Sandia National Laboratories

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ANNUAL SITE ENVIRONMENTAL REPORT

2018

U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

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

2018 Annual Site Environmental Report for Sandia National Laboratories, New Mexico

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for
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 for Sandia are committed to safeguarding the environment reassessing 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 2018. Environmental topics include air quality, ecology, environmental restoration, oil storage, site sustainability, terrestrial surveillance, waste management, water quality, and implementation of the National Environmental Policy Act. This report is prepared in accordance with and as required by DOE O 231.1B, Admin Change 1, *Environment, Safety, and Health Reporting* and has been approved for public distribution.

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Note to the Reader

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, the U.S. Department of Energy views this document as a valuable tool for maintaining a dialogue with our community about the environmental health of this site and the commitment to protect our valuable resources. We continually strive to improve the quality of the contents of this annual report as well as to include information that is important to you. Please provide feedback, comments, questions, or requests for copies of this report 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
ACRR	Annular Core Research Reactor
AHCU	Auxiliary Hot Cell Unit
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
CINT	Center for Integrated Nanotechnologies
CO_2e	carbon dioxide equivalent
CTF	Coyote Test Field
D	
DE	data excluded
DOE	United States Department of Energy
DOECAP	DOE Consolidated Audit Program
DP	discharge permit
E	
ECF	Explosives Components Facility
E. coli	*Escherichia coli*
EISA	Energy Independence and Security Act
EO	executive order
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	
FAST	Federal Automotive Statistical Tool
FFCA	Federal Facility Compliance Act
FFCO	Federal Facility Compliance Order
FY	fiscal year
H	
HDRV	Historical Disposal Requests Validation
HERMES	High-Energy Radiation Megavolt Electron Source
HMX	high melting explosive
HSWA	Hazardous and Solid Waste Amendment
I	
IBL	Ion Beam Laboratory
ISO	International Organization for Standardization
K	
KAFB	Kirtland Air Force Base
L	
Lc	critical level
LEED	Leadership in Energy and Environmental Design
LWDS	Liquid Waste Disposal System
M	
MAPS	Monitoring Avian Productivity and Survivorship
MBTA	Migratory Bird Treaty Act
MCL	maximum contaminant level
MDA	minimal detectable activity or minimum measured activity
MDL	method detection limit
MPN	most probable number
MTRU	mixed transuranic
N	
N/A	not applicable
ND	not detected
NE	not established
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NGF	Neutron Generator Facility
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
NPDES	National Pollutant Discharge Elimination System
NTESS	National Technology & Engineering Solutions of Sandia, LLC
NTU	nephelometric turbidity unit

P

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
PRD	Process Research and Development Laboratory

R

RCRA	Resource Conservation and Recovery Act
RDX	cyclotrimethylenetrinitramine
RMWMU	Radioactive and Mixed Waste Management Unit
RPICL	Radiation Protection Instrument Calibration Laboratory

S

Sandia	Sandia National Laboratories
SARA	Superfund Amendments and Reauthorization Act
SCD	SC Dome
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
SFO	Sandia Field Office
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories, California
SNL/NM	Sandia National Laboratories, New Mexico
spp.	unknown species
SU	standard unit
SWMU	solid waste management unit
SWSP	stormwater sampling point

T

TA	technical area
TAG	Tijeras Arroyo Groundwater
TAVG	TA-V Groundwater
TCLP	toxicity characteristic leaching procedure
TG	treatability group

U

U.S.	United States
USAF	United States Air Force
USC	United States Code
USGS	United States Geological Survey

W

WIPP	Waste Isolation Pilot Plant
WTA3	west of Technical Area III

Units of Measure

Unit	Definition
°C	degree Celsius
°F	degrees Fahrenheit
4 mrem/year	any combination of beta- and/or gamma-emitting radionuclides (as dose rate
Ci/year	curies per year
cm	centimeter
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^3	cubic meter
mb	millibar
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/sa	milligrams per sample

Unit	Definition
mL	milliliter
MPN/100 mL	most probable number per 100 milliliters
mR	milliroentgen
mrem	millirem
mrem/year	millirems per year
mR/year	milliroentgen per year
m/sec	meters per second
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/sa	picocuries per sample
person-rem	person-roentgen equivalent, man
person-rem/year	person-roentgen equivalent, man per year
ppb	parts per billion
ppb v/v	parts per billion volume per volume
ppm	parts per million
rem	Roentgen equivalent man

Data Qualifiers

Laboratory Data Qualifier

Term	Definition
*	a replicate was outside limits
B	analyte detected in the blank
H	analytical holding time was exceeded
J	estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N	a spike was outside limits
U	analyte is absent or below the method detection limit
X	data rejected due to peak not meeting identification criteria

Data Validation Qualifier

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

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, *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 2018.

Environmental Management System

Sandia has a robust Environmental Management System in place to help personnel fulfill their responsibilities of protecting the environment, preventing pollution, and conserving natural resources. The system is certified to the International Organization for Standardization 14001:2015 standard. The Environmental Management System 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 2018, including Scope 1 and Scope 2 greenhouse gas emissions and water use efficiency and management.

Environmental Performance

Environmental performance is tracked through measures and indicators and reported as part of an overall performance evaluation. During the most recent evaluation, Sandia earned an excellent overall rating, and two items related to environmental programs were noted.

Environmental Programs

Air Quality Compliance Program. Program personnel support Sandia in complying with air quality regulations. In 2018, emissions for stationary sources, site-wide volatile organic compounds, and hazardous air pollutants were within permitted levels. Sandia activities resulting in greenhouse gas emissions were below federal reporting thresholds. A release of sulfur hexafluoride was a DOE reportable occurrence. Numerous permits and registrations were maintained.

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

Environmental Life-Cycle Management Program. Management practices focus on sustainable use and protection of natural and cultural resources. In 2018, 52 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 2018, two accidental releases of water to the environment were reported to the New Mexico Environment Department and to the United States Environmental Protection Agency as a best management practice. One of the releases was a DOE reportable occurrence.

Environmental Restoration Operations. Personnel manage sites impacted by past spill, release, or disposal activities. In 2018, six sites remain 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 2018, 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 2018, new recycling avenues for certain waste streams were evaluated and additional recycling bins were provided.

National Environmental Policy Act Program. Program personnel coordinate with DOE to ensure compliance and provide technical assistance in project planning. In 2018, 1,784 proposed projects were reviewed.

Oil Storage Program. Oil storage containers and equipment are managed, operated, and maintained to support compliance with regulations. In 2018, 46 stationary aboveground storage tanks and two underground storage tanks were in operation. One out-of-service underground storage tank was removed in 2018.

Radionuclide National Emission Standards for Hazardous Air Pollutants Program. Radionuclide air emissions from Sandia facilities are reported each year. In 2018, the primary radionuclides released from Sandia facilities were argon-41 and tritium. Calculated doses were well below the federal 10 mrem/year standard.

Stormwater Program. Three United States Environmental Protection Agency National Pollutant Discharge Elimination System permits are maintained, and compliance activities are conducted. In 2018, there were exceedances of various benchmarks, standards, or permit conditions.

Surface Discharge Program. All planned water-based discharges to the ground surface are reviewed to comply with regulations. In 2018, 16 individual discharge requests were approved and met applicable standards. Routine surface discharges are allowed at two evaporation lagoons under an existing discharge permit. In 2018, all permit requirements were met for both lagoons.

Terrestrial Surveillance Program. Surveillance activities are conducted at on-site and off-site locations; soil and vegetation are sampled for various parameters. In 2018, results of the sampling events were below comparison reference values. Environmental dosimeters used to measure radiation indicated levels within natural background values.

Waste Management Program. Waste is managed at permitted units. In 2018, two annual no-notice hazardous waste compliance evaluation inspections were conducted; one resulted in a notice of violation and, and based on the notice, was also a DOE reportable occurrence.

Wastewater Discharge Program. Wastewater is discharged from six permitted on-site outfalls. In 2018, wastewater was monitored, and all discharges met the standards set by the Albuquerque Bernalillo County Water Utility Authority's Sewer Use and Wastewater Control Ordinance requirements.

Other environmental programs and activities that provide services, support compliance, and facilitate Sandia missions included the following.

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

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

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

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.

Safe Drinking Water Protection Program. Drinking water is supplied by the Kirtland Air Force Base system. Sandia personnel ensure the availability of safe drinking water through the DOE-owned drinking water distribution system.

Chapter 1. Introduction

Sandia foothills

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/index.html

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 2018 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 Mission

Sandia National Laboratories—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—anticipates and resolves emerging national security challenges, innovates and discovers new technologies to strengthen the nation's technological superiority, creates value through products and services that solve important national security challenges, and informs 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 2004; ISO 2015) Environmental Management System at the primary operating locations of SNL/NM and SNL/CA. All remaining locations follow the 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 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, Sandia became 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. KAFB is host to more than 450 federal government and private sector tenants and associated units (USAF 2012). KAFB and SNL/NM are adjacent to the city of 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.

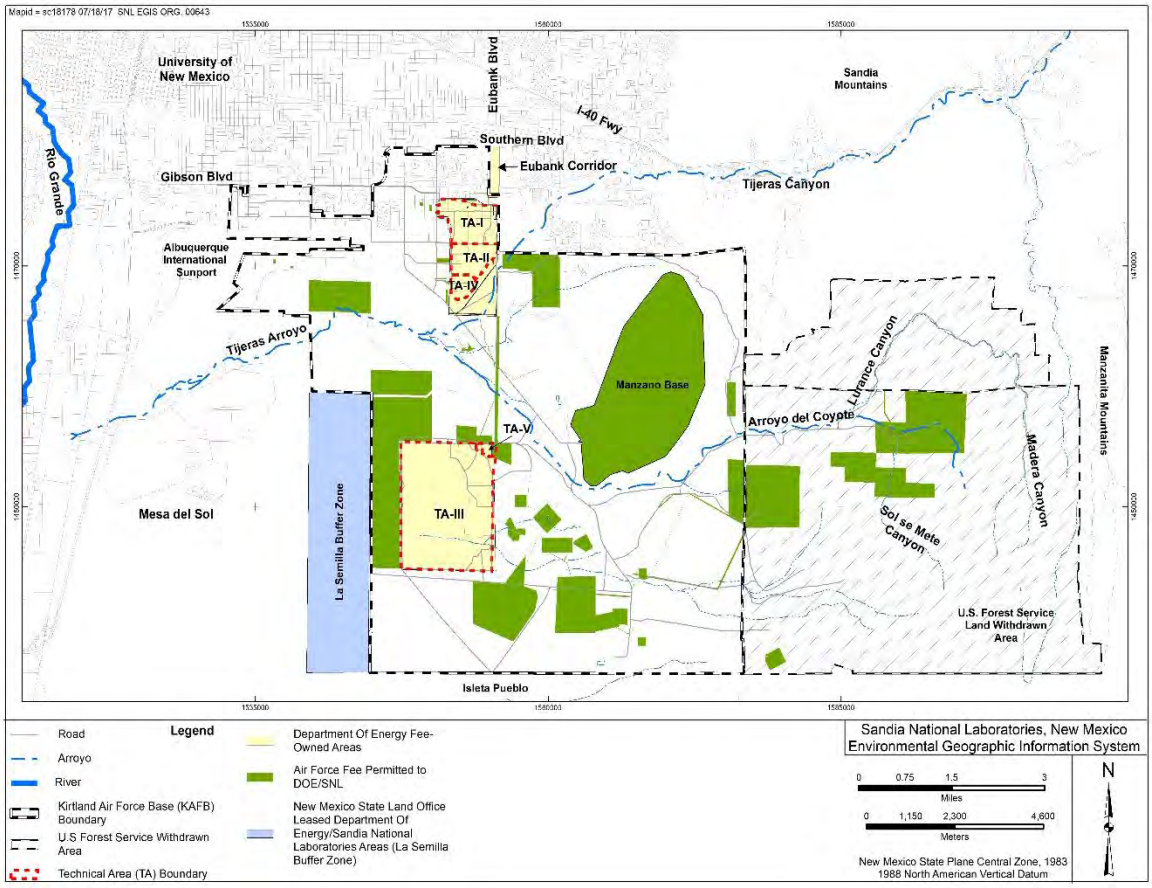

Figure 1-1. Sandia National Laboratories, New Mexico, including technical areas and permitted areas

Sandia operations are conducted on DOE-owned property assigned for operational use, 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 2006b). 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 2018, the Sandia workforce (for all sites) was comprised

of approximately 12,769 employees and contractors. There are approximately 6.53 million gross square feet of existing facilities at SNL/NM (SNL/NM 2019d).

1.4 Demographics

New Mexico is the fifth-largest state in the United States, comprising approximately 121,000 square miles. Based on recent projections, New Mexico's estimated 2018 population was 2,095,428 (Census 2019). Albuquerque is the largest city in the state, with an estimated population in 2018 of 560,218 (Census 2019). The estimated population within a 50-mile radius of the SNL/NM ZIP code is approximately 975,410 residents (Searchbug 2019). Nine counties are contained or partially included in that radius (Figure 1-2).

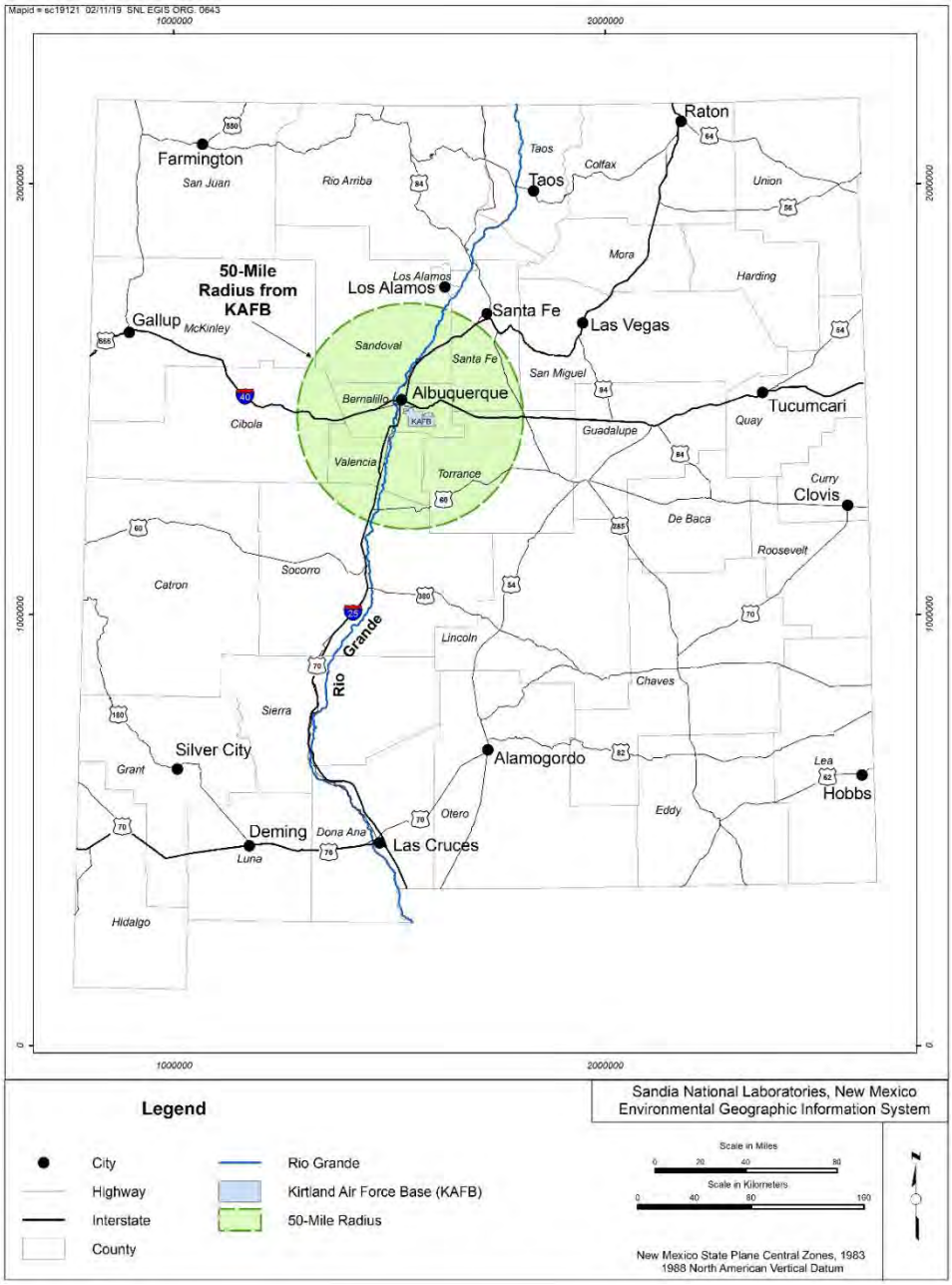

Figure 1-2. State of New Mexico, including counties

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 National Laboratories designation

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.

Red yucca (*Hesperaloe parviflora*) summer seed pods

The most prominent topographic feature in the Albuquerque area is the Sandia Mountains range to the 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 is a major topographic feature that 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 significant 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 has been subjected to relatively recent episodes of basaltic volcanism and ongoing regional rifting (crustal extension). The Rio Grande Rift has 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.

Until recently, water levels were declining 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.

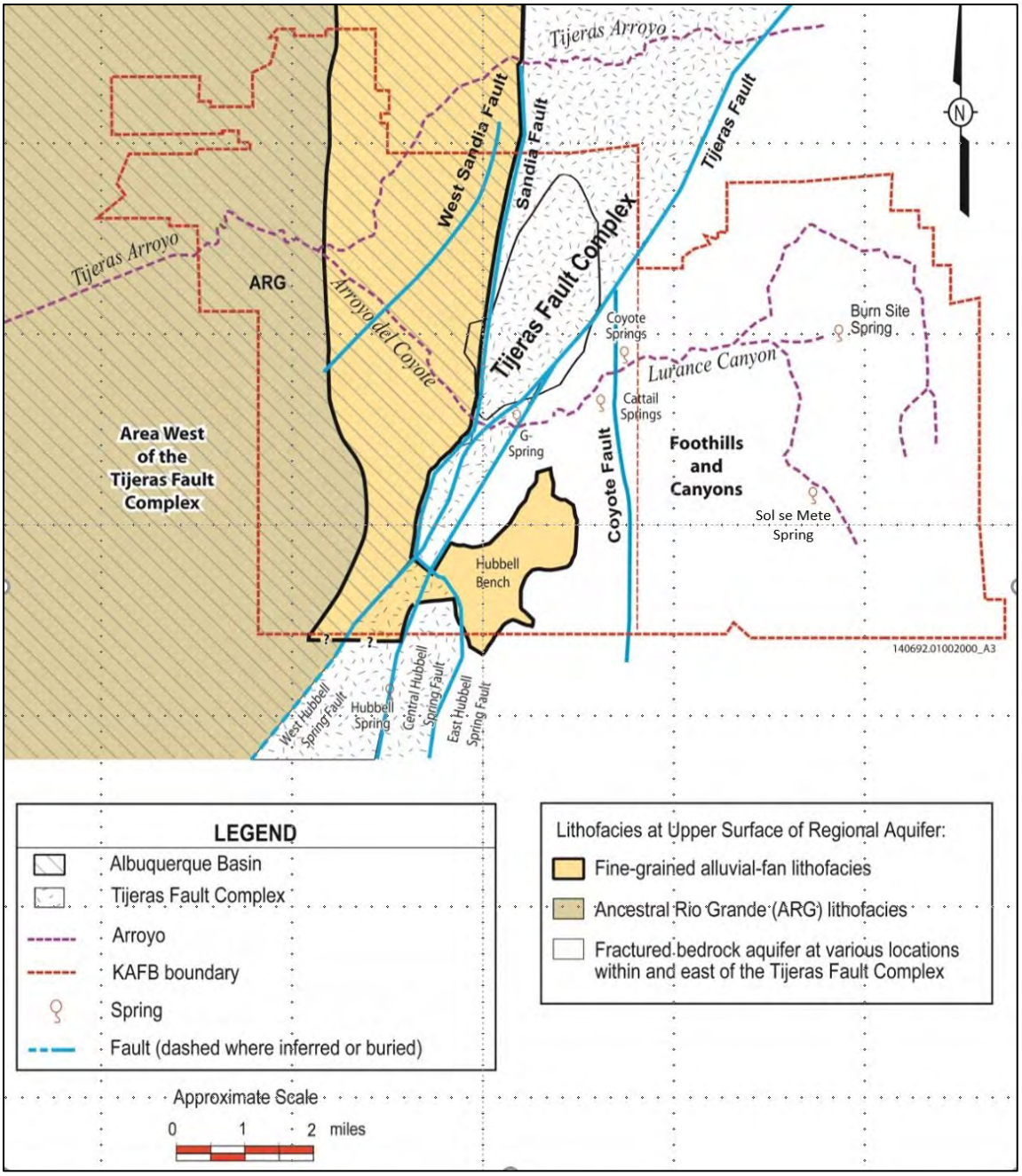

Figure 1-3. Faults and hydrogeologically distinct areas

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 nonnative species to the ecosystem and human disturbance and interactions (through development) within the various habitats.

The desert grasslands of New Mexico have been heavily disturbed over 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.

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.

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*

Table continued on next page

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

Common Name	Scientific Name	Common Name	Scientific Name
Reptiles and Amphibians			
Chihuahuan Spotted Whiptail	*Aspidoscelis exsanguis*	Great Plains Skink	*Eumeces obsoletus*
Desert Side-blotched Lizard	*Uta stansburiana*	Long-nosed Snake	*Rhinocheilus lecontei*
Eastern Collared Lizard	*Crotaphytus collaris*	New Mexico Spadefoot Toad	*Spea multiplicata*
Gopher Snake	*Pituophis catenifer*	New Mexico Whiptail	*Aspidoscelis neomexicana*
Greater Short-horned Lizard	*Phrynosoma hernandesi*	Prairie Rattlesnake	*Crotalus viridis*
Plants			
Apache plume	*Fallugia paradoxa*	New Mexico feathergrass	*Hesperostipa neomexicana*
black grama	*Bouteloua eriopoda*	one-seed juniper	*Juniperus monosperma*
blue grama	*Bouteloua gracilis*	piñon pine	*Pinus edulis*
bush muhly	*Muhlenbergia porteri*	purple three-awn	*Aristida purpurea*
intermediate yucca	*Yucca intermedia*	ring muhly	*Muhlenbergia torreyi*
James' galleta	*Hilaria jamesii*	shrub live oak	*Quercus turbinella*

KAFB = Kirtland Air Force Base

1.6.3 Climate

Large diurnal temperature ranges, summer monsoons, and frequent drying winds are characteristic of 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 for the Albuquerque area (NCDC 2015).

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 10.3 miles per hour. Wind gusts commonly reach 50 miles per hour.

Chapter 2. Compliance Summary

Cougar (*Puma concolor*)

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 are in compliance with federal, state, and local environmental requirements, including DOE directives and presidential executive orders (EOs). As part of this compliance, personnel adhere to reporting and permitting requirements. Permits and registrations in effect in 2018 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 performs work in a safe and environmentally responsible manner to ensure adequate protection for the Members of the Workforce, the public, and the environment; is accountable for the safe and environmentally responsible performance of work; exercises a degree of care commensurate with the work and the associated hazards; and integrates environment, safety, and health into work planning and execution.

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 prevent pollution and conserve natural resources by adhering to the ES&H policy. An Environmental Management System is used to establish objectives and targets that address environmental impacts and increase operating efficiencies through a continuing cycle of planning, implementing, evaluating, and improving programs and processes.

DOE O 436.1, *Departmental Sustainability*, was established to ensure that environmental management systems and site sustainability (Section 2.2) are at the forefront of environmental excellence. This directive is implemented through an ISO 14001-certified (ISO 2004) Environmental Management System. Sandia National Laboratories received initial ISO 14001:2004 certification in June 2009. In 2015, the SNL/NM and Sandia National Laboratories, California (SNL/CA) site-specific certifications were integrated into a multi-site ISO 14001:2004 certification. In 2018, the Environmental Management System was recertified under the new ISO 14001:2015 standard (ISO 2015). Additional information can be found at the following external Environmental Management System website:

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

The Environmental Management System provides the following benefits:

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

For fiscal year (FY) 2018, the Environmental Management System identified that natural resource use, hazardous materials use, and hazardous waste generation continue to be the top three significant aspects for Sandia operations. When significant aspects and negative impacts have been identified, objectives and measurable targets—at all operating levels—are established to guide efforts toward minimizing those aspects and impacts.

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

2.2 Site Sustainability Plan

A Site Sustainability Plan is prepared annually to assist DOE in meeting the current DOE *Strategic Sustainability Performance Plan* (DOE 2016) goals and the broader sustainability program set forth in EO 13834, *Efficient Federal Operations*. Sandia's most recent plan, *FY 2019 Site Sustainability Plan* (SNL/NM 2018a), describes the performance status for FY 2018. 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 2018a).

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

DOE Strategic Sustainability Performance Plan and Goal/Sandia Objective	Sandia Performance Status through FY 2018
Greenhouse Gas Reduction	
Reduce Scope 1 and Scope 2 greenhouse gas emissions by 50% relative to a FY 2008 baseline by FY 2025. Reduce Scope 3 greenhouse gas emissions by 25% relative to a FY 2008 baseline by FY 2025.	Met this objective by reducing Scope 1 and Scope 2 greenhouse gas emissions by 59% relative to a FY 2008 baseline. The Scope 3 greenhouse gas goal is not on track; emissions have continued to increase in parallel with site population and air travel increases. There was a 39% increase in FY 2018 relative to the FY 2008 baseline.
Sustainable Buildings	
Reduce energy intensity in goal-subject buildings by 25% relative to a FY 2015 baseline by 2025.	Met this objective by reducing energy intensity 3.76% in FY 2018 relative to a FY 2015 revised baseline for goal-subject buildings.
Comply with the revised guiding principles for High Performance and Sustainable Buildings for at least 17% (by building count) of existing buildings greater than 5,000 gross square feet by FY 2025, with progress to 100% thereafter.	Met this objective with 17% of buildings, by gross square feet, achieving 2008 guiding principles and therefore being "grandfathered."
Clean and Renewable Energy	
Use no less than 10% clean energy in FY 2017, working toward a 25% reduction by FY 2025.	Met this objective by purchasing renewable energy credits in FY 2018.
Water Use Efficiency and Management	
Reduce potable water intensity by 36% relative to a FY 2007 baseline by FY 2025.	Exceeded this objective with a 27% decrease in potable water intensity in FY 2018 relative to an FY 2007 baseline.
Fleet Management	
Acquire light-duty vehicles,75% of which must be alternative fuel vehicles.	Met this objective in FY18.
Sustainable Acquisition	
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring that BioPreferred and biobased provisions and clauses are included in 95% of applicable contracts.	Efforts are underway to improve the promotion of sustainable acquisition and procurement, including establishing a process to ensure that the appropriate provisions are included in 95% of applicable contracts.
Pollution Prevention and Waste Reduction	
Divert at least 50% of nonhazardous solid waste and construction and demolition debris.	Met this objective by diverting 68% of nonhazardous solid waste and 84% of construction and demolition waste from landfills.
Electronic Stewardship	
Purchase eligible acquisitions so that 95% are EPEAT-registered products each year.	Met this objective with 99.93% of eligible electronics acquisitions being EPEAT-registered products in FY 2018.
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 in FY 2018. This will aide in developing a future climate change resilience plan to meet this objective.

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

On May 17, 2018, EO 13834, *Efficient Federal Operations,* was signed, affirming that agencies shall meet such statuary 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*.

2.2.1 Sustainability Awards

Sustainability awards recognize outstanding contributions of individuals and teams at facilities across the country. The awards celebrate excellence in energy, water, and fleet management, as well as achievements in projects representing exemplary sustainability practices. Sustainability awards may be presented by either the National Nuclear Security Administration or DOE. In 2018, Sandia personnel received three National Nuclear Security Administration Sustainability Awards and three honorable mentions along with one DOE honorable mention (Table 2-2).

National Nuclear Security Administration Sustainability Awards

The National Nuclear Security Administration recognizes sustainability achievements from across the diverse group of national laboratories and sites. Acknowledgements are presented for advancing the effort toward modernization and efficiency. Sandia personnel received National Nuclear Security Administration awards in the categories of Sustainability Champion, Outstanding Sustainability Program, Strategic Partnerships for Sustainability, and Innovative Approach to Sustainability (Table 2-2).

U.S. Department of Energy Sustainability Awards

The DOE Sustainability Performance Office sponsors the DOE Sustainability Awards. Sandia personnel received a DOE honorable mention in the Sustainability Champion category for the Sandia Bike Commuter Group.

Table 2-2. Sustainability awards, 2018

Category	Nomination Title	National Nuclear Security Administration Award	DOE Award
Sustainability Champion	**Against All Odds, Recycling Program Begins at Building 840 South.** An employee in the Building 840 South laboratory complex developed and established a lab recycling program. The employee improved recycling culture by discussing the issue at department meetings, posting information from the Sustainability website, and leading by example. The employee's program is now supported by management.	Honorable Mention	
	Sandia Bike Commuter Group Makes Strides. Over the last year, bike commuters avoided more than 6,208,570 miles of driving with the help of Sandia's Bike Commuter Group. Approximately 1,208 metric tons of carbon dioxide equivalents of emissions were prevented, and 275,936 gallons of gas were saved. These efforts help Sandia make progress toward its DOE goal of a 25% Scope 3 greenhouse gas reduction by 2025.	Honorable Mention	Honorable Mention

Table continued on next page

Table 2-2. Sustainability awards, 2018 (continued)

Category	Nomination Title	National Nuclear Security Administration Award	DOE Award
Outstanding Sustainability Program	**Reduction of SF_6 Emission at Z Machine.** Sulfur hexafluoride (SF_6), an extremely potent greenhouse gas, accounts for approximately 50 percent of Sandia's greenhouse gas Scope 1 and Scope 2 inventory emissions. The Z Machine is Sandia's largest user, and the Z Machine team was able to reduce SF_6 emissions by installing leak detection equipment, improving maintenance, and adding SF_6 reclaimers. These efforts are expected to lead to a recovery of 500 pounds of SF_6 per year.	Winner	
Strategic Partnerships for Sustainability	**Recycling Program at Albuquerque Complex—Teamwork Making It Happen.** The Albuquerque Complex utilized the Air Force's aluminum and plastics recycling program until it was discontinued in 2017. Sandia and National Nuclear Security Administration personnel worked together to develop a program that will serve the Albuquerque Complex and serve as a framework for the New Albuquerque Complex that will be LEED Gold certified.	Winner	
Innovative Approach to Sustainability	**Arsenic Abatement and Deionized-Water Closed-Loop System.** After almost two years of research, the Sandia team procured a closed-loop deionized-water reuse and gallium arsenide particulate filtration system. The closed-loop system eliminated the gallium arsenide waste stream from the sanitary sewer, saved an estimated $320,000 in construction activities, and is estimated to save an additional 500,000 gallons of deionized water per year—a $60,000 annual value.	Winner	
	Operational Change-of-Temperature Chamber. A Sandia employee spearheaded the effort to change the operational process of temperature chamber systems, which will lead to an annual savings of approximately of 5 million gallons of water and 172 megawatt hours of electricity.	Honorable Mention	

DOE = U.S. Department of Energy
LEED = Leadership in Energy and Environmental Design
SF_6 = sulfur hexafluoride

2.3 Environmental Compliance

DOE directives listed in the management and operating contract for Sandia National Laboratories 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 with some included herein for specific operational information. In 2018, the management and operating contractor adhered to the requirements cited below for SNL/NM operations.

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 2018 is provided in Table 9-1.

Environmental Planning

National Environmental Policy Act (NEPA) of 1969

This act requires federal agencies to consider human health and environmental issues associated with proposed actions, be aware of the potential environmental impacts associated with these issues and include this information in early project planning and decision-making. NEPA review of federally funded proposed actions is conducted in accordance with 10 Code of Federal Regulations (CFR) 1021, *National Environmental Policy Act Implementing Procedures* (DOE 2011).

Compliance Status

Section 3.6 provides information on NEPA activities.

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 for inactive hazardous waste sites at all federal facilities. CERCLA also establishes a program to report spills of hazardous substances to the National Response Center (with relevant SNL/NM information included under the heading of Chemical Management).

Compliance Status

As required by CERCLA, a Preliminary Assessment/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.

Hazardous Waste

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 (40 CFR 268) 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

This act regulates (1) the generation, transportation, treatment, storage, and disposal of hazardous chemical waste and nonhazardous solid waste and (2) the storage of hazardous or petroleum products in underground storage tanks.

Under the authority of the New Mexico Hazardous Waste Act of 1978 and with delegated authority from the United States Environmental Protection Agency (EPA) under RCRA, NMED administers hazardous and solid waste regulatory programs in New Mexico. Hazardous and solid waste management activities 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 are currently operated under two permits issued by NMED.

Chapter 3 provides additional information on the RCRA Facility Operating Permit and the Post-Closure Care Permit for the Chemical Waste Landfill.

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 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.

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

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 total effective dose of all potential exposure pathways to the public (including air, water, and the food chain) to 100 mrem/year.

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 effect 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 can include vehicles, equipment, materials, and trackable property (equipment with an acquisition value of $10,000 or greater). 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 exposed to radioactive material or to energy capable of inducing radioactivity in the material. In some cases, both a radiological survey and a process knowledge evaluation are performed. 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. This order references the derived concentration technical standards 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 2018 include the following: Radiation Protection Department personnel processed 515 personal property clearance surveys, no trackable property was cleared, 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 the EPA to describe and regulate 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.

Nonradiological emissions. Air emissions from nonradionuclide sources, such as a portable screen or maintenance shop activities, are permitted under a Class II Air Quality Operating Permit issued by City of Albuquerque.

Radiological emissions. The 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. In 2018, compliance was achieved through permits and registrations.

Radiological emissions. In 2018, compliance was 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 established 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 U.S. 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 Pollution 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 act, NPDES stormwater permits may be issued based on whether stormwater runoff is discharged to “waters of the United States,” as defined in the act.

Compliance Status

Surface discharge. 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*).

Surface water quality standards. While the NMED Surface Water Quality Bureau lacks primacy for permitting and enforcement, 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.

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 Permit, the Multi-Sector General Permit, and the Construction General Permit.

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.

In addition, SNL/NM personnel comply with NMED Petroleum Storage Tank Bureau regulations for oil storage tanks found in 20.5 NMAC, Petroleum Storage Tanks.

Compliance Status

A Spill Prevention, Control, and Countermeasure Plan is maintained.

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 U.S., 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.

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 chemical usage and releases for 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.

Compliance Status

In 2018, there were no reportable quantity releases of extremely hazardous substances requiring notification.

Table 2-3 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 U.S. and is enforced under the New Mexico Pesticide Control Act.

Compliance Status

In 2018, Sandia was in compliance with the Federal Insecticide, Fungicide, and Rodenticide Act. Licensed pest control applicators administer EPA-registered pesticides.

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 the Toxic Substances Control 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 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 the NMAC 20.5, *Petroleum Storage Tanks*.

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

There are procedures in place if eagles are encountered. In 2018, no eagles were encountered.

Chapter 7 presents information on the Ecology Program 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 2018, there were no endangered species identified.

Chapter 7 presents information on endangered species.

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

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 furtherance of the provisions of this chapter."

A Memorandum of Understanding is in place between the U.S. Department of Energy and the U.S. Fish and Wildlife Service Regarding Implementation of Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds" was signed in 2013. This strengthens migratory bird conservation through enhanced collaboration between the two federal agencies in coordination with state, tribal, and local governments.

This collaboration will contribute substantially to the conservation and management of migratory birds and their habitats.

Compliance Status

In 2018, 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 U.S. and Great Britain (for Canada), and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia.

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

Compliance Status

In 2018, 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), was 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 U.S.

Compliance Status

In 2018, compliance was achieved by adherence with the Memorandum of Understanding between the U.S. Department of Energy and the U.S. Fish and Wildlife Service.

Chapter 7 presents information on the Ecology Program.

EO 11988 of 1977, Floodplain Management, as amended

This act 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.

EO 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.

Cultural Resources

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 these sites, and appropriate documentation is undertaken to mitigate adverse effects when necessary. In 2018, there were no activities that required interaction with any Native American tribes.

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

This act governs excavation 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 these sites, and appropriate documentation is undertaken to mitigate adverse effects when necessary. In 2018, several surveys were conducted, and archaeological sites were identified and recorded. No testing or excavation occurred at any of the recorded sites in 2018.

Section 2.3.4 provides details on the assessments and other compliance activities.

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.

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.

Compliance Status

Planning through the NEPA process identifies potential impacts to these sites, and appropriate documentation is undertaken to mitigate adverse effects when necessary. In 2018, numerous historic building assessments were performed.

Section 2.3.4 provides details on the assessments and other compliance activities.

Native American Graves Protection and Repatriation Act, enacted in 1990

This act requires federal agencies and institutions that receive federal funding to 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 these sites, and appropriate documentation is undertaken to mitigate adverse effects when necessary. In 2018, there were no cultural items excavated or discovered.

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/expectations.

Compliance Status

All environmental sampling and analysis that was conducted in 2018 conformed to applicable quality assurance plans.

Chapter 8 provides information on quality assurance.

Apache Wasp (*Polistes apachus*) on Apache plume (*Fallugia paradoxa*)

Table 2-3. Applicable EPCRA reporting requirements, 2018

Section	EPCRA Section Title	Requires Reporting?		Description
		Yes	No	
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. In addition, safety data sheets must be recorded for each chemical entry.
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

2.3.2 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, §§ 17-2-13 through 17-2-15 protecting songbirds, hawks, vultures, owls and horned toads, respectively, *Hunting and Fishing Regulations*
- NMSA 1978, §§ 17-2-37 through 17-2-46, *Wildlife Conservation Act*
- NMSA 1978, §§ 17-6-1 through 17-6-11, *Habitat Protection*
- NMSA 1978, § 75-6-1, *Endangered Plants*
- NMSA 1978, §§ 76-8-1 through 76-8-4, *Protection of Native New Mexico Plants*

2.3.3 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.
- **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 (40 CFR 60), 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 existing major air emission sources. 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.

2.3.4 Cultural Resources

Cultural resources are protected at Sandia National Laboratories. NEPA Program personnel coordinate cultural resources compliance; this includes archeological sites and historic buildings. Actions that could adversely affect cultural resources are analyzed initially in a NEPA checklist review. The DOE National Nuclear Security Administration Sandia Field Office is responsible for ensuring that impacts to cultural resources are assessed and appropriate actions are taken to mitigate impacts.

Archeological Assessment

In 2018, an archaeologist completed 17 surveys, reviewing more than 75 outdoor projects and surveying more than 460 acres. 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 worked with KAFB, and they resulted in three cultural reports to DOE. The reports identified archaeological resources that had been noted during pedestrian surveys, thus an additional written report was prepared for DOE to use in consultation with the State Historic Preservation Office. Consultation was completed on two of the reports, and one is still ongoing.

Historic Building Assessment

In 2010, Sandia personnel performed a site-wide survey and historic building assessment to determine areas and structures that may be eligible for the National Register of Historic Places. The final recommendation to DOE identified eight historic districts and three individually eligible buildings. DOE consults with the New Mexico State Historic Preservation Office on properties that face renovation. DOE has not completed the consultation with the State Historic Preservation Office regarding the 2010 recommendation. The cumulative effect of actions taken since the 2010 survey has resulted in changes to the built environment; therefore, the survey will be revised prior to DOE consultation with the State Historic Preservation Office. The current recommendation to DOE is that there are seven historic districts and two individually eligible buildings at SNL/NM. The properties recommended for eligible status are being treated as historic until final determinations are made. Documentation of buildings previously determined to be eligible for the National Register of Historic Places is ongoing.

In 2018, Sandia personnel provided historic building assessments in response to 22 proposed actions on 21 properties. DOE consulted with the State Historic Preservation Office on one action. DOE did not consult on 13 of the actions based on the results of previous consultations. One project was canceled. Seven actions await decisions. In 2018, DOE completed consultation on one action proposed in 2017.

