2) of the Albuquerque metro area was 918,018 in 2019 (StatsAmerica 2020).

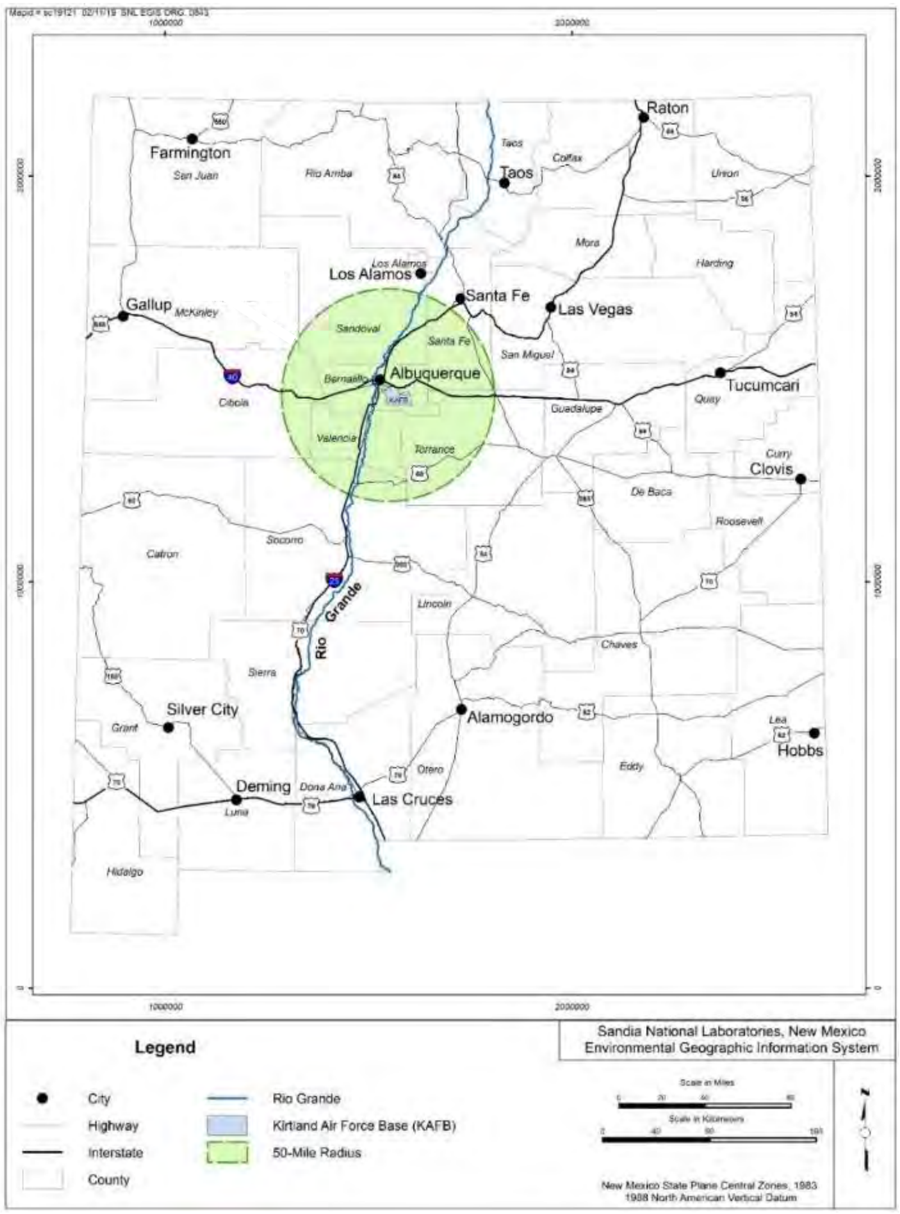


Figure 1-2. State of New Mexico, including counties

1.5 Activities and Facilities

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

Sandia recognized as a national laboratory

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 the Ion Beam Laboratory; the main technical library; several assembly and manufacturing areas; environmental test facilities; and various laboratories, such as 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 section 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, 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 and within the canyons and foothills of the U.S. Forest Service withdrawn area, on the west side of the Manzano Mountains—Arroyo del Coyote, Lurance Canyon, Madera Canyon, and Sol se Mete Canyon (Figure 1-1). The remote test areas are known collectively as the 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, 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 10 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 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.

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

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.

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; Kelley 1977). 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 325 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 are generally 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.

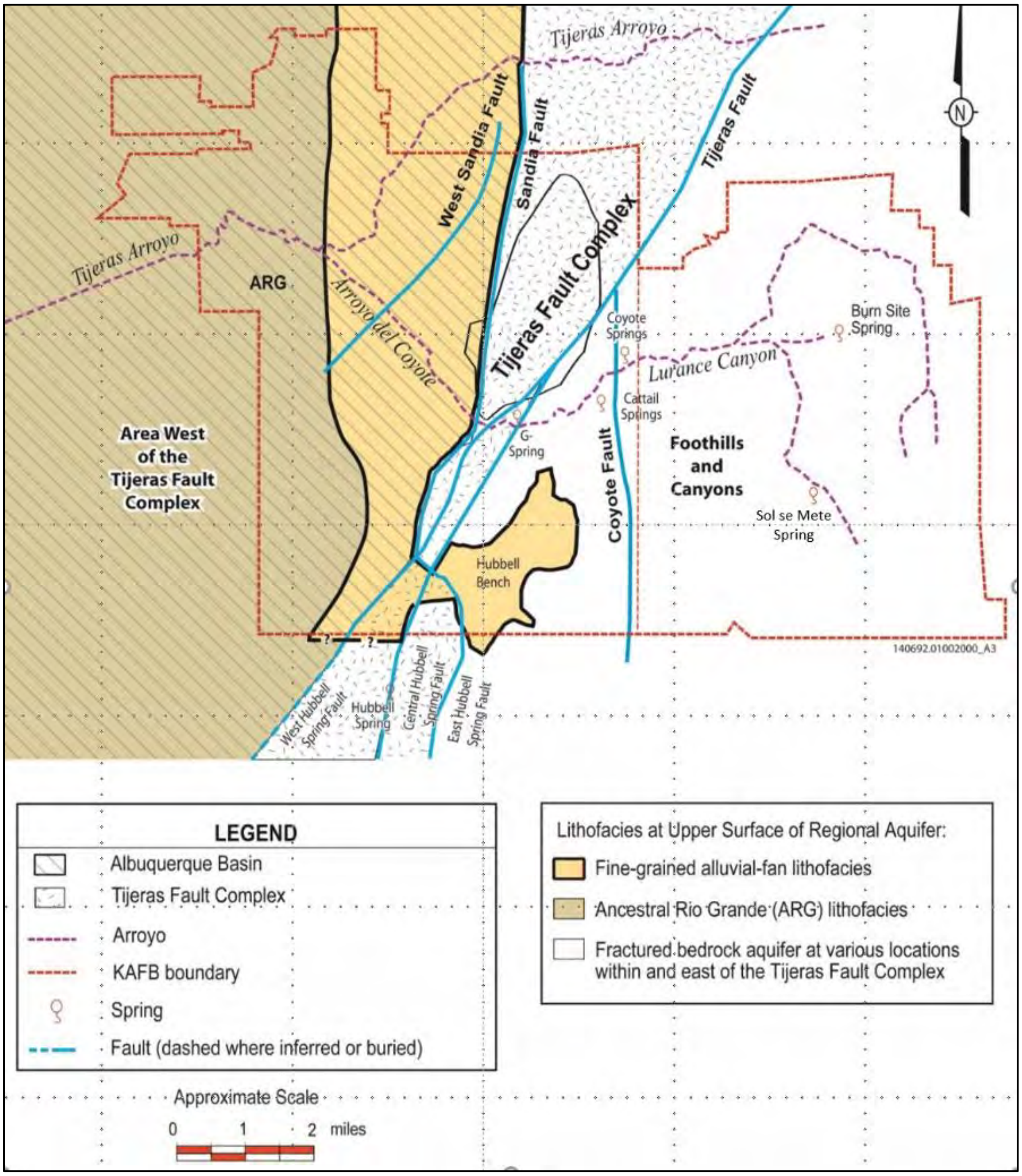


Figure 1-3. Faults and hydrogeologically distinct areas

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). Additionally, one perennial spring (Hubbell Spring) is located immediately south of the KAFB boundary on Isleta Pueblo. Numerous ephemeral springs occur within 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 the 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 of 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 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, providing 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*
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*

KAFB = Kirtland Air Force Base

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 the 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. Wind gusts commonly reach 50 miles per hour.

Chapter 2. Compliance Summary

Great-horned Owl (*Bubo virginianus*)

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

Sandia operations 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 2019 are listed in Chapter 9.

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

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

An Integrated Safety Management System is used to incorporate safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public, and the environment. Thus, management of safety functions becomes an integral part of mission accomplishment and meets requirements outlined by DOE. The following five core functions guide the integration of safety into all work practices: define the scope of work, analyze the hazards, develop and implement hazard controls, perform work within controls, and provide feedback for continuous improvement.

2.1 Environmental Management System

Sandia management takes the responsibility of protecting the environment seriously and requires employees, contractors, and visitors to adhere to the ES&H policy. There is a continuing cycle of planning, implementing, evaluating and improving the EMS. The EMS facilitates identification of the environmental aspects and impacts of Sandia's activities, products, and services; identification of risks and opportunities that could impact the environment; evaluation of applicable compliance obligations; establishment of environmental objectives; and, creation of plans to achieve and monitor those 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*, provides requirements for EMS and sustainability. Sandia personnel implement this order through an ISO 14001-certified (ISO 14001:2004) EMS. Sandia National Laboratories received initial ISO 14001:2004 certification in June 2009. In 2015, the SNL/NM and SNL/CA site-specific certifications 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 to 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) 2019, 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 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 2020 Site Sustainability Plan* (SNL/NM 2019a), describes the performance status for FY 2019. 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 2019a).

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

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2019
Clean and Renewable Energy	
Renewable electric energy should account for not less than 7.5% of a total agency electric consumption by FY 2013 and each year thereafter.	Met this objective by purchasing renewable energy credits. In FY 2019, renewable energy credit purchases accounted for 18.4% of electric consumption.
Electronic Stewardship	
Purchases: 95% of eligible acquisitions each year are EPEAT-registered products.	Met this objective with 98.3% of eligible electronics acquisitions being EPEAT-registered products in FY 2019.
Fleet Management	
75% of light duty vehicle acquisitions must consist of alternative fuel vehicles.	Met this objective in FY 2019.
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 46% in FY 2019 relative to a FY 2008 baseline. However, between FY 2018 and FY 2019, emissions increased by 29%. Scope 3 greenhouse gas decreased by 12.7% in FY 2019 relative to the FY 2008 baseline.
Organizational Resilience	
Discuss overall integration of climate resilience in emergency response, workforce, and operations procedures and protocols.	Began to meet this objective by developing a Climate Change Vulnerability Assessment. The assessment will be integrated into future emergency response operations and building plans.
Pollution Prevention and Waste Reduction	
Reduce at least 50% 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.	Met this objective by diverting 61% of nonhazardous solid waste. Reduced construction and demolition waste by 23% 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.	Implemented efforts to improve the promotion of sustainable acquisition and procurement, including establishing a process to ensure that the appropriate provisions are included in all applicable contracts.
Sustainable Buildings	
Comply with the revised guiding principles for High Performance and Sustainable Buildings for at least 15% (by building count) of existing buildings greater than 5,000 gross square feet by FY 2020, with annual progress thereafter.	Met this objective with 20.98% of buildings achieving compliance with the guiding principles.

Table continued on next page

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

DOE Goal/Sandia Objective	Sandia Performance Status through FY 2019
Sustainable Energy Management	
Reduce energy intensity in goal-subject buildings by 30% relative to an FY 2003 baseline and by 1% year-over-year thereafter.	Did not meet this objective. Energy intensity increased by 3.7 % from FY 2018 to FY 2019.
Water Use Efficiency and Management	
Reduce potable water intensity by 20% relative to an FY 2007 baseline by FY 2015 and 0.5% year-over-year thereafter.	Achieved 20.1% reduction in FY 2019 relative to an FY 2007 baseline.

DOE = U.S. Department of Energy
EPEAT = Electronic Product Environmental Assessment Tool
FY = fiscal year

2.2.1 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. DOE Sustainability 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 2019, Sandia personnel submitted three nominations for the DOE Sustainability Awards; however, they were not selected.

2.3 Environmental Compliance

DOE directives listed in the management and operating contract for Sandia as well as applicable federal, state, and local laws and regulations define the primary contractual obligations for management and operation of Sandia. Directives that pertain to environmental protection and management are discussed in Chapter 1. In 2019, the management and operating contractor adhered to the requirements cited in Section 2.3.1 for SNL/NM operations as stated in the compliance status.

On May 17, 2018, EO 13834, *Efficient Federal Operations,* affirms that agencies shall meet such statutory requirements in a manner that increases efficiency, optimizes performance, eliminates unnecessary use of resources, and protects the environment. Section 8 of the new executive order revokes EO 13693, *Planning for Federal Sustainability in the Next Decade*.

2.3.1 Federal Requirements

Federal environmental requirements applicable to SNL/NM operations, along with the compliance status, follows. A list of permits and registrations in effect in 2019 is provided in Table 10-1.

Environmental Planning

National Environmental Policy Act (NEPA) of 1969

This act requires federal agencies to assess and consider human health and environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these actions, and include this information in early project planning and decision-making. NEPA review of federally funded proposed actions is conducted in accordance with 10 CFR 1021, *National Environmental Policy Act Implementing Procedures*.

Compliance Status

NEPA Checklists are prepared for proposed actions and activities to assess potential environmental consequences. After completion of a NEPA checklist, NEPA Program personnel review projects for compliance with existing DOE NEPA documents and determinations. When required, a NEPA checklist is forwarded to DOE for review and determination. Sandia's site-wide environmental impact statement covers the majority of Sandia operations.

Section 3.7 provides information on NEPA activities.

Hazardous Waste and Environmental Restoration

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

Also known as the "Superfund," this act establishes liability compensation, clean-up, 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. The Superfund Amendments and Reauthorization Act (SARA) of 1986 establishes additional reporting requirements that are addressed under "Chemical Management."

Compliance Status

As required by CERCLA, a Preliminary Assessment and Site Inspection was performed at SNL/NM in 1988. This inspection confirmed that no sites qualify for the National Priorities List, which identifies the nation's high-priority cleanup, or Superfund, sites. Therefore, with respect to inactive hazardous waste sites, there are no CERCLA remediation requirements.

Federal Facility Compliance Act of 1992

This act requires federal facilities to comply with all federal, state, and local requirements for hazardous and solid waste, including full compliance with the restrictions and prohibitions on extended storage of wastes that do not meet the applicable hazardous waste treatment standards.

Note: On October 4, 1995, the New Mexico Environment Department (NMED) issued a Federal Facility Compliance Order to DOE and Sandia National Laboratories (NMED 1995). The order was developed pursuant to the Federal Facility Compliance Act and provides requirements for achieving compliance with the requirements of 40 CFR 268.50 for mixed waste.

Compliance Status

A Site Treatment Plan was developed with an inventory of wastes subject to the compliance order and a schedule for processing the waste.

Section 3.8 provides information on the Waste Management Program.

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

This act regulates (1) the generation, transportation, treatment, storage, and disposal of hazardous chemical waste and nonhazardous solid waste, (2) corrective action for releases of hazardous waste or constituents into the environment, and (3) the storage of hazardous or petroleum products in underground storage tanks.

Under the authority of the New Mexico Solid Waste Act of 1978 and the New Mexico Hazardous Waste Act of 1978 and with delegated authority from the United States Environmental Protection Agency (EPA) under RCRA, NMED administers solid and hazardous waste regulatory programs in New Mexico. Solid waste and hazardous waste management activities at SNL/NM are conducted pursuant to NMED regulations.

The hazardous waste component of hazardous and radioactive mixed waste is subject to the requirements of state and federal regulations for hazardous waste. The radioactive component of mixed waste is regulated under the Atomic Energy Act.

Compliance Status

NMED, DOE, and Sandia entered into a Compliance Order on Consent on April 29, 2004 (NMED 2004). This order provides requirements and establishes schedules and deliverables for corrective action pursuant to the New Mexico Hazardous Waste Act, as well as requirements concerning perchlorate and nitrate pursuant to the New Mexico Solid Waste Act.

Hazardous and mixed waste management units at SNL/NM currently operate under two permits issued by NMED. Chapter 3 provides additional information on waste management activities at SNL/NM and the two permits issued by NMED.

Radiation Protection

Atomic Energy Act of 1946 (42 United States Code [USC] § 2011 et seq.)

This act promotes the proper management of source, special nuclear, and byproduct nuclear materials.

Compliance Status

DOE sets radiation protection standards and retains authority for radionuclides through DOE directives and federal regulations. Compliance is achieved through adherence to these directives and applicable regulations in 10 CFR 830, *Nuclear Safety Management*, and 10 CFR 835, *Occupational Radiation Protection*.

DOE O 435.1 Change 1, Radioactive Waste Management

This order establishes requirements for managing radioactive waste in a manner that protects worker and public health and safety and the environment.

Under this order, DOE contractor-operated facilities are required to plan, document, execute, and evaluate the management of radioactive waste. Sandia operations comply with these requirements with the management of permitted units.

Compliance Status

Section 3.8 provides information on radioactive waste management.

DOE O 458.1 Admin Change 3, Radiation Protection of the Public and the Environment

This order limits the annual doses from all sources of ionizing radiation and exposure pathways that could contribute significantly to total dose. The limits are total effective dose of 100 mrem/year, equivalent dose to the lens of the eye of 1,500 mrem/year, and equivalent dose to the skin or extremities of 5,000 mrem/year. These limits exclude dose from radon and its decay products in air, dose received by patients from medical sources of radiation, and dose from background radiation.

Air pathways. DOE facilities are required to comply with EPA standards for radiation protection as regulated by the National Emission Standards for Hazardous Air Pollutants (NESHAP) and implemented in 40 CFR 61 Subpart H, “National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities,” specific to radionuclides emitted from DOE facilities (except for radon).

Biota. This order protects biota, ensuring that radiological activities having the potential to impact the environment must be conducted in a manner that protects aquatic animal, terrestrial plant, and terrestrial animal populations in local ecosystems from adverse effects due to radiation and radioactive material released from DOE operations.

Residual radioactivity of real and personal property. This order specifies the control and clearance of real and personal property with residual radioactivity. Personal property with residual radioactivity above the limits specified in this order is not cleared from radiological control. Pursuant to written procedures, personal property that is potentially contaminated or activated is surveyed prior to clearance, or a process knowledge evaluation is conducted to verify that the personal property has not been contaminated with radioactive material nor exposed to energy capable of inducing radioactivity in the material. In some cases, both a radiological survey and a process knowledge evaluation are performed. 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.

Sanitary sewer discharges. This order provides the criteria to limit concentration of each radionuclide discharged to publicly owned treatment works.

Water pathways. For a drinking water system operated by DOE, DOE facilities must provide a level of radiation protection equivalent to that provided to members of the public by the community drinking water standards in

40 CFR 141, *National Primary Drinking Water Regulations*, i.e., not to exceed the radionuclide maximum contaminant levels. The regulations reference a derived concentration technical standard for radionuclides in drinking water that could be consumed continuously (365 days a year). This is a conservative approach, which assumes that a member of the public resides at the location continuously.

Compliance Status

Air pathways. The only current pathway for potential exposure from Sandia operations is through air. Chapter 5 provides information about air pathways.

Biota. Currently, terrestrial plants are monitored; no other biota sampling is conducted due to low-impact operations. However, if changing operations or conditions warrant, sampling will be initiated on a case-specific basis to ensure compliance with DOE O 458.1.

Residual radioactivity of real and personal property. Excess property with residual radioactivity above the limits set in DOE O 458.1 is either retained for continued use within DOE facilities or transferred to the SNL/NM Radioactive and Mixed Waste Management Unit for disposal as radioactive waste. Property clearance activities in 2019 included the following: Radiation Protection Department personnel processed 369 personal property clearance surveys, no metals subject to the moratorium or the suspension were cleared, and no real property was cleared.

Sanitary sewer discharges. Section 6.6 provides information on sanitary sewer discharges.

Water pathways. The KAFB Public Water System provides potable water for SNL/NM facilities, and KAFB is responsible for meeting drinking water requirements (see Chapter 6). The DOE-derived concentration technical standards for a drinking water pathway are, therefore, not applicable.

Chapter 4 describes Terrestrial Surveillance Program activities. Chapter 7 describes Ecology Program activities.

Air Quality

Clean Air Act of 1970, as amended

This comprehensive federal law regulates air emissions from stationary and mobile sources. The Act calls for EPA to describe and track air pollutants from stationary and mobile sources and to establish ambient air quality standards.

The City of Albuquerque has direct delegation from EPA Region 6 to administer these standards and issue specific air emission permits and registrations (see Section 2.3.2).

Nonradiological emissions. Sources of nonradiological air emissions, such as boilers and generators, are regulated and/or permitted by the City of Albuquerque.

Radiological emissions. EPA retains compliance authority for all radionuclide air releases, which are regulated by NESHAP and implemented under 40 CFR 61, Subpart H, “National Emissions Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities.” Additional requirements pertaining to radionuclide emissions are contained in DOE O 458.1 Admin Change 3, *Radiation Protection of the Public and the Environment*.

Compliance Status

Nonradiological emissions. Compliance is achieved through adherence to the conditions of permits and applicable regulations.

Radiological emissions. Compliance is achieved through annual reporting of radionuclide air emission releases and dose assessment.

Chapter 5 provides information on air quality compliance.

Water Quality

Clean Water Act of 1972 and amendments

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.

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.

Sanitary sewer discharges. The ABCWUA administers regulations for sanitary sewer discharges based on federal pretreatment standards.

Stormwater. In accordance with the Clean Water Act, NPDES stormwater permits may be issued based on whether stormwater runoff is discharged to "waters of the United States." EPA retains authority for the permitting and enforcement, as the NMED Surface Water Quality Bureau authorization is limited to conducting inspections on behalf of the EPA, reviewing federal permits for adherence with New Mexico law, and serving as a point of contact to disseminate information about the NPDES program to local permitted entities.

Surface water quality standards. While the NMED Surface Water Quality Bureau lacks primacy for permitting and enforcement for point source, it is responsible for proposing water quality standards, developing antidegradation rules, and conducting a triennial review. The New Mexico Water Quality Control Commission has adopted "Standards for Interstate and Intrastate Surface Waters" (20.6.4 NMAC) and the Clean Water Act § 303(d)/ § 305(b), "Integrated List and Report," to protect the quality of the state's surface waters, including waters of the United States.

Compliance Status

Chapter 6 provides information on compliance with water quality regulations. Section 6.5 provides information on the Surface Discharge Program. Section 6.6 provides information on sanitary sewer discharges.

Section 6.4 provides additional information on NPDES permits. 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).

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

This section of the act requires federal agencies to manage stormwater runoff from federal development projects for the protection of water resources.

Compliance Status

Sandia projects planned through the NEPA process are reviewed for EISA § 438 eligibility. If applicable, EISA § 438 requires the use of site planning, design, construction, and maintenance strategies to maintain or restore predevelopment site hydrology (stormwater runoff), ensuring that receiving surface waters (such as the Rio Grande) are not impacted negatively.

Section 6.4 provides information on the Stormwater Program.

Oil Pollution Act of 1990 (§ 311) (with implementing regulations in 40 CFR 112, Oil Pollution Prevention)

This act establishes requirements for the prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities to prevent oil from reaching navigable waters of the United States and adjoining shorelines, and to contain discharges of oil. The act requires the development and implementation of a Spill Prevention, Control, and Countermeasure Plan.

Compliance Status

A Spill Prevention, Control, and Countermeasure Plan is maintained at SNL/NM.

Section 6.2 provides information on the Oil Storage Program.

Safe Drinking Water Act of 1974, as amended

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.

With delegated authority from EPA, NMED administers the safe drinking water regulatory program in New Mexico. Safe drinking water protection activities are conducted under NMED regulations in accordance with 20.7.10 NMAC, *Drinking Water*. These state drinking water regulations have requirements not covered by the Safe Drinking Water Act.

Compliance Status

The KAFB Public Water System provides potable water for SNL/NM facilities, and KAFB is responsible for meeting drinking water requirements. Sandia adheres to NMED regulations during the operations and maintenance of the drinking water system.

Section 6.3 provides information on safe drinking water.

Chemical Management

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

EPCRA, also known as the Superfund Amendments and Reauthorization Act (SARA) Title III, requires reporting of toxic chemicals used and released by federal, state, and local governments and industry. These provisions help increase the public's knowledge of and access to information on chemicals at a facility, their uses, and releases into the environment. The Emergency Release Notification requirements were established under Section 304 of EPCRA. The Toxic Release Inventory reporting requirement was established under Section 313 of EPCRA.

Compliance Status

In 2019, there were no reportable quantity releases of extremely hazardous substances requiring notification under Section 304 of EPCRA.

In 2019, the use, potential releases and other waste management activities at SNL/NM met the threshold that required a Toxic Release Inventory report for lead and lead compounds under Section 313 of EPCRA.

Table 2-2 provides further details on applicable EPCRA requirements.

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

This act governs the registration, distribution, sale, and use of pesticides in the United States and is enforced under the New Mexico Pesticide Control Act.

Compliance Status

All herbicides, rodenticides, and insecticides used at SNL/NM follow EPA requirements and are applied in accordance with applicable label guidelines and regulations by state-licensed contractors.

Toxic Substances Control Act, enacted in 1976 and later amended

This act regulates the manufacture, processing, distribution, use, and disposal of specific chemical substances and/or mixtures.

Compliance Status

At SNL/NM, compliance with this act primarily involves managing asbestos and polychlorinated biphenyls (PCBs). There are no PCB-contaminated transformers at SNL/NM. Asbestos abatement-related activities are conducted in accordance with applicable regulatory requirements, as needed.

Chapter 3 provides information related to managing toxic substances.

Underground and Aboveground Storage Tanks

Under the authority of the New Mexico Hazardous Waste Act of 1978 and the New Mexico Groundwater Protection Act of 1978 and with delegated authority from EPA under RCRA, NMED administers the underground storage tank regulatory program in New Mexico. The New Mexico Hazardous Waste Act and the New Mexico Groundwater Protection Act were both amended in 2001 to give NMED statutory authority to administer an aboveground storage tank regulatory program in New Mexico.

Compliance Status

Applicable SNL/NM underground and aboveground storage tanks are regulated under 20.5 NMAC, *Petroleum Storage Tanks.* Compliance is achieved through tank registrations and adherence to applicable regulatory requirements.

Section 6.2 provides information on the Oil Storage Program.

Pollution Prevention

Pollution Prevention Act of 1990

This act declares as national policy that pollution should be prevented or reduced at the source (42 USC § 13101 et seq.).

A toxic chemical source reduction and recycling report is required for facilities that meet the reporting requirements under EPCRA, Section 313.

Compliance Status

See the previous EPCRA discussion under "Chemical Management."

Natural Resources

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

This act prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions.

Compliance Status

An avian protection plan is in place that addresses potential impact to eagle species known to occur in the area. In 2019, no eagle mortality or nesting concerns were encountered.

Chapter 7 presents information on avian surveillance activities.

Endangered Species Act of 1973, amended in 1982

This act applies to both private individuals and federal agencies. Section 7 of the Endangered Species Act requires consultation with the U.S. Fish and Wildlife Service to ensure that actions are not likely to harm or jeopardize the continued existence of federally listed species or result in the destruction or adverse modification of designated critical habitat.

Compliance Status

Activities with the potential to impact identified endangered species were managed through the NEPA process. In 2019, protected species clearance surveys were conducted as needed and no endangered species were identified.

Chapter 7 presents information on threatened or endangered species potentially occurring at SNL/NM.

Executive Order 11988 of 1977, Floodplain Management, as amended

This executive order requires federal agencies to consider impacts associated with the occupancy and modification of floodplains; reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

Compliance Status

All active Sandia facilities located on KAFB are outside the 500-year floodplain, as described by the U.S. Army Corps of Engineers (USACE 1979). This applies to both major on-site drainages: Tijeras Arroyo and Arroyo del Coyote.

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

This executive order requires federal agencies to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands.

Compliance Status

There are several natural springs on KAFB with a limited wetland setting. These springs, located on lands withdrawn from Cibola National Forest, are managed by the U.S. Air Force and the U.S. Forest Service.

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

These acts were established to ensure that wildlife receives equal consideration with other natural resources when managing ecosystems.

As stated in 16 USC § 2901, the purpose is: "(1) to provide technical assistance to the States for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife; and (2) to encourage all Federal departments and agencies to utilize their statutory and administrative authority, to the maximum extent practicable and consistent with each agency's statutory responsibilities, to conserve and to promote conservation of nongame fish and wildlife and their habitats."

In 2013, DOE and the Department of Interior's Fish and Wildlife Service entered a *Memorandum of Understanding, Responsibilities of Federal Agencies to Protect Migratory Birds,* to enhance collaboration in promoting the conservation of migratory bird populations (DOE and FWS 2013). This strengthens migratory bird conservation between the two federal agencies in coordination with state, tribal, and local governments.

Compliance Status

In 2019, compliance was achieved through vegetation, herpetofauna, and avian surveillance activities.

Chapter 7 presents information on the Ecology Program surveillance activities.

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

This act implemented the 1916 Convention for the Protection of Migratory Birds. The original statute implemented the agreement between the United States and Great Britain (for Canada), and later amendments implemented treaties between the United States and Mexico, the United States and Japan, and the United States. and Russia.

The MBTA prevents taking, killing, possessing, transporting, and importing migratory birds, their eggs, parts, or nests. Federal institutions are not exempt from the MBTA.

Compliance Status

An avian protection plan is in place that provides procedures that address potential impacts to migratory birds know to occur in the area. In 2019, compliance was achieved through migratory bird surveillance activities.

Chapter 7 presents information on the Ecology Program migratory bird surveillance activities.

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), were reauthorized in 2013

This act protects and enhances fish, wildlife, and other natural resources that exist on and are associated with military lands in the United States.

Compliance Status

In 2019, compliance was achieved by adherence with the Memorandum of Understanding between DOE and the U.S. Fish and Wildlife Service.

Chapter 7 presents information on the Ecology Program.

Cultural Resources

AFI 32-7065, Cultural Resources Management Program

This U.S. Air Force Instruction establishes guidelines for managing and protecting cultural resources on property affected by U.S. Air Force operations in the United States.

Compliance Status

Cultural Resource Program personnel ensure the review, oversight, and documentation of cultural resources at SNL/NM. When appropriate, these activities are coordinated with the United States Department of Defense (DOD). In 2019, multiple projects included coordination between DOE and DOD. No adverse effects requiring mitigation were identified.

Chapter 9 provides information on the Cultural Resource Program.

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

This act protects the rights of Native Americans to exercise their traditional religions by ensuring access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

Compliance Status

Planning through the NEPA process identifies potential impacts to cultural resource sites, and appropriate documentation is submitted to DOE to support mitigation of adverse effects when necessary. In 2019, there were activities that required interaction with Native American tribes. All correspondence occurred between the federal agencies.

Chapter 9 provides information on the Cultural Resource Program.

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

This act governs disturbances of archeological sites on federal and Indian lands in the United States and the removal and disposition of archeological collections from those sites.

Compliance Status

Planning through the NEPA process identifies potential impacts to archeological sites, and appropriate documentation is submitted to DOE to support mitigation of adverse effects when necessary. In 2019, several surveys were conducted, and a few archaeological sites were identified and recorded. No testing or excavation occurred at any of the recorded sites in 2019.

Chapter 9 provides information on the Cultural Resource Program.

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

This order addresses interactions with American Indian Tribal representatives in relation to any DOE proposed work that may involve tribal rights and interests.

Compliance Status

Planning through the NEPA process identifies proposed work that may involve tribal rights and interests. No proposed work involved tribal rights and interests and, accordingly, no interactions occurred in 2019.

DODI 4710.02, DOD Interactions with Federally Recognized Tribes

This DOD instruction implements DOD policy, assigns responsibilities, and provides procedures for DOD interactions with federally recognized tribes.

Compliance Status

Cultural Resource Program personnel ensure the review, oversight, and documentation of cultural resources at SNL/NM. When appropriate, these activities are coordinated with DOD. In 2019, no projects included coordination between DOE, DOD, and Native American tribes.

Chapter 9 provides information on the Cultural Resource Program.

DODI 4715.16, Cultural Resources Management

This DOD instruction outlines DOD policy and assigns responsibilities for complying with applicable federal statutory and regulatory requirements, executive orders, and presidential memorandums for the integrated management of cultural resources on DOD-managed lands.

Compliance Status

Cultural Resource Program personnel ensure the review, oversight, and documentation of cultural resources at SNL/NM. When appropriate, these activities are coordinated with DOD. In 2019, multiple projects included coordination between DOE and DOD. No adverse effects requiring mitigation were identified.

Chapter 9 provides information on the Cultural Resource Program.

DOE O 430.1C, Real Property Asset Management

This order establishes the approach for the life-cycle management of real property assets that aligns the real property portfolio with DOE mission needs in a safe, secure, cost-effective, and sustainable manner.

Compliance Status

Planning through the NEPA process identifies potential impacts to real property assets, and appropriate documentation is submitted to DOE to support mitigation of adverse effects when necessary. In 2019, no mitigative actions were required.

Chapter 9 provides information on the Cultural Resource Program.

DOE P 141.1, Management of Cultural Resources

This policy ensures that DOE programs, including the National Nuclear Security Administration, and field elements integrate cultural resources management into their missions and activities.

Compliance Status

Cultural Resource Program personnel ensure the review, oversight, and documentation of cultural resources at SNL/NM. Planning through the NEPA process identifies potential impacts to archaeological sites and historic properties. Appropriate documentation is submitted to DOE to support mitigation of adverse effects when necessary. In 2019, no mitigative actions were required.

Chapter 9 provides information on the Cultural Resource Program.

Native American Graves Protection and Repatriation Act, enacted in 1990

This act requires federal agencies and institutions that receive federal funding to inventory their collections, consult with federally recognized Native American entities, and repatriate human remains or cultural items if items are excavated or discovered.

Compliance Status

Planning through the NEPA process identifies potential impacts to cultural resource sites, and appropriate documentation is submitted to DOE to support mitigation of adverse effects when necessary. In 2019, no cultural items were excavated or discovered.

Chapter 9 provides information on the Cultural Resource Program.

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

This act requires federal agencies to identify, record, and protect cultural resources and to assess the impact of proposed projects on historic or culturally important sites, structures, or objects. The regulations in 36 CFR 800, *Protection of Historic Properties* implement the section 106 process for accommodating historic preservation concerns with the needs of Federal undertakings.

Historic buildings and structures may include structures at least 50 years of age that are historically significant or younger structures that are of exceptional significance. Nominations for eligible properties adhere to the implementing regulations in 36 CFR 60, *National Register of Historic Places.*

Compliance Status

Planning through the NEPA process identifies potential impacts to cultural resource sites, and appropriate documentation is submitted to DOE to support mitigation of adverse effects when necessary. In 2019, multiple historic building assessments were performed; no adverse effects requiring mitigation were identified.

Chapter 9 provides information on the Cultural Resource Program.

Quality Assurance

DOE O 414.1D (DOE O 414.1D Admin Change 1), Quality Assurance

This order is in addition to 10 CFR 830, *Nuclear Safety Management*, Subpart A, "Quality Assurance." The purpose of the order is to achieve quality in all work and ensure products and services meet or exceed customer requirements and expectations.

Compliance Status

All environmental sampling and analysis that was conducted in 2019 conformed to applicable quality assurance plans.

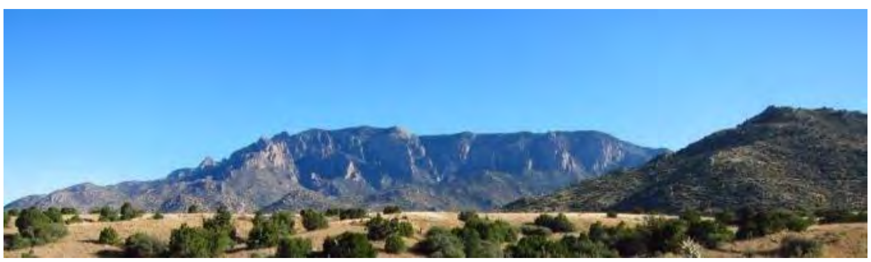
Chapter 8 provides information on quality assurance.

Flame Skimmer (*Libellula saturata*)

Table 2-2. Applicable EPCRA reporting requirements

Section	EPCRA Section Title	Description
301–303	Emergency Planning	Prepare an annual report that lists chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR 355 Appendix B, including the location of the chemicals and emergency contacts.
304	Emergency Release Notification	Provide notification of reportable quantity releases of extremely hazardous substances, as defined by CERCLA, to the required entities.
311–312	Hazardous Chemical Inventory	Report on Community Right-to-Know requirements for (1) all hazardous chemicals present at a facility at any one time in amounts equal to or greater than 10,000 pounds and (2) all extremely hazardous substances present at a facility in amounts equal to or greater than 500 pounds or the Threshold Planning Quantity, whichever is lower. A safety data sheet must be available for hazardous chemicals present at the facility.
313	Toxic Release Inventory	Submit a Toxic Release Inventory report to the required entities for facilities that release toxic chemicals listed in SARA Title III over a threshold value.

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
EPCRA = Emergency Planning and Community Right-to-Know Act
SARA = Superfund Amendments and Reauthorization Act


Sandia foothills

2.3.2 New Mexico State and Local Environmental Regulations

New Mexico Water Quality Control Commission

All discharges made to the ground or to containment areas must be evaluated for compliance with regulations implemented through New Mexico Water Quality Control Commission standards for the protection of groundwater and surface water prior to discharge (New Mexico Administrative Code [NMAC] 20.6.2, *Ground and Surface Water Protection*).

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

EPA guidelines for solid waste management under RCRA require states to develop solid waste management programs, which are then authorized by EPA. NMED administers the solid waste program in New Mexico under the authority of the New Mexico Solid Waste Act. Solid waste management activities at SNL/NM are conducted pursuant to NMED regulations.

Under RCRA, EPA delegates authority to state regulatory programs for hazardous waste. 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 NMED regulations.

New Mexico State Statutes Related to Natural Resources

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

- New Mexico Statutes Annotated (NMSA) 1978, Article 2, *Hunting and Fishing Regulations*
  - NMSA 1978, §§ 17-2-13 through 17-2-15 protecting songbirds; hawks, vultures, and owls; and horned toads, respectively
  - NMSA 1978, §§ 17-2-37 through 17-2-46, *Wildlife Conservation Act*
- NMSA 1978, Article 6, *Habitat Protection*, §§ 17-6-1 through 17-6-11
- NMSA 1978, Article 6, *Endangered Plants*, § 75-6-1
- NMSA 1978, Article 8, *Protection of Native New Mexico Plants*, §§ 76-8-1 through 76-8-4

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. 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 were initially 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 Standard requirements.** As part of an effort to control pollution in the U.S., EPA provides New Source Performance Standard requirements that dictate the level of pollution that a new stationary source may produce. These 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*, which the City of Albuquerque implements in Bernalillo County. A New Source Performance Standard has been established for a number of source categories, including boilers and stationary engines.
- **New Source Review requirements.** The New Source Review permitting program was established as part of the Clean Air Act Amendments of 1977. The City of Albuquerque implements this program in Bernalillo County, New Mexico. New Source Review requirements provide assurance to the public that any large, new, or modified source of air pollutants in their neighborhood 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.

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 2-3 summarizes the primary reporting requirements for applicable releases.

Table 2-3. Reporting requirements to outside agencies (other than DOE) for releases of pollutants or hazardous substances

Report Title	Description	Agency and Regulation
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 Events reported to the ABCWUA are discussed in Chapter 6.	ABCWUA Sewer Use and Wastewater Control Ordinance
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. Dose assessment is discussed in Chapter 5.	EPA 40 CFR 61, Subpart H
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 (2) or 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 Environmental release events reported to NMED are discussed in Chapter 6.	NMED 20.6.2.1203 NMAC

Table continued on next page

Table 2-3. Reporting requirements to outside agencies (other than DOE) for releases of pollutants or hazardous substances (continued)

Report Title	Description	Agency and Regulation
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 the 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 Events reported to EPA are discussed in Chapter 6.	EPA NPDES Multi-Sector General Permit Part 7.7
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 Events reported to the NMED are discussed in Chapter 6.	NMED 20.5.118 NMAC
Reportable Quantity Accidental Release Reporting	CERCLA and EPCRA require reportable quantity release reporting to the National Response Center and to state and local emergency response commissions.	EPA 40 CFR 355, Subpart C
Toxic Release Inventory Report	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.	EPA 40 CFR 372, Subpart B

ABCWUA = Albuquerque Bernalillo County Water Utility Authority
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
EPCRA = Emergency Planning and Community Right-to-Know Act
NESHAP = National Emission Standards for Hazardous Air Pollutants
NMAC = New Mexico Administrative Code
NMED = New Mexico Environment Department
NPDES = National Pollutant Discharge Elimination System
SARA = Superfund Amendments and Reauthorization Act

2.5 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 2019 DOE/NNSA Strategic Performance Evaluation Measurement Plan (PEMP)* (DOE/NNSA/SFO 2019b). Subsequently, the DOE National Nuclear Security Administration Sandia Field Office prepared the *FY2019 Performance Evaluation Summary* (DOE/NNSA/SFO 2020), assessing the management and operating contractor performance for October 1, 2018, through September 30, 2019. 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: Reduce Nuclear Security Threats; DOE and Strategic Partnership Projects Mission

Objectives; and Science, Technology and Engineering. A rating of very good was received in the three remaining categories: Manage the Nuclear Weapons Mission, Operations and Infrastructure, and Leadership. Sandia received an overall rating of very good.

2.5.1 Audits, Appraisals, and Inspections in 2019

Environmental programs are routinely subjected to audits, appraisals, inspections, and/or verifications by external agencies. Table 2-4 summarizes the 2019 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 2019, 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 2-4. Environmental-related external audits, appraisals, inspections, and violations, 2019

Appraising Agency	Title/Description	Date	Summary
New Mexico Environment Department, Petroleum Storage Tank Bureau	Fiscal Year 2019 Biennial Compliance Inspection	January 2019	No findings
Albuquerque Bernalillo County Water Utility Authority	Industrial Wastewater Permit Inspection (2069G, 2069I, 2238A)	February 2019	No findings
City of Albuquerque Air Quality Program	Fugitive Dust Control Permit Pre-Disturbance Site Visits	• February 2019 • March 2019 • August 2019 • August 2019 • August 2019	• Permit issued • Permit issued • Permit issued • Permit issued • Post-inspection notification
Orion Registrar	ISO 14001 Surveillance Audit	March 2019	Two minor nonconformances, four observations, and eight noteworthy practices

Table continued on next page

Table 2-4. Environmental-related external audits, appraisals, inspections, and violations, 2019 (continued)

Appraising Agency	Title/Description	Date	Summary
Albuquerque Bernalillo County Water Utility Authority	Industrial Wastewater Permit Inspection (2069A, 2069F, 2069K)	March 2019	No findings
City of Albuquerque Air Quality Program	Unscheduled inspection related to release of fugitive dust	April 2019	Post-inspection notification issued in 2019 (further actions are pending)
New Mexico Environment Department, Hazardous Waste Bureau	Fiscal Year 2019 annual no-notice hazardous waste compliance evaluation inspection	May 2019	Notice of violation
Albuquerque Bernalillo County Water Utility Authority	Permit 2069K renewal inspection	September 2019	No findings, permit issued
Albuquerque Bernalillo County Water Utility Authority	Permit deficiency: inappropriate solvent discharge to sanitary sewer	November 2019	Notice of violation
New Mexico Environment Department, Hazardous Waste Bureau	Fiscal Year 2020 annual no-notice hazardous waste compliance evaluation inspection	December 2019	Pending (results will be discussed in 2020 ASER)

ASER = Annual Site Environmental Report
ISO = International Standard Organization

2.5.2 Occurrence Reporting in 2019

Under DOE O 232.2A, *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 or determined to be recurring through performance analysis are occurrences. Whereas some environmental releases may not meet DOE O 232.2A reporting thresholds, they may still be reportable to outside agencies.

Per DOE, an *occurrence* is defined as "one or more (i.e., recurring) events or conditions that adversely affect, or may adversely affect, DOE or contractor personnel, the public, property, the environment, or the DOE mission."

Occurrences that meet DOE O 232.2A criteria are entered into the DOE Occurrence Reporting and Processing System database. Corrective actions and closure of occurrence reports are also tracked in the 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):

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

During 2019, eight occurrences met the criteria for reporting in this *Annual Site Environmental Report* (Table 2-5). Table 2-5 also cross-references DOE O 232.2A reportable occurrences that were reportable to an outside agency, if applicable.

Table 2-5. Occurrence reports per DOE O 232.2A, 2019

Reporting Criteria	Month	Report Level	Report Number and Title	Also Reported to an Outside Agency
Group 5 - Environmental 5A(2) Any release (onsite or offsite) of a pollutant from a DOE facility that is above levels or limits specified by outside agencies in a permit, license, or equivalent authorization, when reporting is required in a format other than routine periodic reports.	January	Informational	**NA--SS-SNL-NMSITE-2019-0001** Building 862 Diesel Fuel Underground Storage Tank (UST) Soil Contamination	New Mexico Environment Department
Group 10 - Management Concerns and Issues 10(1) An event, condition, or series of events that does not meet any of the other reporting criteria, but is determined by the Facility Manager or line management to be of safety significance or of concern for that facility or other facilities or activities in the DOE complex.	May	Informational	**NA--SS-SNL-8000-2019-0007** Liquid Nitrogen (LN_2) Overflow Event Outside of Building	N/A
Group 5 - Environmental 5A(4) Any discrete release of 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 byproduct of the operation.	June	Informational	**NA--SS-SNL-1000-2019-0006** Z -Machine Equipment Damage and SF_6 Release	N/A
N/A	July	NOTE	**NOTE-2019-021** Contractor Excavating Broke 10-Inch Water Line	N/A
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.	July	Informational	**NA--SS-SNL-NMSITE-2019-0005** New Mexico Environment Department, Hazardous Waste Bureau: Notice of Violation	N/A
Group 10 - Management Concerns and Issues 10(1) An event, condition, or series of events that does not meet any of the other reporting criteria, but is determined by the Facility Manager or line management to be of safety significance or of concern for that facility or other facilities or activities in the DOE complex.	August	Informational	**NA--SS-SNL-5000-2019-0002** MESA Fab Acid Discharge	N/A

Table continued on next page

Table 2-5. Occurrence reports per DOE O 232.2A, 2019 (continued)

Reporting Criteria	Month	Report Level	Report Number and Title	Also Reported to an Outside Agency
Group 10 - Management Concerns and Issues 10(1) An event, condition, or series of events that does not meet any of the other reporting criteria, but is determined by the Facility Manager or line management to be of safety significance or of concern for that facility or other facilities or activities in the DOE complex.	September	Informational	**NA--SS-SNL-2019-1000-0012** Z-Machine SF_6 Release	N/A
Group 5 - Environmental 5A(2) Any release (onsite or offsite) of a pollutant from a DOE facility that is above levels or limits specified by outside agencies in a permit, license, or equivalent authorization, when reporting is required in a format other than routine periodic reports.	October	Informational	**NA--SS-SNL-5000-2019-0004** Inappropriate Solvent Discharge to Sanitary Sewer System	N/A

CFR = Code of Federal Regulations
CO_2e = carbon dioxide equivalent
DOE = United States Department of Energy
MESA Fab = Microsystems Engineering, Science and Applications fabrication facilities
N/A = not applicable
NOTE = Non-occurrence Trackable Event
SF_6 = sulfur hexafluoride

Chapter 3. Environmental Programs

Prickly pear cactus *(Opuntia species)* with fruit

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 greatly expanded. The current environmental programs and focus areas include:

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

3.1 Chemical Information System and Chemical Exchange Program

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

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.

3.2 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 2019 included Earth Day and the annual EMS Excellence Awards. Environmental education models are used and include topics such as air quality, landfills, groundwater, and watersheds. Sandia personnel and community members are encouraged to provide feedback and to ask questions about any of Sandia's environmental programs.

The annual EMS 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 its inception in 2006, there have been 256 nominations for contributions to the vision of environmental excellence.

3.3 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 2019, environmental impacts of 120 projects were reviewed and documented.

3.4 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 1985).

Areas of Concern at SNL/NM, not regulated as solid waste management units (primarily closed-out septic systems), were not identified in the initial list of sites when the Hazardous and Solid Waste Amendments Module of Permit NM5890110518-1 was issued in 1993 (EPA 1993); however, NMED identified them as requiring investigation (SNL/NM 1996). Later modifications to Permit NM5890110518-1 included additional revisions to the list of solid waste management units and Areas of Concern. 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) with all approved modifications.

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.

3.4.1 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* assessment), potential sites, or individual historical activities have been identified for investigation. Many of these sites were investigated and confirmed to contain few or no contaminants of concern. In 1992, the Environmental Restoration Project (now Environmental Restoration Operations) was officially initiated 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 sites meet NMED criteria. The criteria require the site to be at acceptable levels of risk to human health and the environment. Remediation is performed where needed to meet NMED criteria for Corrective Action Complete status.

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

After NMED grants Corrective Action Complete status to an environmental restoration site, DOE and Sandia personnel submit a request for a Class 3 Permit modification in order to (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 the list of solid waste management units and Areas of Concern for which corrective action is complete. The RCRA Facility Operating Permit (NMED 2015) and all approved modifications lists 317 solid waste management units and Areas of Concern. The RCRA Facility Operating Permit includes two lists of solid waste management units and Areas of Concern for which corrective action is complete: one is a list of 25 solid waste management units and Areas of Concern requiring controls, and the other is a list of 286 solid waste management units and Areas of Concern that do not require controls. 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.

On June 15, 2018, the NMED Hazardous Waste Bureau approved the Class 3 Permit Modification request for Corrective Action Complete status for solid waste management unit (SWMU) 8 and 58 (which are colocated), SWMU 68, SWMU 149, and SWMU 154 (NMED 2018). Therefore, as of 2019, 311 solid waste management units and Areas of Concern no longer required corrective action. Three solid waste management units and three Areas of Concern required corrective action 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).

3.4.2 Groundwater Monitoring at Areas of Concern

In 2019, routine groundwater samples were collected for the three groundwater Areas of Concern (TAVG, TAG, and BSG). A summary of 2019 activities and results is provided in Section 3.5.5 and in Appendix A, "Summary of Groundwater Monitoring in 2019." The *Annual Groundwater Monitoring Report, Calendar Year 2019* (SNL/NM 2020a) documents the results of all groundwater monitoring activities for 2019. The report is available at:

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

3.5 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 (1) post-closure care for the Chemical Waste Landfill and the Corrective Action Management Unit and (2) long-term monitoring and maintenance for the Mixed Waste Landfill and solid waste management units with Corrective Action Complete with Controls status. Program personnel prepare annual reports for NMED on each of these post-closure care and long-term monitoring and maintenance sites.

In addition, groundwater is monitored for:

- Chemical Waste Landfill post-closure care
- Mixed Waste Landfill long-term monitoring and maintenance
- Three groundwater Areas of Concern (TAVG, TAG, and BSG)
- Groundwater Monitoring Program sampling requirements

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. The results of groundwater monitoring activities for 2019 are documented in the *Annual Groundwater Monitoring Report* (SNL/NM 2020a). Appendix A, "Summary of Groundwater Monitoring in 2019," provides an overall summary for 2019.

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*.

3.5.1 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 2019, 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 results were consistent with previous years; trichloroethene was the only volatile organic compound detected. Trichloroethene, however, was not detected in July; this is the first time since post-closure care began that trichloroethene was not detected in any groundwater samples. No analytes were detected at concentrations exceeding the EPA maximum contaminant levels or Post-Closure Care Permit-defined hazardous concentration limits. Groundwater monitoring activities and results are detailed in the *Annual Groundwater Monitoring Report* along with site background information.

In addition to semiannual groundwater monitoring, the Post-Closure Care Permit requires other monitoring, inspections, maintenance, and repair activities. Inspections conducted in 2019 confirm that the Chemical Waste Landfill evapotranspirative cover was in good condition, evenly covered by native perennial grasses. 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 2019 are documented in the *Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2019* (SNL/NM 2020b).

3.5.2 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. The 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.

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.

The 2019 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 2019 soil moisture monitoring results remained consistent with the baseline data for the primary subliner and vertical sensor array monitoring subsystems. Slight increases at two of the Chemical Waste Landfill sanitary sewer monitoring subsystem locations (recorded September 2005 and March 2007) were attributed to a leak in the sanitary sewer system that parallels the Chemical Waste Landfill sanitary sewer monitoring subsystem. A liner was inserted into the sanitary sewer system in September 2010 to seal any leaks. Soil moisture values have since stabilized at the two Chemical Waste Landfill sanitary sewer monitoring locations.

In 2019, 238 gallons of leachate (a listed hazardous waste) were removed from the leachate collection system compared to 256 gallons of leachate removed in 2018. 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 inspections, monitoring, and sampling details—can be found in the *Corrective Action Management Unit Report of Post-Closure Care Activities Calendar Year 2019* (SNL/NM 2020c).

Gunnison's Prairie Dog (*Cynomys gunnisoni*)

3.5.3 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. The NMED Final Order for Corrective Action Complete with Controls (NMED 2016a) 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 required for this landfill are defined in the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan, which was implemented upon NMED approval (NMED 2014) and included in Sandia's RCRA Facility Operating Permit (NMED 2016b; NMED 2016c).

The groundwater monitoring network at the Mixed Waste Landfill consists of four compliance wells and three wells monitored for groundwater elevation only. In 2019, semiannual groundwater monitoring was performed at the Mixed Waste Landfill in April–May and October 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. Groundwater monitoring activities and results are summarized in the *Annual Groundwater Monitoring Report* along with site background information.

In addition to semiannual groundwater monitoring, the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan requires other monitoring, inspections, 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 2019, 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. All Long-Term Monitoring and Maintenance Plan-required monitoring activities for 2019 are documented in the *Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report, April 2019 through March 2020* (SNL/NM 2019c), which will be submitted to NMED in June 2020.

In 2019, the *Mixed Waste Landfill Five-Year Report* (SNL/NM 2019d) was completed as required by the NMED Final Orders (NMED 2005; NMED 2016a) and Long-Term Monitoring and Maintenance Plan. The purpose of the five-year report is to analyze the continued effectiveness of the Mixed Waste Landfill evapotranspirative cover (i.e., a remedy selected by NMED) and reevaluate the feasibility of excavating the Mixed Waste Landfill.

3.5.4 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 (NMED 2015) and all approved modifications. Measures include surveillance of site conditions and maintenance of institutional controls.

Based on the 2019 inspections performed and site conditions observed at 24 solid waste management units, the administrative and physical institutional controls in place at the units are effectively providing continued protection for human health and the environment. In 2019, Sandia completed erosion control construction for the Tijeras Arroyo escarpment near TA-IV. Construction resolved SWMU 45 erosion that was observed during the 2017 and 2018 inspections and implemented a best management practice to prevent erosion for SWMU 46 and SWMU 229. The *Solid Waste Management Unit and Areas of Concern Annual Long-Term Monitoring and Maintenance Report for Calendar Year 2019* (SNL/NM 2020e) was submitted to NMED.

3.5.5 Groundwater Monitoring

Long-Term Stewardship Program personnel collected routine groundwater samples for:

- The Chemical Waste Landfill Post-Closure Care Permit
- The Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan
- Three groundwater Areas of Concern (TAVG, TAG, and BSG) identified in the RCRA Facility Operating Permit issued on January 27, 2015 (NMED 2015)

- 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)

The 2019 water quality results for this sampling were consistent with results from past years. A summary of results is provided in Appendix A, "Summary of Groundwater Monitoring in 2019," and in the *Annual Groundwater Monitoring Report*.

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

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, 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, 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, gross alpha, gross beta, and selected radionuclides
- Groundwater Monitoring Program wells—Target Analyte List metals (plus uranium), inorganics (including nitrate plus nitrite, major anions, and total cyanide), total phenols, total alkalinity, volatile organic compounds, total halogenated organics, gross alpha, gross beta, selected radionuclides, and high explosive compounds (at six wells)

For the TAVG Area of Concern, 17 monitoring wells were sampled in 2019. 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 20.2 μg/L, and nitrite plus nitrate exceeded the maximum contaminant level of 10 mg/L in four wells, with a maximum concentration of 15.3 mg/L.

For the TAG Area of Concern, 21 monitoring wells were sampled in 2019. 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 24.6 mg/L. None of the wells screened in the Regional Aquifer exceeded the maximum contaminant level; the maximum nitrate plus nitrite concentration was 4.24 mg/L. The merging-zone well had a maximum nitrate plus nitrite concentration of 37.1 mg/L.

No concentrations of trichloroethene exceeded the maximum contaminant level (5 μg/L) at any of the 21 wells. For the Perched Groundwater System, the maximum trichloroethene concentration was 4 J μg/L. The J qualified data indicated an estimated value. The maximum trichloroethene concentration in the Regional Aquifer was 0.7 J μg/L. Trichloroethene was not detected (< 0.300 μg/L) in samples collected from the merging-zone well.

For the BSG Area of Concern, 14 wells were sampled. Nitrate plus nitrite exceeded the maximum contaminant levels in eight wells, with a maximum concentration of 40.3 mg/L. All other analytical results for groundwater samples from the three Areas of Concern were below established maximum contaminant levels.

For the Groundwater Monitoring Program, 16 wells and one spring were sampled. Fluoride was detected above the maximum allowable concentration in five groundwater wells and at Coyote Springs. Beryllium concentrations at Coyote Springs exceeded the 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.

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

3.6 Materials Sustainability and Pollution Prevention Program

The Material Sustainability and Pollution Prevention Program is a central element in the EMS and applies to all activities that procure and use resources and generate waste. Program personnel provide guidance and specify strategies, activities, and methods to reduce the quantity and toxicity of waste and pollutants, conserve energy and resources, and purchase 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.

3.6.1 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 generation of commercial solid waste has dropped 46 percent—from 229 pounds per person in 2008 to 123 pounds per person in 2019. 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.

3.6.2 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 2019, original equipment manufactured black toners were restricted for purchase through suppliers and online retailers. Remanufactured black toners are now procured. Also, a biodegradable phone case became available for Members of the Workforce to purchase at a discount. In addition, to-go containers at the on-site cafeteria were evaluated in order to replace them with compostable alternatives to alleviate contamination issues related to the composting program.

3.6.3 Electronics Stewardship

Sandia management is committed to purchasing computer systems, such as green electronics, 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 Electronic Product Evaluation Assessment Tool catalog.

One facet of this effort is to decrease the number of single-purpose electronics in favor of using high-capacity, all-in-one network machines that copy, print, fax, and scan. This saves energy, space, and the need for on-hand inventory of parts and consumables. In addition, the procurement contracts for printers and scanners are restricted and standardized to just a few models in order to reduce the variety of parts and consumables maintained.

3.6.4 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.

3.6.5 Awareness and Outreach

Material Sustainability and Pollution Prevention Program personnel promote the use of green initiatives and available resources to decrease the environmental impact of existing operations. Two hundred recycling bins for paper, plastics, aluminum, coffee pods, and nitrile gloves were added to buildings in 2019, and composting collection bins were added to several new buildings. Team members partner with a local business to process compost waste into a valuable commodity. Program personnel use various communication tools to increase awareness about and bolster participation in recycling, composting, and acquiring sustainable products. Major outreach efforts include Earth Day, Pollution Prevention Week, and America Recycles Day activities. Sandia is also a sponsor of the New Mexico Recycling Coalition.

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

http://p2.sandia.gov

3.7 National Environmental Policy Act Program

NEPA Program personnel provide technical assistance to ensure that operations comply with NEPA and the National Historic Preservation Act 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 Docs software to identify potential environmental impacts.

After a NEPA checklist is completed, 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 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.

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. The analysis may result in preparation of a new environmental assessment, environmental impact statement, or supplemental document to the existing site-wide environmental impact statement. Sandia personnel continue to assist DOE in the development of a new site-wide environmental impact statement.

3.7.1 National Environmental Policy Act Activities in 2019

In 2019, the NEPA team participated in the following environmental activities:

- Initiation of three environmental baseline surveys at the request of DOE to document the current environmental condition of certain non-DOE-owned properties.
- Creation of a new process for reviewing routine maintenance activities at SNL/NM for NEPA compliance and the need for permits and requirements, such as discharge permits, biological surveys, and historic building and archaeological concerns. Through a structured improvement activity, internal team subject matter experts evaluated the previous review process and created a new criterion for project managers to use when planning projects. In addition to addressing environmental compliance risks and formalizing the environmental review process, the new tool also provides searchable documentation of reviews and reduced review times.

Along with these activities, NEPA Program personnel reviewed 342 proposed activities in 2019, including continuation of routine operations. Of these, 191 checklist reviews were completed internally and 128 NEPA checklists were transmitted to DOE for review and determination. In addition, 23 NEPA checklists were transmitted to the U.S. Air Force for review and determination because the proposed projects would take place on Kirtland Air Force Base permitted land.

NEPA activities that required DOE review and determination in 2019 are summarized below. Of these completed NEPA checklists, none required preparation of an environmental assessment or environmental impact statement.

Gray Fox (*Urocyon cinereoargenteus*)

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 program's scope includes removing existing membrane roofs and replacing them with new thermoplastic olefin membrane roofs.

In 2019, NEPA Program personnel completed 26 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 2019, NEPA Program personnel reviewed:
- One transportainer project
- Five new buildings
    - One new single-story metal building
    - One three-story office building
    - Three projects for constructing modular office buildings
- Two demolition and disposal projects

In 2019, NEPA Program personnel completed four NEPA checklists to add additional parking:
- Additional parking south of Hardin Boulevard
- Parking lot extensions in TA-I
- Parking lot extensions in TA-IV
- Installation of a modular parking structure in TA-I

NEPA Program personnel completed three NEPA checklists for road improvement projects:
- Firebreak roads clearing to allow for faster emergency vehicle access
- Pothole repairs to eliminate unsafe driving conditions
- Relocation of an intersection to improve traffic safety and decrease traffic congestion

In addition, NEPA Program personnel reviewed utility projects:
- Two electrical lighting projects
- Two water line projects
- One solar energy nanogrid project

Unmanned Aerial System Projects
In 2019, NEPA Program personnel reviewed six 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
- General construction
- Geotechnical borings
- Lease agreements
- Research and development
- Routine maintenance
- Sandia operations, including
    - Nuclear weapons
    - National security programs

    - Energy
    - Global security
- Waste shipments

3.8 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 material in preparation for shipment to off-site facilities for recycling, storage, treatment, or disposal.

Types of waste handled and shipped in 2019 are summarized in Table 3-1. Wastes recycled in 2019 are summarized in Table 3-2.

Table 3-1. Waste shipped by waste management facilities, 2019

Waste Categories	Waste Shipped (pounds)
Radioactive Waste	
Low-level radioactive waste	61,244
Transuranic waste	0
Subtotal	**61,244**
Mixed Radioactive and Hazardous Waste	
Mixed low-level radioactive waste	28,568
Mixed transuranic waste	0
Subtotal	**28,568**
RCRA Waste	
Hazardous waste	219,958
Subtotal	**219,958**
Toxic Substances Control Act	
PCBs	1,041
PCBs and hazardous waste mixture	0
Subtotal	**1,041**

Table continued on next page

Table 3-1. Waste shipped by waste management facilities, 2019 (continued)

Waste Categories	Waste Shipped (pounds)
Other Regulated Wastes	
Infectious waste	2,685
Asbestos waste	340,267
Chemical waste (includes special waste and industrial solid waste)	600,646
Used oil (not recycled)	0
Subtotal	**943,598**
Solid Waste	
Solid waste collection and recycling center dry waste	1,468,480
Off-site office waste (Sandia Science and Technology Park)	123,562
Cafeteria wet waste	41,360
Construction and demolition waste	5,012,125
Other solid waste	17,055
Subtotal	**6,662,582**
Total Waste Shipped	**7,916,991**

PCB = polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act

Table 3-2. Waste recycled, 2019

Recycle Categories	Waste Recycled (pounds)
Regulated or Chemical Waste Recycled	
Batteries	99,576
Capacitors	4,678
Computer electronics	562,320
Lead	248,754
Light bulbs	8,204
Toner and ink cartridges	19,648
Used oil	108,304
Subtotal	**1,051,484**
Commercial, Construction, and Demolition Solid Waste Recycled	
Asphalt/concrete	182,250
Batteries	3,033
Cardboard	423,453
Carpet	28,460
Chairs	73,340
Compost (food, green, paper, and plywood)	333,367
Food grease	64,360
Metals	1,986,389
Nitrile gloves	1,725
Paper (mixed and white)	136,601
Plastics	40,560
Three-dimensional printer cartridges	10,970
Tires	16,500
Wood	88,900
Subtotal	**3,389,908**
Total Waste Recycled	**4,441,392**

3.8.1 Hazardous and Mixed Waste Permits in 2019

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. The following units and activities are subject to a permit:

- RCRA Facility Operating Permit
  - Auxiliary Hot Cell Unit (waste management)
  - Corrective Action Management Unit (post-closure care)
  - Five Manzano Storage Bunkers (waste management)
  - Hazardous Waste Handling Unit (waste management)
  - Radioactive and Mixed Waste Management Unit (waste management)
  - Solid Waste Management Units and Areas of Concern for which Correction Action is Complete (long-term monitoring and maintenance)
  - Thermal Treatment Unit (waste management)
- Chemical Waste Landfill Post-Closure Care Permit
  - Chemical Waste Landfill (post-closure care)

The RCRA Facility Operating Permit was modified four times during 2019 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 January 4, 2019.
- 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 April 8, 2019.
- Several permit sections were modified effective October 24, 2019:
  - Waste management operations were modified to allow personnel to address specific hazards more effectively in each waste and potentially reduce the number of times each container needs to be handled.
  - Emergency response steps were clarified.
  - Training methods were updated.
  - Sampling and monitoring methods were updated.
- 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 October 31, 2019.

3.8.2 Waste Management Activities in 2019

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

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 2019 are summarized as follows:

- At the Hazardous Waste Handling Unit, hazardous and other regulated wastes were screened, sorted, repackaged, and stored.

- 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, or physical treatment (volume reduction).
- At the Manzano Storage Bunkers, hazardous, mixed, and radioactive wastes were stored and repackaged. Five of the seven bunkers are included in the RCRA Permit.
- At the Auxiliary Hot Cell Unit, mixed and radioactive wastes were generated and stored.
- 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.
- At the Solid Waste Collection and Recycling Center, commercial waste was screened. Other solid wastes and recyclable materials were collected and processed for shipment off site.

3.8.3 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 (NMED 2015 and all approved modifications), 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 Material Sustainability and Pollution Prevention Program personnel (see Section 3.6). Hazardous and mixed waste minimization activities are described in an annual report to NMED (SNL/NM 2019b), 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/

3.8.4 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, and waste management activities. DOE and Sandia personnel also manage transuranic and mixed transuranic wastes, which are generated through research and waste management activities. High-level radioactive waste is not generated at SNL/NM. During 2019, 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, 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, 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 low-level radioactive waste, low-level radioactive mixed waste, transuranic waste, and mixed transuranic 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 annual Site Treatment Plan (NMED 1995 and all approved modifications) and (2) instructions for providing an annual update of activities and a current inventory of stored waste still on-site. During 2019, DOE and Sandia personnel met all regulatory deadlines and provided an annual update of mixed waste activities (SNL/NM 2019f). During 2019, Sandia personnel managed 2.32 cubic meters of mixed transuranic waste that was subject to the Federal Facility Compliance Order. Table 10-3 lists the quantities of mixed waste subject to the Federal Facility Compliance Order at the end of fiscal year 2019. The wastes are subject to a Site Treatment Plan compliance deadline of December 31, 2020.

3.8.5 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 implement 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 operations, 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 PCB. Waste minimization efforts are also applicable to nonhazardous waste, as discussed in sections 3.6 and 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 practical, 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. There are buildings that contain PCB spill contamination sites on concrete floors from old electrical transformers that have since been removed from service; these are maintained for remediation in the future. 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 2019.

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 are allowed to remain in service or are redistributed through the Property Management and Reapplication Department. Table 3-1 summarizes the quantities of asbestos waste shipped in 2019.

3.8.6 Waste Management Program Results

Representatives of the NMED Hazardous Waste Bureau performed two annual no-notice hazardous waste compliance evaluation inspections of the entire SNL/NM site during 2019; one inspection in May and one in December.

- Fiscal Year 2019 inspection, May 20–23, 2019. A Notice of Violation was issued, which is a DOE reportable occurrence (Chapter 2).
- Fiscal Year 2020 inspection, December 2–5, 2019. Results of the inspection are pending.

Chapter 4. Terrestrial Surveillance Program

Perkysue (*Tetraneuris argentea*)

OVERVIEW ■ Terrestrial Surveillance Program personnel collect soil, sediment, and vegetation samples, which are analyzed for radiological, metal, and other site-specific constituents. Samples are taken from on-site locations and then compared with samples from perimeter and off-site locations.

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 Admin Change 3, *Radiation Protection of the Public and the Environment,* which establishes standards and requirements to protect the public and the environment from undue risk from radiation associated with radiological activities under the control of DOE.

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.*

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).

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 for at the on-site, perimeter, and off-site locations, respectively.

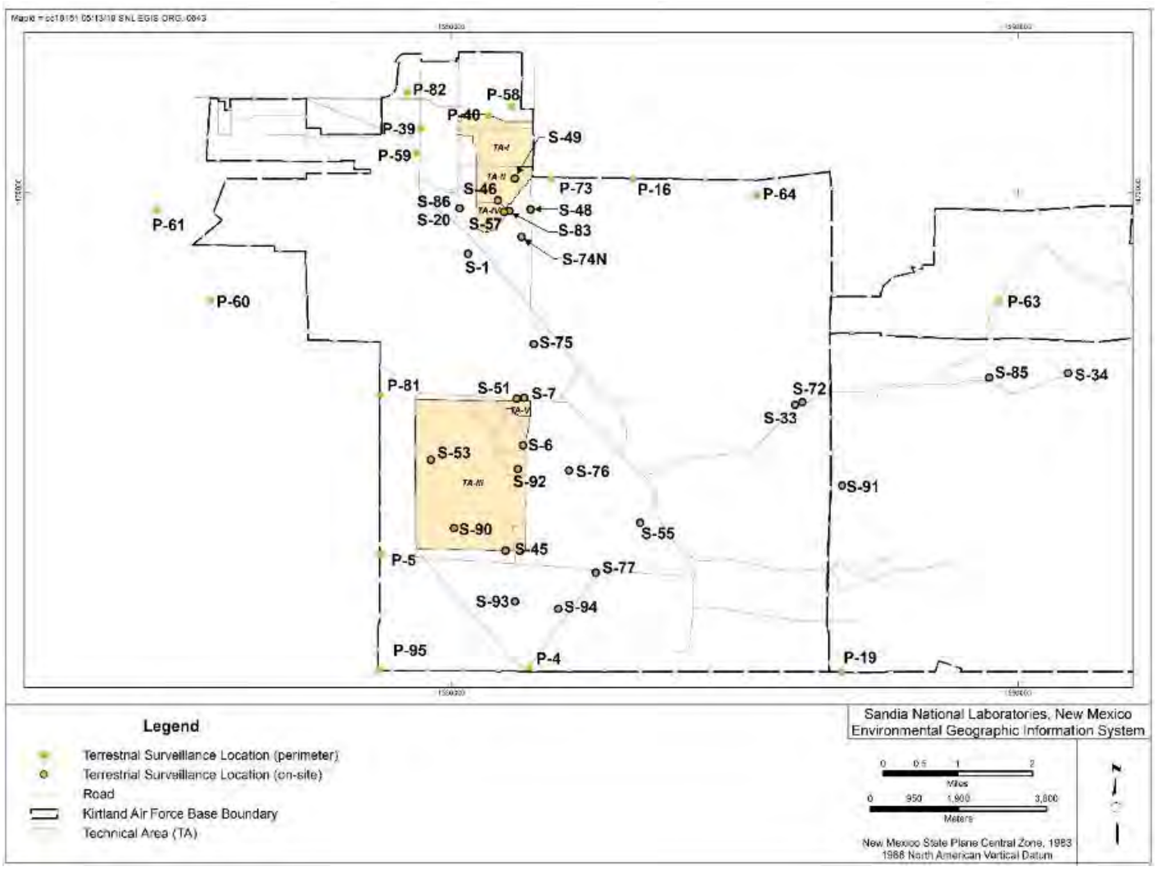


Figure 4-1. Terrestrial Surveillance Program on-site and perimeter sampling locations

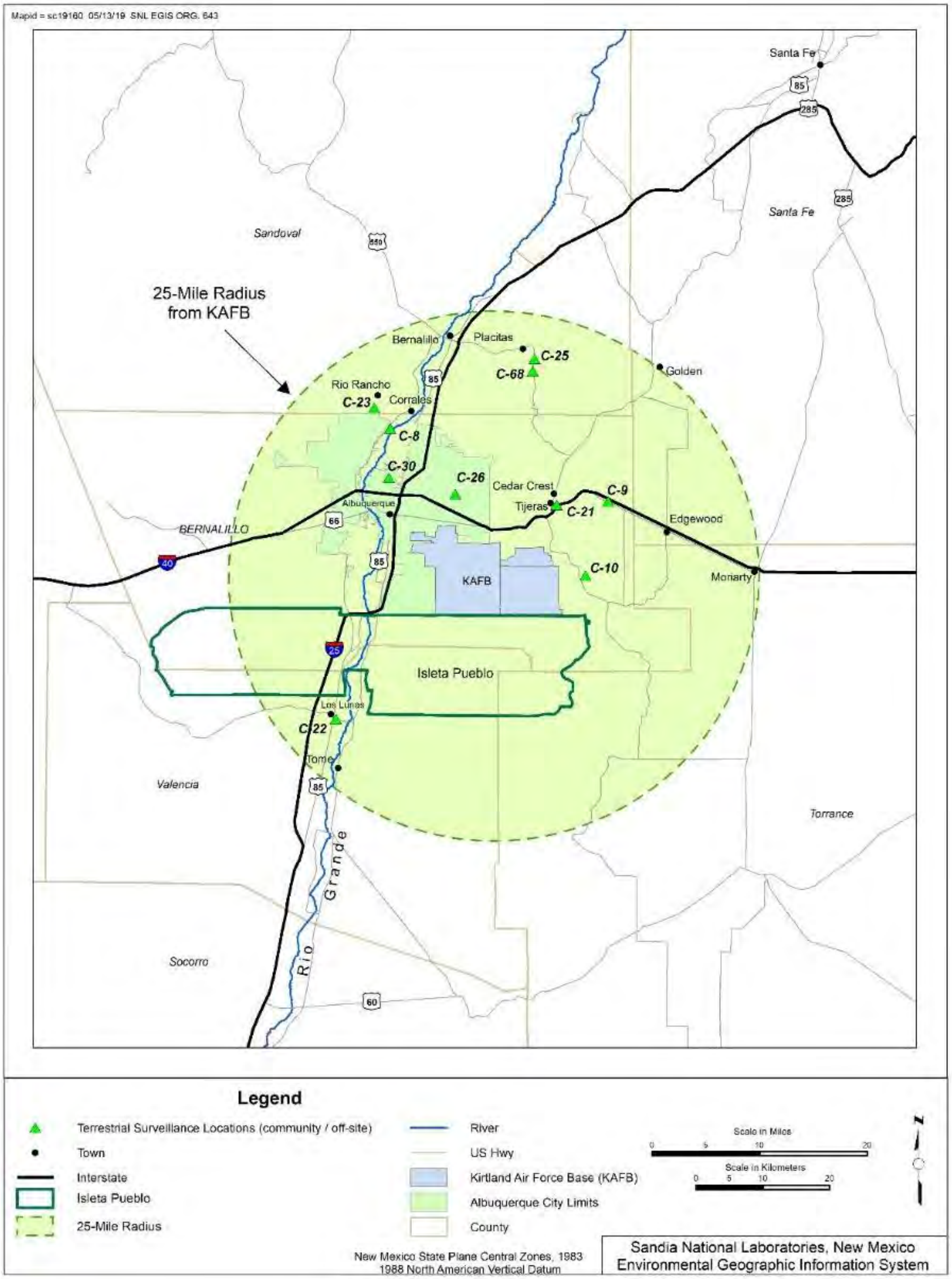


Figure 4-2. Terrestrial Surveillance Program off-site sampling locations

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		X		
S-85	Arroyo del Coyote Cable Site		X		
S-86	Corner of Wyoming 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 for 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.
SWMU = solid waste management unit
TA = technical area

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 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 for dose from ambient gamma radiation.
DOE = U.S. Department of Energy
KAFB = Kirtland Air Force Base
TA = technical area
U.S. = United States

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 for 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 2016a).

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 2014). 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, copper, iron, lead, magnesium, nickel, selenium, silver, thallium, uranium (total), and zinc.

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 is subsequently transported and deposited. *Vegetation* is plant life or the total plant cover of an area.

In 2019, 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 2019 dosimeter data is presented here, but trend analyses will not be performed until several more years of data are available.

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 8.

4.4 Data Analysis and Methodology

The statistical analyses methodology performed on soil, sediment, and vegetation sample results is being revised. Therefore, general statistics, population comparisons, and trend analysis were not conducted this year. However, comparisons of results for samples collected in 2019 to available reference values and previous years were made.

There are no regulatory limits with which to compare concentrations of radiological constituents found in surface soils, sediments, 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)
- United States surface soil concentrations (Kabata-Pendias 2000)

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

Analyte	NM Soil Concentrations[a]		NMED Soil Screening Levels[b]		U.S. Soil Concentrations[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
Zinc	18	84	23,500	389,000	5.0	164

[a] Dragun and Chekiri 2005.
[b] NMED 2019.
[c] Kabata-Pendias 2000.
— = not available
ND = not detected
NM = New Mexico
NMED = New Mexico Environment Department
U.S. = United States

4.5 Terrestrial Surveillance Program Results in 2019

The following Terrestrial Surveillance Program activities occurred in 2019:

- The annual sampling of soil and sediment occurred in early May 2019 at designated locations.
- The annual sampling of vegetation occurred in September 2019 at designated locations.
- The quarterly exchange (deployment and retrieval) of environmental dosimeters occurred at designated locations.

The analytical results for radiological (including environmental dosimeters) and nonradiological parameters for the 2019 sampling events are provided in Appendix B, "Terrestrial Surveillance Analytical Results in 2019."

4.5.1 Radiological Results

Radiological analyses were performed on soil, sediment, and vegetation samples. In 2019, there were no soil, sediment, nor vegetation sample results for radiological constituents that exceeded maximums from previous years.

4.5.2 Dosimeter Results

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

The average dose rate summary statistics for 2019 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 and type, the proximity to bedrock, and the statistical nature of radioactivity.

Table 4-5. Dosimeter dose rate summary statistics by location classification, 2019

Location Classification	Number of Observations	Average (mrem/year)	Median (mrem/year)	Standard Deviation (mrem/year)	Minimum (mrem/year)	Maximum (mrem/year)
On-site	7	66	65	7.9	54	76
Perimeter	7	65	65	10.5	50	85
Off-site	7	60	58	9.0	47	70

4.5.3 Nonradiological Results

Nonradiological parameters include terrestrial surveillance metals, high explosive compounds, and perchlorate. All metal results were compared to values referenced in Section 4.4 and provided in Table 4-4 and to data from previous years.

Metals

In 2019, there were no sample results (soil and sediment) for metals that exceeded the NMED Soil Screening Levels (Table 4-4). No vegetation sample results exceeded maximums from previous years.

High Explosive Compounds

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

Perchlorate

One on-site location (S-53; soil sample) (Figure 4-1)was analyzed for perchlorate. The holding time for sample analyses was exceeded, and results were qualified with a UJ (the analyte was analyzed for but was not detected and the associated value is an estimate and may be inaccurate or imprecise). The estimated result is well below the NMED soil screening level of 54.8 mg/kg for residential use (NMED 2019).

4.6 Additional Activities and Variances

Terrestrial Surveillance Program sampling in 2019 was conducted with the following variances:

- There was insufficient vegetation for collection at locations P-04, P-05, P-06, P-16, P-58, S-06, S-33, S-34, S-45, S-46, S-49, S-51, S-86 (Figure 4-1), C-09, C-10, and C-25 (Figure 4-2).
- At locations where vegetation samples were collected (P-82 and S-55) (Figure 4-1), the radiological and nonradiological results did not warrant further evaluation of biota.

Chapter 5. Air Quality Compliance and Related Programs

Sandia foothills

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 the 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 oxides, 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, the *CY2019 Stationary Source Emissions Inventory Report for Sandia National Laboratories* (DOE/NNSA/SFO 2019a) was submitted to the City of Albuquerque Air Quality Program. In 2019, 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[a], 2019

Carbon Monoxide	Hazardous Air Pollutant	Particulate Matter with a Diameter ≤ 10 µm	Nitrogen Oxide	Sulfur Dioxide	Volatile Organic Compound
12.2	8.6	1.9	10.8	0.4	5.9

[a] 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 2019, potential emissions were 8.64 tons of hazardous air pollutants and 5.92 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 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 carbon dioxide equivalent annually.

During FY 2019, Sandia operations emitted a total of 160,460 tons of carbon dioxide equivalent (including fugitive greenhouse gas emissions). This total includes emissions from the sulfur hexafluoride releases in June and September 2019 that were reportable under DOE O 232.2A, *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 are currently below reporting thresholds.

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 greater 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 2019 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 of the applicable Sandia construction projects that will disturb more than three-quarters of an acre of soil. A list of 2019 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 2019, the stations monitored ambient air for particulate matter that has a diameter equal to or less than 10 microns (PM_{10}) and particulate matter that has a diameter equal to or less than 2.5 microns ($PM_{2.5}$).

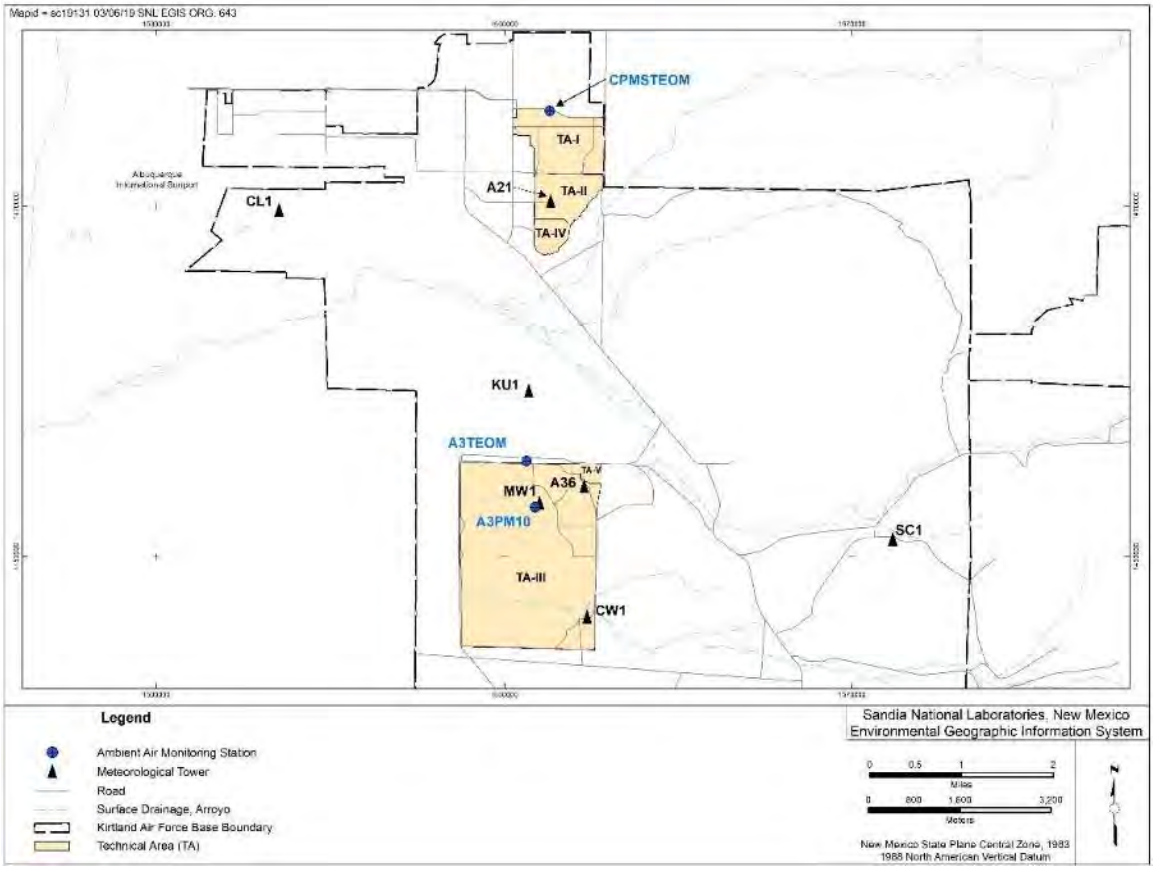


Figure 5-1. Clean air network of meteorological towers and ambient air-monitoring stations

The City of Albuquerque has been delegated authority by the EPA 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 2019 included 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 2019

Ambient air-monitoring data is presented for FY 2019. Laboratory data are available in Appendix C, "Ambient Air Surveillance Results in Fiscal Year 2019," and are summarized below.

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

The monthly and annual averages for $PM_{2.5}$ in FY 2019 are listed in Table 5-2.

Table 5-2. Monthly and annual averages for $PM_{2.5}$, FY 2019

Sample Location	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Average FY 2019
CPMSTEOM[a]	—	—	—	—	—	7.76	7.48	8.79	14.51	10.93	8.54	7.53	9.36
A3TEOM	3.94	4.62	4.40	4.48	4.53	5.04	4.87	5.23	7.76	6.39	6.18	6.16	5.63

Note: All units are in µg/m³.
[a] CPMSTEOM equipment malfunctioned October 2018 through February 2019.
— = no measurement collected or data unreliable
FY = fiscal year
$M_{2.5}$ = particulate matter that has a diameter equal to or less than 2.5 microns

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

The highest monthly average PM_{10} concentration in FY 2019 was 18.6 µg/m³, which occurred at the A3PM10 station in the first quarter of FY 2019. 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 2019

Sample Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Average FY 2019
A3PM10	18.60	2.56	3.12	9.99	8.57

Note: All units are in µg/m³.
FY = fiscal year
PM_{10} = particulate matter that has a diameter equal to or less than 10 microns

The PM_{10} samples are also analyzed for metals and radiological constituents, and the FY 2019 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.

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

Table 5-4. Average results of PM_{10} analysis, FY 2019

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Aluminum	µg/m³	5.84E-02	2,000
Antimony	µg/m³	4.84E-04	500
Arsenic	µg/m³	DE	10
Barium	µg/m³	1.05E-03	50
Beryllium	µg/m³	DE	0.05
Cadmium	µg/m³	DE	10

Table continued on next page

Table 5-4. Average results of PM_{10} analysis, FY 2019 (continued)

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Calcium	µg/m^3	8.82E-02	2,000
Chromium	µg/m^3	1.18E-03	10
Cobalt	µg/m^3	2.44E-05	20
Copper	µg/m^3	1.07E-02	1,000
Iron	µg/m^3	8.07E-02	5,000
Lead	µg/m^3	8.85E-04	150
Magnesium	µg/m^3	2.19E-02	10,000
Manganese	µg/m^3	1.17E-03	200
Nickel	µg/m^3	2.68E-04	50
Potassium	µg/m^3	7.96E-03	2,000
Selenium	µg/m^3	4.36E-04	200
Silver	µg/m^3	DE	10
Sodium	µg/m^3	4.62E-02	5,000
Thallium	µg/m^3	DE	100
Uranium	µg/m^3	DE	200
Vanadium	µg/m^3	DE	50
Zinc	µg/m^3	4.30E-03	10
Actinium-228	pCi/m^3	DE	100
Alpha, gross	pCi/m^3	4.03E-03	0
Americium-241	pCi/m^3	DE	NE
Beryllium-7	pCi/m^3	1.66E-01	40,000
Beta, gross	pCi/m^3	1.62E-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	2.29E-03	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	1.37E-03	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
FY = fiscal year
NE = not established
PM_{10} = particulate matter that has a diameter equal to or less than 10 microns

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

http://clean-air.sandia.gov

5.3.2 Meteorological Monitoring Results

Tower A36 is a 60-meter tower used to describe general meteorology due to its central geographic position and the availability of all network measurements at that location. The 2019 annual summary for Tower A36 is shown in Table 5-5.

New Mexico weather in 2019 was warmer and drier than climatological means. New Mexico statewide averages were 1.5 degrees Fahrenheit warmer and 0.52 inches drier than normal (National Weather Service 2020). The towers of the SNL/NM meteorological observation network ended the year very close to their 1995–2014 temperature averages and with above-average precipitation. Monthly variations in temperature and precipitation can partially be attributed to the equatorial pacific, where 2019 began with weak El Niño conditions in place. The first half of the year was marked by periods of cold and/or wet weather across the network, which did not abate until late spring. January, February, and May were cooler than average while January, March, April, and May were all wetter. After a typically dry June, the monsoon season was hot and dry. KAFB experienced several heavy downpours in July, but the rest of the season produced little rainfall outside of the foothills. Towers A21 and A36 only received approximately one inch of rainfall during August and September combined. The entire network was warmer than average for the months of July, August, and September. After the monsoon season, the autumn months were once again cool and wet. October and November were both cooler than the 1995–2014 averages and the 1.73 inches of precipitation measured at A36 in November was a record for the site. Wind speeds followed the typical annual pattern, peaking in the spring and calming during the winter. Winds were stronger than average in February and March but below average in April. October and December wind speeds were also above the 1995–2014 averages.

Table 5-5. Annual climatic summary from Tower A36, 2019

Measurement	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	2019 Annual
Temperature (°C)													
Average daily high	7.58	10.8	16.9	20.9	23.6	31.2	34.0	33.9	29.7	20.2	13.6	8.93	20.9
Average daily low	−4.36	−3.58	2.36	5.40	7.27	14.2	18.8	18.0	15.0	4.37	−0.78	−3.65	6.09
Monthly mean	2.16	4.40	10.0	14.2	16.4	23.3	26.3	26.0	22.6	13.2	7.50	3.53	14.1
Extremes (°C)													
High	17.2	19.5	25.7	27.7	29.5	35.7	37.1	37.0	35.7	26.6	21.4	16.7	37.1
Low	−14.4	−11.5	−3.70	−1.22	1.97	8.83	13.2	13.2	9.85	−10.3	−7.39	−10.5	−14.4
Relative													
Humidity (percent)	61.2	47.3	41.5	38.3	33.7	28.4	35.4	38.4	40.4	35.0	50.5	58.2	42.4
Precipitation (cm)													
Monthly	1.52	1.17	1.70	3.07	1.45	0.53	4.09	1.68	0.71	1.85	4.39	0.89	23.06
24-hour maximum	0.56	0.69	0.76	1.63	0.74	0.30	1.47	0.66	0.43	1.85	1.37	0.51	1.85
Wind Speed (m/sec)													
Monthly mean	2.81	4.00	4.42	4.07	4.40	4.45	4.04	3.51	3.56	3.85	3.15	2.72	3.75
Highest 24-hour average	7.79	8.04	8.77	9.12	8.26	7.38	8.56	7.35	5.62	6.64	7.56	7.14	9.12
Maximum gust	21.6	23.5	27.5	25.9	28.9	26.5	26.3	21.1	17.6	19.6	27.5	17.8	28.9
Barometric (mb)													
Pressure	836	831	834	832	830	835	837	836	836	835	836	835	834

Note: Winter precipitation may be underestimated due to the amount of precipitation that fell as snow.

In general, the annual statistics for each of the monitoring towers are similar. However, daily meteorology varies considerably across the meteorological network. This real-time variability of meteorological conditions has implications on 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 found in meteorological measurements in 2019.

Table 5-6. Variations and extremes in meteorological measurements across the tower network, 2019

Meteorological Measurement	Minimum	Maximum	Spread
Temperature	**ºC**	**ºC**	**ºC**
Average annual temperature	13.61 Tower SC1	14.36 Tower KU1	0.75
Annual temperature extremes	−15.21 Tower CW1	37.88 Tower WW1	53.09
Average daily maximum temperature	19.92 Tower SC1	21.16 Tower MW1	1.24
Average daily minimum temperature	4.89 Tower CW1	6.92 Tower CL1	2.03
Average daily temperature range	14.17 Tower A21	16.06 Tower CW1	1.89
Precipitation	**cm**	**cm**	**cm**
Annual precipitation extremes	23.06 Tower A36	31.50 Tower SC1	8.44
Maximum daily precipitation	1.85 Tower A36	2.39 Tower SC1	0.54
Greatest monthly precipitation variation	1.68 Tower A36	4.75 Tower SC1	3.07 August

Table continued on next page

Table 5-6. Variations and extremes in meteorological measurements across the tower network, 2019 (continued)

Meteorological Measurement	Minimum	Maximum	Spread
Wind Speed	**m/sec**	**m/sec**	**m/sec**
Average annual wind speed	3.58 Tower A21	3.88 Tower CW1	0.30
Average daily maximum wind speed	8.71 Tower CL1	10.6 Tower A13	1.89
Maximum annual wind gust	28.53 Tower CL1	32.49 Tower A13	3.96

Note: Winter precipitation that falls as snow is underestimated (mostly at Tower SC1).

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.

Western Pygmy Blue (*Brephidium exilis*)

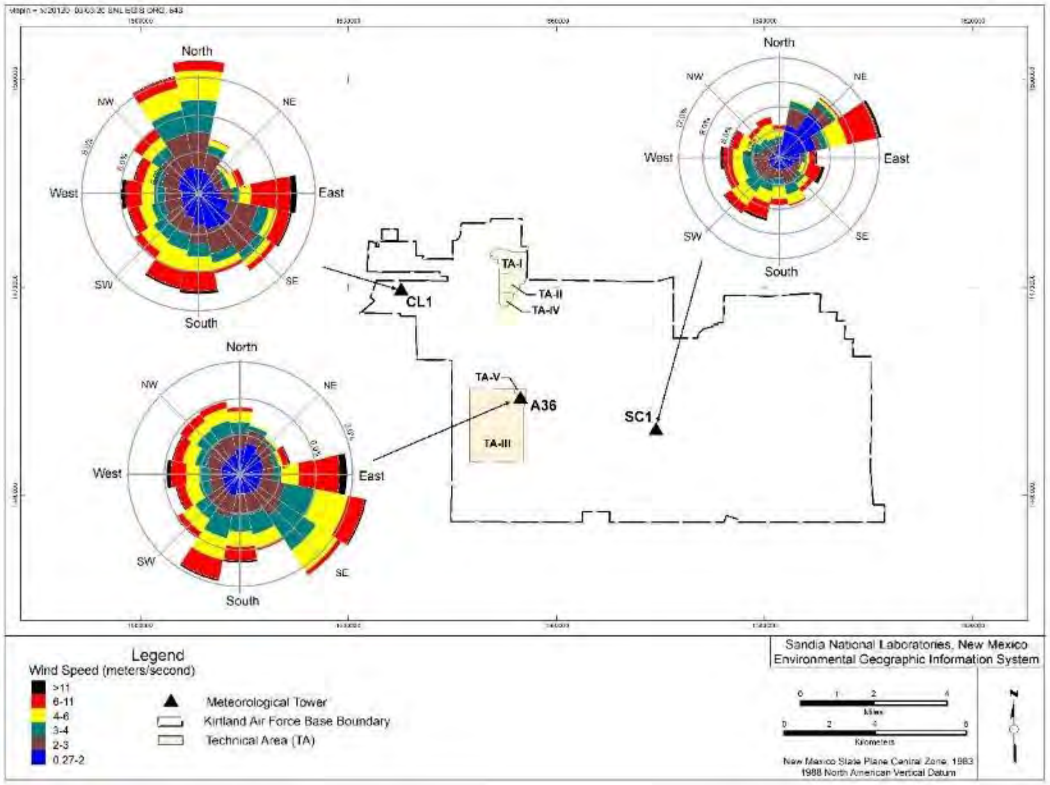


Figure 5-2. Annual wind roses at towers A36, CL1, and SC1

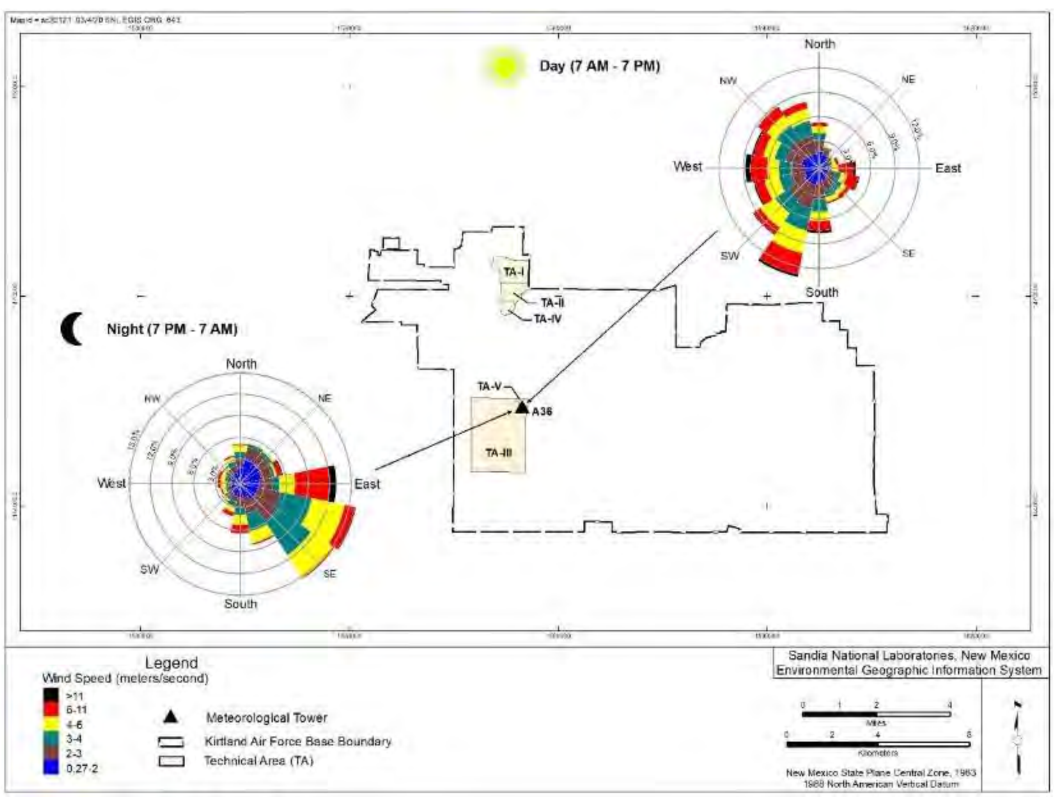


Figure 5-3. Annual wind roses for daytime and nighttime frequency at Tower A36

The relative location of a monitoring tower to local slopes and canyons identifies the exact direction of local topographic influences, which determine the predominant wind for the year and 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 northerly to 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, 2019

Tower	Day	Night
A13	West	East-northeast
A21	West	East-northeast
A36	South-southwest	East-southeast
CL1	South-southwest	North
CW1	South-southwest	East
KU1	South-southwest	Southeast
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 2019 is provided in Table 5-8.

Table 5-8. Radiological dose and release reporting, 2019

Radiologic Dose				
Dose to Off-Site Maximally Exposed Individual (mrem)	Dose to On-Site Maximally Exposed Individual (mrem)	Estimated Population Dose in a 50-Mile Radius of KAFB (person-rem)	Estimated Background Radiation Population Dose (person-rem)	EPA and DOE Dose Limit for Air Pathway (mrem)
6.52E-04	5.13E-04	2.43E-02	2.96E+5	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
4.39E+01	2.03E+00	8.14E-04	6.41E-06	3.92E-06	5.97E-07	1.28E-05	2.00E-08

DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
KAFB = Kirtland Air Force Base

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 2019, SNL/NM* (SNL/NM 2020d).

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 2019.

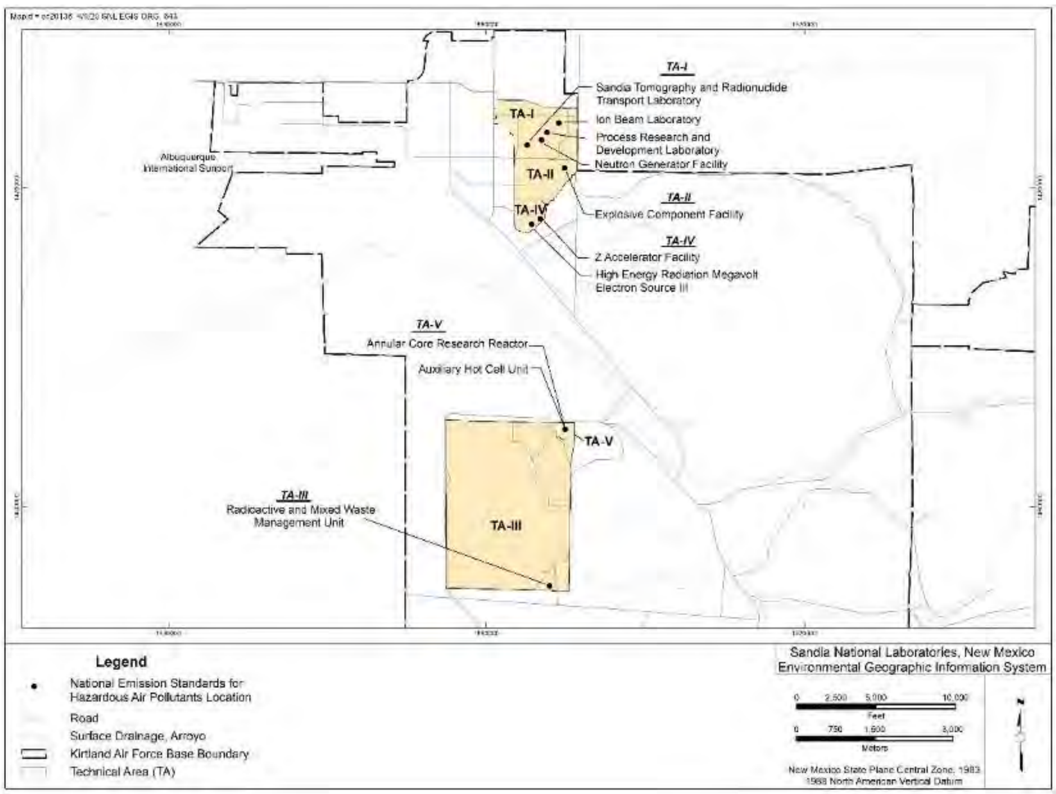


Figure 5-4. Locations of facilities that provided radionuclide inventories

Table 5-9. Summary of radionuclide releases from NESHAP sources, 2019

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	2.03

Table continued on next page

Table 5-9. Summary of radionuclide releases from NESHAP sources, 2019 (continued)

Source Name, Location	Description	Source Type	Monitoring Method	Radionuclide Emitted	Reported Release (Ci/year)
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	Krypton-85 Strontium-90 Cesium-137 Tritium Samarium-151 Plutonium-241 Americium-241 Plutonium-238 Plutonium-239 Uranium-235m[a]	2.0E-08 1.5E-08 1.0E-08 1.3E-09 2.8E-10 2.1E-10 7.0E-11 2.8E-11 2.6E-11 2.6E-11
Explosives Components Facility, TA-II	Facility used to test neutron generator design and manufacturing	Point	Calculation	Tritium	2.7E-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	7.4E-04 7.4E-05
Ion Beam Laboratory, TA-I	Ion and electron accelerators used to study and modify materials systems	Point	Calculation	Tritium	25.2
Neutron Generator Facility, TA-I	Principal production facility for neutron generators	Point	Continuous	Tritium	18.73
Process Research and Development Laboratory, TA-I	Small-scale laboratory operation involved in handling and researching sealed and unsealed tritiated materials	Point	Calculation	Tritium	8.5E-05
Radioactive and Mixed Waste Management Unit, TA-III	Facility used to handle radioactive and mixed waste	Point	Continuous and Calculation	Tritium (oxide) Tritium (elemental) Plutonium-238 Plutonium-239 Plutonium-240 Plutonium-241 Plutonium-242 Americium-241 Uranium-238 Uranium-235 Uranium-234 Strontium-90 Cesium-137 Tritium (particulate)	9.34E-04 1.05E-03 5.10E-07 3.20E-06 1.10E-06 6.80E-06 4.30E-10 1.20E-06 6.80E-08 1.90E-08 5.10E-07 3.90E-06 6.40E-06 1.4E-05
Z Accelerator Facility, TA-IV	Experimental facility used to research light-ion inertial confinement fusion	Point	Calculation	Tritium	1.6E-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.

NESHAP = National Emission Standards for Hazardous Air Pollutants   TA = technical area

TA-I Sources

The Ion Beam Laboratory ion and electron accelerators are used to study and modify materials systems. Activities at the laboratory result in the release of tritium.

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 over 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.

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 chain, 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 the EPA Clean Air Act Assessment Package-1988 (EPA 2013) 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 2019, 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 2015 through 2019. 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.

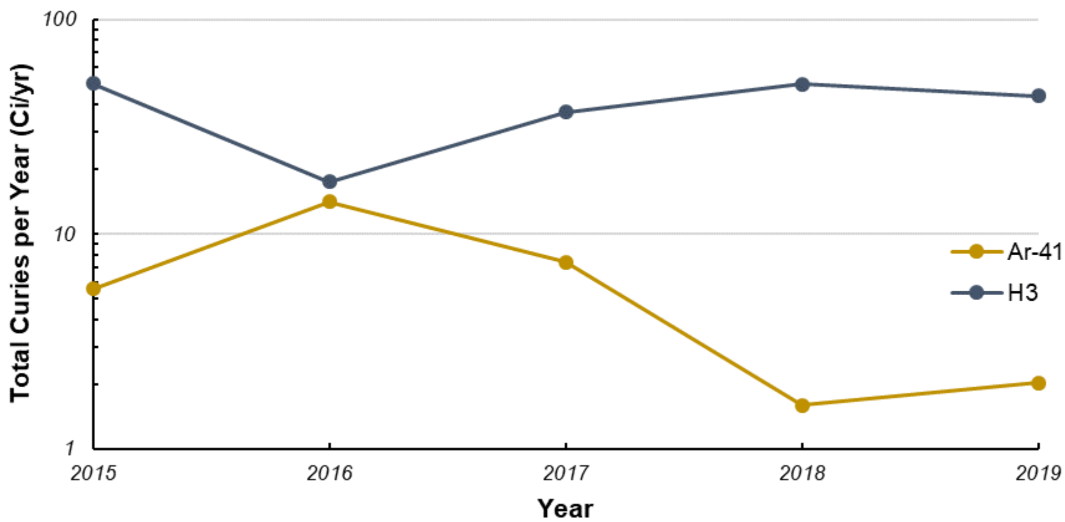


Figure 5-5. Atmospheric releases of argon-41 and tritium, 2015–2019

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). 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 will be updated with next Clean Air Act Assessment Package-1988 revision (expected in 2020).

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-DOD facilities on KAFB.

Meteorology

Data from three meteorological towers (A21, A36, and CW1) in the proximity of emission sources were used in 2019. 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 2013). 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, 2019

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	5.13E-04 mrem/year	10 mrem/year
Off-site receptor effective dose equivalent to the maximally exposed individual	Eubank Gate area	6.52E-04 mrem/year	10 mrem/year
Collective Dose			
Collective regional population	Fifty-mile radius of KAFB	2.43E-02 person-rem/ year	No standard available
Collective KAFB population	KAFB housing	8.95E-04 person-rem/ year	No standard available

DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
KAFB = Kirtland Air Force Base

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 2019, the primary radionuclides released from SNL/NM facilities were tritium and argon 41. In 2019, the on-site maximally exposed individual was located on KAFB at the Homeland Security Building. The on-site maximally exposed individual dose of 5.13E-04 mrem/year resulted primarily from tritium releases at the Ion Beam Laboratory and Neutron Generator Facility and from argon-41 releases at the Annular Core Research Reactor. The off-site maximally exposed individual dose of 6.52E-04 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 of 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 2019 was 2.43E-02 person-rem/year. This is comparable with 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 from 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 2019 calculation resulted in an estimated population dose of 8.95E-04 person-rem/year.

Chapter 6. Water Quality Programs

Mule Deer family (*Odocoileus heminonus*)

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 local, state, and federal agencies.

Sandia personnel ensure water quality through numerous programs. Operations comply with water quality requirements established by local, state, tribal, and federal 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

The NMED and the ABCWUA implement EPA standards at the state and local levels. Currently, EPA Region 6 implements stormwater regulations under the National Protection Discharge Elimination System. Sandia personnel adhere to these regulations and to the water quality guidelines in DOE O 458.1 Admin Change 3, *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 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 to ensure compliance with local, state, and federal reporting requirements.

An *environmental release* is any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of into the environment, which may include (but is not limited to) soil, air, and drain systems.

6.1.1 Events Reported to the New Mexico Environment Department

In 2019, one release to the environment was reported to NMED and EPA. This release did not meet the criteria of a DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, occurrence. This release is summarized as follows:

- On Wednesday, June 26, 2019, Emergency Management Operations personnel responded to a call regarding water flowing from a cooling tower that supports Building 899A, which is located in TA-I. An estimated 5,000 gallons of water overflowed from the cooling tower and discharged to the support platform and ground surface. In addition, it is estimated that approximately 50 gallons of water entered a nearby storm drain. The cooling tower water contained a scale inhibitor at a concentration of approximately 0.113 ppm and bromine (used to control algae growth) at a concentration of 5.0–10.0 ppm.

6.1.2 Events Categorized as a DOE Reportable Occurrence

Three releases in 2019 were reported to outside agencies and met the criteria for DOE reportable occurrences (see Chapter 2). The releases are summarized as follows:

- On December 15, 2018, an underground storage tank located on the south side of Building 862 was removed. Visual inspection of the tank and surrounding soils indicated no leaks or releases had occurred during the operational life of the underground storage tank. However, soil removed from the bottom of the excavation for assessment did exhibit a noticeable hydrocarbon odor. Subsequent laboratory analysis of soil samples received on January 8, 2019, confirmed the presence of petroleum hydrocarbons at concentrations exceeding the regulatory thresholds for release identification. DOE and the NMED Petroleum Storage Tank Bureau were notified of the regulatory exceedance. A steel underground storage tank had previously occupied this location until it was removed in July 1988. The former steel underground storage tank is believed to be the source of the soil contamination identified, based on records associated with removal of the other steel underground storage tank in 1988. Records indicate that the earlier steel underground storage tank had a single pinhole in the tank wall with a small visible leak on the steel pipe; analytical results for soil samples collected at the time of the steel underground storage tank removal in July 1988 identified elevated concentrations of petroleum hydrocarbons. See Section 6.2.1 for additional information.
- On August 1, 2019, Building 858 personnel noticed a fluoride spike and observed a peak of approximately 27.7 ppm. The spike required immediate notification to the ABCWUA, which occurred on the evening of August 1, 2019. Fluoride concentrations for a 24-hour average (12 hours before and after the peak) were 7.8 ppm, which is below the ABCWUA Sewer Use and Wastewater Control Ordinance Daily Maximum Composite Limit of 22.7 ppm. It was determined that an etching process, which used hydrofluoric acid, was occurring at the time of the event. The risk of employee exposure was mitigated by the exhaust system. The ABCWUA did not issue a violation for this release.

- On October 31, 2019, at the Building 808 north high bay (operating under ABCWUA Permit 2069F), a laboratory lead observed a Member of the Workforce discharging a cleaning solvent down the fume hood sink leading to the sanitary sewer system. A cleaning solvent comprised of acetone and isopropanol is used to clean parts in an ultrasonic cleaner within the fume hood. The fume hood had two drains: one to the sanitary sewer system and the other to a hazardous waste container. Over the course of 10 months (January to October 2019), improper solvent discharge had been occurring at the fume hood bench/sink. Solvents were being discharged into the sanitary sewer sink drain instead of the designated solvent hazardous waste container. An estimate of approximately 2 L of 100 percent acetone and approximately 4 L of 100 percent isopropanol, at up to 0.2 L total volume per instance was discharged to the sanitary sewer system. This error was corrected immediately once identified, and managers, environmental programs personnel, and DOE were notified. Immediate notification was made to ABCWUA. A Notice of Violation for Permit 2069F was issued by ABCWUA on November 21, 2019. The ABCWUA deemed that Permit 2069F fully returned to compliance on December 23, 2019, following the submittal of required documentation of installing a drain plug, retraining employees, and defining best management practices.

6.2 Oil Storage Program

The Oil Storage Program supports 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 2016b), 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 50 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) occurs 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 2019. These underground tanks are registered with the NMED Petroleum Storage Tank Bureau. Although 50 stationary aboveground storage tanks were operational in 2019, 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 2019

In January 2019, the NMED Petroleum Storage Tank Bureau conducted a compliance inspection at SNL/NM. No violations were identified.

In February 2019, a 10,000-gallon diesel fuel underground storage tank was permanently closed in accordance with the requirements of the NMED Petroleum Storage Tank Bureau per 20.5.115 NMAC, *Out-of-Service Storage Tank Systems and Closure*. The tank was removed in December 2018 as part of a backup power generation system renovation project that replaced several diesel-powered generators with natural gas-powered generators. A soil sample collected from beneath the tank indicated the presence of petroleum hydrocarbons. As a result, a minimum site assessment in accordance with 20.5.119 NMAC, *Corrective Action for Storage Tank Systems Containing Petroleum Products*, will be performed in 2020 to investigate the extent of soil contamination. The NMED Petroleum Storage Tank Bureau approved the minimum site investigation workplan in December 2019.

6.3 Safe Drinking Water Protection Program

The Safe Drinking Water Protection Program ensures the availability of safe drinking water to 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 DOE-owned and Sandia personnel-operated and -maintained distribution system on KAFB is regulated by the NMED Drinking Water Bureau 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 by helping organizations obtain NPDES permit coverage, conducting routine assessments and stormwater monitoring, 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. SNL/NM operations are covered under three NPDES permits.

Stormwater flowing over the ground surface has the potential to pick up and transport contaminants. Stormwater contaminants—such as oil, solvents, vehicle residues, chemicals, metals, sediments, building materials, hazardous materials, fertilizers, pesticides, herbicides, and sanitary waste—may derive from construction, industrial, and municipal activities. Stormwater Program personnel collaborate with other program and organization personnel to implement stormwater control measures and install best management practices to prevent or reduce contaminants from being discharged from permitted sites or activities. Potential stormwater contaminants are controlled by minimizing stormwater exposure to chemicals and materials, performing good housekeeping practices, installing and maintaining erosion and sediment controls, implementing long-term stabilization practices following construction, maintaining post-construction stormwater runoff management controls, controlling non-stormwater discharges, implementing solid waste management and recycling programs, and stabilizing construction sites. In addition, some facilities, such as the Hazardous Waste Handling Unit and the Radioactive and Mixed Waste Management Unit, have lined catchment basins that collect stormwater so potential contaminants can be evaluated prior to release.

6.4.1 Surface Waters and Stormwater Drainage

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 requirements listed in (20.6.4 NMAC, *Standards for Interstate and Intrastate Surface Waters*), in addition to Federal requirements specific to individual stormwater permits.

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 precipitation. As shown in Figure 6-1, Tijeras Arroyo enters KAFB from the northeast; flows immediately south of TA-I, TA-II, and TA-IV; exits at the west boundary of KAFB; and continues approximately six miles to its outfall at the Rio Grande. Tijeras Arroyo is a significant topographic feature across KAFB, where erosion of unconsolidated basin sediments has resulted in a flood plain of more than one-half mile in some areas.

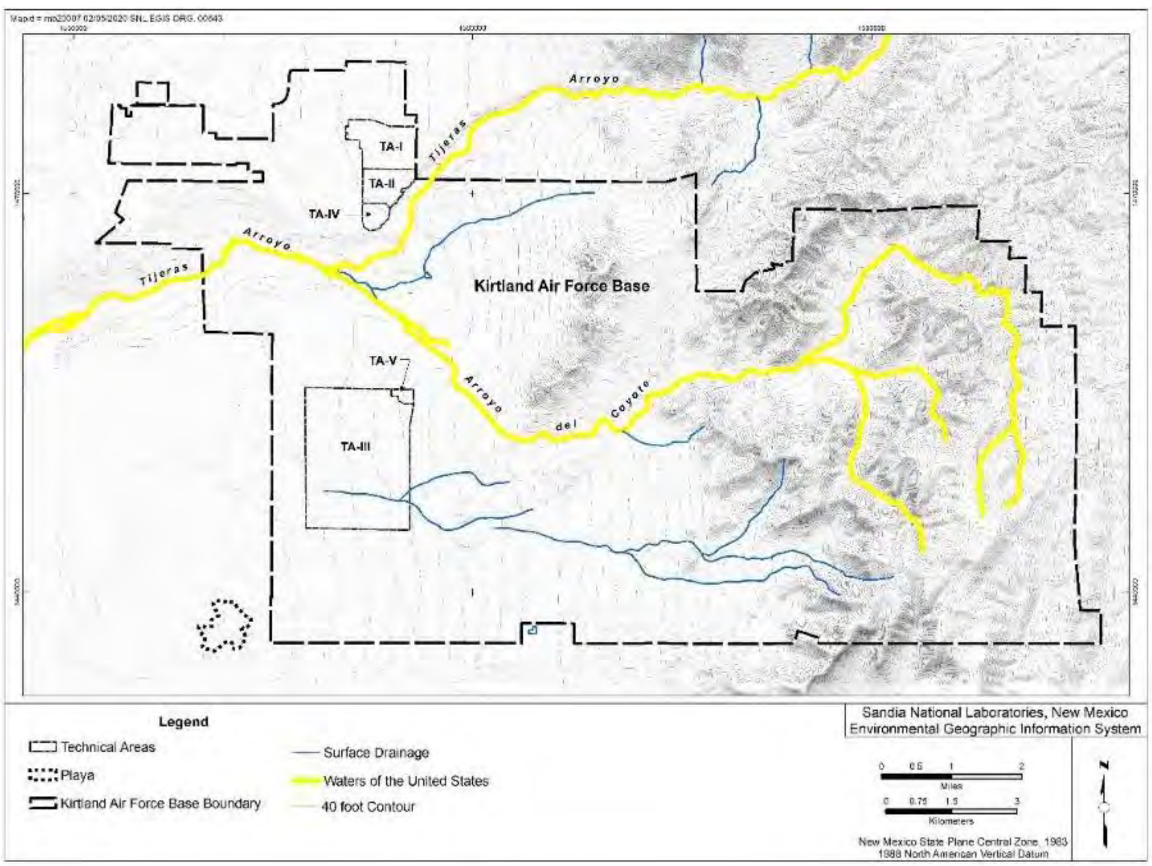


Figure 6-1. Location of SNL/NM technical areas and waters of the United States within KAFB

6.4.2 Multi-Sector General Permit

National Pollutant Discharge Elimination System Permitting

The MSGP regulates stormwater discharges associated with industrial activities that meet criteria for one or more specific industrial sectors as defined in the permit. The permit sectors are based on a limited set of Standard Industrial Classification codes. A total of 18 facilities (also referred to as sites) at SNL/NM operated under the MSGP in 2019 (Table 6-1).

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	05 (No analytical requirement)
Hazardous Waste Treatment, Storage, or Disposal Facilities	K1	Auxiliary Hot Cell Unit	52
		Gun Facility (SWMU 84)	46
		Hazardous Waste Handling Unit	40
		Long Sled Track (SWMU 83)	17
		Manzano Storage Bunkers	51
		Radioactive and Mixed Waste Management Unit	49
		Short Sled Track (SWMU 240)	47
		TA-V Sandlot	52
		Thermal Treatment Unit	48
		Thunder Range 6 Detonation Site	No sampling point (Emergency use only)
		Center for Integrated Nanotechnologies	50 (No analytical requirement)
Landfills	L1 and L2	Classified Waste Landfill	08
Local and Highway Passenger Transportation	P1	Fleet Services	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	41 (No analytical requirement)
		Solid Waste Collection and Recycling Center	42 (No analytical requirement)
		Sprung Tent 11 (Material Sustainability and Pollution Prevention)	57 (No analytical requirement)

MSGP = Multi-Sector General Permit
SWMU = Solid Waste Management Unit
TA = technical area

EPA renewed the MSGP on June 4, 2015. Sandia and DOE then jointly filed a Notice of Intent, as required for operators/owners of industrial activities under the 2015 MSGP. EPA approved the Notice of Intent on September 30, 2015.

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, such as implementing control measures, conducting site inspections, submitting annual reports, sampling stormwater runoff for comparison to benchmark values, and submitting discharge monitoring reports. The Stormwater Pollution Prevention Plan, Notice of Intent, 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_msgp/

Stormwater Quality Monitoring

MSGP sampling is conducted during the wet season—60 percent of the annual rainfall occurs between July 1 and October 31—as authorized by the permit for under-arid and semiarid conditions. The permit allows a monitoring quarter to be defined as one of each 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. Water quality monitoring is not conducted under the MSGP during other times of the year.

Table 6-2 presents the analytical parameters sampled under each applicable industry sector as required by the MSGP. Figure 6-2 illustrates the stormwater sampling points (SWSPs) located at the outfalls of MSGP sites (listed in Table 6-1). The permitted sampling points consist of SWSP-05, SWSP-08, SWSP-17, SWSP-40, SWSP-41, SWSP-42, SWSP-46, SWSP-47, SWSP-48, SWSP-49, SWSP-50, SWSP-51, SWSP-52, and SWSP-57. 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.

Table 6-2. 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.
EPA = U.S. Environmental Protection Agency
MSGP = Multi-Sector General Permit
N/A = not applicable
U.S. = United States

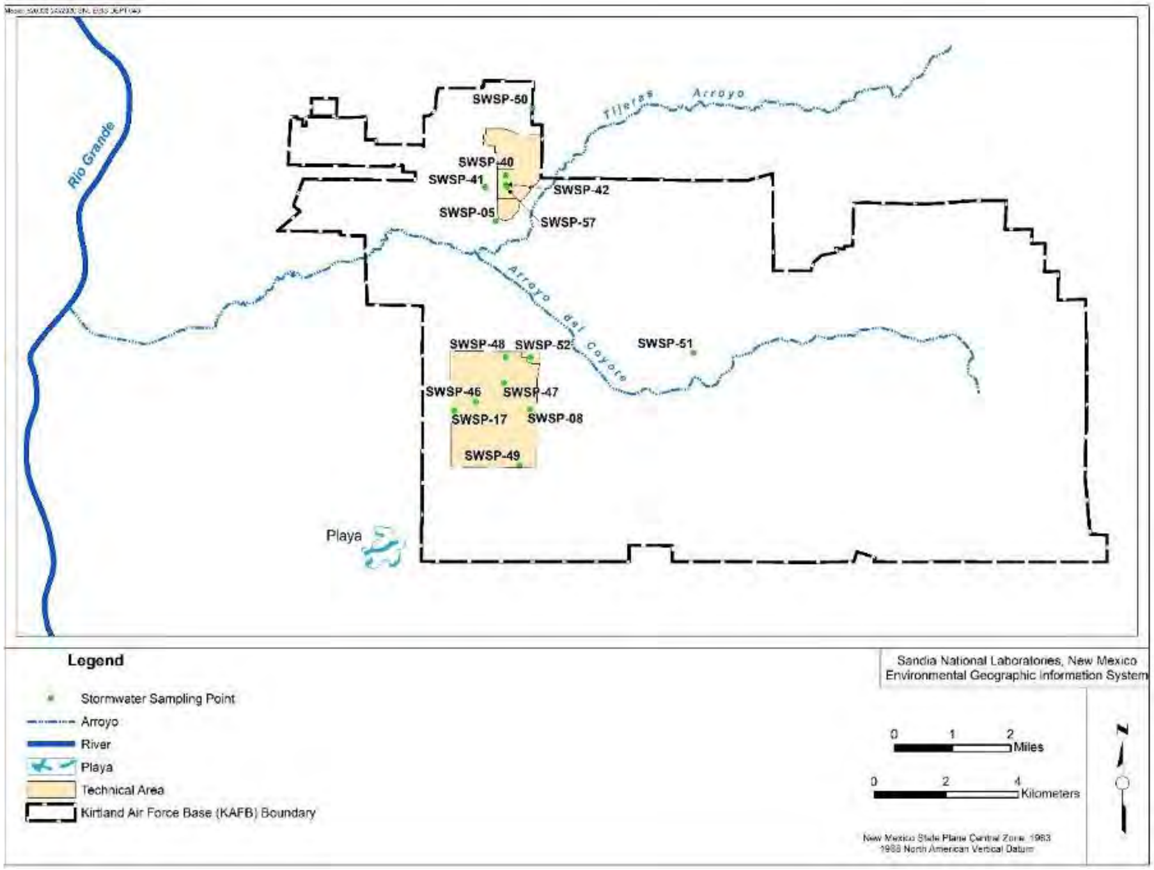


Figure 6-2. MSGP stormwater sampling point locations

6.4.3 Construction General Permit

National Pollutant Discharge Elimination System Permitting

The CGP is intended to regulate stormwater discharges associated with construction activities. Notices of Intent are submitted to the EPA for coverage under the CGP for every construction project anticipated to disturb one or more acres of land, following development of a site-specific Stormwater Pollution Prevention Plan. During 2019, Sandia held active permit coverage for 22 construction sites (see Chapter 10); DOE and its management and operating contractor for Sandia held joint CGP coverage for 4 of these sites. The management and operating contractor and other permittees maintain compliance with the permit by developing and updating a site-specific Stormwater Pollution Prevention Plan, 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.

Stormwater Quality Monitoring

No water quality monitoring is conducted under the CGP.

6.4.4 Middle Rio Grande Municipal Separate Storm Sewer System Permit

National Pollutant Discharge Elimination System Permitting

The MS4 Permit covers the entire centralized storm drainage system within TA-I, TA-II, and TA-IV. The permit establishes requirements to reduce non-point source municipal stormwater pollutants discharged to the Rio Grande. The MS4 Permit became effective upon publication in the Federal

Register on December 22, 2014. DOE and its management and operating contractor for Sandia submitted Notices of Intent and a Stormwater Management Program Plan in June 2015. The EPA approved the Notices of Intent for DOE and its management and operating contractor in November and December 2015, respectively.

Sandia maintains compliance with the MS4 Permit by developing and updating a Stormwater Management Program Plan, implementing control measures, conducting inspections, sampling stormwater, submitting discharge monitoring reports, and submitting annual reports. The MS4 Stormwater Management Program Plan, annual reports, 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

MS4 Permit sampling is conducted when a qualifying rain event occurs year-round. Monitoring is required during both the wet season and the dry season. The wet season occurs between July 1 and October 31, and the dry season occurs between November 1 and June 30. Monitoring is required to be conducted for a minimum of eight events during the permit term (December 22, 2014, through December 19, 2019); at least four monitoring events must be conducted during the wet season, and at least two events are required during the dry season.

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.

The MS4 comprises an area of approximately 1.16 square miles. Figure 6-3 illustrates the stormwater sampling points installed for compliance with the MS4 Permit, located at the inflow (SWSP-02) and at four outflows (SWSP-05, SWSP-24, SWSP-35, and SWSP-36) of the stormwater drainage system (the MS4). Drainage from approximately 90 percent of the MS4 area is conveyed to a concrete-lined channel that discharges directly to the Tijeras Arroyo south of the MS4 area. This outfall location is monitored at SWSP-05. The remaining stormwater discharges from the northwest quadrant of the MS4 to the KAFB MS4 through three separate storm drain locations, referred to as SWSP-24, SWSP-35, and SWSP-36. Stormwater leaving the MS4 at these three points is ultimately conveyed to the Rio Grande via the KAFB MS4 and the Albuquerque Metro Area Flood Control Authority North Diversion Channel.

Automatic samplers are programmed to collect four grab samples 15 minutes apart during the first hour of a discharge event. Field measurements of temperature, potential of hydrogen (pH), conductivity, and dissolved oxygen are made for each subsample, and the subsamples are composited for laboratory analyses. The monitoring constituents required by the MS4 Permit and their associated water quality standards are listed in Table 6-3.

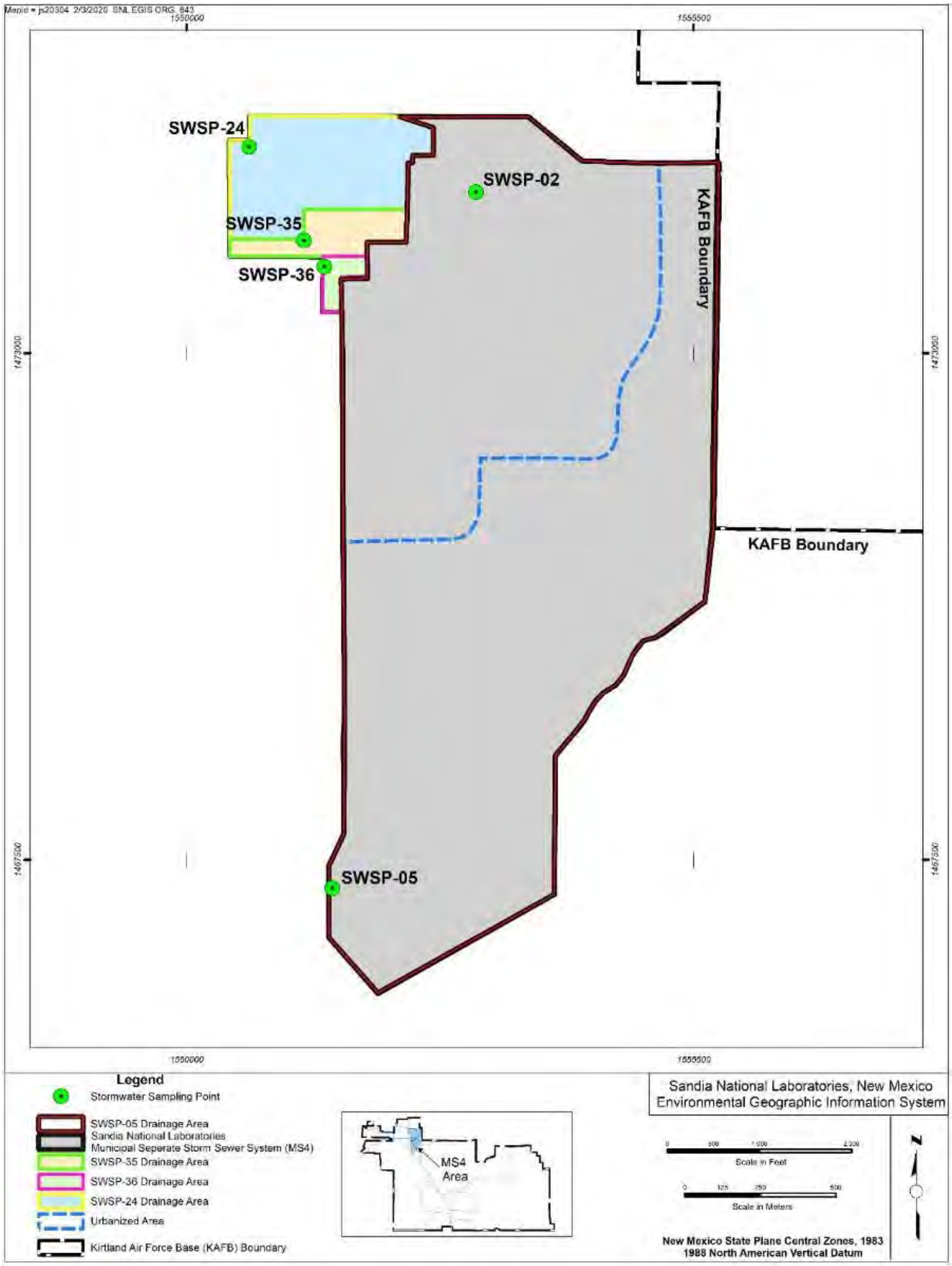


Figure 6-3. Municipal Separate Storm Sewer System drainage areas and monitoring locations

Table 6-3. Municipal Separate Storm Sewer System 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
E. coli = *Escherichia coli*
NMAC = New Mexico Administrative Code
pH = potential of hydrogen

6.4.5 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. Equipment blanks are collected whenever analytical data indicate that sample contamination may be occurring.