Sandia personnel proposed removal of test structures at 15 environmental restoration sites in 2015 and provided historic property assessments of the sites to DOE in 2016. In 2016, KAFB consulted with the State Historic Preservation Office. One of the sites included historic properties, which Sandia personnel are collecting appropriate documentation in coordination with KAFB prior to demolition.

2.4 Reporting Requirements Other than to DOE

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

Table 2-4. 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 or slug discharge that may cause potential problems for the 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, if applicable.	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, if applicable.	NMED 20.6.2.1203 NMAC
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 the EPA are discussed in Chapter 6, if applicable.	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, if applicable.	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

Table continued on next page

Table 2-4. Reporting requirements to outside agencies (other than DOE) for releases of pollutants or hazardous substances (continued)

Report Title	Description	Agency and Regulation
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 *FY18 DOE/NNSA Strategic Performance Evaluation Measurement Plan (PEMP)* (DOE/NNSA 2017). Subsequently, the DOE National Nuclear Security Administration Sandia Field Office prepared the *National Technology & Engineering Solutions of Sandia Performance Evaluation Report (PER)* (DOE/NNSA/SFO 2018), assessing the management and operating contractor performance for May 1, 2017, through September 30, 2018. NTESS earned an overall excellent rating during this performance period. Two items of note related to environmental programs were as follows:

- Accomplishment—The Environmental Management System continued to maintain a mature and compliant program as demonstrated by its completion of the ISO 14001:2015 recertification ahead of schedule.
- Issue—NTESS line implementation of NEPA is inconsistent. As a result, management took positive steps and increased leadership attention to ensure that NEPA reviews are performed early in the program and project planning process.

2.5.1 Audits, Appraisals, and Inspections in 2018

Environmental programs are routinely subjected to audits, appraisals, inspections, and/or verifications by external agencies. Table 2-5 summarizes the 2018 audits, including the findings, notices of violation, and 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 2018, 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 2-5. Environmental-related external audits, appraisals, inspections, and violations, 2018

Appraising Agency	Title/Description	Date	Summary
Albuquerque Bernalillo County Water Utility Authority	Wastewater Permit Inspection of Facilities within Flow Basin 2069A	February 2018	No findings
Orion Registrar	International Organization for Standardization 14001 Surveillance Audit	April 2018	Four minor nonconformances (findings), 7 opportunities for improvement (observations), and 17 strengths (noteworthy practices)
New Mexico Environment Department, Hazardous Waste Bureau	Fiscal Year 2018 Annual Hazardous Waste Compliance Evaluation Inspection	May 2018	No violations
City of Albuquerque	Fugitive Dust Control Construction Permit Pre-Disturbance Site Visits	May, June, July, August, and November 2018	No findings or observations
Albuquerque Bernalillo County Water Utility Authority	Wastewater Permit Inspection of Facilities within Flow Basins 2069F, 2069G, 2069I, 2069K, 2238A	May 2018	No findings
New Mexico Environment Department, Hazardous Waste Bureau	Hazardous Waste Compliance Evaluation Inspection at Advanced Materials Laboratory	September 2018	One notice of violation, 7 violations, and 2 observations
New Mexico Environment Department, Department of Energy Oversight Bureau	Independent Verification of Environmental Monitoring Activities	2018	Information at *https://www.env.nm.gov/doeob/*

2.5.2 Occurrence Reporting in 2018

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 the 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."

All 2018 occurrences that met DOE O 232.2A criteria were 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

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

During 2018, three occurrences met the criteria for reporting in this *Annual Site Environmental Report* (Table 2-6). Table 2-6 also cross-references DOE O 232.2A reportable occurrences that were reportable to an outside agency, if applicable.

Table 2-6. Occurrence reports per DOE O 232.2A, 2018

Reporting Criteria	Month	Report Level	Report Number and Title	Also Reported to Outside Agency
Group 9 - Noncompliance Notifications 9(1) - Any written notification from an outside regulatory agency that a site/facility is considered to be in noncompliance with a schedule or requirement.	October	Informational	**NA--SS-SNL-1000-2018-0010** Notice of Violation: New Mexico Environment Department No-Notice Hazardous Waste Inspection of Advanced Materials Laboratory See Chapter 3	N/A

Table continued on next page

Table 2-6. Occurrence reports per DOE O 232.2A, 2018 (continued)

Reporting Criteria	Month	Report Level	Report Number and Title	Also Reported to Outside Agency
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.	November	Informational	**NA--SS-SNL-1000-2018-0011** HERMES III SF_6 Release See Chapter 5	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.	November	Informational	**NA--SS-SNL-5000-2018-0005** Building 858EF Arsenic Release above Permit Level See Chapter 6	Albuquerque Bernalillo County Water Utility Authority

CFR = Code of Federal Regulations
CO_2e = carbon dioxide equivalent
DOE = U.S. Department of Energy
HERMES = High-Energy Radiation Megavolt Electron Source
N/A = not applicable
SF_6 = sulfur hexafluoride

Chapter 3. Environmental Programs

House Sparrow (*Passer domesticus*)

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 Program
- Environmental Life-Cycle Management Program
- Environmental Restoration Operations
- Long-Term Stewardship Program
- NEPA Program
- Waste Management and Material Sustainability and Pollution Prevention programs

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 115,000 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 Program

Environmental Education Outreach Program 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.

Currently, the outreach team participates in or hosts several in-house and public outreach and awareness events annually. Events conducted in 2018 included Earth Day and the annual Environmental Management System Excellence Awards Program. When working with children, team members often demonstrate environmental education models on topics such as local air quality, landfills, groundwater, and watersheds. The outreach team also encourages Sandia personnel and community members to provide feedback and to ask questions about environmental programs.

The annual Environmental Management System Excellence Awards Program recognizes personnel who demonstrate environmental excellence in areas such as energy and water conservation, environmental protection, waste minimization, and recycling. Since its inception in 2006, the Environmental Management System team has received 244 nominations for individuals and teams who are contributing to the vision of environmental excellence.

The Building 725 Data Center addition is the first building certified under Leadership in Energy and Design (LEEDS) for the campus certification as SNL/NM. The team spearheading the LEED v.4 for Campus (using strategies to conserve energy and water use) also won Sandia's Environmental Management Services Sequoia Award. (Photo by Randy Montoya)

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 2018, environmental impacts of 52 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, the 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 the 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, approximately 500 individual sites, 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; Kauaʻi Test Facility, Hawaiʻi; 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 current Hazardous Waste Facility Operating Permit (NMED 2015) and all approved modifications includes two tables of solid waste management units and Areas of Concern for which corrective action is complete: one is a list of solid waste management units and

Areas of Concern requiring controls, and the other is a list of 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.

Tree cholla (*Cylindropuntia imbricata*)

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 is one site), SWMU 68, SWMU 149, and SWMU 154 (NMED 2018). Therefore, at the end of 2018, 307 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 2018, routine groundwater samples were collected for the three groundwater Areas of Concern (TAVG, TAG, and BSG). A summary of 2018 activities and results is provided in Section 3.5.5 and in Appendix A, "Summary of Groundwater Monitoring in 2018." The *Annual Groundwater Monitoring Report, Calendar Year 2018* (SNL/NM 2019a) documents the results of all groundwater monitoring activities for 2018. 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. Program activities are increasing as remedial activities are completed.

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 the 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)
- The Groundwater Monitoring Program

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 2018 are documented in the *Annual Groundwater Monitoring Report* (SNL/NM 2019a). Appendix A, "Summary of Groundwater Monitoring in 2018," provides an overall summary for 2018.

Groundwater levels are measured in approximately 100 wells on a quarterly or monthly basis. Wells that have stable trends are measured quarterly; wells that have fluctuating water levels due to seasonal pumping at nearby extraction wells are measured monthly. 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. 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 2018, semiannual groundwater monitoring was performed in January and July in accordance with Post-Closure Care Permit requirements. Groundwater samples were analyzed for trichloroethene, nickel, and chromium; January samples were also analyzed for additional volatile organic compounds. Results were consistent with previous years; trichloroethene was the only volatile organic compound detected, and 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 associated with the site. Inspections conducted in 2018 confirm that the evapotranspirative cover was in good condition with even coverage of 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 2018 are documented in the *Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2018* (SNL/NM 2019b).

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 2018 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 2018 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 2018, 256 gallons of leachate (a listed hazardous waste) were removed from the leachate collection system compared to 245 gallons of leachate removed in 2017. 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 2018* (SNL/NM 2019c).

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 landfill 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 NMAC 20.4.1.600. 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 2018, semiannual groundwater monitoring was performed at the Mixed Waste Landfill in April–May and in 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.

Revegetation at the Mixed Waste Landfill

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 2018, the evapotranspirative cover was in excellent condition with even coverage of 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 2018 are documented in the *Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report, April 2018 through March 2019* (SNL/NM 2019e), which will be submitted to NMED in June 2019.

In 2018, the *Mixed Waste Landfill Five-Year Report* (SNL/NM 2019f) was prepared 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 the NMED) and reevaluate the feasibility of excavating the Mixed Waste Landfill.

Tarantula Hawk Wasp (*Pepsis formosa*), the official state insect of New Mexico

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 Hazardous Waste Facility Operating Permit that was issued on January 27, 2015 (NMED 2015). Measures include surveillance of site conditions and maintenance of institutional controls.

In 2018, NMED granted Corrective Action Complete with Controls status to 3 solid waste management units (58FF, 58B/8Y, and 154), which were added to the Long-Term Monitoring and Maintenance Plan and inspected. Based on the 2018 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 2018, Sandia personnel finalized an erosion control design package for the Tijeras Arroyo escarpment near TA-IV, which is planned to start in 2019. Construction will resolve SWMU 45 erosion that was observed during the 2017 and 2018 inspections and will implement 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 2018* (SNL/NM 2019h) 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 LMMP; three groundwater Areas

of Concern (TAVG, TAG, and BSG) identified in the RCRA Facility Operating Permit issued on January 27, 2015 (NMED 2015); and 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 2018 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 2018," 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.

Analyses were conducted as follows:

- TAVG wells—Target Analyte List metals, inorganics (including nitrite plus nitrate, major anions, and perchlorate), total alkalinity, volatile organic compounds, gross alpha, gross beta, and selected radionuclides
- TAG wells—Target Analyte List metals, inorganics (including nitrite plus nitrate and major anions), total alkalinity, volatile organic compounds, gross alpha, gross beta, and selected radionuclides
- BSG wells—Target Analyte List metals, inorganics (including nitrite plus nitrate, 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 nitrite plus nitrate, 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 2018. 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 four wells, with a maximum concentration of 17.7 µg/L; nitrite plus nitrate exceeded the maximum contaminant level of 10 mg/L in two wells, with a maximum concentration of 12.9 mg/L.

For the TAG Area of Concern, 21 monitoring wells screened in either the Perched Groundwater System or the Regional Aquifer were sampled in 2018. For the Perched Groundwater System, nitrite plus nitrate exceeded the maximum contaminant levels in five wells with the maximum being 23.4 mg/L. One of the 11 wells screened in the Regional Aquifer exceeded the nitrite plus nitrate maximum contaminant levels (10 mg/L) with a concentration of 31.6 mg/L reported for a merging-zone well. The remainder of the Regional Aquifer wells had a maximum nitrite plus nitrate concentration of 3.90 mg/L. Trichloroethene did not exceed the maximum contaminant level (5 µg /L) in any of the wells. For the Perched Groundwater System, the maximum trichloroethene concentration was 4.62 µg /L. The maximum nitrite plus nitrate concentration in the Regional Aquifer was 0.910 µg /L.

For the BSG Area of Concern, 10 wells were sampled. Nitrite plus nitrate exceeded the maximum contaminant levels in seven wells, with a maximum concentration of 35.4 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, 12 wells and one spring were sampled. Fluoride was detected above the maximum allowable concentration in four 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 Environmental Management System and applies to all activities that 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 36 percent—from 1,048 metric tons in 2008 to 689 metric tons in 2018. The goal will be considered accomplished when operations meet the internationally accepted definition of Zero Waste, which means reducing waste by 90 percent from the baseline year, i.e., generating less than 105 metric tons 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 2018, common products continued to be replaced in office supply and janitorial contracts with those products containing higher recycled content, reusability, and/or reduced toxicity; and the corporate computer server suppliers integrated the new green equipment standard. In addition, to-go containers at the on-site cafeteria were replaced with recyclable or compostable alternatives, and the interior tray return area was redesigned to educate while efficiently capturing compostable and recyclable materials before the trash station.

3.6.3 Electronic 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 as little environmental impact as possible.

One facet of this effort is to eliminate personal desktop printers in favor of high-capacity all-in-one network machines that copy, print, fax, and scan. This saves energy, maintenance, and the need for on-hand inventory of parts and consumables. Additionally, 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. Ongoing progress is indicated by the 42 percent reduction in pounds of toner cartridge consumption in 2018 over 2017.

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 leveraged 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. More than 175 recycling bins for paper, plastics, and aluminum were added to buildings in 2018, and composting collection bins were added to eight 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 DOE with technical assistance to support Sandia compliance with NEPA and the National Historic Preservation Act at all Sandia locations: SNL/NM; SNL/CA; Tonopah Test Range, Nevada; Kauaʻi Test Facility, Hawaiʻi; and other remote locations as needed. The NEPA team reviews projects for conformance with existing DOE NEPA documents and determinations. NEPA Docs software is used to facilitate reviews and quality assurance activities by providing a consistent framework for reporting and making NEPA documentation readily available for reference.

When required, a NEPA checklist is prepared for DOE review and determination when a proposed action meets any of the following concerns:

- The activity is not covered by existing Sandia NEPA documentation.
- The proposed activity is outside the scope of the existing permit.
- The activity is at a location that is not permitted to Sandia.

3.7.1 National Environmental Policy Act Activities in 2018

In 2018, the NEPA team participated in or completed the following environmental activities:

- Enhanced the NEPA module application by clarifying requirements and the notification process

- Released a new NEPA review and communications process for nuclear deterrence projects
- Prepared and submitted a Kaua'i Test Facility Sitewide Environmental Assessment for public comment
- Completed more than 20 archeological surveys, reviewing more than 75 outdoor projects and surveying more than 500 acres, and provided cultural resource reports to DOE for use in consultation with the State Historic Preservation Office

The NEPA team addressed multiple corrective actions resulting from the disturbance of an eligible archaeological site that occurred in January 2017. As a result, an archaeologist was hired and began implementing archaeological reviews and fieldwork, following New Mexico guidelines and providing documentation to guide DOE for consultation with a New Mexico Historic Preservation Act, Section 106, State Historic Preservation Officer. No occurrences or corrective actions were associated with archaeological resources in 2018.

In addition to these activities, NEPA Program personnel reviewed 1,784 proposed projects in 2018. Of these, 194 checklist reviews were completed internally, and 96 NEPA checklists were transmitted to DOE for review and determination (Table 3-1).

Table 3-1. NEPA reviews completed in 2018

NEPA Reviews	Review Breakouts	Quantity
NEPA software system	Reviews completed by NEPA team	194
	Reviews completed by DOE	96
Other NEPA reviews	Reviews completed by NEPA team	1,470
DOE and U.S. Air Force NEPA documents	Reviews completed by Sandia	7
	Reviews completed by DOE	17
Total NEPA Reviews		**1,784**
Percentage of Total NEPA Reviews Completed by DOE		**7%**
Percentage of NEPA Software System Reviews Completed by DOE		**41%**

DOE = United States Department of Energy
NEPA = National Environmental Policy Act
Sandia = Sandia National Laboratories

3.7.2 Site-Wide Environmental Impact Statement

Sandia personnel continue to assist DOE in the development of a new Site-Wide Environmental Impact Statement.

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. The wastes include the following:

- Radioactive waste (including low-level radioactive waste and transuranic waste)
- Mixed waste (including low-level radioactive mixed waste and mixed transuranic waste)
- Hazardous waste

- Toxic Substances Control Act-regulated waste
- Other regulated wastes
- Construction and demolition waste
- Commercial solid waste

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 2018 are summarized in Table 3-2. Wastes recycled in 2018 are summarized in Table 3-3.

Table 3-2. Waste shipped by waste management facilities, 2018

Waste Categories	Waste Shipped (pounds)
Radioactive Waste	
Low-level radioactive waste	59,187
Transuranic waste	0
Subtotal	**59,187**
Mixed Radioactive and Hazardous Waste	
Mixed low-level radioactive waste	93,369
Mixed transuranic waste	0
Subtotal	**93,369**
RCRA Waste	
Hazardous waste	137,701
Subtotal	**137,701**
Toxic Substances Control Act	
PCBs	439
PCBs and hazardous waste mixture	0
Subtotal	**439**
Other Regulated Wastes	
Infectious waste	3,223
Asbestos waste	88,424
Chemical waste (includes special waste and industrial solid waste)	601,301
Used oil (not recycled)	0
Subtotal	**692,948**
Commercial, Construction, and Demolition Solid Waste	
Solid waste collection and recycling center dry waste	1,342,910
Off-site office waste (Sandia Science and Technology Park)	110,780
Cafeteria wet waste	41,360
Construction and demolition waste	3,839,932
Subtotal	**5,334,982**
Total Waste Shipped	**6,318,626**

PCB = polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act

Table 3-3. Waste recycled, 2018

Recycle Categories	Waste Recycled (pounds)
Regulated or Chemical Waste Recycled	
Batteries	160,147
Capacitors	1,268
Computer electronics	647,749
Lead	23,833
Light ballasts (non-PCB)	1,605
Light bulbs	9,581
Oil, grease, and fuel	32,834
Soil	333
Toner and ink cartridges	9,647
Subtotal	**886,997**
Commercial, Construction, and Demolition Solid Waste Recycled	
Asphalt	27,385,820
Batteries	6,112
Cardboard	391,687
Carpet	52,349
Ceiling tiles	13,650
Chairs	52,240
Compost (food, green, paper, and plywood)	393,265
Food grease	107,600
Metals	1,982,249
Nitrile gloves	3,216
Paper (mixed and white)	165,769
Plastics	80,026
Three-dimensional printer cartridges	5,332
Tires	17,310
Wood	81,060
Subtotal	**30,737,685**
Total Waste Recycled	**31,624,682**

PCB = polychlorinated biphenyl

3.8.1 Waste Management Activities in 2018

Waste management takes place at the following locations: the Hazardous Waste Handling Unit, the Radioactive and Mixed Waste Management Unit, 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 2018 are summarized as follows:

- At the Hazardous Waste Handling Unit, wastes were screened, sorted, repackaged, and stored.
- At the Radioactive and Mixed Waste Management Unit, 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, wastes were stored. Five of the seven bunkers are included in the RCRA Permit.
- At the Auxiliary Hot Cell Unit, wastes were generated and stored.
- At the Thermal Treatment Unit, small quantities of unique explosives 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.

3.8.2 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 2018, legacy wastes (wastes originally generated between 1990 and 1998) were also managed at SNL/NM.

Waste management

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 strontium, plutonium, cobalt, americium, thorium, cesium, 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, plutonium, neptunium, and/or curium.

Low-level radioactive mixed waste and mixed transuranic 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 (2) instructions for providing an annual update of activities and a current inventory of stored waste, still on-site. During 2018, DOE and Sandia personnel met all regulatory deadlines and provided an annual update of mixed waste activities (SNL/NM 2018d). During 2018, Sandia personnel managed 1.924 cubic meters of mixed transuranic waste that was subject to the Federal Facility Compliance Order. Table 9-3 lists the quantities of mixed waste subject to the Federal Facility Compliance Order at the end of fiscal year 2018. The wastes are subject to a Site Treatment Plan compliance deadline of December 31, 2020.

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 9.

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), 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 2018b), which is available to the public in hard copy at the University of New Mexico's Zimmerman Library. An index of RCRA-related documents is also available in the Information Repository at:

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

3.8.4 Other Regulated Waste

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

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 Section 3.8.5.

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.

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), which are being actively managed in compliance with an EPA Toxic Substances Control Act use authorization. Table 3-2 summarizes the PCB waste shipped in 2018.

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. Asbestos-containing building materials 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 consists of 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 3-2 summarizes the quantities of asbestos waste shipped in 2018.

3.8.5 Waste Management Program Results

Representatives of the NMED Hazardous Waste Bureau performed an annual Hazardous Waste Compliance Evaluation Inspection of the entire SNL/NM site in May 2018. No violations were identified. An NMED Hazardous Waste Compliance Evaluation Inspection of the Advanced Materials Laboratory (an off-site facility) was conducted in October 2018, with a Notice of Violation issued, which is a DOE reportable occurrence (Chapter 2).

Chapter 4. Terrestrial Surveillance Program

Coyote Springs wetland

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. The data from 2000 to the present is used for statistical evaluation.

4.1 Regulatory Criteria

The Terrestrial Surveillance Program is designed and conducted to address DOE O 458.1 Admin Change 3, *Radiation Protection of the Public and the Environment,* which establishes standards and requirements to protect the public and the environment from undue risk from radiation associated with radiological activities under the control of DOE.

The Terrestrial Surveillance Program is also conducted to satisfy Sandia's Environmental Management System, 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). On-site and perimeter sample results are compared to off-site sample results.

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. 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. See Section 4.3 for the analytical parameters. Environmental dosimeters, deployed and collected quarterly, are used to measure the cumulative ambient external radiation dose and to closely approximate the dose potentially received from natural and nonnatural sources.

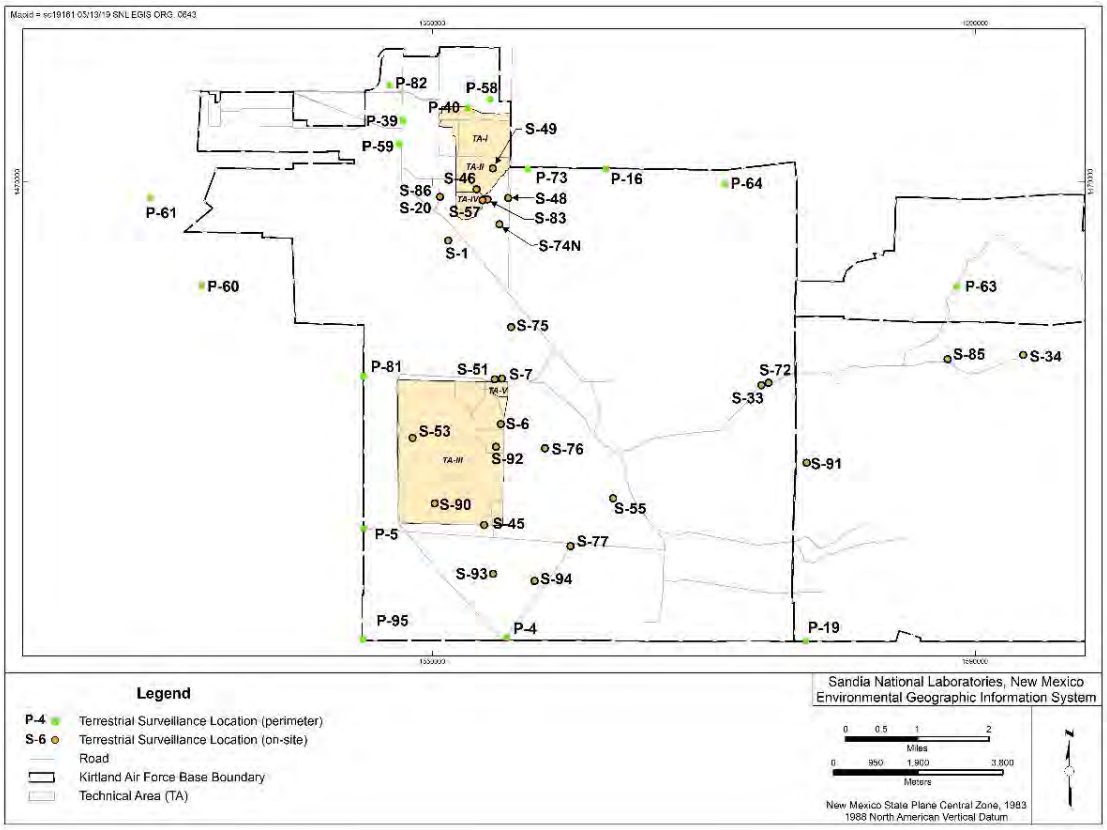

Figure 4-1. Terrestrial Surveillance Program on-site and perimeter sampling locations

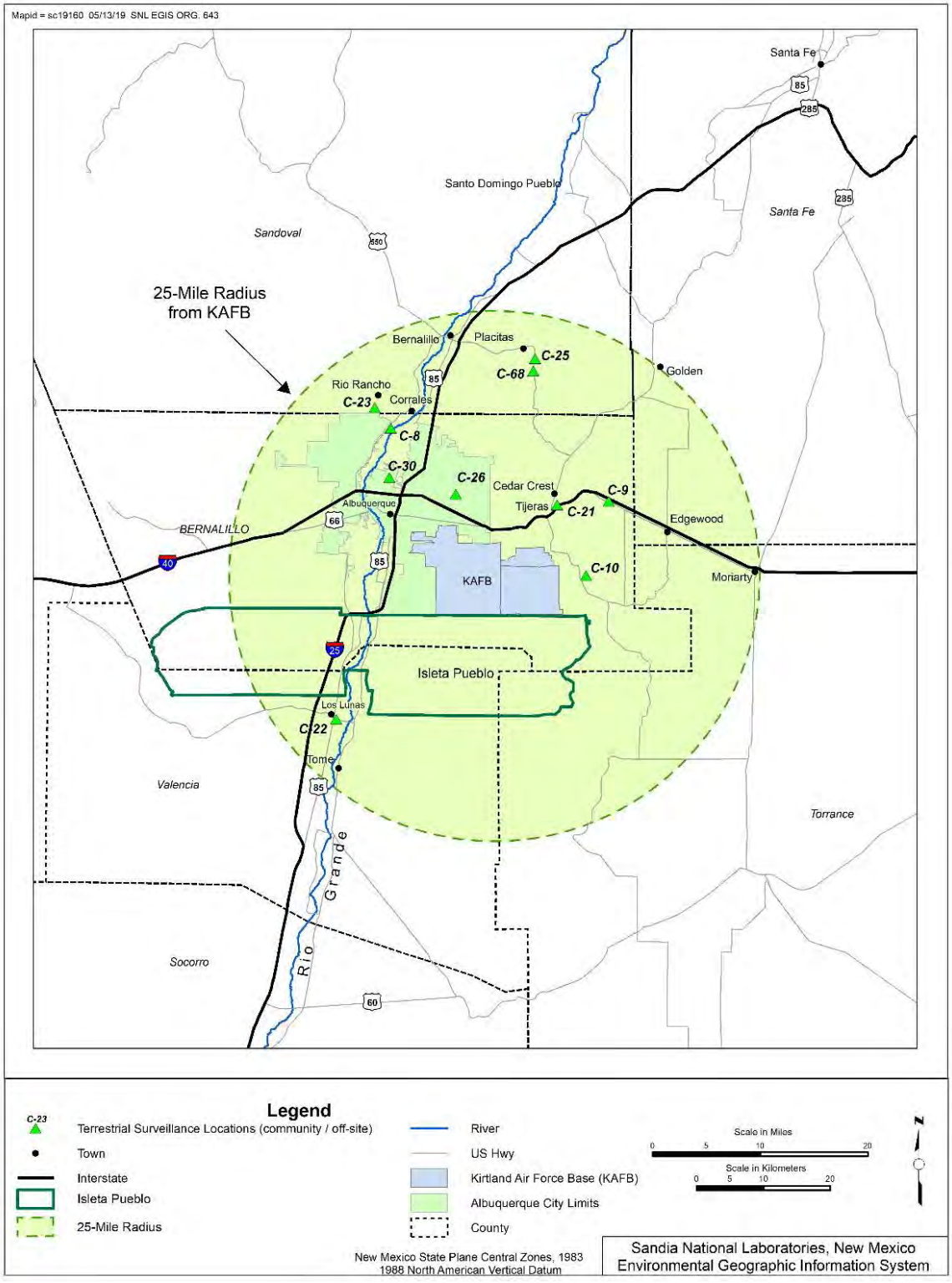

Figure 4-2. Terrestrial Surveillance Program off-site sampling locations

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 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, radionuclides, and tritium.
[b] Vegetation samples are collected annually (except as noted) and analyzed for terrestrial surveillance metals, radionuclides, and tritium.
[c] Dosimeters are analyzed for gamma radiation.
[d] Terrestrial surveillance metals are not included in the sample analysis.
[e] Perchlorate is included in the sample analysis.
[f] High explosives are included in the sample analysis.
[g] Radionuclides, tritium, and metals are not included in the sample analysis.
TA = technical area

Apache plume (*Fallugia paradoxa*)

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, radionuclides, and tritium.
[b] Vegetation samples are collected annually and analyzed for terrestrial surveillance metals, radionuclides, and tritium.
[c] Dosimeters are analyzed for gamma radiation.
DOE = U.S. Department of Energy
KAFB = Kirtland Air Force Base
TA = technical area

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, radionuclides, and tritium.
[c] Vegetation samples are collected annually and analyzed for terrestrial surveillance metals, radionuclides, and tritium.
[d] Dosimeters are analyzed for 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 explosives, perchlorate, tritium, and radionuclides, as specified in Table 4-1, Table 4-2, and Table 4-3. The specific metals list is referred to as the 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.

In 2018, Terrestrial Surveillance Program personnel discontinued the use of thermoluminescent dosimeters to measure ionizing radiation. Optically stimulated luminescent dosimeters are now employed. The optically stimulated luminescent dosimeters are issued and analyzed by an accredited off-site laboratory.

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

Thermoluminescent dosimeter results from previous years are not directly comparable to the optically stimulated luminescent dosimeter results for 2018. Historical thermoluminescent dosimeter data and trend analyses can be found in previous Annual Site Environmental Reports. The 2018 optically stimulated luminescent data is presented here, but trend analyses will not be performed until several more years of data is available.

Field quality control samples were collected and included triplicate 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 Sample Results Analysis and Methodology

Statistical analyses are conducted to compare on-site sample results with perimeter and off-site results, and to establish any trends that may indicate the potential for a release of contaminant(s).

4.4.1 Statistical Analysis and Methodology

Samples are collected from specified locations to enable effective statistical comparisons with results from previous years. Statistical analyses are performed to determine whether a specific on-site sample result differs from perimeter and off-site sample results and to identify trends at specific sampling locations (see Section 4.6). The statistical analysis results are used to prioritize sample results for possible follow-up actions, such as resampling, additional investigation, and/or notifications to applicable entities.

A decision-making tool is used to help determine the appropriate level of concern for each sample result. The statistical analysis prioritization methodology (Shyr, Herrera, and Haaker 1998) is based on a matrix of four priority levels (Table 4-4).

Table 4-4. Priority decision matrix and actions

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

4.4.2 Other Standards for Comparison

In addition to the statistical analyses, analytical results for metals in soil and sediment samples may be compared to values in the following references (presented in Table 4-5):

- Local and regional soil concentrations (Dragun and Chekiri 2005)
- NMED soil screening levels (NMED 2017b)
- U.S. surface soil surface concentrations (Kabata-Pendias 2000)

Table 4-5 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 (mg/kg)	Industrial (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	7.07	35.9	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	96.6	505	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	—	—	—	—
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	—	—	0.782	13.0	0.02	2.8
Zinc	18	84	23,500	389,000	5.0	164

[a] Dragun and Chekiri 2005.
[b] NMED 2017b.
[c] Kabata-Pendias 2000.

— = not available
ND = not detected
NM = New Mexico

NMED = New Mexico Environment Department
U.S. = United States

In some instances, a qualitative inspection of the data may be augmented by the graphical evaluation methodology described and documented in *Chemical Analyses of Soil Samples Collected from the Sandia National Laboratories, New Mexico Environs, 1993–2005* (SNL/NM 2006a). Results in 2018 did not warrant this type of evaluation.

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 U.S. 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).

No regulatory limits are available to directly compare concentrations of radiological constituents in surface soils, sediments, or vegetation.

4.5 Terrestrial Surveillance Program Results in 2018

The following Terrestrial Surveillance Program activities occurred in 2018:

- The annual sampling of soil and sediment occurred in early May 2018 at designated locations.
- The annual sampling of vegetation occurred in September 2018 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 2018 sampling events are summarized in the following sections, and the data are provided in Appendix B, "Terrestrial Surveillance Analytical Results in 2018."

4.5.1 Radiological Results

Radiological analyses were performed on soil, sediment, and vegetation samples. No locations had results that indicated Priority-1, Priority-2, or Priotity-3; all samples were identified as Priority-4 for radiological constituents.

4.5.2 Dosimeter Results

Analysis of the dosimeter data was performed to determine the average exposure rates for the three location classifications and whether any statistical differences between the groups were observed.

In 2018, there was no statistical difference in exposure rates for on-site, perimeter, and off-site locations. Table 4-6 shows the average exposure rate summary statistics for 2018. The average annual exposure rates are below the local estimated value of 89 mrem (equivalent to approximately 89 mR) from natural background sources (Mauro and Briggs 2005). The difference may be attributed to a variety of elevations and type and proximity to bedrock and the statistical nature of radioactivity.

Table 4-6. Dosimeter exposure rate summary statistics by location classification, 2018

Location Classification	Number of Observations	Average (mR/year)	Median (mR/year)	Standard Deviation (mR/year)	Minimum (mR/year)	Maximum (mR/year)
On-site	7	66	67	6.7	52	74
Perimeter	7	65	63	11	54	87
Off-site	7	61	62	9.9	46	75

4.5.3 Nonradiological Results

Nonradiological parameters include terrestrial surveillance metals, high explosive compounds, and perchlorate. In addition to a statistical analysis, all metals results may be compared to values from the references listed in Section 4.4.2 and provided in Table 4-5. The results of the statistical analysis for metals (Table 4-7) identified one location as Priority-2 and one location as Priority-3. No results were identified as Priority-1, and all remaining soil, sediment, and vegetation samples were identified as Priority-4 for nonradiological parameters.

Table 4-7. Metals summary statistics for Priority-2 and Priority-3 sample locations, 2018

Priority	Analyte	Location	Sample Matrix (mg/kg)	Mean (mg/kg)	Standard Deviation (mg/kg)	Minimum (mg/kg)	Maximum (mg/kg)	NMED Soil Screening Level[a]		2018 Result (mg/kg)
								Residential (mg/kg)	Industrial (mg/kg)	
Priority-2	Beryllium	S-33	Soil	1.0	0.34	0.54	1.6	156	2,580	0.54
Priority-3	Lead	S-1	Soil	13	3.1	3.6	19	—	—	14

Note: Statistical data is for 2000–2018.
— = not available
[a] NMED 2017b.
NMED = New Mexico Environment Department

Beryllium

One on-site location (S-33 soil sample) was identified as Priority-2 for beryllium with a result of 0.54 mg/kg. The result was below NMED soil screening levels for residential use. The results at all locations were within the range of values for beryllium in New Mexico surface soils.

High Explosives

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

Lead

One on-site location (S-1 soil sample) was identified as Priority-3 for lead with a result of 14 mg/kg. There is no NMED soil screening level for lead. The results at all locations were within the range of background values for lead in New Mexico surface soils.

Perchlorate

One on-site location (S-53 soil sample) was analyzed for perchlorate with a result of 0.038 J+ mg/kg. The J+ qualified data indicated an estimated value with a positive bias. The estimated result is well below the NMED soil screening level of 54.8 mg/kg for residential use (NMED 2017b).

4.6 Additional Activities and Variances

The sampling in 2018 followed the Terrestrial Surveillance Program plan with the following variances:

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

Chapter 5. Air Quality Compliance and Related Programs

Sandia skies

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 Division 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 NEHAPs. 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 Sandia stationary sources are presented in Table 9-1.

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. In 2018, sources were in compliance 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], 2018

Carbon Monoxide	Hazardous Air Pollutant	Particulate Matter with a Diameter ≤ 10 µm	Nitrogen Oxide	Sulfur Dioxide	Volatile Organic Compound
11.7	9.9	1.8	10.2	0.4	3.7

[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 2018, potential emissions were 9.9 tons of hazardous air pollutants and 3.7 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.

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. A greenhouse gas, as defined in 40 CFR 86.1818–12(a) (40 CFR 86), is an air pollutant comprised of an aggregate group of six greenhouse gases: carbon dioxide, nitrous oxide, methane, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

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 2018, Sandia operations emitted a total of 161,034 tons of carbon dioxide equivalent (including fugitive greenhouse gas emissions). This total includes emissions from the sulfur hexafluoride release in November 2018 that was 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 20.2.60.113 NMAC, *Open Burning of Hazardous Waste*, 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 2018 permits can be found in Chapter 9.

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 2018 permits is included in Chapter 9.

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 2018, 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 ($PM_{2.5}$).

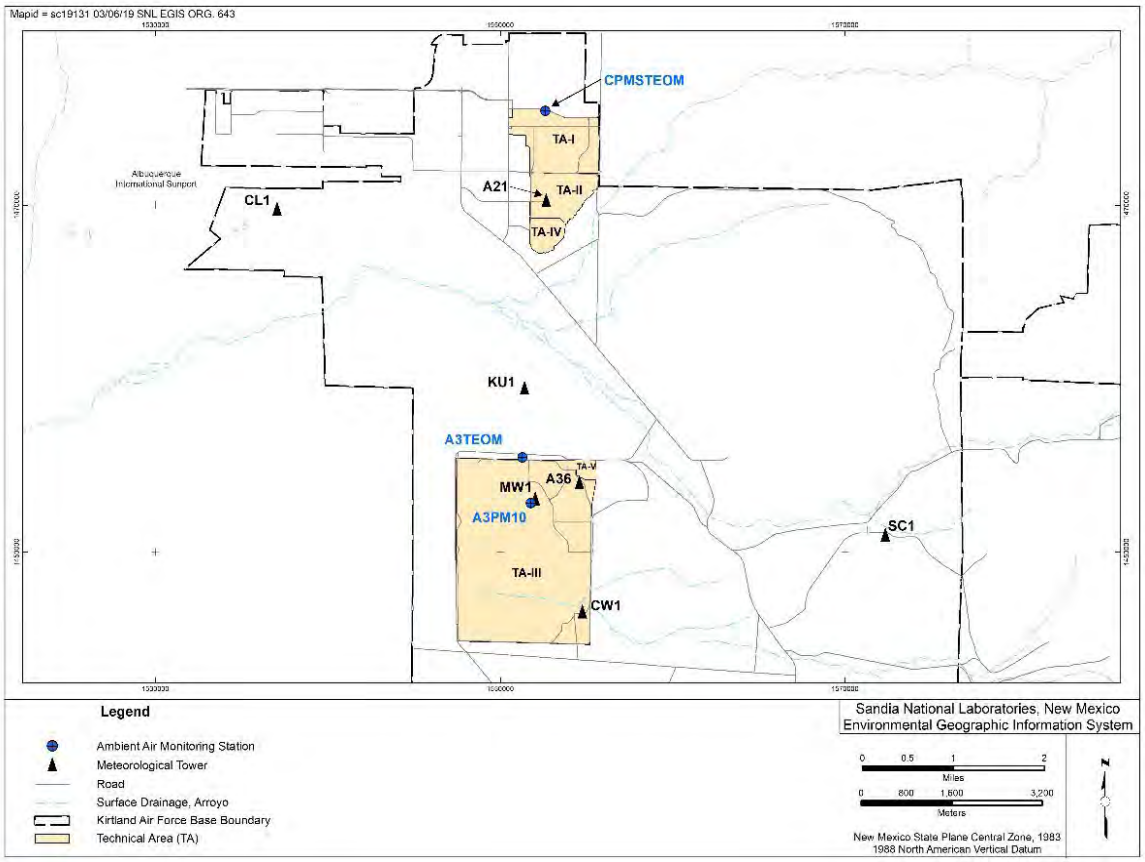

Figure 5-1. Clean air network of meteorological towers and ambient air-monitoring stations

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

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 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 2018 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 2018

Ambient air-monitoring data is presented for the FY 2018. Laboratory data are available in Appendix C, "Ambient Air Surveillance Results in Fiscal Year 2018," and are summarized below.