The analytical laboratory prepares and analyzes quality control samples to estimate (1) the level of contamination introduced by the analytical process and (2) the accuracy of the selected analytical method in accordance with laboratory procedures. Method blanks are analyzed at a minimum frequency of once every 20 samples to determine the presence of contamination or calibration drift originating in the analytical laboratory. Matrix spike analyses are performed at a minimum frequency of one sample per each data package. Replicate analyses are performed at a frequency of once per sample batch to document the precision, or repeatability, of laboratory measurements. See Chapter 8 for more information on quality assurance and quality control.

6.4.6 Stormwater Program Activities in 2019

Multi-Sector General Permit

If the average of four consecutive sample values for a parameter does not exceed the 2015 MSGP benchmark, then it is no longer required to monitor that parameter for the duration of the permit term. For the 2019 wet season—the fourth year in the five-year permit term—only 3 of the 18 permitted sites required benchmark monitoring: the Classified Waste Landfill (SWSP 08), the Gun Facility (SWSP 46), and the Short Sled Track (SWSP 47). There were no benchmark exceedances in

2019 at sites permitted under the MSGP at SNL/NM. Analytical results from the 2019 wet season resulted in the Short Sled Track meeting permit requirements, leaving only two sites that will still require monitoring in the 2020 wet season.

The number of sites that have met permit requirements indicates relatively clean stormwater discharges from industrial activities at SNL/NM. As a best management practice, Stormwater Program personnel visually assess stormwater samples at all permitted sites regardless of whether the site has met permit requirements. The analytical results for 2019, as submitted to EPA, are provided in Appendix D, "Stormwater Sampling Results in 2019."

"Dragon's teeth," stormwater energy dissipater located south of SWSP-05.

Municipal Separate Storm Sewer System Permit

A total of 14 wet weather samples were collected, 11 during the wet season (July 1, 2018, to October 31, 2018) and 3 during the dry season (November 1, 2018, through June 30, 2019). Due to sample volume limitations and permit requirements, not all constituents were analyzed in each of the 14 samples; see Appendix D. Discharges from the MS4 during the monitoring period were below New Mexico water quality standards in all samples and for all constituents except for PCBs, *Escherichia coli* (*E. coli*), and gross alpha.

Gross alpha and dissolved oxygen exceedances are rare and small; they are likely associated with higher-than-typical sediment loads. Efforts have been initiated to identify potential sources of constituents for which exceedances occur and to prepare a reduction strategy. Analytical results submitted to EPA for the July 1, 2018, to June 30, 2019 MS4 monitoring period are provided in Appendix D.

In 2019, total PCBs collected from the Sandia MS4 locations exceeded the New Mexico and Isleta Pueblo water quality standards in all 12 of the 12 samples analyzed for PCBs. PCBs were detected in stormwater at concentrations with a maximum value of 0.0432 µg/L; the Isleta Pueblo water quality standard is 0.00017 µg/L. For reference, snow samples collected at the Sandia Crest (approximately 10,493 feet above mean sea level) contained PCBs as high as 0.00065 µg/L, three times higher than the Isleta Pueblo water quality standard (LANL 2012). PCB concentrations in stormwater at Sandia are within the range found throughout the Albuquerque metropolitan area (Storms et al. 2015). During the 1990s, a campaign was implemented to remove all PCB sources from Sandia operations. There are currently no known PCBs used or stored at SNL/NM. Nonetheless, PCBs degrade slowly and bind strongly to soil particles. They are persistent in the atmosphere and are known to exist in airborne dust and precipitation. Since the 1990s, numerous soil stabilization and sediment control projects have been implemented and more are planned for additional locations with greater erodibility. This will continue to reduce sediment and associated PCB discharges to the stormwater drainage system. In June 2018, two atmospheric deposition samplers were installed within the MS4 (one adjacent to SWSP-02 and the other adjacent to SWSP-05) to aid in evaluating atmospheric deposition of PCBs. Additional stormwater sampling locations upgradient of SWSP-02 are being planned to identify specific areas where PCBs may be entering the storm drain system.

In 2019, *E. coli* results were above the Isleta Pueblo water quality standard in 13 of the 14 samples collected. The Isleta Pueblo water quality standard for *E. coli* is 47 colony-forming units [CFUs]/ 100 mL. The 12 *E. coli* samples collected during this monitoring period had a median of 813 CFU/ 100 mL. The *E. coli* concentrations encountered within the MS4 are typical of values found throughout the Albuquerque area. Data collected between 2003 and 2012 from nine storm drains and arroyos in Albuquerque determined median *E. coli* concentrations of 1,986 to be 8,000 CFU/100 mL (Storms et al. 2015). *E. coli* is found in the intestines of warm-blooded animals. EPA uses *E. coli* in stormwater as an indicator of animal waste and associated harmful bacteria. Anthropogenic sources of *E. coli* in stormwater include pet waste and improperly functioning septic system wastewater treatment facilities. None of these sources exist at SNL/NM; instead, natural sources such as birds, rodents, and raccoons, and to a lesser extent coyotes, rabbits, skunks, and deer are suspected to be contributing to *E. coli* in SNL/NM stormwater. During 2019, a microbial source tracking study was funded and initiated to identify the species from which *E. coli* are originating. Results of the microbial source tracking investigation will inform future efforts to reduce *E. coli* in stormwater.

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 discharges are releases of water and water-based compounds to roads, open areas, or impoundments.

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, dust control, and the cleaning of building exteriors.

In 2019, 23 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 lagoons 1 and 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 monitoring and reporting requirements associated with DP-530 are listed in Table 6-4.

Samples were collected from Lagoon 1 and Lagoon 2 on October 15, 2019. Sample fractions were collected for major cations and anions, 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 6.4.5. 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. Cations have a positive charge and anions have a negative charge.

Although there were no discharges to Lagoon 2 in 2019, 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.

Table 6-4. 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

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 service establishments, and other domestic-type activities. Industrial discharges are produced from general laboratory research operations, including electroplating, metal finishing, microelectronic development, and photographic processes.

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:

www.abcwua.org/Legislation___Ordinances.aspx

Sanitary sewer releases must also meet requirements in DOE O 435.1 Change 1, *Radioactive Waste Management*, and DOE O 458.1 Admin Change 3, *Radiation Protection of the Public and the Environment*.

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

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 voluntarily analyzed 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 6-1). If radionuclides are detected above regulatory limits and contamination is due to short-lived medical radioisotopes, 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 their 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 2019.

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 6-5).

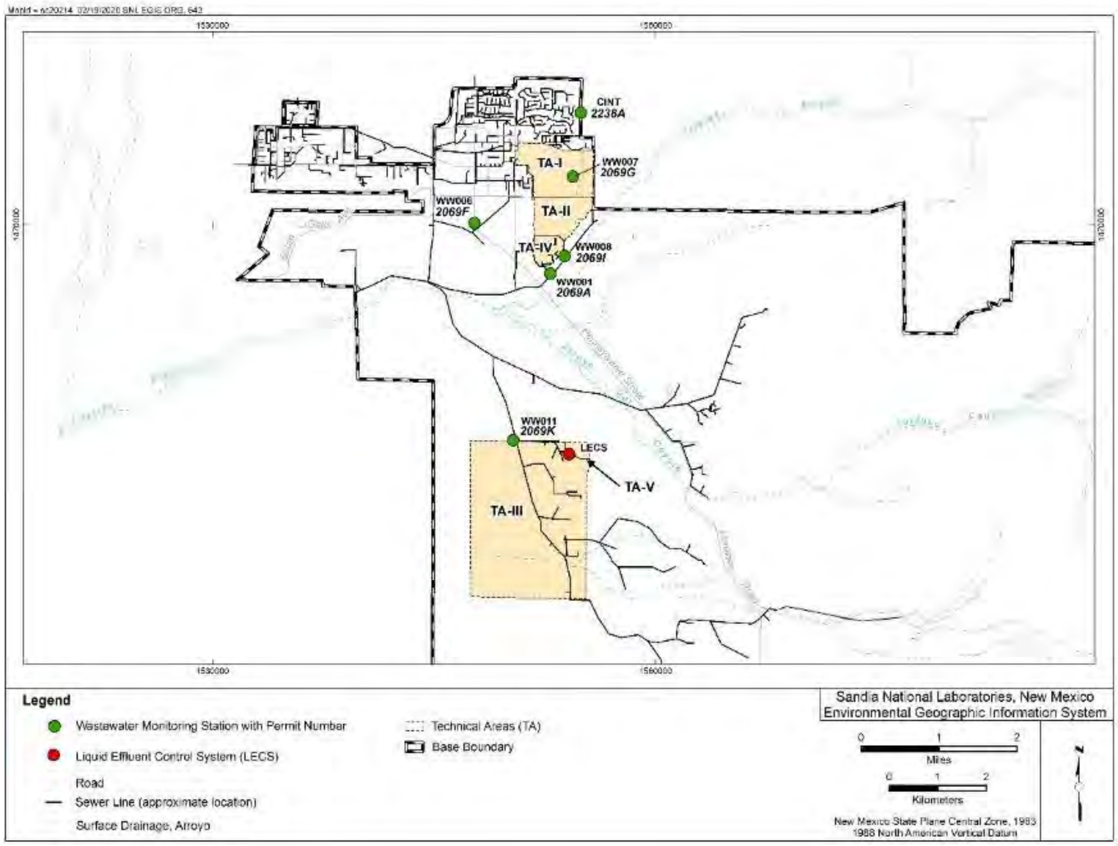


Figure 6-4. Wastewater monitoring station locations

Table 6-5. 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
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.
TA = technical area

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.

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 2019, 339 wastewater discharge requests were approved. Wastewater discharge approvals are not required for buildings that only produce domestic sewage from lavatories, 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 (Figure 6-4) at SNL/NM. Wastewater monitoring station characteristics are listed in Table 6-5. 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 at the Center for Integrated Nanotechnologies to pretreat its process wastewater, which discharges to categorical monitoring station Permit 2238A.

All general outfall monitoring stations are equipped with flow meters and pH sensors that continuously monitor the 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 discharge limits, 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 twice a year) 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 the ABCWUA sampling event, 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 2019 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—fluoride, ammonia, cyanide (for permits 2069F, 2069G, and 2238A only), phosphorus, chemical oxygen demand, 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 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 2019

During 2019, Sandia personnel collected wastewater split samples during the ABCWUA sampling events 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 6-5). All water discharged from the Liquid Effluent Control System in 2019 met requirements for radiological levels in wastewater. All analytical results from sampling conducted in 2019 met ABCWUA Sewer Use and Wastewater Control Ordinance discharge requirements. Analytical results are provided in Appendix E, “Sanitary Outfall Monitoring Results in 2019.”

In addition, the ABCWUA performed annual inspections of facilities that discharge within permitted flow basins 2069G, 2069I, and 2238A in February 2019 and flow basins 2069A, 2069F, and 2069K in March 2019. In September 2019, the ABCWUA performed a permit renewal inspection of flow basin 2069K. Updated permit conditions were added to Permit 2069K concerning notifications for batch discharge from the Liquid Effluent Control System. No issues or findings were identified during any of these inspections.

6.6.6 Sanitary Sewer System Releases in 2019

In 2019, one sanitary sewer system release was reported to the ABCWUA and DOE, which resulted in a Notice of Violation from the ABCWUA and met the criteria for a DOE reportable occurrence (see Chapter 2). Another event was reported to the ABCWUA and DOE; this one was a DOE reportable occurrence but was not considered a violation by the ABCWUA. These events are discussed in Section 6.1.2.

Chapter 7. Ecology Program

Black Swallowtail (*Papilio polyxenes*)

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).
- 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 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 Location Site Name	Vegetation Type or Habitat Description
Grasslands	
Optics Range east of Starfire[a]	Shrub, open woodland, and grassland
Plots 004, 078, DSG-012, Grass SDS-032, Grass SDS-037, and Meadow-115	Grassland
Robotics Vehicle Range[a]	Grassland with sparse dwarf shrub
SC Dome	Shrub, open woodland, and grassland
Solar Tower at the National Solar Tower Test Facility[a]	Dwarf shrub grassland
TA-III[a]	Large shrub grassland
Tijeras Arroyo[a]	Disturbed arroyo shrub-large shrub
West and southwest of TA-III[a]	Large shrub grassland
Woodlands	
Madera Canyon[a]	Closed canopy woodland
Madera Canyon Guzzler	Open woodland, shrub, and grassland
Plots 033, 062, and SPJ-077	Pinyon-juniper woodland
Range Wildlife Guzzler[a]	Open woodland, shrub, and grassland
Winch Site[a]	Open woodland, shrub, and grassland

[a] Denotes a bird survey location.
TA = technical area

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

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).

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 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, scrub, 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 are repeatedly subdivided to characterize the type of grassland. The two main vegetation types at SNL/NM are grasslands and woodlands (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 pinyon and juniper and described as closed pinyon-juniper woodland, or the main structural vegetation type may be scattered pinyon and juniper trees and described as a scattered pinyon-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.

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 for better support of 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 in order to achieve management goals and objectives, (2) improve understanding of the ecosystem, and (3) adjust monitoring efforts as necessary using a well-documented and consistent approach (BLM 2011).

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

7.1.2 Vegetation Monitoring

After a pilot AIM plot was established and completed at Plot 004 in 2017, three additional AIM plots were established and completed at Plot 033, Plot 062, and Plot 078 in 2018. In 2019, five more AIM plots were completed: Plot DSG-012, Plot SDS-032, Plot SDS-037, Plot SPJ-077, and Plot Meadow-115. Each AIM plot covers approximately 0.7 acres, consisting of three 25-meter transects arranged in a spoke design around the plot center. A vegetation transect is a path along which biologists count and record occurrences of plant species; a measuring tape is laid out on the ground surface to define the transect line. Data collected along each transect include the species of vegetation intercepted throughout the line (commonly referred to as line-point intercepts), vegetation height, gaps between canopies of vegetation, and gaps between vegetation bases (where vegetation emerges from the ground); in addition, soil is tested to determine its stability. A complete vegetation species inventory is also conducted throughout the entire plot area.

Five of the AIM plots were established in grasslands: Plot 004, Plot 078, Plot DSG-012, Plot SDS-032, and Plot SDS-037. The other four AIM plots were in pinyon-juniper woodlands: Plot 033, Plot 062, Plot SPJ-077, and Plot Meadow-115 (Table 7-1).

Plot 004

Plot 004, completed in 2017, is in the grassland vegetation type. The plot area is characterized by intermittently spaced clusters of shrub and grass alkali-tolerant vegetation (Figure 7-1). This plot is located in a broad, nearly flat alkali wash. This slightly sloped drainage area appears to carry some ephemeral evaporative flow that leaves a high salt residue in the soil.

Figure 7-1. Plot 004 in the grassland vegetation type with alkali soils

Sixteen species were observed at Plot 004, with an average foliar cover of 28 percent for the plot. The three species encountered the most were *Salsola tragus* at 12 percent foliar cover, *Muhlenbergia arenacea* at 8 percent foliar cover, and *Scleropogon brevifolius* at 7 percent foliar cover. *Salsola tragus* is adapted to a wide range of soil conditions including highly alkaline soils, while *Muhlenbergia arenacea* and *Scleropogon brevifolius* both require alkaline soils for establishment and growth. The remaining more common species observed at the plot—including *Elymus elymoides, Krascheninnikovia lanata*, and *Atriplex canescens*—are also all salt-tolerant halophytes. Data collected at this plot demonstrate a plant community that occurs as expected within the shrub, open woodland, and grassland vegetation type.

Plot 004 likely has variation in the amount of salinity contained in the soils across the site, with the preferential flow pathway soils containing a higher salt content due to greater evaporation in these areas. The average canopy gap was 63.3 percent at this site. This reflects the likely variation in site salinity, with the salt content of many soils too high for plant establishment. Ephemeral flows through these higher saline soil areas may also contribute to difficult conditions for plant establishment. Sixty percent of the line intercept was bare ground with no vegetative cover, and nearly 10 percent of the cover was not living. This high percentage of bare ground and dead plant material characterize the difficult habitability of the site.

Plot 078

Completed in 2018, Plot 078 is located on an alluvial fan slope in the grassland vegetation type. This grassland area is dominated by large shrubs with occasional junipers (Figure 7-2). The area is generally a westward-sloping alluvial outwash from the Manzanita Mountains with small east–west ephemeral drainages crossing the landscape.

Figure 7-2. Plot 078 on an alluvial fan slope in the grassland vegetation type

Diversity at this plot was quite good, with 26 species observed within the plot and an average foliar cover of 75 percent. *Bouteloua eriopoda* (common name black grama grass) was the dominant species at 64 percent foliar cover, followed by *Cylindropuntia imbricata* (common name cane cholla or tree cholla) at 7.3 percent. The grasses *Muhlenbergia arenacea*, *Scleropogon brevifolius*, *Sporobolus contractus,* and *Sporobolus cryptandrus* were all next recorded at 2 percent foliar cover.

Bouteloua eriopoda is an important native perennial prairie grass. At high density, as recorded in this plot, it is a good indicator of high-quality undisturbed habitat. It primarily reproduces by stolons due to its naturally low ratio of viable to sterile seeds.

Cylindropuntia imbricata is a tall cactus that ecologically functions as a shrub or even as a small tree. Cactus Wrens commonly nest in cane chollas, and the fruits provide forage for various wild birds and mammals, including larger mammals such as deer. The thorns also provide cover for many small animals.

Only 12 percent of Plot 078 was recorded as having canopy gaps, which leads to very good soil cover in this semiarid climate. Thick grass cover combined with a good density of cane cholla and scattered juniper demonstrate a plant community that occurs as expected within the large shrub grassland vegetation type.

Plot DSG-012

Completed in 2019, Plot DSG-012 is located on deep sandy soils in the grassland vegetation type. This grassland area is dominated by sand sagebrush and native bunchgrasses. (Figure 7-3).

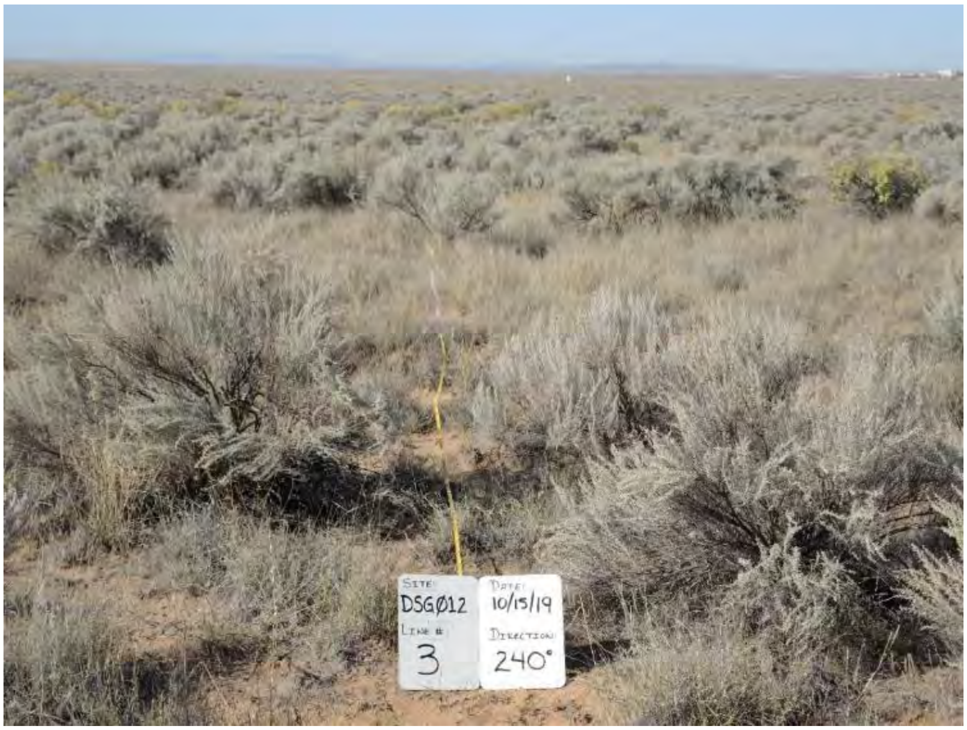


Figure 7-3. Plot DSG-012 on deep sandy soils in the grassland vegetation type

Diversity at this plot was good, with 22 species observed within the plot and good average foliar cover of 62 percent. *Bouteloua eriopoda* (common name black grama grass) was the dominant species at 37.3 percent foliar cover, followed by *Artemisia filifolia* (common name sand sage) at 12.7 percent. Next in abundance were the grasses *Pleuraphis jamesii* (James' galleta) at 7.3 percent foliar cover, *Sporobolus cryptandrus* (sand dropseed) at 6 percent foliar cover, and *Sporobolus flexuosus* (mesa dropseed) at 5.33 percent foliar cover. *Bouteloua eriopoda*, as previously discussed, is an important native perennial prairie grass.

Canopy gaps were recorded for 38.1 percent of Plot 078, and 60.30 percent of the plot was recorded as having basal gaps. Canopy gaps and basal gaps indicate how protected the soil is from the erosive effects of wind and water. Overall, this site has a fairly high percent of gaps, increasing the erosivity of the site.

Soil stability of the plot was low, with an average stability class of 1.8, on a scale of 1 to 6. Unstable soils lose their structural integrity quickly during precipitation events.

Plot Grass SDS-032

Plot Grass SDS-032 is located on an alluvial fan slope in the grassland vegetation type. This grassland area is dominated by native bunchgrasses with occasional dwarf shrubs (Figure 7-4). The area is generally a westward-sloping alluvial outwash from the Manzanita Mountains.

Figure 7-4. Plot Grass SDS-032 on an alluvial fan slope in the grassland vegetation type

Diversity at this plot was good, with 24 species observed within the plot and very good average foliar cover of 66 percent. *Hesperostipa neomexicana* (common names New Mexico needle grass and New Mexico thread grass) was the dominant species at 28 percent foliar cover, followed by *Bouteloua eriopoda* (black grama grass) at 16.7 percent. Other abundant grasses were *Sporobolus contractus* (spike dropseed) at 12 percent foliar cover and *Sporobolus species* (unknown dropseed) at 5.3 percent foliar cover. *Salsola tragus* (Russian thistle), the invasive weed commonly known as tumbleweed after it has died, detaches from its root and disperses seeds as it rolls across the landscape, was present at 6 percent foliar cover. The sub-shrub *Gutierrezia sarothrae* (broom snakeweed) had a foliar cover of 0.7 percent across the plot.

Canopy gaps were recorded for 10.6 percent of Plot Grass SDS-032, and 20.3 percent of the plot was recorded as having basal gaps. This site has a low percentage of gaps, providing extremely good soil protection from the erosive effects of wind and water.

Soil stability of the plot was high, with an average stability class of 4.1, and 38 percent of the soil samples had the highest measurable level of soil stability of all the AIM plots, scoring 6 on a 1 to 6 scale. Stabler soils, as demonstrated at this plot, are better able to retain their structural integrity during precipitation events.

Plot Grass SDS-037

Completed in 2019, Plot Grass SDS-037 is located in the grassland vegetation type. This grassland plot is dominated by native bunchgrasses with scattered cane chollas, which function ecologically as shrubs. (Figure 7-5). The area is generally a westward-sloping alluvial outwash from the Manzanita Mountains.

Figure 7-5. Plot Grass SDS-037 on an alluvial fan slope in the grassland vegetation type

Diversity at this plot was lower than at most of the other AIM plots, with 18 species observed within the plot and good average foliar cover of 63.3 percent. *Sporobolus flexuosus* (common name mesa dropseed) was the dominant species at 43.3 percent foliar cover, followed by *Bouteloua eriopoda* (black grama grass) at 8.7 percent. Next in abundance were two forbs with similar foliar cover: *Plantago patagonica* (woolly plantain) at 7.3 percent and *Descurainia species* (unidentifiable tansymustard) at 6.7 percent.

Canopy gaps were recorded for 6 percent of Plot Grass SDS-032, and 13.6 percent of the plot was recorded as having basal gaps. This is a very low percentage of gaps; this plot has extremely good soil protection from the erosive effects of wind and water.

Although the soil is very well protected by the vegetative cover, the plot's soil stability was only moderate, with an average stability class of 2.9 on a scale of 1 to 6. The plot soils are only moderately able to retain their structural integrity during precipitation events.

Plot 033

Completed in 2018, Plot 033 is located within the transition from a canyon bottom to the toe of a woodland slope in the pinyon-juniper woodland vegetation type (Figure 7-6). A portion of the plot is in an ephemeral mountain stream channel. The canyon bottom portion of this plot has a gradual slope, but most of the plot is located on a steep slope having a 47 percent incline within the woodland part of the plot.

Pinus edulis was the dominant plant species on the plot, with 30.7 percent foliar cover. *Juniperus monosperma*, with 13.3 percent foliar cover, is commonly the codominant tree species in this forested area. Total tree foliar cover at the plot was 44 percent. Overall tree density was around 45 trees per hectare (115 trees per acre) and 1,076 saplings per hectare (2,657 saplings per acre).

Understory species include the grass *Achnatherum robustum* at 10.7 percent foliar cover along with the shrubs *Atriplex canescens* at 9.3 percent of foliar cover and *Cercocarpus montanus* at 4 percent foliar cover. Twenty-nine species were observed on the plot, with 19 species recorded on the line transects. Total foliar cover for the plot was 67 percent, and canopy gaps for the plot averaged 27.6 percent overall.

The soil surface was equally dominated by duff and soil, each accounting for an average of 40.67 percent of the plot soil surface. Rock comprised 16.67 percent of the soil surface.

Figure 7-6. Plot 033 in the pinyon-juniper woodland vegetation type

The center of Plot 033 is located at the upper edge of an ephemeral mountain stream channel. If the plot center had been located more centrally in the vegetation type, the entirety of the plot might have been located within the vegetation type. One of the three transect spokes was partially located in the expected plant community of the ephemeral stream corridor vegetation type. The majority of the transect data was collected beyond the border of the target vegetation type, which is not unexpected when spatially balanced random sampling is used for the plot center. This plot sampled the intended vegetation type to a lesser extent as well as the adjacent closed canopy vegetation type, as evidenced by the high tree density.

Plot 062

Completed in 2018, Plot 062 (Figure 7-7) is located on a very steep slope with a 64 percent incline, occurring in the pinyon-juniper woodland vegetation type. This plot is characterized by the steepness of the entire site on rocky soil with a high-quality native vegetation grass understory and a scattered pinon-juniper overstory.

Figure 7-7. Plot 062 on a very steep slope with a 64 percent incline in the pinyon-juniper woodland vegetation type

The two most abundant species at this site were the grasses *Bouteloua gracilias* (32 percent foliar cover) and *Muhlenbergia pauciflora* (12 percent foliar cover). Trees were the next most abundant site species, with *Juniperous monosperma* (9.3 percent foliar cover) and *Pinus edulis* (8 percent foliar cover) accounting for a total of 17.3 percent foliar cover. Across the site, tree density was approximately 104 trees per hectare and 134 saplings per hectare.

This plot had good species diversity with 38 species documented, including shrubs, cacti, and many forb species in addition to grasses and trees. Only 10 of the 38 species were documented on the line transects within the plot.

Average total foliar cover for the plot was 59 percent, and canopy gaps averaged 44 percent.

Rock was a very high percent of the soil surface at 62 percent. The rocky site surface creates structural integrity in the soil matrix and increases stability on this steep site. Rock also yields an expected high rate of canopy gaps because this hardscape creates a significant amount of space with no growth across the area. Soil accounted for 24 percent of the soil surface, and duff was 12.67 percent.

Plot SPJ-077

Completed in 2019, Plot SPJ-077 is located at 6,300 feet in elevation in the pinyon-juniper woodland vegetation type. Plot center is located in a foothill streambed. The three plot spokes extend from the streambed into the surrounding scattered pinyon-juniper woodland vegetation type (Figure 7-8). There are two main slopes on this plot: (1) the slope of the stream that runs mostly north–south across the plot and (2) an alluvial deposition slope from the hill that rises up to the west and descends down into the larger canyon bottom to the east. The overall slope for the plot is 7.5 percent, with a southeast aspect.

This plot had incredible diversity; 57 species occurred within the plot with an unusually high number of forb species present. The diverse geomorphology of the plot allows for many different soil types and a variety of niches within the plot. The plot was also surveyed at an optimal growth time of year, after the summer heat had passed and approximately one month after the monsoons began.

Figure 7-8. The center of Plot SPJ-077 is located in a foothill streambed and three plot spokes extend from the streambed into the surrounding pinyon-juniper woodland vegetation type

Juniperus monosperma (one-seed juniper) was the dominant plant species on the plot, with 10 percent foliar cover. *Quercus turbinella* (scrub oak) is the codominant shrub/tree species for the plot, with 8 percent foliar cover. *Quercus turbinella* is an evergreen, much-branched, thicket-forming shrub or small tree with a spreading crown in favorable habitats. On this plot, *Quercus turbinella* was present in both shrub and tree growth forms. *Bouteloua gracilis* (blue grama grass) was the next most abundant species with an average cover of 7.3 percent across the plot.

Average tree foliar coverage across the plot was 10 percent. This number is functionally low due to *Quercus turbinella* categorized in the data as a shrub, whereas its function varied ecologically throughout the plot as a shrub and as a tree. Foliar cover of shrubs and sub-shrubs was 23.3 percent across the plot. The average foliar coverage of grasses was 24.7 percent, and the average foliar coverage of forbs was 6 percent.

Canopy gaps were recorded for 6.6 percent of Plot SPJ-077, and 16.8 percent of the plot was recorded as having basal gaps. This is a very low percentage of gaps; this plot has extremely good vegetation soil protection from the erosive effects of wind and water.

The soil is very well protected by the vegetative cover, and the plot's soil stability was determined to be slightly above moderate, with an average stability class of 3.4, on a scale of 1 to 6. The plot soils moderately retain their structural integrity during precipitation events.

Plot Meadow-115

Completed in 2019, Plot Meadow-115 is located at 6,877 feet in elevation and is mostly located within the grassland vegetation type (Figure 7-9). Most of the plot is a meadow, a grassland that occurs in a pinyon-juniper woodland opening. The eastern spoke of the plot extends from the meadow into the adjacent open pinyon-juniper woodland vegetation type. There is a reasonably sharp dividing line between the two vegetation types because the meadow formed after a fire burned through the area in the 1980s. The overall slope for the plot is 31 percent, with a southeast aspect.

This plot had very good diversity, with 48 species occurring within the plot. Having two vegetation types allows for different soil types and a variety of niches within the plot. The plot was surveyed at an optimal growth time of year, after the summer heat had passed and approximately one month after the monsoons began. Loose limestone is common on the soil surface.

Figure 7-9. Plot Meadow-115 has a southeast aspect and a 31 percent slope and is mostly located in the grassland vegetation type

Bouteloua curtipuendula (side-oats grama) was the dominant plant species on the plot, with 22.7 percent foliar cover. *Hesperostipa neomexicana* (commonly known as New Mexico needle grass or New Mexico thread grass) had the next highest foliar coverage at 8.7 percent. *Juniperus monosperma* (one-seed juniper) had the third-highest foliar cover at 6.7 percent and was the only tree species on the plot.

Average tree foliar coverage across the plot was 10 percent. This number is functionally low due to *Quercus turbinella* categorized in the data as a shrub, whereas its function varied ecologically throughout the plot as a shrub and as a tree. Foliar cover of shrubs and sub-shrubs was 23.3 percent across the plot. The average foliar coverage of grasses was 24.7 percent, and the average foliar coverage of forbs was 6 percent.

Overall, grasses had 38.7 percent foliar cover, trees 6.7 had percent foliar cover, forbs had 6 percent foliar cover, and shrubs and sub-shrubs had 5.3 percent foliar cover.

Canopy gaps were recorded for 24.3 percent of Plot-Meadow 115, and 44.8 percent of the plot was recorded as having basal gaps. This is a high percentage of gaps; this plot does not have good vegetation soil protection from the erosive effects of wind and water. However, the total rock cover for the plot is 35.3 percent. This hardscape provides protection for the soil below it. This high rock coverage is likely a persistent feature from the wildlife and subsequent monsoon rains that removed organic materials from the plot in the 1980s.

Although the soil is not very well protected by the vegetative cover, the plot's soil stability was determined to be above moderate, with an average stability class of 3.7, on a scale of 1 to 6. The plot soils moderately retain their structural integrity during precipitation events.

7.1.3 Discussion

The data collected at each of the AIM sites to date is important in providing baseline information about the plots. Assessments among plots is not possible due to the variations among the plots. Each plot will be revisited on a rotating basis to monitor for changes across time; data interpretation will become meaningful after each plot is resampled multiple times. Future analyses will provide insight into ongoing environmental conditions as indicators change or remain consistent.

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

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 larger-sized mammal and bird populations. Lizards prey on insects, thus moderating ant, grasshopper, termite, beetle, and spider populations. Snakes regulate small mammal populations, which help 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.

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 along drift fence arrays were implemented to detect both reptiles and amphibians. A funnel trap consists of wire mesh boxes placed on either side of a 100-foot drift fence (Figure 7-10). The boxes have one-way entrances, whereby animals can easily enter the trap but not exit. This detection technique has proven successful in multiple habitats at SNL/NM and continues to be used.

Four drift fence trapping arrays were set up in 2019 at two sites: the Robotics Vehicle Range and the West TA-III site. The traps are checked twice daily during the field season, and all animals are released.

Figure 7-10. Temporarily closed funnel traps along a drift fence in a desert grassland habitat

7.2.2 Herpetofauna Survey Results

During the 2019 field season, 111 individuals from 13 different species were captured using funnel trapping: six snake and seven lizard species (Figure 7-11). The Common Lesser Earless Lizard (*Holbrookia maculata*) was captured nine times in 2019, once at the west of Technical Area III (WTA3) trapping location and eight times at the Robotics Vehicle Range (RVR) location. This species of lizard had only been detected once in the last seven years. The Desert Massasauga (*Sistrurus tergeminus edwardsii*) is an Endangered Species Act candidate that continues to be encountered in low numbers at the WTA3 location. No amphibians were captured in 2019.

Figure 7-11. Common Lesser Earless Lizard (*Holbrookia maculata*) (left) and Desert Massasauga (*Sistrurus tergeminus edwardsii)* (right)

Site captures by trapping period are shown in Table 7-2. The total number of captures, percent total captures per site, and percent total captures for each trapping period are presented.

Table 7-2. Herpetofauna site captures and releases by trapping period, 2019

Common Name	Scientific Name	2019 Site Captures by Trapping Period						Total
		5/28–6/7		7/17–7/25		8/12–8/22		
		RVR	WTA3	RVR	WTA3	RVR	WTA3	
Lizard								
Chihuahuan Spotted Whiptail	*Aspidoscelis exsanguis*	0	0	0	0	0	0	0
Little Striped Whiptail	*Aspidoscelis inornata*	0	8	0	0	0	0	8
New Mexico Whiptail	*Aspidoscelis neomexicana*	14	8	14	5	2	0	43
Eastern Collared Lizard	*Crotaphytus collaris*	0	0	0	0	0	0	0
Common Lesser Earless Lizard	*Holbrookia maculata*	3	0	4	0	1	1	9
Horned Lizard spp.	*Phrynosoma spp.*	0	0	0	0	0	0	0
Greater Short-horned Lizard	*Phrynosoma hernandesi*	0	0	0	1	0	0	1
Round-tailed Horned Lizard	*Phrynosoma modestum*	0	0	0	0	0	0	0
Great Plains Skink	*Plestiodon obsoletus*	1	0	2	0	0	1	4
Southwestern Fence Lizard	*Sceloporus cowlesi*	4	0	0	0	6	0	10
Spiny Lizard spp.	*Sceloporus spp.*	0	0	1	0	0	0	1
Common Side-blotched Lizard	*Uta stansburiana*	0	0	0	0	2	7	9
Snake								
Painted Desert Glossy Snake	*Arizona elegans philipi*	0	1	0	0	0	0	1
Western Diamond-backed Rattlesnake	*Crotalus atrox*	0	0	0	0	0	0	0
Prairie Rattlesnake	*Crotalus viridis*	0	0	0	0	9	0	9
Ring-necked Snake	*Diadophis punctatus*	0	0	0	0	0	0	0
Chihuahuan Hook-nosed Snake	*Gyalopion canum*	0	0	0	0	0	0	0
Plains Hog-nosed Snake	*Heterodon nasicus*	0	0	0	0	0	0	0
Texas Nightsnake	*Hypsiglena jani texana*	0	0	0	0	0	0	0
Western Coachwhip	*Masticophus flagellum testaceus*	7	0	1	0	0	1	9
Desert Striped Whipsnake	*Masticophis taeniatus taeniatus*	0	0	0	0	0	0	0
Sonoran Gopher Snake	*Pituophis catenifer affinis*	3	0	0	0	0	0	3
Long-nosed Snake	*Rhinocheilus lecontei*	0	1	0	0	0	0	1
Mountain Patch-nosed Snake	*Salvadora grahamiae grahamiae*	0	0	0	0	0	0	0

Table continued on next page

Table 7-2. Herpetofauna site captures and releases by trapping period, 2019 (continued)

Common Name	Scientific Name	2019 Site Captures by Trapping Period						Total
		5/28–6/7		7/17–7/25		8/12–8/22		
		RVR	WTA3	RVR	WTA3	RVR	WTA3	
Snake (continued)								
Desert Massasauga	*Sistrurus tergeminus edwardsii*	0	2	0	1	0	0	3
Amphibian								
Couch's Spadefoot	*Scaphiopus couchii*	0	0	0	0	0	0	0
Mexican Spadefoot	*Spea multiplicata*	0	0	0	0	0	0	0
Total		**32**	**20**	**22**	**7**	**20**	**10**	**111**
Percent Total Captures per Site		**43.2**	**54.1**	**29.7**	**18.9**	**27.0**	**27.0**	
Percent Total Captures		**46.85**		**26.13**		**27.03**		

RVR= Robotics Vehicle Range spp. = unknown species WTA3 = west of Technical Area III

7.3 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 the frame.

Overall, the main goal of the remote-sensor camera monitoring efforts 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 images by the cameras, 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.

7.3.1 Madera Canyon Camera Station Results

In 2019, 44 different species were observed at the Madera Canyon Camera Station (Table 7-3): 8 different mammal species, 32 different bird species, 1 reptile species, and 3 different invertebrate species. No amphibians were observed at the Madera Canyon Camera Station during 2019.

Table 7-3. Wildlife species observed at the Madera Canyon Camera Station, 2019

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mammals													
Coyote	*Canis latrans*		✓	✓	✓	✓	✓	✓	✓				✓
Bobcat	*Lynx rufus*												✓
Striped Skunk	*Mephitis mephitis*			✓									
Mule Deer	*Odocoileus hemionus*	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Javelina	*Pecari tajacu*					✓							
Mountain Lion	*Puma concolor*		✓	✓	✓		✓	✓	✓	✓			
Gray Fox	*Urocyon cinereoargenteus*	✓	✓	✓	✓	✓	✓	✓	✓				
American Black Bear	*Ursus americanus*				✓	✓		✓	✓	✓		✓	
Birds													
Cooper's Hawk	*Accipiter cooperii*					✓	✓						
Black-throated Sparrow	*Amphispiza bilineata*				✓								
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*				✓	✓				✓			
Cedar Waxwing	*Bombycilla cedrorum*				✓								
Great Horned Owl	*Bubo virginianus*								✓		✓		
Red-tailed Hawk	*Buteo jamaicensis*			✓									
Turkey Vulture	*Cathartes aura*				✓	✓	✓	✓					
Northern Flicker	*Colaptes auratus*									✓		✓	✓
Common Raven	*Corvus corax*			✓	✓	✓	✓	✓		✓		✓	
Pinyon Jay	*Gymnorhinus cyanocephalus*				✓	✓	✓	✓					
Cassin's Finch	*Haemorhous cassinii*									✓			
House Finch	*Haemorhous mexicanus*			✓	✓	✓	✓	✓		✓			✓
Dark-eyed Junco	*Junco hyemalis*		✓	✓								✓	✓
Canyon Towhee	*Melozone fusca*			✓		✓	✓						✓
Northern Mockingbird	*Mimus polyglottos*					✓	✓	✓					
Brown-headed Cowbird	*Molothrus ater*						✓						
Townsend's Solitaire	*Myadestes townsendi*			✓	✓					✓			✓
Black-headed Grosbeak	*Pheucticus melanocephalus*					✓	✓	✓					
Spotted Towhee	*Pipilo maculatus*									✓			✓
Say's Phoebe	*Sayornis saya*									✓			✓
Mountain Bluebird	*Sialia currucoides*											✓	✓
Western Bluebird	*Sialia mexicana*			✓								✓	✓
Pine Siskin	*Spinus pinus*									✓			
Lesser Goldfinch	*Spinus psaltria*					✓				✓			
Black-chinned Sparrow	*Spizella atrogularis*				✓	✓	✓						
Brewer's Sparrow	*Spizella breweri*									✓			
Chipping Sparrow	*Spizella passerina*			✓						✓			
American Robin	*Turdus migratorius*							✓		✓		✓	✓
Western Kingbird	*Tyrannus verticalis*						✓						
White-winged Dove	*Zenaida asiatica*			✓	✓	✓	✓	✓	✓	✓			
Mourning Dove	*Zenaida macroura*				✓	✓	✓	✓	✓	✓			✓
White-crowned Sparrow	*Zonotrichia leucophrys*									✓			

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Table 7-3. Wildlife species observed at the Madera Canyon Camera Station, 2019 (continued)

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Reptiles													
Desert Striped Whipsnake	*Coluber taeniatus*									✓			
Amphibians													
None													
Invertebrates													
Arizona Sister	*Adelpha eulalia*									✓			
Cabbage White	*Pieris rapae*									✓			
Unknown Dragonfly										✓			

Since June 2005, 66 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: 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 13 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 Thrasher (*Toxostoma rufum*), Brown-headed Cowbird (*Molothrus ater*), Curve-billed Thrasher (*Toxostoma curvirostre*), Eurasian-collared Dove (*Stretopelia decaocto*), Hepatic Tanager (*Piranga flava*), Lark Sparrow (*Chondestes grammacus*), Steller's Jay (*Cyanocitta stelleri*), Turkey Vulture (*Cathartes aura*), Wild Turkey (*Meleagris gallopavo*), White-tailed Deer (*Odocoileus virginianus*), Javelina (*Pecari tajacu*), and Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*).

On May 18, 2019, a single Javelina was documented at the Madera Canyon Camera Station (Figure 7-12). This is the first time a Javelina has been documented at SNL/NM. The greatest numbers of Javelina in New Mexico are located in the southwestern part of the state, near the bootheel region. In New Mexico, Javelina are predominantly known to occur in Hidalgo, Luna, Doña Ana, Grant, Sierra, Catron, and Socorro counties. There is a possibility that this represents a potential range expansion for this species into Bernalillo County, or at least the first time it has been formally documented. This species can occupy a variety of habitats, including desert, chaparral, oak woodlands, fringes of pine forests, and riparian areas.

Figure 7-12. A Javelina (*Pecari tajacu*) momentarily visits the Madera Canyon Guzzler

American Black Bears have been documented at the Madera Canyon Guzzler each year since monitoring began in 2005. In 2019, bears appeared to be most active during the months of April through September. However, several observations extended into the month of November. At least two different bears visited the guzzler that could be identified from the images. One bear has an ear tag on the right ear. The other does not have a tag and appears to be much larger (possibly a boar, i.e., a male). Figure 7-13 shows the ear-tagged bear bathing in the guzzler. No cubs were recorded visiting the guzzler in 2019.

Figure 7-13. An ear-tagged American Black Bear (*Ursus americanus*) bathing in the Madera Canyon Guzzler

Mountain lions (*Puma concolor*), also known as cougars or pumas, visited the Madera Canyon Guzzler in 2019. Observations of this species indicate that they were most active during the months of February through September. A majority of images appeared to be of the same three individuals (Figure 7-14). One of the individuals, an adult female, has a green ear tag on her right ear. The other two individuals appear to be her cubs. Aside from these three individuals, at least one other mountain lion visited the Madera Canyon Guzzler.

Figure 7-14. A female Mountain Lion (*Puma concolor*) visiting the Madera Canyon Guzzler with her two cubs

Mule Deer (*Odocoileus hemionus*) were documented at the Madera Canyon Guzzler during every month of 2019, except for the month of May. Overall, Mule Deer were detected and observed more than any other species. Observations of this species indicate that they were most active at the guzzler during December, followed by July, and then November. The majority of images appeared to be of rutting bucks (Figure 7-15). There were also several observations of does with fawns.

Figure 7-15. A Mule Deer (*Odocoileus hemionus*) buck, doe, and fawn visiting the Madera Canyon Guzzler

7.3.2 Range Camera Station Results

In 2019, 24 different species were observed at the Range Camera Station (Table 7-4), including 6 different mammal species, 17 different bird species, and 1 amphibian species. No reptiles or invertebrates were observed at the Range Guzzler during 2019.

Table 7-4. Wildlife species observed at the Range Camera Station 2019

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mammals													
Coyote	*Canis latrans*	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
Black-tailed Jackrabbit	*Lepus californicus*	✓				✓							
Bobcat	*Lynx rufus*						✓						✓
Mule Deer	*Odocoileus hemionus*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mountain Lion	*Puma concolor*	✓			✓								
Gray Fox	*Urocyon cinereoargenteus*		✓					✓	✓				
Birds													
Cooper's Hawk	*Accipiter cooperii*			✓								✓	✓
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*										✓		
Golden Eagle	*Aquila chrysaetos*											✓	
Great Horned Owl	*Bubo virginianus*											✓	
Red-tailed Hawk	*Buteo jamaicensis*								✓				
Northern Flicker	*Colaptes auratus*										✓	✓	
Common Raven	*Corvus corax*				✓								
Greater Roadrunner	*Geococcyx californianus*	✓							✓				
Pinyon Jay	*Gymnorhinus cyanocephalus*				✓								
Cassin's Finch	*Haemorhous cassinii*										✓		
House Finch	*Haemorhous mexicanus*					✓							
Townsend's Solitaire	*Myadestes townsendi*				✓								

Table continued on next page

Table 7-4. Wildlife species observed at the Range Camera Station 2019 (continued)

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Birds (continued)													
Mountain Bluebird	*Sialia currucoides*											✓	
Western Bluebird	*Sialia mexicana*										✓	✓	✓
American Robin	*Turdus migratorius*										✓	✓	
White-winged Dove	*Zenaida asiatica*								✓				
Mourning Dove	*Zenaida macroura*					✓	✓	✓	✓				
Reptiles													
None													
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.

Two species have been observed in images at the Range Guzzler in every year of monitoring, Gray Fox (*Urocyon cineroargenteus*) and Mule Deer (*Odocoileus hemionus*). At most, 20 species have been documented in a single calendar year. In addition, 18 species have been documented at the Range Guzzler that have not been documented at the Madera Canyon Guzzler. These include American Badger (*Taxidea taxus*), Ringtail (*Bassariscus astutus)*, Western Spotted Skunk (*Spilogale gracilis)*, Texas Antelope Squirrel (*Ammospermophilus interpres),* and Scaled Quail (*Callipepla squamata*).

Mule Deer (*Odocoileus hemionus*) were documented at the Range Guzzler every month during 2019 (Figure 7-16). 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 July, followed by November, and then December. Overall, there was a higher number of observations of does (295) than bucks (195) throughout the year.

Figure 7-16. A Mule Deer (*Odocoileus hemionus*) buck visiting the Range Guzzler during a light snow

Coyotes (*Canis latrans*) were documented at the Range Guzzler 10 months out of the year in 2019 (Figure 7-17). There were 185 separate observations of Coyotes, the majority of which took place from May through August, with the largest number of observations recorded in June. At this time, it is unclear as to how many unique individuals visited the Range Guzzler during this period of time.

Figure 7-17. A pair of Coyotes (*Canis latrans*) visiting the Range Guzzler

There were only two observations of a Bobcat at the Range Guzzler in 2019, once in the month of June and once in the month of December (Figure 7-18). Both visits were short, lasting approximately 20 seconds in the month of June and approximately 4 seconds during the visit in December. As is normal behavior for this crepuscular species, both visits took place in the early hours of the morning.

Figure 7-18. An early morning visit from a Bobcat (*Lynx rufus*) at the Range Guzzler

7.4 Bat Surveillance

There are 16 species of bats at SNL/NM, with an additional 3 species that are likely to occur. Of these 19 species, only one (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 and white-nose syndrome, a fungal disease. In a study of population projection models, Frick et al. (Frick et al. 2017) 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. 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 we monitor SNL/NM bat populations so potential threats to their survival can be mitigated.

7.4.1 Passive Bat Monitoring

Passive bioacoustics monitoring of bats began in November 2019 using ultrasonic recorders. The recorders were placed at Coyote Springs and at the large pond at the KAFB Golf Course, both with the KAFB Natural Resources program manager's permission.

The ultrasonic recorders were used to monitor bats passively. Since bat activity is centralized over water where bats come to drink and to eat insects, the best placement for the detectors was at ponds at Coyote Springs and the Golf Course. One recorder was placed at each location and cable-locked to a tree (Coyote Springs) or to a metal tripod (Golf Course) approximately 65 feet from the pond. The recorders were set to record each night from 30 minutes before sunset until 30 minutes after sunrise. The Coyote Springs recorder was deployed on November 8, 2019, and the Golf Course recorder was deployed on November 19, 2019. The recorder's digital cards were then retrieved at irregular intervals.

Once the digital cards were retrieved, 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 to *Lasionycteris noctivagans* calls from 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.

7.4.2 Bat Monitoring Results

Eight species were detected using the ultrasonic recorders (Table 7-5): Pale Townsend's Big-eared Bat (*Corynorhinus townsendii pallescens*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Hoary Bat (*Lasiurus cinereus*), Western Small-footed Bat (*Myotis ciliolabrum*), Canyon Bat (*Parastrellus hesperus*), Tricolored Bat (*Perimyotis subflavus*), and Mexican Free-tailed Bat (*Tadarida brasiliensis*).

Table 7-5. Bat monitoring species detections, 2019

Location	Common Name	Scientific Name	Number of Detections[a]
November			
Coyote Springs	Silver-haired Bat	*Lasionycteris noctivagans*	361
	Hoary Bat	*Lasiurus cinereus*	18
	Tricolored Bat	*Perimyotis subflavus*	17
	Mexican Free-tailed Bat	*Tadarida brasiliensis*	7
Golf Course	Silver-haired Bat	*Lasionycteris noctivagans*	80
	Hoary Bat	*Lasiurus cinereus*	10
	Big Brown Bat	*Eptesicus fuscus*	2
	Mexican free-tailed Bat	*Tadarida brasiliensis*	6

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Table 7-5. Bat monitoring species detections, 2019 (continued)

Location	Common Name	Scientific Name	Number of Detections[a]
December			
Coyote Springs	Silver-haired Bat	*Lasionycteris noctivagans*	166
	Hoary Bat	*Lasiurus cinereus*	4
	Tricolored Bat	*Perimyotis subflavus*	1
	Mexican Free-tailed Bat	*Tadarida brasiliensis*	0
	Western Small-footed Bat	*Myotis ciliolabrum*	1
	Big Brown Bat	*Eptesicus fuscus*	1
	Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	1
Golf Course	Silver-haired Bat	*Lasionycteris noctivagans*	43
	Hoary Bat	*Lasiurus cinereus*	1
	Big Brown Bat	*Eptesicus fuscus*	0
	Mexican Free-tailed Bat	*Tadarida brasiliensis*	0
	Canyon Bat	*Parastrellus hesperus*	1

[a] The number of detections does not indicate the number of bats, as a single bat can produce multiple acoustic detections.

7.5 Avian Surveillance

Long-term monitoring of breeding and wintering birds can reveal population trends and dynamics. Data collected aids land use decisions and provides documentation regarding bird population trends regionally and continentally. The two main monitoring methods used at Sandia 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.

7.5.1 Bird Surveys Using Transects

In 2019, bird surveys were conducted during the breeding season, June, and in the winter months of January through March to measure diversity and abundance of birds, and to monitor trends and changes over time associated with particular species and various habitats.

Each survey transect consists of 12 points, and each point is surveyed for five-minute periods. Each transect was surveyed three times during winter and once during the breeding season. Surveys were conducted at Madera Canyon, the Optics Range, the Robotics Vehicle Range, the Solar Tower, TA-III, Tijeras Arroyo, west of TA-III, and the Winch Site.

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.

Winter Bird Transect Survey Results

Forty-seven bird species were encountered during the 2019 winter bird survey season. Table 7-6 presents the species, scientific name, and number of total individuals detected by each transect.

Table 7-6. Winter bird survey species detections, 2019

Common Name	Scientific Name	Number of Detections
Sandhill Crane	*Antigone canadensis*	8
Northern Harrier	*Circus hudsonius*	3
Cooper's Hawk	*Accipiter cooperii*	2
Red-tailed Hawk	*Buteo jamaicensis*	2
Ladder-backed Woodpecker	*Dryobates scalaris*	1
Hairy Woodpecker	*Dryobates villosus*	2
Northern Flicker	*Colaptes auratus*	2
American Kestrel	*Falco sparverius*	9
Say's Phoebe	*Sayornis saya*	2
Loggerhead Shrike	*Lanius ludovicianus*	4
Pinyon Jay	*Gymnorhinus cyanocephalus*	5
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*	8
Clark's Nutcracker	*Nucifraga columbiana*	3
Common Raven	*Corvus corax*	16
Raven sp.	*Corvus sp.*	3
Horned Lark	*Eremophila alpestris*	814
Mountain Chickadee	*Poecile gambeli*	6
Juniper Titmouse	*Baeolophus ridgwayi*	28
Bushtit	*Psaltriparus minimus*	42
White-breasted Nuthatch	*Sitta carolinensis*	3
Brown Creeper	*Certhia americana*	1
Rock Wren	*Salpinctes obsoletus*	1
Canyon Wren	*Catherpes mexicanus*	3
Bewick's Wren	*Thryomanes bewickii*	1
Cactus Wren	*Campylorhynchus brunneicapillus*	2
Western Bluebird	*Sialia mexicana*	12
Mountain Bluebird	*Sialia currucoides*	6
Townsend's Solitaire	*Myadestes townsendi*	16
American Robin	*Turdus migratorius*	3
Crissal Thrasher	*Toxostoma crissale*	2
Sage Thrasher	*Oreoscoptes montanus*	1
House Finch	*Haemorhous mexicanus*	97
Pine Siskin	*Spinus pinus*	2
Lesser Goldfinch	*Spinus psaltria*	1
Chestnut-collared Longspur	*Calcarius ornatus*	43
Spotted Towhee	*Pipilo maculatus*	4
Canyon Towhee	*Melozone fusca*	4
Black-throated Sparrow	*Amphispiza bilineata*	1
Sagebrush Sparrow	*Artemisiospiza nevadensis*	1
Song Sparrow	*Melospiza melodia*	14
Lincoln's Sparrow	*Melospiza lincolnii*	3
White-crowned Sparrow	*Zonotrichia leucophrys*	133
Dark-eyed Junco	*Junco hyemalis*	231
Eastern Meadowlark	*Sturnella magna*	12
Western Meadowlark	*Sturnella neglecta*	14

Note: Species are listed by taxonomic classification.
sp. = unknown species

Breeding Bird Transect Survey Results

In 2019, 57 bird species were seen or heard while conducting the breeding bird surveys. Table 7-7 presents the species, scientific name, and number of total individuals detected by each transect during breeding bird surveys.

Table 7-7. Breeding bird survey species detections, 2019

Common Name	Scientific Name	Total
Scaled Quail	*Callipepla squamata*	1
Eurasian Collared-Dove	*Streptopelia decaocto*	2
White-winged Dove	*Zenaida asiatica*	5
Mourning Dove	*Zenaida macroura*	75
Black-chinned Hummingbird	*Archilochus alexandri*	6
Broad-tailed Hummingbird	*Selasphorus platycercus*	1
Swainson’s Hawk	*Buteo swainsoni*	2
Burrowing Owl	*Athene cunicularia*	3
Ladder-backed Woodpecker	*Dryobates scalaris*	1
American Kestrel	*Falco sparverius*	4
Peregrine Falcon	*Falco peregrinus*	2
Ash-throated Flycatcher	*Myiarchus cinerascens*	12
Cassin’s Kingbird	*Tyrannus vociferans*	2
Western Kingbird	*Tyrannus verticalis*	7
Western Wood-Pewee	*Contopus sordidulus*	5
Gray Flycatcher	*Empidonax wrightii*	8
Say’s Phoebe	*Sayornis saya*	19
Loggerhead Shrike	*Lanius ludovicianus*	3
Gray Vireo	*Vireo vicinior*	12
Plumbeous Vireo	*Vireo plumbeus*	6
Pinyon Jay	*Gymnorhinus cyanocephalus*	9
Woodhouse’s Scrub-Jay	*Aphelocoma woodhouseii*	4
Common Raven	*Corvus corax*	5
Horned Lark	*Eremophila alpestris*	52
Cliff Swallow	*Petrochelidon pyrrhonota*	18
Barn Swallow	*Hirundo rustica*	6
Mountain Chickadee	*Poecile gambeli*	2
Juniper Titmouse	*Baeolophus ridgwayi*	9
Bushtit	*Psaltriparus minimus*	18
Rock Wren	*Salpinctes obsoletus*	1
Canyon Wren	*Catherpes mexicanus*	1
Bewick’s Wren	*Thryomanes bewickii*	8
Blue-gray Gnatcatcher	*Polioptila caerulea*	4
Curve-billed Thrasher	*Toxostoma curvirostre*	1
Northern Mockingbird	*Mimus polyglottos*	50
House Finch	*Haemorhous mexicanus*	32
Lesser Goldfinch	*Spinus psaltria*	1
Spotted Towhee	*Pipilo maculatus*	11
Rufous-crowned Sparrow	*Aimophila ruficeps*	2

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Table 7-7. Breeding bird survey species detections, 2019 (continued)

Common Name	Scientific Name	Total
Canyon Towhee	*Melozone fusca*	4
Cassin's Sparrow	*Peucaea cassinii*	63
Chipping Sparrow	*Spizella passerina*	1
Black-chinned Sparrow	*Spizella atrogularis*	11
Lark Sparrow	*Chondestes grammacus*	2
Black-throated Sparrow	*Amphispiza bilineata*	19
Dark-eyed Junco	*Junco hyemalis*	5
Eastern Meadowlark	*Sturnella magna*	23
Western Meadowlark	*Sturnella neglecta*	14
Scott's Oriole	*Icterus parisorum*	5
Brown-headed Cowbird	*Molothrus ater*	1
Black-throated Gray Warbler	*Setophaga nigrescens*	4
Hepatic Tanager	*Piranga flava*	2
Summer Tanager	*Piranga rubra*	1
Western Tanager	*Piranga ludoviciana*	2
Black-headed Grosbeak	*Pheucticus melanocephalus*	9
Blue Grosbeak	*Passerina caerulea*	4

Note: Species are listed by taxonomic classification.

7.5.2 Bird Banding Monitoring

In 2003, Ecology Program personnel implemented two projects that use bird banding to monitor bird diversity and abundance: fall migration and the Monitoring Avian Productivity and Survivorship protocol (MAPS). 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 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: Monitoring 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 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, sex ratios, and productivity for more than 200 species of breeding birds.

At SNL/NM, MAPS was not run due to personnel changes and reissuing of the U.S. Geological Survey banding permit in 2019. However, this monitoring effort will start up again in 2020.

Fall Migration Banding: Monitoring Results

Fall migration monitoring has been conducted annually since 2003. 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 a shrub, open woodland, and grassland habitat.

During the 2019 fall migration monitoring, 155 birds were captured, representing 39 species. The average number of birds banded per net hour was 0.35 (440 total net hours), or 35 birds per 100 net hours. The average number of birds banded over the 16-year period from 2003 to 2019 was 0.27 birds per net hour, or 27 birds per 100 net hours. A Canyon Towhee (Figure 7-19) was captured during the 2019 fall banding season.

Figure 7-19. Canyon Towhee (*Melozone fusca*) banded during the 2019 fall banding season

Fall migration monitoring continues to show a downward trend for total birds per 100 net hours from 2003 through 2019 (Figure 7-20), even though the past several seasons' capture rates were above average.

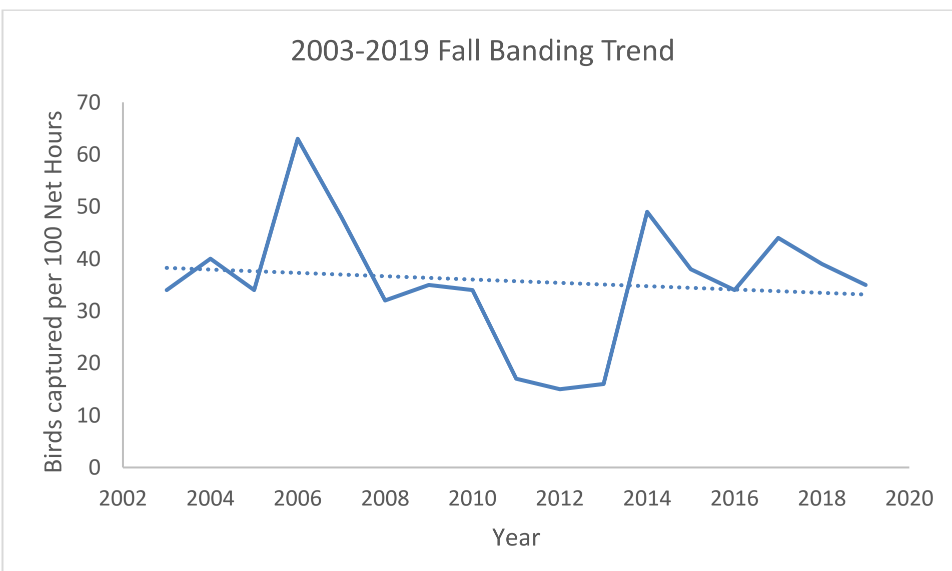

Figure 7-20. Linear trend of all birds captured during fall migration monitoring, 2003–2019

7.6 Eco Ticket System for Monitoring Wildlife

In 2013, Ecology Program personnel launched an Eco Ticket system. Personnel use this web-based program to report issues or concerns with wildlife, which may include snakes, bird nests, injured or 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. Project personnel who require biological surveys before starting outdoor work activities also use the system.

Eco Ticket is the best way to track encounters with wildlife in the workplace and work toward negotiating appropriate management of wildlife within high report areas, which coincides with the Ecology Program mission. Use of this system has increased steadily. Infrastructure Operations personnel use the system most frequently, supporting work orders that require biological surveys. Sorting and analyzing the ticket types adds to understanding the dynamics of wildlife issues at SNL/NM.

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

7.6.1 Eco Ticket Responses

Each Eco Ticket is archived into a database that can be analyzed to gain insight into the locations where animals occur most frequently and ways to manage properly for the safety of the animals and the workforce.

Work Orders and Projects

Before any outdoor work is initiated, Ecology Program personnel survey the work site. The primary reason for these surveys is to locate birds and their nests that are protected under the Migratory Bird Treaty Act.

Wildlife Response

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 of 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.

7.6.2 Eco Ticket System Results

In 2019, Ecology Program personnel responded to 270 Eco Tickets.

There were 44 reported skunk sightings in 2019; in one case, the animal had to be relocated as it was already in a trap set by personnel without knowledge or approval from the Ecology Program personnel. This is up from 6 reported skunk sightings in 2018 and 32 sightings in 2017. The majority (59 percent) of these sightings occurred in the fall (August through October), as this is when young are dispersing from their mothers (Neiswenter, Dowler, and Young 2010).

There were 45 snake removal tickets in 2019, which was down 27 percent from 2018. This is potentially due to the lack of monsoon rains that often correspond with increased activity in herpetofauna species (George, Thompson, and Faaborg 2015; Davis and DeNardo 2010). Of the 45 tickets, 16 were for venomous snakes.

Thirty tickets were placed for non-managed (e.g., pest) species in 2019, such as wasps, ants, and mice.

7.7 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 9 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 were generally unsuccessful. The Ecology Program has since shifted the approach, 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.

7.7.1 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. 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 2019, Ecology Program personnel supported the following ecological restoration projects:

- **TA-IV Escarpment.** The restoration plan specification for the TA-IV Escarpment was developed and then revised several times as the project parameters changed in 2018 on this two-parcel, 9-acre project. Just prior to construction beginning in 2019, the project parameters changed again due to safety concerns. The specification was updated to respond appropriately to the safety concerns and focus on success while not compromising project integrity. However, not all specifications were implemented. Most notably, the agreed-upon wattles for slope interruption were removed without notice from the plan specification. The slopes on this project are quite long and fairly steep. Also of note in this project is that just prior to ripping the slopes, the specification directive to rip the slopes horizontally was overridden. Horizontal ripping is designed to aid in slope interruption, aid in plant establishment, and reduce slope erosion. The slopes were incorrectly ripped vertically. Vertical slope ripping is in the direction of stormwater flow, which allows for increased stormwater velocity down the slopes, increasing rill formation and sediment transport. After ripping, work was halted for two weeks. During this two-week pause, monsoon rains occurred, which resulted in both slope erosion due to the vertical ripping and a significant loss of uncompacted soil that is needed for plant root growth. The North American Monsoon season is July 1 to September 30. This climatic feature is important locally because it typically provides approximately half of the annual precipitation in the project area, and because the seeded warm season native plant species have adapted their life cycle growth and development to coincide with the monsoonal rains. Very little monsoon season moisture occurred after project completion. The final project slopes are at significant risk for forming rills and increased erosion due to the lack of implemented slope interruption. Although this ecological restoration project was not entirely installed per the specification, many portions of the specification were implemented correctly such as amendments, seeding, tackifier, and mulch. Successful ecological restoration without supplemental watering in upland areas of central New Mexico requires a carefully designed strategy due to highly unreliable precipitation. Establishing native vegetation evenly across bare slopes at a density intended to provide permanent soil and slope stabilization is much more difficult than across relatively flat areas. This increased difficulty is due to intense monsoon rain events that can cause erosion and/or wash away plant seeding materials during the plant establishment phase. This project summary includes installation issues to document the project history and to provide advance awareness that the plant establishment and associated soil stabilization may not develop as the specification intended. Ecological restoration is largely a lessons learned process; accurate documentation is important to understanding successes and failures and move the science forward on a positive trajectory.