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

The monthly and annual averages for FY 2018 for $PM_{2.5}$ are listed in Table 5-2.

Table 5-2. Monthly and annual averages for $PM_{2.5}$, FY 2018

Sample Location	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Average FY 2018
CPMSTEOM[a]	3.00	—	—	—	—	—	6.38	8.04	9.55	—	—	—	6.74
A3TEOM[b]	3.10	3.21	3.10	—	—	3.10	6.02	—	—	—	—	4.85	3.90

Note: All units are in µg/m³.
[a] CPMSTEOM equipment malfunctioned November through March and July through September 2018.
[b] A3TEOM equipment malfunctioned January, February, and May through August 2018.
— = no measurement collected or data unreliable
FY = fiscal year $PM_{2.5}$ = 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 2018 was 263.7 µg/m³, which occurred at the A3PM10 station in the third quarter of FY 2018. 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 2018

Sample Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Average FY 2018
A3PM10	—	50.3	263.7	3.7	105.9

Note: All units are in µg/m³. FY = fiscal year
— = no measurement collected 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 2018 averages are listed in Table 5-4. Most of the radionuclides are either naturally occurring or are short-lived decay daughter products detected during analysis and are not emitted from Sandia sources.

Table 5-4. Average results of PM_{10} analysis, FY 2018

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Aluminum	µg/m³	7.53E-02	2,000
Antimony	µg/m³	1.50E-03	500
Arsenic	µg/m³	DE	10
Barium	µg/m³	1.97E-03	50

Table continued on next page

Table 5-4. Average results of PM_{10} analysis, FY 2018 (continued)

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Beryllium	µg/m³	DE	0.05
Cadmium	µg/m³	DE	10
Calcium	µg/m³	7.39E-01	2,000
Chromium	µg/m³	5.06E-03	10
Cobalt	µg/m³	9.28E-04	20
Copper	µg/m³	1.25E-02	1,000
Iron	µg/m³	7.79E-02	5,000
Lead	µg/m³	1.08E-03	150
Magnesium	µg/m³	7.20E-02	10,000
Manganese	µg/m³	2.02E-03	200
Nickel	µg/m³	1.27E-03	50
Potassium	µg/m³	5.45E-02	2,000
Selenium	µg/m³	1.41E-03	200
Silver	µg/m³	3.93E-04	10
Sodium	µg/m³	5.97E-01	5,000
Thallium	µg/m³	DE	100
Uranium	µg/m³	1.75E-05	200
Vanadium	µg/m³	4.16E-04	50
Zinc	µg/m³	2.16E-02	10
Actinium-228	pCi/m³	DE	100
Alpha, gross	pCi/m³	3.79E-02	0
Americium-241	pCi/m³	DE	NE
Beryllium-7	pCi/m³	1.74E+00	40,000
Beta, gross	pCi/m³	1.94E-01	0
Bismuth-212	pCi/m³	DE	700
Bismuth-214	pCi/m³	DE	2,000
Cesium-137	pCi/m³	DE	400
Cobalt-60	pCi/m³	DE	80
Lead-212	pCi/m³	DE	80
Lead-214	pCi/m³	DE	2,000
Neptunium-237	pCi/m³	DE	0
Potassium-40	pCi/m³	DE	900
Radium-223	pCi/m³	DE	NE
Radium-224	pCi/m³	DE	4
Radium-226	pCi/m³	DE	1
Radium-228	pCi/m³	DE	3
Sodium-22	pCi/m³	DE	NE
Thorium-227	pCi/m³	DE	0.7
Thorium-231	pCi/m³	DE	NE
Thorium-234	pCi/m³	DE	400
Uranium-235	pCi/m³	DE	0.1
Uranium-238	pCi/m³	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).

NE = not established
DE = data excluded due to undetected analyte or presumed false positives
FY = fiscal year
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 2018 annual summary for Tower A36 is shown in Table 5-5.

Table 5-5. Annual climatic summary from Tower A36, 2018

Measurement	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	2018 Annual
Temperature (°C)													
Average daily high	11.2	13.7	17.5	23.5	29.3	33.8	33.2	32.0	29.2	19.6	13.1	8.33	22.0
Average daily low	-4.8	-1.2	0.9	6.2	11.9	16.9	18.3	17.0	13.5	7.2	-1.8	-4.4	6.7
Monthly mean	4.8	7.4	10.3	15.7	21.9	26.4	25.5	24.4	21.9	13.7	7.0	2.9	15.2
Extremes (°C)													
High	17.9	19.8	24.5	28.9	34.0	38.1	37.8	35.8	33.5	29.2	20.8	15.3	38.1
Low	-11.5	-7.2	-8.9	-2.8	1.3	11.9	13.6	12.1	9.3	0.2	-9.3	-16.5	-16.5
Relative													
Humidity (percent)	38.8	38.1	31.6	22.0	17.6	22.2	42.1	43.5	43.9	55.9	41.2	52.7	37.5
Precipitation (cm)													
Monthly	0.13	1.80	0.71	0.03	0.30	2.90	11.10	1.40	3.68	4.70	0.00	2.06	28.80
24-hour maximum	0.10	0.86	0.48	0.03	0.30	2.62	3.56	0.94	0.94	2.24	0.00	1.19	3.56
Wind (m/sec)													
Monthly mean	2.94	3.89	3.87	5.08	4.34	4.05	4.10	3.25	3.30	4.01	2.96	3.06	3.74
Highest 24-hour average	5.60	8.38	7.10	10.94	8.83	10.35	9.17	5.05	5.41	9.25	7.10	7.95	10.94
Maximum gust	19.39	22.47	27.23	26.91	26.39	31.27	26.15	23.39	24.39	24.79	21.62	22.46	31.27
Barometric (mb)													
Pressure	838	833	834	833	833	833	839	837	836	835	836	835	835.2

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

Local weather in 2018 was warmer and wetter than climatological means. New Mexico had the third-warmest year on record (National Weather Service 2019). Temperatures were above average across the SNL/NM network for most of the year, with October and November the only exceptions. The autumn departure from warmth could have resulted from the arrival of El Niño conditions, which historically have produced lower temperatures and higher precipitation rates during autumn and winter months. November did not have any recorded precipitation, but September, October, and December were all wetter than average. Late July was marked by significant monsoon outbreaks and precipitation totals approaching network records, which ensured an above-average monsoon season and annual precipitation totaling 3 to 5 inches above average. Wind speeds were right at network averages for the year, but a couple of months with high precipitation saw elevated wind speeds (July and October) while several other months finished below climate norms.

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 2018.

Table 5-6. Variations and extremes in meteorological measurements across the tower network, 2018

Meteorological Measurement	Minimum	Maximum	Spread
Wind Speed	**m/sec**	**m/sec**	**m/sec**
Average annual wind speed	3.56 Tower A21	3.88 Tower CW1	0.32
Greatest difference in wind speed over 24 hours	7.78 Tower KU1	12.46 Tower A13	4.68
Greatest difference in daily maximum wind speed	18.19 Tower CL1	31.63 Tower SC1	13.44
Average difference in daily wind speed	0.90		
Temperature	**ºC**	**ºC**	**ºC**
Average annual temperature	14.63 Tower SC1	15.45 Towers KU1 and MW1	0.82
Network annual temperature extremes	−17.67 Tower SC1	38.51 Tower CW1	56.18
Greatest difference in daily minimum temperature	5.60 Tower CW1	13.49 Tower CL1	7.89
Greatest difference in average daily temperature	10.80 Tower SC1	13.89 Tower KU1	3.09
Greatest difference in daily maximum temperature	16.27 Tower SC1	22.47 Tower KU1	6.20
Precipitation	**cm**	**cm**	**cm**
Annual precipitation (extremes)	28.80 Tower A36	36.07 Tower SC1	7.27
Daily rainfall variation	0.46 Tower A36	3.83 Tower SC1	3.37
Greatest monthly precipitation difference	11.10 Tower A36	13.41 Tower SC1	2.31

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

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.

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 east-northeasterly to southeasterly. During the day, south-southwesterly winds were predominant with little exception.

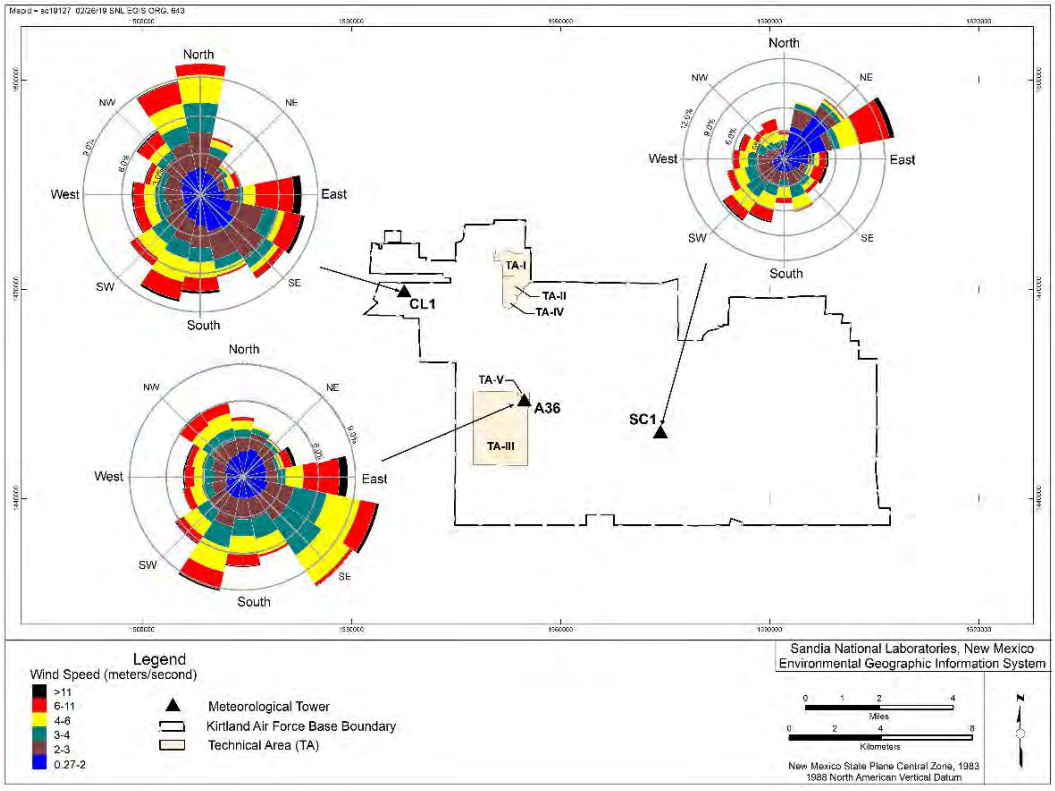

Figure 5-2. Annual wind roses at towers A36, CL1, and SC1

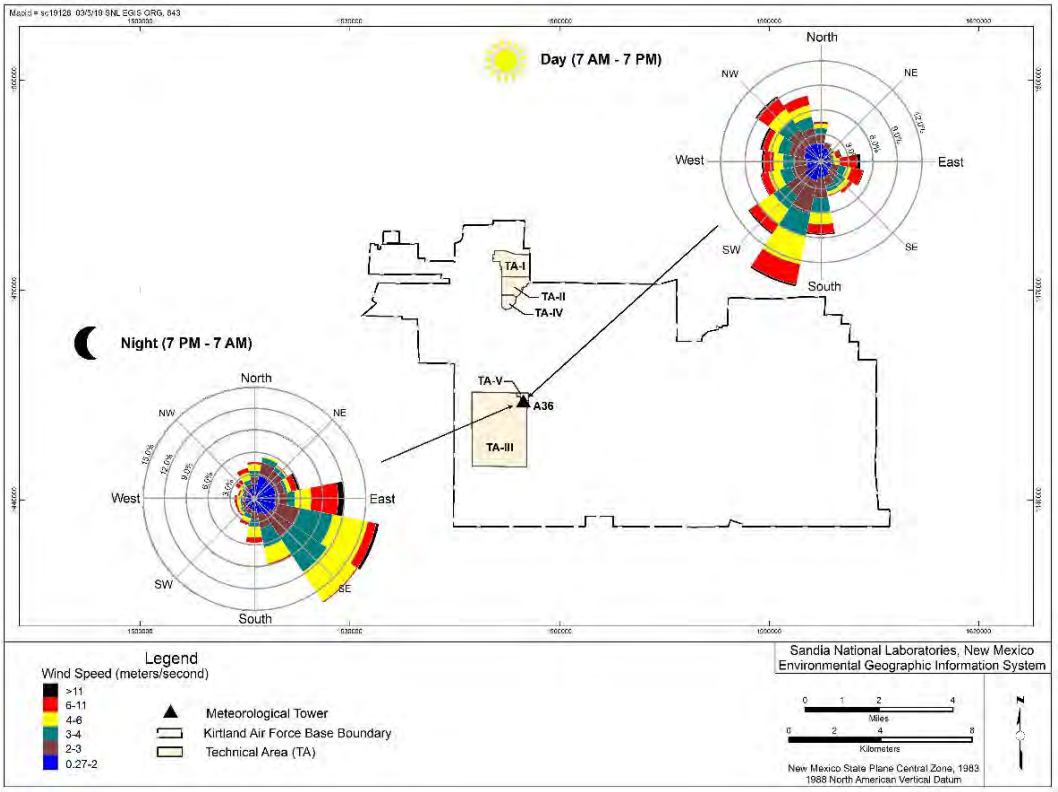

Figure 5-3. Annual wind roses for daytime and nighttime frequency at tower A36

Table 5-7. Predominant wind directions for day and night periods by tower, 2018

Tower	Day	Night
A13	South-southwest	East-northeast
A21	South-southwest	East-northeast
A36	South-southwest	East-southeast
CL1	South-southwest	East-southeast
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 set a maximally exposed individual radiological dose limit of 10 mrem/year resulting from all radiological air emissions produced from a DOE facility. A summary of radiological releases and public doses resulting from Sandia operations in 2018 is provided in Table 5-8.

Table 5-8. Radiological dose and release reporting, 2018

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)**
1.66E-02		3.51E-03		1.82E-02	2.83E+05		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 Radio-strontium**	**Total Uranium**	**Other Actinides**	**Other**
5.00E+01	1.57E+00	7.76E-04	1.01E-08	5.02E-06	2.60E-11	2.39E-06	0.00E+00

> = greater than
< = less than
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 2018, SNL/NM* (SNL/NM 2019g).

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 2018.

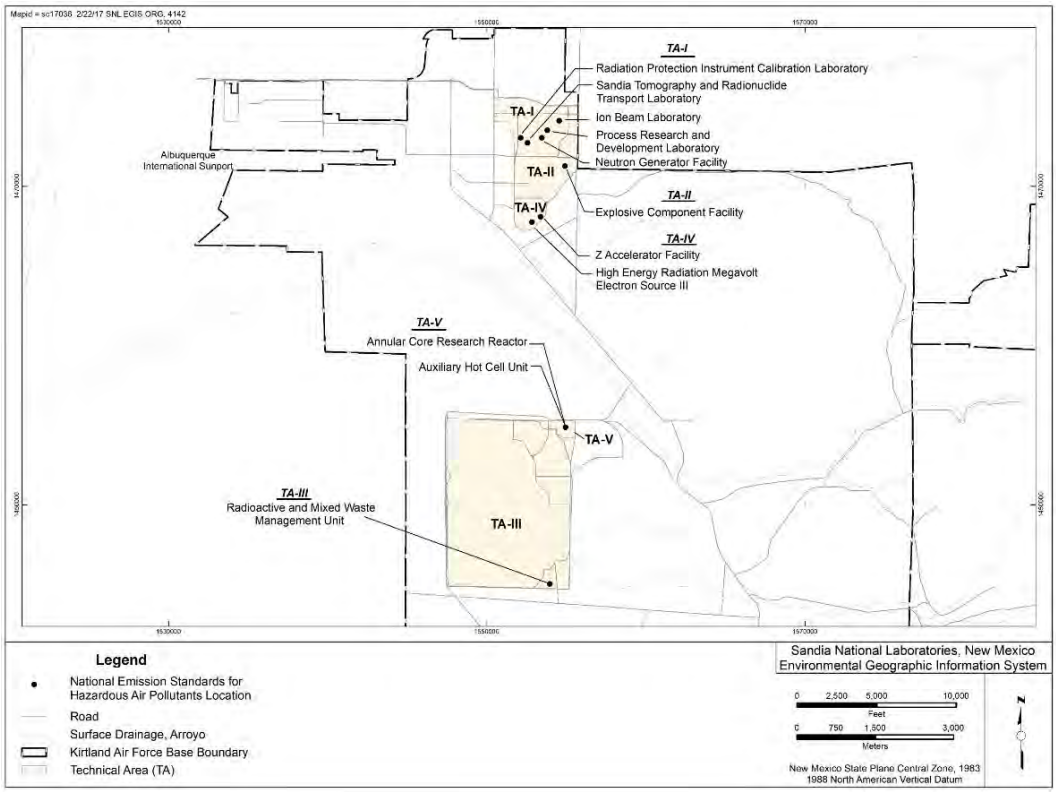

Figure 5-4. Locations of facilities that provided radionuclide inventories

Table 5-9. Summary of radionuclide releases from NESHAP sources, 2018

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	1.57
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	2.08E-08 1.5E-08 1.0E-08
Explosives Components Facility, TA-II	Facility used to test neutron generator design and manufacturing	Point	Calculation	Tritium	1.07E-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	7.05E-04 7.10E-05
Ion Beam Laboratory, TA-I	Ion and electron accelerators used to study and modify materials systems	Point	Calculation	Tritium	38.2
Neutron Generator Facility, TA-I	Principal production facility for neutron generators	Point	Continuous	Tritium	11.83
Process Research and Development Laboratory, TA-I	Small-scale laboratory operation involved in handling and researching sealed and unsealed tritiated materials	Point	Calculation	Tritium	1.5E-04
Radioactive and Mixed Waste Management Unit, TA-III	Facility used to handle radioactive and mixed waste	Point	Continuous and Calculation	Tritium (oxide) Tritium (elemental) Strontium-90 Cesium-137	1.28E-02 1.54E-01 5.02E-06 5.02E-06
Radiation Protection Instrument Calibration Laboratory, TA-I	Laboratory used to calibrate radiation detection equipment	Point	Calculation	Tritium	7.2E-06
Z Accelerator Facility, TA-IV	Experimental facility used to research light-ion inertial confinement fusion	Point	Calculation	Tritium	2.5E-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.
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.

The Radiation Protection Instrument Calibration Laboratory is used to calibrate radiation detection equipment. Activities at the laboratory could result in small releases of tritium.

Sunflower *(Helianthus annuus)* and Bumblebee *(Bombus sp.)*

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 Sandia. 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 2018, 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 2014 through 2018. 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.

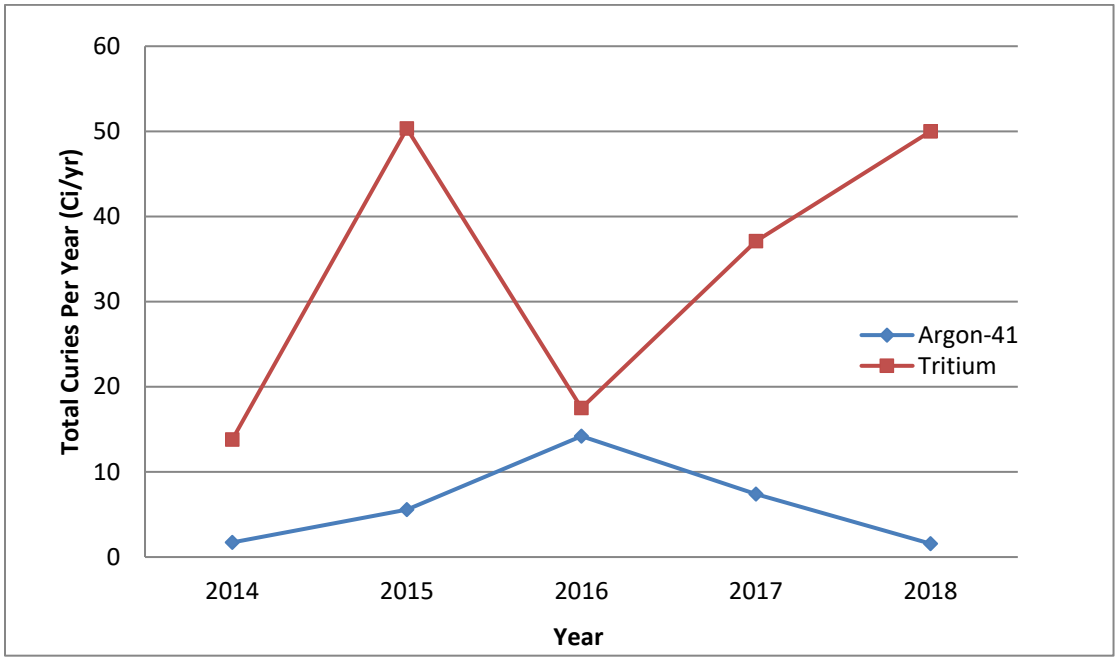

Figure 5-5. Atmospheric releases of argon-41 and tritium, 2014–2018

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).

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-United States Department of Defense facilities on KAFB.

Meteorology

Data from three meteorological towers (A21, A36, and CW1) in the proximity of emission sources were used in 2018. 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 in Appendix D, "NESHAP Dose Assessments in 2018." Dose assessment results are summarized in Table 5-10.

Table 5-10. Calculated dose assessment results for on-site and off-site receptors and for collective populations, 2018

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	Kirtland Storage Facility	3.51E-03 mrem/year	10 mrem/year
Off-site receptor effective dose equivalent to the maximally exposed individual	Eubank Gate area	1.66E-02 mrem/year	10 mrem/year
Collective Dose			
Collective regional population	Fifty-mile radius of KAFB	1.04E-01 person-rem/year	No standard available
Collective KAFB population	KAFB housing	1.57E-02 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 2018, the primary radionuclides released from SNL/NM facilities were tritium and argon-41. In 2018, the on-site maximally exposed individual was located on KAFB at the Kirtland Storage Facility. The on-site maximally exposed individual dose of 3.51E-03 mrem/year resulted primarily from tritium releases at the Ion Beam Laboratory, the Neutron Generator Facility, and argon-41 releases from the Annular Core Research Reactor. The off-site maximally exposed individual dose of 1.66E-02 mrem/year was located at the 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 U.S. 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 2018 was 1.04E-01 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 2018 calculation resulted in an estimated population dose of 1.57E-02 person-rem/year.

Chapter 6. Water Quality Programs

Rainbow over the Manzanita Mountains

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 also adhere 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 into the environment, which may include (but is not limited to) soil, water, air, and drain systems. A set of procedures provide specific instructions for reporting an environmental release and for understanding the communications chain to develop an accurate report. Environmental Release, Response, and Reporting Program personnel implement the procedures and document all aspects of an environmental release to ensure compliance with local, state, and federal reporting requirements.

6.1.1 Events Reported to the New Mexico Environment Department

In 2018, two releases were reported to NMED and EPA as a best management practice. Neither release met the criteria of a DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, occurrence. These releases are summarized as follows:

1. On Friday, February 23, 2018, Emergency Management Operations personnel responded to a call about water flowing from a cooling tower that supports Building 890, located in TA-I. The source of the discharge was the cooling tower; the overflow was caused by a clogged strainer screen, which was primarily clogged by leaves. An estimated 100 gallons of water overflowed from the cooling tower and discharged to the support platform and ground surface. An estimated 50 gallons of cooling tower water entered a nearby storm drain. However, the cooling tower water did not reach the Tijeras Arroyo diversion channel. 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. Additionally, sodium hypochlorite was present at a concentration of 0.1–0.3 ppm. Facilities personnel were able to identify the clogged strainer and return the system back to normal operations.
2. On Wednesday, March 21, 2018, a leak from a potable water line occurred southeast of Building 821, outside TA-I. The release began at approximately 11:30 p.m. and continued for approximately 7 hours. Facilities personnel located the water valves and isolated the leak from the system. The break was caused by a failed fitting at a connection in the irrigation line. An estimated 185,000 gallons of water was released. The flow from the water line break entered the storm drain where it flowed south to the 9th Street conveyance channel before meeting the Tijeras Arroyo. Facilities personnel repaired the PVC pipe and fittings and returned the water line to service.

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

6.1.2 Events Categorized as a DOE Reportable Occurrence

One event in 2018 met the criteria for a DOE reportable occurrence (see Chapter 2). The release is summarized as follows:

- On Wednesday, November 28, 2018, Building 858N personnel responded to a high-arsenic-level alarm from the wastewater discharge effluent flume in the basement of the building. Personnel observed an arsenic reading of 0.0865 mg/L (86.5 ppb) at the Acid Waste Neutralization system effluent flume for ABCWUA Permit 2069G. The observed reading was from a sample taken at approximately 1:30 p.m. and was identified to be above the ABCWUA Daily Maximum Composite Local Limit of 51 ppb. The elevated reading triggered an immediate notification to the ABCWUA at approximately 5:08 p.m. Cleaning activities associated with the metalorganic chemical vapor deposition tools that generate arsenic deposits were the cause of the high arsenic

levels in the wastewater. A downpipe coated with gallium arsenide crystal growth was cleaned using a basic mixture of ammonium hydroxide and hydrogen peroxide solution. The ABCWUA authorized a Return to Compliance date of June 1, 2019. This timeframe allows personnel to implement all corrective actions and ensure that the wastewater effluent met the discharge requirements set forth in ABCWUA Industrial Wastewater Permit 2069G and Sewer Use and Wastewater Control Ordinance. This release was categorized as a DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, occurrence with additional reporting to ABCWUA.

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*, SNL/NM maintains and implements a Spill Prevention, Control, and Countermeasure Plan (SNL/NM 2016c), 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 46 stationary aboveground storage tanks and three underground storage tanks. Additional oil storage capacity in 55-gallon drums, mobile and portable containers, mobile refuelers, and oil-filled operational equipment (transformers, hydraulic elevators, etc.) occurs throughout the site on an as-needed basis. 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 and one 10,000-gallon underground fuel storage tank were operational in 2018. These underground tanks are registered with the NMED Petroleum Storage Tank Bureau. Although 46 stationary aboveground storage tanks were operational in 2018, only seven are subject to NMED Petroleum Storage Tank Bureau regulation and registration. Registration numbers for the three underground storage tanks and seven aboveground storage tanks regulated by the Bureau are provided in Table 9-1. 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 Results in 2018

In December 2018, the 10,000-gallon diesel fuel underground storage tank was removed in accordance with the requirements of the NMED Petroleum Storage Tank Bureau, 20.5.115 NMAC. The tank was removed as part of a backup power generation system renovation project that replaced several diesel-powered generators with natural gas-powered generators. Regulatory closure for this tank will be completed in 2019. As a result, the three underground storage tanks in operation at SNL/NM during 2018 have been reduced to two.

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 Facilities and Emergency Management Center personnel to maintain compliance with applicable federal, state, local, and DOE requirements and to 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, and it can be found at the following website:

http://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 stormwater pollutants. Program personnel maintain regulatory compliance with federal, state, tribal, and local stormwater requirements by helping organizations obtain National Protection Discharge Elimination System permit coverage, conducting routine assessments and stormwater monitoring, and training personnel on stormwater pollution prevention practices. Compliance with National Protection Discharge Elimination System permits reduces the impact of construction, industrial, and municipal activities on the environment.

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, training personnel on how their jobs may impact stormwater quality, 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 of its ability to discharge to "waters of the United States" as defined under the Clean Water Act. Furthermore, the State of New Mexico has defined "surface water(s) of the state" to mean: "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 waters of the state also means all tributaries of such waters, including adjacent wetlands, any manmade bodies of water that were originally created in surface waters of the state or resulted in the impoundment of surface waters of the state, and any 'waters of the United States' as defined in the Clean Water Act that are not included in the preceding description" (20.6.4 NMAC, *Standards for Interstate and Intrastate Surface Waters*).

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," are ephemeral, and flow 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.

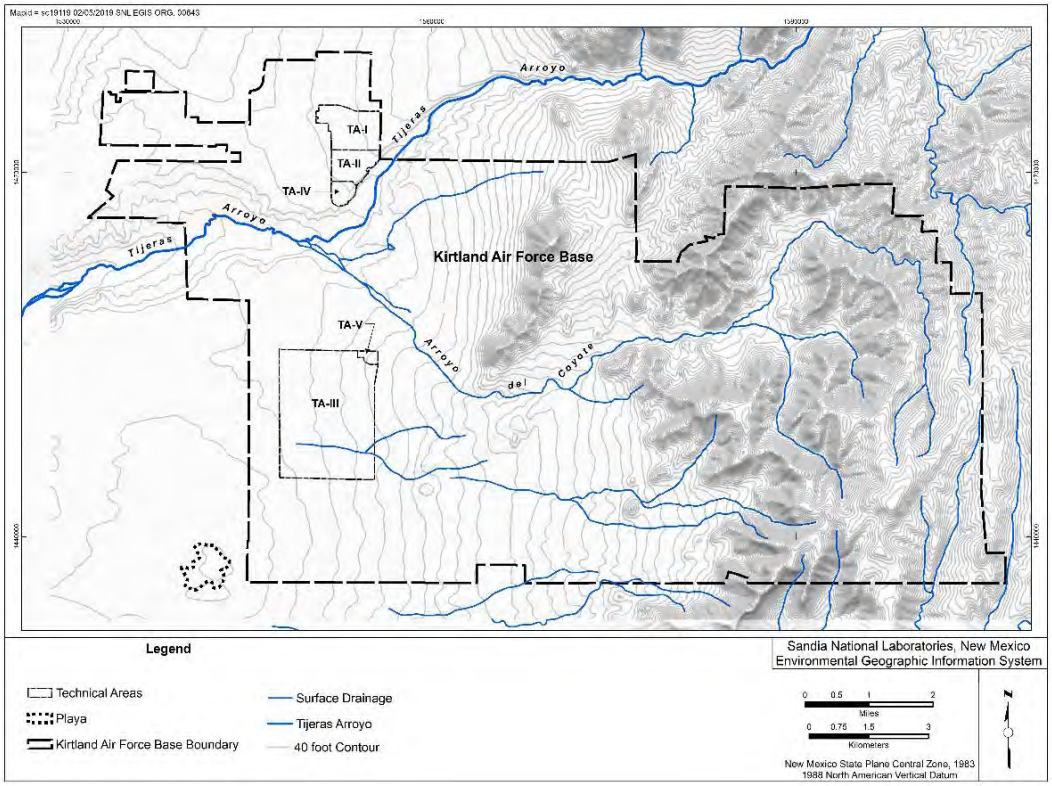

Figure 6-1. Location of SNL/NM technical areas and waters of the United States within KAFB

Stormwater from facilities in TA-I, TA-II, and TA-IV flows to a centralized stormwater drainage system that is comprised of numerous gutters, ditches, inlets, and storm drains. Approximately 90 percent of this area drains to a concrete-lined channel that discharges stormwater directly to the Tijeras Arroyo south of TA-I. Stormwater from the remaining area (in the northwest quadrant of TA-I) flows to the KAFB Municipal Separate Storm Sewer System through three separate storm drains. Stormwater entering the KAFB Municipal Separate Storm Sewer System at these points is ultimately conveyed to the Rio Grande via the Albuquerque Metro Area Flood Control Authority North Diversion Channel.

The Arroyo del Coyote drains much of the eastern mountainous portion of KAFB, including the drainages of Madera Canyon, Lurance Canyon, and Sol se Mete Canyon. The arroyo flows from east to west and joins the Tijeras Arroyo west of the Tijeras Arroyo Golf Course.

The majority of TA-III, TA-V, and Coyote Test Field discharge stormwater within a closed basin. Current U.S. Geological Survey 12-digit maps show TA-V and most of TA-III to be located within the boundary of Closed Basin Hydrologic Unit Code 130202030403, which is defined as a drainage area that is 100 percent noncontributing; all surface flow is internal and no overland flow leaves the basin through the outlet point such that it would contribute surface flow to a stream or river. Activity areas located in the southern portion of TA-III and KAFB have the potential to discharge stormwater via overland flow to unnamed playas located at the lowest elevation of the closed basin immediately southwest of the KAFB boundary (Figure 6-1). Playas are not designated as "waters of the United States," but they are considered "surface waters of the state." There is no centralized

stormwater drainage system for this area and no discernible discharge directly to a water of the United States.

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

6.4.2 National Pollutant Discharge Elimination System Permitting

EPA maintains oversight authority for National Protection Discharge Elimination System permits in New Mexico. The NMED assists EPA with inspections but has no enforcement authority. SNL/NM operations are covered under three National Protection Discharge Elimination System permits.

Multi-Sector General Permit. The Multi-Sector General Permit regulates stormwater discharges associated with industrial activities at SNL/NM. Specific facility activities, as defined under applicable industrial sectors, are also regulated under the Multi-Sector General Permit. EPA renewed this permit on June 4, 2015. Sandia and DOE then jointly filed Notices of Intent, as required for operators/owners of industrial activities under the Multi-Sector General Permit. EPA approved the Notice of Intent on September 30, 2015.

Compliance with the Multi-Sector General Permit is maintained by developing and updating a site-specific Stormwater Pollution Prevention Plan, 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, Notices 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:

http://digitalrepository.unm.edu/snl_msgp/

A total of 22 industrial activity areas (referred to as "sites") at SNL/NM were covered under the Multi-Sector General Permit at the start of 2018. In August 2018, five sites were no longer eligible for coverage and were removed from the permit. The Building 858 Complex and the Neutron Generator Facility were removed after an assessment through the corporate Assurance Information System found that no permitted activities at that site were exposed to stormwater. Three additional sites—SWMU 68, SWMU 43, and SWMU 502—were approved for RCRA Corrective Action Complete under the facility hazardous waste permit and therefore are no longer eligible for coverage under the Multi-Sector General Permit. Table 6-1 lists the 18 sites remaining after August 1, 2018.

Table 6-1. Sites with coverage under the Multi-Sector General Permit and associated stormwater sampling points

Sector Title	Sector	Permitted Sites	Stormwater Sampling Point
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)
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	none; emergency use only
Electronic and Electrical Equipment and Components, Photographic and Optical Goods	AC1	Advanced Manufacturing Process Laboratory	05 (no analytical requirement)
		Center for Integrated Nanotechnologies	50 (no analytical requirement)
Non-metallic Mineral and Mining Dressing; Construction Sand and Gravel	J1	TA-III Borrow Pit	No outfall
Landfills	L1 and L2	Classified Waste Landfill	08
Local and Highway Passenger Transportation	P1	Fleet Services	05 (no analytical requirement)

SWMU = Solid Waste Management Unit TA = technical area

Construction General Permit. The Construction General Permit is intended to regulate stormwater discharges associated with construction activities. Notices of Intent are submitted to the EPA for coverage under the Construction General Permit for every construction project anticipated to disturb one or more acres of land, following development of a site-specific Stormwater Pollution Prevention Plan. During 2018, Sandia held active permit coverage of 12 construction sites (see Chapter 9); DOE and its management and operating contractor for Sandia held joint Construction General Permit coverage for two 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.

Middle Rio Grande Municipal Separate Storm Sewer System Permit. The Municipal Separate Storm Sewer System 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 Municipal Separate Storm Sewer System 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 Municipal Separate Storm Sewer System 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 Municipal Separate Storm Sewer System 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:

http://digitalrepository.unm.edu/snl_ms4/

6.4.3 Stormwater Quality Monitoring

Stormwater quality monitoring is required for compliance with the Multi-Sector General Permit and the Municipal Separate Storm Sewer System Permit. SNL/NM is located in an arid/semiarid region of the Southwest, and historical meteorological data shows that approximately 60 percent of the annual rainfall occurs in four months of the year (July, August, September, and October). Based on this meteorological data, the wet season at SNL/NM for stormwater sampling occurs from July 1 through October 31.

Multi-Sector General Permit. Multi-Sector General Permit sampling is conducted during the wet season as authorized by the permit, where, under arid and semi-arid 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 Multi-Sector General Permit during other times of the year.

Table 6-2 presents the analytical parameters sampled under each industry sector as required by the Multi-Sector General Permit, with the exception of sectors N2, P1, and AC1 where laboratory analysis is not required. Figure 6-2 illustrates the stormwater sampling points (SWSPs) located at the outfalls of Multi-Sector General Permit 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, and SWSP-52. 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. Multi-Sector General Permit stormwater sampling requirements and benchmark values

Pollutant	Multi-Sector General Permit Sector/ Subsector	EPA Benchmark (total; mg/L)	New Mexico Benchmark (total; mg/L)	New Mexico Benchmark (dissolved; mg/L)
Arsenic	K1	N/A	0.01	N/A
Cadmium[a]	K1	N/A	N/A	0.00298[a]
Cyanide	K1	N/A	0.0052	N/A
Lead[a]	K1, N1	N/A	N/A	0.14[a]
Mercury	K1	N/A	0.00077	N/A
Magnesium	K1	0.064	N/A	N/A
Selenium	K1	0.005	N/A	N/A
Silver[a]	K1	N/A	N/A	0.011[a]
Aluminum[a]	N1	N/A	N/A	8.838[a] (total recoverable[b])
Copper[a]	N1	N/A	N/A	0.026[a]

Table continued on next page

Table 6-2. Multi-Sector General Permit stormwater sampling requirements and benchmark values (continued)

Pollutant	Multi-Sector General Permit Sector/ Subsector	EPA Benchmark (total; mg/L)	New Mexico Benchmark (total; mg/L)	New Mexico Benchmark (dissolved; mg/L)
Iron	N1, L2	1.0	N/A	N/A
Zinc[a]	N1	N/A	N/A	0.301[a]
Ammonia	K1	2.14	N/A	N/A
Chemical oxygen demand	K1, N1	120	N/A	N/A
Total nitrogen (nitrate + nitrite)	J1	N/A	132	N/A
Total suspended solids	J1, L1, N1	100	N/A	N/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 N/A = not applicable

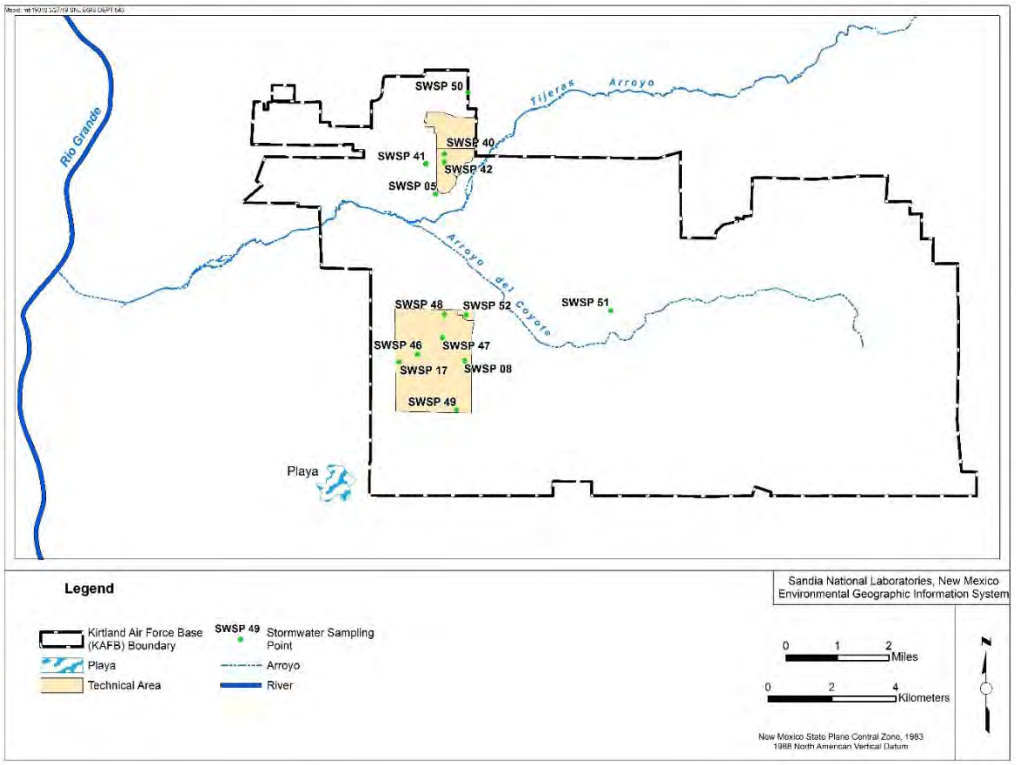

Figure 6-2. Multi-Sector General Permit stormwater sampling point locations

Construction General Permit. There is no water quality monitoring conducted under the Construction General Permit.