- **TA-V Waterline and TA-III Roadway.** In 2018, the TA-V Waterline and TA-III Roadway site was evaluated, and a restoration plan was written and provided to the Infrastructure Operations project manager for this 6.3-acre project area. This project was initially planned to be graveled for final soil stabilization after project completion. Ecological restoration of the project area was determined to be significantly less expensive than gravel. In 2019, the restoration plan specification was implemented; however, it is unknown which or if any aspects of the restoration specification were followed by the subcontractor. The project area is currently covered almost entirely in the annual weed Russian thistle, which turns into a tumbleweed after the plant dies in the winter. The project is currently not on a trajectory toward meeting the criteria for successful revegetation required for Stormwater Pollution Prevention Plan permit termination. A review of this project is planned for 2020; investigating the current project status and initiating correction of the project issues through the warranty. Successful resolution will involve addressing the weed issue and reseeding the project area with native plant species.
- **9940H.** The 9940H site was evaluated in 2019, and a restoration plan was developed and sent to the Infrastructure Operations project manager.
- **TA-II Battery Test Facility.** The original restoration plan specification for the TA-II Battery Test Facility was written in 2017 and then updated in 2018 as the construction project evolved. Construction activities were completed at the end of 2018. In 2019, all seeding activities were completed at this site in accordance with the restoration plan specification. Native vegetation was observed growing across the site in the late summer and fall of 2019.
- **Old Centrifuge Site and Escarpment Stabilization.** The Old Centrifuge Site and Escarpment Stabilization project area was evaluated in 2019, and two restoration specifications were provided to the Infrastructure Operations project manager. The site has extremely steep final slopes; the project plan was designed by a professional engineer with the intent of continuing to have extremely steep slopes in place after construction activities and slope earthwork concluded. This is a very challenging vegetation soil stabilization project due to the unnaturally steep soil slopes without any underlying structural integrity created by rock or other material. The restoration plan specification had to meet a set of criteria that was agreed on by Infrastructure Operations,

Ecology, and Stormwater personnel and the professional engineer. These criteria created a limited number of options for slope stabilization methods. Infrastructure Operations personnel rejected the original restoration plan specification for this project due to post-project removal of slope interruption materials. A second restoration plan specification was written using coir wattles for slope interruption. Both restoration plan specifications included separate work plans to address slope and flat project area issues appropriately.

Additional activities included monitoring restoration projects that were completed in previous years during the 2019 growing season to evaluate their ecological recovery trajectories.

7.8 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 7-8).

A few mammal species protected by the State of New Mexico have been encountered within KAFB boundaries (Table 7-8). 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 7-8. 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				
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	
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	Species of concern	Sensitive	✓
Red Fox	*Vulpes vulpes*	—	Sensitive	
Ringtail	*Bassariscus astutus*	—	Sensitive	✓
Arizona Myotis	*Myotis occultus*	—	Sensitive	✓
Spotted Bat	*Euderma maculatum*	—	Threatened	
Western Small-footed Myotis	*Myotis ciliolabrum*	—	Sensitive	
Western Spotted Skunk	*Spilogale gracilis*	—	Sensitive	
Yuma Myotis	*Myotis yumanensis*	—	Sensitive	

Table continued on next page

Table 7-8. Federally listed and state-listed endangered, threatened, and other species of concern potentially occurring in Bernalillo County, New Mexico (continued)

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed at KAFB
Common Name	**Scientific Name**			
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	—	✓
Common Black Hawk	*Buteogallus anthracinus*	Species of concern	Sensitive	
Gray Vireo	*Vireo vicinior*	—	Threatened	✓
Least Tern	*Sternula antillarum*	Endangered	Threatened	
Mexican Spotted Owl	*Strix occidentalis lucida*	Threatened and critical habitat	Threatened	
Mountain Plover	*Charadrius montanus*	—	Sensitive	
Loggerhead Shrike	*Lanius ludovicianus*	—	Sensitive	✓
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	Threatened	✓
Sprague's Pipit	*Anthus spragueii*	Candidate	—	✓
Western Yellow-billed Cuckoo	*Coccyzus americanus*	Threatened	Sensitive	
Reptiles				
Desert Massasauga	*Sistrurus catenatus dewardsii*	Under review	—	✓
Southwestern Fence Lizard	*Sceloporus cowlesi*	—	Sensitive	✓
Fish				
Rio Grande Chub	*Gila pandora*	—	Sensitive	
Rio Grande Silvery Minnow	*Hybognathus amarus*	Endangered and critical habitat	Threatened	
Invertebrates				
Socorro Mountainsnail	*Oreohelix neomexicana*	—	Sensitive	

Source: Biota Information System of New Mexico. Accessed February 2020. http://www.bison-m.org.
— = no designation
KAFB = Kirtland Air Force Base

Chapter 8. Quality Assurance

Greater Roadrunner (*Geococcyx californianus*)

OVERVIEW ■ Sandia quality assurance teams monitor environmental impacts of work. 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 take responsibility and assume accountability for implementing quality assurance for operations—as specified in ISO 9001, *Quality Management Systems—Requirements* (ISO 9001:2008); DOE O 414.1D, *Quality Assurance*, Attachment 1, "Contractor Requirements Document" (DOE O 414.1D Admin Change 1); and 10 CFR 830, *Nuclear Safety Management* (10 CFR 830), Subpart A, "Quality Assurance"—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.

8.1 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 applicable quality assurance elements. These documents meet appropriate 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.

8.1.1 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.

8.1.2 Contract Laboratory Selection

All off-site contract laboratories 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 2019e). 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 2018). 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).

8.1.3 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. 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.

8.1.4 Data Validation and Records Management

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

The data are validated at a minimum of three levels:

- 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, all groundwater monitoring data, site-wide confirmatory data, radioactive mixed waste characterization data, and a specified percentage of other program data are validated to detailed method-specified requirements.

8.2 Sample Management Office Activities

Sample Management Office activities in 2019 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 2019, Sample Management Office personnel processed 4,127 samples in support of programs and projects at SNL/NM.

8.2.1 Sample Handling and Analyses

In 2019, Sample Management Office personnel processed 4,127 samples in support of programs and projects at SNL/NM. Of the 4,127 samples, 1,025 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 2019:

- Air Quality Compliance
- Decontamination and Demolition
- Environmental Restoration Operation
- Long-Term Stewardship
- Terrestrial Surveillance
- Waste Management
- Water Quality

During 2019, 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
- EMSL Analytical, Inc., in Cinnaminson, New Jersey
- Eurofins TestAmerica in multiple locations
- General Engineering Laboratories in Charleston, South Carolina
- Hall Environmental Analysis Laboratory in Albuquerque, New Mexico
- Landauer, Inc., in Glenwood, Illinois
- Pace Analytical Energy Services, LLC, in Pittsburgh, Pennsylvania
- Radonova Laboratories in Westmont, Illinois
- SiREM in Guelph, Ontario, Canada
- Southwest Research Institute in San Antonio, Texas
- New Mexico Department of Health in Albuquerque, New Mexico
- Trace Analytics LLC in Austin, Texas

8.2.2 Laboratory Quality Assurance Assessments and Validation

In 2019, Sample Management Office personnel continued independent assessments and validation of National Environmental Laboratory Accreditation Conference-approved laboratories used by Sandia 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.

8.2.3 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. In 2018, DOECAP revised the manner in which audits of commercial environmental laboratories are conducted. 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 2019, 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 2019 in DOECAP assessment reports or other applicable DOE programs.

Chapter 9. Cultural Resources

Building 871, housing the Electromagnetic Environments Simulator (built in 1971, an eligible building not in the historic district)

OVERVIEW ■ Cultural Resource 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 to cultural resources are assessed and appropriate actions are taken to mitigate those impacts.

The Cultural Resource Program is primarily focused on long-term preservation and protection of cultural resources and cultural resource compliance to ensure that the heritage of the area and of the landscape is maintained. Long-term preservation and protection also ensure that data is available to make proper land use decisions and to assist with environmental planning. The Cultural Resource 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 2019, 40 archaeological surveys—covering 6,000 acres of land—have been conducted on KAFB, including Sandia-controlled property. Currently, 2,150 historical sites (sites having cultural heritage value) on KAFB have been recommended as eligible under the National Register of Historic Places; approximately 70 percent of those sites are on Sandia-controlled property.

9.1 History and Location

The prehistoric and historic time periods in the Albuquerque area consist of four major cultural and temporal periods: Paleoindian, Archaic, Ancestral Puebloan, and Historic (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. Paleoenvironmental data suggest that the Paleoindian period was marked by fluctuating climatic changes that decreased effective moisture. The Ancestral Pueblo 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. The expedition found 12 large pueblos clustered along the Rio Grande between present-day Bernalillo and Isleta, and several smaller villages to the south. The pueblos, occupied by southern Tiwa groups, were referred to collectively as the Tiguex Province.

In 1598, Juan de Oñate, leading a group of 400 soldiers, friars, and colonists into the Rio Grande Valley, founded the first European settlement—San Gabriel—in New Mexico. 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. San Miguel del Laredo had an enclosed square plaza that served as a defense layout. Eight families from Albuquerque settled at San Miguel in 1817, followed by 39 more families the next year. Some of these families settled along San Antonio Creek, which is a tributary of Tijeras Creek.

Obsidian projectile point (arrowhead)

By the nineteenth century, the area 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. By the twentieth century, three major mining districts were situated in the Manzanita and north Manzano mountains, east of KAFB. The Tijeras Mining District extended southward into the northern portion of 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 when the U.S. Navy began testing a proximity fuze in several of the existing mining shafts (Lintz et al. 1988). This occupation and usage of the U.S. National Forest withdrawn lands continued into the 1940s. Shortly after, the testing area was incorporated into KAFB, which restricted public usage.

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, it was seeing frequent use by military flights for refueling. In January 1941, the U.S. Army acquired Oxnard Field and the land around it and eventually renamed it Albuquerque Army Air Field, using it as a training depot for aircraft mechanics. By 1943, the training program had 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 testing ground for military technology. The New Mexico Proving Ground was established just prior to the start of World War II as a test site for developing the proximity fuze, the research and technical design of which was occurring at Johns Hopkins University. E. J. Workman, a physicist at the University of New Mexico, took on the assignment and contracts for testing the fuze. He arranged for acquisition of land beginning with privately owned land and portions of Cibola National Forest land withdrawn for the purpose. Over several years, the land for the New Mexico Proving Ground was increased with a series of leases and purchases, beginning with privately owned land and portions of Cibola National Forest land withdrawn for the purpose. When the New Mexico Proving Ground closed, the Federal Government kept the land, which is part of the current KAFB.

In July 1945, Los Alamos Scientific Laboratory, located in Los Alamos, New Mexico, under the jurisdiction of the U.S. Army Corps of Engineers, underwent a reorganization, which gathered ordnance engineering activities into Z Division. This group was expected to grow; however, there was no room for this expansion in Los Alamos. A site selection effort resulted in the choice of Albuquerque Army Air Field near Albuquerque, New Mexico, which was not too far from Los Alamos and near an airfield to support testing. On July 14, 1945, the U.S. Army Corps of Engineers requested transfer of jurisdiction for Albuquerque Army Air Field from Air Technical Service Command to the U.S. Engineers, Manhattan District. The Air Base and all leased facilities were transferred on July 21, 1945. The site was then referred to as Sandia Base (Furman 1990).

The Atomic Energy Act of 1946, which President Truman signed on August 1, 1946, created the Atomic Energy Commission and its related entities (the Military Liaison Committee, the General Advisory Committee, and the Congressional Joint Committee on Atomic Energy). The Atomic Energy Commission, a civilian agency, was given control of nuclear energy and related research and development.

On December 31, 1946, President Truman signed an executive order ending the Manhattan Project and transferring control over the United States atomic energy program to the Atomic Energy Commission (Furman 1990). The land and all other property owned by the Manhattan Engineer District transferred to the new Atomic Energy Commission. Thus the land on which Z Division sat became Atomic Energy Commission property. However, Sandia Base itself remained a military base with Z Division within it. In 1971, Sandia Base was merged into KAFB. Today, DOE owns the Sandia technical areas and the built environment on land permitted for its use by the U.S. Air Force and withdrawn 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 test facilities requiring buffer areas between them. 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 Workman proximity fuze testing area) mostly via land permits with the U.S. Air Force and on some land withdrawn from the U.S. Forest Service to DOE.

9.2 Regulatory Criteria

Ensuring compliance with these federal requirements supports the long-term preservation and protection of cultural resources, prevents mission delays, and maintains the trust and 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.

9.3 Archaeological Resources

The Sandia archaeologist manages federal compliance and helps Sandia personnel and the DOE maintain compliance with the National Historic Preservation Act, Section 106. This ensures that cultural resources and their historic and cultural heritage are preserved and protected. The Sandia archaeologist reviews NEPA checklists that include land disturbances and provides recommendations for monitoring field activities at SNL/NM to ensure archeological resources are not adversely impacted. The Sandia archaeologist also makes site eligibility recommendations for inclusion in the National Register of Historic Places.

The archaeological work at SNL/NM is primarily focused on preserving and protecting cultural resources long-term. This is intended to ensure the heritage of the area and of the landscape. Long-term preservation and protection also ensure that data are available to make appropriate land use and environmental planning decisions at SNL/NM.

9.3.1 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 (NMAC 4.10.8; NMAC 4.10.15). In addition, the archaeologist provides recommendations regarding the potential effect of proposed undertakings on prehistoric and historic properties. These include recommendations regarding the 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 and are separated by no more than 66 ft. Areas where cultural materials are sparse (less 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 the 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 (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.

9.3.2 Archaeological Assessments and Analysis in 2019

In 2019, Sandia's archaeologist completed five pedestrian surveys, reviewing more than 150 outdoor projects and surveying more than 10 acres. Additionally, four offsite archaeological reviews were completed. These surveys 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. Additionally, 19 conceptual analyses were completed to support site planning. These reviews included desktop research identifying any potential effects proposed by the site planning.

9.4 Historic Buildings

The Sandia historian surveys and assesses historic buildings in support of 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 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.

9.4.1 Methods

Although the historian does provide internal 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 site of the work, reviews existing photographs and documents of the facilities involved, obtains new photographs, conducts any additional research in the archives or building drawings collection needed to understand the property's past and current role in SNL/NM operations, and evaluates the building's history within the themes (i.e., weapon design, field testing, environmental testing, weapon assembly, military liaison, stockpile surveillance, non-weapons research, and administration/community) provided by the 2010 context statement (Section 9.4.2), 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 National Register of Historic Places eligibility.

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

The context statement, completed in 2010, is actively used in historic building assessments and recommendations as the background against which properties are evaluated. Any recommendation that a property is historic includes the relevant established Sandia theme under which it falls as well as its period of significance.

Once the property is understood in context, the historian makes a recommendation as to whether it is eligible for 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 the proposed work will have an adverse effect on any historic properties or districts, including the property where the work is occurring. Information regarding the property, photographs, a description of the proposed work, any impacts, and the overall recommendation on eligibility are captured on a New Mexico Historic Cultural Properties Inventory form. The Historic Cultural Properties Inventory is submitted as an attachment to the NEPA checklist for DOE review and use in consultation with the New Mexico State Historic Preservation Office.

9.4.2 Previous Building Surveys, Assessments, and Determinations

The Cold War's 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 National Historic Preservation Act, Section 106, during DOE consultation with the New Mexico State Historic Preservation Office.

In 2010, the context statement was thoroughly 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 historic building assessment to identify areas and structures 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 undertake consultation with the State Historic Preservation Office regarding the 2010 recommendation; however, the assessments have been used in National Historic Preservation Act, Section 106, consultation about undertakings to individual properties. The cumulative effect of actions taken since the 2010 survey has resulted in some determinations regarding eligibility of properties included in the survey as well as changes to the built environment; therefore, the survey will be revised prior to any future National Historic Preservation Act, consultation with the State Historic Preservation Office. Table 9-1 provides a list of properties previously determined to be historic and their current status.

Documentary mitigation of adverse effects at properties previously determined to be historic is ongoing. Individual memoranda of understanding between DOE and the New Mexico State Historic Preservation Office specify the type of documentation undertaken for each of the properties. In most instances, Sandia 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. 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 9-1. Properties previously determined to be historic and their current status

Property	District ?	Contributing or Related Elements	State Historic Preservation Office Concurrence	Still Extant?	Still Considered Historic?	Documentation Needed?
300-ft drop tower (S6510)	Yes	S6510, 6510E, 6523B, S6510C (impact pool)	01/12/2004	Yes	Yes	No
10,000-ft 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
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

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Table 9-1. Properties previously determined to be historic and their current status (continued)

Property	District?	Contributing or Related Elements	State Historic Preservation Office Concurrence	Still Extant?	Still Considered Historic?	Documentation Needed?
Gun Site	Yes	S6624, 6625		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

9.4.3 Historic Building Assessments in 2019

In 2019, the historian completed historic building assessments in response to 53 proposed actions at 46 properties. Five of these assessments were reviewed in-house and then completed as they involved only routine maintenance or testing activities that did not alter the built environment; DOE reviewed 39 assessments and included them in consultation with the New Mexico State Historic Preservation Office on 10 actions involving 11 buildings; 8 assessments have not been completed; and one assessment was canceled. Those assessments that did not require consultation with the State Historic Preservation Office included siting and planning proposals as well as work on very young buildings and buildings previously determined not to be historic.

In 2015, Sandia personnel proposed the removal of test structures at 15 environmental restoration sites where Sandia had conducted activities on KAFB property. Sandia provided historic property assessments of the sites to DOE in 2016. DOE provided the information to KAFB, which consulted with the New Mexico 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—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 New Mexico State Historic Preservation Office prior to demolition of the properties. Documentation will be complete in 2020.

9.5 Quality Check and Validation of Process

Each fiscal year, Cultural Resources Program personnel validate 20 NEPA checklists from the previous fiscal year. The review focuses on archaeological concerns for 10 checklists and focuses on historic building issues for the other 10 checklists. The validation activity verifies that cultural resources were addressed within each checklist, that the project 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.

9.6 Additional Activities

In an effort to provide information to the public about cultural resources, a website (Sandia's Cultural Resources in New Mexico) was created to provide historical information and photographs of properties determined to be historic that have since 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 10. Permits, Regulations, and Standards for Environmental Programs

Southwestern Fence Lizard (*Sceloporus cowelsi*)

OVERVIEW ■ Sandia personnel maintain compliance with all required permits, regulations, and standards for environmental programs.

Table 10-1 through Table 10-3 summarize various permits, regulations, and standards that define environmental programs and compliance with those requirements.

Table 10-1. Summary of environmental permits and registrations in effect, 2019

Permit Type and/or Facility Name	Location	Permit/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	3/1/2015	1/31/2020	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
Center for Integrated Nanotechnologies	Center for Integrated Nanotechnologies	2238A	5/1/2016	4/30/2021	ABCWUA

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Table 10-1. Summary of environmental permits and registrations in effect, 2019 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
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	1166	7/1/2019	6/30/2020	NMED
Underground Storage Tank (20,000 gallons)	TA-I	1167	7/1/2019	6/30/2020	NMED
Aboveground Storage Tanks					
Aboveground Storage Tank (3,020 gallons)	TA-I	1163	7/1/2019	6/30/2020	NMED
Aboveground Storage Tank (2,119 gallons)	TA-I	1164	7/1/2019	6/30/2020	NMED
Aboveground Storage Tank (2,000 gallons)	TA-I	1165	7/1/2019	6/30/2020	NMED
Aboveground Storage Tank (5,000 gallons)	TA-III	1168	7/1/2019	6/30/2020	NMED
Aboveground Storage Tank (5,500 gallons)	Coyote Test Field	1169	7/1/2019	6/30/2020	NMED
Aboveground Storage Tank (4,500 gallons)	TA-IV	1170	7/1/2019	6/30/2020	NMED
Aboveground Storage Tank (1,500 gallons)	TA-I	1171	7/1/2019	6/30/2020	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/SFO: NMR04A011	12/22/2015 (NTESS) 11/18/2015 (DOE/SFO)	**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/SFO: NMR04A011	9/30/2015	6/4/2020	EPA
Dynamic Explosives Test Site North	Thunder Range	NTESS: NMR1000FE DOE/SFO: NMR1000F1	5/30/2017	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
Long Sled Track Clearing	TA-III	NTESS: NMR1000FH	5/30/2017	Construction General Permit expires 2/16/2022	EPA

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Table 10-1. Summary of environmental permits and registrations in effect, 2019 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
NPDES Multi-Sector General Permit (continued)					
Division 6000 Igloos	Division 6000 Igloos	NTESS: NMR1000FJ	5/30/2017	Construction General Permit expires 2/16/2022	EPA
Building 725	TA-I	NTESS: NMR1000MX	7/25/2017	Notice of Intent terminated 2/25/2019	EPA
TA-III to TA-V Waterline Replacement	TA-III and TA-V	NTESS: NMR1001BR	5/16/2018	Construction General Permit expires 5/30/2021	EPA
Coyote Test Field Volt Feeder	Coyote Test Field	NTESS: NMR1001GL	7/18/2018	Construction General Permit expires 8/1/2021	EPA
Substation 5 Loop	TA-III	NTESS: NMR1001R7	11/28/2018	Construction General Permit expires 12/12/2021	EPA
Battery Test Facility	TA-II	NTESS: NMR1000XA	11/27/2017	Construction General Permit expires 2/16/2022	EPA
TA-IV Escarpment	TA-IV	NTESS: NMR1001X4	2/27/2019	Construction General Permit expires 2/27/2022	EPA
Building 972	TA-IV	NTESS: NMR10020U	3/29/2019	Construction General Permit expires 3/29/2022	EPA
TA-IV Temporary Structure	TA-IV	NTESS: NMR10026L	6/18/2019	Construction General Permit expires 6/18/2022	EPA
Natural Gas Pipeline	TA-I, II, IV	NTESS: NMR10026M	6/18/2019	Construction General Permit expires 6/18/2022	EPA
Contractor Laydown Yard	TA-II	NTESS: NMR10027B	6/26/2019	Construction General Permit expires 6/26/2022	EPA
Building 812	TA-I	NTESS: NMR1002DJ	9/12/2019	Construction General Permit expires 9/12/2022	EPA
Groundwater Well Installation	Coyote Test Field	NTESS: NMR1002F4	9/26/2019	Construction General Permit expires 9/26/2022	EPA
Building 706 (Hi-Bay)	TA-I	NTESS: NMR10027C	6/26/2019	Construction General Permit expires 6/26/2022	EPA
TA-II Escarpment	TA-II	NTESS: NMR1002LR	12/9/2019	Construction General Permit expires 12/9/2022	EPA
20th Street Parking	TA-I	NTESS: NMR1001ZM	3/27/2019	Notice of Intent terminated 8/8/2019	EPA

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Table 10-1. Summary of environmental permits and registrations in effect, 2019 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
Ecological					
New Mexico Department of Game and Fish Nuisance Permit	Site-wide ecological monitoring activity	119	3/12/2019	3/31/2020	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					
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
Hazardous Waste Permit (Post-Closure Care)	Chemical Waste Landfill	NM5890110518	Issued 10/15/2009; effective 6/2/2011	6/2/2021	NMED
Open Burning/Detonation					
Explosives Testing	Building 9920 Test Site	19-0012	1/1/2019	12/31/2019	City of Albuquerque
Improved Explosive Device and Homemade Explosives Testing and Training	Building 9930 Test Site	19-0011	1/1/2019	12/31/2019	City of Albuquerque
High Heat Flux Tests	Solar Tower	19-0010	1/1/2019	12/31/2019	City of Albuquerque
Explosive Tests	Rocket Sled Track	19-0009	1/1/2019	12/31/2019	City of Albuquerque
Thermal Treatment Unit	Thermal Treatment Unit	19-0008	1/1/2019	12/31/2019	City of Albuquerque
Explosives Testing	Building 9939 Test Site	19-0006	1/1/2019	12/31/2019	City of Albuquerque
Explosives Testing	Thunder Range	19-0005	1/1/2019	12/31/2019	City of Albuquerque
Explosive Applications–Terminal Ballistics Facility	Building 6750	19-0004	1/1/2019	12/31/2019	City of Albuquerque
Thermite Applications–Terminal Ballistics Facility	Building 6750	19-0002	1/1/2019	12/31/2019	City of Albuquerque
Propellant Applications–Terminal Ballistics Facility	Building 6750	19-0003	1/1/2019	12/31/2019	City of Albuquerque
Explosives Training and Testing	Dynamic Explosives Test Site	19-0001	1/1/2019	12/31/2019	City of Albuquerque
Crude Oil Combustion and Fuel Fire Experiments	Burn Site	19-0018	1/28/2019	2/28/2019	City of Albuquerque
Burn Pool Test	TA-III Pad 6742	19-0027	5/1/2019	9/30/2019	City of Albuquerque
Crude Oil Combustion and Fuel Fire Experiments	Burn Site	19-0022	5/29/2019	6/29/2019	City of Albuquerque

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Table 10-1. Summary of environmental permits and registrations in effect, 2019 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
Open Burning/Detonation (continued)					
Crude Oil Combustion and Fuel Fire Experiments	Burn Site	19-0023	6/17/2019	7/17/2019	City of Albuquerque
Crude Oil Combustion and Fuel Fire Experiments	Burn Site	19-0029	6/24/2019	7/24/2019	City of Albuquerque
Fuel/Explosives Applications–Terminal Ballistics Facility	Building 6750	19-0045	9/12/2019	12/31/2019	City of Albuquerque
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/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

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Table 10-1. Summary of environmental permits and registrations in effect, 2019 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
Stationary Source (Air) (continued)					
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
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

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Table 10-1. Summary of environmental permits and registrations in effect, 2019 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
Fugitive Dust Control Construction/ Demolition/Programmatic, as of 12/31/2019					
Fugitive Dust Control Programmatic Permit	Site-wide	8683-P	6/12/2017	6/12/2022	City of Albuquerque
Building 725 Addition	TA-I	8881-C	8/31/2017	8/31/2020	City of Albuquerque
Building 1012 Construction	TA-II	9054-C	12/12/2017	12/12/2019	City of Albuquerque
26007 Igloo Erosion Protection Installation	Remote	9418-C	7/13/2018	7/13/2019	City of Albuquerque
Replace 5 kV Feeder	Remote	9417-C	7/17/2018	7/17/2020	City of Albuquerque
Building 970 Erosion Control	TA-IV	9514-C	8/16/2018	8/16/2020	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
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

Note: The 10,000-gallon underground storage tank in TA-1 was removed on December 15, 2018.
[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.

ABCWUA = Albuquerque Bernalillo County Water Utility Authority
DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
N/A = not applicable
NMED = New Mexico Environment Department
NPDES = National Pollution Discharge Elimination System
NTESS = National Technology & Engineering Solutions of Sandia, LLC
RCRA = Resource Conservation and Recovery Act
SFO = Sandia Field Office
SNL/NM = Sandia National Laboratories, New Mexico
TA = technical area

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	The 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.

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

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 fiscal year 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.

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

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 Revision 14 to 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	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 waste management activities and waste volumes. Requested Revision 15 to 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.
2017–2019	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 to reflect waste management activities and waste volumes.

DOE = U.S. Department of Energy
EPA = U.S. Environmental Protection Agency
FFCA = Federal Facility Compliance Act
FFCO = Federal Facility Compliance Order
FY = fiscal year
HDRV = Historical Disposal Requests Validation
HSWA = Hazardous and Solid Waste Amendment
N/A = not applicable
NMED = New Mexico Environment Department
RCRA = Resource Conservation and Recovery Act
Sandia = Sandia National Laboratories
SNL/NM = Sandia National Laboratories, New Mexico

Table 10-3. Quantity of mixed waste subject to the Federal Facility Compliance Order, end of FY 2019

Waste Category	Volume (m^3)	Description	Status and Plans
TG 1	0	Inorganic debris with 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/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	2.32	MTRU	Stored at SNL/NM; awaiting shipment to WIPP

FY = fiscal year
MTRU = mixed transuranic
N/A = not applicable
SNL/NM = Sandia National Laboratories, New Mexico
TCLP = toxicity characteristic leaching procedure
TG = treatability group
WIPP = Waste Isolation Pilot Plant

Appendix A. Summary of Groundwater Monitoring in 2019

Groundwater monitoring well installation in Lurance Canyon

Table A-1. Sample collection dates for groundwater quality monitoring at SNL/NM, 2019

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					√	

SNL/NM = Sandia National Laboratories, New Mexico
TA = technical area

Table A-2. SNL/NM groundwater monitoring analytical results, 2019

Analyte	Number of Detects	Number of Non-Detects	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Summary of Field Water Quality Parameters (units as indicated below)						
pH in SU	155	0	6.05	7.93	7.39	NE
Specific conductivity in µmhos/cm	155	0	322.6	3,832.7	735.7	NE
Temperature in °C	155	0	12.78	26.99	19.20	NE
Turbidity in NTU	155	0	0.12	134	2.19	NE
Detected Organic Compounds in µg/L						
Acetone	6	141	1.66	3.93	2.53	NE
Chloroform	6	166	0.590	1.07	0.878	80
Dichloroethane, 1,1-	6	161	0.360	0.620	0.442	NE
Dichloroethene, 1,1-	3	169	0.890	1.02	0.973	7.0
Dichloroethene, cis-1,2-	37	130	0.310	4.18	1.145	70
Methylene Chloride	1	166	1.12	1.12	1.12	5.0
Tetrachloroethene	9	163	0.340	1.61	1.089	5.0
Toluene	2	165	0.370	0.470	0.420	1,000
Trichloroethene	75	102	0.350	20.2	4.516	5.0
Detected Metals in mg/L						
Aluminum	11	65	0.0212	0.343	0.0976	NE
Arsenic	103	38	0.0020	0.00879	0.00299	0.010
Barium	76	0	0.00925	0.221	0.06842	2.0
Beryllium	4	72	0.00183	0.00703	0.00446	0.004
Calcium	76	0	37.5	297	92.7	NE
Chromium	5	91	0.00310	0.0479	0.01685	0.100
Cobalt	9	67	0.00035	0.0102	0.00303	NE
Copper	43	33	0.00030	0.00523	0.00153	1.3
Iron	19	122	0.0352	0.524	0.1302	NE
Lead	1	75	0.00254	0.00254	0.00254	0.015
Magnesium	76	0	3.25	67.0	20.92	NE
Detected Metals in mg/L						
Manganese	31	107	0.0011	1.59	0.1443	NE
Molybdenum	8	0	0.00333	0.00567	0.00458	NE
Nickel	16	80	0.00063	0.0239	0.00464	NE
Potassium	76	0	1.29	31.8	3.80	NE
Selenium	54	22	0.00202	0.0287	0.00531	0.050
Silver	1	75	0.0016	0.0016	0.0016	NE
Sodium	76	0	15.8	1,020	64.4	NE
Thallium	3	73	0.000742	0.00115	0.001007	0.002
Uranium	68	0	0.000215	0.0172	0.004664	0.030
Vanadium	42	34	0.00355	0.0119	0.00661	NE
Zinc	24	52	0.0033	0.0649	0.0141	NE

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Table A-2. SNL/NM groundwater monitoring analytical results, 2019 (continued)

Analyte	Number of Detects	Number of Non-Detects	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Detected Inorganic Parameters in mg/L						
Nitrate plus nitrite, as N	174	0	0.122	40.3	8.839	10
Bromide	70	2	0.141	2.97	0.579	NE
Chloride	72	0	10.0	500	64.3	NE
Fluoride	72	0	0.260	2.79	0.964	4.0
Sulfate	72	0	16.9	1,980	124.5	NE
Total organic halogens	12	8	0.0039	0.228	0.0319	NE
Alkalinity as CaCO3	68	0	83.9	1,070	224.6	NE
Detected Radiochemistry Activities in pCi/L (unless noted otherwise)						
Alpha, gross (corrected)[a]	82	0	−6.13	12.77	2.16	15.0[b]
Beta, gross	75	6	1.15	35.1	5.62	4 mrem/year
Cesium-137	1	80	3.97	3.97	3.97	NE
Potassium-40	5	62	46.2	84.9	71.0	NE
Radium-226	7	13	0.336	3.00	1.588	5.0[c]
Radium-228	6	14	0.526	1.34	0.789	5.0[c]
Radon-222	10	0	140	469	298	NE
Uranium-233/234	26	0	0.52	34.6	12.23	NE
Uranium-235/236	21	5	0.0859	0.502	0.2622	NE
Uranium-238	25	1	0.248	5.88	2.649	NE

[a] Corrected results are gross alpha results reported as corrected values (with uranium activities subtracted out).
[b] The 15.0 pCi/L MCL is for corrected gross alpha activity.
[c] The 5.0 pCi/L MCL is for combined radium-226 and radium-228.
$CaCO_3$ = calcium carbonate
MCL = maximum contaminant level
N = nitrogen
NE = not established
NTU = nephelometric turbidity units
pH = potential of hydrogen (negative logarithm of the hydrogen ion concentration)
SNL/NM = Sandia National Laboratories, New Mexico
SU = standard unit

Table A-3. Exceedances for SNL/NM groundwater monitoring wells and springs sampled, 2019

Analyte	Well	Exceedance	Date
Beryllium MCL = 0.004 mg/L	Coyote Springs	0.00702 mg/L[a]	March 2019
	Coyote Springs (duplicate)	0.00703 mg/L[a]	March 2019
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	AVN-1	12.6 mg/L	May 2019
	CYN-MW9	40.3 mg/L	April 2019
		34.2 mg/L	October 2019
	CYN-MW9 (duplicate)	38.4 mg/L	October 2019
	CYN-MW11	11.6 mg/L	April 2019
		12.5 mg/L	October 2019
	CYN-MW11 (duplicate)	12.6 mg/L	October 2019
	CYN-MW12	14.9 mg/L	April 2019
		15.5 mg/L	October 2019
	CYN-MW12 (duplicate)	15.2 mg/L	October 2019
	CYN-MW13	34.3 mg/L	April 2019
		33.4 mg/L	October 2019
	CYN-MW14A	13.6 mg/L	April 2019
		13.0 mg/L	October 2019
	CYN-MW15	20.0 mg/L	April 2019
		19.9 mg/L	October 2019
	CYN-MW16	10.8 mg/L	November 2019
	CYN-MW16 (duplicate)	11.1 mg/L	November 2019
	LWDS-MW1	12.1 mg/L	February 2019
		13.8 mg/L	June 2019
		12.2 mg/L	August 2019
		12.2 mg/L	November 2019
	LWDS-MW1 (duplicate)	11.8 mg/L	August 2019
	LWDS-MW2	12.3 mg/L	May 2019
	LWDS-MW2 (duplicate)	10.1 mg/L	May 2019
	TA2-W-19	11.5 mg/L	February 2019
		13.8 mg/L	June 2019
		11.5 mg/L	August 2019
		12.0 mg/L	November 2019
	TA2-W-19 (duplicate)	12.0 mg/L	November 2019
	TA2-W-28	19.6 mg/L	February 2019
		19.7 mg/L	June 2019
		16.2 mg/L	August 2019
		16.2 mg/L	December 2019
	TA2-W-28 (duplicate)	20.5 m/L	February 2019
	TAV-MW10	11.3 mg/L	February 2019
		15.3 mg/L	June 2019
		11.6 mg/L	August 2019
		11.2 mg/L	November 2019
	TAV-MW10 (duplicate)	11.3 mg/L	November 2019

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Table A-3. Exceedances for SNL/NM groundwater monitoring wells and springs sampled, 2019 (continued)

Analyte	Well	Exceedance	Date
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	TJA-2	12.2 mg/L	February 2019
		13.5 mg/L	June 2019
		10.8 mg/L	August 2019
		11.4 mg/L	December 2019
	TJA-2 (duplicate)	13.9 mg/L	June 2019
	TJA-4	30.0 mg/L	March 2019
		37.1 mg/L	June 2019
		29.5 mg/L	September 2019
		31.7 mg/L	December 2019
	TJA-4 (duplicate)	39.7 mg/L	June 2019
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	TJA-5	19.6 mg/L	August 2019
	TJA-7	22.1 mg/L	March 2019
		24.6 mg/L	June 2019
		22.0 mg/L	September 2019
		22.8 mg/L	December 2019
	TJA-7 (duplicate)	22.8 mg/L	December 2019
Trichloroethene MCL = 5.0 µg/L	LWDS-MW1	15.2 µg/L	February 2019
		17.5 µg/L	June 2019
		11.4 µg/L	August 2019
		20.2 µg/L	November 2019
	LWDS-MW1 (duplicate)	13.6 µg/L	August 2019
	TAV-MW4	5.44 µg/L	May 2019
		5.09 µg/L	August 2019
		5.40 µg/L	November 2019
	TAV-MW4 (duplicate)	5.05 µg/L	August 2019
	TAV-MW8	6.30 µg/L	February 2019
		5.66 µg/L	November 2019
	TAV-MW8 (duplicate)	6.06 µg/L	February 2019
	TAV-MW10	14.6 µg/L	February 2019
		13.0 µg/L	June 2019
		10.6 µg/L	August 2019
		14.9 µg/L	November 2019
	TAV-MW10 (duplicate)	14.7 µg/L	November 2019
	TAV-MW14	6.60 µg/L	February 2019
	TAV-MW14 (duplicate)	5.34 µg/L	November 2019
	TJA-2	5.71 µg/L	February 2019

[a] Analytical result for filtered water sample. All other analytical results are for unfiltered water samples.
MCL = maximum contaminant level
SNL/NM = Sandia National Laboratories, New Mexico

Appendix B. Terrestrial Surveillance Analytical Results in 2019

Desert Tarantula (*Aphonopelma chalcodes*)

Table B-1. Radiological results in soil, 2019

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-9	−0.0246 ± 0.0403	0.0667	U	BD	HASL 300
		pCi/g	C-10	−0.0234 ± 0.1	0.17	U	BD	HASL 300
		pCi/g	C-25	−00823 ± 0.0693	0.112	U	BD	HASL 300
	Cesium-137	pCi/g	C-9	0.0707 ± 0.0233	0.0213		None	HASL 300
		pCi/g	C-10	0.28 ± 0.0409	0.025		None	HASL 300
		pCi/g	C-25	0.151 ± 0.0419	0.026		None	HASL 300
	Tritium	pCi/L	C-9	−34.8 ± 127	241	U	BD	GL-RAD-A-002
		pCi/L	C-10	−2.98 ± 134	246	U	BD	GL-RAD-A-002
		pCi/L	C-25	33.8 ± 135	242	U	BD	GL-RAD-A-002
On-Site	Americium-241	pCi/g	S-1	0.011 ± 0.0135	0.0225	U	BD	HASL 300
		pCi/g	S-6	−0.0128 ± 0.0559	0.0951	U	BD	HASL 300
		pCi/g	S-33	0.024 ± 0.0592	0.109	U	BD	HASL 300
		pCi/g	S-33 DU1	−0.0462 ± 0.0781	0.121	U	BD	HASL 300
		pCi/g	S-33 DU2	−0.00911 ± 0.0207	0.0327	U	BD	HASL 300
		pCi/g	S-34	0.00622 ± 0.0191	0.0312	U	BD	HASL 300
		pCi/g	S-45	0.00726 ± 0.0475	0.0774	U	BD	HASL 300
		pCi/g	S-46	0.0902 ± 0.0787	0.129	U	BD	HASL 300
		pCi/g	S-49	0.00599 ± 0.0121	0.0213	U	BD	HASL 300
		pCi/g	S-51	−0.0164 ± 0.0454	0.0863	U	BD	HASL 300
		pCi/g	S-53	0.00883 ± 0.0282	0.0467	U	BD	HASL 300
		pCi/g	S-53 DU1	0.011 ± 0.0113	0.019	U	BD	HASL 300
		pCi/g	S-53 DU2	0.0754 ± 0.0799	0.12	U	BD	HASL 300
		pCi/g	S-55	−0.0322 ± 0.0503	0.0866	U	BD	HASL 300
		pCi/g	S-57	0.0571 ± 0.0772	0.101	U	BD	HASL 300
		pCi/g	S-76	−0.0203 ± 0.0535	0.0874	U	BD	HASL 300
		pCi/g	S-77	−0.0496 ± 0.0911	0.161	U	BD	HASL 300
		pCi/g	S-86	−0.00981 ± 0.092	0.136	U	BD	HASL 300
		pCi/g	S-90	0.0293 ± 0.0502	0.0878	U	BD	HASL 300
		pCi/g	S-92	0.00867 ± 0.017	0.0287	U	BD	HASL 300

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Table B-1. Radiological results in soil, 2019 (continued)

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Cesium-137	pCi/g	S-1	0.0885 ± 0.0322	0.0242		None	HASL 300
		pCi/g	S-6	0.0335 ± 0.0163	0.014		J	HASL 300
		pCi/g	S-33	0.205 ± 0.0346	0.0251		None	HASL 300
		pCi/g	S-33 DU1	0.232 ± 0.0311	0.022		None	HASL 300
		pCi/g	S-33 DU2	0.228 ± 0.0343	0.0247		None	HASL 300
		pCi/g	S-34	0.0353 ± 0.0229	0.022		J	HASL 300
		pCi/g	S-45	0.0342 ± 0.0202	0.0198		J	HASL 300
		pCi/g	S-46	0.126 ± 0.0272	0.0222		None	HASL 300
		pCi/g	S-49	0.29 ± 0.039	0.0212		None	HASL 300
		pCi/g	S-51	0.027 ± 0.0175	0.0192		J	HASL 300
		pCi/g	S-53	0.0362 ± 0.0148	0.0148		J	HASL 300
		pCi/g	S-53 DU1	0.0149 ± 0.0255	0.0192	U	BD	HASL 300
		pCi/g	S-53 DU2	0.0224 ± 0.0165	0.0187		J	HASL 300
		pCi/g	S-55	0.209 ± 0.0317	0.021		None	HASL 300
		pCi/g	S-57	0.022 ± 0.0146	0.0164		J	HASL 300
		pCi/g	S-76	0.0602 ± 0.0141	0.0133		None	HASL 300
		pCi/g	S-77	0.352 ± 0.0442	0.025		None	HASL 300
		pCi/g	S-86	0.0271 ± 0.0198	0.0176		J	HASL 300
		pCi/g	S-90	0.0775 ± 0.0205	0.0158		None	HASL 300
		pCi/g	S-91	0.138 ± 0.0374	0.0223		None	HASL 300
		pCi/g	S-92	0.127 ± 0.0264	0.0228		None	HASL 300
	Tritium	pCi/L	S-1	191 ± 116	178		J	GL-RAD-A-002
		pCi/L	S-6	65.6 ± 114	197	U	BD	GL-RAD-A-002
		pCi/L	S-33	74.6 ± 104	176	U	BD	GL-RAD-A-002
		pCi/L	S-33 DU1	150 ± 111	176	U	BD	GL-RAD-A-002
		pCi/L	S-33 DU2	53.2 ± 102	176	U	BD	GL-RAD-A-002
		pCi/L	S-34	39.5 ± 101	176	U	BD	GL-RAD-A-002
		pCi/L	S-45	78.8 ± 126	218	U	BD	GL-RAD-A-002
		pCi/L	S-46	200 ± 117	178		J	GL-RAD-A-002

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Table B-1. Radiological results in soil, 2019 (continued)

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Tritium	pCi/L	S-49	16.8 ± 130	235	U	BD	GL-RAD-A-002
		pCi/L	S-51	16.5 ± 138	250	U	BD	GL-RAD-A-002
		pCi/L	S-53	68.1 ± 115	200	U	BD	GL-RAD-A-002
		pCi/L	S-53 DU1	94.3 ± 122	207	U	BD	GL-RAD-A-002
		pCi/L	S-53 DU2	61.8 ± 119	208	U	BD	GL-RAD-A-002
		pCi/L	S-55	46.1 ± 114	202	U	BD	GL-RAD-A-002
		pCi/L	S-57	67.3 ± 74.8	125	U	BD	GL-RAD-A-002
		pCi/L	S-76	54.9 ± 113	198	U	BD	GL-RAD-A-002
		pCi/L	S-77	-28.9 ± 129	242	U	BD	GL-RAD-A-002
		pCi/L	S-86	74.1 ± 117	203	U	BD	GL-RAD-A-002
		pCi/L	S-91	145 ± 110	174	U	BD	GL-RAD-A-002
Perimeter	Americium-241	pCi/g	P-4	0.000455 ± 0.0788	0.131	U	BD	HASL 300
		pCi/g	P-5	−0.0158 ± 0.0686	0.125	U	BD	HASL 300
		pCi/g	P-16	0.0403 ± 0.0904	0.156	U	BD	HASL 300
		pCi/g	P-19	−0.011 +/ -0.0674	0.104	U	BD	HASL 300
		pCi/g	P-58	0.0159 ± 0.015	0.0241	U	BD	HASL 300
		pCi/g	P-59	0.00421 ± 0.0727	0.13	U	BD	HASL 300
		pCi/g	P-61	−0.0315 ± 0.0394	0.0627	U	BD	HASL 300
		pCi/g	P-63	−0.0447 ± 0.101	0.169	U	BD	HASL 300
		pCi/g	P-64	0.0217 ± 0 .0934	0.16	U	BD	HASL 300
		pCi/g	P-64 DU1	0.0203 ± 0.109	0.178	U	BD	HASL 300
		pCi/g	P-64 DU2	0.0175 ± 0.0188	0.178	U	BD	HASL 300
		pCi/g	P-81	−0.049 ± 0.0808	0.145	U	BD	HASL 300
		pCi/g	P-82	0.00796 ± 0.0138	0.024	U	BD	HASL 300
		pCi/g	P-95	−0.0598 ± 0.0995	0.138	U	BD	HASL 300
	Cesium-137	pCi/g	P-4	0.187 ± 0.0432	0.0261		None	HASL 300
		pCi/g	P-5	0.0761 ± 0.0219	0.0199		None	HASL 300
		pCi/g	P-16	0.118 ± 0.03	0.0279		None	HASL 300
		pCi/g	P-19	0.467 ± 0.0503	0.0242		None	HASL 300

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Table B-1. Radiological results in soil, 2019 (continued)

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Cesium-137	pCi/g	P-58	0.0301 ± 0.0266	0.0172		J	HASL 300
		pCi/g	P-59	0.185 ± 0.0304	0.0183		None	HASL 300
		pCi/g	P-61	0.0243 ± 0.0401	0.0279	U	BD	HASL 300
		pCi/g	P-63	0.259 ± 0.0417	0.0243		None	HASL 300
		pCi/g	P-64	0.254 ± 0.0379	0.025		None	HASL 300
		pCi/g	P-64 DU1	0.253 ± 0.0385	0.028		None	HASL 300
		pCi/g	P-64 DU2	0.356 ± 0.041	0.0204		None	HASL 300
		pCi/g	P-81	0.163 ± 0.0385	0.0239		None	HASL 300
		pCi/g	P-82	0.0326 ± 0.0166	0.0176		J	HASL 300
		pCi/g	P-95	0.0596 ± 0.0213	0.0194		None	HASL 300
	Tritium	pCi/L	P-4	59 ± 117	206	U	BD	GL-RAD-A-002
		pCi/L	P-5	80.2 ± 120	206	U	BD	GL-RAD-A-002
		pCi/L	P-16	131 ± 108	175	U	BD	GL-RAD-A-002
		pCi/L	P-19	80.6 ± 119	205	U	BD	GL-RAD-A-002
		pCi/L	P-59	93.2 ± 85	139	U	BD	GL-RAD-A-002
		pCi/L	P-63	3.92 ± 134	246	U	BD	GL-RAD-A-002
		pCi/L	P-64	72.9 ± 102	172	U	BD	GL-RAD-A-002
		pCi/L	P-64 DU1	97.8 ± 105	175	U	BD	GL-RAD-A-002
		pCi/L	P-64 DU2	137 ± 109	175	U	BD	GL-RAD-A-002
		pCi/L	P-81	52.9 ± 115	203	U	BD	GL-RAD-A-002
		pCi/L	P-82	11.4 ± 109	202	U	BD	GL-RAD-A-002
		pCi/L	P-95	12.9 ± 111	206	U	BD	GL-RAD-A-002

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, 2019

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-68	−0.00259 ± 0.0564	0.0972	U	BD	HASL 300
	Cesium-137	pCi/g	C-68	0.0443 ± 0.0207	0.0268		J	HASL 300
	Tritium	pCi/L	C-68	−138 ± 117	243	U	BD	GL-RAD-A-002
On-Site	Americium-241	pCi/g	S-72	0.0156 ± 0.0867	0.151	U	BD	HASL 300
		pCi/g	S-74	−0.00379 ± 0.0116	0.0186	U	BD	HASL 300
		pCi/g	S-74 DU1	0.00207 ± 0.0251	0.0417	U	BD	HASL 300
		pCi/g	S-74 DU2	−0.00166 ± 0.0489	0.0939	U	BD	HASL 300
		pCi/g	S-75	0.0332 ± 0.0591	0.101	U	BD	HASL 300
		pCi/g	S-85	−0.0523 ± 0.0707	0.126	U	BD	HASL 300
	Cesium-137	pCi/g	S-72	0.0497 ± 0.0227	0.0195		J	HASL 300
		pCi/g	S-74	0.00579 ± 0.00871	0.0138	U	BD	HASL 300
		pCi/g	S-74 DU1	0.00991 ± 0.0157	0.0248	U	BD	HASL 300
		pCi/g	S-74 DU2	0.0567 ± 0.0107	0.0166	U	BD	HASL 300
		pCi/g	S-75	0.00677 ± 0.0105	0.0164	U	BD	HASL 300
		pCi/g	S-85	0.0284 ± 0.0225	0.0206		J	HASL 300
	Tritium	pCi/L	S-72	98.9 ± 106	175	U	BD	GL-RAD-A-002
		pCi/L	S-74	109 ± 124	207	U	BD	GL-RAD-A-002
		pCi/L	S-74 DU1	44.1 ± 116	208	U	BD	GL-RAD-A-002
		pCi/L	S-74 DU2	75.3 ± 116	199	U	BD	GL-RAD-A-002
		pCi/L	S-85	87.8 ± 104	174	U	BD	GL-RAD-A-002
Perimeter	Americium-241	pCi/g	P-60	0.0169 ± 0.0385	0.0668	U	BD	HASL 300
		pCi/g	P-73	0.0102 ± 0.0557	0.0975	U	BD	HASL 300
	Cesium-137	pCi/g	P-60	0.00774 ± 0.0138	0.0249	U	BD	HASL 300
		pCi/g	P-73	−0.0088 ± 0.0108	0.0151	U	BD	HASL 300
	Tritium	pCi/L	P-73	140 ± 113	182	U	BD	GL-RAD-A-002

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.

Table B-3. Radiological results in vegetation, 2019

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Americium-241	pCi/g	S-55	−0.00177 ± 0.0322	0.0473	U	BD	HASL 300
	Cesium-137	pCi/g	S-55	0.00659 ± 0.0162	0.0262	U	BD	HASL 300
	Tritium	pCi/L	S-55	131 ± 114	184	U	BD	GL-RAD-A-002
Perimeter	Americium-241	pCi/g	P-82	−0.00277 ± 0.0873	0.132	U	BD	HASL 300
	Cesium-137	pCi/g	P-82	−0.00851 ± 0.0164	0.0255	U	BD	HASL 300
	Tritium	pCi/L	P-82	146 ± 117	186	U	BD	GL-RAD-A-002

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.

Table B-4. Dosimeter measurements, 2019

Location Classification	Location Number	1st Quarter (83 Days)		2nd Quarter (99 Days)		3rd Quarter (86 Days)		4th Quarter (97 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	32.8	13.2	40.2	19	39.8	16	46.1	18.5
	C-21	33.4	13.7	40.8	19.7	39	15.3	48.4	20.9
	C-22	31.4	11.7	39.1	17.9	36.4	12.6	43.4	15.8
	C-23	30.9	11.3	34.3	13.1	32.2	8.4	41.9	14.3
	C-25	31.3	11.6	34.1	13	35.6	11.9	41.2	13.7
	C-26	34.7	15.1	36.2	15.1	34.5	10.7	43.4	15.8
	C-30	35.3	15.6	40.2	19.1	38.8	15	46.5	18.9
On-Site	S-1	35.5	15.8	39.9	18.8	41.1	17.3	47	19.5
	S-6	32	12.4	34.3	13.1	35.3	11.5	44.2	16.6
	S-7	33.3	13.6	38.5	17.4	35.9	12.1	44.7	17.2
	S-20	34.8	15.2	40	18.9	36.2	12.5	45.7	18.1
	S-45	35.6	16	37.4	16.2	39	15.3	45.1	17.5
	S-46	36.1	16.5	39.5	18.3	43.1	19.3	47.2	19.6
	S-48	37	17.3	42.3	21.2	41.5	17.7	47.4	19.9
Perimeter	P-4	35.5	15.9	37.9	16.7	37.9	14.2	46.1	18.5
	P-5	31	11.4	34.6	13.5	32.8	9	43.1	15.6
	P-16	38.1	18.4	44.3	23.1	43.5	19.7	51.5	23.9
	P-19	34	14.4	39.2	18	37.4	13.6	46.3	18.8
	P-39	37.2	17.5	37.1	16	39.1	15.3	46.3	18.7
	P-40	32	12.3	37	15.8	37.6	13.8	47.7	20.1
	P-81	32.7	13	38.3	17.1	37.8	14	47.4	19.8

Table B-5. Nonradiological results in soil, 2019

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Community	Aluminum	C-9	11,000	45.1	99.2		J	SW-846 3050B/6020B
	Antimony	C-9	0.303	0.303	1.84	U	1.84UJ	SW-846 3050B/6010D
	Arsenic	C-9	3.02	0.335	0.992		None	SW-846 3050B/6020B
	Beryllium	C-9	0.518	0.0198	0.0992		None	SW-846 3050B/6020B
	Cadmium	C-9	0.146	0.0198	0.198	J	J+	SW-846 3050B/6020B
	Chromium	C-9	12.2	0.198	0.595		J+	SW-846 3050B/6020B
	Copper	C-9	8.49	0.0655	0.397		J	SW-846 3050B/6020B
	Iron	C-9	10,800	65.5	198		J	SW-846 3050B/6020B
	Lead	C-9	11.1	0.0992	0.397	N	J	SW-846 3050B/6020B
	Magnesium	C-9	3,500	1.98	5.95		None	SW-846 3050B/6020B
	Nickel	C-9	9.96	0.0992	0.397		J	SW-846 3050B/6020B
	Selenium	C-9	0.772	0.357	0.992	JN	J	SW-846 3050B/6020B
	Silver	C-9	0.0919	0.0919	0.46	U	None	SW-846 3050B/6010D
	Thallium	C-9	0.139	0.139	0.397	U	None	SW-846 3050B/6020B
	Uranium, total	C-9	0.378	0.0131	0.0397	B	None	SW-846 3050B/6020B
	Zinc	C-9	33.8	0.794	3.97		J+	SW-846 3050B/6020B
On-Site	Aluminum	S-1	12,100	44.5	97.8		J	SW-846 3050B/6020B
	Antimony	S-1	0.314	0.314	1.9	U	1.9UJ	SW-846 3050B/6010D
	Arsenic	S-1	2.53	0.331	0.978		None	SW-846 3050B/6020B
	Beryllium	S-1	0.518	0.0196	0.0978		None	SW-846 3050B/6020B
	Cadmium	S-1	0.215	0.0196	0.196		J+	SW-846 3050B/6020B
	Chromium	S-1	10.5	0.196	0.587		J+	SW-846 3050B/6020B
	Copper	S-1	12.3	0.0646	0.391		J	SW-846 3050B/6020B
	Iron	S-1	13,900	64.6	196		J	SW-846 3050B/6020B
	Lead	S-1	12	0.0978	0.391	N	J	SW-846 3050B/6020B
	Magnesium	S-1	4,840	1.96	5.87		J	SW-846 3050B/6020B
	Nickel	S-1	11	0.0978	0.391		J	SW-846 3050B/6020B
	Selenium	S-1	1.16	0.352	0.978	N	J	SW-846 3050B/6020B
	Silver	S-1	0.0951	0.0951	0.475	U	None	SW-846 3050B/6010D
	Thallium	S-1	0.19	0.137	0.391	J	None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Uranium, total	S-1	0.727	0.0129	0.0391	B	None	SW-846 3050B/6020B
	Zinc	S-1	42.6	0.783	3.91		J+	SW-846 3050B/6020B
	Aluminum	S-6	10,400	22	48.4		J	SW-846 3050B/6020B
	Antimony	S-6	0.32	0.32	1.94	U	1.94UJ	SW-846 3050B/6010D
	Arsenic	S-6	2.25	0.327	0.967		None	SW-846 3050B/6020B
	Beryllium	S-6	0.418	0.0193	0.0967		None	SW-846 3050B/6020B
	Cadmium	S-6	0.162	0.0193	0.193	J	None	SW-846 3050B/6020B
	Chromium	S-6	7	0.193	0.58		None	SW-846 3050B/6020B
	Copper	S-6	6.55	0.0638	0.387		None	SW-846 3050B/6020B
	Iron	S-6	7,080	6.38	19.3		J	SW-846 3050B/6020B
	Lead	S-6	5.28	0.0967	0.387		None	SW-846 3050B/6020B
	Magnesium	S-6	2,570	1.93	5.8		None	SW-846 3050B/6020B
	Nickel	S-6	6.66	0.0967	0.387		None	SW-846 3050B/6020B
	Selenium	S-6	0.638	0.348	0.967	JN	J	SW-846 3050B/6020B
	Silver	S-6	0.0969	0.0969	0.484	U	None	SW-846 3050B/6010D
	Thallium	S-6	0.135	0.135	0.387	U	None	SW-846 3050B/6020B
	Uranium, total	S-6	0.309	0.0128	0.0387		None	SW-846 3050B/6020B
	Zinc	S-6	21.8	0.774	3.87		J	SW-846 3050B/6020B
	Aluminum	S-33	9,440	4.3	9.45		J	SW-846 3050B/6020B
	Antimony	S-33	0.302	0.302	1.83	U	1.83UJ	SW-846 3050B/6010D
	Arsenic	S-33	3.46	0.319	0.945		None	SW-846 3050B/6020B
	Beryllium	S-33	0.609	0.0189	0.0945		None	SW-846 3050B/6020B
	Cadmium	S-33	0.247	0.0189	0.189		J+	SW-846 3050B/6020B
	Chromium	S-33	10.5	0.189	0.567		J+	SW-846 3050B/6020B
	Copper	S-33	9.07	0.0624	0.378		J	SW-846 3050B/6020B
	Iron	S-33	9,660	62.4	189		J	SW-846 3050B/6020B
	Lead	S-33	13.6	0.0945	0.378	N	J	SW-846 3050B/6020B
	Magnesium	S-33	3,790	1.89	5.67		J	SW-846 3050B/6020B
	Nickel	S-33	9.87	0.0945	0.378		J	SW-846 3050B/6020B
	Selenium	S-33	0.885	0.34	0.945	JN	J	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Silver	S-33	0.0914	0.0914	0.457	U	None	SW-846 3050B/6010D
	Thallium	S-33	0.132	0.132	0.378	U	None	SW-846 3050B/6020B
	Uranium, total	S-33	0.677	0.0125	0.0378	B	None	SW-846 3050B/6020B
	Zinc	S-33	34.2	0.756	3.78		J+	SW-846 3050B/6020B
	Aluminum	S-33 DU1	7,120	4.5	9.88		J	SW-846 3050B/6020B
	Antimony	S-33 DU1	0.306	0.306	1.85	U	1.85UJ	SW-846 3050B/6010D
	Arsenic	S-33 DU1	2.62	0.334	0.988		None	SW-846 3050B/6020B
	Beryllium	S-33 DU1	0.448	0.0198	0.0988		None	SW-846 3050B/6020B
	Cadmium	S-33 DU1	0.187	0.0198	0.198	J	J+	SW-846 3050B/6020B
	Chromium	S-33 DU1	7.7	0.198	0.593		J+	SW-846 3050B/6020B
	Copper	S-33 DU1	6.75	0.0652	0.395		J	SW-846 3050B/6020B
	Iron	S-33 DU1	7,400	6.52	19.8		J	SW-846 3050B/6020B
	Lead	S-33 DU1	9.16	0.0988	0.395	N	J	SW-846 3050B/6020B
	Magnesium	S-33 DU1	2,830	1.98	5.93		J	SW-846 3050B/6020B
	Nickel	S-33 DU1	7.28	0.0988	0.395		J	SW-846 3050B/6020B
	Selenium	S-33 DU1	0.675	0.356	0.988	JN	J	SW-846 3050B/6020B
	Silver	S-33 DU1	0.0926	0.0926	0.463	U	None	SW-846 3050B/6010D
	Thallium	S-33 DU1	0.138	0.138	0.395	U	None	SW-846 3050B/6020B
	Uranium, total	S-33 DU1	0.568	0.0123	0.0374	B	None	SW-846 3050B/6020B
	Zinc	S-33 DU1	26.3	0.791	3.95		J+	SW-846 3050B/6020B
	Aluminum	S-33 DU2	8,130	4.25	9.35		J	SW-846 3050B/6020B
	Antimony	S-33 DU2	0.317	0.317	1.92	U	1.92UJ	SW-846 3050B/6010D
	Arsenic	S-33 DU2	3.15	0.316	0.935		None	SW-846 3050B/6020B
	Beryllium	S-33 DU2	0.549	0.0187	0.0935		None	SW-846 3050B/6020B
	Cadmium	S-33 DU2	0.248	0.0187	0.187		J+	SW-846 3050B/6020B
	Chromium	S-33 DU2	9.39	0.187	0.561		J+	SW-846 3050B/6020B
	Copper	S-33 DU2	8.76	0.0617	0.374		J	SW-846 3050B/6020B
	Iron	S-33 DU2	8,750	6.17	18.7		J	SW-846 3050B/6020B
	Lead	S-33 DU2	12.2	0.0935	0.374	N	J	SW-846 3050B/6020B
	Magnesium	S-33 DU2	3,710	1.87	5.61		J	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Nickel	S-33 DU2	9.79	0.0935	0.374		J	SW-846 3050B/6020B
	Selenium	S-33 DU2	0.771	0.336	0.935	JN	J	SW-846 3050B/6020B
	Silver	S-33 DU2	0.0962	0.0962	0.481	U	None	SW-846 3050B/6010D
	Thallium	S-33 DU2	0.131	0.131	0.374	U	None	SW-846 3050B/6020B
	Uranium, total	S-33 DU2	0.559	0.013	0.0395	B	None	SW-846 3050B/6020B
	Zinc	S-33 DU2	34.8	0.748	3.74		J+	SW-846 3050B/6020B
	Aluminum	S-34	12,700	43.6	95.8		J	SW-846 3050B/6020B
	Antimony	S-34	0.313	0.313	1.89	U	1.89UJ	SW-846 3050B/6010D
	Arsenic	S-34	4.07	0.324	0.958		None	SW-846 3050B/6020B
	Beryllium	S-34	0.647	0.0192	0.0958		None	SW-846 3050B/6020B
	Cadmium	S-34	0.155	0.0192	0.192	J	None	SW-846 3050B/6020B
	Chromium	S-34	15	0.192	0.575		None	SW-846 3050B/6020B
	Copper	S-34	8.02	0.0632	0.383		J	SW-846 3050B/6020B
	Iron	S-34	12,500	63.2	192		J	SW-846 3050B/6020B
	Lead	S-34	9.15	0.0958	0.383	N	J	SW-846 3050B/6020B
	Magnesium	S-34	3,240	1.92	5.75		J	SW-846 3050B/6020B
	Nickel	S-34	11.4	0.0958	0.383		J	SW-846 3050B/6020B
	Selenium	S-34	0.988	0.345	0.958	N	J	SW-846 3050B/6020B
	Silver	S-34	0.108	0.0947	0.473	J	None	SW-846 3050B/6010D
	Thallium	S-34	0.136	0.134	0.383	J	None	SW-846 3050B/6020B
	Uranium, total	S-34	0.426	0.0126	0.0383	B	None	SW-846 3050B/6020B
	Zinc	S-34	30.3	0.766	3.83		J	SW-846 3050B/6020B
	Aluminum	S-45	10,700	22.2	48.7		J	SW-846 3050B/6020B
	Antimony	S-45	0.315	0.315	1.91	U	1.91UJ	SW-846 3050B/6010D
	Arsenic	S-45	2.41	0.329	0.975		None	SW-846 3050B/6020B
	Beryllium	S-45	0.453	0.0195	0.0975		None	SW-846 3050B/6020B
	Cadmium	S-45	0.154	0.0195	0.195	J	None	SW-846 3050B/6020B
	Chromium	S-45	8.31	0.195	0.585		None	SW-846 3050B/6020B
	Copper	S-45	6.39	0.0643	0.39		None	SW-846 3050B/6020B
	Iron	S-45	7,780	6.43	19.5		J	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Lead	S-45	8.02	0.0975	0.39		None	SW-846 3050B/6020B
	Magnesium	S-45	3,120	1.95	5.85		None	SW-846 3050B/6020B
	Nickel	S-45	6.77	0.0975	0.39		None	SW-846 3050B/6020B
	Selenium	S-45	0.636	0.351	0.975	JN	J	SW-846 3050B/6020B
	Silver	S-45	0.0956	0.0956	0.478	U	None	SW-846 3050B/6010D
	Thallium	S-45	0.136	0.136	0.39	U	None	SW-846 3050B/6020B
	Uranium, total	S-45	0.317	0.0129	0.039		None	SW-846 3050B/6020B
	Zinc	S-45	25.7	0.78	3.9		J	SW-846 3050B/6020B
	Aluminum	S-51	11100	42.1	92.4		J	SW-846 3050B/6020B
	Antimony	S-51	0.31	0.31	1.88	U	1.88UJ	SW-846 3050B/6010D
	Arsenic	S-51	2.44	0.312	0.924		None	SW-846 3050B/6020B
	Beryllium	S-51	0.453	0.0185	0.0924		None	SW-846 3050B/6020B
	Cadmium	S-51	0.109	0.0185	0.185	J	None	SW-846 3050B/6020B
	Chromium	S-51	15.6	0.185	0.555		None	SW-846 3050B/6020B
	Copper	S-51	7.25	0.061	0.37	B	None	SW-846 3050B/6020B
	Iron	S-51	8,550	6.1	18.5	B	J	SW-846 3050B/6020B
	Lead	S-51	7.14	0.0924	0.37	*	J	SW-846 3050B/6020B
	Magnesium	S-51	3,240	1.85	5.55		None	SW-846 3050B/6020B
	Nickel	S-51	7.55	0.0924	0.37		None	SW-846 3050B/6020B
	Selenium	S-51	0.808	0.333	0.924	J	None	SW-846 3050B/6020B
	Silver	S-51	0.0938	0.0938	0.469	U	None	SW-846 3050B/6010D
	Thallium	S-51	0.129	0.129	0.37	U	None	SW-846 3050B/6020B
	Uranium, total	S-51	0.44	0.0122	0.037		None	SW-846 3050B/6020B
	Zinc	S-51	41.8	0.739	3.7		J	SW-846 3050B/6020B
	Aluminum	S-53	6,880	4.46	9.8		J	SW-846 3050B/6020B
	Antimony	S-53	0.308	0.308	1.87	U	1.87UJ	SW-846 3050B/6010D
	Arsenic	S-53	1.34	0.331	0.98		None	SW-846 3050B/6020B
	Beryllium	S-53	0.288	0.0196	0.098		None	SW-846 3050B/6020B
	Cadmium	S-53	0.133	0.0196	0.196	J	None	SW-846 3050B/6020B
	Chromium	S-53	5.2	0.196	0.588		None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Copper	S-53	4.71	0.0647	0.392		None	SW-846 3050B/6020B
	Iron	S-53	5,310	6.47	19.6		J	SW-846 3050B/6020B
	Lead	S-53	6.09	0.098	0.392		None	SW-846 3050B/6020B
	Magnesium	S-53	1,680	1.96	5.88		None	SW-846 3050B/6020B
	Nickel	S-53	4.33	0.098	0.392		None	SW-846 3050B/6020B
	Selenium	S-53	0.457	0.353	0.98	JN	J	SW-846 3050B/6020B
	Silver	S-53	0.0933	0.0933	0.466	U	None	SW-846 3050B/6010D
	Thallium	S-53	0.137	0.137	0.392	U	None	SW-846 3050B/6020B
	Uranium, total	S-53	0.214	0.0129	0.0392		None	SW-846 3050B/6020B
	Zinc	S-53	17.3	0.784	3.92		J	SW-846 3050B/6020B
	Aluminum	S-53 DU1	7,030	4.55	10		J	SW-846 3050B/6020B
	Antimony	S-53 DU1	0.322	0.322	1.95	U	1.95UJ	SW-846 3050B/6010D
	Arsenic	S-53 DU1	1.36	0.338	1		None	SW-846 3050B/6020B
	Beryllium	S-53 DU1	0.284	0.02	0.1		None	SW-846 3050B/6020B
	Cadmium	S-53 DU1	0.089	0.02	0.2	J	None	SW-846 3050B/6020B
	Chromium	S-53 DU1	5.27	0.2	0.6		None	SW-846 3050B/6020B
	Copper	S-53 DU1	4.52	0.066	0.4		None	SW-846 3050B/6020B
	Iron	S-53 DU1	5,360	6.6	20		J	SW-846 3050B/6020B
	Lead	S-53 DU1	6.18	0.1	0.4		None	SW-846 3050B/6020B
	Magnesium	S-53 DU1	1,660	2	6		None	SW-846 3050B/6020B
	Nickel	S-53 DU1	4.4	0.1	0.4		None	SW-846 3050B/6020B
	Selenium	S-53 DU1	0.373	0.36	1	JN	J	SW-846 3050B/6020B
	Silver	S-53 DU1	0.0977	0.0977	0.488	U	None	SW-846 3050B/6010D
	Thallium	S-53 DU1	0.14	0.14	0.4	U	None	SW-846 3050B/6020B
	Uranium, total	S-53 DU1	0.449	0.0126	0.0382		None	SW-846 3050B/6020B
	Zinc	S-53 DU1	16.9	0.8	4		J	SW-846 3050B/6020B
	Aluminum	S-53 DU2	7,630	4.34	9.54		J	SW-846 3050B/6020B
	Antimony	S-53 DU2	0.315	0.315	1.91	U	1.91UJ	SW-846 3050B/6010D
	Arsenic	S-53 DU2	1.51	0.323	0.954		None	SW-846 3050B/6020B
	Beryllium	S-53 DU2	0.312	0.0191	0.0954		None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Cadmium	S-53 DU2	0.146	0.0191	0.191	J	None	SW-846 3050B/6020B
	Chromium	S-53 DU2	5.52	0.191	0.573		None	SW-846 3050B/6020B
	Copper	S-53 DU2	5.02	0.063	0.382		None	SW-846 3050B/6020B
	Iron	S-53 DU2	5,800	6.3	19.1		J	SW-846 3050B/6020B
	Lead	S-53 DU2	6.75	0.0954	0.382		None	SW-846 3050B/6020B
	Magnesium	S-53 DU2	1,840	1.91	5.73		None	SW-846 3050B/6020B
	Nickel	S-53 DU2	4.78	0.0954	0.382		None	SW-846 3050B/6020B
	Selenium	S-53 DU2	0.679	0.344	0.954	JN	J	SW-846 3050B/6020B
	Silver	S-53 DU2	0.0954	0.0954	0.477	U	None	SW-846 3050B/6010D
	Thallium	S-53 DU2	0.134	0.134	0.382	U	None	SW-846 3050B/6020B
	Uranium, total	S-53 DU2	0.23	0.0132	0.04		None	SW-846 3050B/6020B
	Zinc	S-53 DU2	19.8	0.763	3.82		J	SW-846 3050B/6020B
	Aluminum	S-55	9,940	21.7	47.8		J	SW-846 3050B/6020B
	Antimony	S-55	3.89	0.317	1.92	B	J+	SW-846 3050B/6010D
	Arsenic	S-55	2.19	0.323	0.956		None	SW-846 3050B/6020B
	Beryllium	S-55	0.455	0.0191	0.0956		None	SW-846 3050B/6020B
	Cadmium	S-55	0.195	0.0191	0.191		None	SW-846 3050B/6020B
	Chromium	S-55	7.62	0.191	0.574		None	SW-846 3050B/6020B
	Copper	S-55	5.88	0.0631	0.382		None	SW-846 3050B/6020B
	Iron	S-55	7,930	6.31	19.1		J	SW-846 3050B/6020B
	Lead	S-55	8.33	0.0956	0.382		None	SW-846 3050B/6020B
	Magnesium	S-55	3,030	1.91	5.74		None	SW-846 3050B/6020B
	Nickel	S-55	6.48	0.0956	0.382		None	SW-846 3050B/6020B
	Selenium	S-55	0.818	0.344	0.956	JN	J	SW-846 3050B/6020B
	Silver	S-55	0.096	0.096	0.48	U	None	SW-846 3050B/6010D
	Thallium	S-55	0.134	0.134	0.382	U	None	SW-846 3050B/6020B
	Uranium, total	S-55	0.437	0.0126	0.0382		None	SW-846 3050B/6020B
	Zinc	S-55	26.4	0.765	3.82		J	SW-846 3050B/6020B
	Aluminum	S-57	7,110	4.19	9.21		J	SW-846 3050B/6020B
	Antimony	S-57	0.311	0.311	1.88	U	1.88UJ	SW-846 3050B/6010D

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Arsenic	S-57	3.02	0.311	0.921		None	SW-846 3050B/6020B
	Beryllium	S-57	0.294	0.0184	0.0921		None	SW-846 3050B/6020B
	Cadmium	S-57	0.144	0.0184	0.184	J	None	SW-846 3050B/6020B
	Chromium	S-57	6.19	0.184	0.552		J+	SW-846 3050B/6020B
	Copper	S-57	6.57	0.0608	0.368	B	None	SW-846 3050B/6020B
	Iron	S-57	7,940	6.08	18.4	B	J	SW-846 3050B/6020B
	Lead	S-57	7.23	0.0921	0.368	*	J	SW-846 3050B/6020B
	Magnesium	S-57	4,170	1.84	5.52		None	SW-846 3050B/6020B
	Nickel	S-57	5.94	0.0921	0.368		None	SW-846 3050B/6020B
	Selenium	S-57	0.852	0.331	0.921	J	None	SW-846 3050B/6020B
	Silver	S-57	0.471	0.471	2.35	U	None	SW-846 3050B/6010D
	Thallium	S-57	0.129	0.129	0.368	U	None	SW-846 3050B/6020B
	Uranium, total	S-57	0.876	0.0122	0.0368		None	SW-846 3050B/6020B
	Zinc	S-57	83.6	0.737	3.68		J	SW-846 3050B/6020B
	Aluminum	S-90	6,130	4.54	9.98		J	SW-846 3050B/6020B
	Antimony	S-90	0.326	0.326	1.98	U	1.98UJ	SW-846 3050B/6010D
	Arsenic	S-90	1.72	0.337	0.998		None	SW-846 3050B/6020B
	Beryllium	S-90	0.259	0.02	0.0998		None	SW-846 3050B/6020B
	Cadmium	S-90	0.119	0.02	0.2	J	None	SW-846 3050B/6020B
	Chromium	S-90	5.2	0.2	0.599		None	SW-846 3050B/6020B
	Copper	S-90	3.87	0.0659	0.399	B	None	SW-846 3050B/6020B
	Iron	S-90	5,140	6.59	20	B	J	SW-846 3050B/6020B
	Lead	S-90	5.78	0.0998	0.399	*	J	SW-846 3050B/6020B
	Magnesium	S-90	1,420	2	5.99		None	SW-846 3050B/6020B
	Nickel	S-90	4.1	0.0998	0.399		None	SW-846 3050B/6020B
	Selenium	S-90	0.58	0.359	0.998	J	None	SW-846 3050B/6020B
	Silver	S-90	0.0988	0.0988	0.494	U	None	SW-846 3050B/6010D
	Thallium	S-90	0.14	0.14	0.399	U	None	SW-846 3050B/6020B
	Uranium, total	S-90	0.261	0.0132	0.0399		None	SW-846 3050B/6020B
	Zinc	S-90	16.4	0.798	3.99		J	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Aluminum	S-91	6,270	4.52	9.94		J	SW-846 3050B/6020B
	Antimony	S-91	0.328	0.328	1.99	U	1.99UJ	SW-846 3050B/6010D
	Arsenic	S-91	3.74	0.336	0.994		None	SW-846 3050B/6020B
	Beryllium	S-91	0.4	0.0199	0.0994		None	SW-846 3050B/6020B
	Cadmium	S-91	0.168	0.0199	0.199	J	J+	SW-846 3050B/6020B
	Chromium	S-91	6.83	0.199	0.596		J+	SW-846 3050B/6020B
	Copper	S-91	5.99	0.0656	0.398		J	SW-846 3050B/6020B
	Iron	S-91	10,800	65.6	199		J	SW-846 3050B/6020B
	Lead	S-91	8.64	0.0994	0.398	N	J	SW-846 3050B/6020B
	Magnesium	S-91	2,670	1.99	5.96		J	SW-846 3050B/6020B
	Nickel	S-91	8.69	0.0994	0.398		J	SW-846 3050B/6020B
	Selenium	S-91	1.07	0.358	0.994	N	J	SW-846 3050B/6020B
	Silver	S-91	0.497	0.497	2.49	U	None	SW-846 3050B/6010D
	Thallium	S-91	0.172	0.139	0.398	J	None	SW-846 3050B/6020B
	Uranium, total	S-91	0.352	0.0131	0.0398	B	None	SW-846 3050B/6020B
	Zinc	S-91	33	0.795	3.98		J+	SW-846 3050B/6020B
	Aluminum	S-92	7,310	4.28	9.42		J	SW-846 3050B/6020B
	Antimony	S-92	0.302	0.302	1.83	U	1.83UJ	SW-846 3050B/6010D
	Arsenic	S-92	1.47	0.318	0.942		None	SW-846 3050B/6020B
	Beryllium	S-92	0.318	0.0188	0.0942		None	SW-846 3050B/6020B
	Cadmium	S-92	0.103	0.0188	0.188	J	None	SW-846 3050B/6020B
	Chromium	S-92	6.35	0.188	0.565		None	SW-846 3050B/6020B
	Copper	S-92	5.37	0.0621	0.377	B	None	SW-846 3050B/6020B
	Iron	S-92	6,200	6.21	18.8	B	J	SW-846 3050B/6020B
	Lead	S-92	7.06	0.0942	0.377	*	J	SW-846 3050B/6020B
	Magnesium	S-92	1,670	1.88	5.65		None	SW-846 3050B/6020B
	Nickel	S-92	5.01	0.0942	0.377		None	SW-846 3050B/6020B
	Selenium	S-92	0.639	0.339	0.942	J	None	SW-846 3050B/6020B
	Silver	S-92	0.0914	0.0914	0.457	U	None	SW-846 3050B/6010D
	Thallium	S-92	0.132	0.132	0.377	U	None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Uranium, total	S-92	0.303	0.0124	0.0377		None	SW-846 3050B/6020B
	Zinc	S-92	20.1	0.753	3.77		J	SW-846 3050B/6020B
Perimeter	Aluminum	P-4	7,600	4.28	9.4		J	SW-846 3050B/6020B
	Antimony	P-4	0.302	0.302	1.83	U	1.83UJ	SW-846 3050B/6010D
	Arsenic	P-4	1.78	0.318	0.94		None	SW-846 3050B/6020B
	Beryllium	P-4	0.327	0.0188	0.094		None	SW-846 3050B/6020B
	Cadmium	P-4	0.15	0.0188	0.188	J	None	SW-846 3050B/6020B
	Chromium	P-4	6.27	0.188	0.564		None	SW-846 3050B/6020B
	Copper	P-4	5.15	0.062	0.376		None	SW-846 3050B/6020B
	Iron	P-4	6,180	6.2	18.8		J	SW-846 3050B/6020B
	Lead	P-4	9.22	0.094	0.376		None	SW-846 3050B/6020B
	Magnesium	P-4	2,540	1.88	5.64		None	SW-846 3050B/6020B
	Nickel	P-4	5.56	0.094	0.376		None	SW-846 3050B/6020B
	Selenium	P-4	0.606	0.338	0.94	JN	J	SW-846 3050B/6020B
	Silver	P-4	0.0916	0.0916	0.458	U	None	SW-846 3050B/6010D
	Thallium	P-4	0.132	0.132	0.376	U	None	SW-846 3050B/6020B
	Uranium, total	P-4	0.324	0.0124	0.0376		None	SW-846 3050B/6020B
	Zinc	P-4	20.7	0.752	3.76		J	SW-846 3050B/6020B
	Aluminum	P-5	6,490	4.43	9.75		J	SW-846 3050B/6020B
	Antimony	P-5	0.327	0.327	1.98	U	1.98UJ	SW-846 3050B/6010D
	Arsenic	P-5	1.17	0.329	0.975		None	SW-846 3050B/6020B
	Beryllium	P-5	0.287	0.0195	0.0975		None	SW-846 3050B/6020B
	Cadmium	P-5	0.0979	0.0195	0.195	J	None	SW-846 3050B/6020B
	Chromium	P-5	5.15	0.195	0.585		None	SW-846 3050B/6020B
	Copper	P-5	3.93	0.0643	0.39		None	SW-846 3050B/6020B
	Iron	P-5	5,060	6.43	19.5		J	SW-846 3050B/6020B
	Lead	P-5	4.84	0.0975	0.39		None	SW-846 3050B/6020B
	Magnesium	P-5	1,490	1.95	5.85		None	SW-846 3050B/6020B
	Nickel	P-5	4.06	0.0975	0.39		None	SW-846 3050B/6020B
	Selenium	P-5	0.485	0.351	0.975	JN	J	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Silver	P-5	0.108	0.099	0.495	J	None	SW-846 3050B/6010D
	Thallium	P-5	0.136	0.136	0.39	U	None	SW-846 3050B/6020B
	Uranium, total	P-5	0.208	0.0129	0.039		None	SW-846 3050B/6020B
	Zinc	P-5	15.6	0.78	3.9		J	SW-846 3050B/6020B
	Aluminum	P-16	10,300	44.9	98.6		J	SW-846 3050B/6020B
	Antimony	P-16	0.325	0.325	1.97	U	1.97UJ	SW-846 3050B/6010D
	Arsenic	P-16	2.08	0.333	0.986		None	SW-846 3050B/6020B
	Beryllium	P-16	0.491	0.0197	0.0986		None	SW-846 3050B/6020B
	Cadmium	P-16	0.173	0.0197	0.197	J	None	SW-846 3050B/6020B
	Chromium	P-16	6.88	0.197	0.592		None	SW-846 3050B/6020B
	Copper	P-16	9.07	0.0651	0.394		J	SW-846 3050B/6020B
	Iron	P-16	12,100	65.1	197		J	SW-846 3050B/6020B
	Lead	P-16	8.39	0.0986	0.394	N	J	SW-846 3050B/6020B
	Magnesium	P-16	4,050	1.97	5.92		J	SW-846 3050B/6020B
	Nickel	P-16	7.39	0.0986	0.394		J	SW-846 3050B/6020B
	Selenium	P-16	1.27	0.355	0.986	N	J	SW-846 3050B/6020B
	Silver	P-16	0.22	0.0986	0.493	J	J+	SW-846 3050B/6010D
	Thallium	P-16	0.141	0.138	0.394	J	None	SW-846 3050B/6020B
	Uranium, total	P-16	0.596	0.013	0.0394	B	None	SW-846 3050B/6020B
	Zinc	P-16	37.3	0.789	3.94		J	SW-846 3050B/6020B
	Aluminum	P-19	9,950	21.5	47.3		J	SW-846 3050B/6020B
	Antimony	P-19	0.32	0.32	1.94	U	1.94UJ	SW-846 3050B/6010D
	Arsenic	P-19	2.18	0.32	0.947		None	SW-846 3050B/6020B
	Beryllium	P-19	0.407	0.0189	0.0947		None	SW-846 3050B/6020B
	Cadmium	P-19	0.298	0.0189	0.189		None	SW-846 3050B/6020B
	Chromium	P-19	11.6	0.189	0.568		None	SW-846 3050B/6020B
	Copper	P-19	10.4	0.0625	0.379		None	SW-846 3050B/6020B
	Iron	P-19	10,500	31.3	94.7		J	SW-846 3050B/6020B
	Lead	P-19	16	0.0947	0.379		None	SW-846 3050B/6020B
	Magnesium	P-19	3,870	1.89	5.68		None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Nickel	P-19	11.8	0.0947	0.379		None	SW-846 3050B/6020B
	Selenium	P-19	0.921	0.341	0.947	JN	J	SW-846 3050B/6020B
	Silver	P-19	0.0971	0.0971	0.485	U	None	SW-846 3050B/6010D
	Thallium	P-19	0.133	0.133	0.379	U	None	SW-846 3050B/6020B
	Uranium, total	P-19	0.359	0.0125	0.0379		None	SW-846 3050B/6020B
	Zinc	P-19	44.4	0.758	3.79		J	SW-846 3050B/6020B
	Aluminum	P-58	9,790	45.2	99.4		J	SW-846 3050B/6020B
	Antimony	P-58	0.329	0.329	2	U	2.0UJ	SW-846 3050B/6010D
	Arsenic	P-58	3.14	0.336	0.994		None	SW-846 3050B/6020B
	Beryllium	P-58	0.383	0.0199	0.0994		None	SW-846 3050B/6020B
	Cadmium	P-58	0.198	0.0199	0.199	J	None	SW-846 3050B/6020B
	Chromium	P-58	7.93	0.199	0.596		J+	SW-846 3050B/6020B
	Copper	P-58	9.56	0.0656	0.398	B	None	SW-846 3050B/6020B
	Iron	P-58	10,400	65.6	199	B	J	SW-846 3050B/6020B
	Lead	P-58	15.2	0.0994	0.398	*	J	SW-846 3050B/6020B
	Magnesium	P-58	4,190	1.99	5.96		None	SW-846 3050B/6020B
	Nickel	P-58	7.38	0.0994	0.398		None	SW-846 3050B/6020B
	Selenium	P-58	0.996	0.358	0.994		None	SW-846 3050B/6020B
	Silver	P-58	0.0998	0.0998	0.499	U	None	SW-846 3050B/6010D
	Thallium	P-58	0.139	0.139	0.398	U	None	SW-846 3050B/6020B
	Uranium, total	P-58	0.77	0.0131	0.0398		None	SW-846 3050B/6020B
	Zinc	P-58	40.3	0.795	3.98		J	SW-846 3050B/6020B
	Aluminum	P-61	5,970	4.45	9.78		J	SW-846 3050B/6020B
	Antimony	P-61	0.308	0.308	1.87	U	1.87UJ	SW-846 3050B/6010D
	Arsenic	P-61	2.17	0.331	0.978		None	SW-846 3050B/6020B
	Beryllium	P-61	0.286	0.0196	0.0978		None	SW-846 3050B/6020B
	Cadmium	P-61	0.286	0.0196	0.196		J+	SW-846 3050B/6020B
	Chromium	P-61	6.49	0.196	0.587		J+	SW-846 3050B/6020B
	Copper	P-61	8.82	0.0646	0.391		J	SW-846 3050B/6020B
	Iron	P-61	5,580	6.46	19.6		J	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Lead	P-61	13	0.0978	0.391	N	J	SW-846 3050B/6020B
	Magnesium	P-61	2,690	1.96	5.87		None	SW-846 3050B/6020B
	Nickel	P-61	5.02	0.0978	0.391		J	SW-846 3050B/6020B
	Selenium	P-61	0.486	0.352	0.978	JN	J	SW-846 3050B/6020B
	Silver	P-61	0.0935	0.0935	0.467	U	None	SW-846 3050B/6010D
	Thallium	P-61	0.137	0.137	0.391	U	None	SW-846 3050B/6020B
	Uranium, total	P-61	0.408	0.0129	0.0391	B	None	SW-846 3050B/6020B
	Zinc	P-61	29.3	0.783	3.91		J+	SW-846 3050B/6020B
	Aluminum	P-63	13,000	45.3	99.6		J	SW-846 3050B/6020B
	Antimony	P-63	0.302	0.302	1.83	U	1.83UJ	SW-846 3050B/6010D
	Arsenic	P-63	2.67	0.337	0.996		None	SW-846 3050B/6020B
	Beryllium	P-63	0.493	0.0199	0.0996		None	SW-846 3050B/6020B
	Cadmium	P-63	0.288	0.0199	0.199		None	SW-846 3050B/6020B
	Chromium	P-63	11.8	0.199	0.598		None	SW-846 3050B/6020B
	Copper	P-63	8.71	0.0657	0.398	B	None	SW-846 3050B/6020B
	Iron	P-63	11,600	65.7	199	B	J	SW-846 3050B/6020B
	Lead	P-63	10.1	0.0996	0.398	*	J	SW-846 3050B/6020B
	Magnesium	P-63	3,540	1.99	5.98		None	SW-846 3050B/6020B
	Nickel	P-63	10.1	0.0996	0.398		None	SW-846 3050B/6020B
	Selenium	P-63	0.962	0.359	0.996	J	None	SW-846 3050B/6020B
	Silver	P-63	0.0914	0.0914	0.457	U	None	SW-846 3050B/6010D
	Thallium	P-63	0.139	0.139	0.398	U	None	SW-846 3050B/6020B
	Uranium, total	P-63	0.511	0.0131	0.0398		None	SW-846 3050B/6020B
	Zinc	P-63	33.8	0.797	3.98		J	SW-846 3050B/6020B
	Aluminum	P-64	10,900	43	94.5		J	SW-846 3050B/6020B
	Antimony	P-64	0.314	0.314	1.9	U	1.9UJ	SW-846 3050B/6010D
	Arsenic	P-64	2.6	0.319	0.945		None	SW-846 3050B/6020B
	Beryllium	P-64	0.448	0.0189	0.0945		None	SW-846 3050B/6020B
	Cadmium	P-64	0.238	0.0189	0.189		None	SW-846 3050B/6020B
	Chromium	P-64	6.51	0.189	0.567		None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Copper	P-64	12.3	0.0624	0.378		J	SW-846 3050B/6020B
	Iron	P-64	18,200	62.4	189		J	SW-846 3050B/6020B
	Lead	P-64	10.1	0.0945	0.378	N	J	SW-846 3050B/6020B
	Magnesium	P-64	6,890	1.89	5.67		J	SW-846 3050B/6020B
	Nickel	P-64	8.86	0.0945	0.378		J	SW-846 3050B/6020B
	Selenium	P-64	1.86	0.34	0.945	N	J	SW-846 3050B/6020B
	Silver	P-64	0.0951	0.0951	0.475	U	None	SW-846 3050B/6010D
	Thallium	P-64	0.132	0.132	0.378	U	None	SW-846 3050B/6020B
	Uranium, total	P-64	0.589	0.0125	0.0378	B	None	SW-846 3050B/6020B
	Zinc	P-64	61.9	0.756	3.78		J	SW-846 3050B/6020B
	Aluminum	P-64 DU1	12,600	41.5	91.2		J	SW-846 3050B/6020B
	Antimony	P-64 DU1	0.294	0.294	1.78	U	1.78UJ	SW-846 3050B/6010D
	Arsenic	P-64 DU1	2.98	0.308	0.912		None	SW-846 3050B/6020B
	Beryllium	P-64 DU1	0.526	0.0182	0.0912		None	SW-846 3050B/6020B
	Cadmium	P-64 DU1	0.243	0.0182	0.182		J+	SW-846 3050B/6020B
	Chromium	P-64 DU1	7.5	0.182	0.547		J+	SW-846 3050B/6020B
	Copper	P-64 DU1	14.6	0.0602	0.365		J	SW-846 3050B/6020B
	Iron	P-64 DU1	20,400	60.2	182		J	SW-846 3050B/6020B
	Lead	P-64 DU1	12.2	0.0912	0.365	N	J	SW-846 3050B/6020B
	Magnesium	P-64 DU1	8,140	1.82	5.47		J	SW-846 3050B/6020B
	Nickel	P-64 DU1	9.41	0.0912	0.365		J	SW-846 3050B/6020B
	Selenium	P-64 DU1	2.37	0.328	0.912	N	J	SW-846 3050B/6020B
	Silver	P-64 DU1	0.0891	0.0891	0.446	U	None	SW-846 3050B/6010D
	Thallium	P-64 DU1	0.129	0.128	0.365	J	None	SW-846 3050B/6020B
	Uranium, total	P-64 DU1	0.728	0.012	0.0365	B	None	SW-846 3050B/6020B
	Zinc	P-64 DU1	70	0.73	3.65		J	SW-846 3050B/6020B
	Aluminum	P-64 DU2	10,200	39.7	87.3		J	SW-846 3050B/6020B
	Antimony	P-64 DU2	0.297	0.297	1.8	U	1.8UJ	SW-846 3050B/6010D
	Arsenic	P-64 DU2	2.46	0.295	0.873		None	SW-846 3050B/6020B
	Beryllium	P-64 DU2	0.446	0.0175	0.0873		None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Cadmium	P-64 DU2	0.399	0.0175	0.175		None	SW-846 3050B/6020B
	Chromium	P-64 DU2	6.04	0.175	0.524		None	SW-846 3050B/6020B
	Copper	P-64 DU2	11.7	0.0576	0.349		J	SW-846 3050B/6020B
	Iron	P-64 DU2	16,400	57.6	175		J	SW-846 3050B/6020B
	Lead	P-64 DU2	10.7	0.0873	0.349	N	J	SW-846 3050B/6020B
	Magnesium	P-64 DU2	6,180	1.75	5.24		J	SW-846 3050B/6020B
	Nickel	P-64 DU2	7.64	0.0873	0.349		J	SW-846 3050B/6020B
	Selenium	P-64 DU2	2.04	0.314	0.873	N	J	SW-846 3050B/6020B
	Silver	P-64 DU2	0.0899	0.0899	0.45	U	None	SW-846 3050B/6010D
	Thallium	P-64 DU2	0.122	0.122	0.349	U	None	SW-846 3050B/6020B
	Uranium, total	P-64 DU2	0.583	0.0115	0.0349	B	None	SW-846 3050B/6020B
	Zinc	P-64 DU2	56.3	0.698	3.49		J	SW-846 3050B/6020B
	Aluminum	P-81	10,600	21.9	48.1		J	SW-846 3050B/6020B
	Antimony	P-81	0.315	0.315	1.91	U	1.91UJ	SW-846 3050B/6010D
	Arsenic	P-81	1.75	0.325	0.962		None	SW-846 3050B/6020B
	Beryllium	P-81	0.489	0.0192	0.0962		None	SW-846 3050B/6020B
	Cadmium	P-81	0.142	0.0192	0.192	J	None	SW-846 3050B/6020B
	Chromium	P-81	8.1	0.192	0.577		None	SW-846 3050B/6020B
	Copper	P-81	7.15	0.0635	0.385		None	SW-846 3050B/6020B
	Iron	P-81	8,290	6.35	19.2		J	SW-846 3050B/6020B
	Lead	P-81	8.5	0.0962	0.385		None	SW-846 3050B/6020B
	Magnesium	P-81	2,450	1.92	5.77		None	SW-846 3050B/6020B
	Nickel	P-81	7.2	0.0962	0.385		None	SW-846 3050B/6020B
	Selenium	P-81	0.675	0.346	0.962	JN	J	SW-846 3050B/6020B
	Silver	P-81	0.102	0.0954	0.477	J	None	SW-846 3050B/6010D
	Thallium	P-81	0.135	0.135	0.385	U	None	SW-846 3050B/6020B
	Uranium, total	P-81	0.368	0.0127	0.0385		None	SW-846 3050B/6020B
	Zinc	P-81	24.5	0.769	3.85		J	SW-846 3050B/6020B
	Aluminum	P-82	10,300	21.8	48		J	SW-846 3050B/6020B
	Antimony	P-82	0.314	0.314	1.9	U	1.9UJ	SW-846 3050B/6010D

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Arsenic	P-82	3.35	0.324	0.96		None	SW-846 3050B/6020B
	Beryllium	P-82	0.43	0.0192	0.096		None	SW-846 3050B/6020B
	Cadmium	P-82	0.134	0.0192	0.192	J	J+	SW-846 3050B/6020B
	Chromium	P-82	7.11	0.192	0.576		J+	SW-846 3050B/6020B
	Copper	P-82	7	0.0633	0.384		None	SW-846 3050B/6020B
	Iron	P-82	8,430	6.33	19.2		J	SW-846 3050B/6020B
	Lead	P-82	7.59	0.096	0.384		None	SW-846 3050B/6020B
	Magnesium	P-82	4,210	1.92	5.76		None	SW-846 3050B/6020B
	Nickel	P-82	7.26	0.096	0.384		None	SW-846 3050B/6020B
	Selenium	P-82	0.877	0.345	0.96	JN	J	SW-846 3050B/6020B
	Silver	P-82	0.0951	0.0951	0.475	U	None	SW-846 3050B/6010D
	Thallium	P-82	0.134	0.134	0.384	U	None	SW-846 3050B/6020B
	Uranium, total	P-82	0.608	0.0127	0.0384		None	SW-846 3050B/6020B
	Zinc	P-82	27.5	0.768	3.84		J	SW-846 3050B/6020B
	Aluminum	P-95	10,500	21.9	48.2		J	SW-846 3050B/6020B
	Antimony	P-95	0.319	0.319	1.93	U	1.93UJ	SW-846 3050B/6010D
	Arsenic	P-95	2.03	0.326	0.963		None	SW-846 3050B/6020B
	Beryllium	P-95	0.425	0.0193	0.0963		None	SW-846 3050B/6020B
	Cadmium	P-95	0.155	0.0193	0.193	J	None	SW-846 3050B/6020B
	Chromium	P-95	8.42	0.193	0.578		None	SW-846 3050B/6020B
	Copper	P-95	6.92	0.0636	0.385		None	SW-846 3050B/6020B
	Iron	P-95	7,780	6.36	19.3		J	SW-846 3050B/6020B
	Lead	P-95	8.38	0.0963	0.385		None	SW-846 3050B/6020B
	Magnesium	P-95	2,920	1.93	5.78		None	SW-846 3050B/6020B
	Nickel	P-95	7.27	0.0963	0.385		None	SW-846 3050B/6020B
	Selenium	P-95	0.755	0.347	0.963	JN	J	SW-846 3050B/6020B
	Silver	P-95	0.0965	0.0965	0.483	U	None	SW-846 3050B/6010D
	Thallium	P-95	0.135	0.135	0.385	U	None	SW-846 3050B/6020B

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Table B-5. Nonradiological results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Uranium, total	P-95	0.244	0.0127	0.0385		None	SW-846 3050B/6020B
	Zinc	P-95	23.8	0.771	3.85		J	SW-846 3050B/6020B

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.
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.

Table B-6. Nonradiological results in sediment, 2019

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Community	Aluminum	C-68	3860	4.5	9.9		J	SW-846 3050B/6020B
	Antimony	C-68	0.308	0.308	1.87	U	1.87UJ	SW-846 3050B/6010D
	Arsenic	C-68	7.46	0.335	0.99		None	SW-846 3050B/6020B
	Beryllium	C-68	0.241	0.0198	0.099		None	SW-846 3050B/6020B
	Cadmium	C-68	0.265	0.0198	0.198		J+	SW-846 3050B/6020B
	Chromium	C-68	5.45	0.198	0.594		J+	SW-846 3050B/6020B
	Copper	C-68	4.21	0.0653	0.396		J	SW-846 3050B/6020B
	Iron	C-68	5,160	6.53	19.8		J	SW-846 3050B/6020B
	Lead	C-68	6.05	0.099	0.396	N	J	SW-846 3050B/6020B
	Magnesium	C-68	2,220	1.98	5.94		None	SW-846 3050B/6020B
	Nickel	C-68	5.71	0.099	0.396		J	SW-846 3050B/6020B
	Selenium	C-68	0.859	0.356	0.99	JN	J	SW-846 3050B/6020B
	Silver	C-68	0.467	0.467	2.34	U	None	SW-846 3050B/6010D
	Thallium	C-68	0.139	0.139	0.396	U	None	SW-846 3050B/6020B
	Uranium, Total	C-68	0.987	0.0131	0.0396	B	None	SW-846 3050B/6020B
	Zinc	C-68	15.7	0.792	3.96		J+	SW-846 3050B/6020B
On-Site	Aluminum	S-72	7,880	4.46	9.8		J	SW-846 3050B/6020B
	Antimony	S-72	0.319	0.319	1.93	U	1.93UJ	SW-846 3050B/6010D
	Arsenic	S-72	2.88	0.331	0.98		None	SW-846 3050B/6020B
	Beryllium	S-72	0.408	0.0196	0.098		None	SW-846 3050B/6020B
	Cadmium	S-72	0.165	0.0196	0.196	J	J+	SW-846 3050B/6020B
	Chromium	S-72	10.1	0.196	0.588		J+	SW-846 3050B/6020B
	Copper	S-72	7.54	0.0647	0.392		J	SW-846 3050B/6020B
	Iron	S-72	8,560	6.47	19.6		J	SW-846 3050B/6020B
	Lead	S-72	11.5	0.098	0.392	N	J	SW-846 3050B/6020B
	Magnesium	S-72	3,860	1.96	5.88		J	SW-846 3050B/6020B
	Nickel	S-72	9.27	0.098	0.392		J	SW-846 3050B/6020B
	Selenium	S-72	0.74	0.353	0.98	JN	J	SW-846 3050B/6020B
	Silver	S-72	0.483	0.483	2.41	U	None	SW-846 3050B/6010D

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Table B-6. Nonradiological results in sediment, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Thallium	S-72	0.137	0.137	0.392	U	None	SW-846 3050B/6020B
	Uranium, Total	S-72	0.632	0.0129	0.0392	B	None	SW-846 3050B/6020B
	Zinc	S-72	25.4	0.784	3.92		J+	SW-846 3050B/6020B
	Aluminum	S-74	4,980	4.22	9.28		J	SW-846 3050B/6020B
	Antimony	S-74	0.314	0.314	1.9	U	1.9UJ	SW-846 3050B/6010D
	Arsenic	S-74	1.31	0.314	0.928		None	SW-846 3050B/6020B
	Beryllium	S-74	0.238	0.0186	0.0928		None	SW-846 3050B/6020B
	Cadmium	S-74	0.25	0.0186	0.186		J+	SW-846 3050B/6020B
	Chromium	S-74	3.94	0.186	0.557		J+	SW-846 3050B/6020B
	Copper	S-74	5.68	0.0612	0.371		None	SW-846 3050B/6020B
	Iron	S-74	8,180	6.12	18.6		J	SW-846 3050B/6020B
	Lead	S-74	3.72	0.0928	0.371		None	SW-846 3050B/6020B
	Magnesium	S-74	3,170	1.86	5.57		None	SW-846 3050B/6020B
	Nickel	S-74	4.47	0.0928	0.371		None	SW-846 3050B/6020B
	Selenium	S-74	0.964	0.334	0.928	N	J	SW-846 3050B/6020B
	Silver	S-74	0.0951	0.0951	0.475	U	None	SW-846 3050B/6010D
	Thallium	S-74	0.13	0.13	0.371	U	None	SW-846 3050B/6020B
	Uranium, Total	S-74	0.782	0.0122	0.0371		None	SW-846 3050B/6020B
	Zinc	S-74	29.5	0.742	3.71		J	SW-846 3050B/6020B
	Aluminum	S-74 DU1	4,290	4.34	9.54		J	SW-846 3050B/6020B
	Antimony	S-74 DU1	0.315	0.315	1.91	U	1.91UJ	SW-846 3050B/6010D
	Arsenic	S-74 DU1	1.2	0.323	0.954		None	SW-846 3050B/6020B
	Beryllium	S-74 DU1	0.238	0.0191	0.0954		None	SW-846 3050B/6020B
	Cadmium	S-74 DU1	0.22	0.0189	0.189		J+	SW-846 3050B/6020B
	Chromium	S-74 DU1	3.12	0.191	0.573		J+	SW-846 3050B/6020B
	Copper	S-74 DU1	4.19	0.063	0.382		None	SW-846 3050B/6020B
	Iron	S-74 DU1	7,810	6.24	18.9		J	SW-846 3050B/6020B
	Lead	S-74 DU1	3.23	0.0954	0.382		None	SW-846 3050B/6020B
	Magnesium	S-74 DU1	2,640	1.91	5.73		None	SW-846 3050B/6020B

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Table B-6. Nonradiological results in sediment, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Nickel	S-74 DU1	3.78	0.0954	0.382		None	SW-846 3050B/6020B
	Selenium	S-74 DU1	0.933	0.344	0.954	JN	J	SW-846 3050B/6020B
	Silver	S-74 DU1	0.0956	0.0956	0.478	U	None	SW-846 3050B/6010D
	Thallium	S-74 DU1	0.134	0.134	0.382	U	None	SW-846 3050B/6020B
	Uranium	S-74 DU1	0.65	0.0125	0.0378		None	SW-846 3050B/6020B
	Zinc	S-74 DU1	27.7	0.756	3.78		J	SW-846 3050B/6020B
	Aluminum	S-74 DU2	4,730	4.3	9.45		J	SW-846 3050B/6020B
	Antimony	S-74 DU2	0.323	0.323	1.96	U	1.96UJ	SW-846 3050B/6010D
	Arsenic	S-74 DU2	1.14	0.319	0.945		None	SW-846 3050B/6020B
	Beryllium	S-74 DU2	0.239	0.0189	0.0945		None	SW-846 3050B/6020B
	Cadmium	S-74 DU2	0.194	0.0191	0.191		J+	SW-846 3050B/6020B
	Chromium	S-74 DU2	3.04	0.189	0.567		J+	SW-846 3050B/6020B
	Copper	S-74 DU2	4.66	0.0624	0.378		None	SW-846 3050B/6020B
	Iron	S-74 DU2	6,470	6.3	19.1		J	SW-846 3050B/6020B
	Lead	S-74 DU2	3.45	0.0945	0.378		None	SW-846 3050B/6020B
	Magnesium	S-74 DU2	3,020	1.89	5.67		None	SW-846 3050B/6020B
	Nickel	S-74 DU2	4.27	0.0945	0.378		None	SW-846 3050B/6020B
	Selenium	S-74 DU2	0.71	0.34	0.945	JN	J	SW-846 3050B/6020B
	Silver	S-74 DU2	0.0978	0.0978	0.489	U	None	SW-846 3050B/6010D
	Thallium	S-74 DU2	0.132	0.132	0.378	U	None	SW-846 3050B/6020B
	Uranium	S-74 DU2	0.845	0.0126	0.0382		None	SW-846 3050B/6020B
	Zinc	S-74 DU2	23.9	0.763	3.82		J	SW-846 3050B/6020B
	Aluminum	S-75	3,390	4.47	9.82		J	SW-846 3050B/6020B
	Antimony	S-75	0.287	0.287	1.74	U	1.74UJ	SW-846 3050B/6010D
	Arsenic	S-75	1.06	0.332	0.982		None	SW-846 3050B/6020B
	Beryllium	S-75	0.228	0.0196	0.0982		None	SW-846 3050B/6020B
	Cadmium	S-75	1.74	0.0196	0.196		None	SW-846 3050B/6020B
	Chromium	S-75	4.42	0.196	0.589		J+	SW-846 3050B/6020B
	Copper	S-75	8.01	0.0648	0.393		J	SW-846 3050B/6020B

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Table B-6. Nonradiological results in sediment, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Iron	S-75	4,690	6.48	19.6		J	SW-846 3050B/6020B
	Lead	S-75	3.55	0.0982	0.393	N	J	SW-846 3050B/6020B
	Magnesium	S-75	2,270	1.96	5.89		J	SW-846 3050B/6020B
	Nickel	S-75	5.02	0.0982	0.393		J	SW-846 3050B/6020B
	Selenium	S-75	0.749	0.354	0.982	JN	J	SW-846 3050B/6020B
	Silver	S-75	0.087	0.087	0.435	U	None	SW-846 3050B/6010D
	Thallium	S-75	0.138	0.138	0.393	U	None	SW-846 3050B/6020B
	Uranium, Total	S-75	0.628	0.013	0.0393	B	None	SW-846 3050B/6020B
	Zinc	S-75	14.1	0.786	3.93		J+	SW-846 3050B/6020B
	Aluminum	S-85	6,760	4.43	9.73		J	SW-846 3050B/6020B
	Antimony	S-85	0.32	0.32	1.94	U	1.94UJ	SW-846 3050B/6010D
	Arsenic	S-85	2.61	0.329	0.973		None	SW-846 3050B/6020B
	Beryllium	S-85	0.309	0.0195	0.0973		None	SW-846 3050B/6020B
	Cadmium	S-85	0.125	0.0195	0.195	J	J+	SW-846 3050B/6020B
	Chromium	S-85	8.08	0.195	0.584		J+	SW-846 3050B/6020B
	Copper	S-85	5	0.0642	0.389		J	SW-846 3050B/6020B
	Iron	S-85	7,240	6.42	19.5		J	SW-846 3050B/6020B
	Lead	S-85	7.16	0.0973	0.389	N	J	SW-846 3050B/6020B
	Magnesium	S-85	2,300	1.95	5.84		J	SW-846 3050B/6020B
	Nickel	S-85	7.43	0.0973	0.389		J	SW-846 3050B/6020B
	Selenium	S-85	0.636	0.35	0.973	JN	J	SW-846 3050B/6020B
	Silver	S-85	0.0969	0.0969	0.484	U	None	SW-846 3050B/6010D
	Thallium	S-85	0.136	0.136	0.389	U	None	SW-846 3050B/6020B
	Uranium, Total	S-85	0.464	0.0128	0.0389	B	None	SW-846 3050B/6020B
	Zinc	S-85	20.4	0.778	3.89		J+	SW-846 3050B/6020B
Perimeter	Aluminum	P-60	4,070	4.31	9.47		J	SW-846 3050B/6020B
	Antimony	P-60	0.282	0.282	1.71	U	1.71UJ	SW-846 3050B/6010D
	Arsenic	P-60	1.23	0.32	0.947		None	SW-846 3050B/6020B
	Beryllium	P-60	0.196	0.0189	0.0947		None	SW-846 3050B/6020B

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Table B-6. Nonradiological results in sediment, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Cadmium	P-60	0.0794	0.0189	0.189	J	J+	SW-846 3050B/6020B
	Chromium	P-60	3.94	0.189	0.568		J+	SW-846 3050B/6020B
	Copper	P-60	4.64	0.0625	0.379		J	SW-846 3050B/6020B
	Iron	P-60	6,380	6.25	18.9		J	SW-846 3050B/6020B
	Lead	P-60	7.74	0.0947	0.379	N	J	SW-846 3050B/6020B
	Magnesium	P-60	2,330	1.89	5.68		None	SW-846 3050B/6020B
	Nickel	P-60	4.56	0.0947	0.379		J	SW-846 3050B/6020B
	Selenium	P-60	0.525	0.341	0.947	JN	J	SW-846 3050B/6020B
	Silver	P-60	0.0853	0.0853	0.427	U	None	SW-846 3050B/6010D
	Thallium	P-60	0.133	0.133	0.379	U	None	SW-846 3050B/6020B
	Uranium, Total	P-60	0.539	0.0125	0.0379	B	None	SW-846 3050B/6020B
	Zinc	P-60	18.5	0.758	3.79		J+	SW-846 3050B/6020B
	Aluminum	P-73	6,530	4.17	9.16		J	SW-846 3050B/6020B
	Antimony	P-73	0.325	0.325	1.97	U	1.97UJ	SW-846 3050B/6010D
	Arsenic	P-73	1.79	0.31	0.916		None	SW-846 3050B/6020B
	Beryllium	P-73	0.316	0.0183	0.0916		None	SW-846 3050B/6020B
	Cadmium	P-73	0.497	0.0183	0.183		J+	SW-846 3050B/6020B
	Chromium	P-73	6.44	0.183	0.549		J+	SW-846 3050B/6020B
	Copper	P-73	6.82	0.0604	0.366		J	SW-846 3050B/6020B
	Iron	P-73	9,690	60.4	183		J	SW-846 3050B/6020B
	Lead	P-73	5.39	0.0916	0.366	N	J	SW-846 3050B/6020B
	Magnesium	P-73	3,450	1.83	5.49		J	SW-846 3050B/6020B
	Nickel	P-73	7.1	0.0916	0.366		J	SW-846 3050B/6020B
	Selenium	P-73	0.929	0.33	0.916	N	J	SW-846 3050B/6020B
	Silver	P-73	0.0986	0.0986	0.493	U	None	SW-846 3050B/6010D
	Thallium	P-73	0.128	0.128	0.366	U	None	SW-846 3050B/6020B

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Table B-6. Nonradiological results in sediment, 2019 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Uranium, Total	P-73	0.908	0.0121	0.0366	B	None	SW-846 3050B/6020B
	Zinc	P-73	24.8	0.733	3.66		J+	SW-846 3050B/6020B

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.
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.
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.

Table B-7. Nonradiological results in vegetation, 2019

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Aluminum	S-55	68.1	4.45	9.78	N	J	SW-846 3050B/6020B
	Antimony	S-55	0.325	0.325	1.97	NU	1.97UJ	SW-846 3050B/6010D
	Arsenic	S-55	0.331	0.331	0.978	U	None	SW-846 3050B/6020B
	Beryllium	S-55	0.0196	0.0196	0.0978	U	None	SW-846 3050B/6020B
	Cadmium	S-55	0.0198	0.0196	0.196	J	None	SW-846 3050B/6020B
	Chromium	S-55	0.196	0.196	0.587	U	None	SW-846 3050B/6020B
	Copper	S-55	5.17	0.0646	0.391	B	None	SW-846 3050B/6020B
	Iron	S-55	74.6	6.46	19.6	N	J	SW-846 3050B/6020B
	Lead	S-55	0.115	0.0978	0.391	J	None	SW-846 3050B/6020B
	Magnesium	S-55	1,230	1.96	5.87		None	SW-846 3050B/6020B
	Nickel	S-55	0.457	0.0978	0.391		None	SW-846 3050B/6020B
	Selenium	S-55	0.352	0.352	0.978	U	None	SW-846 3050B/6020B
	Silver	S-55	0.0986	0.0986	0.493	U	None	SW-846 3050B/6010D
	Thallium	S-55	0.137	0.137	0.391	U	None	SW-846 3050B/6020B
	Uranium, Total	S-55	0.0129	0.0129	0.0391	U	None	SW-846 3050B/6020B
	Zinc	S-55	21.5	3.91	19.6	BN	J	SW-846 3050B/6020B
Perimeter	Aluminum	P-82	271	4.17	9.16	N	J	SW-846 3050B/6020B
	Antimony	P-82	0.78	0.311	1.89	JN	J	SW-846 3050B/6010D
	Arsenic	P-82	0.31	0.31	0.916	U	None	SW-846 3050B/6020B
	Beryllium	P-82	0.0183	0.0183	0.0916	U	None	SW-846 3050B/6020B
	Cadmium	P-82	0.0469	0.0183	0.183	J	None	SW-846 3050B/6020B
	Chromium	P-82	0.247	0.183	0.549	J	None	SW-846 3050B/6020B
	Copper	P-82	4.27	0.0604	0.366	B	None	SW-846 3050B/6020B
	Iron	P-82	247	6.04	18.3	N	J	SW-846 3050B/6020B
	Lead	P-82	0.486	0.0916	0.366		None	SW-846 3050B/6020B
	Magnesium	P-82	996	1.83	5.49		None	SW-846 3050B/6020B
	Nickel	P-82	0.578	0.0916	0.366		None	SW-846 3050B/6020B
	Selenium	P-82	0.553	0.33	0.916	J	None	SW-846 3050B/6020B
	Silver	P-82	0.0943	0.0943	0.472	U	None	SW-846 3050B/6010D
	Thallium	P-82	0.128	0.128	0.366	U	None	SW-846 3050B/6020B

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Table B-7. Nonradiological results in vegetation, 2019 (continued)

Location Classification	Analyte	Location	Result (µg/kg)	MDL (µg/kg)	PQL (µg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Uranium, Total	P-82	0.0145	0.0121	0.0366	J	None	SW-846 3050B/6020B
	Zinc	P-82	14.9	0.733	3.66	BN	J	SW-846 3050B/6020B

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.
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.
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.

Table B-8. Perchlorate results in soil, 2019

Location Classification	Analyte	Location	Result (µg/kg)	MDL (µg/kg)	PQL (µg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Perchlorate	S-53	0.0135	0.0135	0.0396	NUh	UJ	EPA 314.0
	Perchlorate	S-53 DU1	0.0134	0.0134	0.0394	NUh	UJ	EPA 314.0
	Perchlorate	S-53 DU2	0.0135	0.0135	0.0397	NUh	UJ	EPA 314.0

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
H = The analytical holding time was exceeded.
N = A spike was outside limits.
U = The analyte was absent or below the method detection limit.

Data Validation Qualifier
UJ = The analyte was analyzed for but was not detected. The associated value was an estimate and might be inaccurate or imprecise.

Table B-9. High explosive compound results in soil, 2019

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	49.5	49.5	149	U	None	SW-846 8330A
	Amino-4,6-dinitrotoluene, 2-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Dinitrobenzene, 1,3-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,4-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,6-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	HMX	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Nitro-benzene	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 2-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 3-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 4-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Pentaerythritol tetranitrate	S-90	81.7	81.7	495	U	None	SW-846 8330A
	RDX	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Tetryl	S-90	49.5	49.5	149	NU	UJ	SW-846 8330A
	Trinitrobenzene, 1,3,5-	S-90	49.5	49.5	149	U	None	SW-846 8330A
	Trinitrotoluene, 2,4,6-	S-90	49.5	49.5	149	NU	None	SW-846 8330A
	Amino-2,6-dinitrotoluene, 4-	S-93	50	50	150	U	None	SW-846 8330A
	Amino-4,6-dinitrotoluene, 2-	S-93	50	50	150	U	None	SW-846 8330A
	Dinitrobenzene, 1,3-	S-93	50	50	150	U	None	SW-846 8330A
	Dinitrotoluene, 2,4-	S-93	50	50	150	U	None	SW-846 8330A
	Dinitrotoluene, 2,6-	S-93	50	50	150	U	None	SW-846 8330A
	HMX	S-93	50	50	150	U	None	SW-846 8330A
	Nitro-benzene	S-93	50	50	150	U	None	SW-846 8330A
	Nitrotoluene, 2-	S-93	50	50	150	U	None	SW-846 8330A
	Nitrotoluene, 3-	S-93	50	50	150	U	None	SW-846 8330A
	Nitrotoluene, 4-	S-93	50	50	150	U	None	SW-846 8330A
	Pentaerythritol tetranitrate	S-93	82.5	82.5	500	U	None	SW-846 8330A
	RDX	S-93	50	50	150	U	None	SW-846 8330A
	Tetryl	S-93	50	50	150	NU	UJ	SW-846 8330A

Table continued on next page

Table B-9. High explosive compound results in soil, 2019 (continued)

Location Classification	Analyte	Location	Result (µg/kg)	MDL (µg/kg)	PQL (µg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Trinitrobenzene, 1,3,5-	S-93	50	50	150	U	None	SW-846 8330A
	Trinitrotoluene, 2,4,6-	S-93	50	50	150	NU	None	SW-846 8330A
	Amino-2,6-dinitrotoluene, 4-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Amino-4,6-dinitrotoluene, 2-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Dinitrobenzene, 1,3-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,4-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,6-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	HMX	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Nitro-benzene	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Nitrotoluene, 2-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Nitrotoluene, 3-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Nitrotoluene, 4-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Pentaerythritol tetranitrate	S-94	82.1	82.1	498	U	None	SW-846 8330A
	RDX	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Tetryl	S-94	49.8	49.8	149	NU	UJ	SW-846 8330A
	Trinitrobenzene, 1,3,5-	S-94	49.8	49.8	149	U	None	SW-846 8330A
	Trinitrotoluene, 2,4,6-	S-94	49.8	49.8	149	NU	None	SW-846 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
N = A spike was outside limits.
U = The analyte was absent or below the method detection limit.

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 2019

Apache plume (*Fallugia paradoxa*)

Table C-1. Ambient air metals analysis, FY 2019

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
A3PM	10-Dec-2018	Aluminum	0.0539	0.08	0.0272	J
		Antimony	<0.00132	0.004	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00343	0.002	0.0004	
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.855	0.1	0.032	B
		Chromium	0.00278	0.002	0.0006	
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.0364	0.004	0.0012	
		Iron	0.0789	0.1	0.032	J
		Lead	0.00262	0.004	0.00132	J
		Magnesium	0.0728	0.12	0.034	J
		Manganese	0.00148	0.004	0.0008	J
		Nickel	0.00132	0.002	0.0006	J
		Potassium	0.059	0.1	0.0256	J
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.841	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	0.0185	0.004	0.0016	
	1-Mar-2019	Aluminum	0.0763	0.08	0.0272	J
		Antimony	<0.00132	0.004	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00314	0.002	0.0004	
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	1.37	0.1	0.032	

Table continued on next page

Table C-1. Ambient air metals analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
A3PM	1-Mar-2019	Chromium	0.00315	0.002	0.0006	
		Cobalt	0.000772	0.002	0.0006	J
		Copper	0.011	0.004	0.0012	
		Iron	0.114	0.1	0.032	
		Lead	0.00139	0.004	0.00132	J
		Magnesium	0.0894	0.12	0.034	J
		Manganese	0.00329	0.004	0.0008	J
		Nickel	0.000795	0.002	0.0006	J
		Potassium	0.0553	0.1	0.0256	J
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.7	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	0.0473	0.004	0.0016	
	23-May-2019	Aluminum	0.113	0.08	0.0272	
		Antimony	0.00304	0.008	0.00132	J
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00302	0.002	0.0004	B
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.556	0.1	0.032	
		Chromium	0.00361	0.004	0.0006	J
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.00813	0.008	0.0012	
		Iron	0.125	0.1	0.032	
		Lead	0.00149	0.008	0.00132	J
		Magnesium	0.121	0.12	0.034	
		Manganese	0.0034	0.004	0.0008	J

Table continued on next page

Table C-1. Ambient air metals analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
A3PM	23-May-2019	Nickel	0.000727	0.002	0.0006	J
		Potassium	0.0726	0.1	0.0256	J
		Selenium	0.00533	0.012	0.002	JB
		Silver	<0.0004	0.002	0.0004	U
		Sodium	1.05	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	0.0267	0.008	0.0016	B
	22-Jul-2019	Aluminum	0.125	0.08	0.0272	
		Antimony	0.00203	0.008	0.00132	JB
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00466	0.002	0.0004	
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.614	0.1	0.032	
		Chromium	0.00905	0.004	0.0006	
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.0157	0.008	0.0012	
		Iron	0.191	0.1	0.032	
		Lead	0.00517	0.008	0.00132	J
		Magnesium	0.108	0.12	0.034	J
		Manganese	0.0112	0.004	0.0008	B
		Nickel	0.00101	0.002	0.0006	J
		Potassium	0.0526	0.1	0.0256	J
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.753	0.1	0.028	
		Thallium	<0.002	0.008	0.002	U
		Uranium	<0.0000264	0.00008	0.0000264	U

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Table C-1. Ambient air metals analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
A3PM	22-Jul-2019	Vanadium	0.000457	0.002	0.0004	J
		Zinc	0.0374	0.008	0.0016	B
BKPM	10-Dec-2018	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	0.00157	0.004	0.00132	J
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.000874	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	0.000653	0.002	0.0004	J
		Calcium	0.839	0.1	0.032	B
		Chromium	0.00255	0.002	0.0006	
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.00127	0.004	0.0012	J
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.004	0.00132	U
		Magnesium	0.0646	0.12	0.034	J
		Manganese	<0.0008	0.004	0.0008	U
		Nickel	0.000831	0.002	0.0006	J
		Potassium	0.0476	0.1	0.0256	J
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.791	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	0.0198	0.004	0.0016	
	1-Mar-2019	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	<0.00132	0.004	0.00132	U
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.000925	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U

Table continued on next page

Table C-1. Ambient air metals analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
BKPM	1-Mar-2019	Cadmium	<0.0004	0.002	0.0004	U
		Calcium	1.06	0.1	0.032	
		Chromium	0.0035	0.002	0.0006	
		Cobalt	0.000619	0.002	0.0006	J
		Copper	0.002	0.004	0.0012	J
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.004	0.00132	U
		Magnesium	0.084	0.12	0.034	J
		Manganese	<0.0008	0.004	0.0008	U
		Nickel	0.000602	0.002	0.0006	J
		Potassium	0.0344	0.1	0.0256	J
		Selenium	<0.002	0.012	0.002	U
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.909	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	0.0319	0.004	0.0016	
	23-May-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	0.00128	0.002	0.0004	JB
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.329	0.1	0.032	
		Chromium	0.00262	0.004	0.0006	J
		Cobalt	<0.0006	0.002	0.0006	U
		Copper	0.00133	0.008	0.0012	J
		Iron	<0.032	0.1	0.032	U
		Lead	<0.00132	0.008	0.00132	U

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Table C-1. Ambient air metals analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
BKPM	23-May-2019	Magnesium	0.0538	0.12	0.034	J
		Manganese	0.000888	0.004	0.0008	J
		Nickel	0.000771	0.002	0.0006	J
		Potassium	0.0552	0.1	0.0256	J
		Selenium	0.00259	0.012	0.002	JB
		Silver	<0.0004	0.002	0.0004	U
		Sodium	0.858	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	0.0411	0.008	0.0016	B
	22-Jul-2019	Aluminum	<0.0272	0.08	0.0272	U
		Antimony	0.00193	0.008	0.00132	JB
		Arsenic	<0.002	0.012	0.002	U
		Barium	0.00084	0.002	0.0004	J
		Beryllium	<0.0004	0.002	0.0004	U
		Cadmium	<0.0004	0.002	0.0004	U
		Calcium	0.332	0.1	0.032	
		Chromium	0.00274	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	0.00134	0.008	0.00132	J
		Magnesium	0.0505	0.12	0.034	J
		Manganese	0.000948	0.004	0.0008	JB
		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	0.705	0.1	0.028	

Table continued on next page

Table C-1. Ambient air metals analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
BKPM	22-Jul-2019	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	0.0256	0.008	0.0016	B

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 2019

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
A3PM	10-Dec-18	Actinium-228	13.3	32.6	27.9	13.3	U
		Alpha, gross	6.09	2.15	2.75	1.22	
		Americium-241	−0.334	6.76	6.42	3.11	U
		Beryllium-7	274	64.3	48	23	
		Beta, gross	27.5	1.91	1.86	0.9	
		Bismuth-212	50.7	51	85.2	40.5	U
		Bismuth-214	12	20.4	12	5.74	U
		Cesium-137	−2.98	3.7	5.72	2.71	U
		Cobalt-60	1.11	3.13	5.9	2.71	U
		Lead-212	−0.549	9.67	10.7	5.19	U
		Lead-214	4.04	16.1	13.8	6.66	U
		Neptunium-237	−1.15	5.94	9.72	4.67	U
		Potassium-40	−63.6	93	96.9	46.1	U
		Radium-223	52.3	62.1	99.4	47.9	U
		Radium-224	−111	96.1	86.9	42	U
		Radium-226	−140	149	125	61	U
		Radium-228	13.3	32.6	27.9	13.3	U
		Sodium-22	2.66	3.41	6.31	2.93	U
		Thorium-227	−11.8	23.8	34.8	16.7	U
		Thorium-231	19.6	52.5	39.3	19.1	U
		Thorium-234	−107	105	102	50	U
		Uranium-235	−13.7	31.2	28.3	13.8	U
		Uranium-238	−107	105	102	50	U
	1-Mar-19	Actinium-228	33	33.1	33	15.2	U
		Alpha, gross	20.8	6.11	7.56	3.39	
		Americium-241	0.853	27.7	44.6	21.7	U
		Beryllium-7	439	89.2	62.6	30	
		Beta, gross	74.8	5.8	5.7	2.74	
		Bismuth-212	27.8	60.1	109	51.8	U
		Bismuth-214	14.5	18	16	7.66	U

Table continued on next page

Table C-2. Ambient air radiological analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
A3PM	1-Mar-19	Cesium-137	−0.175	4.17	7.56	3.6	U
		Cobalt-60	3.96	4.66	8.27	3.87	U
		Lead-212	−7.06	11.8	13.2	6.45	U
		Lead-214	−0.156	17.2	17.4	8.44	U
		Neptunium-237	2.94	7.76	13.3	6.45	U
		Potassium-40	11.1	126	72.5	33.6	U
		Radium-223	7.12	74.6	128	62	U
		Radium-224	−148	101	119	57.6	U
		Radium-226	−97.3	162	181	89	U
		Radium-228	33	33.1	33	15.2	U
		Sodium-22	8.55	5.16	6.51	3	X
		Thorium-227	−14.1	29.8	49.1	23.8	U
		Thorium-231	−53.8	109	107	52.3	U
		Thorium-234	−383	615	453	221	U
		Uranium-235	−20.2	42.4	42.7	20.8	U
		Uranium-238	−383	615	453	221	U
	23-May-19	Actinium-228	4.08	29.9	30.4	14.5	U
		Alpha, gross	4.45	1.49	1.67	0.705	
		Americium-241	6.22	11	18.5	8.96	U
		Beryllium-7	323	67.6	51.8	24.8	
		Beta, gross	16.1	2.27	2.88	1.38	
		Bismuth-212	25.4	48.9	86.3	41	U
		Bismuth-214	−10	15.6	14.7	7.09	U
		Cesium-137	−7.21	8.61	8.06	3.88	U
		Cobalt-60	2.38	3.44	6.4	2.96	U
		Lead-212	3.98	12.5	9.23	4.47	U
		Lead-214	−11.1	17.5	13.4	6.47	U
		Neptunium-237	2.43	6.55	11	5.28	U
		Potassium-40	−17	85.7	90.7	43	U
		Radium-223	32.3	69.7	107	51.7	U

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Table C-2. Ambient air radiological analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
A3PM	23-May-19	Radium-224	−155	139	100	48.7	U
		Radium-226	19.6	183	159	77.8	U
		Radium-228	4.08	29.9	30.4	14.5	U
		Sodium-22	−1.39	3.22	5.62	2.58	U
		Thorium-227	−32.9	29.3	39.3	18.9	U
		Thorium-231	−15.2	68.8	59.9	29.1	U
		Thorium-234	23.3	233	154	74.4	U
		Uranium-235	7.96	43.4	29.1	14.1	U
		Uranium-238	23.3	233	154	74.4	U
	22-Jul-19	Actinium-228	0.778	37.5	26.5	12.6	U
		Alpha, gross	2.56	2.95	4.94	2.26	U
		Americium-241	5.51	18	33	16	U
		Beryllium-7	240	63.3	44.8	21.4	
		Beta, gross	39.7	6.59	9.31	4.54	
		Bismuth-212	101	97.9	80.8	38.2	X
		Bismuth-214	4.87	29.7	14.8	7.05	U
		Cesium-137	1.66	3.72	6.58	3.13	U
		Cobalt-60	7.64	6.09	9.89	4.64	U
		Lead-212	14.7	13.1	8.11	3.92	X
		Lead-214	−5.75	15	16.1	7.76	U
		Neptunium-237	2.61	6.18	10.3	4.95	U
		Potassium-40	−12.6	123	108	50.9	U
		Radium-223	30.1	59.1	97.9	47.1	U
		Radium-224	−12.1	57.5	87.9	42.5	U
		Radium-226	30.1	665	89.9	43.5	U
		Radium-228	0.778	37.5	26.5	12.6	U
		Sodium-22	−1.63	4.71	7.99	3.7	U
		Thorium-227	28.4	32.8	38.7	18.7	U
		Thorium-231	14.7	55.8	39.8	19.3	U
		Thorium-234	34.6	120	96.2	47.1	U