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

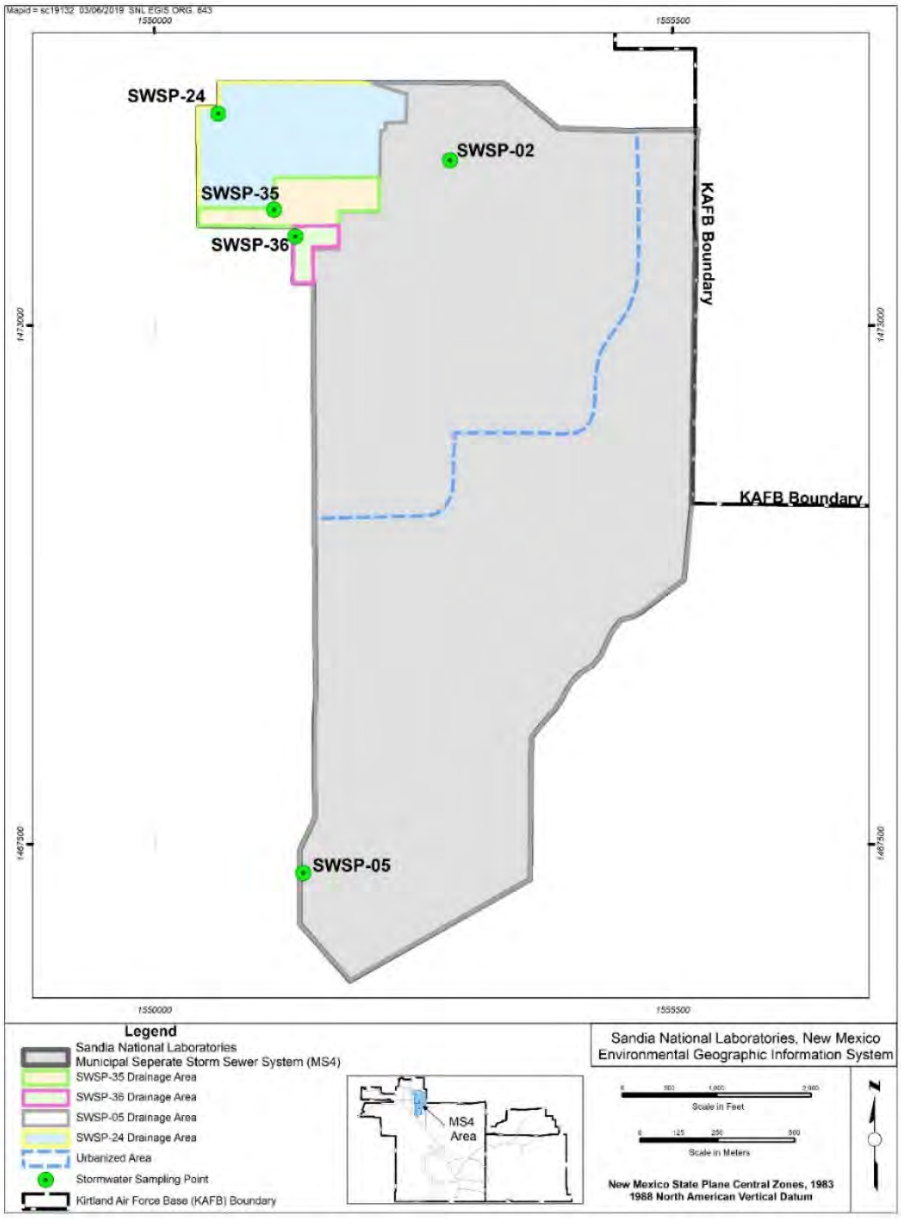

Figure 6-3. Municipal Separate Storm Sewer System drainage areas and monitoring locations

A portion of the inflow to the Municipal Separate Storm Sewer System is derived from Sandia-controlled areas, and a portion of the inflow is derived from KAFB-controlled areas. All inflow at SWSP-02 is conveyed through the Municipal Separate Storm Sewer System discharge point at SWSP-05.

Automatic samplers meet the grab sample requirement described in Part III.A.1.c of the Municipal Separate Storm Sewer System Permit. The 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. Each composited sample is filtered and preserved (as appropriate) and processed at the Sample Management Office before shipment to the appropriate laboratory for analysis. Wet weather monitoring constituents required in the Municipal Separate Storm Sewer System Permit, along with acceptable analytical methods (from 40 CFR 136, *Guidelines for Establishing Test Processing for the Analysis of Pollutants*) and their associated water quality standards, are listed in Table 6-3.

Table 6-3. Municipal Separate Storm Sewer System Permit sampling requirements and water quality standards

Parameter	Water Quality Standard[a]
pH	6.6–9.0
Temperature	less than 32.0 °C
Conductivity	—
Dissolved oxygen	greater than 5.0 mg/L
Total suspended solids	—
Total dissolved solids	1500 mg/L
Chemical oxygen demand	—
Five-day biological oxygen demand	—
Oil and grease	15 mg/L
E. coli	47 CFU/100 mL
Total Kjeldahl nitrogen	8.5 mg/L
Nitrate plus nitrite	132 mg/L
Dissolved phosphorous	—
Total phosphorous	—
Polychlorinated biphenyl	0.00017 µg/L
Gross alpha	15 pCi/L

[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
NMAC = New Mexico Administrative Code
pH = potential of hydrogen

6.4.4 Stormwater Data Quality Assurance

Given the variability of precipitation events in the arid region, the volume of stormwater collected at monitoring points is often insufficient to achieve the minimum volume for laboratory analysis of all required parameters. Parameters are prioritized and analyzed based on the volume of stormwater necessary for analysis and their relevance with respect to potential pollutant discharges. Any remaining parameters are analyzed with stormwater collected from the next storm event within the same monitoring period.

Quality assurance, control, and assessment processes are used to 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 only collected whenever analytical data indicate that sample contamination may be occurring.

An 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.

Stormwater drainage channel south of SWSP-05.

6.4.5 Stormwater Program Activities in 2018

Multi-Sector General Permit. Stormwater samples were collected during the 2018 wet season. Samples were collected when there was sufficient volume of runoff for laboratory analysis of required parameters. During a July 2018 storm event, precipitation was sufficient and wide-spread enough to result in collection of stormwater runoff at all Multi-Sector General Permit outfall locations. This was not the case for the subsequent three monitoring periods (August through October), during which one or more outfalls received an insufficient volume of stormwater to collect full samples.During the 2018 monitoring period, two parameters (iron and total suspended solids) at the Classified Waste Landfill (SWSP-08) exceeded Multi-Sector General Permit benchmarks. No additional exceedances occurred at Multi-Sector General Permit stormwater sampling points in the 2018 monitoring season.

During a 25-year storm event on July 14, 2018, iron and total suspended solids were more than four times greater than the Multi-Sector General Permit benchmark value at the Classified Waste Landfill (SWSP-08). This triggered a permit condition for the Stormwater Pollution Prevention Plan, requiring a review to determine whether modifications to site control measures were necessary. The following factors led to the conclusion that corrective actions were not required: (1) the site

inspection did not identify erosion or discharge of stormwater beyond the immediate site area, (2) the visual assessment did not identify sediment in the sample, and (3) the site is located in a closed basin and there is no potential for discharge to "waters of the United States." As a best management practice, a 20-foot fiber roll was installed around the outfall at the southwest corner of the site.

If the average of four consecutive sample values for a parameter does not exceed the Multi-Sector General Permit benchmark, monitoring of that parameter is no longer required for the duration of the permit term. Each year during the permit term, additional parameters that do not exceed benchmarks are removed from the Multi-Sector General Permit monitoring program. In 2018 (the third full year of monitoring under this permit term), all parameters at three outfalls—SWSP-17, SWSP-48, and SWSP-51—were below the benchmark, and no longer require monitoring. At SWSP-47, arsenic, mercury, and selenium were below the benchmarks and no longer require monitoring. Additional parameters were removed in prior years during the permit term for the reasons presented in Section 6.4.2. The number of sites that no longer require monitoring indicates relatively clean stormwater discharges from industrial activities regulated under the Multi-Sector General Permit. The analytical results for 2018, as submitted to EPA, are provided in Appendix E, "Stormwater Sampling Results in 2018."

Municipal Separate Storm Sewer System Permit. A total of 14 wet weather samples were collected, 7 during the wet season (July 1, 2017, to October 31, 2017) and 7 during the dry season (November 1, 2017, through June 30, 2018). Discharges from the Municipal Separate Storm Sewer System during the monitoring period were below New Mexico water quality standards in all samples and for all constituents except for some instances of total PCBs, *Escherichia coli* (*E. coli*), and gross alpha. The Municipal Separate Storm Sewer System Permit requires that permittees use the monitoring results to guide efforts to improve the quality of stormwater discharges. 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, 2017, to June 30, 2018, Municipal Separate Storm Sewer System monitoring period are provided in Appendix E.

Total PCBs collected from the Sandia Municipal Separate Storm Sewer System locations exceeded the New Mexico and Isleta Pueblo water quality standards in 13 of the 14 samples. PCBs were detected in stormwater at exceptionally low concentrations with a maximum value of 0.0523 µg/L; however, 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). Additionally, the PCB concentrations in stormwater at Sandia are within the range found throughout the Albuquerque metropolitan area (Storms et al. 2015).

The Rio Grande provides 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.

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 Municipal Separate Storm Sewer System (one adjacent to SWSP-02 and the other adjacent to SWSP-05) to aid in evaluating atmospheric deposition of PCBs. Additional stormwater sampling

locations ungradient of SWSP-02 are being planned to identify specific areas where PCBs may be entering the storm drain system.

The Isleta Pueblo water quality standard for *E. coli* is 47 colony-forming unit [CFU]/100 mL. *E. coli* results were above the Isleta Pueblo water quality standard in 13 of the 14 samples collected. The 14 *E. coli* samples collected during this monitoring period had a median of 664 CFU/100 mL. The *E. coli* concentrations encountered within the Municipal Separate Storm Sewer System 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 8,000 CFU/100 mL (Storms et al. 2015).

E. coli is found in the intestines of warm-blooded animals, including birds, rodents, dogs, raccoons, cats, and deer. 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. A sampling plan to identify the animals contributing *E. coli* to stormwater (microbial source tracking) is currently being developed.

Gross alpha values were slightly above the water quality standard in 4 of the 14 samples; 3 of these samples were from SWSP-02 and one was from the downstream sampler at SWSP-05. Elevated gross alpha is strongly correlated to sediment load (i.e., total suspended solids) in the stormwater samples. In October 2018, a sediment control structure was installed upgradient of SWSP-02 to decrease relatively large sediment loads that were originating from areas of unstabilized natural soils.

6.5 Surface Discharge Program

All water and water-based compounds that discharge to the ground surface are evaluated 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 made to roads, open areas, or impoundments. Surface discharges are only made with the approval of the Surface Discharge Program. 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 confined areas such as reservoirs.

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 2018, 16 individual surface discharge requests were approved. Approved releases were in compliance 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 surface discharge lagoons in TA-IV. Both lagoons are permitted through NMED in Discharge Permit (DP) 530. The two surface discharge 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 and Renewals*, 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 expires on September 5, 2019. 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 August 21, 2018. 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 6.4.4. See Chapter 8 for more information on quality assurance and quality control.

Although there were no discharges to Lagoon 2 in 2018, 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.* Additionally, monthly inspections are performed on both lagoons to verify water levels and ensure that no damage to the lagoons exists.

Table 6-4. Discharge Permit 530 monitoring and reporting requirements

Action	Frequency	Reporting
Volume of wastewater discharged	Monthly	Annually
Inspection of lagoons	Monthly	Documented in checklists
Lagoon water samples	Annually	Annually
Inspection of sump pump stations	Quarterly	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 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 and radioactive alarm systems, a control room, and an ion exchange/filtration unit (a treatment processor). The Liquid Effluent Control System is an engineered facility operating within an established safety envelope.

Wastewater samples are analyzed for tritium, gross alpha, gross beta, and gamma spectroscopy to ensure that radiological levels meet regulatory standards before the water is released to the public sewer system. If radioactivity levels 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. Once the radioactivity level is at or below regulatory limits, the water can be discharged safely to the public sewer system. Discharges to the sanitary sewer from the Liquid Effluent Control System and other Sandia activities did not exceed standards for radionuclides at any of the wastewater monitoring stations in 2018.

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).

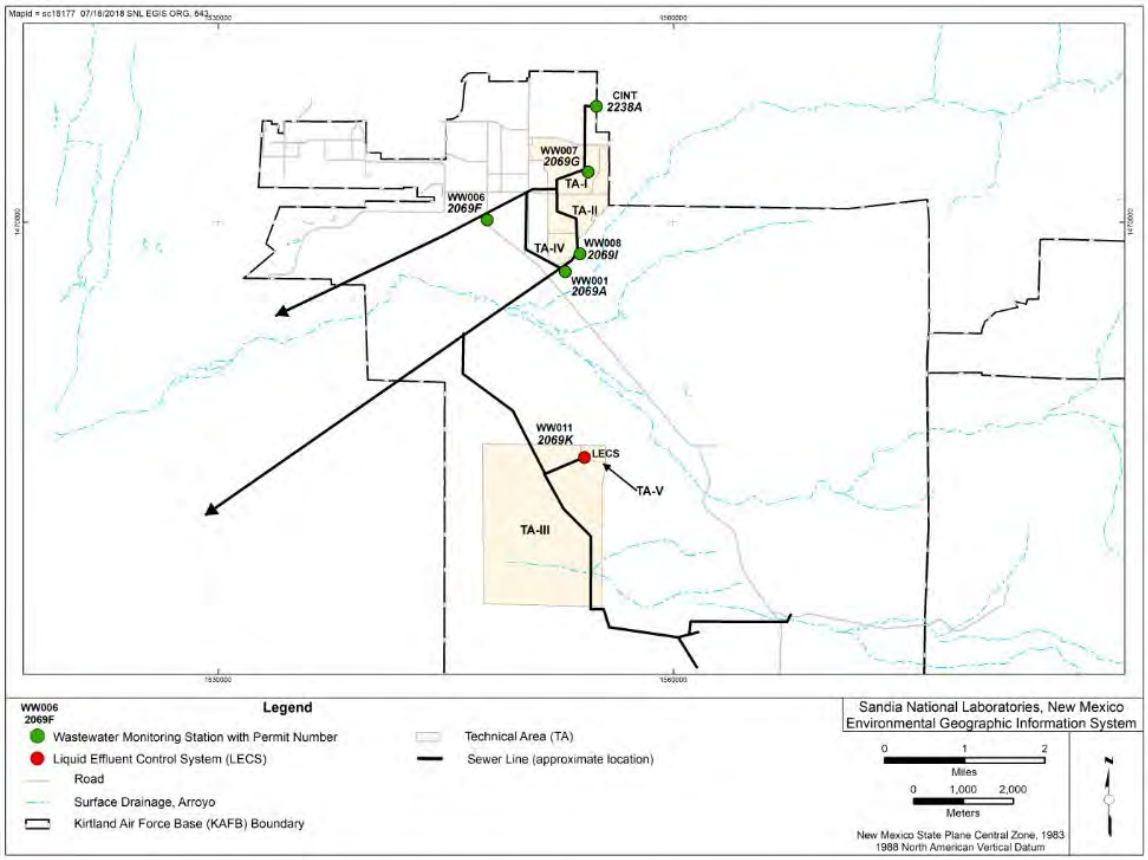

Figure 6-4. Wastewater monitoring station locations

Table 6-5. Wastewater discharge permits and 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" include 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 (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 that are detected above the permit-specific limits at a wastewater monitoring station usually 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 2018, 341 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 monitoring stations permitted by the ABCWUA (Figure 6-4) at SNL/NM. Wastewater monitoring station characteristics are also 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.

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 computer system that has alarm processing, remote real-time display of data, and report-generating capabilities. If the wastewater pH approaches discharge limits, an auto dialer 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.

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

ABCWUA personnel sample wastewater from Sandia-permitted outfalls on a regular basis (usually twice a year) to determine compliance with permit requirements. The NMED DOE Oversight Bureau is notified when sampling is scheduled to occur and is offered the opportunity to obtain split samples for analysis. All samples are obtained as 24-hour flow proportional or time-weighted composites. In addition, Sandia personnel collect samples (sample splits) during the ABCWUA

sampling event that are sent to an EPA-approved laboratory for analysis. The ABCWUA determines which parameters it plans to analyze. Wastewater monitoring parameters are as follows:

- Metals—aluminum, arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc
- Radiological constituents—gamma spectroscopy, gross alpha, gross beta, and tritium
- General chemistry—fluoride, ammonia, cyanide, semivolatile organic compounds, and volatile organic compounds

Discharge 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 2018

During 2018, Sandia personnel collected wastewater samples (sample splits) during the ABCWUA and NMED DOE Oversight Bureau sampling events. Laboratory analytical results for these split wastewater 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 2018 met requirements for radiological levels in wastewater. All analytical results from sampling conducted in 2018 met ABCWUA Sewer Use and Wastewater Control Ordinance discharge requirements. Analytical results are provided in Appendix F, "Sanitary Outfall Monitoring Results in 2018."

In addition, the ABCWUA performed a permit renewal inspection within permitted flow basin 2069A in February 2018. In May 2018, ABCWUA performed a permit inspection of flow basins 2069F, 2069G, 2069I, 2069K, and 2238A. No issues were identified during the inspections.

6.6.6 Sanitary Sewer System Releases in 2018

In 2018, there was one sanitary sewer system release. This event is discussed in Section 6.1.2 and also met the criteria for a DOE reportable occurrence (see Chapter 2).

Chapter 7. Ecology Program

Two-tailed Swallowtail (*Papilio multicaudata*)

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 at Sandia 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 7-1 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 occurs throughout the year for routine and nonroutine activities. Surveys of flora and fauna are conducted in six primary habitat types. Sampling locations and vegetation habitats are described in Table 7-1.

Table 7-1. Sampling locations with vegetation habitat

Sampling Location Site Name	Vegetation Habitat
Madera Canyon[a]	Closed canopy woodland
Madera Canyon Guzzler	Shrub, open woodland, and grassland
Optics Range east of Starfire[a]	Shrub, open woodland, and grassland
Range Wildlife Guzzler[a]	Shrub, open woodland, and 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
Winch Site[a]	Shrub, open woodland, and grassland

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

7.1 Vegetation Surveillance

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

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

Vegetation monitoring enables better ecosystem understanding and allows for 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).

7.1.1 Vegetation Monitoring Strategy

In 2017, Ecology Program personnel began adoption of the national Assessment, Inventory, and Monitoring (AIM) vegetation method. Vegetation monitoring strategies were reviewed and evaluated in 2017, with the goal of implementing a long-term approach that provides a landscape level, data-driven understanding of ecosystem conditions for better support of management decisions, resources, and reporting.

Published by the Bureau of Land Management in 2011 (BLM 2011), AIM was 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 strategy provides a framework that includes methods, protocols, and principles to quantitatively assess the condition, trend, amount, location, and spatial pattern of natural resources on the nation's public lands. The 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.

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

By using standardized monitoring indicators and methods for collecting vegetation data, land managers have a basis from which to adaptively manage resources in order to achieve management goals and objectives, improve understanding of the ecosystem, and adjust monitoring efforts as necessary using a well-documented and consistent approach.

7.1.2 Vegetation Monitoring in 2018

Four AIM plots were designated and then sampled in 2018. The only 2018 plot that was in a grassland vegetation community occurred in the shrub, open woodland, and grassland vegetation type. The other three 2018 plots were in a piñon-juniper vegetation community in three different vegetation types: shrub, open woodland and grassland; disturbed arroyo shrub-large shrub; and closed canopy woodland.

The data collected from each plot was analyzed using the Database for Inventory, Monitoring and Assessment software developed for AIM data collection, management, and interpretation. Analysis results for each plot include: the percent of the plot that is canopy cover, basal cover, foliage cover, dead vegetation cover, or bare ground; the total amount of ground cover and the total amount of litter; the percent that is foliage and basal cover by plant species; the percent of the soil surface that is covered by soil or basal plant surface; a complete plant species list; and the soil stability for protected areas, unprotected areas, and average for the plot.

These data results collectively provide insight into soil and site stability, hydrologic function, and biotic integrity. These three attributes define the foundation of most terrestrial ecosystems. Nearly all human values that are supported by ecosystems depend on minimizing soil erosion, controlling the flow of water through the system, and maintaining biotic recovery processes (Herrick et al. 2009).

The SNL/NM 2018 data for the four AIM plots were evaluated independently of each other because the plots include different vegetation types. Plot data will begin to become meaningful in future years, as more plots are completed and trends can be detected as indicators of change or as data

remain consistent across time. Individual 2018 plot data is not provided in this report due to the lack of trending comparisons.

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.

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

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

7.2.1 Drift Fence Trapping

Many different techniques are available to detect the presence of reptiles and amphibians in the environment. In 2012, funnel traps (Figure 7-1) 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. The boxes have one-way entrances, whereby animals can easily enter the trap but not exit. This detection technique has proven successful in two of the grassland habitats at SNL/NM and continues to be used.

Figure 7-1. Temporarily closed funnel traps along a drift fence in a desert grassland habitat

Four drift fence trapping arrays were set up in 2018 at two sites: the SC Dome area and the West TA-III site. The traps are checked twice daily during the field season, and all animals are released.

7.2.2 Herpetofauna Survey Results

For the 2018 field season, 78 individuals from 16 different species were captured using funnel trapping: eight snake species, six lizard species, and two amphibian species. Of those species, Texas Nightsnake (*Hypsiglena jani texana*) was captured for the first time in 2018 at the SC Dome site (Figure 7-2).

Figure 7-2. Texas Nightsnake (*Hypsiglena jani texana*), a nonvenomous species that is widespread across New Mexico

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, 2018

Species		2018 Site Captures and Releases by Trapping Period and Site						
		5/29/18–6/8/18		7/16/18–7/26/18		8/20/18–9/5/18		
Common Name	Scientific Name	SCD	WTA3	SCD	WTA3	SCD	WTA3	Total
Lizard								
Chihuahuan Spotted Whiptail	*Aspidoscelis exsanguis*	16		20		2		38
Little Striped Whiptail	*Aspidoscelis inornata*		1					1
New Mexico Whiptail	*Aspidoscelis neomexicana*	1	2		4	3	1	11
Eastern Collared Lizard	*Crotaphytus collaris*	2				1		3
Common Lesser Earless Lizard	*Holbrookia maculata*							0
Horned Lizard spp.	*Phrynosoma* spp.							0
Greater Short-horned Lizard	*Phrynosoma hernandesi*							0
Round-tailed Horned Lizard	*Phrynosoma modestum*							0
Great Plains Skink	*Plestiodon obsoletus*				1		2	3
Southwestern Fence Lizard	*Sceloporus cowlesi*							0
Common Side-blotched Lizard	*Uta stansburiana*		4		1		4	9

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Table 7-2. Herpetofauna site captures/releases by trapping period, 2018 (continued)

Species		2018 Site Captures/Releases by Trapping Period and Site						Total
Common Name	Scientific Name	5/29/18–6/8/18		7/16/18–7/26/18		8/20/18–9/5/18		
Snake								
Painted Desert Glossy Snake	*Arizona elegans philipi*						1	1
Western Coachwhip	*Coluber flagellum testaceus*		1		1			2
Desert Striped Whipsnake	*Coluber taeniatus taeniatus*	1						1
Western Diamond-backed Rattlesnake	*Crotalus atrox*			2				2
Prairie Rattlesnake	*Crotalus viridis*							0
Ring-necked Snake	*Diadophis punctatus*							0
Chihuahuan Hook-nosed Snake	*Gyalopion canum*							0
Plains Hog-nosed Snake	*Heterodon nasicus*							0
Texas Nightsnake	*Hypsiglena jani texana*			1				1
Sonoran Gopher Snake	*Pituophis catenifer affinis*							0
Long-nosed Snake	*Rhinocheilus lecontei*				1			1
Mountain Patch-nosed Snake	*Salvadora grahamiae grahamiae*					1		1
Desert Massasauga	*Sistrurus tergeminus edwardsii*		1				1	2
Amphibian								
Couch's Spadefoot	*Scaphiopus couchii*				1			1
Mexican Spadefoot	*Spea multiplicata*				1			1
Total		**20**	**9**	**23**	**10**	**7**	**9**	**78**
Percent Total Capture per Site		**40.00**	**32.14**	**46.00**	**35.71**	**14.00**	**32.14**	
Percent Total Capture		**37.18**		**42.31**		**20.51**		

SCD = SC Dome spp. = unknown species WTA3 = west of Technical Area III

7.3 Remote Camera Surveillance

Ecology Program personnel have conducted passive surveillance for a diversity of wildlife in various habitats since 2005.

7.3.1 Remote Camera Stations

Wildlife water guzzlers, commonly used throughout the arid western United States, capture and store precipitation (rainfall and snowfall) for use by wildlife. Wildlife may rely on these artificial water sources to help meet their biologic and metabolic needs during times of water stress (Krausman et al. 2006). Two guzzlers are maintained on DOE-permitted or fee-owned land: the Madera Canyon Guzzler in a closed canopy woodland, and the Range Wildlife Guzzler in a shrub, open woodland, and grassland habitat. The guzzlers consist of a catchment system, a storage tank, and a ground-level open-water trough.

Automated cameras have been maintained at the two wildlife guzzlers since July 2005. The motion-activated cameras provide a safe, passive, and cost-effective method of sampling animal populations with little to no effect on the individual animals. The cameras record wildlife that are using the water sources day and night year-round, documenting the presence, abundance, diversity, and activity of medium- and large-sized mammals. The cameras also record birds, reptiles, and amphibians, thus enhancing understanding of these species.

7.3.2 Madera Canyon Guzzler Results

In 2018, 39 different species were captured in images at the Madera Canyon Guzzler (Table 7-3). Camera sensitivity settings were adjusted to help eliminate the majority of small bird images, as other more effective methods are employed to count and survey birds (including bird banding and surveys using transects). This allowed cameras to capture guzzler use by medium- and large-sized wildlife, including mammals, raptors, and other large birds.

Table 7-3. Madera Canyon Guzzler species occurrences, 2018

Species		2018 Occurrences	Months Occurred[a]
Common Name	**Latin Name**	**Total**	**Total**
American Black Bear	*Ursus americanus*	59	3
American Robin	*Turdus migratorius*	68	6
Black-headed Grosbeak	*Pheucticus melanocephalus*	154	3
Black-tailed Jackrabbit	*Lepus Californicus*	22	3
Bobcat	*Felis rufus*	3	1
Brown Thrasher	*Toxostoma rufum*	2	1
Canyon Towhee	*Pipilo fuscus*	9	4
Chipping Sparrow	*Spizella passerina*	3	1
Common Raven	*Corvus corax*	579	5
Cooper's Hawk	*Accipiter cooperii*	4	2
Cougar	*Puma concolor*	48	8
Coyote	*Canis latrans*	27	5
Dark-eyed Junco	*Junco hyemalis*	4	1
Desert Cottontail	*Sylvilagus audobonii*	13	1
Eurasian-collared Dove	*Stretopelia decaocto*	2	1
Gray Fox	*Urocyon cineroargenteus*	450	11
Great Horned Owl	*Bubo virginianus*	15	3
Hepatic Tanager	*Piranga flava*	3	1
House Finch	*Carpodacus mexicanus*	130	3
Juniper Titmouse	*Baeolophus ridgway*	1	1
Lesser Goldfinch	*Carduelis psaltria*	3	1
Mourning Dove	*Zenaida macroura*	996	4
Mule Deer	*Odocoileus hemionus*	812	10
Northern Mockingbird	*Mimus polyglottis*	64	3
Pinyon Jay	*Gymnorhinus cyanocaphalus*	8	2
Red-shafted Flicker	*Colaptes auratus*	9	1
Rock Squirrel	*Spermophilus variegatus*	34	4
Sage Thrasher	*Oreoscoptes montanus*	3	1
Say's Phoebe	*Sayornis saya*	4	1

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Table 7-3. Madera Canyon Guzzler species occurrences, 2018 (continued)

Species		2018 Occurrences	Months Occurred[a]
Common Name	**Latin Name**	**Total**	**Total**
Steller's Jay	*Cyanocitta stelleri*	7	1
Striped Skunk	*Mephitis mephitis*	171	6
Townsend's Solitaire	*Myadestes townsendi*	8	2
Turkey Vulture	*Cathartes aura*	58	3
Western Bluebird	*Sialia mexicana*	4	2
Western Kingbird	*Tyrannus verticalis*	13	2
Western Tanager	*Piranga ludoviciana*	1	1
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*	195	6
White-winged Dove	*Zenaida asiatica*	351	4
Yellow-headed Blackbird	*Xanthocephalus Xanthocephlaus*	1	1

[a] No data was collected in February 2018.

In 2018, five new bird species were captured by the Madera Canyon Guzzler camera: Brown Thrasher (*Toxostoma rufum)* (Figure 7-3), Eurasian-collared Dove (*Stretopelia decaocto*), Hepatic Tanager (*Piranga flava)*, Steller's Jay (*Cyanocitta stelleri*) (Figure 7-4), and Yellow-headed Blackbird *Xanthocephalus Xanthocephlaus)*. These species have been documented onsite through other means of wildlife monitoring specific to birds.

Since June 2005, 69 species have been recorded and identified at the Madera Canyon Guzzler. Of these, seven species have been documented in each calendar year since monitoring with remote-sensor cameras began. These include: 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 Red-shafted Flicker (*Colaptes auratus*). An additional 12 species have been documented at the Madera Canyon Guzzler that have not been recorded using the Range Wildlife Guzzler. These are: Audubon's Warbler (*Setophaga coronata audubon*i), Brown Thrasher, Brown-headed Cowbird (*Molothrus ater*), Curve-billed Thrasher (*Toxostoma curvirostre*), Eurasian-collared Dove, Hepatic Tanager, Lark Sparrow (*Chondestes grammacus*), Steller's Jay, Turkey Vulture (*Cathartes aura*), Wild Turkey (*Meleagris gallopavo*), white-tailed deer (*Odocoileus virginianus*), and Yellow-headed Blackbird.

Figure 7-3. A Brown Thrasher (*Toxostoma rufum*) runs in front of the Madera Canyon Guzzler

Figure 7-4. A Steller's Jay (*Cyanocitta stelleri*) takes some time to preen at the Madera Canyon Guzzler

American Black Bears have been documented using the Madera Canyon Guzzler each year since monitoring began in 2005. They appear on average in 78 images per year. The most active time is March through September, being their active season before hibernation. In 2018, black bears were recorded in 59 images, representing 19 events (visits). Two bears frequented the guzzler in 2018. Figure 7-5 shows a bear leaving the guzzler after taking a dip. No cubs were recorded visiting the guzzler in 2018. Studies have been done on animal patterns based on food availability; the major limiting factor in cub survival and sow reproduction (Costello et al. 2003). Sows only breed every other year and will not deposit fertilized eggs if conditions are unfavorable.

Figure 7-5. An American Black Bear (*Ursus americanus*) leaves the Madera Canyon Guzzler after taking a dip

A Cougar (*Puma concolor*), also known as a Mountain Lion or Puma, appeared in 48 images over eight months. This is close to the average of 37 images per year recorded from 2005 to 2018. Most of the images were from two different individuals (Figure 7-6). One of the individuals had been collared, part of an ongoing collaboration between KAFB and New Mexico State University researchers studying large predators. Cougars can breed during any month of the year, but typically most cub births occur between May and October. Because there is such a wide range in which breeding and birthing occurs, it is difficult to determine with certainty the age of Cougars.

Figure 7-6. A Cougar (*Puma concolor*) visiting the Madera Canyon Guzzler in June 2018

Mule Deer (*Odocoileus hemionus*) had the most recorded sightings at the Madera Canyon Guzzler in 2018 with a total of 812 images. This is close to the average of 778 photos annually. The number of images remained higher throughout the fall and winter months. They reached their peak abundance in December with a total of 177 images; in previous years, this peak occurred in the summer months prior to the start of monsoonal rains. This year, the majority of images came from individuals and pairs of does and bucks, as opposed to herds (Figure 7-7).

Figure 7-7. A Mule Deer (*Odocoileus hemionus*) buck attempts to break the ice covering the Madera Canyon Guzzler

7.3.3 Range Wildlife Guzzler Results

In 2018, 19 species were documented using the Range Wildlife Guzzler (Table 7-4). Lower numbers of species were documented than in previous years, likely as a result of using less sensitive camera settings than in the past; the current camera settings target medium- and large-sized wildlife to the exclusion of smaller species. Coyotes, Gray Fox, and Mule Deer continuously visited the guzzler throughout the year, while other species tended to show up in the season leading up to and following monsoonal rains.

Since monitoring began at the Range Wildlife Guzzler, 73 species have been documented in remote-sensor camera images. Additionally, toads, bats, and other small mammals have been captured in

images but were not identified to the species level. This brings the number of animals documented at the Range Wildlife Guzzler to 77.

Two species have been observed in images at the Range Wildlife 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 Wildlife Guzzler that have not been recorded 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*).

Table 7-4. Range Wildlife Guzzler species occurrences, 2018

Species		2018 Occurrences	Months Occurred
Common Name	Latin Name	Total	Total
Black-tailed Jackrabbit	*Lepus californicus*	1	1
Chipping Sparrow	*Spizella passerina*	11	1
Cooper's Hawk	*Accipiter cooperii*	20	2
Cougar	*Puma concolor*	15	3
Coyote	*Canis latrans*	495	10
Golden Eagle	*Aquila chrysaetos*	44	4
Gray Fox	*Urocyon cineroargenteus*	66	8
Great Horned Owl	*Bubo virginianus*	9	2
Greater Roadrunner	*Geococcyx californianus*	3	1
Lark Sparrow	*Chondestes grammacus*	6	2
Lazuli Bunting	*Passerina amoena*	1	1
Mourning Dove	*Zenaida macroura*	135	5
Mule Deer	*Odocoileus hemionus*	2,799	11
Northern Mockingbird	*Mimus polyglottis*	4	1
Pinyon Jay	*Gymnorhinus cyanocephalus*	6	2
Toad spp.	*Bufo* spp.	329	2
Townsend's Solitaire	*Myadestes townsendi*	3	1
Western Bluebird	*Sialia mexicana*	2	1
Western Diamondback	*Crotalus atrox*	39	1

spp. = unknown species

Mule Deer were observed using the Range Wildlife Guzzler in every month of 2018 (February yielded no data due to technical difficulties). A total of 2,799 images, representing approximately 933 events, were captured of Mule Deer, making them the species most often recorded during the year. Coyote (*Canis latrans*) were the next highest recorded species in 495 images representing 165 events (Figure 7-8). A sole Gray Fox was recorded at the guzzler in eight months of 2018 (Figure 7-9); this appears to be the same individual recorded at the Range Wildlife Guzzler in 2016 and 2017. All other recorded species were seen less frequently.

December had the most captured images of Mule Deer with a total of 543 images. November was next with 474 total captured images. This compared to 2017 data, where December and November months had a combined total of 3,382 images. A greater dispersal of rain events in 2018 could account for the lower annual numbers at the Range Wildlife Guzzler when compared to 2017; in other words, the animals didn't need to rely on the guzzler for water as much in 2018.

Figure 7-8. A pair of Coyotes (*Canis latrans*) were documented at the Range Wildlife Guzzler throughout August 2018

Figure 7-9. A Gray Fox (*Urocyon cinereoargenteus*) visits the guzzler in April 2018

7.4 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 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.

7.4.1 Bird Surveys Using Transects

In 2018, bird surveys were conducted during the breeding season (May through June) and in the winter months (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 is surveyed three times during both the winter bird surveys and the breeding bird surveys. 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.

Winter Bird Transect Survey Results

Forty-seven bird species (and two undetermined species) were encountered during the 2017–2018 winter bird survey season**.** Table 7-5 presents the species, scientific name, and numbers of individuals detected by transect during the winter bird survey in 2018.

Table 7-5. Winter bird survey species detections, 2018

Species		Total
Common Name	**Scientific Name**	
Mourning Dove	*Zenaida macroura*	2
Northern Harrier	*Circus hudsonius*	1
Sharp-shinned Hawk	*Accipiter striatus*	1
Williamson's Sapsucker	*Sphyrapicus thyroideus*	1
Ladder-backed Woodpecker	*Picoides scalaris*	10
Hairy Woodpecker	*Picoides villosus*	6
Northern Flicker	*Colaptes auratus*	6
American Kestrel	*Falco sparverius*	1
Prairie Falcon	*Falco mexicanus*	1
Say's Phoebe	*Sayornis saya*	3
Loggerhead Shrike	*Lanius ludovicianus*	7
Pinyon Jay	*Gymnorhinus cyanocephalus*	30
Woodhouse's Scrub-Jay	*Aphelocoma woodhouseii*	7
Common Raven	*Corvus corax*	15
Raven spp.	*Corvus* spp.	3
Horned Lark	*Eremophila alpestris*	555
Mountain Chickadee	*Poecile gambeli*	13
Juniper Titmouse	*Baeolophus ridgway*	37
Bushtit	*Psaltriparus minimus*	9
Red-breasted Nuthatch	*Sitta canadensis*	2
White-breasted Nuthatch	*Sitta carolinensis*	3
Brown Creeper	*Certhia americana*	1
Rock Wren	*Salpinctes obsoletus*	2
Canyon Wren	*Catherpes mexicanus*	1
Bewicks's Wren	*Thryomanes bewickii*	6
Cactus Wren	*Campylorhynchus brunneicapillus*	3
Golden-crowned Kinglet	*Regulus satrapa*	2
Western Bluebird	*Sialia mexicana*	55
Mountain Bluebird	*Sialia currucoides*	87
Townsend's Solitaire	*Myadestes townsendi*	30
American Robin	*Turdus migratorius*	16
Curve-billed Thrasher	*Toxostoma curvirostre*	2
Crissal Thrasher	*Toxostoma crissale*	8
Sage Thrasher	*Oreoscoptes montanus*	13
Cedar Waxwing	*Bombycilla cedrorum*	2
House Finch	*Haemorhous mexicanus*	46
Cassin's Finch	*Haemorhous cassinii*	1
Pine Siskin	*Spinus pinus*	1

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Table 7-5. Winter bird survey species detections, 2018 (continued)

Species		Total
Common Name	**Scientific Name**	
Spotted Towhee	*Pipilo maculatus*	4
Rufous-crowned Sparrow	*Aimophila ruficeps*	2
Canyon Towhee	*Melozone fusca*	6
Song Sparrow	*Melospiza melodia*	3
Lincoln's Sparrow	*Melospiza lincolnii*	1
White-crowned Sparrow	*Zonotrichia leucophrys*	17
Dark-eyed Junco	*Junco hyemalis*	147
Eastern Meadowlark	*Sturnella magna*	3
Western Meadowlark	*Sturnella neglecta*	29
Meadowlark spp.	*Sturnella* spp.	1

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

Breeding Bird Transect Survey Results

In 2018, 66 bird species (and 2 undetermined species) were seen or heard while conducting the breeding bird surveys. Table 7-6 presents the species, scientific name, and numbers of individuals detected by transect during breeding bird surveys in 2018. Some individuals encountered during the first survey period were likely late migrants or winter resident birds that had not yet departed to their breeding grounds.

Table 7-6. Breeding bird survey species detections, 2018

Species		Total
Common Name	**Scientific Name**	
Scaled Quail	*Callipepla squamata*	6
Wild Turkey	*Meleagris gallopavo*	1
Eurasian Collared Dove	*Streptopelia decaocto*	1
White-winged Dove	*Zenaida asiatica*	8
Mourning Dove	*Zenaida macroura*	36
Black-chinned Hummingbird	*Archilochus alexandri*	11
Broad-tailed Hummingbird	*Selasphorus platycercus*	6
Killdeer	*Charadrius vociferus*	1
Swainson's Hawk	*Buteo swainsoni*	7
Red-tailed Hawk	*Buteo jamaicensis*	2
Burrowing Owl	*Athene cunicularia*	1
Ladder-backed Woodpecker	*Picoides scalaris*	8
Hairy Woodpecker	*Picoides villosus*	3
American Kestrel	*Falco sparverius*	6
Western Wood Pewee	*Contopus sordidulus*	17
Gray Flycatcher	*Empidonax wrightii*	9
Say's Phoebe	*Sayornis saya*	28
Ash-throated Flycatcher	*Myiarchus cinerascens*	40
Cassin's Kingbird	*Tyrannus vociferans*	13
Western Kingbird	*Tyrannus verticalis*	11

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Table 7-6. Breeding bird survey species detections, 2018 (continued)

Species		Total
Common Name	**Scientific Name**	
Loggerhead Shrike	*Lanius ludovicianus*	6
Gray Vireo	*Vireo vicinior*	20
Plumbeous Vireo	*Vireo plumbeus*	17
Warbling Vireo	*Vireo gilvus*	1
Pinyon Jay	*Gymnorhinus cyanocephalus*	7
Woodhouses's Scrub Jay	*Aphelocoma woodhouseii*	13
Chihuahuan Raven	*Corvus cryptoleucus*	1
Common Raven	*Corvus corax*	7
Horned Lark	*Eremophila alpestris*	90
Cliff Swallow	*Petrochelidon pyrrhonota*	13
Barn Swallow	*Hirundo rustica*	10
Swallow spp.	N/A	1
Mountain Chickadee	*Poecile gambeli*	4
Juniper Titmouse	*Baeolophus ridgwayi*	18
Bushtit	*Psaltriparus minimus*	56
White-breasted Nuthatch	*Sitta carolinensis*	2
Rock Wren	*Salpinctes obsoletus*	8
Canyon Wren	*Catherpes mexicanus*	1
Bewick's Wren	*Thryomanes bewickii*	35
Cactus Wren	*Campylorhynchus brunneicapillus*	4
Blue-gray Gnatcatcher	*Polioptila caerulea*	8
Western Bluebird	*Sialia mexicana*	4
Curve-billed Thrasher	*Toxostoma curvirostre*	2
Northern Mockingbird	*Mimus polyglottos*	113
House Finch	*Haemorhous mexicanus*	92
Lesser Goldfinch	*Spinus psaltria*	5
Spotted Towhee	*Pipilo maculatus*	42
Rufous-crowned Sparrow	*Aimophila ruficeps*	5
Canyon Towhee	*Melozone fusca*	11
Cassin's Sparrow	*Peucaea cassinii*	52
Chipping Sparrow	*Spizella passerina*	3
Black-chinned Sparrow	*Spizella atrogularis*	27
Lark Sparrow	*Chondestes grammacus*	12
Black-throated Sparrow	*Amphispiza bilineata*	40
Eastern Meadowlark	*Sturnella magna*	51
Western Meadowlark	*Sturnella neglecta*	25
Meadowlark spp.	*Sturnella* spp.	1
Bullock's Oriole	*Icterus bullockii*	3
Scott's Oriole	*Icterus parisorum*	17
Brown-headed Cowbird	*Molothrus ater*	16
MacGillivray's Warbler	*Geothlypis tolmiei*	1
Yellow-rumped Warbler	*Setophaga coronata*	2
Black-throated Gray Warbler	*Setophaga nigrescens*	18

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Table 7-6. Breeding bird survey species detections, 2018 (continued)

Species		Total
Common Name	**Scientific Name**	
Hepatic Tanager	*Piranga flava*	4
Western Tanager	*Piranga ludoviciana*	3
Black-headed Grosbeak	*Pheucticus melanocephalus*	39
Blue Grosbeak	*Passerina caerulea*	5

Note: Species are listed by taxonomic classification.
N/A = not applicable
spp. = unknown species

7.4.2 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.

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.

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). Additionally, 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, a total of 117 individual birds representing 25 species were captured and released in 2018. Of these, 95 were newly banded, 19 were banded previously (repeats), and 3 were released without being banded. The number of birds captured per net hour for the MAPS season was 0.25 (470.0 total net hours). For 2018, the four most abundant captured species were: Black-throated Sparrow (24), Bushtit (12), Northern Mockingbird (12), and Gray Flycatcher (11).

The 2018 capture rate (25.0 birds per 100 net hours) was above the average rate of 21.2 birds per 100 net hours from all previous years. However, the MAPS season analysis of total birds per net hour over the past 15 years continues to show an overall downward trend (Figure 7-10).

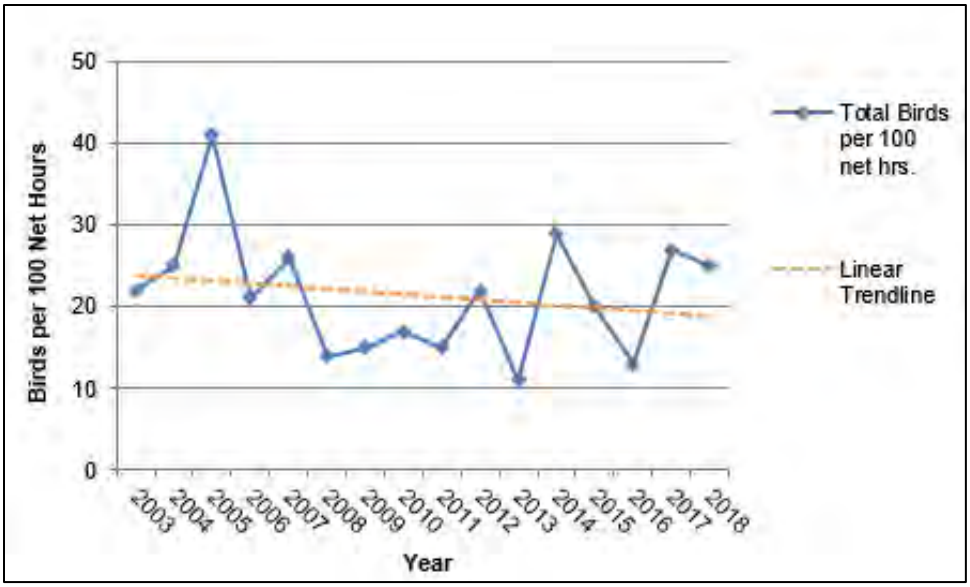

Figure 7-10. Linear trend of all birds captured during the MAPS monitoring project, 2003–2018

Fall Migration Banding: Monitoring Results

Fall migration monitoring has been conducted annually since 2003. Ecology Program personnel monitor birds weekly from early August through late October. 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 2018 fall migration monitoring, a total of 189 birds were captured, representing 36 species. Of the 189 birds, 174 were newly banded, 11 were banded previously (repeats), and 4 were released without being banded. The average number of birds banded per net hour was 0.38 (495.4 total net hour), or 38 birds per 100 net hours. The average number of birds banded over the 16-year period from 2003 to 2018 was 0.27 birds per net hour, or 27 birds per 100 net hours.

The three most abundant captured species during the fall migration monitoring were: Chipping Sparrow (65), Wilson's Warbler (17), and Gray Flycatcher (13).

Of note, a Northern Mockingbird recaptured in 2018 was first banded in 2012 as a two-year-old (Figure 7-11). This individual at time of recapture was eight years old.

Figure 7-11. Northern Mockingbird (*Mimus polyglottos*)

The fall migration monitoring continues to show a downward trend for total birds per 100 net hours from 2003 through 2018 (Figure 7-12), even though the past several seasons' capture rates were above average.

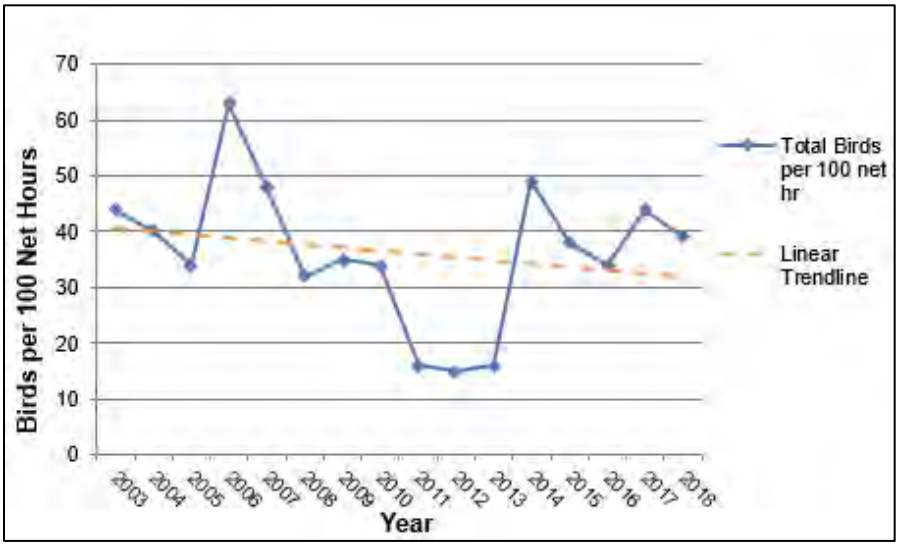

Figure 7-12. Linear trend of all birds captured during the fall migration monitoring project, 2003–2018

7.5 Eco Ticket System for Monitoring Wildlife

In 2013, Ecology Program personnel launched an Eco Ticket system. This is a web-based software program that helps to provide prompt notification and timely communication with personnel who have issues or concerns with wildlife they encounter. 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 ways of appropriately managing wildlife within high report areas, which coincides with the Ecology Program mission.

Use of this system by personnel has been increasing steadily. Facilities and Emergency Management Center personnel use the system most frequently, supporting work orders that require biological surveys. Individuals most commonly submit Eco Ticket requests for assistance with wildlife issues, which may include snakes, bird nests, injured or trapped wildlife, and dead wildlife. Sorting and analyzing the ticket types adds to understanding the dynamics of wildlife issues at SNL/NM.

In 2018, tickets relating to mammals decreased, specifically those concerning urban wildlife. Urban wildlife include species, such as striped skunks or raccoons, that occur in conjunction with areas developed by humans. An educational campaign by Ecology Program personnel may have contributed to decreasing the interactions with urban wildlife. Urban wildlife and other mammals often reported through the Eco Ticket system include Desert Cottontails (*Sylvilagus audubonii*), Striped Skunks (*Mephitis mephitis*), and Raccoons (*Procyon lotor*). Badgers (*Taxidea taxus*), Coyotes (*Canis latrans*), Black-tailed Jackrabbits (*Lepus californicus*), and Bobcats (*Felis rufus)* have also been reported in smaller quantities. Most of the mammals reported are within TA-I, TA-II, and TA-IV.

Many of the urban mammals reported are very resourceful and highly adaptable, so, when paired with available food, shelter, and water resources, there is no reason for these animals to move away from urban life (Dell'Amore 2016). Manipulating their habitat is the best means of controlling their presence in an urban setting (Cecil 2016). Other wildlife reported include reptiles, amphibians, a plethora of bird species, and some insects, all of which are monitored through the Eco Ticket system.

7.5.1 Eco Ticket Responses

Ecology Program personnel respond to Eco Ticket system requests in various ways, which are discussed below.

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 identify birds protected under the Migratory Bird Treaty Act. The surveys also search for signs of other federal- and state-protected wildlife.

Wildlife Response

For Eco Tickets pertaining to a wildlife issue, Ecology Program personnel will 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 whether inside or outside 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 an appropriate habitat.

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

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

7.5.2 Eco Ticket System Results

In 2018, Ecology Program personnel responded to 392 Eco Tickets.

There were 6 reported skunk sightings throughout the year; in two cases the animal had to be relocated. This is down from 32 reported skunk sightings in 2017. There were only 2 sightings in 2014 and 2015 combined. Because of their defensive behaviors, reports of skunks in urban areas have been known to be out of proportion to their actual urban densities (Bateman and Fleming 2012). Data will continue to be monitored to gain a better understanding of their presence and abundance at SNL/NM.

Reported sightings also dropped for raccoons in 2018, with 4 individuals reported compared to 7 in 2017. Only 2 raccoon sightings were reported in 2015. Food and water availability within urban habitats provide a favorable living environment (Bateman and Fleming 2012), which can cause these animals to seek shelter close to humans. These animals will also continue to be tracked with data from Eco Tickets in subsequent years.

Desert cottontails are common along edge habitat at SNL/NM. Unfortunately, most of the rabbits encountered are deceased, likely due to their presence along roadways. Only 6 rabbits were reported in 2018, 5 of which were deceased or passed from injuries shortly after a biologist arrived.

There were three confirmed sightings of a bobcat in 2018. The three sightings are mostly likely of the same individual. Biologists also encountered a Gunnison's prairie dog (*Cynomys gunnisoni*) that was trapped inside a building this year.

7.6 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).

Jennifer Payne, an ecologist at Sandia, is one of two Certified Ecological Restoration Practitioners in New Mexico, a title held by only 150 people in the country.

Ecology Program personnel have been providing ecological restoration guidance and support to a variety of projects since 2009. The successful recovery of degraded lands in central New Mexico is extremely challenging. SNL/NM resides in an arid climate that receives less than nine inches of precipitation per year, experiences drying winds in the spring, and has hot summers and cold winters. Prior to Ecology Program personnel becoming involved with the restoration of degraded sites, reseeding efforts 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 determine 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.

7.6.1 Ecological Restoration Support Role

Ecology Program personnel provide support on projects to improve the quality of degraded land. Ecological restoration projects are most often related to construction activities, commonly in support of the Stormwater Pollution Prevention Plan development process. When possible, a biological evaluation of an area is conducted to document the native biological community prior to beginning activities that will disturb the earth. If a pre-disturbance evaluation of the area is not possible, 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 in planning the restoration work. Ecology Program personnel develop a detailed written restoration plan, or specification, for the project. This is provided to Facilities 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 2018, Ecology Program personnel supported the following ecological restoration projects:

- TA-IV Escarpment—A restoration plan was developed and then revised several times as the project parameters changed on this 9-acre project. Construction is planned for 2019.
- TA-V Waterline—A site evaluation was conducted, and a restoration plan was developed and sent to the Facilities and Emergency Management 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.
- 5K Volt Feeder Line—A site evaluation was conducted, and a restoration plan was developed and sent to the Facilities and Emergency Management project manager.
- TA-II Battery Test Facility—The restoration plan for this project was updated in 2018 as the construction project evolved. Construction was completed at the end of 2018, and restoration is planned for 2019.
- TA-III Roadway—A site evaluation was conducted, and a restoration plan was developed and sent to the Facilities and Emergency Management project manager for this dirt roadway area.
- Building 9972 Telecommunications Line—Ecological restoration of this 2.5-acre project area concluded with the establishment of native seedlings across the project area in July 2018. Native vegetation became well developed across the area by October 2018.

Additional activities included monitoring restoration projects (completed in previous years) during the 2018 growing season for their ecological recovery trajectories.

7.7 Federally Listed and State-Listed Threatened, Endangered, and Sensitive Species

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

A few mammal species protected by the State of New Mexico have been encountered within KAFB boundaries (Table 7-7). 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 7-7. Federally listed and state-listed threatened, endangered, and other sensitive species 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 hudsonius luteus*	Endangered and critical habitat	Endangered	
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii*	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	
Birds				
Aplomado Falcon	*Falco femoralis*	Endangered	Endangered	
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	Species of concern	Threatened	
Baird's Sparrow	*Ammodramus bairdii*	Species of concern	Threatened	
Bald Eagle	*Haliaeetus leucocephalus*	—	Threatened	✓
Bell's Vireo	*Vireo bellii*	Species of concern	Threatened	✓
Black Swift	*Cypseloides niger*	—	Sensitive	
Broad-billed Hummingbird	*Cynanthus latirostris*	—	Threatened	
Brown Pelican	*Pelecanus occidentalis*	—	Endangered	
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	—	✓

Table continued on next page

Table 7-7. Threatened, endangered, and other sensitive species occurring or 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 (continued)				
White-eared Hummingbird	*Hylocharis leucotis*	—	Threatened	
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	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 April 18, 2018. 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 (ISO 2008), the Contractor Requirements Document of DOE Order 414.1D (DOE O 414.1D Admin Change 1), *Quality Assurance,* and in 10 CFR 830 (10 CFR 830), *Nuclear Safety Management*, 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 sample collection, sample preservation and handling, sample control, laboratory quality control, required limits of detection, field quality control, health and safety, schedules and frequency of sampling, data review, 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, personnel provide guidance and sample management support for field activities. However, program leads are responsible for each distinct 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 (QAPP) for the Sample Management Office* (SNL/NM 2016b). 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 2018c). 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. Additionally, sample results can be affected by the variability present at each sample location.

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

Quality control sample results are compared either to statistically established control criteria or to prescribed acceptance control limits. Analytical results generated concurrently with quality control sample results within established limits are considered acceptable. If quality control analytical results exceed control limits, the results are qualified and corrective action is initiated if warranted. Reanalysis is then performed for samples in the analytical batch as specified in the Statement of Work and 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 the 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.

Additionally, 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.

Western Diamondback (*Crotalus atrox*)

8.2 Sample Management Office Activities

Sample Management Office activities in 2018 included sample packaging, shipping, and tracking to off-site contracted laboratories, and reviewing all data deliverables for compliance with contract and data quality requirements.

8.2.1 Sample Handling and Analyses

In 2018, Sample Management Office personnel processed 3,910 samples in support of programs and projects at SNL/NM. Of the 3,910 samples, 952 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 2018:

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

- Waste Management
- Water Quality

During 2018, the following contract laboratories were employed to analyze samples:

- ALS Environmental in Salt Lake City, Utah
- Amplified Geochemical Imaging in Newark, Delaware
- Cape Fear Analytical in Wilmington, North Carolina
- General Engineering Laboratories in Charleston, South Carolina
- Hall Environmental Analysis Laboratory in Albuquerque, New Mexico
- Landauer in Glenwood, Illinois
- Pace Analytical Energy Services in Pittsburgh, Pennsylvania
- Radonova in Westmont, Illinois
- SiREM Laboratory in Guelph, Ontario, Canada
- Southwest Research Institute in San Antonio, Texas
- State of New Mexico Department of Health in Albuquerque, New Mexico
- TestAmerica Laboratories in St. Louis, Missouri; Richland, Washington; and West Sacramento, California

In 2018, Sample Management Office personnel processed 3,910 samples in support of programs and projects at SNL/NM.

8.2.2 Laboratory Quality Assurance Assessments and Validation

In 2018, 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 how 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 United States Department of Defense/DOE *Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (DoD/DOE 2017), which guides DOECAP audits.

In 2018, DOECAP and/or the accrediting bodies conducted assessments at six 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 2018 in DOECAP assessment reports or other applicable DOE programs.

Chapter 9. Permits, Regulations, and Standards for Environmental Programs

Lady Beetle (*Coccinellidae*)

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

Table 9-1 through Table 9-3 summarize various permits, regulations, and standards that define environmental programs and compliance with those requirements.

Table 9-1. Summary of environmental permits and registrations in effect, 2018

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	4/1/2014	3/31/2019	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	9/1/2014	7/31/2019	ABCWUA
General	WW011 Station Manhole, north of TA-III (includes TA-III and TA-V, and Coyote Test Field sewer lines)	2069K	11/1/2014	9/30/2019	ABCWUA
Center for Integrated Nanotechnologies	Center for Integrated Nanotechnologies	2238A	5/1/2016	4/30/2021	ABCWUA

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Table 9-1. Summary of environmental permits and registrations in effect, 2018 (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	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	1374	7/1/2018	6/30/2019	NMED
Underground Storage Tank (20,000 gallons)	TA-I	1375	7/1/2018	6/30/2019	NMED
Underground Storage Tank (10,000 gallons)	TA-I	1379	7/1/2018	6/30/2019	NMED
Aboveground Storage Tanks					
Aboveground Storage Tank (3,020 gallons)	TA-I	1371	7/1/2018	6/30/2019	NMED
Aboveground Storage Tank (2,119 gallons)	TA-I	1372	7/1/2018	6/30/2019	NMED
Aboveground Storage Tank (2,000 gallons)	TA-I	1373	7/1/2018	6/30/2019	NMED
Aboveground Storage Tank (5,000 gallons)	TA-III	1376	7/1/2018	6/30/2019	NMED
Aboveground Storage Tank (5,500 gallons)	Coyote Test Field	1377	7/1/2018	6/30/2019	NMED
Aboveground Storage Tank (4,500 gallons)	TA-IV	1378	7/1/2018	6/30/2019	NMED
Aboveground Storage Tank (1,500 gallons)	TA-I	1380	7/1/2018	6/30/2019	NMED
NPDES Rio Grande Watershed-Based Municipal Separate Storm Sewer System Permit					
NPDES Multi Sector General Permit	TA-I, TA-II and TA-IV	NTESS: NMR053122 DOE/SFO: NMR053114	12/22/2015 (NTESS) 11/18/2015 (DOE/SFO)	12/19/2019	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
NPDES Construction General Permit					
Laser Applications Facility	TA-I	NTESS: NMR1000B7	5/22/2017	Notice of Intent terminated 1/16/2018	EPA
Dynamic Explosives Test Site Thunder Range	Thunder Range	NTESS: NMR1000FD DOE/SFO: NMR1000F2	5/30/2017	Notice of Intent terminated 7/18/2018	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

Table continued on next page

Table 9-1. Summary of environmental permits and registrations in effect, 2018 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
NPDES Construction General Permit (continued)					
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
Telecommunications Cable Installation to Building 9972	Coyote Test Field	NTESS: NMR1000FI	5/30/2017	Notice of Intent terminated 11/28/2018	EPA
Division 6000 Igloos	Division 6000 Igloos	NTESS: NMR1000FJ	5/30/2017	Construction General Permit expires 2/16/2022	EPA
TA-III Road Replacement	TA-III	NTESS: NMR1000FK	5/30/2017	Notice of Intent terminated 7/18/2018	EPA
Reestablish North Drainage Channel and Address Erosion at Building 970	TA-IV	NTESS: NMR1001GM	8/1/2018	Notice of Intent terminated 10/22/2018	EPA
Building 9920 to Building 9956 Fiber Line	Coyote Test Field	NTESS: NMR1000FL	5/30/2017	Notice of Intent terminated 11/28/2018	EPA
956 Running Track	TA-II	NTESS: NMR1001CC	6/6/2018	Notice of Intent terminated 12/18/2018	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
Ecological					
New Mexico Department of Game and Fish Nuisance Permit	Site-wide ecological monitoring activity	119	3/25/2017	3/31/2019	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	2931	4/4/2017	12/31/2019	New Mexico Department of Game and Fish
Hazardous Waste Permit (Post-Closure Care)	Chemical Waste Landfill	NM5890110518	Issued 10/15/2009; effective 6/2/2011	6/2/2021	NMED

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Table 9-1. Summary of environmental permits and registrations in effect, 2018 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
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
Open Burning/Detonation					
Explosives Testing	Building 9920 Test Site	18-0004	1/1/2018	12/31/2018	City of Albuquerque
Improved Explosive Device and Homemade Explosives Testing and Training	Building 9930 Test Site	18-0005	1/1/2018	12/31/2018	City of Albuquerque
High Heat Flux Tests	Solar Tower	18-0006	1/1/2018	12/31/2018	City of Albuquerque
Explosive Tests	Rocket Sled Track	18-0007	1/1/2018	12/31/2018	City of Albuquerque
Thermal Treatment Unit	Thermal Treatment Unit	18-0008	1/1/2018	12/31/2018	City of Albuquerque
Crude Oil Combustion and Fuel Fire Experiments	Burn Site	18-0009	1/1/2018	12/31/2018	City of Albuquerque
Explosives Testing	Building 9939 Test Site	18-0010	1/1/2018	12/31/2018	City of Albuquerque
Explosives Testing	Thunder Range	18-0011	1/1/2018	12/31/2018	City of Albuquerque
Explosive Applications–Terminal Ballistics Facility	Building 6750	18-0012	1/1/2018	12/31/2018	City of Albuquerque
Thermite Applications–Terminal Ballistics Facility	Building 6750	18-0013	1/1/2018	12/31/2018	City of Albuquerque
Propellant Applications–Terminal Ballistics Facility	Building 6750	18-0014	1/1/2018	12/31/2018	City of Albuquerque
Explosives Training and Testing	Dynamic Explosives Test Site	18-0015	1/1/2018	12/31/2018	City of Albuquerque
Crude Oil Fire Ball Tests	Pad 6742B Test Site	18-0027	6/1/2018	12/31/2018	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

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Table 9-1. Summary of environmental permits and registrations in effect, 2018 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
Stationary Source (Air) (continued)					
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-M2	1/20/2014	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
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

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Table 9-1. Summary of environmental permits and registrations in effect, 2018 (continued)

Permit Type and/or Facility Name	Location	Permit/Registration Number	Issue Date	Expiration Date	Regulatory Agency
Stationary Source (Air) (continued)					
Building 891 Boiler	TA-I	Registration 2119	11/29/2010	N/A	City of Albuquerque
Building 892 Boiler	TA-I	Registration 2120	11/30/2010	N/A	City of Albuquerque
Building 894 Boiler	TA-I	Registration 2121	11/30/2010	N/A	City of Albuquerque
Building 897 Boiler	TA-I	Registration 2122	11/30/2010	N/A	City of Albuquerque
Building 960 Boiler	TA-IV	Registration 2169	9/27/2011	N/A	City of Albuquerque
Building 895 Boiler	TA-I	Registration 2170	9/27/2011	N/A	City of Albuquerque
Building 800 Boiler	TA-I	Registration 2171	9/27/2011	N/A	City of Albuquerque
Building 6585 Boiler	TA-V	Registration 2172-RV1	1/26/2012	N/A	City of Albuquerque
Building 6597 Boiler	TA-V	Registration 2173	2/10/2012	N/A	City of Albuquerque
Building 6580 Boiler	TA-V	Registration 2174-RV1	2/26/2012	N/A	City of Albuquerque
Building 981 Boiler	TA-IV	Registration 2175	9/22/2011	N/A	City of Albuquerque
Building 983 Boiler	TA-IV	Registration 3111	9/13/2013	N/A	City of Albuquerque
Building 963 Boiler	TA-IV	Registration 3211	2/15/2015	N/A	City of Albuquerque
Building 970 Boiler	TA-IV	Registration 3302	12/29/2016	N/A	City of Albuquerque
Fugitive Dust Control Construction/ Demolition/Programmatic, as of 12/31/2018					
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

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

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

Table 9-2. Summary of compliance history with regard to mixed waste

Date	Milestone	Comment
Nov 1984	1984 HSWA to RCRA	Extended storage became an issue 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 an site treatment plan for mixed waste.
Dec 1992	Notice of Noncompliance issued	The EPA issued an 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 an site treatment plan, to be updated annually.
Mar 1996	Site treatment plan milestones met	Updated the site treatment plan to reflect fiscal year 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 and treatment/ 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.
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 and treatment/disposal technologies and established new deadlines.

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Table 9-2. Summary of compliance history with regard to mixed waste (continued)

Date	Milestone	Comment
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 and treatment/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 and treatment/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.
2012–2014	No site treatment plan milestones	Treated wastes on-site and shipped mixed wastes to off-site treatment/ 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	No site treatment plan milestones	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.

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Table 9-2. Summary of compliance history with regard to mixed waste (continued)

Date	Milestone	Comment
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.
2017–2018	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
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 9-3. Quantity of mixed waste subject to the Federal Facility Compliance Order, end of FY 2018

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	1.924	MTRU	Stored at SNL/NM; awaiting shipment to WIPP

< = less than
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 2018

Perkysue (*Tetraneuris argentea*)

Table A-1. Sample collection dates for groundwater quality monitoring at SNL/NM, 2018

Sampling Event	Groundwater Monitoring Program (12 wells plus 1 spring)	Chemical Waste Landfill (4 wells)	Mixed Waste Landfill (4 wells)	TA-V Groundwater Area of Concern (18 wells)	Tijeras Arroyo Groundwater Area of Concern (20 wells)	Burn Site Groundwater Area of Concern (10 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, 2018

Analyte	Number of Detects	Number of Non-Detects[a]	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Summary of Field Water Quality Parameters (units as indicated below)						
pH in SU	146	0	6.36	7.94	7.44	NE
Specific Conductivity in µmhos/cm	146	0	229.1	4,000.77	771.9	NE
Temperature in °C	146	0	11.66	25.97	19.36	NE
Turbidity in NTU	146	0	0.10	15.8	1.08	NE
Detected Organic Compounds in µg/L						
Acetone	16	117	1.60	3.61	2.50	NE
Chloroform	8	146	0.300	0.960	0.728	NE
Dichloroethane, 1,1-	4	145	0.320	0.400	0.370	NE
Dichloroethene, 1,1-	2	152	0.820	0.830	0.825	7.0
Dichloroethene, cis-1,2-	38	111	0.310	3.88	0.965	70
Methylene Chloride	1	148	2.10	2.10	2.10	5.0
Tetrachloroethene	10	144	0.300	1.36	0.718	5.0
Toluene	2	147	0.330	0.470	0.400	1,000
Trichlorobenzene, 1,2,4-	1	138	0.300	0.300	0.300	70
Trichloroethene	72	87	0.310	18.0	4.169	5.0
Detected Metals in mg/L						
Aluminum	15	54	0.0202	0.193	0.0722	NE
Arsenic	80	46	0.00204	0.00633	0.00276	0.010
Barium	69	0	0.00857	0.222	0.06799	2.0
Beryllium	1	68	0.00698	0.00698	0.00698	0.004
Calcium	69	0	37.4	315	85.2	NE
Chromium	6	83	0.0032	0.0668	0.0176	0.100
Cobalt	4	65	0.00030	0.00894	0.00277	NE
Copper	34	35	0.000319	0.00646	0.000840	NE
Iron	29	97	0.0371	0.331	0.0693	NE
Magnesium	69	0	3.04	61.3	20.18	NE
Detected Metals in mg/L						
Manganese	22	101	0.0012	1.35	0.0651	NE
Mercury	2	83	0.000077	0.000096	0.000087	0.002
Molybdenum	1	0	0.00160	0.00160	0.00160	NE
Nickel	22	67	0.00061	0.0224	0.00302	NE
Potassium	69	0	1.73	28.8	3.67	NE
Selenium	46	23	0.00203	0.0288	0.00525	0.050
Silver	1	68	0.00085	0.00085	0.00085	NE
Sodium	69	0	17.4	10,801,080	64.8	NE
Thallium	1	68	0.00113	0.00113	0.00113	0.002
Uranium	68	1	0.00104	0.0165	0.00448	0.030
Vanadium	57	12	0.00331	0.0112	0.00605	NE
Zinc	26	43	0.00341	0.0400	0.01034	NE

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Table A-2. SNL/NM groundwater monitoring analytical results, 2018 (continued)

Analyte	Number of Detects	Number of Non-Detects[a]	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Detected Inorganic Parameters in mg/L						
Nitrate plus nitrite, as N	157	0	0.131	35.4	8.679	10
Bromide	68	1	0.143	2.82	0.585	NE
Chloride	69	0	9.50	477	59.48	NE
Fluoride	69	0	0.143	2.82	0.894	4.0
Sulfate	69	0	16.6	19,301,930	118.8	NE
Total Cyanide	1	15	0.00401	0.00401	0.00401	0.200
Total Organic Halogens	5	11	0.00418	0.0168	0.00808	NE
Total Phenols	2	14	0.00332	0.00561	0.00447	NE
Alkalinity as $CaCO_3$	69	0	84.2	10,501,050	211.3	NE
Perchlorate	2	1	0.00404	0.00460	0.00432	NE
Detected Radiochemistry Activities in pCi/L (unless noted otherwise)						
Alpha, gross (corrected)[b]	79	0	-12.00	13.76	3.00	15.0[c]
Beta, gross	74	5	2.11	26.2	5.29	4 mrem/ year
Potassium-40	5	70	45.4	83.8	57.2	NE
Radium-226	8	8	0.451	2.05	1.190	5.0[d]
Radium-228	3	13	0.514	0.730	0.609	5.0[d]
Radon-222	10	0	115	497	270	NE
Uranium-233/234	15	0	0.53	35.9	14.23	NE
Uranium-235/236	14	1	0.234	1.05	0.548	NE
Uranium-238	15	0	0.136	6.31	3.108	NE

[a] Of the 11,262 analyses performed, 85 percent were non-detects.
[b] Gross alpha results reported as corrected values (uranium activities subtracted out).
[c] The 15.0 pCi/L MCL is for corrected gross alpha activity.
[d] The 5.0 pCi/L MCL is for combined radium-226 and radium-228.

$CaCO_3$ = calcium carbonate
CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
MCL = maximum contaminant level; established by the U.S. Environmental Protection Agency Primary Drinking Water Regulations (Title 40 CFR § 141.11[b]), National Primary Drinking Water Standards (EPA May 2009)
NE = not established
NTU = nephelometric turbidity unit
pH = potential of hydrogen (negative logarithm of the hydrogen ion concentration)
SNL/NM = Sandia National Laboratories, New Mexico
SU = standard unit
U.S. = United States

Table A-3. Exceedances for SNL/NM groundwater monitoring wells and springs sampled, 2018

Analyte	Well	Exceedance	Date
Beryllium MCL = 0.004 mg/L	Coyote Springs	0.00698[a] mg/L	March 2018
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	CYN-MW9	29.1 mg/L	April 2018
		32.2 mg/L	October 2018
	CYN-MW9 (duplicate)	29.5 mg/L	April 2018
	CYN-MW10	13.1 mg/L	April 2018
		10.2 mg/L	October 2018
	CYN-MW11	15.1 mg/L	April 2018
		12.5 mg/L	October 2018
	CYN-MW12	14.4 mg/L	April 2018
		15.2 mg/L	October 2018
	CYN-MW12 (duplicate)	14.5 mg/L	April 2018
	CYN-MW13	32.4 mg/L	April 2018
		34.8 mg/L	October 2018
	CYN-MW13 (duplicate)	35.4 mg/L	October 2018
	CYN-MW14A	12.2 mg/L	April 2018
		12.7 mg/L	October 2018
	CYN-MW14A (duplicate)	12.7 mg/L	October 2018
	CYN-MW15	20.3 mg/L	April 2018
		20.7 mg/L	October 2018
	CYN-MW15 (duplicate)	21.4 mg/L	October 2018
	LWDS-MW1	12.1 mg/L	February 2018
		12.9 mg/L	June 2018
		12.0 mg/L	August 2018
		11.9 mg/L	November 2018
	LWDS-MW1 (duplicate)	12.3 mg/L	February 2018
	TA2-W-19	11.0 mg/L	March 2018
		10.6 mg/L	June 2018
		11.2 mg/L	September 2018
		12.8 mg/L	November 2018
	TA2-W-19 (duplicate)	10.5 mg/L	June 2018
	TA2-W-28	17.5 mg/L	March 2018
		16.4 mg/L	June 2018
		15.6 mg/L	September 2018
		17.1 mg/L	December 2018
	TAV-MW10	11.4 mg/L	February 2018
		12.0 mg/L	June 2018
		11.3 mg/L	September 2018
		11.4 mg/L	November 2018
	TAV-MW10 (duplicate)	10.8 mg/L	September 2018

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Table A-3. Exceedances for SNL/NM groundwater monitoring wells and springs sampled, 2018 (continued)

Analyte	Well	Exceedance	Date
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	TJA-2	11.5 mg/L	March 2018
		10.9 mg/L	June 2018
		11.0 mg/L	September 2018
		11.5 mg/L	December 2018
	TJA-2 (duplicate)	11.5 mg/L	December 2018
	TJA-4	31.6 mg/L	March 2018
		29.1 mg/L	June 2018
		30.7 mg/L	September 2018
		30.2 mg/L	December 2018
Nitrate plus Nitrite (as Nitrogen) MCL = 10.0 mg/L	TJA-5	21.7 mg/L	June 2018
	TJA-7	22.8 mg/L	March 2018
		21.1 mg/L	June 2018
		23.4 mg/L	September 2018
		22.9 mg/L	December 2018
	TJA-7 (duplicate)	21.6 mg/L	June 2018
Trichloroethene MCL = 5.0 µg/L	LWDS-MW1	17.7 µg/L	February 2018
		17.4 µg/L	June 2018
		15.7 µg/L	August 2018
		16.8 µg/L	November 2018
	LWDS-MW1 (duplicate)	18.0 µg/L	February 2018
	TAV-MW10	8.42 µg/L	February 2018
		9.71 µg/L	June 2018
		9.52 µg/L	September 2018
		9.72 µg/L	November 2018
	TAV-MW10 (duplicate)	9.64 µg/L	September 2018
	TAV-MW12	6.37 µg/L	February 2018
		5.66 µg/L	May 2018
	TAV-MW12 (duplicate)	6.11 µg/L	February 2018
	TAV-MW14	5.45 µg/L	June 2018

[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 2018

Burrowing Owl (*Athene cunicularia*)

Table B-1. Radiological results in soil, 2018

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-9	-0.0105 ± 0.0441	0.0748	U	BD	HASL-300
		pCi/g	C-10	-0.00222 ± 0.0407	0.0619	U	BD	HASL-300
		pCi/g	C-25	-0.0059 ± 0.0589	0.0988	U	BD	HASL-300
	Cesium-137	pCi/g	C-9	0.186 ± 0.0348	0.0291		None	HASL-300
		pCi/g	C-10	0.993 ± 0.0967	0.0279		None	HASL-300
		pCi/g	C-25	0.136 ± 0.0423	0.0276		None	HASL-300
	Tritium	pCi/L	C-9	110 ± 118	197	U	BD	GL-RAD-A-002
		pCi/L	C-10	88.2 ± 122	205	U	BD	GL-RAD-A-002
		pCi/L	C-25	45.7 ± 116	199	U	BD	GL-RAD-A-002
	Uranium	mg/kg	C-9	0.503 ±	0.0387	B	None	SW-846 3050B/6020
On-Site	Americium-241	pCi/g	S-1	0.0181 ± 0.105	0.174	U	BD	HASL-300
		pCi/g	S-6	-0.0214 ± 0.0565	0.0913	U	BD	HASL-300
		pCi/g	S-33	-0.000296 ± 0.0671	0.114	U	BD	HASL-300
		pCi/g	S-34	0.016 ± 0.0465	0.079	U	BD	HASL-300
		pCi/g	S-45	-0.0419 ± 0.0748	0.124	U	BD	HASL-300
		pCi/g	S-46	-0.00434 ± 0.0372	0.0638	U	BD	HASL-300
		pCi/g	S-49	-0.0114 ± 0.0579	0.0985	U	BD	HASL-300
		pCi/g	S-51	0.00106 ± 0.0391	0.0678	U	BD	HASL-300
		pCi/g	S-53	0.0185 ± .0869	0.16	U	BD	HASL-300
		pCi/g	S-55	0.0071 ± 0.0596	0.106	U	BD	HASL-300
		pCi/g	S-57	-0.0258 ± 0.0437	0.0723	U	BD	HASL-300
		pCi/g	S-76	-0.0305 ± 0.108	0.183	U	BD	HASL-300
		pCi/g	S-77	0.0135 ± 0.0827	0.119	U	BD	HASL-300
		pCi/g	S-86	0.00205 ± 0.0193	0.0327	U	BD	HASL-300
		pCi/g	S-90	0.0362 ± 0.0433	0.0751	U	BD	HASL-300
		pCi/g	S-92	0.0392 ± 0.0776	0.138	U	BD	HASL-300
	Cesium-137	pCi/g	S-1	0.126 ± 0.0303	0.0273		None	HASL-300
		pCi/g	S-6	0.0834 ± 0.0255	0.0242		None	HASL-300
		pCi/g	S-33	0.261 ± 0.0486	0.0332		None	HASL-300

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Table B-1. Radiological results in soil, 2018 (continued)