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Table C-2. Ambient air radiological analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
A3PM	22-Jul-19	Uranium-235	0.835	40.5	26.3	12.7	U
		Uranium-238	34.6	120	96.2	47.1	U
BKPM	10-Dec-18	Actinium-228	31.9	24.8	31.9	15.1	U
		Alpha, gross	6.95	2.3	2.78	1.21	
		Americium-241	12.4	19	32.1	15.5	U
		Beryllium-7	16.6	33.9	59.9	28.6	U
		Beta, gross	17	1.73	2.12	1.03	
		Bismuth-212	−9.43	57.3	96.7	45.7	U
		Bismuth-214	−7.52	16.3	17.9	8.61	U
		Cesium-137	0.0671	4.21	7.28	3.45	U
		Cobalt-60	2.93	4.79	8.62	4.01	U
		Lead-212	−6.59	13.6	12.2	5.92	U
		Lead-214	8.51	18.3	16.3	7.89	U
		Neptunium-237	−3.95	6.96	11.9	5.72	U
		Potassium-40	11	122	84.1	39	U
		Radium-223	36	68	122	58.8	U
		Radium-224	−168	105	107	51.8	U
		Radium-226	−141	160	158	77.2	U
		Radium-228	31.9	24.8	31.9	15.1	U
		Sodium-22	−1.35	4.66	7.99	3.7	U
		Thorium-227	12.6	28.8	47.9	23.1	U
		Thorium-231	−11	80	77.7	37.7	U
		Thorium-234	151	428	327	159	U
		Uranium-235	−15	39.1	35.8	17.4	U
		Uranium-238	151	428	327	159	U
	1-Mar-19	Actinium-228	−11.2	26.1	29.2	13.9	U
		Alpha, gross	3.01	3.89	6.63	2.93	U
		Americium-241	2.01	17.5	28.3	13.7	U
		Beryllium-7	4.31	32	56	26.9	U
		Beta, gross	1.93	4.54	7.71	3.74	U

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Table C-2. Ambient air radiological analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
BKPM	1-Mar-19	Bismuth-212	49	53.5	88.4	42.1	U
		Bismuth-214	16.1	18.6	13	6.25	X
		Cesium-137	−1.51	3.78	6.21	2.95	U
		Cobalt-60	−1.36	3.79	6.45	2.99	U
		Lead-212	6.98	13.2	10.1	4.91	U
		Lead-214	8.11	17.1	13	6.29	U
		Neptunium-237	−3.75	7.29	11	5.32	U
		Potassium-40	−44.2	89.7	93.8	44.5	U
		Radium-223	−52.3	68	109	52.7	U
		Radium-224	17.6	65.9	107	52.1	U
		Radium-226	0.822	202	113	55	U
		Radium-228	−11.2	26.1	29.2	13.9	U
		Sodium-22	1.14	3.29	6.06	2.8	U
		Thorium-227	8.91	24.8	44.4	21.5	U
		Thorium-231	56.8	48.8	73.2	35.6	U
		Thorium-234	14.1	336	303	148	U
		Uranium-235	13.2	41.9	32.6	15.9	U
		Uranium-238	14.1	336	303	148	U
	23-May-19	Actinium-228	−30.9	46.5	33.1	15.8	U
		Alpha, gross	2.01	1.84	3.04	1.41	U
		Americium-241	−8.91	25.8	45.4	22.1	U
		Beryllium-7	−19.9	36.8	59.3	28.4	U
		Beta, gross	1.19	1.44	2.42	1.17	U
		Bismuth-212	54.5	58.1	101	48	U
		Bismuth-214	16.8	24.2	18.3	8.85	U
		Cesium-137	−2.31	4.49	7.17	3.41	U
		Cobalt-60	−3.87	4.63	7.1	3.28	U
		Lead-212	−4.18	11.7	13.6	6.65	U
		Lead-214	−2.09	16.6	16.6	8.04	U
		Neptunium-237	−5.98	8.03	12.6	6.1	U

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Table C-2. Ambient air radiological analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
BKPM	23-May-19	Potassium-40	4.09	121	66.7	30.7	U
		Radium-223	46.5	76.3	130	62.9	U
		Radium-224	−214	123	117	57	U
		Radium-226	34	204	118	57.2	U
		Radium-228	−30.9	46.5	33.1	15.8	U
		Sodium-22	−0.56	4.1	7.31	3.4	U
		Thorium-227	−23.2	30.6	48.1	23.3	U
		Thorium-231	−35.3	104	102	49.7	U
		Thorium-234	−484	446	444	217	U
		Uranium-235	−27.6	45	40.1	19.5	U
		Uranium-238	−484	446	444	217	U
	22-Jul-19	Actinium-228	−11.9	29.2	32.2	15.3	U
		Alpha, gross	2.06	2.66	4.36	1.98	U
		Americium-241	2.41	3.89	6.47	3.13	U
		Beryllium-7	6.74	34.4	61.1	29.2	U
		Beta, gross	0.742	5.4	9.25	4.51	U
		Bismuth-212	−9.45	56.5	95.4	45	U
		Bismuth-214	2.4	15.5	12.5	6	U
		Cesium-137	−0.124	4.38	7.54	3.58	U
		Cobalt-60	3.22	3.79	6.9	3.21	U
		Lead-212	−11.1	18.1	12.4	6	U
		Lead-214	−7.63	16.5	12.8	6.16	U
		Neptunium-237	2.61	6.97	12.7	6.1	U
		Potassium-40	−40.9	80.6	100	47.6	U
		Radium-223	13.3	69.2	126	60.6	U
		Radium-224	−129	93.1	110	53	U
		Radium-226	−104	166	160	78	U
		Radium-228	−11.9	29.2	32.2	15.3	U
		Sodium-22	−2.39	3.78	6.25	2.89	U
		Thorium-227	7.77	28.3	47.4	22.8	U

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Table C-2. Ambient air radiological analysis, FY 2019 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
BKPM	22-Jul-19	Thorium-231	−52.5	86.1	75.8	36.7	U
		Thorium-234	−285	369	310	151	U
		Uranium-235	−11.6	35.3	35.3	17.1	U
		Uranium-238	−285	369	310	151	U

FY = fiscal year
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 Results in 2019

Summer stormwater

Table D-1. MSGP stormwater sampling results, 2019

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-47	29-Jul-19	Ammonia	1.02	0.017	0.05	Unfiltered
		Cadmium	0.00224	0.0003	0.001	Filtered
		Chemical oxygen demand	34.4	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.0829	0.0005	0.002	Filtered
		Silver	0.000962	0.0003	0.001	Filtered
	4-Oct-19	Ammonia	0.851	0.017	0.05	Unfiltered
		Cadmium	<0.0003	0.0003	0.001	Filtered
		Chemical oxygen demand	94.8	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		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

MSGP = Multi-Sector General Permit

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

SWSP = stormwater sampling point

Table D-2. MS4 sampling results, July 1, 2018, through June 30, 2019

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Sample Preparation	Units
SWSP-02	31-Jul-18	Alpha, gross	30.2	0.542	1.32	Unfiltered	pCi/L
		Beta, gross	25.1	1.17	2.39	Unfiltered	pCi/L
		E. Coli	1,607		10	Unfiltered	CFU/100 mL
	20-Sep-18	Alpha, gross	11.2	0.429	0.997	Unfiltered	pCi/L
		Biochemical oxygen demand	23		2	Unfiltered	mg/L
		Beta, gross	13.9	0.289	0.608	Unfiltered	pCi/L
		Chemical oxygen demand	79	8.95	20	Unfiltered	mg/L
		E. Coli	12,033		10	Unfiltered	CFU/100 mL
		Grease and oil	1.35	1.26	4.5	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.653	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	2.32	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.111	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.377	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	110	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	138	5.7	25	Unfiltered	mg/L
		Total PCB congeners	43,200		108	Unfiltered	pg/L
	24-Oct-18	Alpha, gross	6.8	0.257	0.59	Unfiltered	pCi/L
		Beta, gross	9.63	0.426	0.973	Unfiltered	pCi/L
		Chemical oxygen demand	45.9	8.95	20	Unfiltered	mg/L
		E. Coli	1,046.2		1	Unfiltered	CFU/100 mL
		Grease and oil	<1.23	1.23	4.39	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.619	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	1.1	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.0929	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.251	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	101	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	130	5.7	25	Unfiltered	mg/L
		Total PCB congeners	7,480		105	Unfiltered	pg/L
	23-Apr-19	Grease and oil	1.39	1.3	4.63	Unfiltered	mg/L

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Table D-2. Municipal Separate Storm Sewer System sampling results, July 1, 2018, through June 30, 2019 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Sample Preparation	Units
SWSP-05	31-Jul-18	Alpha, gross	9.42	1.15	2.48	Unfiltered	pCi/L
		Biochemical oxygen demand	7		2	Unfiltered	mg/L
		Beta, gross	12.6	0.919	1.9	Unfiltered	pCi/L
		Chemical oxygen demand	75.2	8.95	20	Unfiltered	mg/L
		E. Coli	813		10	Unfiltered	CFU/100 mL
		Grease and oil	<1.3	1.3	4.63	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.696	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	1.47	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.0643	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.267	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	95.7	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	124	5.7	25	Unfiltered	mg/L
	20-Sep-18	Alpha, gross	6.85	0.425	0.99	Unfiltered	pCi/L
		Biochemical oxygen demand	25		2	Unfiltered	mg/L
		Beta, gross	10.4	0.42	0.869	Unfiltered	pCi/L
		Chemical oxygen demand	106	8.95	20	Unfiltered	mg/L
		E. Coli	110		10	Unfiltered	CFU/100 mL
		Grease and oil	1.53	1.26	4.5	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.725	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	2.25	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.132	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.222	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	101	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	79	5.7	25	Unfiltered	mg/L
		Total PCB congeners	4,030		103	Unfiltered	pg/L
	24-Oct-18	Alpha, gross	3.39	0.253	0.567	Unfiltered	pCi/L
		Biochemical oxygen demand	14		2	Unfiltered	mg/L
		Beta, gross	9.71	0.429	0.967	Unfiltered	pCi/L
		Chemical oxygen demand	88.6	8.95	20	Unfiltered	mg/L
		E. Coli	2,419.6		1	Unfiltered	CFU/100 mL
		Grease and oil	1.3	1.22	4.35	Unfiltered	mg/L

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Table D-2. Municipal Separate Storm Sewer System sampling results, July 1, 2018, through June 30, 2019 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Sample Preparation	Units
SWSP-05	24-Oct-18	Nitrate plus nitrite as N	0.491	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	1.07	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.0668	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.146	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	98.6	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	41	5.7	25	Unfiltered	mg/L
		Total PCB congeners	2,450		103	Unfiltered	pg/L
SWSP-24	20-Sep-18	Alpha, gross	2.24	0.385	0.976	Unfiltered	pCi/L
		Biochemical oxygen demand	24		2	Unfiltered	mg/L
		Beta, gross	12.6	0.232	0.482	Unfiltered	pCi/L
		Chemical oxygen demand	130	8.95	20	Unfiltered	mg/L
		E. Coli	>24,196		10	Unfiltered	CFU/100 mL
		Nitrate plus nitrite as N	0.78	0.085	0.25	Unfiltered	mg/L
		Nitrogen, Kjeldahl	2.47	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.108	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.143	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	82.9	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	39	5.7	25	Unfiltered	mg/L
		Total PCB congeners	9,470		104	Unfiltered	pg/L
SWSP-35	20-Sep-18	Alpha, gross	1.67	0.391	0.989	Unfiltered	pCi/L
		Biochemical oxygen demand	25		2	Unfiltered	mg/L
		Beta, gross	11	0.215	0.448	Unfiltered	pCi/L
		Chemical oxygen demand	126	8.95	20	Unfiltered	mg/L
		E. Coli	110		10	Unfiltered	CFU/100 mL
		Nitrate plus nitrite as N	0.942	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	2.43	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.104	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.156	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	82.9	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	28	5.7	25	Unfiltered	mg/L
		Total PCB congeners	5,220		103	Unfiltered	pg/L

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Table D-2. Municipal Separate Storm Sewer System sampling results, July 1, 2018, through June 30, 2019 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Sample Preparation	Units
SWSP-35	24-Oct-18	Alpha, gross	1.2	0.252	0.543	Unfiltered	pCi/L
		Biochemical oxygen demand	14		2	Unfiltered	mg/L
		Beta, gross	11.1	0.436	0.972	Unfiltered	pCi/L
		Chemical oxygen demand	68.9	8.95	20	Unfiltered	mg/L
		E. Coli	4.1		1	Unfiltered	CFU/100 mL
		Grease and oil	1.33	1.33	4.76	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.745	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	1.18	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.0551	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.101	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	78.6	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	25	5.7	25	Unfiltered	mg/L
		Total PCB congeners	2,540		106	Unfiltered	pg/L
	31-Oct-18	Alpha, gross	5.31	0.171	0.391	Unfiltered	pCi/L
		Biochemical oxygen demand	23		2	Unfiltered	mg/L
		Beta, gross	20.7	0.262	0.543	Unfiltered	pCi/L
		Chemical oxygen demand	85.5	8.95	20	Unfiltered	mg/L
		E. Coli	4		1	Unfiltered	mg/L
		Grease and oil	1.7	1.25	4.46	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.795	0.085	0.25	Unfiltered	mg/L
		Nitrogen, Kjeldahl	1.18	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.104	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.124	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	58.6	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	27	5.7	25	Unfiltered	mg/L
		Total PCB congeners	2,380		111	Unfiltered	pg/L
	18-Apr-19	Alpha, gross	1.58	0.493	1.09	Unfiltered	pCi/L
		Biochemical oxygen demand	17		2	Unfiltered	mg/L
		Beta, gross	13.7	0.888	1.83	Unfiltered	pCi/L
		Chemical oxygen demand	267	8.95	20	Unfiltered	mg/L
		E. Coli	20		10	Unfiltered	CFU/100 mL

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Table D-2. Municipal Separate Storm Sewer System sampling results, July 1, 2018, through June 30, 2019 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Sample Preparation	Units
SWSP-35	18-Apr-19	Grease and oil	3.15	1.26	4.5	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.747	0.017	0.05	Unfiltered	mg/L
		Nitrogen, Kjeldahl	0.779	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.0919	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.124	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	72.9	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	12	5.7	25	Unfiltered	mg/L
		Total PCB congeners	1,320		108	Unfiltered	pg/L
	23-Apr-19	Alpha, gross	0.541	0.75	1.6	Unfiltered	pCi/L
		Biochemical oxygen demand	19		2	Unfiltered	mg/L
		Beta, gross	8.71	1.04	2.14	Unfiltered	pCi/L
		Chemical oxygen demand	62.8	8.95	20	Unfiltered	mg/L
		E. Coli	816.4		1	Unfiltered	CFU/100 mL
		Grease and oil	<1.33	1.33	4.76	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.265	0.017	0.05	Filtered	mg/L
		Nitrogen, Kjeldahl	0.799	0.033	0.1	Unfiltered	mg/L
		Phosphorus, dissolved	0.0707	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.111	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	14.3	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	23.6	2.28	10	Unfiltered	mg/L
		Total PCB congeners	6,270		111	Unfiltered	pg/L
SWSP-36	31-Jul-18	Alpha, gross	4.34	0.558	1.24	Unfiltered	pCi/L
		Biochemical oxygen demand	9		2	Unfiltered	mg/L
		Beta, gross	8.55	0.876	1.81	Unfiltered	pCi/L
		E. Coli	11		1	Unfiltered	CFU/100 mL
		Nitrate plus nitrite as N	0.664	0.017	0.05	Unfiltered	mg/L

CFU = colony forming unit
E. coli = Escherichia coli
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
N = nitrogen
P = phosphorus
PCB = polychlorinated biphenyl
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
SWSP = stormwater sampling point

Appendix E. Sanitary Outfalls Monitoring Results in 2019

Desert Cottontail (*Sylvilagus audubonii*)

Table E-1. Inorganic results for permitted sanitary outfalls, May 2019

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	6-May-2019	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		7-May-2019	Aluminum	0.025	0.0193	J	EPA 200.8
			Ammonia	0.15	0.017	BN	EPA 350.1
			Arsenic	0.0128	0.002		EPA 200.8
			Boron	0.0671	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00197	0.0003	J	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
			Fluoride	0.902	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.115	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		0.0033	U	EPA 200.8
		8-May-2019	Aluminum	0.0234	0.0193	J	EPA 200.8
			Ammonia	0.891	0.017	BN	EPA 350.1
			Arsenic	0.012	0.002		EPA 200.8
			Boron	0.126	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00694	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	8-May-2019	Fluoride	1.68	0.033		EPA 300.0
			Lead	0.000518	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.104	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	0.00381	0.0033	J	EPA 200.8
		9-May-2019	Aluminum	0.0207	0.0193	J	EPA 200.8
			Ammonia	0.0768	0.017	BN	EPA 350.1
			Arsenic	0.0126	0.002		EPA 200.8
			Boron	0.219	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0154	0.0003		EPA 200.8
			Fluoride	0.645	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0787	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Selenium	0.00212	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.00421	0.0033	J	EPA 200.8
		10-May-2019	Aluminum	0.0205	0.0193	J	EPA 200.8
			Ammonia	0.68	0.017	B	EPA 350.1
			Arsenic	0.0105	0.002		EPA 200.8
			Boron	0.0953	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00216	0.0003		EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	10-May-2019	Fluoride	1.11	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.102	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		0.0033	U	EPA 200.8
WW001	2069A	7-May-2019	Aluminum	0.167	0.0193		EPA 200.8
			Ammonia	16.2	0.425	BN	EPA 350.1
			Arsenic	0.0109	0.002		EPA 200.8
			Boron	0.133	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0224	0.0003		EPA 200.8
			Fluoride	1.28	0.033		EPA 300.0
			Lead	0.00831	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0123	0.0002		EPA 200.8
			Nickel	0.00158	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver	0.000566	0.0003	J	EPA 200.8
			Zinc	0.103	0.0033		EPA 200.8
		8-May-2019	Aluminum	0.0528	0.0193		EPA 200.8
			Ammonia	19	0.425	BN	EPA 350.1
			Arsenic	0.0115	0.002		EPA 200.8
			Boron	0.125	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00425	0.003	J	EPA 200.8
			Copper	0.019	0.0003		EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	8-May-2019	Fluoride	4.04	0.033		EPA 300.0
			Lead	0.0227	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.011	0.0002		EPA 200.8
			Nickel	0.00195	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0931	0.0033		EPA 200.8
		9-May-2019	Aluminum	0.172	0.0193		EPA 200.8
			Ammonia	12.6	0.425	BN	EPA 350.1
			Arsenic	0.00964	0.002		EPA 200.8
			Boron	0.108	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0281	0.0003		EPA 200.8
			Fluoride	3.1	0.033		EPA 300.0
			Lead	0.00823	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0104	0.0002		EPA 200.8
			Nickel	0.00296	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.139	0.0033		EPA 200.8
		10-May-2019	Aluminum	0.0498	0.0193	J	EPA 200.8
			Ammonia	16.2	0.425	B	EPA 350.1
			Arsenic	0.0103	0.002		EPA 200.8
			Boron	0.125	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0233	0.0003		EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	10-May-2019	Fluoride	3.28	0.033		EPA 300.0
			Lead	0.0117	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0193	0.0002		EPA 200.8
			Nickel	0.00251	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0524	0.0033		EPA 200.8
WW006	2069F	6-May-2019	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		7-May-2019	Aluminum	0.127	0.0193		EPA 200.8
			Ammonia	33.8	0.425	BN	EPA 350.1
			Arsenic	0.0106	0.002		EPA 200.8
			Boron	0.177	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0281	0.0003		EPA 200.8
			Cyanide, total	0.00358	0.00167	J	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total	0.00188	0.00167	J	EPA 335.4
			Fluoride	0.565	0.033		EPA 300.0
			Lead	0.00117	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0506	0.0002		EPA 200.8
			Nickel	0.00201	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.108	0.0033		EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	8-May-2019	Aluminum	0.0997	0.0193		EPA 200.8
			Ammonia	38	0.425	BN	EPA 350.1
			Arsenic	0.00947	0.002		EPA 200.8
			Boron	0.136	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0255	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	0.711	0.033		EPA 300.0
			Lead	0.00079	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0402	0.0002		EPA 200.8
			Nickel	0.00147	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0889	0.0033		EPA 200.8
		9-May-2019	Aluminum	0.0892	0.0193		EPA 200.8
			Ammonia	35	0.425	BN	EPA 350.1
			Arsenic	0.00702	0.002		EPA 200.8
			Boron	0.14	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0244	0.0003		EPA 200.8
			Fluoride	0.61	0.033		EPA 300.0
			Lead	0.000673	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0429	0.0002		EPA 200.8
			Nickel	0.00149	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	9-May-2019	Silver	0.000349	0.0003	J	EPA 200.8
			Zinc	0.0631	0.0033		EPA 200.8
		10-May-2019	Aluminum	0.0884	0.0193		EPA 200.8
			Ammonia	54	0.85	B	EPA 350.1
			Arsenic	0.00762	0.002		EPA 200.8
			Boron	0.163	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0228	0.0003		EPA 200.8
			Fluoride	0.586	0.033		EPA 300.0
			Lead	0.00109	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0449	0.0002		EPA 200.8
			Nickel	0.00167	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0796	0.0033		EPA 200.8
WW007	2069G	6-May-2019	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		7-May-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	3.74	0.085	BN	EPA 350.1
			Arsenic	0.00313	0.002	J	EPA 200.8
			Boron	0.0367	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00272	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
			Fluoride	1.52	0.033		EPA 300.0

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	7-May-2019	Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0127	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		0.0033	U	EPA 200.8
		8-May-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	8.4	0.085	BN	EPA 350.1
			Arsenic	0.00572	0.002		EPA 200.8
			Boron	0.0598	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00458	0.003	J	EPA 200.8
			Copper	0.0056	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
			Fluoride	6.82	0.165		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0118	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		0.0033	U	EPA 200.8
		9-May-2019	Aluminum	0.024	0.0193	J	EPA 200.8
			Ammonia	4.39	0.085	BN	EPA 350.1
			Arsenic	0.00384	0.002	J	EPA 200.8
			Boron	0.0525	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	9-May-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.00366	0.0003		EPA 200.8
			Fluoride	4.25	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0133	0.0002		EPA 200.8
			Nickel	0.000983	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
		10-May-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	5.8	0.085	B	EPA 350.1
			Arsenic	0.00354	0.002	J	EPA 200.8
			Boron	0.0463	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00235	0.0003		EPA 200.8
			Fluoride	2.45	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0267	0.0002		EPA 200.8
			Nickel	0.00192	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	7-May-2019	Aluminum	0.0624	0.0193		EPA 200.8
			Ammonia	17.4	0.425	BN	EPA 350.1
			Arsenic	0.0108	0.002		EPA 200.8
			Boron	0.157	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	7-May-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.0369	0.0003		EPA 200.8
			Fluoride	0.64	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00504	0.0002		EPA 200.8
			Nickel	0.00477	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.054	0.0033		EPA 200.8
		8-May-2019	Aluminum	0.0457	0.0193	J	EPA 200.8
			Ammonia	38	0.425	BN	EPA 350.1
			Arsenic	0.00855	0.002		EPA 200.8
			Boron	0.124	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0299	0.0003		EPA 200.8
			Fluoride	0.578	0.033		EPA 300.0
			Lead	0.000559	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00455	0.0002		EPA 200.8
			Nickel	0.00457	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0538	0.0033		EPA 200.8
		9-May-2019	Aluminum	0.105	0.0193		EPA 200.8
			Ammonia	28.5	0.425	BN	EPA 350.1
			Arsenic	0.00865	0.002		EPA 200.8
			Boron	0.112	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	9-May-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.023	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	0.00574	0.0002		EPA 200.8
			Nickel	0.00341	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0431	0.0033		EPA 200.8
		10-May-2019	Aluminum	0.0312	0.0193	J	EPA 200.8
			Ammonia	35.3	0.425	B	EPA 350.1
			Arsenic	0.00913	0.002		EPA 200.8
			Boron	0.133	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0133	0.0003		EPA 200.8
			Fluoride	0.537	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00602	0.0002		EPA 200.8
			Nickel	0.00283	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0293	0.0033		EPA 200.8
WW011	2069K	7-May-2019	Aluminum	0.0572	0.0193		EPA 200.8
			Ammonia	16.6	0.425	BN	EPA 350.1
			Arsenic	0.0059	0.002		EPA 200.8
			Boron	0.237	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	7-May-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.0148	0.0003		EPA 200.8
			Fluoride	0.657	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0762	0.0002		EPA 200.8
			Nickel	0.00178	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0436	0.0033		EPA 200.8
		8-May-2019	Aluminum	0.0395	0.0193	J	EPA 200.8
			Ammonia	20.8	0.425	BN	EPA 350.1
			Arsenic	0.00603	0.002		EPA 200.8
			Boron	0.209	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0139	0.0003		EPA 200.8
			Fluoride	0.791	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0596	0.0002		EPA 200.8
			Nickel	0.00177	0.0006	J	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-May-2019	Aluminum	0.0338	0.0193	J	EPA 200.8
			Ammonia	15.8	0.425	BN	EPA 350.1
			Arsenic	0.00508	0.002		EPA 200.8
			Boron	0.174	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-1. Inorganic results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	9-May-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.0113	0.0003		EPA 200.8
			Fluoride	0.502	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0535	0.0002		EPA 200.8
			Nickel	0.0017	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0343	0.0033		EPA 200.8
		10-May-2019	Aluminum	0.0307	0.0193	J	EPA 200.8
			Ammonia	19.6	0.425	B	EPA 350.1
			Arsenic	0.00488	0.002	J	EPA 200.8
			Boron	0.2	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00914	0.0003		EPA 200.8
			Fluoride	0.549	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0478	0.0002		EPA 200.8
			Nickel	0.00204	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0295	0.0033		EPA 200.8

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.
N = A spike was outside limits.
U = The analyte was absent or below the method detection limit.

Table E-2. Radiological results for permitted sanitary outfalls, May 2019

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	07-May-2019	Actinium-228	−9.39 ± 12.3	10.7	U	EPA 901.1
			Alpha, gross	0.261 ± .928	1.64	U	EPA 900.0/SW-846 9310
			Americium-241	−.884 ± 5.3	8.55	U	EPA 901.1
			Beryllium-7	4.94 ± 9.92	17.9	U	EPA 901.1
			Beta, gross	0.42 ± 0.705	1.18	U	EPA 900.0/SW-846 9310
			Bismuth-212	21.7 ± 34.5	32.6	U	EPA 901.1
			Bismuth-214	6.94 ± 7.75	6.94	U	EPA 901.1
			Cesium-137	0.159 ± 1.27	2.28	U	EPA 901.1
			Cobalt-60	0.369 ± 1.23	2.38	U	EPA 901.1
			Lead-212	3.2 ± 5.49	3.7	U	EPA 901.1
			Lead-214	1.51 ± 6.35	5.68	U	EPA 901.1
			Neptunium-237	−0.242 ± 2.31	4.2	U	EPA 901.1
			Potassium-40	56.2 ± 43.2	24.7		EPA 901.1
			Radium-223	−0.255 ± 23.1	42	U	EPA 901.1
			Radium-224	−13 ± 35.9	39.5	U	EPA 901.1
			Radium-226	13.3 ± 231	38	U	EPA 901.1
			Radium-228	−9.39 ± 12.3	10.7	U	EPA 901.1
			Sodium-22	−0.313 ± 1.32	2.42	U	EPA 901.1
			Thorium-227	5.49 ± 10.1	16.6	U	EPA 901.1
			Thorium-231	23.7 ± 22.4	24.3	U	EPA 901.1
			Thorium-234	91.8 ± 117	101	U	EPA 901.1
			Tritium	49.8 ± 105	185	U	EPA 906.0 Modified
			Uranium-235	1.58 ± 13.9	11.7	U	EPA 901.1
			Uranium-238	91.8 ± 117	101	U	EPA 901.1
		08-May-2019	Actinium-228	−6.61 ± 14.5	18.6	U	EPA 901.1
			Alpha, gross	0.88 ± 1.83	3.27	U	EPA 900.0/SW-846 9310
			Americium-241	−1.52 ± 14.5	23.1	U	EPA 901.1
			Beryllium-7	−6.26 ± 18.1	30.4	U	EPA 901.1
			Beta, gross	4.8 ± 1.84	2.81		EPA 900.0/SW-846 9310
			Bismuth-212	−40.8 ± 52	51.3	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	08-May-2019	Bismuth-214	−6.63 ± 8.17	9.26	U	EPA 901.1
			Cesium-137	3.37 ± 2.77	4.6	U	EPA 901.1
			Cobalt-60	−0.0112 ± 2.17	3.94	U	EPA 901.1
			Lead-212	−5.23 ± 7.75	7.9	U	EPA 901.1
			Lead-214	0.868 ± 9.68	8.95	U	EPA 901.1
			Neptunium-237	4.64 ± 7	7.42	U	EPA 901.1
			Potassium-40	−5.42 ± 46.1	61.5	U	EPA 901.1
			Radium-223	−41.5 ± 42.1	62.5	U	EPA 901.1
			Radium-224	−116 ± 66.6	63.7	U	EPA 901.1
			Radium-226	93.7 ± 108	105	U	EPA 901.1
			Radium-228	−6.61 ± 14.5	18.6	U	EPA 901.1
			Sodium-22	0.891 ± 2.45	4.51	U	EPA 901.1
			Thorium-227	−7.18 ± 14.8	25.2	U	EPA 901.1
			Thorium-231	0.0662 ± 46.3	47.8	U	EPA 901.1
			Thorium-234	5.95 ± 233	186	U	EPA 901.1
			Tritium	−18.8 ± 83.9	163	U	EPA 906.0 Modified
			Uranium-235	16.5 ± 28.1	19.8	U	EPA 901.1
			Uranium-238	5.95 ± 233	186	U	EPA 901.1
		09-May-2019	Actinium-228	28.1 ± 23	28.1	U	EPA 901.1
			Alpha, gross	2.83 ± 7.72	13.7	U	EPA 900.0/SW-846 9310
			Americium-241	−1.16 ± 3.21	5.01	U	EPA 901.1
			Beryllium-7	−30.5 ± 41.1	30	U	EPA 901.1
			Beta, gross	13.8 ± 9.67	15.9	U	EPA 900.0/SW-846 9310
			Bismuth-212	−13.4 ± 50.3	63.1	U	EPA 901.1
			Bismuth-214	16.5 ± 13.1	16.5	U	EPA 901.1
			Cesium-137	0.991 ± 2.56	4.51	U	EPA 901.1
			Cobalt-60	0.184 ± 2.59	4.6	U	EPA 901.1
			Lead-212	6.75 ± 8.16	5.56	X	EPA 901.1
			Lead-214	0.0636 ± 9.46	8.76	U	EPA 901.1
			Neptunium-237	0.401 ± 3.81	6.86	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	09-May-2019	Potassium-40	70.8 ± 56.7	44.5		EPA 901.1
			Radium-223	−14.6 ± 36.4	62.6	U	EPA 901.1
			Radium-224	27.2 ± 39.2	63.1	U	EPA 901.1
			Radium-226	40.6 ± 92.1	109	U	EPA 901.1
			Radium-228	28.1 ± 23	28.1	U	EPA 901.1
			Sodium-22	−0.482 ± 2.25	4.02	U	EPA 901.1
			Thorium-227	0.607 ± 14.2	25.7	U	EPA 901.1
			Thorium-231	−25.6 ± 29.3	32.9	U	EPA 901.1
			Thorium-234	6.87 ± 67.6	50.1	U	EPA 901.1
			Tritium	5.96 ± 92.9	168	U	EPA 906.0 Modified
			Uranium-235	15.9 ± 22.8	17.1	U	EPA 901.1
			Uranium-238	6.87 ± 67.6	50.1	U	EPA 901.1
		10-May-2019	Actinium-228	11 ± 19.5	19.3	U	EPA 901.1
			Alpha, gross	0.731 ± .686	1.12	U	EPA 900.0/SW-846 9310
			Americium-241	−1.53 ± 3.24	4.97	U	EPA 901.1
			Beryllium-7	−12.1 ± 18.8	30	U	EPA 901.1
			Beta, gross	0.99 ± .735	1.21	U	EPA 900.0/SW-846 9310
			Bismuth-212	10.3 ± 31.3	58.9	U	EPA 901.1
			Bismuth-214	6.97 ± 9.04	9.55	U	EPA 901.1
			Cesium-137	1.33 ± 2.5	4.4	U	EPA 901.1
			Cobalt-60	0.526 ± 2.4	4.51	U	EPA 901.1
			Lead-212	6.93 ± 7.04	5.29	X	EPA 901.1
			Lead-214	3.67 ± 9.65	7.24	U	EPA 901.1
			Neptunium-237	−0.59 ± 3.71	6.57	U	EPA 901.1
			Potassium-40	−13.5 ± 45.8	64.9	U	EPA 901.1
			Radium-223	−13.2 ± 36.8	63.6	U	EPA 901.1
			Radium-224	11.6 ± 35.4	58.3	U	EPA 901.1
			Radium-226	41.5 ± 97.5	107	U	EPA 901.1
			Radium-228	11 ± 19.5	19.3	U	EPA 901.1
			Sodium-22	0.999 ± 2.45	4.63	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	10-May-2019	Thorium-227	−6.26 ± 14.2	24.5	U	EPA 901.1
			Thorium-231	−17.8 ± 28.1	30.7	U	EPA 901.1
			Thorium-234	28.7 ± 77.9	51.2	U	EPA 901.1
			Tritium	−66 ± 83.8	162	U	EPA 906.0 Modified
			Uranium-235	−9.88 ± 17.9	20.7	U	EPA 901.1
			Uranium-238	28.7 ± 77.9	51.2	U	EPA 901.1
WW001	2069A	07-May-2019	Actinium-228	9.49 ± 14.3	11.9	U	EPA 901.1
			Alpha, gross	3.19 ± 2.09	3.28	U	EPA 900.0/SW-846 9310
			Americium-241	6.02 ± 8.2	13.3	U	EPA 901.1
			Beryllium-7	−0.508 ± 10.6	18.9	U	EPA 901.1
			Beta, gross	12.7 ± 1.8	2.35		EPA 900.0/SW-846 9310
			Bismuth-212	24 ± 37.2	34.2	U	EPA 901.1
			Bismuth-214	−0.1 ± 4.99	6.3	U	EPA 901.1
			Cesium-137	0.753 ± 1.49	2.62	U	EPA 901.1
			Cobalt-60	1.25 ± 1.68	3.07	U	EPA 901.1
			Lead-212	0.139 ± 4.6	4.85	U	EPA 901.1
			Lead-214	−1.39 ± 5.23	5.72	U	EPA 901.1
			Neptunium-237	1.14 ± 2.63	4.77	U	EPA 901.1
			Potassium-40	15.9 ± 47.7	25.3	U	EPA 901.1
			Radium-223	−6.71 ± 25.7	45.6	U	EPA 901.1
			Radium-224	−36.9 ± 32.1	42.5	U	EPA 901.1
			Radium-226	18.3 ± 72.6	71	U	EPA 901.1
			Radium-228	9.49 ± 14.3	11.9	U	EPA 901.1
			Sodium-22	−1.36 ± 2.54	2.69	U	EPA 901.1
			Thorium-227	−5.57 ± 11.1	17.4	U	EPA 901.1
			Thorium-231	−17.9 ± 34.2	33.2	U	EPA 901.1
			Thorium-234	111 ± 148	110	X	EPA 901.1
			Tritium	78.7 ± 104	176	U	EPA 906.0 Modified
			Uranium-235	2.19 ± 20.1	13.3	U	EPA 901.1
			Uranium-238	111 ± 148	110	X	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	8-May-2019	Actinium-228	2.15 ± 18.2	16	U	EPA 901.1
			Alpha, gross	0.11 ± 1.73	3.13	U	EPA 900.0/SW-846 9310
			Americium-241	−10.4 ± 14.5	23.5	U	EPA 901.1
			Beryllium-7	6.39 ± 15.8	28.3	U	EPA 901.1
			Beta, gross	6.3 ± 1.75	2.65		EPA 900.0/SW-846 9310
			Bismuth-212	9.45 ± 28.4	49.8	U	EPA 901.1
			Bismuth-214	2.95 ± 10.3	6.97	U	EPA 901.1
			Cesium-137	0.405 ± 2.14	3.75	U	EPA 901.1
			Cobalt-60	0.176 ± 2.12	3.87	U	EPA 901.1
			Lead-212	0.185 ± 6.06	6.57	U	EPA 901.1
			Lead-214	−1.38 ± 6.97	8.04	U	EPA 901.1
			Neptunium-237	−1.14 ± 3.55	6.24	U	EPA 901.1
			Potassium-40	2.67 ± 54.6	36.1	U	EPA 901.1
			Radium-223	−21.9 ± 36.4	61.2	U	EPA 901.1
			Radium-224	28.1 ± 40.7	58	U	EPA 901.1
			Radium-226	−38.5 ± 76.3	76.6	U	EPA 901.1
			Radium-228	2.15 ± 18.2	16	U	EPA 901.1
			Sodium-22	0.612 ± 2.35	4.31	U	EPA 901.1
			Thorium-227	−9.79 ± 14	23.2	U	EPA 901.1
			Thorium-231	−8.84 ± 39.2	46.3	U	EPA 901.1
			Thorium-234	116 ± 219	179	U	EPA 901.1
			Tritium	20.3 ± 91.3	167	U	EPA 906.0 Modified
			Uranium-235	−7.33 ± 18.7	19.1	U	EPA 901.1
			Uranium-238	116 ± 219	179	U	EPA 901.1
		9-May-2019	Actinium-228	14.1 ± 16.6	10.4	X	EPA 901.1
			Alpha, gross	2.53 ± 1.59	2.41		EPA 900.0/SW-846 9310
			Americium-241	3.67 ± 6.16	9.58	U	EPA 901.1
			Beryllium-7	−7.16 ± 14.4	23.8	U	EPA 901.1
			Beta, gross	7.8 ± 1.55	2.2		EPA 900.0/SW-846 9310
			Bismuth-212	10.1 ± 25.9	45	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	9-May-2019	Bismuth-214	0.957 ± 8.16	5.82	U	EPA 901.1
			Cesium-137	2.33 ± 2.02	3.27	U	EPA 901.1
			Cobalt-60	1.9 ± 1.95	3.53	U	EPA 901.1
			Lead-212	−1.64 ± 4.47	5.89	U	EPA 901.1
			Lead-214	−0.973 ± 5.66	7.07	U	EPA 901.1
			Neptunium-237	−2.4 ± 3.26	5.24	U	EPA 901.1
			Potassium-40	8.09 ± 47.9	35.2	U	EPA 901.1
			Radium-223	−0.81 ± 31.1	54.9	U	EPA 901.1
			Radium-224	−60 ± 42.6	54	U	EPA 901.1
			Radium-226	0.539 ± 71.6	72.8	U	EPA 901.1
			Radium-228	14.1 ± 16.6	10.4	X	EPA 901.1
			Sodium-22	−1.87 ± 2.52	3.02	U	EPA 901.1
			Thorium-227	−5.04 ± 14.2	22	U	EPA 901.1
			Thorium-231	−0.052 ± 31.2	35.2	U	EPA 901.1
			Thorium-234	47.6 ± 87.8	79.3	U	EPA 901.1
			Tritium	9.24 ± 93.7	169	U	EPA 906.0 Modified
			Uranium-235	4.3 ± 16.8	16.1	U	EPA 901.1
			Uranium-238	47.6 ± 87.8	79.3	U	EPA 901.1
		10-May-2019	Actinium-228	10.6 ± 17.8	17.6	U	EPA 901.1
			Alpha, gross	1.65 ± 1.77	2.95	U	EPA 900.0/SW-846 9310
			Americium-241	−30.5 ± 28.3	25.3	U	EPA 901.1
			Beryllium-7	16.4 ± 19.3	32.8	U	EPA 901.1
			Beta, gross	10.8 ± 1.38	1.76		EPA 900.0/SW-846 9310
			Bismuth-212	−15.3 ± 38.2	50.8	U	EPA 901.1
			Bismuth-214	0.717 ± 7.32	6.77	U	EPA 901.1
			Cesium-137	−0.373 ± 1.89	3.42	U	EPA 901.1
			Cobalt-60	0.288 ± 2.42	3.87	U	EPA 901.1
			Lead-212	1.09 ± 8.73	5.41	U	EPA 901.1
			Lead-214	−6.53 ± 7.32	8.1	U	EPA 901.1
			Neptunium-237	0.767 ± 3.67	6.54	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	10-May-2019	Potassium-40	−28.7 ± 46.5	57.5	U	EPA 901.1
			Radium-223	−0.994 ± 34.9	61.7	U	EPA 901.1
			Radium-224	20.3 ± 38.8	62.2	U	EPA 901.1
			Radium-226	43 ± 102	103	U	EPA 901.1
			Radium-228	10.6 ± 17.8	17.6	U	EPA 901.1
			Sodium-22	0.71 ± 2.69	4.34	U	EPA 901.1
			Thorium-227	−8.3 ± 14.8	24.7	U	EPA 901.1
			Thorium-231	−29.4 ± 47.7	54.1	U	EPA 901.1
			Thorium-234	19.4 ± 280	199	U	EPA 901.1
			Tritium	−39.3 ± 90.9	172	U	EPA 906.0 Modified
			Uranium-235	5.57 ± 30.3	18.9	U	EPA 901.1
			Uranium-238	19.4 ± 280	199	U	EPA 901.1
WW006	2069F	7-May-2019	Actinium-228	−12.4 ± 12.7	13	U	EPA 901.1
			Alpha, gross	5.01 ± 2.64	4.04		EPA 900.0/SW-846 9310
			Americium-241	−8.94 ± 18.6	18.2	U	EPA 901.1
			Beryllium-7	2.09 ± 11.7	21.2	U	EPA 901.1
			Beta, gross	23.4 ± 2.19	2.37		EPA 900.0/SW-846 9310
			Bismuth-212	4.94 ± 22.2	39.3	U	EPA 901.1
			Bismuth-214	−0.188 ± 6.26	7.24	U	EPA 901.1
			Cesium-137	0.278 ± 1.63	2.89	U	EPA 901.1
			Cobalt-60	−0.431 ± 1.67	2.98	U	EPA 901.1
			Lead-212	0.38 ± 5.96	5.73	U	EPA 901.1
			Lead-214	4.99 ± 8.92	6.43	U	EPA 901.1
			Neptunium-237	−1.25 ± 2.79	4.87	U	EPA 901.1
			Potassium-40	26.4 ± 52.7	29.3	U	EPA 901.1
			Radium-223	26.4 ± 30.2	52.1	U	EPA 901.1
			Radium-224	12.1 ± 31.3	48	U	EPA 901.1
			Radium-226	9.88 ± 87.4	49.4	U	EPA 901.1
			Radium-228	−12.4 ± 12.7	13	U	EPA 901.1
			Sodium-22	0.153 ± 1.61	3	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	7-May-2019	Thorium-227	6.67 ± 12.2	20	U	EPA 901.1
			Thorium-231	0.891 ± 49.8	36.2	U	EPA 901.1
			Thorium-234	117 ± 208	212	U	EPA 901.1
			Tritium	18.8 ± 91.9	169	U	EPA 906.0 Modified
			Uranium-235	−10.2 ± 17.8	17.8	U	EPA 901.1
			Uranium-238	117 ± 208	212	U	EPA 901.1
		8-May-2019	Actinium-228	−12.1 ± 16.5	14.6	U	EPA 901.1
			Alpha, gross	3 ± 2.07	3.3	U	EPA 900.0/SW-846 9310
			Americium-241	7.44 ± 10.2	15.3	U	EPA 901.1
			Beryllium-7	−6.59 ± 16.9	28	U	EPA 901.1
			Beta, gross	16.8 ± 1.91	2.4		EPA 900.0/SW-846 9310
			Bismuth-212	−12.8 ± 26.7	46.1	U	EPA 901.1
			Bismuth-214	1.16 ± 9.41	7.74	U	EPA 901.1
			Cesium-137	0.904 ± 2.02	3.48	U	EPA 901.1
			Cobalt-60	1.55 ± 1.91	3.5	U	EPA 901.1
			Lead-212	0.405 ± 7.4	6.38	U	EPA 901.1
			Lead-214	−4.76 ± 7.4	7.84	U	EPA 901.1
			Neptunium-237	2.28 ± 3.92	6.74	U	EPA 901.1
			Potassium-40	34.2 ± 46.3	33.2	X	EPA 901.1
			Radium-223	−10.5 ± 38.3	65.4	U	EPA 901.1
			Radium-224	−7.31 ± 38.3	59.6	U	EPA 901.1
			Radium-226	42 ± 82.3	81.9	U	EPA 901.1
			Radium-228	−12.1 ± 16.5	14.6	U	EPA 901.1
			Sodium-22	0.863 ± 1.72	3.21	U	EPA 901.1
			Thorium-227	−18 ± 23.2	26.1	U	EPA 901.1
			Thorium-231	−1.28 ± 31.5	41.1	U	EPA 901.1
			Thorium-234	251 ± 170	115	X	EPA 901.1
			Tritium	−36.9 ± 94.4	186	U	EPA 906.0 Modified
			Uranium-235	3.55 ± 22.3	18.5	U	EPA 901.1
			Uranium-238	251 ± 170	115	X	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	9-May-2019	Actinium-228	−5.02 ± 12.2	15.1	U	EPA 901.1
			Alpha, gross	9.22 ± 3.81	5.16		EPA 900.0/SW-846 9310
			Americium-241	2.24 ± 5.43	8.95	U	EPA 901.1
			Beryllium-7	8.81 ± 22.6	23.4	U	EPA 901.1
			Beta, gross	22.1 ± 3.04	3.67		EPA 900.0/SW-846 9310
			Bismuth-212	4.01 ± 34.8	42.8	U	EPA 901.1
			Bismuth-214	−5.47 ± 7.57	7.86	U	EPA 901.1
			Cesium-137	1.16 ± 1.86	3.19	U	EPA 901.1
			Cobalt-60	−2.95 ± 3.4	3.2	U	EPA 901.1
			Lead-212	−2.22 ± 4.63	5.84	U	EPA 901.1
			Lead-214	−2.25 ± 5.73	6.93	U	EPA 901.1
			Neptunium-237	0.694 ± 3.18	5.71	U	EPA 901.1
			Potassium-40	−31.4 ± 41.4	54.9	U	EPA 901.1
			Radium-223	−30 ± 34.2	53.4	U	EPA 901.1
			Radium-224	−99.6 ± 61	50.1	U	EPA 901.1
			Radium-226	−55.8 ± 61.3	79.3	U	EPA 901.1
			Radium-228	−5.02 ± 12.2	15.1	U	EPA 901.1
			Sodium-22	0.873 ± 1.79	3.28	U	EPA 901.1
			Thorium-227	−12 ± 13.5	21.2	U	EPA 901.1
			Thorium-231	9.68 ± 33.5	29.8	U	EPA 901.1
			Thorium-234	18.9 ± 101	72.9	U	EPA 901.1
			Tritium	−18.5 ± 90.9	168	U	EPA 906.0 Modified
			Uranium-235	−24.6 ± 19.9	17.1	U	EPA 901.1
			Uranium-238	18.9 ± 101	72.9	U	EPA 901.1
		10-May-2019	Actinium-228	−8.76 ± 15.2	16.7	U	EPA 901.1
			Alpha, gross	2.49 ± 1.53	2.38		EPA 900.0/SW-846 9310
			Americium-241	1.83 ± 10.1	18.3	U	EPA 901.1
			Beryllium-7	−13.2 ± 19.6	31.8	U	EPA 901.1
			Beta, gross	23.7 ± 1.75	1.76		EPA 900.0/SW-846 9310
			Bismuth-212	36.8 ± 42	46	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	10-May-2019	Bismuth-214	−5.36 ± 8.27	8.67	U	EPA 901.1
			Cesium-137	1.27 ± 2.11	3.78	U	EPA 901.1
			Cobalt-60	0.0768 ± 2.24	4.15	U	EPA 901.1
			Lead-212	−0.712 ± 5.35	6.99	U	EPA 901.1
			Lead-214	0.0129 ± 7.56	8.2	U	EPA 901.1
			Neptunium-237	0.243 ± 3.42	6.28	U	EPA 901.1
			Potassium-40	101 ± 57	44.1		EPA 901.1
			Radium-223	−2.81 ± 35.6	64.5	U	EPA 901.1
			Radium-224	−53.4 ± 46.6	61.2	U	EPA 901.1
			Radium-226	43.8 ± 72	58.2	U	EPA 901.1
			Radium-228	−8.76 ± 15.2	16.7	U	EPA 901.1
			Sodium-22	−0.827 ± 2.4	3.63	U	EPA 901.1
			Thorium-227	−0.385 ± 15.4	25.6	U	EPA 901.1
			Thorium-231	−19.8 ± 38.7	42.4	U	EPA 901.1
			Thorium-234	−47.8 ± 146	173	U	EPA 901.1
			Tritium	12.6 ± 94.6	170	U	EPA 906.0 Modified
			Uranium-235	11.4 ± 23.7	17.4	U	EPA 901.1
			Uranium-238	−47.8 ± 146	173	U	EPA 901.1
WW007	2069G	7-May-2019	Actinium-228	−9.17 ± 15.3	14.2	U	EPA 901.1
			Alpha, gross	0.588 ± 1.5	2.6	U	EPA 900.0/SW-846 9310
			Americium-241	5.66 ± 9.62	14.6	U	EPA 901.1
			Beryllium-7	8.15 ± 14.8	25.3	U	EPA 901.1
			Beta, gross	3.6 ± .95	1.42		EPA 900.0/SW-846 9310
			Bismuth-212	34.3 ± 38.1	44.8	U	EPA 901.1
			Bismuth-214	1.71 ± 8.99	6.64	U	EPA 901.1
			Cesium-137	1.42 ± 2.82	3.1	U	EPA 901.1
			Cobalt-60	0.309 ± 1.8	3.25	U	EPA 901.1
			Lead-212	2.78 ± 7.11	5.28	U	EPA 901.1
			Lead-214	2.71 ± 6.42	7.29	U	EPA 901.1
			Neptunium-237	−1.67 ± 3.56	5.94	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	7-May-2019	Potassium-40	10.8 ± 42.1	32.5	U	EPA 901.1
			Radium-223	−17.1 ± 35.8	59.6	U	EPA 901.1
			Radium-224	44.1 ± 40.7	58.5	U	EPA 901.1
			Radium-226	−26.5 ± 60.8	74.1	U	EPA 901.1
			Radium-228	−9.17 ± 15.3	14.2	U	EPA 901.1
			Sodium-22	−0.432 ± 1.65	2.89	U	EPA 901.1
			Thorium-227	−1.43 ± 13.5	23.5	U	EPA 901.1
			Thorium-231	33.8 ± 25.5	35.8	U	EPA 901.1
			Thorium-234	11.1 ± 146	139	U	EPA 901.1
			Tritium	−17 ± 89.6	173	U	EPA 906.0 Modified
			Uranium-235	−6.94 ± 17	18.5	U	EPA 901.1
			Uranium-238	11.1 ± 146	139	U	EPA 901.1
		8-May-2019	Actinium-228	−1.28 ± 19	20.1	U	EPA 901.1
			Alpha, gross	2.67 ± 2.08	3.36	U	EPA 900.0/SW-846 9310
			Americium-241	9.18 ± 16.7	25.6	U	EPA 901.1
			Beryllium-7	−3.87 ± 16.6	28.9	U	EPA 901.1
			Beta, gross	10.2 ± 1.49	1.76		EPA 900.0/SW-846 9310
			Bismuth-212	30.5 ± 43.7	45.7	U	EPA 901.1
			Bismuth-214	8.52 ± 11.4	10.4	U	EPA 901.1
			Cesium-137	1.23 ± 5.69	3.66	U	EPA 901.1
			Cobalt-60	0.874 ± 2.31	4.48	U	EPA 901.1
			Lead-212	5.74 ± 7.65	8	U	EPA 901.1
			Lead-214	5.99 ± 9.93	9.16	U	EPA 901.1
			Neptunium-237	−0.302 ± 4.05	7.18	U	EPA 901.1
			Potassium-40	40.2 ± 51.5	39.4	X	EPA 901.1
			Radium-223	−23.4 ± 46	68.9	U	EPA 901.1
			Radium-224	9.44 ± 42	67.8	U	EPA 901.1
			Radium-226	53.2 ± 97.7	112	U	EPA 901.1
			Radium-228	−1.28 ± 19	20.1	U	EPA 901.1
			Sodium-22	1.65 ± 2.35	4.53	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	8-May-2019	Thorium-227	−8.07 ± 15.8	26.8	U	EPA 901.1
			Thorium-231	31 ± 68.9	51.8	U	EPA 901.1
			Thorium-234	45.5 ± 299	194	U	EPA 901.1
			Tritium	−11.7 ± 98.5	188	U	EPA 906.0 Modified
			Uranium-235	14.5 ± 31	22.1	U	EPA 901.1
			Uranium-238	45.5 ± 299	194	U	EPA 901.1
		9-May-2019	Actinium-228	1.16 ± 11.1	13.6	U	EPA 901.1
			Alpha, gross	2.13 ± 1.03	1.46		EPA 900.0/SW-846 9310
			Americium-241	6.95 ± 10.1	15.9	U	EPA 901.1
			Beryllium-7	0.147 ± 13.6	24.5	U	EPA 901.1
			Beta, gross	1.04 ± .654	1.06	U	EPA 900.0/SW-846 9310
			Bismuth-212	13.4 ± 22.7	40.9	U	EPA 901.1
			Bismuth-214	11.6 ± 9.57	5.7	X	EPA 901.1
			Cesium-137	0.613 ± 1.75	3.15	U	EPA 901.1
			Cobalt-60	3.22 ± 3.62	3.72	U	EPA 901.1
			Lead-212	4.09 ± 6.2	6.34	U	EPA 901.1
			Lead-214	−5.29 ± 6.88	7.02	U	EPA 901.1
			Neptunium-237	3.15 ± 3.55	6.12	U	EPA 901.1
			Potassium-40	−8.2 ± 38.2	52.6	U	EPA 901.1
			Radium-223	−14.6 ± 34.9	54.7	U	EPA 901.1
			Radium-224	3.96 ± 35.1	53.6	U	EPA 901.1
			Radium-226	19.3 ± 72.7	78.8	U	EPA 901.1
			Radium-228	1.16 ± 11.1	13.6	U	EPA 901.1
			Sodium-22	−0.167 ± 1.79	3.13	U	EPA 901.1
			Thorium-227	−10.7 ± 14.6	21.7	U	EPA 901.1
			Thorium-231	−16.7 ± 37.2	41.3	U	EPA 901.1
			Thorium-234	82.1 ± 168	163	U	EPA 901.1
			Tritium	14.2 ± 91.7	164	U	EPA 906.0 Modified
			Uranium-235	1.81 ± 19.5	17.4	U	EPA 901.1
			Uranium-238	82.1 ± 168	163	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	10-May-2019	Actinium-228	−3.2 ± 14.2	18.4	U	EPA 901.1
			Alpha, gross	2.95 ± .976	1.22		EPA 900.0/SW-846 9310
			Americium-241	−8.99 ± 13	22.2	U	EPA 901.1
			Beryllium-7	6.51 ± 17.7	31.8	U	EPA 901.1
			Beta, gross	2.95 ± .794	1.2		EPA 900.0/SW-846 9310
			Bismuth-212	26.8 ± 32.3	58.3	U	EPA 901.1
			Bismuth-214	16.1 ± 11.6	16.2	U	EPA 901.1
			Cesium-137	−1.49 ± 2.3	3.34	U	EPA 901.1
			Cobalt-60	1.91 ± 2.2	4.3	U	EPA 901.1
			Lead-212	7.74 ± 9.15	7.74	U	EPA 901.1
			Lead-214	−1.94 ± 7.62	8.25	U	EPA 901.1
			Neptunium-237	1.11 ± 3.45	6.34	U	EPA 901.1
			Potassium-40	−29.9 ± 50.8	56.7	U	EPA 901.1
			Radium-223	−4.58 ± 35	63.1	U	EPA 901.1
			Radium-224	21.6 ± 39.3	60.9	U	EPA 901.1
			Radium-226	22.8 ± 81.2	81.8	U	EPA 901.1
			Radium-228	−3.2 ± 14.2	18.4	U	EPA 901.1
			Sodium-22	1.61 ± 2.25	4.39	U	EPA 901.1
			Thorium-227	−0.866 ± 14.8	24.6	U	EPA 901.1
			Thorium-231	0.472 ± 36.7	47.6	U	EPA 901.1
			Thorium-234	−144 ± 174	214	U	EPA 901.1
			Tritium	−37.3 ± 87.1	164	U	EPA 906.0 Modified
			Uranium-235	5.18 ± 18.3	16.8	U	EPA 901.1
			Uranium-238	−144 ± 174	214	U	EPA 901.1
WW008	2069I	7-May-2019	Actinium-228	11 ± 14	9.04	X	EPA 901.1
			Alpha, gross	4.38 ± 2.04	2.97		EPA 900.0/SW-846 9310
			Americium-241	−0.0738 ± 5.93	9.06	U	EPA 901.1
			Beryllium-7	−1.7 ± 11.5	19.8	U	EPA 901.1
			Beta, gross	13.8 ± 1.46	1.44		EPA 900.0/SW-846 9310
			Bismuth-212	9.45 ± 20.2	35.1	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	7-May-2019	Bismuth-214	3.96 ± 7.74	6.29	U	EPA 901.1
			Cesium-137	1.68 ± 1.74	2.87	U	EPA 901.1
			Cobalt-60	1.59 ± 1.53	2.75	U	EPA 901.1
			Lead-212	−0.554 ± 4.85	4.97	U	EPA 901.1
			Lead-214	−1.47 ± 6.76	5.86	U	EPA 901.1
			Neptunium-237	−0.765 ± 2.96	4.55	U	EPA 901.1
			Potassium-40	19.9 ± 35.3	26.1	U	EPA 901.1
			Radium-223	60 ± 57.6	60	U	EPA 901.1
			Radium-224	−79.8 ± 45.1	41.7	U	EPA 901.1
			Radium-226	−10.5 ± 61	65.9	U	EPA 901.1
			Radium-228	11 ± 14	9.04	X	EPA 901.1
			Sodium-22	−0.649 ± 1.42	2.43	U	EPA 901.1
			Thorium-227	−0.00375 ± 9.91	17.5	U	EPA 901.1
			Thorium-231	−28.8 ± 31.7	30	U	EPA 901.1
			Thorium-234	143 ± 117	76.9	X	EPA 901.1
			Tritium	73.6 ± 114	196	U	EPA 906.0 Modified
			Uranium-235	−5.91 ± 14.5	14.7	U	EPA 901.1
			Uranium-238	143 ± 117	76.9	X	EPA 901.1
		8-May-2019	Actinium-228	0.972 ± 18.7	18.3	U	EPA 901.1
			Alpha, gross	3.25 ± 1.79	2.72		EPA 900.0/SW-846 9310
			Americium-241	−0.716 ± 15	25.8	U	EPA 901.1
			Beryllium-7	4.37 ± 17.6	30.9	U	EPA 901.1
			Beta, gross	91.2 ± 3.7	2.31		EPA 900.0/SW-846 9310
			Bismuth-212	38 ± 31.4	52.9	U	EPA 901.1
			Bismuth-214	7.99 ± 12.3	8.9	U	EPA 901.1
			Cesium-137	−1.25 ± 2.96	3.74	U	EPA 901.1
			Cobalt-60	−0.87 ± 2.32	3.91	U	EPA 901.1
			Lead-212	1.22 ± 7.09	5.83	U	EPA 901.1
			Lead-214	−1.35 ± 6.41	7.96	U	EPA 901.1
			Neptunium-237	−0.177 ± 3.73	6.58	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	8-May-2019	Potassium-40	93.2 ± 41.7	37.2	X	EPA 901.1
			Radium-223	−24.2 ± 38	61.9	U	EPA 901.1
			Radium-224	30.5 ± 41.2	64.8	U	EPA 901.1
			Radium-226	−81.1 ± 88.9	108	U	EPA 901.1
			Radium-228	0.972 ± 18.7	18.3	U	EPA 901.1
			Sodium-22	0.767 ± 2.19	4.04	U	EPA 901.1
			Thorium-227	11.4 ± 15.6	26.9	U	EPA 901.1
			Thorium-231	−5.8 ± 43.9	53.2	U	EPA 901.1
			Thorium-234	−164 ± 217	257	U	EPA 901.1
			Tritium	117 ± 105	165	U	EPA 906.0 Modified
			Uranium-235	4.29 ± 24.1	22.8	U	EPA 901.1
			Uranium-238	−164 ± 217	257	U	EPA 901.1
		9-May-2019	Actinium-228	10.7 ± 14.5	14.2	U	EPA 901.1
			Alpha, gross	2.41 ± 1.62	2.56	U	EPA 900.0/SW-846 9310
			Americium-241	8.53 ± 10.4	16	U	EPA 901.1
			Beryllium-7	0.171 ± 13.8	24.8	U	EPA 901.1
			Beta, gross	15.5 ± 1.4	1.41		EPA 900.0/SW-846 9310
			Bismuth-212	27.7 ± 26.8	45.2	U	EPA 901.1
			Bismuth-214	4.1 ± 6.73	5.6	U	EPA 901.1
			Cesium-137	−0.526 ± 1.68	2.9	U	EPA 901.1
			Cobalt-60	0.259 ± 2.11	3.55	U	EPA 901.1
			Lead-212	4.92 ± 7.18	6.35	U	EPA 901.1
			Lead-214	1.6 ± 8.38	7.2	U	EPA 901.1
			Neptunium-237	0.995 ± 3.17	5.78	U	EPA 901.1
			Potassium-40	9.53 ± 47.8	28.9	U	EPA 901.1
			Radium-223	−33.3 ± 34.6	53.6	U	EPA 901.1
			Radium-224	49.1 ± 40.2	55.2	U	EPA 901.1
			Radium-226	−74.7 ± 74.9	80.6	U	EPA 901.1
			Radium-228	10.7 ± 14.5	14.2	U	EPA 901.1
			Sodium-22	−0.218 ± 1.71	2.97	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	9-May-2019	Thorium-227	−8.02 ± 14.1	21.7	U	EPA 901.1
			Thorium-231	14.9 ± 46.4	38.2	U	EPA 901.1
			Thorium-234	108 ± 186	132	U	EPA 901.1
			Tritium	−24.8 ± 90.2	168	U	EPA 906.0 Modified
			Uranium-235	2.66 ± 17.4	19.5	U	EPA 901.1
			Uranium-238	108 ± 186	132	U	EPA 901.1
		10-May-2019	Actinium-228	12.4 ± 15.7	9.81	X	EPA 901.1
			Alpha, gross	1.84 ± .971	1.36		EPA 900.0/SW-846 9310
			Americium-241	−2.23 ± 7.17	10.7	U	EPA 901.1
			Beryllium-7	11 ± 15.8	27.6	U	EPA 901.1
			Beta, gross	20.3 ± 1.75	1.93		EPA 900.0/SW-846 9310
			Bismuth-212	44.4 ± 40.3	40.6		EPA 901.1
			Bismuth-214	−2.65 ± 5.86	6.83	U	EPA 901.1
			Cesium-137	−0.282 ± 1.81	3.09	U	EPA 901.1
			Cobalt-60	1.45 ± 1.82	3.43	U	EPA 901.1
			Lead-212	2.94 ± 6.63	4.5	U	EPA 901.1
			Lead-214	0.77 ± 5.26	6.51	U	EPA 901.1
			Neptunium-237	0.19 ± 3.2	5.12	U	EPA 901.1
			Potassium-40	47.9 ± 40.7	24.1		EPA 901.1
			Radium-223	4.7 ± 29.3	52.2	U	EPA 901.1
			Radium-224	3.45 ± 30.3	48.7	U	EPA 901.1
			Radium-226	6.12 ± 77.3	76.6	U	EPA 901.1
			Radium-228	12.4 ± 15.7	9.81	X	EPA 901.1
			Sodium-22	−0.462 ± 1.62	2.89	U	EPA 901.1
			Thorium-227	0.915 ± 12.1	21.6	U	EPA 901.1
			Thorium-231	6.29 ± 36.4	33.7	U	EPA 901.1
			Thorium-234	74.9 ± 127	132	U	EPA 901.1
			Tritium	−28.2 ± 89.9	168	U	EPA 906.0 Modified
			Uranium-235	5.83 ± 18.1	15.6	U	EPA 901.1
			Uranium-238	74.9 ± 127	132	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	7-May-2019	Actinium-228	1.37 ± 13.4	8.87	U	EPA 901.1
			Alpha, gross	3.3 ± 1.81	2.77		EPA 900.0/SW-846 9310
			Americium-241	0.692 ± 7.76	12.9	U	EPA 901.1
			Beryllium-7	−1.14 ± 11.2	19.8	U	EPA 901.1
			Beta, gross	20.7 ± 1.84	1.58		EPA 900.0/SW-846 9310
			Bismuth-212	−12.1 ± 28.3	35.4	U	EPA 901.1
			Bismuth-214	−1.67 ± 5	6.06	U	EPA 901.1
			Cesium-137	0.529 ± 1.47	2.61	U	EPA 901.1
			Cobalt-60	1.19 ± 1.46	2.71	U	EPA 901.1
			Lead-212	7.68 ± 6.1	3.98	X	EPA 901.1
			Lead-214	6.29 ± 9.6	6.29	U	EPA 901.1
			Neptunium-237	−0.592 ± 2.59	4.63	U	EPA 901.1
			Potassium-40	25.8 ± 48.7	24.4	X	EPA 901.1
			Radium-223	−0.696 ± 25.2	45.6	U	EPA 901.1
			Radium-224	12.9 ± 28.5	43.6	U	EPA 901.1
			Radium-226	−6.79 ± 57.5	71.3	U	EPA 901.1
			Radium-228	1.37 ± 13.4	8.87	U	EPA 901.1
			Sodium-22	−0.637 ± 2.47	2.78	U	EPA 901.1
			Thorium-227	−5.14 ± 11.2	17.6	U	EPA 901.1
			Thorium-231	−14.3 ± 34	33.9	U	EPA 901.1
			Thorium-234	82.5 ± 146	143	U	EPA 901.1
			Tritium	75.4 ± 104	176	U	EPA 906.0 Modified
			Uranium-235	−12.2 ± 16.9	15.7	U	EPA 901.1
			Uranium-238	82.5 ± 146	143	U	EPA 901.1
		8-May-2019	Actinium-228	10.1 ± 19.6	17.2	U	EPA 901.1
			Alpha, gross	2.66 ± 1.26	1.77		EPA 900.0/SW-846 9310
			Americium-241	−1.16 ± 10.9	18.1	U	EPA 901.1
			Beryllium-7	5.7 ± 16.9	30.6	U	EPA 901.1
			Beta, gross	18.9 ± 1.68	1.57		EPA 900.0/SW-846 9310
			Bismuth-212	−29.4 ± 53.8	51.9	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	8-May-2019	Bismuth-214	6.87 ± 8.81	6.99	U	EPA 901.1
			Cesium-137	0.021 ± 1.96	3.47	U	EPA 901.1
			Cobalt-60	−0.712 ± 2.32	4.06	U	EPA 901.1
			Lead-212	4.45 ± 6.75	6.91	U	EPA 901.1
			Lead-214	0.247 ± 8.66	8.23	U	EPA 901.1
			Neptunium-237	−0.226 ± 3.38	6.16	U	EPA 901.1
			Potassium-40	35.4 ± 51.6	39.3	U	EPA 901.1
			Radium-223	−17.4 ± 35.1	60.7	U	EPA 901.1
			Radium-224	−50 ± 55.8	57	U	EPA 901.1
			Radium-226	3.28 ± 92.8	83.5	U	EPA 901.1
			Radium-228	10.1 ± 19.6	17.2	U	EPA 901.1
			Sodium-22	1.01 ± 2.23	4.23	U	EPA 901.1
			Thorium-227	−7.96 ± 15.4	24	U	EPA 901.1
			Thorium-231	15.2 ± 26.2	42.6	U	EPA 901.1
			Thorium-234	50.9 ± 177	135	U	EPA 901.1
			Tritium	126 ± 109	171	U	EPA 906.0 Modified
			Uranium-235	17.5 ± 24.8	17.1	X	EPA 901.1
			Uranium-238	50.9 ± 177	135	U	EPA 901.1
		9-May-2019	Actinium-228	−2.86 ± 11.6	16.5	U	EPA 901.1
			Alpha, gross	3.49 ± 2.14	3.29		EPA 900.0/SW-846 9310
			Americium-241	5.15 ± 13.9	23	U	EPA 901.1
			Beryllium-7	14.8 ± 16.1	28.1	U	EPA 901.1
			Beta, gross	23.6 ± 1.97	2.27		EPA 900.0/SW-846 9310
			Bismuth-212	44.3 ± 32.9	51.6	U	EPA 901.1
			Bismuth-214	−6.61 ± 8.14	8.4	U	EPA 901.1
			Cesium-137	2.23 ± 2.1	3.58	U	EPA 901.1
			Cobalt-60	0.278 ± 2.12	3.99	U	EPA 901.1
			Lead-212	6.52 ± 8.06	5.5	X	EPA 901.1
			Lead-214	3.16 ± 8.94	6.63	U	EPA 901.1
			Neptunium-237	−1.46 ± 3.23	5.65	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	9-May-2019	Potassium-40	−12.5 ± 39.6	54.2	U	EPA 901.1
			Radium-223	−9.27 ± 31.7	56.7	U	EPA 901.1
			Radium-224	−5.58 ± 39.3	59.5	U	EPA 901.1
			Radium-226	29.7 ± 35.9	56.4	U	EPA 901.1
			Radium-228	−2.86 ± 11.6	16.5	U	EPA 901.1
			Sodium-22	−1.85 ± 2.01	3.04	U	EPA 901.1
			Thorium-227	−3.68 ± 15.3	22.8	U	EPA 901.1
			Thorium-231	−3.97 ± 45.4	51.1	U	EPA 901.1
			Thorium-234	193 ± 242	245	U	EPA 901.1
			Tritium	−4.76 ± 90.4	165	U	EPA 906.0 Modified
			Uranium-235	−1.86 ± 15.6	22	U	EPA 901.1
			Uranium-238	193 ± 242	245	U	EPA 901.1
		10-May-2019	Actinium-228	−1.72 ± 10.9	13.6	U	EPA 901.1
			Alpha, gross	3.16 ± 1.35	1.84		EPA 900.0/SW-846 9310
			Americium-241	−2.17 ± 8.77	15.4	U	EPA 901.1
			Beryllium-7	0.677 ± 13.6	24.7	U	EPA 901.1
			Beta, gross	32.3 ± 2.26	2.51		EPA 900.0/SW-846 9310
			Bismuth-212	6.24 ± 25.2	44.9	U	EPA 901.1
			Bismuth-214	5.81 ± 9.77	7.79	U	EPA 901.1
			Cesium-137	0.712 ± 1.67	3.01	U	EPA 901.1
			Cobalt-60	−1.36 ± 1.73	2.71	U	EPA 901.1
			Lead-212	3.56 ± 6.71	5.09	U	EPA 901.1
			Lead-214	2.56 ± 6.8	7.08	U	EPA 901.1
			Neptunium-237	0.982 ± 2.93	5.39	U	EPA 901.1
			Potassium-40	59.4 ± 48.7	31.4		EPA 901.1
			Radium-223	−13.7 ± 31.7	55.3	U	EPA 901.1
			Radium-224	4.05 ± 32.4	50.1	U	EPA 901.1
			Radium-226	−12 ± 61.8	82.7	U	EPA 901.1
			Radium-228	−1.72 ± 10.9	13.6	U	EPA 901.1
			Sodium-22	0.0895 ± 1.75	3.26	U	EPA 901.1

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Table E-2. Radiological results for permitted sanitary outfalls, May 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	10-May-2019	Thorium-227	−3.57 ± 13	21.1	U	EPA 901.1
			Thorium-231	−10.1 ± 33.6	38.3	U	EPA 901.1
			Thorium-234	−123 ± 140	165	U	EPA 901.1
			Tritium	−24.7 ± 88.7	165	U	EPA 906.0 Modified
			Uranium-235	−3.5 ± 15.9	19.6	U	EPA 901.1
			Uranium-238	−123 ± 140	165	U	EPA 901.1

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.