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Cesium-137	pCi/g	S-34	0.0463 ± 0.031	0.0321		J	HASL-300
		pCi/g	S-45	0.0369 ± 0.0215	0.0274		J	HASL-300
		pCi/g	S-46	0.0926 ± 0.0276	0.0241		None	HASL-300
		pCi/g	S-49	0.238 ± 0.0379	0.0241		None	HASL-300
		pCi/g	S-51	0.0185 ± 0.0188	0.0315	U	BD	HASL-300
		pCi/g	S-53	0.0469 ± 0.0284	0.0296		J	HASL-300
		pCi/g	S-55	0.319 ± 0.054	0.0266		None	HASL-300
		pCi/g	S-57	0.0288 ± 0.0189	0.0207		J	HASL-300
		pCi/g	S-76	0.0718 ± 0.0393	0.0366		J	HASL-300
		pCi/g	S-77	-0.00537 ± 0.0104	0.0186	U	BD	HASL-300
		pCi/g	S-86	0.0398 ± 0.03	0.0257		J	HASL-300
		pCi/g	S-90	0.205 ± 0.0505	0.0276		None	HASL-300
		pCi/g	S-92	0.144 ± 0.028	0.0241		None	HASL-300
	Tritium	pCi/L	S-33	0-24.7 ± 98.3	182	U	BD	GL-RAD-A-002
		pCi/L	S-34	522 ± 156	182		J	GL-RAD-A-002
		pCi/L	S-55	-20.4 ± 91.9	170	U	BD	GL-RAD-A-002
		pCi/L	S-76	-11.5 ± 106	183	U	BD	GL-RAD-A-002
		pCi/L	S-77	-29.1 ± 98.5	183	U	BD	GL-RAD-A-002
		pCi/L	S-86	-26.4 ± 105	192	U	BD	GL-RAD-A-002
	Uranium	mg/kg	S-1	0.635 ±	0.0388	B	None	SW-846 3050B/6020
		mg/kg	S-6	0.303 ±	0.0396	B	None	SW-846 3050B/6020
		mg/kg	S-33	0.751 ±	0.038	B	None	SW-846 3050B/6020
		mg/kg	S-34	0.437 ±	0.0375	B	None	SW-846 3050B/6020
		mg/kg	S-45	0.297 ±	0.0388	B	None	SW-846 3050B/6020
		mg/kg	S-51	0.845 ±	0.037		None	SW-846 3050B/6020
		mg/kg	S-53	0.337 ±	0.0387	B	None	SW-846 3050B/6020
		mg/kg	S-55	0.69 ±	0.0399	B	None	SW-846 3050B/6020
		mg/kg	S-57	0.877 ±	0.0375		None	SW-846 3050B/6020
		mg/kg	S-90	0.243 ±	0.0395		None	SW-846 3050B/6020

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Table B-1. Radiological results in soil, 2018 (continued)

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Uranium	mg/kg	S-92	0.346 ±	0.0383		None	SW-846 3050B/6020
Perimeter	Americium-241	pCi/g	P-4	0.00234 ± 0.095	0.181	U	BD	HASL-300
		pCi/g	P-5	-0.00694 ± 0.0579	0.106	U	BD	HASL-300
		pCi/g	P-16	0.000144 ± 0.0224	0.0407	U	BD	HASL-300
		pCi/g	P-19	-0.018 ± 0.0244	0.0386	U	BD	HASL-300
		pCi/g	P-58	0.0306 ± 0.084	0.146	U	BD	HASL-300
		pCi/g	P-59	-0.0354 ± 0.0774	0.144	U	BD	HASL-300
		pCi/g	P-61	0.00166 ± 0.094	0.164	U	BD	HASL-300
		pCi/g	P-63	0.0222 ± 0.0525	0.0846	U	BD	HASL-300
		pCi/g	P-64	-0.0405 ± 0.13	0.213	U	BD	HASL-300
		pCi/g	P-81	-0.0349 ± 0.0911	0.173	U	BD	HASL-300
		pCi/g	P-82	-0.0018 ± 0.12	0.207	U	BD	HASL-300
		pCi/g	P-95	0.00308 ± 0.048	0.0852	U	BD	HASL-300
	Cesium-137	pCi/g	P-4	0.194 ± 0.0424	0.0274		None	HASL-300
		pCi/g	P-5	0.136 ± 0.0342	0.0259		None	HASL-300
		pCi/g	P-16	0.117 ± 0.0422	0.0324		None	HASL-300
		pCi/g	P-19	0.407 ± 0.0582	0.0297		None	HASL-300
		pCi/g	P-58	0.0706 ± 0.0261	0.0256		J	HASL-300
		pCi/g	P-59	0.19 ± 0.0373	0.0272		None	HASL-300
		pCi/g	P-61	0.0164 ± 0.0205	0.0346	U	BD	HASL-300
		pCi/g	P-63	0.247 ± 0.0457	0.0281		None	HASL-300
		pCi/g	P-64	0.616 ± 0.0728	0.0323		None	HASL-300
		pCi/g	P-81	0.159 ± 0.0343	0.0331		None	HASL-300
		pCi/g	P-82	0.0556 ± 0.0419	0.0297		J	HASL-300
		pCi/g	P-95	0.0666 ± 0.0303	0.0247		J	HASL-300
	Tritium	pCi/L	P-19	-32.5 ± 109	199	U	BD	GL-RAD-A-002
		pCi/L	P-58	93.2 ± 123	207	U	BD	GL-RAD-A-002
		pCi/L	P-61	119 ± 122	202	U	BD	GL-RAD-A-002
		pCi/L	P-63	79.3 ± 117	198	U	BD	GL-RAD-A-002

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Table B-1. Radiological results in soil, 2018 (continued)

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Tritium	pCi/L	P-81	-108 ± 123	231	U	BD	GL-RAD-A-002
		pCi/L	P-82	-164 ± 122	236	U	BD	GL-RAD-A-002
	Uranium	mg/kg	P-4	0.324 ±	0.0396	B	None	SW-846 3050B/6020
		mg/kg	P-5	0.231 ±	0.0383	B	None	SW-846 3050B/6020
		mg/kg	P-16	0.779 ±	0.039		None	SW-846 3050B/6020
		mg/kg	P-19	0.215 ±	0.0366		None	SW-846 3050B/6020
		mg/kg	P-58	0.491 ±	0.0393		None	SW-846 3050B/6020
		mg/kg	P-61	0.455 ±	0.0399	B	None	SW-846 3050B/6020
		mg/kg	P-63	0.421 ±	0.0388		None	SW-846 3050B/6020
		mg/kg	P-64	0.669 ±	0.0382		None	SW-846 3050B/6020
		mg/kg	P-81	0.374 ±	0.0373	B	None	SW-846 3050B/6020
		mg/kg	P-82	0.593 ±	0.0393	B	None	SW-846 3050B/6020
		mg/kg	P-95	0.222 ±	0.0396	B	None	SW-846 3050B/6020

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

Laboratory Data Qualifiers
B = analyte detected in the blank
U = analyte result was below the MDA

Data Validation Qualifiers
BD = below detection limit as used in radiochemistry to identify results that are not statistically different from zero
J = associated value is an estimated quantity
None = no data validation for corrected gross alpha activity

Table B-2. Radiological results in sediment, 2018

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-8	-0.00653 ± 0.0215	0.0379	U	BD	HASL-300
		pCi/g	C-68	0.0154 ± 0.0966	0.181	U	BD	HASL-300
	Cesium-137	pCi/g	C-8	0.0992 ± 0.0314	0.0286		None	HASL-300
		pCi/g	C-68	0.0264 ± 0.0207	0.026		J	HASL-300
	Tritium	pCi/L	C-8	53 ± 121	207	U	BD	GL-RAD-A-002
		pCi/L	C-68	83.6 ± 119	200	U	BD	GL-RAD-A-002
	Uranium	mg/kg	C-68	1.04 ±	0.0384	B	None	SW-846 3050B/6020
On-Site	Americium-241	pCi/g	S-72	-0.035 ± 0.089	0.145	U	BD	HASL-300
		pCi/g	S-74N	-0.00365 ± 0.017	0.0328	U	BD	HASL-300
		pCi/g	S-75	0.0451 ± 0.113	0.197	U	BD	HASL-300
		pCi/g	S-83	0.0118 ± 0.0453	0.0767	U	BD	HASL-300
		pCi/g	S-85	0.0209 ± 0.0684	0.116	U	BD	HASL-300
		pCi/g	S-91	0.000265 ± 0.0533	0.0961	U	BD	HASL-300
	Cesium-137	pCi/g	S-72	0.0313 ± 0.0228	0.0362	U	BD	HASL-300
		pCi/g	S-74N	0.00913 ± 0.0138	0.0256	U	BD	HASL-300
		pCi/g	S-75	0.13 ± 0.0357	0.0261		None	HASL-300
		pCi/g	S-83	0.145 ± 0.0334	0.0283		None	HASL-300
		pCi/g	S-85	0.0282 ± 0.0263	0.0311	U	BD	HASL-300
		pCi/g	S-91	0.0833 ± 0.033	0.0296		J	HASL-300
	Tritium	pCi/L	S-72	136 ± 115	188	U	BD	GL-RAD-A-002
		pCi/L	S-83	82.8 ± 112	190	U	BD	GL-RAD-A-002
	Uranium	mg/kg	S-72	0.719 ±	0.0389		None	SW846 3050B/6020
		mg/kg	S-74N	0.768 ±	0.0386	B	None	SW-846 3050B/6020
		mg/kg	S-75	0.581 ±	0.039	B	None	SW-846 3050B/6020
		mg/kg	S-83	0.698 ±	0.0379	B	None	SW-846 3050B/6020
		mg/kg	S-85	0.747 ±	0.0389		None	SW-846 3050B/6020
		mg/kg	S-91	0.49 ±	0.0389	B	None	SW-846 3050B/6020
Perimeter	Americium-241	pCi/g	P-60	-0.0689 ± 0.0721	0.107	U	BD	HASL-300
		pCi/g	P-73	0.0297 ± 0.0873	0.149	U	BD	HASL-300

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Table B-2. Radiological results in sediment, 2018 (continued)

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Cesium-137	pCi/g	P-60	0.0012 ± 0.0138	0.0256	U	BD	HASL-300
		pCi/g	P-73	0.0114 ± 0.0165	0.0299	U	BD	HASL-300
	Uranium	mg/kg	P-60	0.665 ±	0.0385	B	None	SW-846 3050B/6020
		mg/kg	P-73	1.03 ±	0.038	B	None	SW-846 3050B/6020

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

Laboratory Data Qualifiers
B = analyte detected in the blank
U = analyte is absent or below the method detection limit

Data Validation Qualifiers
BD = below detection limit as used in radiochemistry to identify results that are not statistically different from zero
J = associated value is an estimated quantity
None = no data validation for corrected gross alpha activity

Table B-3. Radiological results in vegetation, 2018

Location Classification	Analyte	Units	Location	Activity	MDA	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Community	Americium-241	pCi/g	C-25	0.0545 ± 0.0844	0.112	U	BD	HASL-300
	Cesium-137	pCi/g	C-25	0.007 ± 0.0242	0.039	U	BD	HASL-300
	Tritium	pCi/L	C-25	7.77 ± 87.4	158	U	BD	GL-RAD-A-002
On-Site	Americium-241	pCi/g	S-33	-0.00206 ± 0.0489	0.0658	U	BD	HASL-300
		pCi/g	S-33	0.0228 ± 0.0528	0.0753	U	BD	HASL-300
		pCi/g	S-46	-0.0979 ± 0.0946	0.0697	U	BD	HASL-300
		pCi/g	S-49	-0.0358 ± 0.0679	0.0934	U	BD	HASL-300
	Cesium-137	pCi/g	S-33	0.000484 ± 0.018	0.0293	U	BD	HASL-300
		pCi/g	S-33	0.0245 ± 0.0271	0.0378	U	BD	HASL-300
		pCi/g	S-46	0.00341 ± 0.0154	0.026	U	BD	HASL-300
		pCi/g	S-49	0.00135 ± 0.0186	0.0319	U	BD	HASL-300
	Tritium	pCi/L	S-33	26 ± 128	229	U	BD	GL-RAD-A-002
		pCi/L	S-33	79.9 ± 125	214	U	BD	GL-RAD-A-002
		pCi/L	S-46	71.4 ± 131	227	U	BD	GL-RAD-A-002
		pCi/L	S-49	54.6 ± 123	215	U	BD	GL-RAD-A-002
	Uranium	mg/kg	S-33	< 0.0128 ±	0.0389	U	None	SW-846 3050B/6020
		mg/kg	S-33	0.0146 ±	0.04	J	0.04U	SW-846 3050B/6020

MDA = minimal detectable activity or minimum measured activity in a sample required to ensure a 95% probability that the measured activity is accurately quantified above the critical level
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
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
U = analyte result was below the MDA

Data Validation Qualifiers
BD = below detection limit as used in radiochemistry to identify results that are not statistically different from zero
None = no data validation for corrected gross alpha activity
U = The analyte was analyzed for but was not detected. The associated numerical value is the sample quantitation limit

Table B-4. Dosimeter measurements, 2018

Location Classification	Location Number	1st Quarter (99 Days)		2nd Quarter (90 Days)		3rd Quarter (93 Days)		4th Quarter (100 Days)	
		Gross Exposure (mR)	Net Exposure (mR)	Gross Exposure (mR)	Net Exposure (mR)	Gross Exposure (mR)	Net Exposure (mR)	Gross Exposure (mR)	Net Exposure (mR)
Community	C-10	42.1	19.2	43.8	18.8	36.7	15.4	42.7	21.7
	C-21	42	19.1	34.3	14.1	40.5	19.2	37.7	16.7
	C-22	38.4	15.5	34.4	14.2	35.2	13.9	35.6	14.6
	C-23	35.5	12.6	31	10.7	33.4	12.1	32	11
	C-25	37.3	14.4	33.2	12.9	31.9	10.6	34.6	13.6
	C-26	37.5	14.6	36.7	16.5	36.3	15	36.9	15.9
	C-30	39.8	16.9	35.3	15	36.6	15.3	38.6	17.6
On-Site	S-1	39.8	16.9	36.2	15.9	36.6	15.3	39.5	18.5
	S-6	34.9	12	34.2	14	34.1	12.8	34.5	13.5
	S-7	39	16.1	37.3	17	35.7	14.3	38.7	17.7
	S-20	39.6	16.7	37.3	17.1	38	16.7	37.1	16.1
	S-45	39.8	16.9	37.8	17.5	34.5	13.2	39.4	18.4
	S-46	37.1	14.2	41.2	21	38	16.6	38.2	17.2
	S-48	40.7	17.8	41.4	21.2	38.1	16.7	39.7	18.7
Perimeter	P-4	36.2	13.3	37.9	17.6	35	13.7	39.9	18.9
	P-5	36.7	13.8	33.8	13.6	33.3	12	37.9	16.9
	P-16	45.4	22.5	43.2	23	41.2	19.9	42.2	21.2
	P-19	38.5	15.6	39.2	18.9	38.4	17	39.6	18.6
	P-39	38	15.1	33.8	13.6	36.3	15	40	19
	P-40	34.5	11.6	34.7	14.5	34.7	13.4	35.6	14.6
	P-81	39.7	16.8	36.9	16.6	36.8	15.5	37.4	16.4

Table B-5. Nonradiological results in soil, 2018

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	16,700	44	96.7		J	SW-846 3050B/6020
	Antimony	C-9	1.52	1.52	4.61	U	None	SW-846 3050B/6010B
	Arsenic	C-9	3.51	0.327	0.967		None	SW-846 3050B/6020
	Beryllium	C-9	0.676	0.0193	0.0967		None	SW-846 3050B/6020
	Cadmium	C-9	0.189	0.0193	0.193	J	J+	SW-846 3050B/6020
	Chromium	C-9	17.2	0.193	0.58		None	SW-846 3050B/6020
	Copper	C-9	12.4	0.0638	0.193		None	SW-846 3050B/6020
	Iron	C-9	17,200	63.8	193		J	SW-846 3050B/6020
	Lead	C-9	18	0.0967	0.387		None	SW-846 3050B/6020
	Magnesium	C-9	4,700	1.93	5.8		None	SW-846 3050B/6020
	Nickel	C-9	13.2	0.0967	0.387		None	SW-846 3050B/6020
	Selenium	C-9	1.15	0.348	0.967	N	J	SW-846 3050B/6020
	Silver	C-9	0.0923	0.0923	0.461	U	None	SW-846 3050B/6010B
	Thallium	C-9	0.135	0.135	0.387	U	None	SW-846 3050B/6020
	Zinc	C-9	48	0.774	1.93	B	J	SW-846 3050B/6020
On-Site	Aluminum	S-1	14,700	44.1	96.9		J	SW-846 3050B/6020
	Antimony	S-1	1.58	1.58	4.78	U	None	SW-846 3050B/6010B
	Arsenic	S-1	2.66	0.328	0.969		None	SW-846 3050B/6020
	Beryllium	S-1	0.528	0.0194	0.0969		None	SW-846 3050B/6020
	Cadmium	S-1	0.247	0.0194	0.194		J+	SW-846 3050B/6020
	Chromium	S-1	10.8	0.194	0.581		None	SW-846 3050B/6020
	Copper	S-1	12.8	0.064	0.194		None	SW-846 3050B/6020
	Iron	S-1	17,700	64	194		J	SW-846 3050B/6020
	Lead	S-1	13.6	0.0969	0.388		None	SW-846 3050B/6020
	Magnesium	S-1	5,120	1.94	5.81		None	SW-846 3050B/6020
	Nickel	S-1	11.8	0.0969	0.388		None	SW-846 3050B/6020
	Selenium	S-1	1.47	0.349	0.969	N	J	SW-846 3050B/6020
	Silver	S-1	0.0956	0.0956	0.478	U	None	SW-846 3050B/6010B
	Thallium	S-1	0.19	0.136	0.388	J	None	SW-846 3050B/6020
	Zinc	S-1	47.3	0.775	1.94	B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (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-6	9,140	4.5	9.9		J	SW-846 3050B/6020
	Antimony	S-6	0.307	0.307	0.931	U	None	SW-846 3050B/6010B
	Arsenic	S-6	1.82	0.335	0.99		None	SW-846 3050B/6020
	Beryllium	S-6	0.379	0.0198	0.099		None	SW-846 3050B/6020
	Cadmium	S-6	0.107	0.0198	0.198	J	None	SW-846 3050B/6020
	Chromium	S-6	7.61	0.198	0.594		None	SW-846 3050B/6020
	Copper	S-6	10.3	0.0653	0.198		None	SW-846 3050B/6020
	Iron	S-6	8,030	6.53	19.8		J	SW-846 3050B/6020
	Lead	S-6	6.57	0.099	0.396		None	SW-846 3050B/6020
	Magnesium	S-6	2,140	1.98	5.94		None	SW-846 3050B/6020
	Nickel	S-6	6.03	0.099	0.396		None	SW-846 3050B/6020
	Selenium	S-6	0.764	0.356	0.99	JN	J	SW-846 3050B/6020
	Silver	S-6	0.189	0.0931	0.466	J	None	SW-846 3050B/6010B
	Thallium	S-6	0.139	0.139	0.396	U	None	SW-846 3050B/6020
	Zinc	S-6	27.4	0.792	1.98	B	J	SW-846 3050B/6020
	Aluminum	S-33	10,600	43.3	95.1		J	SW-846 3050B/6020
	Antimony	S-33	1.11	0.318	0.963	N	J	SW-846 3050B/6010B
	Arsenic	S-33	3.2	0.321	0.951		None	SW-846 3050B/6020
	Beryllium	S-33	0.535	0.019	0.0951		None	SW-846 3050B/6020
	Cadmium	S-33	0.237	0.019	0.19		J+	SW-846 3050B/6020
	Chromium	S-33	11.7	0.19	0.57	N	J	SW-846 3050B/6020
	Copper	S-33	10.7	0.0627	0.19		None	SW-846 3050B/6020
	Iron	S-33	12,800	62.7	190		J	SW-846 3050B/6020
	Lead	S-33	12.6	0.0951	0.38		None	SW-846 3050B/6020
	Magnesium	S-33	4,290	1.9	5.7		None	SW-846 3050B/6020
	Nickel	S-33	11.8	0.0951	0.38		None	SW-846 3050B/6020
	Selenium	S-33	1.07	0.342	0.951	N	J	SW-846 3050B/6020
	Silver	S-33	0.0963	0.0963	0.482	U	None	SW-846 3050B/6010B
	Thallium	S-33	0.133	0.133	0.38	U	None	SW-846 3050B/6020
	Zinc	S-33	33.9	0.76	1.9		None	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil 2018 (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-34	13,000	42.7	93.8		J	SW-846 3050B/6020
	Antimony	S-34	1.63	1.63	4.93	NU	UJ	SW-846 3050B/6010B
	Arsenic	S-34	3.32	0.317	0.938		None	SW-846 3050B/6020
	Beryllium	S-34	0.582	0.0188	0.0938		None	SW-846 3050B/6020
	Cadmium	S-34	0.158	0.0188	0.188	J	None	SW-846 3050B/6020
	Chromium	S-34	11.6	0.188	0.563	N	J	SW-846 3050B/6020
	Copper	S-34	8.22	0.0619	0.188		None	SW-846 3050B/6020
	Iron	S-34	12,500	61.9	188		J	SW-846 3050B/6020
	Lead	S-34	9.2	0.0938	0.375		None	SW-846 3050B/6020
	Magnesium	S-34	3,300	1.88	5.63		None	SW-846 3050B/6020
	Nickel	S-34	11.8	0.0938	0.375		None	SW-846 3050B/6020
	Selenium	S-34	1.21	0.338	0.938	N	J	SW-846 3050B/6020
	Silver	S-34	0.0986	0.0986	0.493	U	None	SW-846 3050B/6010B
	Thallium	S-34	0.131	0.131	0.375	U	None	SW-846 3050B/6020
	Zinc	S-34	33.7	0.75	1.88		None	SW-846 3050B/6020
	Aluminum	S-45	7,710	4.42	9.71		J	SW-846 3050B/6020
	Antimony	S-45	0.323	0.323	0.978	U	None	SW-846 3050B/6010B
	Arsenic	S-45	2.13	0.328	0.971		None	SW-846 3050B/6020
	Beryllium	S-45	0.31	0.0194	0.0971		None	SW-846 3050B/6020
	Cadmium	S-45	0.0882	0.0194	0.194	J	None	SW-846 3050B/6020
	Chromium	S-45	6.46	0.194	0.583		None	SW-846 3050B/6020
	Copper	S-45	5.02	0.0641	0.194		None	SW-846 3050B/6020
	Iron	S-45	6,880	6.41	19.4		J	SW-846 3050B/6020
	Lead	S-45	6.3	0.0971	0.388		None	SW-846 3050B/6020
	Magnesium	S-45	2,440	1.94	5.83		None	SW-846 3050B/6020
	Nickel	S-45	5.19	0.0971	0.388		None	SW-846 3050B/6020
	Selenium	S-45	0.707	0.35	0.971	JN	J	SW-846 3050B/6020
	Silver	S-45	0.141	0.0978	0.489	J	None	SW-846 3050B/6010B
	Thallium	S-45	0.136	0.136	0.388	U	None	SW-846 3050B/6020
	Zinc	S-45	21.5	0.777	1.94	B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (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-51	6,900	4.21	9.24	*	J	SW-846 3050B/6020
	Antimony	S-51	3.19	3.19	9.67	NU	9.67UJ	SW-846 3050B/6010B
	Arsenic	S-51	2.1	0.312	0.924	N	J	SW-846 3050B/6020
	Beryllium	S-51	0.367	0.0185	0.0924		None	SW-846 3050B/6020
	Cadmium	S-51	0.119	0.0185	0.185	J	None	SW-846 3050B/6020
	Chromium	S-51	15.2	0.185	0.555	N	J	SW-846 3050B/6020
	Copper	S-51	6.93	0.061	0.185	*N	J	SW-846 3050B/6020
	Iron	S-51	7,290	6.1	18.5	*	J	SW-846 3050B/6020
	Lead	S-51	6.71	0.0924	0.37	N	J	SW-846 3050B/6020
	Magnesium	S-51	2,790	1.85	5.55	*	None	SW-846 3050B/6020
	Nickel	S-51	7.23	0.0924	0.37	*N	J	SW-846 3050B/6020
	Selenium	S-51	0.413	0.333	0.924	JN	J	SW-846 3050B/6020
	Silver	S-51	0.0967	0.0967	0.484	U	None	SW-846 3050B/6010B
	Thallium	S-51	0.129	0.129	0.37	U	None	SW-846 3050B/6020
	Zinc	S-51	47	0.739	1.85	*B	J	SW-846 3050B/6020
	Aluminum	S-53	7,600	4.4	9.67		J	SW-846 3050B/6020
	Antimony	S-53	0.32	0.32	0.971	U	None	SW-846 3050B/6010B
	Arsenic	S-53	1.45	0.327	0.967		None	SW-846 3050B/6020
	Beryllium	S-53	0.334	0.0193	0.0967		None	SW-846 3050B/6020
	Cadmium	S-53	0.102	0.0193	0.193	J	None	SW-846 3050B/6020
	Chromium	S-53	5.9	0.193	0.58		None	SW-846 3050B/6020
	Copper	S-53	4.94	0.0638	0.193		None	SW-846 3050B/6020
	Iron	S-53	6,420	6.38	19.3		J	SW-846 3050B/6020
	Lead	S-53	6.94	0.0967	0.387		None	SW-846 3050B/6020
	Magnesium	S-53	1,810	1.93	5.8		None	SW-846 3050B/6020
	Nickel	S-53	4.83	0.0967	0.387		None	SW-846 3050B/6020
	Selenium	S-53	0.662	0.348	0.967	JN	J	SW-846 3050B/6020
	Silver	S-53	0.187	0.0971	0.485	J	None	SW-846 3050B/6010B
	Thallium	S-53	0.135	0.135	0.387	U	None	SW-846 3050B/6020
	Zinc	S-53	18.8	0.774	1.93	B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (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-55	9,850	4.54	9.98		J	SW-846 3050B/6020
	Antimony	S-55	0.317	0.317	0.96	U	None	SW-846 3050B/6010B
	Arsenic	S-55	2.2	0.337	0.998		None	SW-846 3050B/6020
	Beryllium	S-55	0.43	0.02	0.0998		None	SW-846 3050B/6020
	Cadmium	S-55	0.166	0.02	0.2	J	None	SW-846 3050B/6020
	Chromium	S-55	7.91	0.2	0.599		None	SW-846 3050B/6020
	Copper	S-55	6.33	0.0659	0.2		None	SW-846 3050B/6020
	Iron	S-55	8,650	6.59	20		J	SW-846 3050B/6020
	Lead	S-55	9.13	0.0998	0.399		None	SW-846 3050B/6020
	Magnesium	S-55	3,220	2	5.99		None	SW-846 3050B/6020
	Nickel	S-55	6.93	0.0998	0.399		None	SW-846 3050B/6020
	Selenium	S-55	0.899	0.359	0.998	JN	J	SW-846 3050B/6020
	Silver	S-55	0.222	0.096	0.48	J	None	SW-846 3050B/6010B
	Thallium	S-55	0.14	0.14	0.399	U	None	SW-846 3050B/6020
	Zinc	S-55	29.1	0.798	2	B	J	SW-846 3050B/6020
	Aluminum	S-57	6,090	4.27	9.38	*	J	SW-846 3050B/6020
	Antimony	S-57	3.23	3.23	9.78	NU	9.78UJ	SW-846 3050B/6010B
	Arsenic	S-57	2.67	0.317	0.938	N	J	SW-846 3050B/6020
	Beryllium	S-57	0.303	0.0188	0.0938		None	SW-846 3050B/6020
	Cadmium	S-57	0.198	0.0188	0.188		None	SW-846 3050B/6020
	Chromium	S-57	5.48	0.188	0.563	N	J	SW-846 3050B/6020
	Copper	S-57	5.8	0.0619	0.188	*N	J	SW-846 3050B/6020
	Iron	S-57	7,260	6.19	18.8	*	J	SW-846 3050B/6020
	Lead	S-57	6.39	0.0938	0.375	N	J	SW-846 3050B/6020
	Magnesium	S-57	3,850	1.88	5.63	*	None	SW-846 3050B/6020
	Nickel	S-57	5.57	0.0938	0.375	*N	J	SW-846 3050B/6020
	Selenium	S-57	0.441	0.338	0.938	JN	J	SW-846 3050B/6020
	Silver	S-57	0.0978	0.0978	0.489	U	None	SW-846 3050B/6010B
	Thallium	S-57	0.131	0.131	0.375	U	None	SW-846 3050B/6020
	Zinc	S-57	84	0.75	1.88	*B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (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-90	5,000	4.49	9.87		J	SW-846 3050B/6020
	Antimony	S-90	0.314	0.314	0.953	U	UJ	SW-846 3050B/6010B
	Arsenic	S-90	1.75	0.333	0.987		None	SW-846 3050B/6020
	Beryllium	S-90	0.258	0.0197	0.0987		None	SW-846 3050B/6020
	Cadmium	S-90	0.118	0.0197	0.197	J	None	SW-846 3050B/6020
	Chromium	S-90	5.03	0.197	0.592		None	SW-846 3050B/6020
	Copper	S-90	4.06	0.0651	0.197	B	None	SW-846 3050B/6020
	Iron	S-90	5,390	6.51	19.7		J	SW-846 3050B/6020
	Lead	S-90	6.64	0.0987	0.395		None	SW-846 3050B/6020
	Magnesium	S-90	1,400	1.97	5.92		None	SW-846 3050B/6020
	Nickel	S-90	4.25	0.0987	0.395		None	SW-846 3050B/6020
	Selenium	S-90	0.777	0.355	0.987	J	None	SW-846 3050B/6020
	Silver	S-90	0.0953	0.0953	0.476	U	None	SW-846 3050B/6010B
	Thallium	S-90	0.138	0.138	0.395	U	None	SW-846 3050B/6020
	Zinc	S-90	20.1	0.789	1.97	B	J	SW-846 3050B/6020
	Aluminum	S-92	6,270	4.36	9.58	*	J	SW-846 3050B/6020
	Antimony	S-92	3.07	3.07	9.31	NU	9.31UJ	SW-846 3050B/6010B
	Arsenic	S-92	1.32	0.324	0.958	N	J	SW-846 3050B/6020
	Beryllium	S-92	0.358	0.0192	0.0958		None	SW-846 3050B/6020
	Cadmium	S-92	0.121	0.0192	0.192	J	None	SW-846 3050B/6020
	Chromium	S-92	6.22	0.192	0.575	N	J	SW-846 3050B/6020
	Copper	S-92	5.6	0.0632	0.192	*N	J	SW-846 3050B/6020
	Iron	S-92	6,560	6.32	19.2	*	J	SW-846 3050B/6020
	Lead	S-92	7.71	0.0958	0.383	N	J	SW-846 3050B/6020
	Magnesium	S-92	1,640	1.92	5.75	*	None	SW-846 3050B/6020
	Nickel	S-92	5.46	0.0958	0.383	*N	J	SW-846 3050B/6020
	Selenium	S-92	0.465	0.345	0.958	JN	J	SW-846 3050B/6020
	Silver	S-92	0.0931	0.0931	0.466	U	None	SW-846 3050B/6010B
	Thallium	S-92	0.134	0.134	0.383	U	None	SW-846 3050B/6020
	Zinc	S-92	24.8	0.766	1.92	*B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-4	8,950	4.5	9.9		J	SW-846 3050B/6020
	Antimony	P-4	0.3	0.3	0.909	U	None	SW-846 3050B/6010B
	Arsenic	P-4	2.03	0.335	0.99		None	SW-846 3050B/6020
	Beryllium	P-4	0.351	0.0198	0.099		None	SW-846 3050B/6020
	Cadmium	P-4	0.125	0.0198	0.198	J	None	SW-846 3050B/6020
	Chromium	P-4	8.23	0.198	0.594		None	SW-846 3050B/6020
	Copper	P-4	5.42	0.0653	0.198		None	SW-846 3050B/6020
	Iron	P-4	8,100	6.53	19.8		J	SW-846 3050B/6020
	Lead	P-4	8.17	0.099	0.396		None	SW-846 3050B/6020
	Magnesium	P-4	2,900	1.98	5.94		None	SW-846 3050B/6020
	Nickel	P-4	6.41	0.099	0.396		None	SW-846 3050B/6020
	Selenium	P-4	1.02	0.356	0.99	N	J	SW-846 3050B/6020
	Silver	P-4	0.157	0.0909	0.455	J	None	SW-846 3050B/6010B
	Thallium	P-4	0.139	0.139	0.396	U	None	SW-846 3050B/6020
	Zinc	P-4	24.7	0.792	1.98	B	J	SW-846 3050B/6020
	Aluminum	P-5	6,310	4.36	9.58		J	SW-846 3050B/6020
	Antimony	P-5	0.322	0.322	0.977	U	None	SW-846 3050B/6010B
	Arsenic	P-5	1.31	0.324	0.958		None	SW-846 3050B/6020
	Beryllium	P-5	0.285	0.0192	0.0958		None	SW-846 3050B/6020
	Cadmium	P-5	0.0887	0.0192	0.192	J	None	SW-846 3050B/6020
	Chromium	P-5	6.26	0.192	0.575		None	SW-846 3050B/6020
	Copper	P-5	4.94	0.0632	0.192		None	SW-846 3050B/6020
	Iron	P-5	6,000	6.32	19.2		J	SW-846 3050B/6020
	Lead	P-5	6.32	0.0958	0.383		None	SW-846 3050B/6020
	Magnesium	P-5	1,520	1.92	5.75		None	SW-846 3050B/6020
	Nickel	P-5	4.52	0.0958	0.383		None	SW-846 3050B/6020
	Selenium	P-5	0.586	0.345	0.958	JN	J	SW-846 3050B/6020
	Silver	P-5	0.0977	0.0977	0.488	U	None	SW-846 3050B/6010B
	Thallium	P-5	0.134	0.134	0.383	U	None	SW-846 3050B/6020
	Zinc	P-5	19.7	0.766	1.92	B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-16	8,950	4.44	9.76		J	SW-846 3050B/6020
	Antimony	P-16	0.321	0.321	0.972	U	UJ	SW-846 3050B/6010B
	Arsenic	P-16	2.13	0.33	0.976		None	SW-846 3050B/6020
	Beryllium	P-16	0.475	0.0195	0.0976		None	SW-846 3050B/6020
	Cadmium	P-16	0.161	0.0195	0.195	J	None	SW-846 3050B/6020
	Chromium	P-16	6.65	0.195	0.585		None	SW-846 3050B/6020
	Copper	P-16	10.3	0.0644	0.195	B	None	SW-846 3050B/6020
	Iron	P-16	12,600	64.4	195		J	SW-846 3050B/6020
	Lead	P-16	10.8	0.0976	0.39		None	SW-846 3050B/6020
	Magnesium	P-16	4,100	1.95	5.85		None	SW-846 3050B/6020
	Nickel	P-16	7.42	0.0976	0.39		None	SW-846 3050B/6020
	Selenium	P-16	1.47	0.351	0.976		None	SW-846 3050B/6020
	Silver	P-16	0.0972	0.0972	0.486	U	None	SW-846 3050B/6010B
	Thallium	P-16	0.137	0.137	0.39	U	None	SW-846 3050B/6020
	Zinc	P-16	47.3	0.781	1.95	B	J	SW-846 3050B/6020
	Aluminum	P-19	5,200	4.16	9.14	*	J	SW-846 3050B/6020
	Antimony	P-19	3.23	3.23	9.78	NU	9.78UJ	SW-846 3050B/6010B
	Arsenic	P-19	1.3	0.309	0.914	N	J	SW-846 3050B/6020
	Beryllium	P-19	0.218	0.0183	0.0914		None	SW-846 3050B/6020
	Cadmium	P-19	0.0834	0.0183	0.183	J	None	SW-846 3050B/6020
	Chromium	P-19	5.97	0.183	0.548	N	J	SW-846 3050B/6020
	Copper	P-19	6.24	0.0603	0.183	*N	J	SW-846 3050B/6020
	Iron	P-19	6,600	6.03	18.3	*	J	SW-846 3050B/6020
	Lead	P-19	9.55	0.0914	0.366	N	J	SW-846 3050B/6020
	Magnesium	P-19	1,970	1.83	5.48	*	None	SW-846 3050B/6020
	Nickel	P-19	6.12	0.0914	0.366	*N	J	SW-846 3050B/6020
	Selenium	P-19	0.421	0.329	0.914	JN	J	SW-846 3050B/6020
	Silver	P-19	0.0978	0.0978	0.489	U	None	SW-846 3050B/6010B
	Thallium	P-19	0.128	0.128	0.366	U	None	SW-846 3050B/6020
	Zinc	P-19	24.6	0.731	1.83	*B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-58	7,350	4.47	9.82	*	J	SW-846 3050B/6020
	Antimony	P-58	3.17	3.17	9.62	NU	9.62UJ	SW-846 3050B/6010B
	Arsenic	P-58	2.34	0.332	0.982	N	J	SW-846 3050B/6020
	Beryllium	P-58	0.384	0.0196	0.0982		None	SW-846 3050B/6020
	Cadmium	P-58	0.185	0.0196	0.196	J	None	SW-846 3050B/6020
	Chromium	P-58	6.59	0.196	0.589	N	J	SW-846 3050B/6020
	Copper	P-58	8.06	0.0648	0.196	*N	J	SW-846 3050B/6020
	Iron	P-58	7,970	6.48	19.6	*	J	SW-846 3050B/6020
	Lead	P-58	16.2	0.0982	0.393	N	J	SW-846 3050B/6020
	Magnesium	P-58	3,500	1.96	5.89	*	None	SW-846 3050B/6020
	Nickel	P-58	6.92	0.0982	0.393	*N	J	SW-846 3050B/6020
	Selenium	P-58	0.544	0.354	0.982	JN	J	SW-846 3050B/6020
	Silver	P-58	0.0962	0.0962	0.481	U	None	SW-846 3050B/6010B
	Thallium	P-58	0.138	0.138	0.393	U	None	SW-846 3050B/6020
	Zinc	P-58	38.9	0.786	1.96	*B	J	SW-846 3050B/6020
	Aluminum	P-61	7,710	4.54	9.98		J	SW-846 3050B/6020
	Antimony	P-61	0.329	0.329	0.996	U	None	SW-846 3050B/6010B
	Arsenic	P-61	3.01	0.337	0.998		None	SW-846 3050B/6020
	Beryllium	P-61	0.341	0.02	0.0998		None	SW-846 3050B/6020
	Cadmium	P-61	0.176	0.02	0.2	J	J+	SW-846 3050B/6020
	Chromium	P-61	6.64	0.2	0.599		None	SW846 3050B/6020
	Copper	P-61	7.58	0.0659	0.2		None	SW-846 3050B/6020
	Iron	P-61	8,500	6.59	20		J	SW-846 3050B/6020
	Lead	P-61	8.76	0.0998	0.399		None	SW-846 3050B/6020
	Magnesium	P-61	3,530	2	5.99		None	SW-846 3050B/6020
	Nickel	P-61	6.35	0.0998	0.399		None	SW-846 3050B/6020
	Selenium	P-61	0.7	0.359	0.998	JN	J	SW-846 3050B/6020
	Silver	P-61	0.0996	0.0996	0.498	U	None	SW-846 3050B/6010B
	Thallium	P-61	0.14	0.14	0.399	U	None	SW-846 3050B/6020
	Zinc	P-61	28.4	0.798	2	B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-63	9,530	4.41	9.69	*	J	SW-846 3050B/6020
	Antimony	P-63	3.22	3.22	9.75	NU	9.75UJ	SW-846 3050B/6010B
	Arsenic	P-63	2.35	0.328	0.969	N	J	SW-846 3050B/6020
	Beryllium	P-63	0.476	0.0194	0.0969		None	SW-846 3050B/6020
	Cadmium	P-63	0.218	0.0194	0.194		None	SW-846 3050B/6020
	Chromium	P-63	10.4	0.194	0.581	N	J	SW-846 3050B/6020
	Copper	P-63	8.75	0.064	0.194	*N	J	SW-846 3050B/6020
	Iron	P-63	10,600	32	96.9	*	J	SW-846 3050B/6020
	Lead	P-63	10.4	0.0969	0.388	N	J	SW-846 3050B/6020
	Magnesium	P-63	3,330	1.94	5.81	*	None	SW-846 3050B/6020
	Nickel	P-63	10.1	0.0969	0.388	*N	J	SW-846 3050B/6020
	Selenium	P-63	0.708	0.349	0.969	JN	J	SW-846 3050B/6020
	Silver	P-63	0.0975	0.0975	0.487	U	None	SW-846 3050B/6010B
	Thallium	P-63	0.136	0.136	0.388	U	None	SW-846 3050B/6020
	Zinc	P-63	37.6	0.775	1.94	*B	J	SW-846 3050B/6020
	Aluminum	P-64	12,000	21.7	47.8	*	J	SW-846 3050B/6020
	Antimony	P-64	3.08	3.08	9.35	NU	9.35UJ	SW-846 3050B/6010B
	Arsenic	P-64	2.3	0.323	0.956	N	J	SW-846 3050B/6020
	Beryllium	P-64	0.533	0.0191	0.0956		None	SW-846 3050B/6020
	Cadmium	P-64	0.211	0.0191	0.191		None	SW-846 3050B/6020
	Chromium	P-64	6.84	0.191	0.574	N	J	SW-846 3050B/6020
	Copper	P-64	13.3	0.0631	0.191	*N	J	SW-846 3050B/6020
	Iron	P-64	19,500	31.5	95.6	*	J	SW-846 3050B/6020
	Lead	P-64	12.9	0.0956	0.382	N	J	SW-846 3050B/6020
	Magnesium	P-64	7,320	1.91	5.74	*	None	SW-846 3050B/6020
	Nickel	P-64	9.15	0.0956	0.382	*N	J	SW-846 3050B/6020
	Selenium	P-64	1.81	0.344	0.956	N	J	SW-846 3050B/6020
	Silver	P-64	0.0935	0.0935	0.467	U	UJ	SW-846 3050B/6010B
	Thallium	P-64	0.134	0.134	0.382	U	None	SW-846 3050B/6020
	Zinc	P-64	82.9	0.765	1.91	*B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-81	11,200	42.4	93.3		J	SW-846 3050B/6020
	Antimony	P-81	0.319	0.319	0.965	U	None	SW-846 3050B/6010B
	Arsenic	P-81	1.91	0.315	0.933		None	SW-846 3050B/6020
	Beryllium	P-81	0.538	0.0187	0.0933		None	SW-846 3050B/6020
	Cadmium	P-81	0.134	0.0187	0.187	J	None	SW-846 3050B/6020
	Chromium	P-81	9.52	0.187	0.56		None	SW-846 3050B/6020
	Copper	P-81	7.82	0.0616	0.187		None	SW-846 3050B/6020
	Iron	P-81	9,770	61.6	187		J	SW-846 3050B/6020
	Lead	P-81	8.88	0.0933	0.373		None	SW-846 3050B/6020
	Magnesium	P-81	2,830	1.87	5.6		None	SW-846 3050B/6020
	Nickel	P-81	8.04	0.0933	0.373		None	SW-846 3050B/6020
	Selenium	P-81	1.04	0.336	0.933	N	J	SW-846 3050B/6020
	Silver	P-81	0.108	0.0965	0.483	J	None	SW-846 3050B/6010B
	Thallium	P-81	0.131	0.131	0.373	U	None	SW-846 3050B/6020
	Zinc	P-81	28.2	0.746	1.87	B	J	SW-846 3050B/6020
	Aluminum	P-82	11,800	44.7	98.2		J	SW-846 3050B/6020
	Antimony	P-82	1.51	1.51	4.57	U	None	SW-846 3050B/6010B
	Arsenic	P-82	3.51	0.332	0.982		None	SW-846 3050B/6020
	Beryllium	P-82	0.433	0.0196	0.0982		None	SW-846 3050B/6020
	Cadmium	P-82	0.157	0.0196	0.196	J	J+	SW-846 3050B/6020
	Chromium	P-82	11.3	0.196	0.589		None	SW-846 3050B/6020
	Copper	P-82	8.38	0.0648	0.196		None	SW-846 3050B/6020
	Iron	P-82	13,000	64.8	196		J	SW-846 3050B/6020
	Lead	P-82	10.3	0.0982	0.393		None	SW-846 3050B/6020
	Magnesium	P-82	5,010	1.96	5.89		None	SW-846 3050B/6020
	Nickel	P-82	9.04	0.0982	0.393		None	SW-846 3050B/6020
	Selenium	P-82	1.01	0.354	0.982	N	J	SW-846 3050B/6020
	Silver	P-82	0.0914	0.0914	0.457	U	None	SW-846 3050B/6010B
	Thallium	P-82	0.138	0.138	0.393	U	None	SW-846 3050B/6020
	Zinc	P-82	33.2	0.786	1.96	B	J	SW-846 3050B/6020

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Table B-5. Nonradiological results in soil, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Aluminum	P-95	8,740	4.5	9.9		J	SW-846 3050B/6020
	Antimony	P-95	0.325	0.325	0.984	U	None	SW-846 3050B/6010B
	Arsenic	P-95	1.58	0.335	0.99		None	SW-846 3050B/6020
	Beryllium	P-95	0.337	0.0198	0.099		None	SW-846 3050B/6020
	Cadmium	P-95	0.102	0.0198	0.198	J	None	SW-846 3050B/6020
	Chromium	P-95	7.15	0.198	0.594		None	SW-846 3050B/6020
	Copper	P-95	5.47	0.0653	0.198		None	SW-846 3050B/6020
	Iron	P-95	7,110	6.53	19.8		J	SW-846 3050B/6020
	Lead	P-95	7.17	0.099	0.396		None	SW-846 3050B/6020
	Magnesium	P-95	2,470	1.98	5.94		None	SW-846 3050B/6020
	Nickel	P-95	5.75	0.099	0.396		None	SW-846 3050B/6020
	Selenium	P-95	0.65	0.356	0.99	JN	J	SW-846 3050B/6020
	Silver	P-95	0.15	0.0984	0.492	J	None	SW-846 3050B/6010B
	Thallium	P-95	0.139	0.139	0.396	U	None	SW-846 3050B/6020
	Zinc	P-95	22.3	0.792	1.98	B	J	SW-846 3050B/6020

MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific
PQL = 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 = analyte detected in the blank
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit

Data Validation Qualifiers
J = associated value is an estimated quantity
J+ = The associated numerical value is an estimated quantity with a suspected positive base
None = no data validation for corrected gross alpha activity
UJ = The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise

Table B-6. Nonradiological results in sediment, 2018

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	7,780	4.37	9.6		J	SW-846 3050B/6020
	Antimony	C-68	0.324	0.324	0.982	U	None	SW-846 3050B/6010B
	Arsenic	C-68	4.77	0.324	0.96		None	SW-846 3050B/6020
	Beryllium	C-68	0.383	0.0192	0.096		None	SW-846 3050B/6020
	Cadmium	C-68	0.239	0.0192	0.192		J+	SW-846 3050B/6020
	Chromium	C-68	9.82	0.192	0.576		None	SW-846 3050B/6020
	Copper	C-68	5.88	0.0633	0.192		None	SW-846 3050B/6020
	Iron	C-68	8,970	63.3	192		J	SW-846 3050B/6020
	Lead	C-68	7.72	0.096	0.384		None	SW-846 3050B/6020
	Magnesium	C-68	3,390	1.92	5.76		None	SW-846 3050B/6020
	Nickel	C-68	10	0.096	0.384		None	SW-846 3050B/6020
	Selenium	C-68	1.04	0.345	0.96	N	J	SW-846 3050B/6020
	Silver	C-68	0.0982	0.0982	0.491	U	None	SW-846 3050B/6010B
	Thallium	C-68	0.134	0.134	0.384	U	None	SW-846 3050B/6020
	Zinc	C-68	25.4	0.768	1.92	B	J	SW-846 3050B/6020
On-Site	Aluminum	S-72	7,990	4.42	9.72		J	SW-846 3050B/6020
	Antimony	S-72	0.331	0.331	1	U	UJ	SW-846 3050B/6010B
	Arsenic	S-72	3.47	0.329	0.972		None	SW-846 3050B/6020
	Beryllium	S-72	0.412	0.0194	0.0972		None	SW-846 3050B/6020
	Cadmium	S-72	0.193	0.0194	0.194	J	J+	SW-846 3050B/6020
	Chromium	S-72	9.37	0.194	0.583		None	SW-846 3050B/6020
	Copper	S-72	11.1	0.0642	0.194	B	None	SW-846 3050B/6020
	Iron	S-72	11,000	64.2	194		J	SW-846 3050B/6020
	Lead	S-72	23.4	0.0972	0.389		None	SW-846 3050B/6020
	Magnesium	S-72	4,460	1.94	5.83		None	SW-846 3050B/6020
	Nickel	S-72	9.38	0.0972	0.389		None	SW-846 3050B/6020
	Selenium	S-72	1.12	0.35	0.972		None	SW-846 3050B/6020
	Silver	S-72	0.1	0.1	0.501	U	None	SW-846 3050B/6010B
	Thallium	S-72	0.136	0.136	0.389	U	None	SW-846 3050B/6020

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Table B-6. Nonradiological results in sediment, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Zinc	S-72	31.5	0.778	1.94	B	J	SW-846 3050B/6020
	Aluminum	S-74N	4,360	4.39	9.65		J	SW-846 3050B/6020
	Antimony	S-74N	1.57	1.57	4.76	U	None	SW-846 3050B/6010B
	Arsenic	S-74N	1.34	0.326	0.965		None	SW-846 3050B/6020
	Beryllium	S-74N	0.242	0.0193	0.0965		None	SW-846 3050B/6020
	Cadmium	S-74N	0.0944	0.0193	0.193	J	J+	SW-846 3050B/6020
	Chromium	S-74N	4.57	0.193	0.579		None	SW-846 3050B/6020
	Copper	S-74N	6.46	0.0637	0.193		None	SW-846 3050B/6020
	Iron	S-74N	12,300	63.7	193		J	SW-846 3050B/6020
	Lead	S-74N	4.48	0.0965	0.386		None	SW-846 3050B/6020
	Magnesium	S-74N	2,920	1.93	5.79		None	SW-846 3050B/6020
	Nickel	S-74N	4.87	0.0965	0.386		None	SW-846 3050B/6020
	Selenium	S-74N	0.967	0.347	0.965	N	J	SW-846 3050B/6020
	Silver	S-74N	0.21	0.0952	0.476	J	J+	SW-846 3050B/6010B
	Thallium	S-74N	0.135	0.135	0.386	U	None	SW-846 3050B/6020
	Zinc	S-74N	25.4	0.772	1.93	B	J	SW-846 3050B/6020
	Aluminum	S-75	9,650	4.43	9.75		J	SW-846 3050B/6020
	Antimony	S-75	1.59	1.59	4.81	U	None	SW-846 3050B/6010B
	Arsenic	S-75	2.51	0.329	0.975		None	SW-846 3050B/6020
	Beryllium	S-75	0.437	0.0195	0.0975		None	SW-846 3050B/6020
	Cadmium	S-75	0.173	0.0195	0.195	J	J+	SW-846 3050B/6020
	Chromium	S-75	11.2	0.195	0.585		None	SW-846 3050B/6020
	Copper	S-75	12.3	0.0643	0.195		None	SW-846 3050B/6020
	Iron	S-75	14,100	64.3	195		J	SW-846 3050B/6020
	Lead	S-75	10.8	0.0975	0.39		None	SW-846 3050B/6020
	Magnesium	S-75	4,460	1.95	5.85		None	SW-846 3050B/6020
	Nickel	S-75	10.6	0.0975	0.39		None	SW-846 3050B/6020
	Selenium	S-75	1.16	0.351	0.975	N	J	SW-846 3050B/6020
	Silver	S-75	0.0962	0.0962	0.481	U	None	SW-846 3050B/6010B

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Table B-6. Nonradiological results in sediment, 2018 (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-75	0.136	0.136	0.39	U	None	SW-846 3050B/6020
	Zinc	S-75	35.8	0.78	1.95	B	J	SW-846 3050B/6020
	Aluminum	S-83	10,800	43.1	94.7		J	SW-846 3050B/6020
	Antimony	S-83	0.385	0.324	0.982	JN	J-	SW-846 3050B/6010B
	Arsenic	S-83	2.91	0.32	0.947		None	SW-846 3050B/6020
	Beryllium	S-83	0.463	0.0189	0.0947		None	SW-846 3050B/6020
	Cadmium	S-83	0.231	0.0189	0.189		J+	SW-846 3050B/6020
	Chromium	S-83	9.08	0.189	0.568	N	J	SW-846 3050B/6020
	Copper	S-83	12	0.0625	0.189		None	SW-846 3050B/6020
	Iron	S-83	13,400	62.5	189		J	SW-846 3050B/6020
	Lead	S-83	11	0.0947	0.379		None	SW-846 3050B/6020
	Magnesium	S-83	5,220	1.89	5.68		None	SW-846 3050B/6020
	Nickel	S-83	9.78	0.0947	0.379		None	SW-846 3050B/6020
	Selenium	S-83	1.19	0.341	0.947	N	J	SW-846 3050B/6020
	Silver	S-83	0.0982	0.0982	0.491	U	None	SW-846 3050B/6010B
	Thallium	S-83	0.144	0.133	0.379	J	None	SW-846 3050B/6020
	Zinc	S-83	40.5	0.758	1.89		None	SW-846 3050B/6020
	Aluminum	S-85	6,690	4.43	9.74		J	SW-846 3050B/6020
	Antimony	S-85	0.319	0.319	0.966	U	UJ	SW-846 3050B/6010B
	Arsenic	S-85	3.09	0.329	0.974		None	SW-846 3050B/6020
	Beryllium	S-85	0.339	0.0195	0.0974		None	SW-846 3050B/6020
	Cadmium	S-85	0.129	0.0195	0.195	J	J+	SW-846 3050B/6020
	Chromium	S-85	8.68	0.195	0.584		None	SW-846 3050B/6020
	Copper	S-85	7.33	0.0643	0.195	B	None	SW-846 3050B/6020
	Iron	S-85	8,830	6.43	19.5		J	SW-846 3050B/6020
	Lead	S-85	9.67	0.0974	0.389		None	SW-846 3050B/6020
	Magnesium	S-85	2,420	1.95	5.84		None	SW-846 3050B/6020
	Nickel	S-85	7.73	0.0974	0.389		None	SW-846 3050B/6020
	Selenium	S-85	1.12	0.35	0.974		None	SW-846 3050B/6020

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Table B-6. Nonradiological results in sediment, 2018 (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-85	0.0966	0.0966	0.483	U	None	SW-846 3050B/6010B
	Thallium	S-85	0.136	0.136	0.389	U	None	SW-846 3050B/6020
	Zinc	S-85	23.6	0.779	1.95	B	J	SW-846 3050B/6020
	Aluminum	S-91	5,420	4.43	9.73		J	SW-846 3050B/6020
	Antimony	S-91	0.311	0.311	0.942	U	None	SW-846 3050B/6010B
	Arsenic	S-91	3.39	0.329	0.973		None	SW-846 3050B/6020
	Beryllium	S-91	0.371	0.0195	0.0973		None	SW-846 3050B/6020
	Cadmium	S-91	0.141	0.0195	0.195	J	J+	SW-846 3050B/6020
	Chromium	S-91	6.53	0.195	0.584		None	SW-846 3050B/6020
	Copper	S-91	7.79	0.0642	0.195		None	SW-846 3050B/6020
	Iron	S-91	12,100	64.2	195		J	SW-846 3050B/6020
	Lead	S-91	8.35	0.0973	0.389		None	SW-846 3050B/6020
	Magnesium	S-91	2,190	1.95	5.84		None	SW-846 3050B/6020
	Nickel	S-91	7.96	0.0973	0.389		None	SW-846 3050B/6020
	Selenium	S-91	1.08	0.35	0.973	N	J	SW-846 3050B/6020
	Silver	S-91	0.0942	0.0942	0.471	U	None	SW-846 3050B/6010B
	Thallium	S-91	0.136	0.136	0.389	U	None	SW-846 3050B/6020
	Zinc	S-91	26.7	0.778	1.95	B	J	SW-846 3050B/6020
Perimeter	Aluminum	P-60	7,860	4.38	9.63		J	SW-846 3050B/6020
	Antimony	P-60	1.52	1.52	4.6	U	None	SW-846 3050B/6010B
	Arsenic	P-60	2	0.326	0.963		None	SW-846 3050B/6020
	Beryllium	P-60	0.368	0.0193	0.0963		None	SW-846 3050B/6020
	Cadmium	P-60	0.132	0.0193	0.193	J	J+	SW-846 3050B/6020
	Chromium	P-60	8.13	0.193	0.578		None	SW-846 3050B/6020
	Copper	P-60	8.83	0.0636	0.193		None	SW-846 3050B/6020
	Iron	P-60	12,400	63.6	193		J	SW-846 3050B/6020
	Lead	P-60	6.68	0.0963	0.385		None	SW-846 3050B/6020
	Magnesium	P-60	3,260	1.93	5.78		None	SW-846 3050B/6020
	Nickel	P-60	7.59	0.0963	0.385		None	SW-846 3050B/6020

Table continued on next page

Table B-6. Nonradiological results in sediment, 2018 (continued)

Location Classification	Analyte	Location	Result (mg/kg)	MDL (mg/kg)	PQL (mg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
Perimeter	Selenium	P-60	1.15	0.347	0.963	N	J	SW-846 3050B/6020
	Silver	P-60	0.0919	0.0919	0.46	U	None	SW-846 3050B/6010B
	Thallium	P-60	0.135	0.135	0.385	U	None	SW-846 3050B/6020
	Zinc	P-60	27.6	0.771	1.93	B	J	SW-846 3050B/6020
	Aluminum	P-73	5,750	4.32	9.49		J	SW-846 3050B/6020
	Antimony	P-73	1.61	1.61	4.87	U	None	SW-846 3050B/6010B
	Arsenic	P-73	1.76	0.321	0.949		None	SW-846 3050B/6020
	Beryllium	P-73	0.297	0.019	0.0949		None	SW-846 3050B/6020
	Cadmium	P-73	0.127	0.019	0.19	J	J+	SW-846 3050B/6020
	Chromium	P-73	5.99	0.19	0.569		None	SW-846 3050B/6020
	Copper	P-73	7.12	0.0626	0.19		None	SW-846 3050B/6020
	Iron	P-73	11,700	62.6	190		J	SW-846 3050B/6020
	Lead	P-73	5.97	0.0949	0.38		None	SW-846 3050B/6020
	Magnesium	P-73	3,230	1.9	5.69		None	SW-846 3050B/6020
	Nickel	P-73	5.98	0.0949	0.38		None	SW-846 3050B/6020
	Selenium	P-73	1.31	0.342	0.949	N	J	SW-846 3050B/6020
	Silver	P-73	0.0975	0.0975	0.487	U	None	SW-846 3050B/6010B
	Thallium	P-73	0.133	0.133	0.38	U	None	SW-846 3050B/6020
	Zinc	P-73	28.3	0.759	1.9	B	J	SW-846 3050B/6020

MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific
PQL = 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 = analyte detected in the blank
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit

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

Table B-7. Nonradiological results in vegetation, 2018

Location Classification	Analyte	Location	Result (µg/kg)	MDL (µg/kg)	PQL (µg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Aluminum	S-33	12.2	4.43	9.73		None	SW-846 3050B/6020
	Aluminum	S-33	224	4.55	10		None	SW-846 3050B/6020
	Antimony	S-33	0.328	0.328	0.994	U	None	SW-846 3050B/6010B
	Antimony	S-33	0.32	0.32	0.969	U	None	SW-846 3050B/6010B
	Arsenic	S-33	0.329	0.329	0.973	U	None	SW-846 3050B/6020
	Arsenic	S-33	0.338	0.338	1	U	None	SW-846 3050B/6020
	Beryllium	S-33	0.0254	0.02	0.1	J	None	SW-846 3050B/6020
	Beryllium	S-33	0.0195	0.0195	0.0973	U	None	SW-846 3050B/6020
	Cadmium	S-33	0.169	0.02	0.2	J	None	SW-846 3050B/6020
	Cadmium	S-33	0.0712	0.0195	0.195	J	None	SW-846 3050B/6020
	Chromium	S-33	0.195	0.195	0.584	U	None	SW-846 3050B/6020
	Chromium	S-33	0.222	0.2	0.6	J	None	SW-846 3050B/6020
	Copper	S-33	4.77	0.066	0.2	B	None	SW-846 3050B/6020
	Copper	S-33	2.54	0.0642	0.195	B	None	SW-846 3050B/6020
	Iron	S-33	216	6.6	20		None	SW-846 3050B/6020
	Iron	S-33	18.5	6.42	19.5	J	None	SW-846 3050B/6020
	Lead	S-33	0.3	0.1	0.4	J	None	SW-846 3050B/6020
	Lead	S-33	0.0973	0.0973	0.389	U	None	SW-846 3050B/6020
	Magnesium	S-33	683	2	6		None	SW-846 3050B/6020
	Magnesium	S-33	1,080	1.95	5.84		None	SW-846 3050B/6020
	Nickel	S-33	0.457	0.1	0.4		None	SW-846 3050B/6020
	Nickel	S-33	0.48	0.0973	0.389		None	SW-846 3050B/6020
	Selenium	S-33	0.36	0.36	1	U	None	SW-846 3050B/6020
	Selenium	S-33	0.35	0.35	0.973	U	None	SW-846 3050B/6020
	Silver	S-33	0.0969	0.0969	0.484	U	None	SW-846 3050B/6010B
	Silver	S-33	0.0994	0.0994	0.497	U	None	SW-846 3050B/6010B
	Thallium	S-33	0.136	0.136	0.389	U	None	SW-846 3050B/6020
	Thallium	S-33	0.14	0.14	0.4	U	None	SW-846 3050B/6020
	Zinc	S-33	16.1	0.778	1.95		None	SW-846 3050B/6020
	Zinc	S-33	31.5	0.8	2		None	SW-846 3050B/6020

Table B-8. Perchlorate results in soil, 2018

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	11.5	0.5	2	J-	J-	SW-846 6850 Modified
	Perchlorate	S-53	0.038	0.0135	0.0398	J	J+	EPA 314.0

MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific
PQL = practical quantitation limit; the lowest concentration of analytes in a sample that can be determined reliably within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions

Laboratory Data Qualifier
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
J- = The associated numerical value is an estimated quantity with a suspected negative base

Data Validation Qualifier
J+ = The associated numerical value is an estimated quantity with a suspected positive base
J- = The associated numerical value is an estimated quantity with a suspected negative base

Table B-9. High explosives results in soil, 2018

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-		49.5	49.5	149	U	None	SW-846 8330A
	Dinitrobenzene, 1,3-		49.5	49.5	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,4-		49.5	49.5	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,6-		49.5	49.5	149	U	None	SW-846 8330A
	HMX		49.5	49.5	149	U	None	SW-846 8330A
	Nitro-benzene		49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 2-		49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 3-		49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 4-		49.5	49.5	149	U	None	SW-846 8330A
	Pentaerythritol tetranitrate		81.7	81.7	495	U	None	SW-846 8330A
	RDX		49.5	49.5	149	U	None	SW-846 8330A
	Tetryl		49.5	49.5	149	U	None	SW-846 8330A
	Trinitrobenzene, 1,3,5-		49.5	49.5	149	U	None	SW-846 8330A
	Trinitrotoluene, 2,4,6-		49.5	49.5	149	NU	None	SW-846 8330A
	Amino-2,6-dinitrotoluene, 4-	S-93	49.3	49.3	148	U	None	SW-846 8330A
	Amino-4,6-dinitrotoluene, 2-		49.3	49.3	148	U	None	SW-846 8330A
	Dinitrobenzene, 1,3-		49.3	49.3	148	U	None	SW-846 8330A
	Dinitrotoluene, 2,4-		49.3	49.3	148	U	None	SW-846 8330A
	Dinitrotoluene, 2,6-		49.3	49.3	148	U	None	SW-846 8330A
	HMX		49.3	49.3	148	U	None	SW-846 8330A
	Nitro-benzene		49.3	49.3	148	U	None	SW-846 8330A
	Nitrotoluene, 2-		49.3	49.3	148	U	None	SW-846 8330A
	Nitrotoluene, 3-		49.3	49.3	148	U	None	SW-846 8330A
	Nitrotoluene, 4-		49.3	49.3	148	U	None	SW-846 8330A
	Pentaerythritol tetranitrate		81.3	81.3	493	U	None	SW-846 8330A
	RDX		49.3	49.3	148	U	None	SW-846 8330A
	Tetryl		49.3	49.3	148	U	None	SW-846 8330A
	Trinitrobenzene, 1,3,5-		49.3	49.3	148	U	None	SW-846 8330A

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Table B-9. High explosives results in soil, 2018 (continued)

Location Classification	Analyte	Location	Result (µg/kg)	MDL (µg/kg)	PQL (µg/kg)	Laboratory Data Qualifiers	Data Validation Qualifiers	Analytical Method
On-Site	Trinitrotoluene, 2,4,6-		49.3	49.3	148	NU	None	SW-846 8330A
	Amino-2,6-dinitrotoluene, 4-	S-94	49.5	49.5	149	U	None	SW-846 8330A
	Amino-4,6-dinitrotoluene, 2-		49.5	49.5	149	U	None	SW-846 8330A
	Dinitrobenzene, 1,3-		49.5	49.5	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,4-		49.5	49.5	149	U	None	SW-846 8330A
	Dinitrotoluene, 2,6-		49.5	49.5	149	U	None	SW-846 8330A
	HMX		49.5	49.5	149	U	None	SW-846 8330A
	Nitro-benzene		49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 2-		49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 3-		49.5	49.5	149	U	None	SW-846 8330A
	Nitrotoluene, 4-		49.5	49.5	149	U	None	SW-846 8330A
	Pentaerythritol tetranitrate		81.7	81.7	495	U	None	SW-846 8330A
	RDX		49.5	49.5	149	U	None	SW-846 8330A
	Tetryl		49.5	49.5	149	U	None	SW-846 8330A
	Trinitrobenzene, 1,3,5-		49.5	49.5	149	U	None	SW-846 8330A
	Trinitrotoluene, 2,4,6-		49.5	49.5	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% 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 = analyte is absent or below the method detection limit

Data Validation Qualifier
None = no data validation for corrected gross alpha activity

Appendix C. Ambient Air Surveillance Results in Fiscal Year 2018

Clouded Sulphur (*Colias philodice*) on Chamisa flowers (*Chrysothamnus nauseosus*)

Table C-1. Ambient air metals analysis, FY 2018

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
A3PM	21-Mar-18	Aluminum	0.0578	0.08	0.0272	J
		Antimony	< 0.00132	0.004	0.00132	U
		Arsenic	< 0.002	0.012	0.002	U
		Barium	0.00253	0.002	0.0004	
		Beryllium	< 0.0004	0.002	0.0004	U
		Cadmium	< 0.0004	0.002	0.0004	U
		Calcium	0.542	0.1	0.032	
		Chromium	0.00155	0.002	0.0006	J
		Cobalt	< 0.0006	0.002	0.0006	U
		Copper	0.0182	0.004	0.0012	
		Iron	0.0632	0.1	0.032	J
		Lead	< 0.00132	0.004	0.00132	U
		Magnesium	0.0598	0.12	0.034	J
		Manganese	0.00158	0.004	0.0008	J
		Nickel	< 0.0006	0.002	0.0006	U
		Potassium	0.05	0.1	0.0256	J
		Selenium	< 0.002	0.012	0.002	U
		Silver	< 0.0004	0.002	0.0004	U
		Sodium	0.649	0.1	0.028	
		Thallium	< 0.002	0.008	0.002	U
		Uranium	0.0000276	0.00008	0.0000264	J
		Vanadium	< 0.0004	0.002	0.0004	U
		Zinc	0.0243	0.004	0.0016	
	31-May-18	Aluminum	0.195	0.08	0.0272	
		Antimony	0.00243	0.004	0.00132	J
		Arsenic	< 0.002	0.012	0.002	U
		Barium	0.00387	0.002	0.0004	
		Beryllium	< 0.0004	0.002	0.0004	U
		Cadmium	< 0.0004	0.002	0.0004	U
		Calcium	1.12	0.1	0.032	

Table continued on next page

Table C-1. Ambient air metals analysis, FY 2018 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
A3PM	31-May-18	Chromium	0.0195	0.002	0.0006	
		Cobalt	0.00232	0.002	0.0006	
		Copper	0.00888	0.004	0.0012	
		Iron	0.206	0.1	0.032	
		Lead	0.00161	0.004	0.00132	J
		Magnesium	0.174	0.12	0.034	
		Manganese	0.0053	0.004	0.0008	
		Nickel	0.00245	0.002	0.0006	
		Potassium	0.133	0.1	0.0256	
		Selenium	< 0.002	0.012	0.002	U
		Silver	0.000634	0.002	0.0004	J
		Sodium	1.13	0.1	0.028	
		Thallium	< 0.002	0.008	0.002	U
		Uranium	0.000028	0.00008	0.0000264	J
		Vanadium	0.000672	0.002	0.0004	J
		Zinc	0.0401	0.004	0.0016	
	28-Sep-18	Aluminum	0.108	0.08	0.0272	
		Antimony	< 0.00132	0.004	0.00132	U
		Arsenic	< 0.002	0.012	0.002	U
		Barium	0.003	0.002	0.0004	
		Beryllium	< 0.0004	0.002	0.0004	U
		Cadmium	< 0.0004	0.002	0.0004	U
		Calcium	1.87	0.1	0.032	
		Chromium	0.00336	0.002	0.0006	
		Cobalt	0.000668	0.002	0.0006	J
		Copper	0.0321	0.004	0.0012	
		Iron	0.104	0.1	0.032	
		Lead	0.00185	0.004	0.00132	J
		Magnesium	0.111	0.12	0.034	J
		Manganese	0.00281	0.004	0.0008	J

Table continued on next page

Table C-1. Ambient air metals analysis, FY 2018 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
A3PM	28-Sep-18	Nickel	0.00163	0.002	0.0006	J
		Potassium	0.0781	0.1	0.0256	J
		Selenium	0.00225	0.012	0.002	JB
		Silver	< 0.0004	0.002	0.0004	U
		Sodium	1.07	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	0.0389	0.004	0.0016	
BKPM	21-Mar-18	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	0.000408	0.002	0.0004	J
		Beryllium	< 0.0004	0.002	0.0004	U
		Cadmium	< 0.0004	0.002	0.0004	U
		Calcium	0.308	0.1	0.032	
		Chromium	0.00121	0.002	0.0006	J
		Cobalt	< 0.0006	0.002	0.0006	U
		Copper	< 0.0012	0.004	0.0012	U
		Iron	< 0.032	0.1	0.032	U
		Lead	< 0.00132	0.004	0.00132	U
		Magnesium	0.0345	0.12	0.034	J
		Manganese	< 0.0008	0.004	0.0008	U
		Nickel	< 0.0006	0.002	0.0006	U
		Potassium	< 0.0256	0.1	0.0256	U
		Selenium	< 0.002	0.012	0.002	U
		Silver	< 0.0004	0.002	0.0004	U
		Sodium	0.585	0.1	0.028	
		Thallium	< 0.002	0.008	0.002	U
		Uranium	< 0.0000264	0.00008	0.0000264	U

Table continued on next page

Table C-1. Ambient air metals analysis, FY 2018 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
BKPM	21-Mar-18	Vanadium	< 0.0004	0.002	0.0004	U
		Zinc	0.0236	0.004	0.0016	
	31-May-18	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	0.00099	0.002	0.0004	J
		Beryllium	< 0.0004	0.002	0.0004	U
		Cadmium	< 0.0004	0.002	0.0004	U
		Calcium	0.566	0.1	0.032	
		Chromium	0.00308	0.002	0.0006	
		Cobalt	< 0.0006	0.002	0.0006	U
		Copper	0.00275	0.004	0.0012	J
		Iron	< 0.032	0.1	0.032	U
		Lead	< 0.00132	0.004	0.00132	U
		Magnesium	0.0729	0.12	0.034	J
		Manganese	< 0.0008	0.004	0.0008	U
		Nickel	0.000626	0.002	0.0006	J
		Potassium	0.0325	0.1	0.0256	J
		Selenium	< 0.002	0.012	0.002	U
		Silver	0.00042	0.002	0.0004	J
		Sodium	0.968	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	0.0207	0.004	0.0016	
	28-Sep-18	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	0.000771	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 2018 (continued)

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifiers
BKPM	28-Sep-18	Cadmium	< 0.0004	0.002	0.0004	U
		Calcium	1.19	0.1	0.032	
		Chromium	0.00294	0.002	0.0006	
		Cobalt	< 0.0006	0.002	0.0006	U
		Copper	< 0.0012	0.004	0.0012	U
		Iron	< 0.032	0.1	0.032	U
		Lead	< 0.00132	0.004	0.00132	U
		Magnesium	0.0854	0.12	0.034	J
		Manganese	< 0.0008	0.004	0.0008	U
		Nickel	0.000654	0.002	0.0006	J
		Potassium	< 0.0256	0.1	0.0256	U
		Selenium	0.00224	0.012	0.002	JB
		Silver	< 0.0004	0.002	0.0004	U
		Sodium	1.06	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	0.0347	0.004	0.0016	

MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific
PQL = 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 = analyte detected in the blank
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
U = analyte is absent or below the method detection limit

Table C-2. Ambient air radiological analysis, FY 2018

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
A3PM	21-Mar-18	Actinium-228	12.5	39.7	31.9	15.1	U
		Alpha, gross	4.66	2.09	2.64	1.19	
		Americium-241	-0.198	18	30.9	14.9	U
		Beryllium-7	364	83	60.2	28.7	
		Beta, gross	32.4	5.37	3.05	1.48	
		Bismuth-212	22.7	58.2	101	48	U
		Bismuth-214	-2.33	19.2	17.2	8.27	U
		Cesium-137	0.419	4.33	7.55	3.59	U
		Cobalt-60	-0.534	4.34	7.67	3.53	U
		Lead-212	3.88	14.2	9.83	4.74	U
		Lead-214	-20.5	20.1	15.4	7.43	U
		Neptunium-237	1.29	7.52	12.5	6	U
		Potassium-40	0.203	115	70.9	32.4	U
		Radium-223	-65.6	73.1	116	55.8	U
		Radium-224	-7.07	68.9	106	51.1	U
		Radium-226	97.8	157	105	50.8	U
		Radium-228	12.5	39.7	31.9	15.1	U
		Sodium-22	-3.89	4.7	7.13	3.27	U
		Thorium-227	13.9	28.7	47.8	23.1	U
		Thorium-231	-85.6	90.7	75.4	36.5	U
		Thorium-234	47.2	408	331	161	U
		Uranium-235	-25.8	41.5	36.4	17.7	U
		Uranium-238	47.2	408	331	161	U
	31-May-18	Actinium-228	20.4	27.2	26.5	12.6	U
		Alpha, gross	6.89	2.44	3.32	1.51	
		Americium-241	1.11	3.57	6.15	2.97	U
		Beryllium-7	244	63.8	48.8	23.3	
		Beta, gross	23.7	2.91	3.1	1.47	
		Bismuth-212	-4.8	46.7	81.3	38.5	U
		Bismuth-214	20.2	16.3	12.4	5.91	X

Table continued on next page

Table C-2. Ambient air radiological analysis, FY 2018 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
A3PM	31-May-18	Cesium-137	-0.00848	3.57	6.28	2.99	U
		Cobalt-60	0.578	3.49	6.44	2.98	U
		Lead-212	1.38	11.9	8.1	3.92	U
		Lead-214	5.96	17.7	13.4	6.46	U
		Neptunium-237	-1.83	6.09	9.9	4.77	U
		Potassium-40	-50.4	90.2	85.5	40.4	U
		Radium-223	-26.1	64.3	103	49.5	U
		Radium-224	18	57.5	90.5	43.8	U
		Radium-226	25.2	144	89.5	43.3	U
		Radium-228	20.4	27.2	26.5	12.6	U
		Sodium-22	2.46	3.88	6.44	2.99	U
		Thorium-227	22.2	25.1	40.1	19.4	U
		Thorium-231	38	54.5	35.2	17	X
		Thorium-234	21.4	115	103	50.7	U
		Uranium-235	-18.5	33.3	27.9	13.6	U
		Uranium-238	21.4	115	103	50.7	U
	28-Sep-18	Actinium-228	-10.5	30.5	30.4	14.7	U
		Alpha, gross	6.55	2.39	3.38	1.56	
		Americium-241	-15.5	22.9	35.1	17.1	U
		Beryllium-7	219	71.6	55.4	26.9	
		Beta, gross	36.3	2.96	2.98	1.45	
		Bismuth-212	83.1	79.2	81.1	39.1	X
		Bismuth-214	-9.02	19	16	7.79	U
		Cesium-137	3.22	3.73	6.13	2.96	U
		Cobalt-60	2.4	3.71	6.49	3.09	U
		Lead-212	-4.24	13	14.4	7.1	U
		Lead-214	2.72	23.7	15.4	7.52	U
		Neptunium-237	-1.19	6.89	12.2	5.97	U
		Potassium-40	10.5	121	55.4	26.2	U
		Radium-223	23.2	67.3	120	58.5	U

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Table C-2. Ambient air radiological analysis, FY 2018 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
A3PM	28-Sep-18	Radium-224	-219	128	119	58.1	U
		Radium-226	-334	260	169	83.3	U
		Radium-228	-10.5	30.5	30.4	14.7	U
		Sodium-22	-0.187	3.38	5.96	2.83	U
		Thorium-227	11.4	30.4	49.5	24.2	U
		Thorium-231	-54	92.1	84.3	41.3	U
		Thorium-234	35.2	399	365	179	U
		Uranium-235	-20.9	44.6	38.8	19	U
		Uranium-238	35.2	399	365	179	U
BKPM	21-Mar-18	Actinium-228	-5.52	34.5	35.3	16.8	U
		Alpha, gross	1.43	1.57	2.57	1.16	U
		Americium-241	1.52	33.2	57.8	28	U
		Beryllium-7	-7.14	38.6	67	32	U
		Beta, gross	3.77	1.83	2.79	1.35	
		Bismuth-212	-107	136	105	49.6	U
		Bismuth-214	7.33	27.6	21.3	10.3	U
		Cesium-137	-0.254	4.77	8.2	3.9	U
		Cobalt-60	-2.57	4.8	7.98	3.68	U
		Lead-212	-9.74	14.5	15.7	7.66	U
		Lead-214	-18.8	23.7	20.2	9.77	U
		Neptunium-237	-7.63	9.02	14.3	6.9	U
		Potassium-40	12.6	121	78.9	36.3	U
		Radium-223	60.6	84.5	147	70.8	U
		Radium-224	-219	131	138	66.9	U
		Radium-226	-85.9	198	220	108	U
		Radium-228	-5.52	34.5	35.3	16.8	U
		Sodium-22	6.23	7.9	7.9	3.65	U
		Thorium-227	-7.56	32.1	57	27.5	U
		Thorium-231	-15.8	110	107	52.1	U
		Thorium-234	-465	493	516	252	U