Table E-3. Inorganic results for permitted sanitary outfalls, August 2019

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	5-Aug-19	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
		6-Aug-19	Aluminum	0.0204	0.0193	J	EPA 200.8
			Ammonia	0.336	0.017	B	SM 4500-NH_3-A
			Arsenic	0.0102	0.002		EPA 200.8
			Boron	0.0909	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00899	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
			Fluoride	0.938	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0765	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	0.00633	0.0033	J	EPA 200.8
		7-Aug-19	Aluminum	0.0212	0.0193	J	EPA 200.8
			Ammonia	0.467	0.017	*BN	SM 4500-NH_3-A
			Arsenic	0.00943	0.002		EPA 200.8
			Boron	0.193	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00211	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	7-Aug-19	Fluoride	2.54	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0939	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		0.0033	U	EPA 200.8
		8-Aug-19	Aluminum	0.0253	0.0193	J	EPA 200.8
			Ammonia	2.14	0.085	*BN	SM 4500-NH_3-A
			Arsenic	0.00959	0.002		EPA 200.8
			Boron	0.105	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00133	0.0003	J	EPA 200.8
			Fluoride	5.27	0.066		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0931	0.0002	B	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	0.0053	0.0033	JB	EPA 200.8
		9-Aug-19	Aluminum	0.0306	0.0193	J	EPA 200.8
			Ammonia	0.233	0.017	*BN	SM 4500-NH_3-A
			Arsenic	0.00935	0.002		EPA 200.8
			Boron	0.184	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00328	0.0003		EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	9-Aug-19	Fluoride	0.695	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0917	0.0002	B	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	0.00944	0.0033	JB	EPA 200.8
WW001	2069A	6-Aug-19	Aluminum	0.0742	0.0193		EPA 200.8
			Ammonia	12.4	0.425	B	SM 4500-NH_3-A
			Arsenic	0.00926	0.002		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	0.0148	0.0003		EPA 200.8
			Fluoride	2.2	0.033		EPA 300.0
			Lead	0.00411	0.0005		EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.00993	0.0002		EPA 200.8
			Nickel	0.00144	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.043	0.0033		EPA 200.8
		7-Aug-19	Aluminum	0.0421	0.0193	J	EPA 200.8
			Ammonia	14.3	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.00826	0.002		EPA 200.8
			Boron	0.118	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0126	0.0003		EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	7-Aug-19	Fluoride	2.15	0.033		EPA 300.0
			Lead	0.0048	0.0005		EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0105	0.0002		EPA 200.8
			Nickel	0.00148	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0701	0.0033		EPA 200.8
		8-Aug-19	Aluminum	0.045	0.0193	J	EPA 200.8
			Ammonia	11.9	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.0111	0.002		EPA 200.8
			Boron	0.121	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0145	0.0003		EPA 200.8
			Fluoride	2.5	0.033		EPA 300.0
			Lead	0.00798	0.0005		EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0118	0.0002	B	EPA 200.8
			Nickel	0.00201	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0476	0.0033	BN	EPA 200.8
		9-Aug-19	Aluminum	0.0494	0.0193	J	EPA 200.8
			Ammonia	9.95	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.0102	0.002		EPA 200.8
			Boron	0.117	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0104	0.0003		EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	9-Aug-19	Fluoride	1.34	0.033		EPA 300.0
			Lead	0.00886	0.0005		EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0107	0.0002	B	EPA 200.8
			Nickel	0.00113	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0293	0.0033	BN	EPA 200.8
WW006	2069F	5-Aug-19	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total	0.00201	0.00167	J	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total	0.00219	0.00167	J	EPA 335.4
		6-Aug-19	Aluminum	0.129	0.0193		EPA 200.8
			Ammonia	53.5	0.85	B	SM 4500-NH_3-A
			Arsenic	0.00852	0.002		EPA 200.8
			Boron	0.169	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0252	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total	0.0023	0.00167	J	EPA 335.4
			Cyanide, total	0.00521	0.00167		EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	0.867	0.033		EPA 300.0
			Lead	0.000833	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0286	0.0002		EPA 200.8
			Nickel	0.00185	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	6-Aug-19	Zinc	0.116	0.0033		EPA 200.8
		7-Aug-19	Aluminum	0.156	0.0193		EPA 200.8
			Ammonia	45.3	0.85	*BN	SM 4500-NH_3-A
			Arsenic	0.00841	0.002		EPA 200.8
			Boron	0.155	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0246	0.0003		EPA 200.8
			Fluoride	0.857	0.033		EPA 300.0
			Lead	0.00188	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0132	0.0002		EPA 200.8
			Nickel	0.00223	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver	0.00044	0.0003	J	EPA 200.8
			Zinc	0.133	0.0033		EPA 200.8
		8-Aug-19	Aluminum	0.115	0.0193		EPA 200.8
			Ammonia	46.7	0.85	*BN	SM 4500-NH_3-A
			Arsenic	0.01	0.002		EPA 200.8
			Boron	0.196	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0211	0.0003		EPA 200.8
			Fluoride	1.37	0.033		EPA 300.0
			Lead	0.000902	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0142	0.0002	B	EPA 200.8
			Nickel	0.00188	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver	0.000588	0.0003	J	EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	8-Aug-19	Zinc	0.077	0.0033	BN	EPA 200.8
		9-Aug-19	Aluminum	0.104	0.0193		EPA 200.8
			Ammonia	35.3	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.00824	0.002		EPA 200.8
			Boron	0.145	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0173	0.0003		EPA 200.8
			Fluoride	0.622	0.033		EPA 300.0
			Lead	0.00089	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.00882	0.0002	B	EPA 200.8
			Nickel	0.00156	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0721	0.0033	BN	EPA 200.8
WW007	2069G	6-Aug-19	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.259	0.017	B	SM 4500-NH_3-A
			Arsenic	0.00252	0.002	J	EPA 200.8
			Boron	0.0352	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00171	0.0003	J	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
			Fluoride	2.83	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	6-Aug-19	Molybdenum	0.0107	0.0002		EPA 200.8
			Nickel	0.000688	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.00332	0.0033	J	EPA 200.8
		7-Aug-19	Aluminum		0.0193	U	EPA 200.8
			Ammonia	2.23	0.085	*BN	SM 4500-NH_3-A
			Arsenic	0.00264	0.002	J	EPA 200.8
			Boron	0.0811	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00184	0.0003	J	EPA 200.8
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Fluoride	2.98	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0118	0.0002		EPA 200.8
			Nickel	0.000728	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
		8-Aug-19	Aluminum		0.0193	U	EPA 200.8
			Ammonia	1.67	0.017	*BN	SM 4500-NH_3-A
			Arsenic	0.00388	0.002	J	EPA 200.8
			Boron	0.0422	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	8-Aug-19	Copper	0.00251	0.0003		EPA 200.8
			Fluoride	4.62	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0119	0.0002	B	EPA 200.8
			Nickel	0.000677	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.00936	0.0033	JB	EPA 200.8
		9-Aug-19	Aluminum		0.0193	U	EPA 200.8
			Ammonia	2.08	0.085	*BN	SM 4500-NH_3-A
			Arsenic	0.00314	0.002	J	EPA 200.8
			Boron	0.0651	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00154	0.0003	J	EPA 200.8
			Fluoride	1.2	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0118	0.0002	B	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	0.00431	0.0033	JB	EPA 200.8
WW008	2069I	6-Aug-19	Aluminum	0.127	0.0193		EPA 200.8
			Ammonia	18.1	0.425	B	SM 4500-NH_3-A
			Arsenic	0.0074	0.002		EPA 200.8
			Boron	0.127	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	6-Aug-19	Copper	0.0287	0.0003		EPA 200.8
			Fluoride	0.754	0.033		EPA 300.0
			Lead	0.000652	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.00489	0.0002		EPA 200.8
			Nickel	0.00476	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0553	0.0033		EPA 200.8
		7-Aug-19	Aluminum	0.0709	0.0193		EPA 200.8
			Ammonia	17	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.00871	0.002		EPA 200.8
			Boron	0.13	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0175	0.0003		EPA 200.8
			Fluoride	0.822	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.00534	0.0002		EPA 200.8
			Nickel	0.00419	0.0006		EPA 200.8
			Selenium	0.00255	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.035	0.0033		EPA 200.8
		8-Aug-19	Aluminum	0.117	0.0193		EPA 200.8
			Ammonia	25.8	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.0092	0.002		EPA 200.8
			Boron	0.148	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	8-Aug-19	Copper	0.0301	0.0003		EPA 200.8
			Fluoride	0.674	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0054	0.0002	B	EPA 200.8
			Nickel	0.00538	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0709	0.0033	BN	EPA 200.8
		9-Aug-19	Aluminum	0.0785	0.0193		EPA 200.8
			Ammonia	22.1	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.0087	0.002		EPA 200.8
			Boron	0.14	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0233	0.0003		EPA 200.8
			Fluoride	0.656	0.033		EPA 300.0
			Lead	0.000539	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.00435	0.0002	B	EPA 200.8
			Nickel	0.00351	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0606	0.0033	BN	EPA 200.8
WW011	2069K	6-Aug-19	Aluminum	0.0562	0.0193		EPA 200.8
			Ammonia	15.3	0.425	B	SM 4500-NH_3-A
			Arsenic	0.00522	0.002		EPA 200.8
			Boron	0.263	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	6-Aug-19	Copper	0.013	0.0003		EPA 200.8
			Fluoride	0.717	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0377	0.0002		EPA 200.8
			Nickel	0.00159	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0561	0.0033		EPA 200.8
		7-Aug-19	Aluminum	0.0219	0.0193	J	EPA 200.8
			Ammonia	26	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.00573	0.002		EPA 200.8
			Boron	0.231	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00902	0.0003		EPA 200.8
			Fluoride	0.657	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0285	0.0002		EPA 200.8
			Nickel	0.00132	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0354	0.0033		EPA 200.8
		8-Aug-19	Aluminum	0.0686	0.0193		EPA 200.8
			Ammonia	18.8	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.00615	0.002		EPA 200.8
			Boron	0.323	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8

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Table E-3. Inorganic results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	8-Aug-19	Copper	0.015	0.0003		EPA 200.8
			Fluoride	0.714	0.033		EPA 300.0
			Lead	0.000631	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0183	0.0002	B	EPA 200.8
			Nickel	0.00174	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.198	0.0033	BN	EPA 200.8
		9-Aug-19	Aluminum	0.0989	0.0193		EPA 200.8
			Ammonia	15	0.425	*BN	SM 4500-NH_3-A
			Arsenic	0.00651	0.002		EPA 200.8
			Boron	0.367	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0175	0.0003		EPA 200.8
			Fluoride	0.633	0.033		EPA 300.0
			Lead	0.000753	0.0005	J	EPA 200.8
			Mercury		0.000067	UH	EPA 245.1/245.2
			Molybdenum	0.0155	0.0002	B	EPA 200.8
			Nickel	0.00211	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0727	0.0033	BN	EPA 200.8

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

Table E-4. Radiological results for permitted sanitary outfalls, August 2019

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	06-Aug-2019	Actinium-228	−1.92 ± 13.5	17.5	U	EPA 901.1
			Alpha, gross	−6.96 ± 6.24	13.3	NU	EPA 900.0/SW-846 9310
			Americium-241	1.58 ± 10.2	18.4	U	EPA 901.1
			Beryllium-7	1.22 ± 15.8	28.6	U	EPA 901.1
			Beta, gross	23.4 ± 7.75	12.2		EPA 900.0/SW-846 9310
			Bismuth-212	29.5 ± 33.7	57.9	U	EPA 901.1
			Bismuth-214	5.94 ± 9.79	7.47	U	EPA 901.1
			Cesium-137	0.929 ± 2.28	4.06	U	EPA 901.1
			Cobalt-60	1.15 ± 1.75	3.49	U	EPA 901.1
			Lead-212	5.98 ± 8.36	7.2	U	EPA 901.1
			Lead-214	−2.6 ± 6.52	8.5	U	EPA 901.1
			Neptunium-237	−.849 ± 3.65	6.54	U	EPA 901.1
			Potassium-40	90.4 ± 49.4	48.4		EPA 901.1
			Radium-223	−6.6 ± 35.7	64.1	U	EPA 901.1
			Radium-224	−23.6 ± 52	61.9	U	EPA 901.1
			Radium-226	−41.2 ± 69.1	81.3	U	EPA 901.1
			Radium-228	−1.92 ± 13.5	17.5	U	EPA 901.1
			Sodium-22	0.5 ± 2.24	4.2	U	EPA 901.1
			Thorium-227	3.17 ± 14.5	24.4	U	EPA 901.1
			Thorium-231	27.3 ± 26.9	43.7	U	EPA 901.1
			Thorium-234	8.73 ± 171	151	U	EPA 901.1
			Tritium	−17.7 ± 96.2	177	U	EPA 906.0 Modified
			Uranium-235	5.71 ± 20	20.4	U	EPA 901.1
			Uranium-238	8.73 ± 171	151	U	EPA 901.1
		07-Aug-2019	Actinium-228	1.39 ± 13.6	15.8	U	EPA 901.1
			Alpha, gross	0.0351 ± 0.592	1.1	NU	EPA 900.0/SW-846 9310
			Americium-241	1.01 ± 2.65	4.38	U	EPA 901.1
			Beryllium-7	−11.1 ± 15.5	25	U	EPA 901.1
			Beta, gross	0.907 ± 0.7	1.16	U	EPA 900.0/SW-846 9310
			Bismuth-212	36.8 ± 31.6	52	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	07-Aug-2019	Bismuth-214	0.392 ± 10.7	9.15	U	EPA 901.1
			Cesium-137	−0.879 ± 1.97	3.29	U	EPA 901.1
			Cobalt-60	1.62 ± 2.3	4.09	U	EPA 901.1
			Lead-212	−0.374 ± 4.37	5.73	U	EPA 901.1
			Lead-214	1.57 ± 8.11	7.58	U	EPA 901.1
			Neptunium-237	2.36 ± 3.42	6.09	U	EPA 901.1
			Potassium-40	−13.9 ± 43.8	49.2	U	EPA 901.1
			Radium-223	−23.4 ± 36.2	54	U	EPA 901.1
			Radium-224	−51.3 ± 41.7	52.6	U	EPA 901.1
			Radium-226	0.0771 ± 60.8	82	U	EPA 901.1
			Radium-228	1.39 ± 13.6	15.8	U	EPA 901.1
			Sodium-22	−1.62 ± 2.14	3.4	U	EPA 901.1
			Thorium-227	2.06 ± 12.6	21	U	EPA 901.1
			Thorium-231	−4.68 ± 22.8	27.2	U	EPA 901.1
			Thorium-234	9.41 ± 69.9	77.7	U	EPA 901.1
			Tritium	42.2 ± 99.6	173	U	EPA 906.0 Modified
			Uranium-235	−6.74 ± 15.5	16.9	U	EPA 901.1
			Uranium-238	9.41 ± 69.9	77.7	U	EPA 901.1
		08-Aug-2019	Actinium-228	−19.4 ± 15.6	16.1	U	EPA 901.1
			Alpha, gross	1.05 ± 1.08	1.79	U	EPA 900.0/SW-846 9310
			Americium-241	−0.998 ± 14.9	24.2	U	EPA 901.1
			Beryllium-7	−4.89 ± 17.5	30	U	EPA 901.1
			Beta, gross	1.1 ± 1.01	1.68	U	EPA 900.0/SW-846 9310
			Bismuth-212	13.8 ± 29.4	52.4	U	EPA 901.1
			Bismuth-214	0.883 ± 10	8.86	U	EPA 901.1
			Cesium-137	0.757 ± 2.19	3.91	U	EPA 901.1
			Cobalt-60	−0.906 ± 4.26	4.67	U	EPA 901.1
			Lead-212	3.17 ± 9.53	8.14	U	EPA 901.1
			Lead-214	−1.98 ± 7.85	8.71	U	EPA 901.1
			Neptunium-237	−.74 ± 3.98	6.95	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	08-Aug-2019	Potassium-40	−60.4 ± 61.1	61.9	U	EPA 901.1
			Radium-223	−19.6 ± 41.4	69.5	U	EPA 901.1
			Radium-224	−4.15 ± 41.1	64.7	U	EPA 901.1
			Radium-226	49.8 ± 106	69.7	U	EPA 901.1
			Radium-228	−19.4 ± 15.6	16.1	U	EPA 901.1
			Sodium-22	2.08 ± 2.29	4.33	U	EPA 901.1
			Thorium-227	11.2 ± 15.5	26.6	U	EPA 901.1
			Thorium-231	40.7 ± 36.3	52.6	U	EPA 901.1
			Thorium-234	−239 ± 234	239	U	EPA 901.1
			Tritium	−11.4 ± 103	189	U	EPA 906.0 Modified
			Uranium-235	−13.1 ± 24.4	24	U	EPA 901.1
			Uranium-238	−239 ± 234	239	U	EPA 901.1
		09-Aug-2019	Actinium-228	14.1 ± 8.38	8.87	X	EPA 901.1
			Alpha, gross	−0.12 ± 0.587	1.15	U	EPA 900.0/SW-846 9310
			Americium-241	1.68 ± 8.88	13.1	U	EPA 901.1
			Beryllium-7	−2.78 ± 11	19.2	U	EPA 901.1
			Beta, gross	1.3 ± 0.681	1.1		EPA 900.0/SW-846 9310
			Bismuth-212	−14.4 ± 36.4	35.3	U	EPA 901.1
			Bismuth-214	4.72 ± 6.58	4.77	U	EPA 901.1
			Cesium-137	−0.196 ± 1.47	2.55	U	EPA 901.1
			Cobalt-60	−0.0691 ± 1.52	2.77	U	EPA 901.1
			Lead-212	4.25 ± 5.88	3.93	X	EPA 901.1
			Lead-214	−1.1 ± 6.15	5.96	U	EPA 901.1
			Neptunium-237	−1.8 ± 2.69	4.51	U	EPA 901.1
			Potassium-40	−0.358 ± 40.1	42.2	U	EPA 901.1
			Radium-223	−7.43 ± 26	46.2	U	EPA 901.1
			Radium-224	36.6 ± 33.1	38.5	U	EPA 901.1
			Radium-226	59 ± 82.2	42.9	X	EPA 901.1
			Radium-228	14.1 ± 8.38	8.87	X	EPA 901.1
			Sodium-22	−0.325 ± 1.63	2.56	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	09-Aug-2019	Thorium-227	2.67 ± 11.1	18.4	U	EPA 901.1
			Thorium-231	24.5 ± 45.3	30.7	U	EPA 901.1
			Thorium-234	−146 ± 140	143	U	EPA 901.1
			Tritium	−71.3 ± 99	192	U	EPA 906.0 Modified
			Uranium-235	−1.66 ± 14	15.7	U	EPA 901.1
			Uranium-238	−146 ± 140	143	U	EPA 901.1
WW001	2069A	06-Aug-2019	Actinium-228	5.34 ± 12.8	8.32	U	EPA 901.1
			Alpha, gross	4.27 ± 1.66	2.21	N	EPA 900.0/SW-846 9310
			Americium-241	0.267 ± 7.33	11.7	U	EPA 901.1
			Beryllium-7	0.944 ± 11.4	20.5	U	EPA 901.1
			Beta, gross	11.5 ± 1.89	2.6		EPA 900.0/SW-846 9310
			Bismuth-212	−23.8 ± 32.6	34.1	U	EPA 901.1
			Bismuth-214	−2.4 ± 5.64	6.04	U	EPA 901.1
			Cesium-137	0.903 ± 1.43	2.52	U	EPA 901.1
			Cobalt-60	−1.93 ± 2.88	2.71	U	EPA 901.1
			Lead-212	6.29 ± 6.23	6.3	U	EPA 901.1
			Lead-214	2.93 ± 7.98	5.87	U	EPA 901.1
			Neptunium-237	−2.66 ± 2.81	4.4	U	EPA 901.1
			Potassium-40	−28.7 ± 41.4	42.7	U	EPA 901.1
			Radium-223	19.3 ± 28.1	49.2	U	EPA 901.1
			Radium-224	22.6 ± 29.9	44.1	U	EPA 901.1
			Radium-226	6.86 ± 67.7	66.7	U	EPA 901.1
			Radium-228	5.34 ± 12.8	8.32	U	EPA 901.1
			Sodium-22	0.883 ± 1.48	2.63	U	EPA 901.1
			Thorium-227	3.18 ± 11.2	18.5	U	EPA 901.1
			Thorium-231	21.8 ± 42.4	29.8	U	EPA 901.1
			Thorium-234	125 ± 152	130	U	EPA 901.1
			Tritium	18.3 ± 96.5	172	U	EPA 906.0 Modified
			Uranium-235	−12.7 ± 14	15.3	U	EPA 901.1
			Uranium-238	125 ± 152	130	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	7-Aug-2019	Actinium-228	1.43 ± 16.9	14.8	U	EPA 901.1
			Alpha, gross	2.17 ± 2.1	3.46	NU	EPA 900.0/SW-846 9310
			Americium-241	3.23 ± 11.1	19.8	U	EPA 901.1
			Beryllium-7	−0.0349 ± 13.6	23.7	U	EPA 901.1
			Beta, gross	13.4 ± 2.12	3.01		EPA 900.0/SW-846 9310
			Bismuth-212	15.8 ± 35.1	39.5	U	EPA 901.1
			Bismuth-214	0.773 ± 9.04	6.19	U	EPA 901.1
			Cesium-137	2.05 ± 3.28	3.26	U	EPA 901.1
			Cobalt-60	−3.69 ± 4.44	3.15	U	EPA 901.1
			Lead-212	0.493 ± 7.54	6.31	U	EPA 901.1
			Lead-214	−2.66 ± 7.45	7.09	U	EPA 901.1
			Neptunium-237	0.78 ± 3.09	5.43	U	EPA 901.1
			Potassium-40	−74.2 ± 62.2	48.7	U	EPA 901.1
			Radium-223	−28.9 ± 34.3	53.3	U	EPA 901.1
			Radium-224	15.1 ± 33.6	52.8	U	EPA 901.1
			Radium-226	2.61 ± 402	55.2	U	EPA 901.1
			Radium-228	1.43 ± 16.9	14.8	U	EPA 901.1
			Sodium-22	0.142 ± 1.67	3.14	U	EPA 901.1
			Thorium-227	0.466 ± 12.4	21.8	U	EPA 901.1
			Thorium-231	27.9 ± 27.5	44	U	EPA 901.1
			Thorium-234	−119 ± 200	196	U	EPA 901.1
			Tritium	−44.9 ± 94.4	178	U	EPA 906.0 Modified
			Uranium-235	0.229 ± 24.6	17.8	U	EPA 901.1
			Uranium-238	−119 ± 200	196	U	EPA 901.1
		8-Aug-2019	Actinium-228	4.86 ± 17	16.4	U	EPA 901.1
			Alpha, gross	3.56 ± 1.63	2.19		EPA 900.0/SW-846 9310
			Americium-241	1.69 ± 9.83	16.7	U	EPA 901.1
			Beryllium-7	1.54 ± 18.2	31.6	U	EPA 901.1
			Beta, gross	12 ± 1.82	2.55		EPA 900.0/SW-846 9310
			Bismuth-212	−20.1 ± 40.2	53.6	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	8-Aug-2019	Bismuth-214	0.839 ± 8.45	8.39	U	EPA 901.1
			Cesium-137	2.16 ± 2.51	4.19	U	EPA 901.1
			Cobalt-60	−1.65 ± 2.15	3.31	U	EPA 901.1
			Lead-212	2.63 ± 7.74	7.2	U	EPA 901.1
			Lead-214	3.96 ± 5.33	9.03	U	EPA 901.1
			Neptunium-237	1.24 ± 4.25	7.48	U	EPA 901.1
			Potassium-40	2.07 ± 54.9	37.5	U	EPA 901.1
			Radium-223	−5.97 ± 39.7	69.1	U	EPA 901.1
			Radium-224	−18.9 ± 55.1	66.6	U	EPA 901.1
			Radium-226	42.7 ± 101	69.1	U	EPA 901.1
			Radium-228	4.86 ± 17	16.4	U	EPA 901.1
			Sodium-22	0.969 ± 2.12	3.94	U	EPA 901.1
			Thorium-227	−23.9 ± 19.3	26	U	EPA 901.1
			Thorium-231	3.28 ± 42.7	43.1	U	EPA 901.1
			Thorium-234	−100 ± 135	154	U	EPA 901.1
			Tritium	59.2 ± 107	185	U	EPA 906.0 Modified
			Uranium-235	12.6 ± 25.2	20.3	U	EPA 901.1
			Uranium-238	−100 ± 135	154	U	EPA 901.1
		9-Aug-2019	Actinium-228	−22 ± 19	16	U	EPA 901.1
			Alpha, gross	2.89 ± 2.07	3.32	U	EPA 900.0/SW-846 9310
			Americium-241	−3.22 ± 15.6	24.3	U	EPA 901.1
			Beryllium-7	11.9 ± 16.2	27.8	U	EPA 901.1
			Beta, gross	12.2 ± 1.55	2.05		EPA 900.0/SW-846 9310
			Bismuth-212	25.1 ± 28.7	50.8	U	EPA 901.1
			Bismuth-214	7.27 ± 10.6	6.53	X	EPA 901.1
			Cesium-137	2.16 ± 3.65	3.5	U	EPA 901.1
			Cobalt-60	−1.14 ± 2.33	3.8	U	EPA 901.1
			Lead-212	1.73 ± 5.64	7.47	U	EPA 901.1
			Lead-214	−1.18 ± 6.52	7.63	U	EPA 901.1
			Neptunium-237	−2.31 ± 3.64	5.94	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	9-Aug-2019	Potassium-40	−15.6 ± 38.1	50.6	U	EPA 901.1
			Radium-223	8.56 ± 35.4	62.6	U	EPA 901.1
			Radium-224	−116 ± 65.5	60.2	U	EPA 901.1
			Radium-226	−77.5 ± 82.7	98.6	U	EPA 901.1
			Radium-228	−22 ± 19	16	U	EPA 901.1
			Sodium-22	−0.0871 ± 2.12	3.77	U	EPA 901.1
			Thorium-227	0.346 ± 13.8	24.5	U	EPA 901.1
			Thorium-231	−40 ± 47.6	47.8	U	EPA 901.1
			Thorium-234	66.8 ± 255	193	U	EPA 901.1
			Tritium	50 ± 107	185	U	EPA 906.0 Modified
			Uranium-235	−14.5 ± 21.6	20.9	U	EPA 901.1
			Uranium-238	66.8 ± 255	193	U	EPA 901.1
WW006	2069F	6-Aug-2019	Actinium-228	−12.9 ± 17.2	10.4	U	EPA 901.1
			Alpha, gross	2.14 ± 2.22	3.67	NU	EPA 900.0/SW-846 9310
			Americium-241	−1.39 ± 4.8	7.39	U	EPA 901.1
			Beryllium-7	6.27 ± 9.51	16.7	U	EPA 901.1
			Beta, gross	21 ± 3.24	4.56		EPA 900.0/SW-846 9310
			Bismuth-212	8.93 ± 16.1	28.2	U	EPA 901.1
			Bismuth-214	1.57 ± 6.72	5.23	U	EPA 901.1
			Cesium-137	0.528 ± 1.13	2	U	EPA 901.1
			Cobalt-60	−0.525 ± 1.15	2.03	U	EPA 901.1
			Lead-212	−2.94 ± 4.44	4.13	U	EPA 901.1
			Lead-214	0.766 ± 6.11	4.67	U	EPA 901.1
			Neptunium-237	0.949 ± 2.02	3.61	U	EPA 901.1
			Potassium-40	9.56 ± 35.6	19.4	U	EPA 901.1
			Radium-223	−6.27 ± 19	33	U	EPA 901.1
			Radium-224	−31.1 ± 24	32.1	U	EPA 901.1
			Radium-226	−92.7 ± 62.1	49.7	U	EPA 901.1
			Radium-228	−12.9 ± 17.2	10.4	U	EPA 901.1
			Sodium-22	−0.901 ± 2.03	2.38	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	6-Aug-2019	Thorium-227	−1.84 ± 7.66	13.5	U	EPA 901.1
			Thorium-231	35 ± 24.2	19.1	X	EPA 901.1
			Thorium-234	−61.6 ± 99.4	86.2	U	EPA 901.1
			Tritium	14.1 ± 95.7	171	U	EPA 906.0 Modified
			Uranium-235	5.99 ± 11.8	11.4	U	EPA 901.1
			Uranium-238	−61.6 ± 99.4	86.2	U	EPA 901.1
		7-Aug-2019	Actinium-228	0.692 ± 16.7	13	U	EPA 901.1
			Alpha, gross	2.48 ± 1.57	2.4	N	EPA 900.0/SW-846 9310
			Americium-241	−6.55 ± 19.9	29.5	U	EPA 901.1
			Beryllium-7	5.44 ± 15.9	28.2	U	EPA 901.1
			Beta, gross	20.1 ± 1.94	2.39		EPA 900.0/SW-846 9310
			Bismuth-212	−15.2 ± 28.2	45.2	U	EPA 901.1
			Bismuth-214	−5.35 ± 7.45	9.2	U	EPA 901.1
			Cesium-137	−0.446 ± 2.11	3.59	U	EPA 901.1
			Cobalt-60	−1.5 ± 1.92	3.02	U	EPA 901.1
			Lead-212	2.83 ± 8.77	7.69	U	EPA 901.1
			Lead-214	−5.96 ± 7.69	8.11	U	EPA 901.1
			Neptunium-237	−0.131 ± 3.85	6.78	U	EPA 901.1
			Potassium-40	4.02 ± 60.4	39.8	U	EPA 901.1
			Radium-223	6.6 ± 38.5	68.1	U	EPA 901.1
			Radium-224	53.5 ± 46.7	67.6	U	EPA 901.1
			Radium-226	−82.3 ± 82.6	90.3	U	EPA 901.1
			Radium-228	0.692 ± 16.7	13	U	EPA 901.1
			Sodium-22	−0.572 ± 1.97	3.53	U	EPA 901.1
			Thorium-227	−5.15 ± 15.9	27.5	U	EPA 901.1
			Thorium-231	49.8 ± 42	53.6	U	EPA 901.1
			Thorium-234	172 ± 302	257	U	EPA 901.1
			Tritium	−28.4 ± 93.8	174	U	EPA 906.0 Modified
			Uranium-235	−8.97 ± 19.2	23.4	U	EPA 901.1
			Uranium-238	172 ± 302	257	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	8-Aug-2019	Actinium-228	0.25 ± 15.1	14.1	U	EPA 901.1
			Alpha, gross	3.14 ± 1.89	2.81		EPA 900.0/SW-846 9310
			Americium-241	4.62 ± 6.7	10.3	U	EPA 901.1
			Beryllium-7	5.56 ± 13.8	24.5	U	EPA 901.1
			Beta, gross	21 ± 2.37	2.94		EPA 900.0/SW-846 9310
			Bismuth-212	−0.696 ± 27	41.4	U	EPA 901.1
			Bismuth-214	−3.97 ± 6.39	7.43	U	EPA 901.1
			Cesium-137	0.128 ± 2.76	3.17	U	EPA 901.1
			Cobalt-60	3.39 ± 3.45	3.57	U	EPA 901.1
			Lead-212	2.86 ± 5.25	4.78	U	EPA 901.1
			Lead-214	2.28 ± 7.01	7.09	U	EPA 901.1
			Neptunium-237	0.0465 ± 3.06	5.44	U	EPA 901.1
			Potassium-40	40.2 ± 42.2	30.1	X	EPA 901.1
			Radium-223	11 ± 30.7	54.6	U	EPA 901.1
			Radium-224	−10.9 ± 44	50.6	U	EPA 901.1
			Radium-226	33.8 ± 73	81.2	U	EPA 901.1
			Radium-228	0.25 ± 15.1	14.1	U	EPA 901.1
			Sodium-22	−0.695 ± 1.71	2.97	U	EPA 901.1
			Thorium-227	−20.8 ± 25.1	19.5	U	EPA 901.1
			Thorium-231	14.8 ± 39.1	33.1	U	EPA 901.1
			Thorium-234	−61.7 ± 100	130	U	EPA 901.1
			Tritium	176 ± 125	192	U	EPA 906.0 Modified
			Uranium-235	4.43 ± 17.5	16.9	U	EPA 901.1
			Uranium-238	−61.7 ± 100	130	U	EPA 901.1
		9-Aug-2019	Actinium-228	1.27 ± 13.7	11.8	U	EPA 901.1
			Alpha, gross	3.06 ± 1.47	2.15		EPA 900.0/SW-846 9310
			Americium-241	−5.6 ± 15.2	17.6	U	EPA 901.1
			Beryllium-7	3.98 ± 13.5	24.5	U	EPA 901.1
			Beta, gross	18.7 ± 1.66	1.92		EPA 900.0/SW-846 9310
			Bismuth-212	4.92 ± 24.6	44	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	9-Aug-2019	Bismuth-214	10.2 ± 5.86	6.2		EPA 901.1
			Cesium-137	0.88 ± 1.75	3.16	U	EPA 901.1
			Cobalt-60	−0.275 ± 1.8	3.32	U	EPA 901.1
			Lead-212	3.62 ± 7.5	4.64	U	EPA 901.1
			Lead-214	−2.24 ± 6.33	6.55	U	EPA 901.1
			Neptunium-237	0.596 ± 3.06	5.6	U	EPA 901.1
			Potassium-40	39.4 ± 51.5	31	X	EPA 901.1
			Radium-223	−0.674 ± 31.8	57.6	U	EPA 901.1
			Radium-224	8.33 ± 33.5	51.5	U	EPA 901.1
			Radium-226	19 ± 72.8	51.6	U	EPA 901.1
			Radium-228	1.27 ± 13.7	11.8	U	EPA 901.1
			Sodium-22	−0.45 ± 1.68	3.05	U	EPA 901.1
			Thorium-227	2.95 ± 13	21.7	U	EPA 901.1
			Thorium-231	1.56 ± 44.3	38.3	U	EPA 901.1
			Thorium-234	38.8 ± 183	139	U	EPA 901.1
			Tritium	−1.07 ± 99.4	181	U	EPA 906.0 Modified
			Uranium-235	−3.36 ± 15.5	17.2	U	EPA 901.1
			Uranium-238	38.8 ± 183	139	U	EPA 901.1
WW007	2069G	6-Aug-2019	Actinium-228	−2.54 ± 13.9	18.2	U	EPA 901.1
			Alpha, gross	2.34 ± 1.25	1.92	N	EPA 900.0/SW-846 9310
			Americium-241	12.7 ± 14.7	22.9	U	EPA 901.1
			Beryllium-7	−7 ± 17.7	29.5	U	EPA 901.1
			Beta, gross	0.7 ± 0.922	1.55	U	EPA 900.0/SW-846 9310
			Bismuth-212	48.2 ± 38.3	49.9	U	EPA 901.1
			Bismuth-214	3.23 ± 9.81	7.64	U	EPA 901.1
			Cesium-137	1.34 ± 2.13	3.94	U	EPA 901.1
			Cobalt-60	2.09 ± 2.44	4.49	U	EPA 901.1
			Lead-212	−2.64 ± 6.21	8.06	U	EPA 901.1
			Lead-214	−6.96 ± 8.34	8.6	U	EPA 901.1
			Neptunium-237	2.49 ± 4.03	7.1	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	6-Aug-2019	Potassium-40	42.6 ± 55.8	38	X	EPA 901.1
			Radium-223	−16 ± 40.5	69	U	EPA 901.1
			Radium-224	−127 ± 71.8	65.3	U	EPA 901.1
			Radium-226	23.3 ± 102	66.8	U	EPA 901.1
			Radium-228	−2.54 ± 13.9	18.2	U	EPA 901.1
			Sodium-22	1.59 ± 4.6	3.85	U	EPA 901.1
			Thorium-227	−19.8 ± 17.9	25.7	U	EPA 901.1
			Thorium-231	−35 ± 48.2	50.7	U	EPA 901.1
			Thorium-234	214 ± 232	169	X	EPA 901.1
			Tritium	21.8 ± 94.8	168	U	EPA 906.0 Modified
			Uranium-235	−5.43 ± 20.3	23.4	U	EPA 901.1
			Uranium-238	214 ± 232	169	X	EPA 901.1
		7-Aug-2019	Actinium-228	−3.98 ± 12.2	15.3	U	EPA 901.1
			Alpha, gross	2.23 ± 1.84	2.92	NU	EPA 900.0/SW-846 9310
			Americium-241	2.44 ± 15.4	19.4	U	EPA 901.1
			Beryllium-7	3.36 ± 14.3	26	U	EPA 901.1
			Beta, gross	11.2 ± 2.21	3.23		EPA 900.0/SW-846 9310
			Bismuth-212	22.2 ± 23.7	42.3	U	EPA 901.1
			Bismuth-214	4.63 ± 6.21	6.35	U	EPA 901.1
			Cesium-137	−.323 ± 1.77	3.11	U	EPA 901.1
			Cobalt-60	−1.23 ± 2.15	3.63	U	EPA 901.1
			Lead-212	4.3 ± 8.15	6.81	U	EPA 901.1
			Lead-214	0.069 ± 6.5	7.5	U	EPA 901.1
			Neptunium-237	0.597 ± 3.21	5.89	U	EPA 901.1
			Potassium-40	90.5 ± 51.9	32.2		EPA 901.1
			Radium-223	11.2 ± 33	60.2	U	EPA 901.1
			Radium-224	29.2 ± 35.3	56.8	U	EPA 901.1
			Radium-226	33.6 ± 83.6	59.5	U	EPA 901.1
			Radium-228	−3.98 ± 12.2	15.3	U	EPA 901.1
			Sodium-22	1.07 ± 1.89	3.67	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	7-Aug-2019	Thorium-227	1.42 ± 14	23.3	U	EPA 901.1
			Thorium-231	−18.6 ± 34.6	39.6	U	EPA 901.1
			Thorium-234	54.1 ± 195	142	U	EPA 901.1
			Tritium	−49.9 ± 91	173	U	EPA 906.0 Modified
			Uranium-235	6.94 ± 15.9	18.6	U	EPA 901.1
			Uranium-238	54.1 ± 195	142	U	EPA 901.1
		8-Aug-2019	Actinium-228	−2.59 ± 13.6	15.1	U	EPA 901.1
			Alpha, gross	2.55 ± 1.09	1.45		EPA 900.0/SW-846 9310
			Americium-241	1.22 ± 2.66	4.68	U	EPA 901.1
			Beryllium-7	15.4 ± 17.7	30.5	U	EPA 901.1
			Beta, gross	3.44 ± .907	1.35		EPA 900.0/SW-846 9310
			Bismuth-212	33.3 ± 31.5	52.7	U	EPA 901.1
			Bismuth-214	−6.59 ± 8.73	8.25	U	EPA 901.1
			Cesium-137	−1.11 ± 1.98	3.22	U	EPA 901.1
			Cobalt-60	1.66 ± 2.36	4.05	U	EPA 901.1
			Lead-212	6.88 ± 6.71	4.9		EPA 901.1
			Lead-214	1.51 ± 8.09	7.53	U	EPA 901.1
			Neptunium-237	0.554 ± 3.09	5.67	U	EPA 901.1
			Potassium-40	7 ± 45	55.9	U	EPA 901.1
			Radium-223	−6.76 ± 29.9	53.5	U	EPA 901.1
			Radium-224	30.4 ± 35.9	53.5	U	EPA 901.1
			Radium-226	2.15 ± 76.4	78.7	U	EPA 901.1
			Radium-228	−2.59 ± 13.6	15.1	U	EPA 901.1
			Sodium-22	0.269 ± 1.93	3.63	U	EPA 901.1
			Thorium-227	−11.3 ± 13.2	18.9	U	EPA 901.1
			Thorium-231	−11.5 ± 23.4	26.8	U	EPA 901.1
			Thorium-234	−36 ± 60.1	76.3	U	EPA 901.1
			Tritium	−110 ± 91.9	186	U	EPA 906.0 Modified
			Uranium-235	−12.4 ± 15.1	16.1	U	EPA 901.1
			Uranium-238	−36 ± 60.1	76.3	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	9-Aug-2019	Actinium-228	8.39 ± 16.5	16.1	U	EPA 901.1
			Alpha, gross	1.53 ± 1.23	1.99	U	EPA 900.0/SW-846 9310
			Americium-241	−8.32 ± 9.62	14.9	U	EPA 901.1
			Beryllium-7	2.03 ± 13.7	24.4	U	EPA 901.1
			Beta, gross	2.56 ± 0.884	1.38		EPA 900.0/SW-846 9310
			Bismuth-212	−3.31 ± 33.1	44.1	U	EPA 901.1
			Bismuth-214	−4.21 ± 7.49	7.43	U	EPA 901.1
			Cesium-137	1.2 ± 1.9	3.32	U	EPA 901.1
			Cobalt-60	1.36 ± 2.03	3.74	U	EPA 901.1
			Lead-212	4.9 ± 7.27	5.01	U	EPA 901.1
			Lead-214	8.38 ± 7.42	8.38	U	EPA 901.1
			Neptunium-237	−0.636 ± 3.46	5.49	U	EPA 901.1
			Potassium-40	−35.5 ± 43.6	51.1	U	EPA 901.1
			Radium-223	1.25 ± 33	58.9	U	EPA 901.1
			Radium-224	−16.9 ± 34.6	53.6	U	EPA 901.1
			Radium-226	−81.9 ± 78.3	79.6	U	EPA 901.1
			Radium-228	8.39 ± 16.5	16.1	U	EPA 901.1
			Sodium-22	−0.943 ± 1.87	3.12	U	EPA 901.1
			Thorium-227	−9.02 ± 14.7	22	U	EPA 901.1
			Thorium-231	14.5 ± 40.9	38.7	U	EPA 901.1
			Thorium-234	−21.4 ± 138	155	U	EPA 901.1
			Tritium	−16.7 ± 103	190	U	EPA 906.0 Modified
			Uranium-235	−15.9 ± 18.4	18.5	U	EPA 901.1
			Uranium-238	−21.4 ± 138	155	U	EPA 901.1
WW008	2069I	6-Aug-2019	Actinium-228	17.5 ± 13.2	17.6	U	EPA 901.1
			Alpha, gross	3.24 ± 1.29	1.77	N	EPA 900.0/SW-846 9310
			Americium-241	−4.42 ± 8.16	12.7	U	EPA 901.1
			Beryllium-7	0.886 ± 9.94	17.9	U	EPA 901.1
			Beta, gross	12.9 ± 1.61	2.07		EPA 900.0/SW-846 9310
			Bismuth-212	−33.8 ± 38.7	31.7	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	6-Aug-2019	Bismuth-214	−2.67 ± 5.54	5.82	U	EPA 901.1
			Cesium-137	−1.25 ± 1.49	2.27	U	EPA 901.1
			Cobalt-60	0.216 ± 1.59	2.59	U	EPA 901.1
			Lead-212	3.33 ± 5.95	4.96	U	EPA 901.1
			Lead-214	−2.12 ± 6.13	5.61	U	EPA 901.1
			Neptunium-237	0.619 ± 2.5	4.54	U	EPA 901.1
			Potassium-40	8.69 ± 52.8	26.1	U	EPA 901.1
			Radium-223	−12.6 ± 26.1	40.3	U	EPA 901.1
			Radium-224	15.2 ± 27.4	41.7	U	EPA 901.1
			Radium-226	80.9 ± 90.5	80.9	U	EPA 901.1
			Radium-228	17.5 ± 13.2	17.6	U	EPA 901.1
			Sodium-22	−0.624 ± 1.49	2.57	U	EPA 901.1
			Thorium-227	−1.21 ± 10.8	17.7	U	EPA 901.1
			Thorium-231	3.1 ± 42.3	31.7	U	EPA 901.1
			Thorium-234	27.5 ± 153	106	U	EPA 901.1
			Tritium	−33.3 ± 91.3	171	U	EPA 906.0 Modified
			Uranium-235	4.25 ± 17	13.3	U	EPA 901.1
			Uranium-238	27.5 ± 153	106	U	EPA 901.1
		7-Aug-2019	Actinium-228	4.4 ± 14.9	7.45	U	EPA 901.1
			Alpha, gross	1.61 ± 1.65	2.74	NU	EPA 900.0/SW-846 9310
			Americium-241	3.35 ± 9.14	16.6	U	EPA 901.1
			Beryllium-7	1.38 ± 11.1	18.7	U	EPA 901.1
			Beta, gross	15.9 ± 1.57	1.9		EPA 900.0/SW-846 9310
			Bismuth-212	−8.15 ± 36.8	34.2	U	EPA 901.1
			Bismuth-214	10.7 ± 7.99	4.13		EPA 901.1
			Cesium-137	−0.0351 ± 1.2	2.35	U	EPA 901.1
			Cobalt-60	1.59 ± 1.28	2.62	U	EPA 901.1
			Lead-212	−6.96 ± 5.63	5.7	U	EPA 901.1
			Lead-214	−5.91 ± 7.79	6.34	U	EPA 901.1
			Neptunium-237	−0.636 ± 2.71	4.43	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	7-Aug-2019	Potassium-40	15.7 ± 56.2	28.4	U	EPA 901.1
			Radium-223	−0.921 ± 26.4	44	U	EPA 901.1
			Radium-224	4.32 ± 22.8	39.2	U	EPA 901.1
			Radium-226	57.8 ± 90.3	83	U	EPA 901.1
			Radium-228	4.4 ± 14.9	7.45	U	EPA 901.1
			Sodium-22	−2.1 ± 1.6	1.77	U	EPA 901.1
			Thorium-227	4.6 ± 10.6	18.1	U	EPA 901.1
			Thorium-231	0.297 ± 57.4	31.3	U	EPA 901.1
			Thorium-234	−141 ± 201	190	U	EPA 901.1
			Tritium	−4.54 ± 96.7	176	U	EPA 906.0 Modified
			Uranium-235	−19.6 ± 16.3	17.3	U	EPA 901.1
			Uranium-238	−141 ± 201	190	U	EPA 901.1
		8-Aug-2019	Actinium-228	−3.58 ± 15.9	16.5	U	EPA 901.1
			Alpha, gross	4.13 ± 1.48	1.89		EPA 900.0/SW-846 9310
			Americium-241	2.43 ± 13.5	24.9	U	EPA 901.1
			Beryllium-7	7.07 ± 19	30.3	U	EPA 901.1
			Beta, gross	16.9 ± 1.67	1.93		EPA 900.0/SW-846 9310
			Bismuth-212	3.39 ± 29.4	54	U	EPA 901.1
			Bismuth-214	−10.5 ± 10.1	8.94	U	EPA 901.1
			Cesium-137	0.0127 ± 1.9	3.53	U	EPA 901.1
			Cobalt-60	1.67 ± 2.31	4.48	U	EPA 901.1
			Lead-212	0.837 ± 6.56	7.24	U	EPA 901.1
			Lead-214	2.55 ± 9.14	8.07	U	EPA 901.1
			Neptunium-237	−3.38 ± 5.7	6.42	U	EPA 901.1
			Potassium-40	74.3 ± 47.2	38.6	X	EPA 901.1
			Radium-223	−36.7 ± 39.7	60.6	U	EPA 901.1
			Radium-224	1.58 ± 38.3	63.1	U	EPA 901.1
			Radium-226	−48.3 ± 70.8	83.8	U	EPA 901.1
			Radium-228	−3.58 ± 15.9	16.5	U	EPA 901.1
			Sodium-22	−1.35 ± 2.46	4.19	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	8-Aug-2019	Thorium-227	5.6 ± 15	24.9	U	EPA 901.1
			Thorium-231	57.6 ± 67.6	42.7	X	EPA 901.1
			Thorium-234	−97.9 ± 203	232	U	EPA 901.1
			Tritium	−21.7 ± 101	187	U	EPA 906.0 Modified
			Uranium-235	−1.38 ± 18.2	19.1	U	EPA 901.1
			Uranium-238	−97.9 ± 203	232	U	EPA 901.1
		9-Aug-2019	Actinium-228	3.93 ± 17.4	13.3	U	EPA 901.1
			Alpha, gross	3.47 ± 1.59	2.32		EPA 900.0/SW-846 9310
			Americium-241	−4.59 ± 9.49	14.5	U	EPA 901.1
			Beryllium-7	9.39 ± 14	24.8	U	EPA 901.1
			Beta, gross	15 ± 1.51	1.77		EPA 900.0/SW-846 9310
			Bismuth-212	−15.8 ± 33.4	40.7	U	EPA 901.1
			Bismuth-214	1.61 ± 7.22	5.54	U	EPA 901.1
			Cesium-137	0.135 ± 1.74	3.1	U	EPA 901.1
			Cobalt-60	−3.74 ± 3.36	2.93	U	EPA 901.1
			Lead-212	11.4 ± 8.13	11.5	U	EPA 901.1
			Lead-214	0.913 ± 7.57	7.06	U	EPA 901.1
			Neptunium-237	−1.92 ± 3.13	5.31	U	EPA 901.1
			Potassium-40	4.45 ± 49.7	28	U	EPA 901.1
			Radium-223	38.2 ± 44.1	54.3	U	EPA 901.1
			Radium-224	21 ± 34.1	51.5	U	EPA 901.1
			Radium-226	43.9 ± 72.5	76.9	U	EPA 901.1
			Radium-228	3.93 ± 17.4	13.3	U	EPA 901.1
			Sodium-22	0.337 ± 1.66	2.98	U	EPA 901.1
			Thorium-227	3.39 ± 13.4	22.3	U	EPA 901.1
			Thorium-231	33.7 ± 47.6	36	U	EPA 901.1
			Thorium-234	92.7 ± 179	123	U	EPA 901.1
			Tritium	−27.6 ± 100	186	U	EPA 906.0 Modified
			Uranium-235	3.12 ± 15.2	18.6	U	EPA 901.1
			Uranium-238	92.7 ± 179	123	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	6-Aug-2019	Actinium-228	4.88 ± 19.1	18.4	U	EPA 901.1
			Alpha, gross	2.96 ± 1.74	2.72	N	EPA 900.0/SW-846 9310
			Americium-241	−2.97 ± 13.7	24.5	U	EPA 901.1
			Beryllium-7	0.213 ± 17.6	31.2	U	EPA 901.1
			Beta, gross	18.5 ± 1.59	1.92		EPA 900.0/SW-846 9310
			Bismuth-212	21.3 ± 32.4	57.4	U	EPA 901.1
			Bismuth-214	0.6 ± 7.57	8.89	U	EPA 901.1
			Cesium-137	2.18 ± 2.36	4.11	U	EPA 901.1
			Cobalt-60	0.414 ± 4.37	5.3	U	EPA 901.1
			Lead-212	−0.248 ± 7.68	8.3	U	EPA 901.1
			Lead-214	−2.82 ± 8.09	9.22	U	EPA 901.1
			Neptunium-237	−1.3 ± 4.18	7.21	U	EPA 901.1
			Potassium-40	−38.8 ± 57.9	67.8	U	EPA 901.1
			Radium-223	−44.3 ± 50.6	68.4	U	EPA 901.1
			Radium-224	−127 ± 72.8	68.5	U	EPA 901.1
			Radium-226	16 ± 102	70.1	U	EPA 901.1
			Radium-228	4.88 ± 19.1	18.4	U	EPA 901.1
			Sodium-22	−0.832 ± 2.07	3.74	U	EPA 901.1
			Thorium-227	6.3 ± 16.6	29.3	U	EPA 901.1
			Thorium-231	72.9 ± 52	54.3	X	EPA 901.1
			Thorium-234	−67.5 ± 205	255	U	EPA 901.1
			Tritium	−27.7 ± 95.1	177	U	EPA 906.0 Modified
			Uranium-235	11.2 ± 30.4	23.2	U	EPA 901.1
			Uranium-238	−67.5 ± 205	255	U	EPA 901.1
		7-Aug-2019	Actinium-228	2.46 ± 15.3	18.5	U	EPA 901.1
			Alpha, gross	1.56 ± 1.27	2.06	NU	EPA 900.0/SW-846 9310
			Americium-241	−.97 ± 3.3	5.19	U	EPA 901.1
			Beryllium-7	12.2 ± 19	33.4	U	EPA 901.1
			Beta, gross	22.4 ± 1.74	1.91		EPA 900.0/SW-846 9310
			Bismuth-212	32.7 ± 33.4	60.1	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	7-Aug-2019	Bismuth-214	−10.5 ± 8.99	8.6	U	EPA 901.1
			Cesium-137	−.000755 ± 2.44	4.23	U	EPA 901.1
			Cobalt-60	1.13 ± 2.75	5.13	U	EPA 901.1
			Lead-212	7.09 ± 7.75	5.39	X	EPA 901.1
			Lead-214	5.28 ± 5.01	8.33	U	EPA 901.1
			Neptunium-237	0.74 ± 3.72	6.71	U	EPA 901.1
			Potassium-40	37.6 ± 70	46.7	U	EPA 901.1
			Radium-223	−7.84 ± 36.2	63.8	U	EPA 901.1
			Radium-224	20 ± 37.7	61.5	U	EPA 901.1
			Radium-226	2.15 ± 74.8	103	U	EPA 901.1
			Radium-228	2.46 ± 15.3	18.5	U	EPA 901.1
			Sodium-22	0.126 ± 2.46	4.53	U	EPA 901.1
			Thorium-227	9.39 ± 14.3	25.4	U	EPA 901.1
			Thorium-231	11.6 ± 36.9	28.4	U	EPA 901.1
			Thorium-234	−68.9 ± 75	98.6	U	EPA 901.1
			Tritium	−50.2 ± 90	171	U	EPA 906.0 Modified
			Uranium-235	2.51 ± 21.9	18.1	U	EPA 901.1
			Uranium-238	−68.9 ± 75	98.6	U	EPA 901.1
		8-Aug-2019	Actinium-228	7.99 ± 19.7	22.7	U	EPA 901.1
			Alpha, gross	1.86 ± 1.34	2.1	U	EPA 900.0/SW-846 9310
			Americium-241	2.76 ± 3.88	6.33	U	EPA 901.1
			Beryllium-7	1.42 ± 20.7	36.1	U	EPA 901.1
			Beta, gross	21.1 ± 2.1	2.37		EPA 900.0/SW-846 9310
			Bismuth-212	40.1 ± 40.1	70.5	U	EPA 901.1
			Bismuth-214	−5 ± 9.17	11	U	EPA 901.1
			Cesium-137	0.31 ± 3.98	5.22	U	EPA 901.1
			Cobalt-60	−0.102 ± 2.73	5	U	EPA 901.1
			Lead-212	7.59 ± 7.57	6.48	X	EPA 901.1
			Lead-214	−1.15 ± 9.97	10.4	U	EPA 901.1
			Neptunium-237	3.35 ± 4.48	7.73	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	8-Aug-2019	Potassium-40	−43.7 ± 56.1	76.6	U	EPA 901.1
			Radium-223	−9.43 ± 45.6	78.8	U	EPA 901.1
			Radium-224	36.2 ± 46.4	71.9	U	EPA 901.1
			Radium-226	−65.4 ± 84.9	89.7	U	EPA 901.1
			Radium-228	7.99 ± 19.7	22.7	U	EPA 901.1
			Sodium-22	1.29 ± 2.97	5.55	U	EPA 901.1
			Thorium-227	−2.84 ± 15.8	27.7	U	EPA 901.1
			Thorium-231	37 ± 28.4	30.9	X	EPA 901.1
			Thorium-234	−2.58 ± 67.7	86.5	U	EPA 901.1
			Tritium	153 ± 117	183	U	EPA 906.0 Modified
			Uranium-235	1.69 ± 16.6	20.2	U	EPA 901.1
			Uranium-238	−2.58 ± 67.7	86.5	U	EPA 901.1
		9-Aug-2019	Actinium-228	−6.93 ± 13.1	12.8	U	EPA 901.1
			Alpha, gross	3.03 ± 1.29	1.74		EPA 900.0/SW-846 9310
			Americium-241	0.222 ± 4.45	7.32	U	EPA 901.1
			Beryllium-7	−0.00919 ± 12.3	21.2	U	EPA 901.1
			Beta, gross	27.4 ± 1.87	1.84		EPA 900.0/SW-846 9310
			Bismuth-212	−11 ± 39.6	37.4	U	EPA 901.1
			Bismuth-214	1.74 ± 7.68	6.66	U	EPA 901.1
			Cesium-137	0.471 ± 1.59	2.72	U	EPA 901.1
			Cobalt-60	1.25 ± 1.74	3.06	U	EPA 901.1
			Lead-212	3.51 ± 5.2	4.06	U	EPA 901.1
			Lead-214	−6.24 ± 7.52	5.79	U	EPA 901.1
			Neptunium-237	2.35 ± 2.84	4.82	U	EPA 901.1
			Potassium-40	29.8 ± 50.2	29.2	X	EPA 901.1
			Radium-223	−14.6 ± 27	45.3	U	EPA 901.1
			Radium-224	1.51 ± 26.6	43.2	U	EPA 901.1
			Radium-226	−57.9 ± 65.3	65.3	U	EPA 901.1
			Radium-228	−6.93 ± 13.1	12.8	U	EPA 901.1
			Sodium-22	0.917 ± 1.69	3	U	EPA 901.1

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Table E-4. Radiological results for permitted sanitary outfalls, August 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	9-Aug-2019	Thorium-227	−2.98 ± 10.1	17.8	U	EPA 901.1
			Thorium-231	−11.8 ± 28.1	27.9	U	EPA 901.1
			Thorium-234	16.9 ± 102	91.7	U	EPA 901.1
			Tritium	74.8 ± 107	181	U	EPA 906.0 Modified
			Uranium-235	8.25 ± 18.8	15.2	U	EPA 901.1
			Uranium-238	16.9 ± 102	91.7	U	EPA 901.1

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
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.

Table E-5. Inorganic results for permitted sanitary outfalls, November 2019

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	4-Nov-2019	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		5-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.153	0.017		EPA 350.1
			Arsenic	0.00716	0.002		EPA 200.8
			Boron	0.0595	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00931	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
			Fluoride	0.73	0.033		EPA 300.0
			Lead	0.000557	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00503	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Selenium	0.00201	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.004	0.0033	J	EPA 200.8
		6-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.233	0.017		EPA 350.1
			Arsenic	0.00528	0.002		EPA 200.8
			Boron	0.118	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00204	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	6-Nov-2019	Fluoride	1.26	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0052	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Selenium	0.0025	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc		0.0033	U	EPA 200.8
		7-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.111	0.017		EPA 350.1
			Arsenic	0.00526	0.002		EPA 200.8
			Boron	0.0833	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00197	0.0003	J	EPA 200.8
			Fluoride	0.705	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00457	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	0.00432	0.0033	J	EPA 200.8
		8-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.825	0.017		EPA 350.1
			Arsenic	0.00628	0.002		EPA 200.8
			Boron	0.0843	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00191	0.0003	J	EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	8-Nov-2019	Fluoride	2.02	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0046	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	0.00464	0.0033	J	EPA 200.8
WW001	2069A	5-Nov-2019	Aluminum	0.0516	0.0193		EPA 200.8
			Ammonia	15.2	0.425		EPA 350.1
			Arsenic	0.00455	0.002	J	EPA 200.8
			Boron	0.101	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00364	0.003	J	EPA 200.8
			Copper	0.0441	0.0003		EPA 200.8
			Fluoride	1.85	0.033		EPA 300.0
			Lead	0.00219	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0137	0.0002		EPA 200.8
			Nickel	0.00199	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0418	0.0033		EPA 200.8
		6-Nov-2019	Aluminum	0.0425	0.0193	J	EPA 200.8
			Ammonia	14.9	0.425		EPA 350.1
			Arsenic	0.00458	0.002	J	EPA 200.8
			Boron	0.122	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00394	0.003	J	EPA 200.8
			Copper	0.0355	0.0003		EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	6-Nov-2019	Fluoride	1.61	0.033		EPA 300.0
			Lead	0.00107	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0133	0.0002		EPA 200.8
			Nickel	0.00214	0.0006		EPA 200.8
			Selenium	0.00217	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0651	0.0033		EPA 200.8
		7-Nov-2019	Aluminum	0.0587	0.0193		EPA 200.8
			Ammonia	17.3	0.425		EPA 350.1
			Arsenic	0.00462	0.002	J	EPA 200.8
			Boron	0.0905	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00538	0.003	J	EPA 200.8
			Copper	0.0213	0.0003		EPA 200.8
			Fluoride	1.37	0.033		EPA 300.0
			Lead	0.00823	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0109	0.0002		EPA 200.8
			Nickel	0.00264	0.0006		EPA 200.8
			Selenium	0.00289	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0883	0.0033		EPA 200.8
		8-Nov-2019	Aluminum	0.0442	0.0193	J	EPA 200.8
			Ammonia	21.1	0.425		EPA 350.1
			Arsenic	0.00427	0.002	J	EPA 200.8
			Boron	0.0878	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00336	0.003	J	EPA 200.8
			Copper	0.0225	0.0003		EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	8-Nov-2019	Fluoride	1.47	0.033		EPA 300.0
			Lead	0.00149	0.0005	J	EPA 200.8
			Mercury	0.00007	0.000067	J	EPA 245.1/245.2
			Molybdenum	0.0285	0.0002		EPA 200.8
			Nickel	0.00147	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0587	0.0033		EPA 200.8
WW006	2069F	4-Nov-2019	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total	0.00177	0.00167	J	EPA 335.4
		5-Nov-2019	Aluminum	0.0952	0.0193		EPA 200.8
			Ammonia	42.5	0.425		EPA 350.1
			Arsenic	0.00374	0.002	J	EPA 200.8
			Boron	0.121	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0217	0.0003		EPA 200.8
			Cyanide, total	0.0026	0.00167	J	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total	0.00218	0.00167	J	EPA 335.4
			Fluoride	0.604	0.033		EPA 300.0
			Lead	0.000804	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00449	0.0002		EPA 200.8
			Nickel	0.00185	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0695	0.0033		EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	6-Nov-2019	Aluminum	0.1	0.0193		EPA 200.8
			Ammonia	57.5	0.85		EPA 350.1
			Arsenic	0.00329	0.002	J	EPA 200.8
			Boron	0.157	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
			Cyanide, total	0.0051	0.00167		EPA 335.4
			Cyanide, total	0.0018	0.00167	J	EPA 335.4
			Fluoride	0.568	0.033		EPA 300.0
			Lead	0.000859	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00385	0.0002		EPA 200.8
			Nickel	0.00193	0.0006	J	EPA 200.8
			Selenium	0.00382	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0996	0.0033		EPA 200.8
		7-Nov-2019	Aluminum	0.129	0.0193		EPA 200.8
			Ammonia	59.5	0.85		EPA 350.1
			Arsenic	0.00304	0.002	J	EPA 200.8
			Boron	0.136	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0298	0.0003		EPA 200.8
			Fluoride	0.55	0.033		EPA 300.0
			Lead	0.00198	0.0005	J	EPA 200.8
			Mercury	0.000071	0.000067	J	EPA 245.1/245.2
			Molybdenum	0.0043	0.0002		EPA 200.8
			Nickel	0.0021	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	7-Nov-2019	Silver		0.0003	U	EPA 200.8
			Zinc	0.108	0.0165		EPA 200.8
		8-Nov-2019	Aluminum	0.129	0.0193		EPA 200.8
			Ammonia	67.5	0.85		EPA 350.1
			Arsenic	0.00348	0.002	J	EPA 200.8
			Boron	0.13	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0277	0.0003		EPA 200.8
			Fluoride	0.774	0.033		EPA 300.0
			Lead	0.00181	0.0005	J	EPA 200.8
			Mercury	0.000093	0.000067	J	EPA 245.1/245.2
			Molybdenum	0.00487	0.0002		EPA 200.8
			Nickel	0.00203	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.163	0.0165		EPA 200.8
WW007	2069G	4-Nov-2019	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		5-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.922	0.017		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0216	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00587	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

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	5-Nov-2019	Fluoride	2.04	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00842	0.0002		EPA 200.8
			Nickel	0.00133	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.00537	0.0033	J	EPA 200.8
		6-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	2.2	0.085		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0204	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0047	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	1.61	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00829	0.0002		EPA 200.8
			Nickel	0.0011	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
		7-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	1.45	0.017		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0189	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	7-Nov-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.00583	0.0003		EPA 200.8
			Fluoride	1.25	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.019	0.0002		EPA 200.8
			Nickel	0.0012	0.0006	J	EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.004	0.0033	J	EPA 200.8
		8-Nov-2019	Aluminum		0.0193	U	EPA 200.8
			Ammonia	1.49	0.017		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0255	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.00466	0.0003		EPA 200.8
			Fluoride	1.47	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0259	0.0002		EPA 200.8
			Nickel	0.00109	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	5-Nov-2019	Aluminum	0.0871	0.0193		EPA 200.8
			Ammonia	41	0.425		EPA 350.1
			Arsenic	0.00468	0.002	J	EPA 200.8
			Boron	0.155	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	5-Nov-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.0303	0.0003		EPA 200.8
			Fluoride	0.462	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00424	0.0002		EPA 200.8
			Nickel	0.0174	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0697	0.0033		EPA 200.8
		6-Nov-2019	Aluminum	0.0483	0.0193	J	EPA 200.8
			Ammonia	43	0.425		EPA 350.1
			Arsenic	0.00408	0.002	J	EPA 200.8
			Boron	0.121	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0223	0.0003		EPA 200.8
			Fluoride	0.724	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00392	0.0002		EPA 200.8
			Nickel	0.00906	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.052	0.0033		EPA 200.8
		7-Nov-2019	Aluminum	0.0854	0.0193		EPA 200.8
			Ammonia	45.5	0.85		EPA 350.1
			Arsenic	0.00351	0.002	J	EPA 200.8
			Boron	0.112	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	7-Nov-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.0317	0.0003		EPA 200.8
			Fluoride	0.574	0.033		EPA 300.0
			Lead	0.000676	0.0005	J	EPA 200.8
			Mercury	0.000105	0.000067	J	EPA 245.1/245.2
			Molybdenum	0.00362	0.0002		EPA 200.8
			Nickel	0.0182	0.0006		EPA 200.8
			Selenium	0.00217	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0718	0.0033		EPA 200.8
		8-Nov-2019	Aluminum	0.0539	0.0193		EPA 200.8
			Ammonia	37.3	0.425		EPA 350.1
			Arsenic	0.00374	0.002	J	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	0.0563	0.0003		EPA 200.8
			Fluoride	0.633	0.033		EPA 300.0
			Lead	0.000961	0.0005	J	EPA 200.8
			Mercury	0.000076	0.000067	J	EPA 245.1/245.2
			Molybdenum	0.00365	0.0002		EPA 200.8
			Nickel	0.00807	0.0006		EPA 200.8
			Selenium	0.00208	0.002	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0617	0.0033		EPA 200.8
WW011	2069K	5-Nov-2019	Aluminum	0.0692	0.0193		EPA 200.8
			Ammonia	21.7	0.425		EPA 350.1
			Arsenic	0.00324	0.002	J	EPA 200.8
			Boron	0.29	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

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Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	5-Nov-2019	Chromium		0.003	U	EPA 200.8
			Copper	0.0301	0.0003		EPA 200.8
			Fluoride	0.483	0.033		EPA 300.0
			Lead	0.00132	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0892	0.0002		EPA 200.8
			Nickel	0.00229	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Zinc	0.0729	0.0033		EPA 200.8
		6-Nov-2019	Aluminum	0.111	0.0193		EPA 200.8
			Ammonia	21.1	0.425		EPA 350.1
			Arsenic	0.00377	0.002	J	EPA 200.8
			Boron	0.266	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium	0.00462	0.003	J	EPA 200.8
			Copper	0.0584	0.0003		EPA 200.8
			Fluoride	0.594	0.033		EPA 300.0
			Lead	0.00218	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.103	0.0002		EPA 200.8
			Nickel	0.0029	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver	0.000343	0.0003	J	EPA 200.8
			Zinc	0.118	0.0165		EPA 200.8
		7-Nov-2019	Aluminum	0.111	0.0193		EPA 200.8
			Ammonia	21.5	0.425		EPA 350.1
			Arsenic	0.00359	0.002	J	EPA 200.8
			Boron	0.238	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8

Table continued on next page

Table E-5. Inorganic results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	7-Nov-2019	Chromium	0.00391	0.003	J	EPA 200.8
			Copper	0.0438	0.0003		EPA 200.8
			Fluoride	0.585	0.033		EPA 300.0
			Lead	0.00163	0.0005	J	EPA 200.8
			Mercury	0.000071	0.000067	J	EPA 245.1/245.2
			Molybdenum	0.113	0.0002		EPA 200.8
			Nickel	0.00334	0.0006		EPA 200.8
			Selenium	0.00209	0.002	J	EPA 200.8
			Silver	0.000612	0.0003	J	EPA 200.8
			Zinc	0.131	0.0165		EPA 200.8
		8-Nov-2019	Aluminum	0.084	0.0193		EPA 200.8
			Ammonia	19.6	0.425		EPA 350.1
			Arsenic	0.00328	0.002	J	EPA 200.8
			Boron	0.197	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chromium		0.003	U	EPA 200.8
			Copper	0.0349	0.0003		EPA 200.8
			Fluoride	0.654	0.033		EPA 300.0
			Lead	0.00145	0.0005	J	EPA 200.8
			Mercury	0.000073	0.000067	J	EPA 245.1/245.2
			Molybdenum	0.0728	0.0002		EPA 200.8
			Nickel	0.00238	0.0006		EPA 200.8
			Selenium		0.002	U	EPA 200.8
			Silver	0.000916	0.0003	J	EPA 200.8
			Zinc	0.26	0.0165		EPA 200.8

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
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-6. Radiological results for permitted sanitary outfalls, November 2019

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	05-Nov-2019	Actinium-228	−8.46 ± 13.9	11.6	U	EPA 901.1
			Alpha, gross	2.05 ± 8.63hj	15.4	U	EPA 900.0/SW-846 9310
			Americium-241	2.32 ± 6.23	9.69	U	EPA 901.1
			Beryllium-7	−5.98 ± 12.5	20.6	U	EPA 901.1
			Beta, gross	18.3 ± 7.57	12		EPA 900.0/SW-846 9310
			Bismuth-212	8.13 ± 23.1	40.2	U	EPA 901.1
			Bismuth-214	−2.89 ± 7.9	7.8	U	EPA 901.1
			Cesium-137	0.617 ± 2.25	2.95	U	EPA 901.1
			Cobalt-60	1.95 ± 3.18	3.31	U	EPA 901.1
			Lead-212	3.01 ± 5.7	5.45	U	EPA 901.1
			Lead-214	4.77 ± 7.18	6.99	U	EPA 901.1
			Neptunium-237	1.81 ± 2.84	4.96	U	EPA 901.1
			Potassium-40	41.4 ± 45	27.1	X	EPA 901.1
			Radium-223	2.02 ± 42.6	53.8	U	EPA 901.1
			Radium-224	22.2 ± 29.6	46.4	U	EPA 901.1
			Radium-226	72.2 ± 75.8	72.2	U	EPA 901.1
			Radium-228	−8.46 ± 13.9	11.6	U	EPA 901.1
			Sodium-22	0.711 ± 1.62	3.03	U	EPA 901.1
			Thorium-227	−2.12 ± 10.5	18.4	U	EPA 901.1
			Thorium-231	−3.47 ± 29.8	34.8	U	EPA 901.1
			Thorium-234	73.7 ± 115	125	U	EPA 901.1
			Tritium	−6.23 ± 96.9	181	U	EPA 906.0 Modified
			Uranium-235	14.4 ± 17.1	14.1	X	EPA 901.1
			Uranium-238	73.7 ± 115	125	U	EPA 901.1
		06-Nov-2019	Actinium-228	−0.655 ± 12.1	12.5	U	EPA 901.1
			Alpha, gross	1.02 ± 1.02	1.66	U	EPA 900.0/SW-846 9310
			Americium-241	2.03 ± 6.21	9.68	U	EPA 901.1
			Beryllium-7	1.1 ± 14	24.4	U	EPA 901.1
			Beta, gross	1.69 ± 0.714	1.14		EPA 900.0/SW-846 9310
			Bismuth-212	−3.16 ± 22.2	37.7	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	06-Nov-2019	Bismuth-214	1.21 ± 6.01	7.11	U	EPA 901.1
			Cesium-137	−2.21 ± 2.56	2.92	U	EPA 901.1
			Cobalt-60	−0.732 ± 1.51	2.56	U	EPA 901.1
			Lead-212	1 ± 4.99	4.03	U	EPA 901.1
			Lead-214	0.15 ± 6.2	6.17	U	EPA 901.1
			Neptunium-237	3.6 ± 3.55	5.06	U	EPA 901.1
			Potassium-40	−10.4 ± 28.5	40.1	U	EPA 901.1
			Radium-223	−61.1 ± 47.2	47.2	U	EPA 901.1
			Radium-224	4.58 ± 27.4	44.2	U	EPA 901.1
			Radium-226	−47.3 ± 59	71.5	U	EPA 901.1
			Radium-228	−0.655 ± 12.1	12.5	U	EPA 901.1
			Sodium-22	0.0412 ± 1.58	2.9	U	EPA 901.1
			Thorium-227	−10.3 ± 11.6	17.8	U	EPA 901.1
			Thorium-231	30.9 ± 39.8	29.8	X	EPA 901.1
			Thorium-234	104 ± 116	82.3	X	EPA 901.1
			Tritium	−36.1 ± 92.4	178	U	EPA 906.0 Modified
			Uranium-235	0.878 ± 16.7	16.6	U	EPA 901.1
			Uranium-238	104 ± 116	82.3	X	EPA 901.1
		07-Nov-2019	Actinium-228	13.6 ± 20.4	18.7	U	EPA 901.1
			Alpha, gross	1.02 ± .847	1.38	*U	EPA 900.0/SW-846 9310
			Americium-241	0.719 ± 12.3	21.3	U	EPA 901.1
			Beryllium-7	16.9 ± 18.2	30.4	U	EPA 901.1
			Beta, gross	0.94 ± .574	.937		EPA 900.0/SW-846 9310
			Bismuth-212	15.9 ± 28.1	51.2	U	EPA 901.1
			Bismuth-214	3.73 ± 9.69	8.77	U	EPA 901.1
			Cesium-137	0.759 ± 1.92	3.56	U	EPA 901.1
			Cobalt-60	−0.983 ± 2.31	3.84	U	EPA 901.1
			Lead-212	9.05 ± 9.32	9.05	U	EPA 901.1
			Lead-214	−4.7 ± 7.88	8.49	U	EPA 901.1
			Neptunium-237	−4.43 ± 4.2	6.12	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	07-Nov-2019	Potassium-40	12 ± 51.7	35.6	U	EPA 901.1
			Radium-223	34.1 ± 42.6	64.9	U	EPA 901.1
			Radium-224	8.99 ± 34.4	61.6	U	EPA 901.1
			Radium-226	−53.4 ± 78.8	95.4	U	EPA 901.1
			Radium-228	13.6 ± 20.4	18.7	U	EPA 901.1
			Sodium-22	−0.265 ± 2.01	3.55	U	EPA 901.1
			Thorium-227	5.4 ± 14.1	25.1	U	EPA 901.1
			Thorium-231	11.8 ± 46.5	44.1	U	EPA 901.1
			Thorium-234	7.18 ± 182	212	U	EPA 901.1
			Tritium	54.1 ± 101	175	U	EPA 906.0 Modified
			Uranium-235	−14.8 ± 20.2	20.2	U	EPA 901.1
			Uranium-238	7.18 ± 182	212	U	EPA 901.1
		08-Nov-2019	Actinium-228	5.56 ± 12.4	9.67	U	EPA 901.1
			Alpha, gross	1.03 ± 1.44	2.46	*U	EPA 900.0/SW-846 9310
			Americium-241	1.06 ± 6.07	11.1	U	EPA 901.1
			Beryllium-7	7.91 ± 13.4	24.2	U	EPA 901.1
			Beta, gross	0.601 ± .763	1.28	U	EPA 900.0/SW-846 9310
			Bismuth-212	23.3 ± 37.9	41	U	EPA 901.1
			Bismuth-214	−2.79 ± 6.28	7.2	U	EPA 901.1
			Cesium-137	−1.82 ± 4.14	4.1	U	EPA 901.1
			Cobalt-60	−0.48 ± 1.78	3.19	U	EPA 901.1
			Lead-212	1.36 ± 4.13	6.13	U	EPA 901.1
			Lead-214	3.06 ± 8.69	5.51	U	EPA 901.1
			Neptunium-237	0.000333 ± 4.26	5.18	U	EPA 901.1
			Potassium-40	−24.8 ± 38.2	46.9	U	EPA 901.1
			Radium-223	−7.43 ± 30.9	50.6	U	EPA 901.1
			Radium-224	−49.1 ± 38.9	50	U	EPA 901.1
			Radium-226	41.1 ± 79.8	71.9	U	EPA 901.1
			Radium-228	5.56 ± 12.4	9.67	U	EPA 901.1
			Sodium-22	0.523 ± 1.7	3.22	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	08-Nov-2019	Thorium-227	−0.201 ± 11.3	19.2	U	EPA 901.1
			Thorium-231	−20.6 ± 37.8	33.8	U	EPA 901.1
			Thorium-234	45.9 ± 150	130	U	EPA 901.1
			Tritium	49.9 ± 101	177	U	EPA 906.0 Modified
			Uranium-235	3.58 ± 21.3	15.5	U	EPA 901.1
			Uranium-238	45.9 ± 150	130	U	EPA 901.1
WW001	2069A	05-Nov-2019	Actinium-228	−22.1 ± 19.7	17.3	U	EPA 901.1
			Alpha, gross	1.94 ± 2.21	3.71	U	EPA 900.0/SW-846 9310
			Americium-241	−1.02 ± 13	23.4	U	EPA 901.1
			Beryllium-7	−4.9 ± 17.5	26.7	U	EPA 901.1
			Beta, gross	10.6 ± 1.86	2.64		EPA 900.0/SW-846 9310
			Bismuth-212	3.45 ± 25.6	45.6	U	EPA 901.1
			Bismuth-214	6.46 ± 10.9	9.1	U	EPA 901.1
			Cesium-137	6.08 ± 5.06	3.56	X	EPA 901.1
			Cobalt-60	−1.2 ± 1.98	3.39	U	EPA 901.1
			Lead-212	2.31 ± 8.65	5.66	U	EPA 901.1
			Lead-214	−4.48 ± 8.16	8.28	U	EPA 901.1
			Neptunium-237	−0.232 ± 3.47	6.11	U	EPA 901.1
			Potassium-40	−33.8 ± 51.4	52.3	U	EPA 901.1
			Radium-223	3.58 ± 36.7	65	U	EPA 901.1
			Radium-224	52.2 ± 45	64.6	U	EPA 901.1
			Radium-226	−62.5 ± 88.8	101	U	EPA 901.1
			Radium-228	−22.1 ± 19.7	17.3	U	EPA 901.1
			Sodium-22	−0.832 ± 1.98	3.54	U	EPA 901.1
			Thorium-227	−11.2 ± 15.8	25.5	U	EPA 901.1
			Thorium-231	−23.6 ± 51.6	50.4	U	EPA 901.1
			Thorium-234	7.06 ± 201	237	U	EPA 901.1
			Tritium	−5.69 ± 90.2	168	U	EPA 906.0 Modified
			Uranium-235	−9.54 ± 21.7	23	U	EPA 901.1
			Uranium-238	7.06 ± 201	237	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	6-Nov-2019	Actinium-228	4.22 ± 18	15.3	U	EPA 901.1
			Alpha, gross	2.52 ± 2.5	4.17	U	EPA 900.0/SW-846 9310
			Americium-241	2.4 ± 10	15.6	U	EPA 901.1
			Beryllium-7	4.51 ± 16.6	28.8	U	EPA 901.1
			Beta, gross	11.7 ± 1.82	2.61		EPA 900.0/SW-846 9310
			Bismuth-212	8.72 ± 28.7	52.3	U	EPA 901.1
			Bismuth-214	−1.32 ± 9.11	8.14	U	EPA 901.1
			Cesium-137	1.34 ± 2.3	3.89	U	EPA 901.1
			Cobalt-60	1.97 ± 1.96	3.51	U	EPA 901.1
			Lead-212	0.774 ± 6.62	7.16	U	EPA 901.1
			Lead-214	−5.3 ± 7.97	8.1	U	EPA 901.1
			Neptunium-237	−2.29 ± 3.99	6.57	U	EPA 901.1
			Potassium-40	−33.7 ± 42.4	46.4	U	EPA 901.1
			Radium-223	−20.7 ± 38.2	63.2	U	EPA 901.1
			Radium-224	−108 ± 62.9	62.2	U	EPA 901.1
			Radium-226	−52.6 ± 69.5	78.1	U	EPA 901.1
			Radium-228	4.22 ± 18	15.3	U	EPA 901.1
			Sodium-22	3.19 ± 2.41	3.22	U	EPA 901.1
			Thorium-227	−1.98 ± 14.5	25.5	U	EPA 901.1
			Thorium-231	−4.93 ± 37.5	39.3	U	EPA 901.1
			Thorium-234	17.3 ± 128	146	U	EPA 901.1
			Tritium	30.6 ± 99.5	178	U	EPA 906.0 Modified
			Uranium-235	−18 ± 19.9	20	U	EPA 901.1
			Uranium-238	17.3 ± 128	146	U	EPA 901.1
		7-Nov-2019	Actinium-228	−2.21 ± 11.2	13.9	U	EPA 901.1
			Alpha, gross	3.89 ± 1.9	2.9	*	EPA 900.0/SW-846 9310
			Americium-241	−4.43 ± 4.97	7.76	U	EPA 901.1
			Beryllium-7	−10.2 ± 15.2	24.2	U	EPA 901.1
			Beta, gross	11.5 ± 1.39	1.66		EPA 900.0/SW-846 9310
			Bismuth-212	10.6 ± 23.3	42.3	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	7-Nov-2019	Bismuth-214	4.93 ± 8.85	5.96	U	EPA 901.1
			Cesium-137	0.436 ± 1.84	3.14	U	EPA 901.1
			Cobalt-60	1.29 ± 1.92	3.4	U	EPA 901.1
			Lead-212	4.64 ± 6.2	6.22	U	EPA 901.1
			Lead-214	6.03 ± 8.7	6.9	U	EPA 901.1
			Neptunium-237	−0.0243 ± 2.88	5.12	U	EPA 901.1
			Potassium-40	−25.3 ± 41.8	48.1	U	EPA 901.1
			Radium-223	−17.7 ± 29.9	49.8	U	EPA 901.1
			Radium-224	−30.4 ± 44.5	50	U	EPA 901.1
			Radium-226	59.1 ± 83.2	72.5	U	EPA 901.1
			Radium-228	−2.21 ± 11.2	13.9	U	EPA 901.1
			Sodium-22	0.343 ± 1.7	3.05	U	EPA 901.1
			Thorium-227	4.09 ± 11.7	21	U	EPA 901.1
			Thorium-231	−4.94 ± 28.4	31.2	U	EPA 901.1
			Thorium-234	−51 ± 84.2	104	U	EPA 901.1
			Tritium	−13.9 ± 99.8	189	U	EPA 906.0 Modified
			Uranium-235	7.5 ± 17.4	14.6	U	EPA 901.1
			Uranium-238	−51 ± 84.2	104	U	EPA 901.1
		8-Nov-2019	Actinium-228	−13.5 ± 12.1	12.2	U	EPA 901.1
			Alpha, gross	1.1 ± 2.01	3.46	*U	EPA 900.0/SW-846 9310
			Americium-241	15.6 ± 11.3	15.7	U	EPA 901.1
			Beryllium-7	−1.78 ± 14.8	23.4	U	EPA 901.1
			Beta, gross	11.2 ± 1.39	1.77		EPA 900.0/SW-846 9310
			Bismuth-212	10.6 ± 23.8	38.1	U	EPA 901.1
			Bismuth-214	−4.76 ± 7.09	7.05	U	EPA 901.1
			Cesium-137	0.664 ± 1.68	2.71	U	EPA 901.1
			Cobalt-60	−0.179 ± 1.6	2.91	U	EPA 901.1
			Lead-212	9.08 ± 7	9.08	U	EPA 901.1
			Lead-214	1.04 ± 6.46	6.65	U	EPA 901.1
			Neptunium-237	−0.0208 ± 2.74	4.98	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	8-Nov-2019	Potassium-40	10.5 ± 44.5	23.8	U	EPA 901.1
			Radium-223	23.2 ± 30.3	49.8	U	EPA 901.1
			Radium-224	−24.5 ± 42.9	48.4	U	EPA 901.1
			Radium-226	20.1 ± 73.7	76.4	U	EPA 901.1
			Radium-228	−13.5 ± 12.1	12.2	U	EPA 901.1
			Sodium-22	−1.04 ± 1.54	2.52	U	EPA 901.1
			Thorium-227	−6.86 ± 12.5	19.4	U	EPA 901.1
			Thorium-231	30.2 ± 39.1	32.9	U	EPA 901.1
			Thorium-234	68.6 ± 155	120	U	EPA 901.1
			Tritium	31.3 ± 98.7	176	U	EPA 906.0 Modified
			Uranium-235	19.6 ± 25.3	14.7	X	EPA 901.1
			Uranium-238	68.6 ± 155	120	U	EPA 901.1
WW006	2069F	5-Nov-2019	Actinium-228	−1.09 ± 10.7	11.4	U	EPA 901.1
			Alpha, gross	1.71 ± 3.06	5.26	U	EPA 900.0/SW-846 9310
			Americium-241	−0.499 ± 5.54	9.75	U	EPA 901.1
			Beryllium-7	3.47 ± 12.5	20.6	U	EPA 901.1
			Beta, gross	20.6 ± 2.91	3.79		EPA 900.0/SW-846 9310
			Bismuth-212	20.1 ± 30.2	30.7	U	EPA 901.1
			Bismuth-214	−2.63 ± 6.1	6.64	U	EPA 901.1
			Cesium-137	0.453 ± 1.55	2.79	U	EPA 901.1
			Cobalt-60	0.95 ± 1.61	3.06	U	EPA 901.1
			Lead-212	−2.37 ± 4.87	5.11	U	EPA 901.1
			Lead-214	0.255 ± 7.02	6.24	U	EPA 901.1
			Neptunium-237	1.19 ± 2.59	4.74	U	EPA 901.1
			Potassium-40	7.45 ± 45.7	23.6	U	EPA 901.1
			Radium-223	−19.2 ± 27.1	45.1	U	EPA 901.1
			Radium-224	28.5 ± 39.1	41.8	U	EPA 901.1
			Radium-226	8.32 ± 65.6	43.8	U	EPA 901.1
			Radium-228	−1.09 ± 10.7	11.4	U	EPA 901.1
			Sodium-22	−0.547 ± 1.55	2.76	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	5-Nov-2019	Thorium-227	−1.26 ± 11	18.1	U	EPA 901.1
			Thorium-231	4.03 ± 22.7	29.7	U	EPA 901.1
			Thorium-234	−39.6 ± 92.4	107	U	EPA 901.1
			Tritium	−33.2 ± 97.5	187	U	EPA 906.0 Modified
			Uranium-235	−2.57 ± 12.9	15.3	U	EPA 901.1
			Uranium-238	−39.6 ± 92.4	107	U	EPA 901.1
		6-Nov-2019	Actinium-228	7.86 ± 18.6	15.6	U	EPA 901.1
			Alpha, gross	4.19 ± 1.8	2.7		EPA 900.0/SW-846 9310
			Americium-241	0.624 ± 9.37	14.6	U	EPA 901.1
			Beryllium-7	12.6 ± 18.4	31.1	U	EPA 901.1
			Beta, gross	22.4 ± 1.9	2.03		EPA 900.0/SW-846 9310
			Bismuth-212	7.14 ± 27.6	50.4	U	EPA 901.1
			Bismuth-214	−2.18 ± 8.64	7.36	U	EPA 901.1
			Cesium-137	0.238 ± 2.13	3.63	U	EPA 901.1
			Cobalt-60	2.32 ± 2.39	3.62	U	EPA 901.1
			Lead-212	5.57 ± 9.7	6.89	U	EPA 901.1
			Lead-214	−5.41 ± 8.01	8.18	U	EPA 901.1
			Neptunium-237	−1.53 ± 3.88	6.56	U	EPA 901.1
			Potassium-40	3.97 ± 49.5	34.7	U	EPA 901.1
			Radium-223	0.208 ± 36.6	64	U	EPA 901.1
			Radium-224	41.1 ± 39.3	63.3	U	EPA 901.1
			Radium-226	−2.96 ± 65.9	81.9	U	EPA 901.1
			Radium-228	7.86 ± 18.6	15.6	U	EPA 901.1
			Sodium-22	0.479 ± 1.68	3.13	U	EPA 901.1
			Thorium-227	2.47 ± 14.7	26	U	EPA 901.1
			Thorium-231	−14 ± 38.3	39.4	U	EPA 901.1
			Thorium-234	45.7 ± 146	143	U	EPA 901.1
			Tritium	−8.7 ± 100	187	U	EPA 906.0 Modified
			Uranium-235	1.29 ± 21.8	20.6	U	EPA 901.1
			Uranium-238	45.7 ± 146	143	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	7-Nov-2019	Actinium-228	−6.84 ± 11.4	11.9	U	EPA 901.1
			Alpha, gross	3.72 ± 2.83	4.62	*U	EPA 900.0/SW-846 9310
			Americium-241	1.87 ± 8.82	14.2	U	EPA 901.1
			Beryllium-7	−0.47 ± 13.4	24	U	EPA 901.1
			Beta, gross	19.9 ± 2.33	3		EPA 900.0/SW-846 9310
			Bismuth-212	49.6 ± 33.8	37.1	X	EPA 901.1
			Bismuth-214	1.35 ± 8.33	5.54	U	EPA 901.1
			Cesium-137	−0.116 ± 1.62	2.86	U	EPA 901.1
			Cobalt-60	0.0707 ± 1.63	3.06	U	EPA 901.1
			Lead-212	4.07 ± 6.2	6.18	U	EPA 901.1
			Lead-214	−2.5 ± 6.45	7.01	U	EPA 901.1
			Neptunium-237	−2.4 ± 3.06	5.01	U	EPA 901.1
			Potassium-40	−43.3 ± 41.7	51.8	U	EPA 901.1
			Radium-223	5.34 ± 28.4	51.6	U	EPA 901.1
			Radium-224	−17.2 ± 43.4	53	U	EPA 901.1
			Radium-226	−40.4 ± 72	77.2	U	EPA 901.1
			Radium-228	−6.84 ± 11.4	11.9	U	EPA 901.1
			Sodium-22	−0.321 ± 1.66	2.83	U	EPA 901.1
			Thorium-227	0.274 ± 12.6	20.8	U	EPA 901.1
			Thorium-231	−11.5 ± 37.5	39.1	U	EPA 901.1
			Thorium-234	85.1 ± 149	117	U	EPA 901.1
			Tritium	15 ± 93.3	170	U	EPA 906.0 Modified
			Uranium-235	9.38 ± 22.8	18.1	U	EPA 901.1
			Uranium-238	85.1 ± 149	117	U	EPA 901.1
		8-Nov-2019	Actinium-228	−3.01 ± 14.1	15.1	U	EPA 901.1
			Alpha, gross	3.22 ± 1.68	2.59	*	EPA 900.0/SW-846 9310
			Americium-241	−0.0588 ± 9.8	17.1	U	EPA 901.1
			Beryllium-7	−1.26 ± 12.7	22.6	U	EPA 901.1
			Beta, gross	22.8 ± 1.64	1.58		EPA 900.0/SW-846 9310
			Bismuth-212	24.1 ± 27.9	47.8	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	8-Nov-2019	Bismuth-214	−2.1 ± 6.49	6.79	U	EPA 901.1
			Cesium-137	0.287 ± 1.68	2.72	U	EPA 901.1
			Cobalt-60	−1.24 ± 1.93	3.2	U	EPA 901.1
			Lead-212	2.84 ± 6.56	6.15	U	EPA 901.1
			Lead-214	2.29 ± 7.25	6.89	U	EPA 901.1
			Neptunium-237	0.968 ± 3.01	5.48	U	EPA 901.1
			Potassium-40	−1.59 ± 43.5	56.8	U	EPA 901.1
			Radium-223	−21.5 ± 31.2	51.8	U	EPA 901.1
			Radium-224	−12.5 ± 32.1	46.8	U	EPA 901.1
			Radium-226	14.2 ± 77.5	52.6	U	EPA 901.1
			Radium-228	−3.01 ± 14.1	15.1	U	EPA 901.1
			Sodium-22	1.49 ± 1.91	3.59	U	EPA 901.1
			Thorium-227	6.56 ± 14.1	21.4	U	EPA 901.1
			Thorium-231	34 ± 32.3	35.7	U	EPA 901.1
			Thorium-234	−48.5 ± 132	162	U	EPA 901.1
			Tritium	−16.1 ± 91.3	173	U	EPA 906.0 Modified
			Uranium-235	−6.86 ± 15.9	17	U	EPA 901.1
			Uranium-238	−48.5 ± 132	162	U	EPA 901.1
WW007	2069G	5-Nov-2019	Actinium-228	6.52 ± 16.3	14.8	U	EPA 901.1
			Alpha, gross	2.52 ± 1.18	1.72		EPA 900.0/SW-846 9310
			Americium-241	0.862 ± 16	24.5	U	EPA 901.1
			Beryllium-7	−5.09 ± 14.5	24.4	U	EPA 901.1
			Beta, gross	2.46 ± 0.985	1.57		EPA 900.0/SW-846 9310
			Bismuth-212	17.4 ± 25.8	44.6	U	EPA 901.1
			Bismuth-214	−5.16 ± 8.83	7.98	U	EPA 901.1
			Cesium-137	−1.8 ± 1.95	2.81	U	EPA 901.1
			Cobalt-60	1.44 ± 1.93	3.6	U	EPA 901.1
			Lead-212	−0.215 ± 5.1	6.18	U	EPA 901.1
			Lead-214	2.34 ± 8.62	7.67	U	EPA 901.1
			Neptunium-237	−1.57 ± 3.45	5.81	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	5-Nov-2019	Potassium-40	−35.7 ± 38.5	48.2	U	EPA 901.1
			Radium-223	−13.5 ± 37	62.9	U	EPA 901.1
			Radium-224	−82.2 ± 54.9	56.8	U	EPA 901.1
			Radium-226	131 ± 127	131	U	EPA 901.1
			Radium-228	6.52 ± 16.3	14.8	U	EPA 901.1
			Sodium-22	−0.858 ± 1.81	3.11	U	EPA 901.1
			Thorium-227	−3.38 ± 13.9	24.2	U	EPA 901.1
			Thorium-231	−16.1 ± 48.6	50	U	EPA 901.1
			Thorium-234	256 ± 293	256	U	EPA 901.1
			Tritium	0.891 ± 101	186	U	EPA 906.0 Modified
			Uranium-235	−14.5 ± 20.3	20.3	U	EPA 901.1
			Uranium-238	256 ± 293	256	U	EPA 901.1
		6-Nov-2019	Actinium-228	−7.11 ± 13.1	12.5	U	EPA 901.1
			Alpha, gross	1.53 ± 1.6	2.66	U	EPA 900.0/SW-846 9310
			Americium-241	−.536 ± 6.17	9.5	U	EPA 901.1
			Beryllium-7	1.68 ± 12	21.2	U	EPA 901.1
			Beta, gross	3.03 ± 1	1.57		EPA 900.0/SW-846 9310
			Bismuth-212	9.67 ± 21.3	37.4	U	EPA 901.1
			Bismuth-214	2.03 ± 7.52	5.08	U	EPA 901.1
			Cesium-137	0.0113 ± 2.85	2.9	U	EPA 901.1
			Cobalt-60	−0.202 ± 1.62	2.92	U	EPA 901.1
			Lead-212	0.94 ± 5.47	4.18	U	EPA 901.1
			Lead-214	4.35 ± 7.71	6.29	U	EPA 901.1
			Neptunium-237	2.06 ± 2.87	4.98	U	EPA 901.1
			Potassium-40	−16.1 ± 28	36.9	U	EPA 901.1
			Radium-223	−19.5 ± 37.3	46.7	U	EPA 901.1
			Radium-224	7.56 ± 27.1	43.7	U	EPA 901.1
			Radium-226	−28.7 ± 56.2	71.7	U	EPA 901.1
			Radium-228	−7.11 ± 13.1	12.5	U	EPA 901.1
			Sodium-22	−1.19 ± 1.58	2.49	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	6-Nov-2019	Thorium-227	2.17 ± 10.5	18.8	U	EPA 901.1
			Thorium-231	11.2 ± 39.9	30.4	U	EPA 901.1
			Thorium-234	77 ± 110	80.8	U	EPA 901.1
			Tritium	23.8 ± 102	185	U	EPA 906.0 Modified
			Uranium-235	−3.91 ± 15	15.9	U	EPA 901.1
			Uranium-238	77 ± 110	80.8	U	EPA 901.1
		7-Nov-2019	Actinium-228	−21 ± 19.6	18	U	EPA 901.1
			Alpha, gross	−0.394 ± 1.17	2.17	*U	EPA 900.0/SW-846 9310
			Americium-241	−10.5 ± 14.2	23.4	U	EPA 901.1
			Beryllium-7	12.7 ± 17.4	30.2	U	EPA 901.1
			Beta, gross	0.864 ± 0.833	1.39	U	EPA 900.0/SW-846 9310
			Bismuth-212	15.8 ± 29	51.4	U	EPA 901.1
			Bismuth-214	1.49 ± 8.84	9.18	U	EPA 901.1
			Cesium-137	1.88 ± 2.28	3.93	U	EPA 901.1
			Cobalt-60	3.97 ± 3.45	4.06	U	EPA 901.1
			Lead-212	3.33 ± 7.72	6.04	U	EPA 901.1
			Lead-214	−3.08 ± 8.07	8.53	U	EPA 901.1
			Neptunium-237	1.73 ± 3.81	6.71	U	EPA 901.1
			Potassium-40	−15.7 ± 51.7	57.5	U	EPA 901.1
			Radium-223	−11.8 ± 37.4	64.3	U	EPA 901.1
			Radium-224	22.5 ± 40.6	63.9	U	EPA 901.1
			Radium-226	−65.9 ± 88.9	100	U	EPA 901.1
			Radium-228	−21 ± 19.6	18	U	EPA 901.1
			Sodium-22	1.7 ± 2.28	4.32	U	EPA 901.1
			Thorium-227	−4.12 ± 15.2	26.2	U	EPA 901.1
			Thorium-231	−9 ± 51.2	53	U	EPA 901.1
			Thorium-234	−28.6 ± 203	241	U	EPA 901.1
			Tritium	52.2 ± 99.6	173	U	EPA 906.0 Modified
			Uranium-235	−10.2 ± 22	23.5	U	EPA 901.1
			Uranium-238	−28.6 ± 203	241	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	8-Nov-2019	Actinium-228	−6.16 ± 12.4	16	U	EPA 901.1
			Alpha, gross	2.57 ± 1.48	2.32	*	EPA 900.0/SW-846 9310
			Americium-241	−5.65 ± 16.9	25.4	U	EPA 901.1
			Beryllium-7	23.7 ± 25	25.7	U	EPA 901.1
			Beta, gross	0.915 ± .672	1.1	U	EPA 900.0/SW-846 9310
			Bismuth-212	4.97 ± 26.5	48.2	U	EPA 901.1
			Bismuth-214	2.1 ± 8.72	9.15	U	EPA 901.1
			Cesium-137	−0.0704 ± 2.08	3.32	U	EPA 901.1
			Cobalt-60	−3.74 ± 3.68	3.63	U	EPA 901.1
			Lead-212	5.62 ± 7.79	7.25	U	EPA 901.1
			Lead-214	7.37 ± 10.2	8.17	U	EPA 901.1
			Neptunium-237	−3.81 ± 4.07	6.06	U	EPA 901.1
			Potassium-40	32 ± 42.9	32.9	U	EPA 901.1
			Radium-223	9.23 ± 35.4	61.9	U	EPA 901.1
			Radium-224	32.5 ± 39	59.3	U	EPA 901.1
			Radium-226	23.4 ± 99.1	98.6	U	EPA 901.1
			Radium-228	−6.16 ± 12.4	16	U	EPA 901.1
			Sodium-22	−0.831 ± 1.95	3.25	U	EPA 901.1
			Thorium-227	−7.65 ± 14.1	23.4	U	EPA 901.1
			Thorium-231	17.3 ± 55.2	46.7	U	EPA 901.1
			Thorium-234	−268 ± 260	252	U	EPA 901.1
			Tritium	−22 ± 90.5	173	U	EPA 906.0 Modified
			Uranium-235	−10 ± 19.4	20.3	U	EPA 901.1
			Uranium-238	−268 ± 260	252	U	EPA 901.1
WW008	2069I	5-Nov-2019	Actinium-228	3.81 ± 6.85	12.8	U	EPA 901.1
			Alpha, gross	3.12 ± 1.72	2.62		EPA 900.0/SW-846 9310
			Americium-241	0.969 ± 2.42	3.98	U	EPA 901.1
			Beryllium-7	11.5 ± 24.8	22.9	U	EPA 901.1
			Beta, gross	19.3 ± 1.78	1.8		EPA 900.0/SW-846 9310
			Bismuth-212	−11.1 ± 45.5	45.1	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	5-Nov-2019	Bismuth-214	12.6 ± 9.64	6.24	X	EPA 901.1
			Cesium-137	−0.448 ± 1.86	3.19	U	EPA 901.1
			Cobalt-60	1.02 ± 1.97	3.68	U	EPA 901.1
			Lead-212	3.51 ± 6.01	5.34	U	EPA 901.1
			Lead-214	−0.732 ± 5.75	7.23	U	EPA 901.1
			Neptunium-237	2.2 ± 3.05	5.39	U	EPA 901.1
			Potassium-40	117 ± 45.5	30.8		EPA 901.1
			Radium-223	−7.86 ± 28.5	50.6	U	EPA 901.1
			Radium-224	11.8 ± 30.1	46.1	U	EPA 901.1
			Radium-226	−46.4 ± 59.9	72.4	U	EPA 901.1
			Radium-228	3.81 ± 6.85	12.8	U	EPA 901.1
			Sodium-22	−.203 ± 1.89	3.43	U	EPA 901.1
			Thorium-227	−12.6 ± 13.3	18.4	U	EPA 901.1
			Thorium-231	−17.5 ± 26.2	24.2	U	EPA 901.1
			Thorium-234	55.9 ± 61.1	69.5	U	EPA 901.1
			Tritium	16.5 ± 101	183	U	EPA 906.0 Modified
			Uranium-235	−0.64 ± 15.4	16.3	U	EPA 901.1
			Uranium-238	55.9 ± 61.1	69.5	U	EPA 901.1
		6-Nov-2019	Actinium-228	−4.84 ± 12.5	12.8	U	EPA 901.1
			Alpha, gross	3.74 ± 2.22	3.5		EPA 900.0/SW-846 9310
			Americium-241	3.85 ± 6.36	9.78	U	EPA 901.1
			Beryllium-7	6.31 ± 13.6	23.8	U	EPA 901.1
			Beta, gross	20.4 ± 1.66	1.84		EPA 900.0/SW-846 9310
			Bismuth-212	4.63 ± 23.1	40.1	U	EPA 901.1
			Bismuth-214	7.9 ± 7.7	7.9	U	EPA 901.1
			Cesium-137	−1.25 ± 2.36	2.91	U	EPA 901.1
			Cobalt-60	1.89 ± 1.91	3.41	U	EPA 901.1
			Lead-212	3.49 ± 5.35	4.35	U	EPA 901.1
			Lead-214	3.41 ± 7.58	6.61	U	EPA 901.1
			Neptunium-237	0.385 ± 2.77	4.91	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	6-Nov-2019	Potassium-40	58.8 ± 35.4	27.1		EPA 901.1
			Radium-223	7.92 ± 50	50.2	U	EPA 901.1
			Radium-224	15.9 ± 29.3	46.7	U	EPA 901.1
			Radium-226	−27.9 ± 57.4	71.8	U	EPA 901.1
			Radium-228	−4.84 ± 12.5	12.8	U	EPA 901.1
			Sodium-22	0.864 ± 1.73	3.21	U	EPA 901.1
			Thorium-227	3.68 ± 11	19.6	U	EPA 901.1
			Thorium-231	32.9 ± 44.8	32.3	X	EPA 901.1
			Thorium-234	26.6 ± 149	85.9	U	EPA 901.1
			Tritium	52.7 ± 109	190	U	EPA 906.0 Modified
			Uranium-235	9.09 ± 17.1	17.2	U	EPA 901.1
			Uranium-238	26.6 ± 149	85.9	U	EPA 901.1
		7-Nov-2019	Actinium-228	5.33 ± 17.3	16.8	U	EPA 901.1
			Alpha, gross	2.29 ± 1.26	1.86	*	EPA 900.0/SW-846 9310
			Americium-241	−1.77 ± 18.5	29.6	U	EPA 901.1
			Beryllium-7	−3.52 ± 16.7	29.3	U	EPA 901.1
			Beta, gross	15.5 ± 1.35	1.36		EPA 900.0/SW-846 9310
			Bismuth-212	−2.4 ± 27.1	47.3	U	EPA 901.1
			Bismuth-214	−1.28 ± 9.42	9.25	U	EPA 901.1
			Cesium-137	−1.5 ± 2.23	3.54	U	EPA 901.1
			Cobalt-60	−0.0018 ± 2.13	3.98	U	EPA 901.1
			Lead-212	5.83 ± 7.63	7.85	U	EPA 901.1
			Lead-214	−2.88 ± 9.02	9.32	U	EPA 901.1
			Neptunium-237	2.38 ± 3.92	6.98	U	EPA 901.1
			Potassium-40	7.63 ± 66	40.1	U	EPA 901.1
			Radium-223	−6.39 ± 39.3	70	U	EPA 901.1
			Radium-224	25.4 ± 43.2	65	U	EPA 901.1
			Radium-226	18.9 ± 96.5	90.9	U	EPA 901.1
			Radium-228	5.33 ± 17.3	16.8	U	EPA 901.1
			Sodium-22	1.25 ± 2.05	3.93	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	WW008	Thorium-227	−6.05 ± 15.1	26.5	U	EPA 901.1
			Thorium-231	−19.1 ± 46.3	51.8	U	EPA 901.1
			Thorium-234	287 ± 297	288	U	EPA 901.1
			Tritium	113 ± 109	176	U	EPA 906.0 Modified
			Uranium-235	4.89 ± 22.4	21	U	EPA 901.1
			Uranium-238	287 ± 297	288	U	EPA 901.1
		8-Nov-2019	Actinium-228	−2.26 ± 15.1	15.6	U	EPA 901.1
			Alpha, gross	3.39 ± 1.7	2.58	*	EPA 900.0/SW-846 9310
			Americium-241	0.134 ± 9.38	16.9	U	EPA 901.1
			Beryllium-7	−24.2 ± 29.7	25.9	U	EPA 901.1
			Beta, gross	5.17 ± 1.81	2.91		EPA 900.0/SW-846 9310
			Bismuth-212	10.7 ± 29.3	51.4	U	EPA 901.1
			Bismuth-214	−7.03 ± 8.73	8.37	U	EPA 901.1
			Cesium-137	0.791 ± 1.97	3.5	U	EPA 901.1
			Cobalt-60	−0.967 ± 2.39	3.5	U	EPA 901.1
			Lead-212	9.17 ± 6.62	4.9		EPA 901.1
			Lead-214	0.314 ± 9.37	7.77	U	EPA 901.1
			Neptunium-237	2.02 ± 3.47	6.25	U	EPA 901.1
			Potassium-40	14.1 ± 45.4	32.8	U	EPA 901.1
			Radium-223	14.2 ± 68.8	59.6	U	EPA 901.1
			Radium-224	30.4 ± 37.5	56.3	U	EPA 901.1
			Radium-226	−33.8 ± 73.5	77.6	U	EPA 901.1
			Radium-228	−2.26 ± 15.1	15.6	U	EPA 901.1
			Sodium-22	2.32 ± 2.29	4.13	U	EPA 901.1
			Thorium-227	7.2 ± 13.9	23.1	U	EPA 901.1
			Thorium-231	−32.8 ± 39.2	38.5	U	EPA 901.1
			Thorium-234	50.2 ± 161	161	U	EPA 901.1
			Tritium	16.7 ± 97.9	178	U	EPA 906.0 Modified
			Uranium-235	23.5 ± 19.4	23.5	U	EPA 901.1
			Uranium-238	50.2 ± 161	161	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	5-Nov-2019	Actinium-228	−1.91 ± 13.7	14.7	U	EPA 901.1
			Alpha, gross	1.94 ± 1.33	2.13	U	EPA 900.0/SW-846 9310
			Americium-241	−4.83 ± 9.8	14.5	U	EPA 901.1
			Beryllium-7	6.86 ± 16.6	28.7	U	EPA 901.1
			Beta, gross	24.3 ± 1.9	1.56		EPA 900.0/SW-846 9310
			Bismuth-212	38 ± 34.2	51.9	U	EPA 901.1
			Bismuth-214	1.57 ± 9.73	8.23	U	EPA 901.1
			Cesium-137	−0.569 ± 2.19	3.62	U	EPA 901.1
			Cobalt-60	0.788 ± 1.9	3.51	U	EPA 901.1
			Lead-212	3.42 ± 6.09	6.68	U	EPA 901.1
			Lead-214	1.71 ± 8.52	8.1	U	EPA 901.1
			Neptunium-237	0.111 ± 4.25	6.68	U	EPA 901.1
			Potassium-40	17.5 ± 51.6	37.5	U	EPA 901.1
			Radium-223	−48.2 ± 43	61	U	EPA 901.1
			Radium-224	23.8 ± 37.5	58.8	U	EPA 901.1
			Radium-226	61.4 ± 85.8	81.2	U	EPA 901.1
			Radium-228	−1.91 ± 13.7	14.7	U	EPA 901.1
			Sodium-22	1.4 ± 1.9	3.48	U	EPA 901.1
			Thorium-227	−0.2 ± 14.8	26	U	EPA 901.1
			Thorium-231	7.68 ± 32.9	40.8	U	EPA 901.1
			Thorium-234	332 ± 211	117	X	EPA 901.1
			Tritium	26.2 ± 100	180	U	EPA 906.0 Modified
			Uranium-235	4.64 ± 11.6	18.4	U	EPA 901.1
			Uranium-238	332 ± 211	117	X	EPA 901.1
		6-Nov-2019	Actinium-228	8.4 ± 16.8	15.9	U	EPA 901.1
			Alpha, gross	2.55 ± 1.88	3.02	U	EPA 900.0/SW-846 9310
			Americium-241	10.2 ± 11	16.2	U	EPA 901.1
			Beryllium-7	12.2 ± 18.7	31.8	U	EPA 901.1
			Beta, gross	26.3 ± 1.72	1.73		EPA 900.0/SW-846 9310
			Bismuth-212	10 ± 28.3	51.6	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	6-Nov-2019	Bismuth-214	2.62 ± 10.3	7.15	U	EPA 901.1
			Cesium-137	−0.506 ± 2.17	3.61	U	EPA 901.1
			Cobalt-60	−0.187 ± 1.79	3.21	U	EPA 901.1
			Lead-212	0.933 ± 8.5	6.98	U	EPA 901.1
			Lead-214	−9.67 ± 8.85	8.02	U	EPA 901.1
			Neptunium-237	−1.82 ± 3.94	6.6	U	EPA 901.1
			Potassium-40	−17 ± 41.3	51.2	U	EPA 901.1
			Radium-223	−12.8 ± 38.5	65.6	U	EPA 901.1
			Radium-224	41.1 ± 40.9	60.6	U	EPA 901.1
			Radium-226	28.6 ± 80.5	61.8	U	EPA 901.1
			Radium-228	8.4 ± 16.8	15.9	U	EPA 901.1
			Sodium-22	0.337 ± 1.87	3.41	U	EPA 901.1
			Thorium-227	12.1 ± 17.4	26.9	U	EPA 901.1
			Thorium-231	−9.38 ± 38.2	40.4	U	EPA 901.1
			Thorium-234	79.2 ± 144	148	U	EPA 901.1
			Tritium	45.8 ± 104	182	U	EPA 906.0 Modified
			Uranium-235	−7.57 ± 18.5	20.6	U	EPA 901.1
			Uranium-238	79.2 ± 144	148	U	EPA 901.1
		7-Nov-2019	Actinium-228	−11.1 ± 13.2	13.6	U	EPA 901.1
			Alpha, gross	2.52 ± 1.41	2.11	*	EPA 900.0/SW-846 9310
			Americium-241	6.72 ± 9.04	15.4	U	EPA 901.1
			Beryllium-7	−0.345 ± 14.2	25	U	EPA 901.1
			Beta, gross	22.2 ± 1.62	1.59		EPA 900.0/SW-846 9310
			Bismuth-212	−20.5 ± 27.4	41.5	U	EPA 901.1
			Bismuth-214	4.1 ± 7.85	6.18	U	EPA 901.1
			Cesium-137	1.19 ± 1.81	3.15	U	EPA 901.1
			Cobalt-60	−0.873 ± 1.95	3.29	U	EPA 901.1
			Lead-212	5.72 ± 8.39	6.23	U	EPA 901.1
			Lead-214	2.49 ± 9.82	7.53	U	EPA 901.1
			Neptunium-237	−1.17 ± 3.17	5.52	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	7-Nov-2019	Potassium-40	15.1 ± 46.8	29.6	U	EPA 901.1
			Radium-223	2.58 ± 31.7	56.8	U	EPA 901.1
			Radium-224	4.44 ± 39.6	54.9	U	EPA 901.1
			Radium-226	−69.7 ± 69.9	74	U	EPA 901.1
			Radium-228	−11.1 ± 13.2	13.6	U	EPA 901.1
			Sodium-22	0.509 ± 1.81	3.35	U	EPA 901.1
			Thorium-227	−7.53 ± 12.6	21.3	U	EPA 901.1
			Thorium-231	5.49 ± 38.4	35.8	U	EPA 901.1
			Thorium-234	6.11 ± 158	123	U	EPA 901.1
			Tritium	27.2 ± 99.4	179	U	EPA 906.0 Modified
			Uranium-235	0.375 ± 19.8	18.6	U	EPA 901.1
			Uranium-238	6.11 ± 158	123	U	EPA 901.1
		8-Nov-2019	Actinium-228	8.9 ± 15.2	14	U	EPA 901.1
			Alpha, gross	0.838 ± 1.93	3.36	*U	EPA 900.0/SW-846 9310
			Americium-241	−0.117 ± 5.43	8.64	U	EPA 901.1
			Beryllium-7	−4.3 ± 14.1	24	U	EPA 901.1
			Beta, gross	24.4 ± 1.72	1.75		EPA 900.0/SW-846 9310
			Bismuth-212	−47.6 ± 45.2	39.4	U	EPA 901.1
			Bismuth-214	1.14 ± 6.49	5.95	U	EPA 901.1
			Cesium-137	2.28 ± 2.5	2.96	U	EPA 901.1
			Cobalt-60	−1.17 ± 2.74	2.94	U	EPA 901.1
			Lead-212	3.08 ± 5.34	4.25	U	EPA 901.1
			Lead-214	−2.41 ± 6.57	6.86	U	EPA 901.1
			Neptunium-237	0.502 ± 2.86	5.11	U	EPA 901.1
			Potassium-40	76.2 ± 39	27.2		EPA 901.1
			Radium-223	−16.4 ± 29.4	49.2	U	EPA 901.1
			Radium-224	−.488 ± 28.2	45.6	U	EPA 901.1
			Radium-226	−48.5 ± 57.8	64.8	U	EPA 901.1
			Radium-228	8.9 ± 15.2	14	U	EPA 901.1
			Sodium-22	−0.369 ± 1.54	2.72	U	EPA 901.1

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Table E-6. Radiological results for permitted sanitary outfalls, November 2019 (continued)

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	8-Nov-2019	Thorium-227	6.91 ± 11.8	20.7	U	EPA 901.1
			Thorium-231	−10.5 ± 27.1	31.8	U	EPA 901.1
			Thorium-234	10.7 ± 112	76.5	U	EPA 901.1
			Tritium	50.3 ± 98.2	171	U	EPA 906.0 Modified
			Uranium-235	−5.42 ± 21.9	16.3	U	EPA 901.1
			Uranium-238	10.7 ± 112	76.5	U	EPA 901.1

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

Laboratory Data Qualifier
* = A replicate 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.

Glossary

Spider wasp (*Pompilidae*) on a desert willow (*Chilopsis linearis*)

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

analyte A substance or chemical constituent undergoing analysis.

anthropogenic Of, relating to, or resulting from the influence of human beings on nature.

antimony A metallic element having four allotropic forms, the most common of which is a hard, extremely brittle, lustrous, silver-white, crystalline material. It is used in a wide variety of alloys, especially with lead in battery plates, and in the manufacture of flameproofing compounds, paint, semiconductor devices, and ceramic products.

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. A source of groundwater for wells and springs.

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 elements 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 sediments accumulate.

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.

C

catchment basin The geographical area draining into a river or reservoir.

cesium-137 A radioactive isotope of cesium used in radiation therapy and found in atmospheric fallout.

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 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) EPA requirements for treatment, storage, and disposal facilities handling hazardous waste to undertake corrective actions to clean up spills resulting from failure to follow hazardous waste management procedures or from other mistakes. The process includes cleanup procedures designed to guide treatment, storage, and disposal facilities in avoiding spills. (2) An action identified to correct a finding that, when completed, fixes a problem or prevents 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.

derived concentration technical standard Concentrations of radionuclides in water and air that could be consumed continuously or inhaled for one year and not exceed the DOE primary radiation standard for the public (100 mrem/year effective dose equivalent).

discharge Any liquid or solid that flows or is placed on or 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 on or onto any land or into any water.

discharge limit The maximum concentration of a specified pollutant allowed to be discharged in a volume of water or wastewater.

discharge point The site or location of the release, flow, or runoff of any waste governed by regulation.

diurnal (1) Relating to or occurring in a 24-hour period; daily. (2) Occurring or active during the daytime rather than at night: 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 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 that benefit humans at no cost.

effective dose equivalent The weighted average of dose equivalents in certain human organs or tissues; can be used to estimate the health-effects risk of 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 in eight different electronics to determine the environmental attributes of a particular electronic office product. Currently, the tool only targets computer desktops/towers, notebook computers (laptops), and monitors.

electroplating The act of coating or covering with a thin layer of metal by electrodeposition.

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 (EMS) 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 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 listed 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 (ES&H) A program designed to protect and preserve the environment and to ensure the safety and health of the organization's employees, contractors, visitors, and the public.

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

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.

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.

high-level radioactive waste Waste generated in the core fuel of a nuclear reactor; found at nuclear reactors or by nuclear fuel reprocessing.

I

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

industrial discharge Wastewater discharge from industrial and commercial sources that may contain pollutants at levels that could affect the quality of receiving waters or interfere with publicly owned treatments works.

inertial confinement fusion A method of controlled fusion in which the rapid implosion of a fuel pellet—produced by laser, electron, or ion beams—raises the pellet core's temperature and density to levels at which nuclear fusion can take place before the pellet flies apart.

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

ion An atom or molecule with a net electric charge due to the loss or gain of one or more electrons. Cations have a positive charge and anions have a negative charge.

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 Waste that is less hazardous than most waste associated with a nuclear reactor; generated by hospitals, research laboratories, and certain industries. DOE, the Nuclear Regulatory Commission, and EPA share responsibilities for managing low-level radioactive 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. The program emphasizes purchasing sustainable products, using less materials, reducing waste and toxicity, recovering more of the materials that are used, slowing climate change, and ensuring sufficient resources to meet society's needs today and in the future.

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

N

National Emissions Standards for Hazardous Air Pollutants (NESHAP) Emissions standards set by EPA for an air pollutant 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 (NEPA) 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 (NPDES) 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, 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 (e.g., protons, deuterons, or electrons) by applying electrical potential differences for the purpose of physics experiments.

O

occurrence One or more (i.e., recurring) events or conditions that adversely affect, or may adversely affect, DOE or contractor personnel, the public, property, the environment, or the DOE mission. Events or conditions meeting the criteria thresholds identified in this order, or determined to be recurring through performance analysis, are occurrences.

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 groundwater Groundwater that is unconfined and separated from an underlying main body of groundwater by an unsaturated zone (also known as perched water).

perennial spring A spring 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 (PCB) A chemical term limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances that contain such material. 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.

pulsed power Technology used to generate and apply energetic beams and high-power energy pulses.

Q

quadrant A usually rectangular plot used for ecological or population studies.

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 (anthropogenic) 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.

Resource and Conservation Recovery Act (RCRA) Federal guidance for regulating hazardous chemical waste and nonhazardous solid waste, including hazardous or petroleum products in underground storage tanks.

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 that manages environmental analytical laboratory contracts and assists 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 The portion of liquid effluent exclusive of industrial wastewater and stormwater. It includes the liquid discharges from restrooms and food preparation 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.

semivolatile organic compound An organic chemical compound that volatilizes slowly at a standard temperature (20°C and 1 atmosphere pressure).

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.

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 with 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 (anthropogenic) 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.

uranium A heavy, silvery-white metallic element, radioactive and toxic, easily oxidized, and having 14 known isotopes of which uranium-238 is the most abundant in nature. The element occurs in several minerals, including uraninite and carnotite, from which it is extracted and processed for use in research, nuclear fuels, and nuclear weapons.

U.S. Environmental Protection Agency (EPA) 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 within which the moisture content is less than saturation (except in the capillary fringe) and pressure is less than atmospheric. Soil pore space also typically contains air or other gases. The capillary fringe is included in the vadose zone.

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

volatile organic compound An organic chemical compound with a high vapor pressure at standard temperature (20°C and 1 atmosphere 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 The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point.

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 rose A graphical presentation of wind speed and direction frequency distribution.

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40 CFR 122. *EPA Administered Permit Programs: The National Pollutant Discharge Elimination System (NPDES)*.

40 CFR 136. *Guidelines for Establishing Test Processing for the Analysis of Pollutants*.

40 CFR 141. *National Primary Drinking Water Regulations*.

40 CFR 143. *National Secondary Drinking Water Regulations*.

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40 CFR 268. *Land Disposal Restrictions*.

40 CFR 280. *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks*.

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40 CFR 355. *Emergency Planning and Notification*.

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Clean Water Act (CWA) of 1977 (the Federal Water Pollution Control Act) (33 USC § 1251).

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. (42 USC § 9601). Amended by the Superfund Amendments and Reauthorization Act (SARA).

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Federal Facility Compliance Act (FFCA) of 1992 (42 USC § 6961).

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 USC § 136).

Fish and Wildlife Conservation, 1982 (16 USC §§ 2901–2911).

Fish and Wildlife Conservation Act (Public Law [PL] 96-366).

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National Environmental Policy Act (NEPA) of 1969 (42 USC § 4321).

National Historic Preservation Act of 1966, as amended (16 USC § 470 et seq.).

Native American Graves Protection and Repatriation Act, enacted in 1990.

New Mexico Hazardous Waste Act of 1978.

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Resource Conservation and Recovery Act (RCRA) of 1976 (42 USC § 6901 et seq.).

Safe Drinking Water Act (SDWA) (42 USC § 300f).

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Superfund Amendments and Reauthorization Act (SARA) of 1986 (see CERCLA).

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20.11.2 NMAC, *Fees*.

20.11.8 NMAC, *New Mexico Ambient Air Quality Standards*.

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4.10.8 NMAC, *Permits to Conduct Archaeological Investigations on State Land*.

4.10.15 NMAC, *Standards for Survey and Inventory*.

NMSA 1978, §§ 17-2-13 through 17-2-15 protecting songbirds, hawks, vultures, owls and horned toads, respectively, *Hunting and Fishing Regulations*.

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20.5 NMAC, *Petroleum Storage Tanks*.

- 20.5.115 NMAC, *Out-of-Service Storage Tank Systems and Closure*.
- 20.5.118 NMAC, *Reporting and Investigation of Suspected and Confirmed Releases*.
- 20.5.119 NMAC, *Corrective Action for Storage Tank Systems Containing Petroleum Products*.

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20.6.2 NMAC, *Ground and Surface Water Protection*.

- 20.6.2.1203 NMAC, *Notification of Discharge-Removal*.
- 20.6.2.3106 NMAC, *Application for Discharge Permits and Renewals*.
- 20.6.2.3109 NMAC, *Secretary Approval, Disapproval, Modification or Termination of Discharge Permits, and Requirement for Abatement Plans*.

20.6.4 NMAC, *Standards for Interstate and Intrastate Surface Waters*.

20.7.10 NMAC, *Drinking Water*.

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