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Table C-2. Ambient air radiological analysis, FY 2018 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
BKPM	21-Mar-18	Uranium-235	10.9	56.3	46.8	22.8	U
		Uranium-238	-465	493	516	252	U
	31-May-18	Actinium-228	10.6	42.9	22	10.3	U
		Alpha, gross	1.77	1.05	1.52	0.65	
		Americium-241	6.6	12.5	20.3	9.85	U
		Beryllium-7	27.4	32.9	56.3	27	U
		Beta, gross	2.7	1.35	2.12	1.01	
		Bismuth-212	36.6	53.7	92.1	43.8	U
		Bismuth-214	12.4	17.6	13.1	6.26	U
		Cesium-137	-8.76	10.6	9.43	4.56	U
		Cobalt-60	-0.276	3.68	6.63	3.07	U
		Lead-212	2.6	13.8	12.7	6.2	U
		Lead-214	1.55	17.3	14.1	6.82	U
		Neptunium-237	-4.03	6.64	11.2	5.42	U
		Potassium-40	14.9	95.3	66.5	30.8	U
		Radium-223	10.5	61	110	53.2	U
		Radium-224	40	71.3	108	52.2	U
		Radium-226	13.2	146	163	79.7	U
		Radium-228	10.6	42.9	22	10.3	U
		Sodium-22	1.14	3.54	6.56	3.05	U
		Thorium-227	3.12	27.1	44.7	21.7	U
		Thorium-231	-91.9	87.6	65.5	31.9	U
		Thorium-234	39.5	229	172	83.4	U
		Uranium-235	-35.1	38.9	36.3	17.7	U
		Uranium-238	39.5	229	172	83.4	U
	28-Sep-18	Actinium-228	-14.9	31.5	31.4	14.9	U
		Alpha, gross	2.01	1.86	3.06	1.41	U
		Americium-241	10.1	18.1	32.9	15.9	U
		Beryllium-7	61.3	49.1	60.9	29	
		Beta, gross	1.56	1.7	2.84	1.38	U

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Table C-2. Ambient air radiological analysis, FY 2018 (continued)

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers
BKPM	28-Sep-18	Bismuth-212	27.7	56.8	98.5	46.6	U
		Bismuth-214	-11.5	15.7	16.8	8.07	U
		Cesium-137	2.4	4.44	7.69	3.65	U
		Cobalt-60	10.1	7.33	10.1	3.99	U
		Lead-212	8.55	14.8	12.7	6.19	U
		Lead-214	-13.8	18.5	15.2	7.31	U
		Neptunium-237	-1.84	6.86	12.2	5.89	U
		Potassium-40	42.3	129	74	34	U
		Radium-223	12.3	68.5	125	59.9	U
		Radium-224	-47.8	122	110	52.9	U
		Radium-226	-166	178	158	77	U
		Radium-228	-14.9	31.5	31.4	14.9	U
		Sodium-22	-0.365	4.43	7.82	3.62	U
		Thorium-227	-21.3	29.5	44.3	21.3	U
		Thorium-231	-31.1	85.3	76.7	37.2	U
		Thorium-234	-96.7	324	321	156	U
		Uranium-235	-40.1	38.1	34.1	16.5	U
		Uranium-238	-96.7	324	321	156	U

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

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

Appendix D. National Emission Standards for Hazardous Air Pollutants Dose Assessments in 2018

Flame Skimmer (*Libellula saturata*)

Table D-1. On-site receptor effective dose equivalent by facility, 2018

Receptor	Effective Dose Equivalent to Maximally Exposed Individual[a]										Total	Overall Rank
	ACRR	NGF	RMWMU	Z Machine	HERMES	RPICL	ECF	PRD	AHCU	IBL		
Air Force Research Laboratory Cryogenic Cooling Research Facility	2.00E-04	6.00E-04	3.90E-06	3.20E-09	1.30E-09	1.80E-12	6.80E-10	4.70E-11	3.30E-09	1.80E-03	2.60E-03	15
Armed Forces Reserve Center	2.60E-04	6.20E-04	3.90E-06	1.10E-07	2.20E-07	3.20E-11	9.30E-09	6.10E-10	3.60E-09	1.80E-03	2.68E-03	8
Chestnut Site	2.40E-04	6.00E-04	4.30E-05	2.30E-09	7.20E-11	2.20E-12	6.40E-10	5.50E-11	3.50E-09	1.80E-03	2.68E-03	10
Child Development Center at Maxwell Family Housing	1.20E-04	6.00E-04	2.50E-06	5.60E-09	1.30E-09	7.20E-12	1.40E-09	1.70E-10	1.60E-09	1.80E-03	2.52E-03	16
Golf Course Clubhouse	6.70E-04	6.00E-04	6.10E-06	9.90E-09	7.90E-09	5.20E-12	2.30E-09	1.30E-10	8.00E-09	1.80E-03	3.08E-03	2
Homeland Security building	1.60E-04	7.00E-04	3.10E-06	3.20E-08	7.80E-08	5.30E-11	2.50E-08	1.90E-09	2.00E-09	2.10E-03	2.96E-03	4
Honeywell Systems and Support Site	1.70E-04	7.10E-04	2.90E-06	2.70E-08	4.20E-08	4.60E-10	8.80E-09	4.80E-09	2.60E-09	2.10E-03	2.98E-03	3
Lovelace Respiratory Research Institute	7.70E-05	5.90E-04	4.70E-06	1.30E-09	6.20E-11	1.10E-12	3.70E-10	2.80E-11	1.30E-09	1.80E-03	2.47E-03	19
KAFB Fire Station	1.30E-04	6.50E-04	2.50E-06	1.40E-08	1.40E-08	1.00E-10	6.20E-09	2.00E-09	2.10E-09	2.00E-03	2.78E-03	5
KAFB Landfill	2.30E-04	6.10E-04	3.80E-06	2.00E-08	7.40E-08	1.00E-11	8.60E-09	4.00E-10	2.80E-09	1.80E-03	2.64E-03	12
Kirtland Elementary School	1.10E-04	6.00E-04	2.50E-06	5.20E-09	1.10E-09	7.60E-12	1.30E-09	1.80E-10	1.60E-09	1.80E-03	2.51E-03	7
Kirtland family housing	9.00E-05	6.40E-04	2.40E-06	9.10E-09	6.10E-09	4.60E-11	5.50E-09	1.40E-09	1.30E-09	2.00E-03	2.73E-03	18
Kirtland storage facility	1.10E-03	6.00E-04	7.60E-06	1.10E-08	4.90E-09	7.10E-12	1.80E-09	1.70E-10	1.60E-08	1.80E-03	3.51E-03	1
Manzano offices (fire station)	2.50E-04	6.00E-04	5.30E-06	2.90E-09	1.00E-09	2.70E-12	9.80E-10	6.90E-11	4.10E-09	1.80E-03	2.66E-03	11
Maxwell Family Housing (southeast corner)	1.20E-04	6.00E-04	2.30E-06	6.10E-09	1.70E-09	7.90E-12	1.50E-09	1.90E-10	1.70E-09	1.80E-03	2.52E-03	17
Richard W. Davis Advanced Laser Facility	2.60E-04	6.20E-04	3.40E-06	1.70E-08	1.50E-08	2.80E-11	4.00E-09	6.00E-10	3.20E-09	1.80E-03	2.68E-03	9
Sandia Elementary School	8.50E-05	6.30E-04	2.30E-06	9.10E-09	6.50E-09	4.40E-11	4.80E-09	1.10E-09	1.30E-09	1.90E-03	2.62E-03	14
TA-IV Cafeteria	2.20E-04	6.20E-04	4.00E-06	1.60E-07	8.60E-07	3.40E-11	1.20E-08	7.10E-10	2.70E-09	1.90E-03	2.75E-03	6
Wherry Elementary School	1.10E-04	6.20E-04	2.50E-06	1.40E-08	1.20E-08	3.20E-11	3.50E-09	6.90E-10	1.80E-09	1.90E-03	2.63E-03	13

[a] (all units mrem/year)
ACRR = Annular Core Research Reactor
AHCU = Auxiliary Hot Cell Unit
ECF = Explosives Components Facility
HERMES = High-Energy Radiation Megavolt Electron Source
IBL = Ion Beam Laboratory
KAFB = Kirtland Air Force Base
NGF = Neutron Generator Facility
PRD = Process Research and Development Laboratory
RMWMU = Radioactive and Mixed Waste Management Unit
RPICL = Radiation Protection Instrument Calibration Laboratory
TA = technical area

Table D-2. Off-site receptor effective dose equivalent by facility, 2018

Receptor	Effective Dose Equivalent to Maximally Exposed Individual[a]										Total	Overall Rank
	ACRR	NGF	RMWMU	Z Machine	HERMES	RPICL	ECF	PRD	AHCU	IBL		
City of Albuquerque Environmental Health Department (bio-disease)	2.60E-05	4.90E-04	8.70E-06	7.80E-08	3.50E-10	4.40E-10	4.10E-08	1.10E-08	6.40E-09	1.40E-02	1.45E-02	6
Eubank Gate area	2.50E-05	5.60E-04	4.60E-06	9.00E-08	1.90E-08	4.60E-10	5.20E-08	1.30E-08	5.40E-09	1.60E-02	1.66E-02	1
Four Hills neighborhood	2.80E-05	4.90E-04	4.80E-06	7.70E-08	2.60E-09	4.40E-10	4.00E-08	1.10E-08	5.50E-09	1.40E-02	1.45E-02	7
Isleta Casino	5.40E-06	4.90E-04	5.10E-06	7.30E-08	2.50E-14	4.30E-10	3.80E-08	1.10E-08	4.10E-09	1.40E-02	1.45E-02	8
La Luz Early Childhood Center	2.10E-05	5.40E-04	4.30E-06	8.40E-08	8.80E-09	4.50E-10	4.40E-08	1.20E-08	5.10E-09	1.40E-02	1.46E-02	2
Mesa Del Sol housing development	2.50E-05	4.90E-04	9.80E-06	7.50E-08	7.00E-12	4.30E-10	3.90E-08	1.10E-08	5.40E-09	1.40E-02	1.45E-02	5
New Mexico School for the Blind and Visually Impaired	1.90E-05	5.10E-04	4.10E-06	8.20E-08	6.10E-09	4.50E-10	4.30E-08	1.20E-08	5.00E-09	1.40E-02	1.45E-02	4
United States Geological Society facility	7.00E-06	4.90E-04	3.00E-06	7.20E-08	3.00E-11	4.30E-10	3.80E-08	1.10E-08	4.10E-09	1.40E-02	1.45E-02	9
Veterans Administration Hospital	2.10E-05	5.00E-05	4.30E-06	8.40E-08	4.50E-09	4.40E-10	4.10E-08	1.20E-08	5.10E-09	1.40E-02	1.41E-02	10
Willow Wood neighborhood	2.00E-05	5.40E-04	4.20E-06	8.20E-08	6.80E-09	4.40E-10	4.30E-08	1.10E-08	5.00E-09	1.40E-02	1.46E-02	3

[a] (all units mrem/year)
ACRR = Annular Core Research Reactor
AHCU = Auxiliary Hot Cell Unit
ECF = Explosives Components Facility
HERMES = High-Energy Radiation Megavolt Electron Source
IBL = Ion Beam Laboratory
NGF = Neutron Generator Facility
PRD = Process Research and Development Laboratory
RMWMU = Radioactive and Mixed Waste Management Unit
RPICL = Radiation Protection Instrument Calibration Laboratory

Appendix E. Stormwater Sampling Results in 2018

Lightning in New Mexico

Table E-1. Multi-Sector General Permit stormwater sampling results, 2018

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-08	16-Jul-18	Iron	10.8	0.033	0.1	Unfiltered
		Solids, total suspended	1,990	11.4	50	Unfiltered
SWSP-17	16-Jul-18	Ammonia	1.27	0.017	0.05	Unfiltered
		Arsenic	0.0071	0.002	0.005	Unfiltered
		Cadmium	< 0.0003	0.0003	0.001	Unfiltered
		Chemical Oxygen Demand	145	8.95	20	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	0.000795	0.0005	0.002	Unfiltered
		Magnesium	9.37	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Unfiltered
	4-Sep-18	Ammonia	0.609	0.017	0.05	Unfiltered
		Arsenic	0.00795	0.002	0.005	Unfiltered
		Cadmium	< 0.0003	0.0003	0.001	Filtered
		Chemical Oxygen Demand	140	8.95	20	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	0.00084	0.0005	0.002	Filtered
		Magnesium	13.4	0.01	0.03	Unfiltered
		Mercury	0.000178	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Filtered

Table continued on next page

Table E-1. Multi-Sector General Permit stormwater sampling results, 2018 (continued)

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-17	24-Oct-18	Cadmium	< 0.0003	0.0003	0.001	Filtered
		Chemical Oxygen Demand	47.6	8.95	20	Unfiltered
		Lead	0.000521	0.0005	0.002	Filtered
		Silver	< 0.0003	0.0003	0.001	Filtered
	25-Oct-18	Ammonia	0.105	0.017	0.05	Unfiltered
		Arsenic	0.00269	0.002	0.005	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Magnesium	10.9	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
SWSP-22	12-Jul-18	Ammonia	0.806	0.017	0.05	Unfiltered
		Arsenic	0.00482	0.002	0.005	Unfiltered
		Cadmium	< 0.0003	0.0003	0.001	Filtered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	0.000683	0.0005	0.002	Filtered
		Magnesium	7.42	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Filtered
	25-Jul-18	Chemical Oxygen Demand	43.5	8.95	20	Unfiltered
SWSP-32	12-Jul-18	Arsenic	0.00811	0.002	0.005	Unfiltered
		Chemical Oxygen Demand	60.4	8.95	20	Unfiltered
		Magnesium	14.7	0.01	0.03	Unfiltered
SWSP-43	12-Jul-18	Ammonia	0.88	0.017	0.05	Unfiltered
		Arsenic	0.00376	0.002	0.005	Unfiltered
		Cadmium	< 0.0003	0.0003	0.001	Filtered
		Chemical Oxygen Demand	138	8.95	20	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	< 0.0005	0.0005	0.002	Filtered
		Magnesium	9.38	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Filtered
SWSP-46	16-Jul-18	Ammonia	1.54	0.017	0.05	Unfiltered
		Arsenic	0.00639	0.002	0.005	Unfiltered
		Cadmium	< 0.0003	0.0003	0.001	Unfiltered
		Chemical Oxygen Demand	75.8	8.95	20	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	0.000606	0.0005	0.002	Unfiltered
		Magnesium	9.28	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	0.00212	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Unfiltered

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Table E-1. Multi-Sector General Permit stormwater sampling results, 2018 (continued)

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-47	16-Jul-18	Ammonia	0.352	0.017	0.05	Unfiltered
		Arsenic	0.0022	0.002	0.005	Unfiltered
		Cadmium	< 0.0003	0.0003	0.001	Unfiltered
		Chemical Oxygen Demand	66.7	8.95	20	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	< 0.0005	0.0005	0.002	Unfiltered
		Magnesium	2.52	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Unfiltered
SWSP-48	16-Jul-18	Ammonia	0.992	0.017	0.05	Unfiltered
		Chemical Oxygen Demand	136	8.95	20	Unfiltered
		Magnesium	6.71	0.01	0.03	Unfiltered
	20-Aug-18	Chemical Oxygen Demand	68.2	8.95	20	Unfiltered
		Magnesium	7.17	0.01	0.03	Unfiltered
	4-Sep-18	Ammonia	0.318	0.017	0.05	Unfiltered
		Chemical Oxygen Demand	76.1	8.95	20	Unfiltered
		Magnesium	2.17	0.01	0.03	Unfiltered
SWSP-51	12-Jul-18	Ammonia	0.669	0.017	0.05	Unfiltered
		Arsenic	0.00296	0.002	0.005	Unfiltered
		Cadmium	<.0003	0.0003	0.001	Filtered
		Chemical Oxygen Demand	73.6	8.95	20	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	< 0.0005	0.0005	0.002	Filtered
		Magnesium	3.37	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Filtered
	20-Aug-18	Ammonia	0.195	0.017	0.05	Unfiltered
		Arsenic	< 0.002	0.002	0.005	Unfiltered
		Cadmium	<.0003	0.0003	0.001	Unfiltered
		Chemical Oxygen Demand	56.3	8.95	20	Unfiltered
		Cyanide, total	< 0.00167	0.00167	0.005	Unfiltered
		Lead	< 0.0005	0.0005	0.002	Unfiltered
		Magnesium	0.85	0.01	0.03	Unfiltered
		Mercury	< 0.000067	0.000067	0.0002	Unfiltered
		Selenium	< 0.002	0.002	0.005	Unfiltered
		Silver	< 0.0003	0.0003	0.001	Unfiltered

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

PQL = 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 E-2. Municipal Separate Storm Sewer System sampling results, July 1, 2017, through June 30, 2018

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Units	Sample Preparation
SWSP-02	1-Aug-17	Alpha, gross	34.6	1.49	3.22	pCi/L	Unfiltered
		Biochemical oxygen demand	10		2	mg/L	Unfiltered
		Chemical oxygen demand	96.1	8.95	20	mg/L	Unfiltered
		E. coli	3,076	10	10	MPN/100 mL	Unfiltered
		Nitrate plus nitrite as N	1.02	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	1.76	0.033	0.1	mg/L	Unfiltered
		Phosphorus, dissolved	0.0733	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.495	0.02	0.05	mg/L	Unfiltered
		Solids, total suspended	292	11.4	50	mg/L	Unfiltered
		Total PCB congeners	0.0523		0.0000207	µg/L	Unfiltered
	30-Aug-17	Alpha, gross	19.5	1.02	2.26	pCi/L	Unfiltered
		Biochemical oxygen demand	8		2	mg/L	Unfiltered
		Chemical oxygen demand	43.8	8.95	20	mg/L	Unfiltered
		E. coli	487	10	10	MPN/100 mL	Unfiltered
		Grease and oil	<1.2	1.2	4.27	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.642	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	1.74	0.033	0.1	mg/L	Unfiltered
		Phosphorus, dissolved	0.205	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.799	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	55.7	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	300	57	250	mg/L	Unfiltered
		Total PCB congeners	0.0358		0.0000208	µg/L	Unfiltered
	28-Sep-17	Alpha, gross	5.5	0.332	0.735	pCi/L	Unfiltered
		Biochemical oxygen demand	9		2	mg/L	Unfiltered
		Chemical oxygen demand	60.7	8.95	20	mg/L	Unfiltered
		E. coli	24,196	10	10	MPN/100 mL	Unfiltered
		Grease and oil	<1.31	1.31	4.67	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.566	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	1.32	0.033	0.1	mg/L	Unfiltered
		Phosphorus, dissolved	0.196	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.387	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	91.4	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	140	11.4	50	mg/L	Unfiltered
		Total PCB congeners	0.0159		0.0000225	µg/L	Unfiltered

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Table E-2. Municipal Separate Storm Sewer System sampling results, July 1, 2017, through June 30, 2018 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Units	Sample Preparation
SWSP-02	22-May-18	Alpha, gross	19.1	0.767	1.72	pCi/L	Unfiltered
		Biochemical oxygen demand	34		2	mg/L	Unfiltered
		Chemical oxygen demand	103	8.95	20	mg/L	Unfiltered
		E. coli	548		10	MPN/100	Unfiltered
		Nitrate plus nitrite as N	1.19	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	3.62	0.033	0.1	mg/L	Unfiltered
		Phosphorus, total as P	0.282	0.02	0.05	mg/L	Unfiltered
		Phosphorus, total as P	0.67	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	150	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	337	5.7	25	mg/L	Unfiltered
		Total PCB congeners	0.0084		0.000046	µg/L	Unfiltered
SWSP-05	1-Aug-17	Alpha, gross	6.25	0.681	1.46	pCi/L	Unfiltered
		Biochemical oxygen demand	19		2	mg/L	Unfiltered
		E. coli	20	10	10	MPN/100 mL	Unfiltered
		Nitrate plus nitrite as N	0.575	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	1.55	0.033	0.1	mg/L	Unfiltered
		Phosphorus, dissolved	0.153	0.02	0.05	mg/L	Filtered
		Total PCB Ccngeners	0.000808		0.0000223	µg/L	Unfiltered
	22-May-18	Alpha, gross	15.4	0.867	1.93	pCi/L	Unfiltered
		Biochemical oxygen deman	37		2	mg/L	Unfiltered
		Chemical oxygen demand	107	8.95	20	mg/L	Unfiltered
		E. coli	727		10	MPN/100 mL	Unfiltered
		Grease and oil	1.54	1.35	4.81	mg/L	Unfiltered
		Nitrate plus nitrite as N	1.01	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	3.13	0.033	0.1	mg/L	Unfiltered
		Phosphorus, total as P	0.207	0.02	0.05	mg/L	Unfiltered
		Phosphorus, total as P	0.534	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	151	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	287	5.7	25	mg/L	Unfiltered
		Total PCB congeners	0.00479		0.0000437	µg/L	Unfiltered
SWSP-24	1-Aug-17	Biochemical oxygen demand	14		2	mg/L	Unfiltered
		Chemical oxygen demand	136	8.95	20	mg/L	Unfiltered
		E. coli	1,274	10	10	MPN/100 mL	Unfiltered
		Nitrogen, Kjeldahl	1.37	0.033	0.1	mg/L	Unfiltered

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Table E-2. Municipal Separate Storm Sewer System sampling results, July 1, 2017, through June 30, 2018 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Units	Sample Preparation
SWSP-24	1-Aug-17	Phosphorus, dissolved	0.0607	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.153	0.02	0.05	mg/L	Unfiltered
		Total PCB congeners	0.0129		0.0000215	µg/L	Unfiltered
	30-Aug-17	Alpha, gross	10.1	0.452	0.979	pCi/L	Unfiltered
		Biochemical oxygen demand	6.7		2	mg/L	Unfiltered
		Chemical oxygen demand	50	8.95	20	mg/L	Unfiltered
		E. coli	3,654	10	10	MPN/100 mL	Unfiltered
		Grease and oil	1.57	1.3	4.63	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.607	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	1.26	0.033	0.1	mg/L	Unfiltered
		Phosphorus, dissolved	0.117	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.322	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	32.9	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	182	11.4	50	mg/L	Unfiltered
		Total PCB congeners	0.01		0.0000222	µg/L	Unfiltered
	28-Sep-17	Alpha, gross	5.98	0.284	0.623	pCi/L	Unfiltered
		Biochemical oxygen demand	8		10	mg/L	Unfiltered
		Chemical oxygen demand	86.2	8.95	20	mg/L	Unfiltered
		E. coli	4,611	10	10	MPN/100 mL	Unfiltered
		Grease and oil	2.5	1.35	4.81	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.288	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	0.84	0.033	0.1	mg/L	Unfiltered
		Phosphorus, dissolved	0.133	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.168	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	54.3	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	98	5.7	25	mg/L	Unfiltered
		Total PCB congeners	0.0108		0.0000225	µg/L	Unfiltered
	15-Feb-18	Alpha, gross	0.196	0.6	1.29	pCi/L	Unfiltered
		Biochemical oxygen demand	33		2	mg/L	Unfiltered
		Chemical oxygen demand	139	8.95	20	mg/L	Unfiltered
		E. coli	109		10	MPN/100 mL	Unfiltered
		Grease and oil	1.56	1.28	4.59	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.649	0.17	0.5	mg/L	Unfiltered
		Nitrogen, Kjeldahl	1.69	0.033	0.1	mg/L	Unfiltered

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Table E-2. Municipal Separate Storm Sewer System sampling results, July 1, 2017, through June 30, 2018 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Units	Sample Preparation
SWSP-24	15-Feb-18	Phosphorus, dissolved	0.2	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.236	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	116	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	18	5.7	25	mg/L	Unfiltered
		Total PCB congeners	0.00286		0.0000211	µg/L	Unfiltered
	22-May-18	Alpha, gross	12.1	0.608	1.36	pCi/L	Unfiltered
		Biochemical oxygen demand	43		2	mg/L	Unfiltered
		Chemical oxygen demand	131	8.95	20	mg/L	Unfiltered
		E. coli	1,354		10	MPN/100 mL	Unfiltered
		Grease and oil	2.54	1.23	4.39	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.779	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	3.53	0.033	0.1	mg/L	Unfiltered
		Phosphorus, total as P	0.442	0.02	0.05	mg/L	Unfiltered
		Phosphorus, total as P	0.609	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	133	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	208	5.7	25	mg/L	Unfiltered
		Total PCB congeners	0.0141		0.000423	µg/L	Unfiltered
SWSP-36	1-Aug-17	Alpha, gross	2.98	0.415	0.913	pCi/L	Unfiltered
		Biochemical oxygen demand	18		2	mg/L	Unfiltered
		Chemical oxygen demand	80.3	8.95	20	mg/L	Unfiltered
		E. coli	365.4	1	1	MPN/100 mL	Unfiltered
		Grease and oil	1.54	1.2	4.27	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.567	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	0.7	0.033	0.1	mg/L	Unfiltered
		Phosphorus, total as P	0.0429	0.02	0.05	mg/L	Unfiltered
		Phosphorus, dissolved	0.0468	0.02	0.05	mg/L	Filtered
		Solids, total dissolved	58.6	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	36	5.7	25	mg/L	Unfiltered
		Total PCB congeners	0.00358		0.0000228	µg/L	Unfiltered
	30-Aug-17	Alpha, gross	1.19	0.428	0.938	pCi/L	Unfiltered
		Biochemical oxygen demand	6		2	mg/L	Unfiltered
		Chemical oxygen demand	84.7	8.95	20	mg/L	Unfiltered
		E. coli	602	10	10	MPN/100 mL	Unfiltered
		Nitrate plus nitrite as N	0.663	0.017	0.05	mg/L	Unfiltered

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Table E-2. Municipal Separate Storm Sewer System sampling results, July 1, 2017, through June 30, 2018 (continued)

Sampling Point	Sample Date	Analyte	Result	MDL	PQL	Units	Sample Preparation
SWSP-36	30-Aug-17	Nitrogen, Kjeldahl	0.943	0.033	0.1	mg/L	Unfiltered
		Phosphorus, total as P	0.31	0.02	0.05	mg/L	Unfiltered
	28-Sep-17	Alpha, gross	3.31	0.167	0.372	pCi/L	Unfiltered
		Biochemical oxygen demand	16		2	mg/L	Unfiltered
		Chemical oxygen demand	78.3	8.95	20	mg/L	Unfiltered
		E. coli	145	1	1	MPN/100 mL	Unfiltered
		Grease and oil	3.52	1.33	4.76	mg/L	Unfiltered
		Nitrate plus nitrite as N	0.331	0.017	0.05	mg/L	Unfiltered
		Nitrogen, Kjeldahl	0.783	0.033	0.1	mg/L	Unfiltered
		Phosphorus, dissolved	0.0587	0.02	0.05	mg/L	Filtered
		Phosphorus, total as P	0.127	0.02	0.05	mg/L	Unfiltered
		Solids, total dissolved	34.3	3.4	14.3	mg/L	Unfiltered
		Solids, total suspended	42	2.28	10	mg/L	Unfiltered
		Total PCB congeners	0.0121		0.0000215	µg/L	Unfiltered

E. coli = *Escherichia coli*
MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific
MPN = most probable number
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 F. Sanitary Outfalls Monitoring Results in 2018

Coyote (*Canis latrans*)

Table F-1. Inorganic results for permitted sanitary outfalls, February–April 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	12-Feb-18	104415-001	Cyanide, total		0.00167	U	EPA 335.4
			104416-001	Cyanide, total		0.00167	U	EPA 335.4
			104414-001	Cyanide, total		0.00167	U	EPA 335.4
			104413-001	Cyanide, total		0.00167	U	EPA 335.4
		13-Feb-18	104417-001	Aluminum		0.0193	U	EPA 200.8
			104417-001	Arsenic	0.0031	0.002	J	EPA 200.8
			104417-001	Boron	0.0441	0.0052		EPA 200.8
			104417-001	Cadmium		0.0003	U	EPA 200.8
			104417-001	Chromium		0.003	U	EPA 200.8
			104417-001	Copper	0.00213	0.0003		EPA 200.8
			104417-002	Fluoride	1.11	0.033		EPA 300.0
			104417-001	Lead		0.0005	U	EPA 200.8
			104417-001	Mercury		0.000067	U	EPA 245.1/245.2
			104417-001	Molybdenum	0.038	0.0002		EPA 200.8
			104417-001	Nickel		0.0006	U	EPA 200.8
			104417-001	Selenium	0.0024	0.002	J	EPA 200.8
			104417-001	Silver		0.0003	U	EPA 200.8
			104417-001	Zinc		0.0033	U	EPA 200.8
		14-Feb-18	104418-001	Aluminum		0.0193	U	EPA 200.8
			104418-001	Arsenic	0.00281	0.002	J	EPA 200.8
			104418-001	Boron	0.0347	0.0052		EPA 200.8
			104418-001	Cadmium		0.0003	U	EPA 200.8
			104418-001	Chromium		0.003	U	EPA 200.8
			104418-001	Copper	0.00247	0.0003		EPA 200.8
			104418-002	Fluoride	1.2	0.033		EPA 300.0
			104418-001	Lead		0.0005	U	EPA 200.8
			104418-001	Mercury		0.000067	U	EPA 245.1/245.2
			104418-001	Molybdenum	0.0507	0.0002	B	EPA 200.8
			104418-001	Nickel		0.0006	U	EPA 200.8

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Table F-1. Inorganic results for permitted sanitary outfalls, February–April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	14-Feb-18	104418-001	Selenium	0.0026	0.002	J	EPA 200.8
			104418-001	Silver		0.0003	U	EPA 200.8
			104418-001	Zinc		0.0033	U	EPA 200.8
		24-Apr-18	104767-005	Ammonia	0.0449	0.017	J	EPA 350.1
		25-Apr-18	104774-001	Ammonia	0.469	0.017		EPA 350.1
WW001	2069A	24-Apr-18	104763-001	Aluminum	0.0503	0.0193		EPA 200.8
			104763-007	Ammonia	13.7	0.425		EPA 350.1
			104763-001	Arsenic	0.00365	0.002	J	EPA 200.8
			104763-001	Boron	0.0801	0.0052		EPA 200.8
			104763-001	Cadmium		0.0003	U	EPA 200.8
			104763-001	Chromium		0.003	U	EPA 200.8
			104763-001	Copper	0.026	0.0003	*N	EPA 200.8
			104763-002	Fluoride	3.09	0.033		EPA 300.0
			104763-001	Lead	0.00346	0.0005		EPA 200.8
			104763-001	Mercury		0.000067	U	EPA 245.1/245.2
			104763-001	Molybdenum	0.0194	0.0002		EPA 200.8
			104763-001	Nickel	0.00142	0.0006	J	EPA 200.8
			104763-001	Selenium	0.00314	0.002	J	EPA 200.8
			104763-001	Silver		0.0003	U	EPA 200.8
			104763-001	Zinc	0.0514	0.0033		EPA 200.8
		25-Apr-18	104771-001	Aluminum	0.0531	0.0193		EPA 200.8
			104771-003	Ammonia	14.5	0.425		EPA 350.1
			104771-001	Arsenic	0.00466	0.002	J	EPA 200.8
			104771-001	Boron	0.0629	0.0052		EPA 200.8
			104771-001	Cadmium		0.0003	U	EPA 200.8
			104771-001	Chromium		0.003	U	EPA 200.8
			104771-001	Copper	0.0175	0.0003	N	EPA 200.8
			104771-002	Fluoride	4.25	0.033		EPA 300.0
			104771-001	Lead	0.0633	0.0005		EPA 200.8

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Table F-1. Inorganic results for permitted sanitary outfalls, February–April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	25-Apr-18	104771-001	Mercury		0.000067	U	EPA 245.1/245.2
			104771-001	Molybdenum	0.0118	0.0002		EPA 200.8
			104771-001	Nickel	0.0013	0.0006	J	EPA 200.8
			104771-001	Selenium	0.00253	0.002	J	EPA 200.8
			104771-001	Silver		0.0003	U	EPA 200.8
			104771-001	Zinc	0.0341	0.0033		EPA 200.8
WW006	2069F	23-Apr-18	104747-001	Cyanide, total	0.0107	0.00167		EPA 335.4
			104746-001	Cyanide, total	0.00247	0.00167	J	EPA 335.4
			104745-001	Cyanide, total	0.00713	0.00167		EPA 335.4
			104748-001	Cyanide, total	0.00507	0.00167		EPA 335.4
		24-Apr-18	104761-001	Aluminum	0.0962	0.0193		EPA 200.8
			104761-007	Ammonia	44.3	0.85		EPA 350.1
			104761-001	Arsenic	0.00335	0.002	J	EPA 200.8
			104761-001	Boron	0.112	0.0052		EPA 200.8
			104761-001	Cadmium		0.0003	U	EPA 200.8
			104761-001	Chromium		0.003	U	EPA 200.8
			104761-001	Copper	0.0219	0.0003	*N	EPA 200.8
			104752-001	Cyanide, total	0.00267	0.00167	J	EPA 335.4
			104749-001	Cyanide, total	0.00466	0.00167	J	EPA 335.4
			104750-001	Cyanide, total	0.00318	0.00167	J	EPA 335.4
			104751-001	Cyanide, total	0.00313	0.00167	J	EPA 335.4
			104761-002	Fluoride	0.76	0.033		EPA 300.0
			104761-001	Lead	0.000673	0.0005	J	EPA 200.8
			104761-001	Mercury		0.000067	U	EPA 245.1/245.2
			104761-001	Molybdenum	0.0344	0.0002		EPA 200.8
			104761-001	Nickel	0.00201	0.0006		EPA 200.8
			104761-001	Selenium	0.00273	0.002	J	EPA 200.8
			104761-001	Silver	0.000761	0.0003	J	EPA 200.8
			104761-001	Zinc	0.104	0.0033		EPA 200.8

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Table F-1. Inorganic results for permitted sanitary outfalls, February–April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	25-Apr-18	104772-001	Aluminum	0.0553	0.0193		EPA 200.8
			104772-003	Ammonia	40.2	0.85		EPA 350.1
			104772-001	Arsenic	0.00333	0.002	J	EPA 200.8
			104772-001	Boron	0.0663	0.0052		EPA 200.8
			104772-001	Cadmium		0.0003	U	EPA 200.8
			104772-001	Chromium		0.003	U	EPA 200.8
			104772-001	Copper	0.0139	0.0003	N	EPA 200.8
			104772-002	Fluoride	0.805	0.033		EPA 300.0
			104772-001	Lead		0.0005	U	EPA 200.8
			104772-001	Mercury		0.000067	U	EPA 245.1/245.2
			104772-001	Molybdenum	0.0343	0.0002		EPA 200.8
			104772-001	Nickel	0.00106	0.0006	J	EPA 200.8
			104772-001	Selenium		0.002	U	EPA 200.8
			104772-001	Silver	0.0012	0.0003		EPA 200.8
			104772-001	Zinc	0.0769	0.0033		EPA 200.8
WW007	2069G	23-Apr-18	104755-001	Cyanide, total		0.00167	U	EPA 335.4
			104756-001	Cyanide, total	0.00264	0.00167	J	EPA 335.4
			104754-001	Cyanide, total	0.00259	0.00167	J	EPA 335.4
			104753-001	Cyanide, total	0.00319	0.00167	J	EPA 335.4
		24-Apr-18	104765-001	Aluminum		0.0193	U	EPA 200.8
			104765-004	Ammonia	2.53	0.085		EPA 350.1
			104765-001	Arsenic		0.002	U	EPA 200.8
			104765-001	Boron	0.0259	0.0052		EPA 200.8
			104765-001	Cadmium		0.0003	U	EPA 200.8
			104765-001	Chromium		0.003	U	EPA 200.8
			104765-001	Copper	0.00541	0.0003	*N	EPA 200.8
			104765-002	Fluoride	4.81	0.033		EPA 300.0
			104765-001	Lead		0.0005	U	EPA 200.8
			104765-001	Mercury	0.000217	0.000067		EPA 245.1/245.2

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Table F-1. Inorganic results for permitted sanitary outfalls, February–April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	24-Apr-18	104765-001	Molybdenum	0.011	0.0002		EPA 200.8
			104765-001	Nickel		0.0006	U	EPA 200.8
			104765-001	Selenium		0.002	U	EPA 200.8
			104765-001	Silver		0.0003	U	EPA 200.8
			104765-001	Zinc		0.0033	U	EPA 200.8
		25-Apr-18	104773-001	Aluminum		0.0193	U	EPA 200.8
			104773-003	Ammonia	3.22	0.085		EPA 350.1
			104773-001	Arsenic		0.002	U	EPA 200.8
			104773-001	Boron	0.0195	0.0052		EPA 200.8
			104773-001	Cadmium		0.0003	U	EPA 200.8
			104773-001	Chromium		0.003	U	EPA 200.8
			104773-001	Copper	0.00296	0.0003		EPA 200.8
			104773-002	Fluoride	5.87	0.066		EPA 300.0
			104773-001	Lead		0.0005	U	EPA 200.8
			104773-001	Mercury	0.000123	0.000067	J	EPA 245.1/245.2
			104773-001	Molybdenum	0.0101	0.0002		EPA 200.8
			104773-001	Nickel	0.000727	0.0006	J	EPA 200.8
			104773-001	Selenium		0.002	U	EPA 200.8
			104773-001	Silver		0.0003	U	EPA 200.8
			104773-001	Zinc		0.0033	U	EPA 200.8
WW008	2069I	23-Apr-18	104740-001	Cyanide, total	0.00435	0.00167	J	EPA 335.4
			104737-001	Cyanide, total	0.00406	0.00167	J	EPA 335.4
			104738-001	Cyanide, total	0.00423	0.00167	J	EPA 335.4
			104739-001	Cyanide, total	0.00905	0.00167		EPA 335.4
		24-Apr-18	104759-001	Aluminum	0.0561	0.0193		EPA 200.8
			104759-007	Ammonia	44.5	0.85		EPA 350.1
			104759-001	Arsenic	0.00367	0.002	J	EPA 200.8
			104759-001	Boron	0.0703	0.0052		EPA 200.8
			104759-001	Cadmium		0.0003	U	EPA 200.8

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Table F-1. Inorganic results for permitted sanitary outfalls, February–April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	24-Apr-18	104759-001	Chromium		0.003	U	EPA 200.8
			104759-001	Copper	0.0231	0.0003	*N	EPA 200.8
			104759-002	Fluoride	0.798	0.033		EPA 300.0
			104759-001	Lead	0.000548	0.0005	J	EPA 200.8
			104759-001	Mercury		0.000067	U	EPA 245.1/245.2
			104759-001	Molybdenum	0.00495	0.0002		EPA 200.8
			104759-001	Nickel	0.00542	0.0006		EPA 200.8
			104759-001	Selenium	0.00288	0.002	J	EPA 200.8
			104759-001	Silver		0.0003	U	EPA 200.8
			104759-001	Zinc	0.0532	0.0033		EPA 200.8
		25-Apr-18	104770-001	Aluminum	0.0446	0.0193	J	EPA 200.8
			104770-003	Ammonia	52.5	0.85		EPA 350.1
			104770-001	Arsenic	0.00341	0.002	J	EPA 200.8
			104770-001	Boron	0.0673	0.0052		EPA 200.8
			104770-001	Cadmium		0.0003	U	EPA 200.8
			104770-001	Chromium		0.003	U	EPA 200.8
			104770-001	Copper	0.0167	0.0003	N	EPA 200.8
			104770-002	Fluoride	0.75	0.033		EPA 300.0
			104770-001	Lead		0.0005	U	EPA 200.8
			104770-001	Mercury		0.000067	U	EPA 245.1/245.2
			104770-001	Molybdenum	0.0036	0.0002		EPA 200.8
			104770-001	Nickel	0.00463	0.0006		EPA 200.8
			104770-001	Selenium	0.00234	0.002	J	EPA 200.8
			104770-001	Silver		0.0003	U	EPA 200.8
			104770-001	Zinc	0.0439	0.0033		EPA 200.8
WW011	2069K	24-Apr-18	104757-001	Aluminum	0.174	0.0193		EPA 200.8
			104757-007	Ammonia	38.9	0.85		EPA 350.1
			104757-001	Arsenic	0.00507	0.002		EPA 200.8
			104757-001	Boron	0.182	0.0052		EPA 200.8

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Table F-1. Inorganic results for permitted sanitary outfalls, February–April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	24-Apr-18	104757-001	Cadmium	0.000333	0.0003	J	EPA 200.8
			104757-001	Chromium	0.00519	0.003	J	EPA 200.8
			104757-001	Copper	0.0837	0.0003	*N	EPA 200.8
			104757-002	Fluoride	0.355	0.033		EPA 300.0
			104757-001	Lead	0.0035	0.0005		EPA 200.8
			104757-001	Mercury		0.000067	U	EPA 245.1/245.2
			104757-001	Molybdenum	0.364	0.0002		EPA 200.8
			104757-001	Nickel	0.00284	0.0006		EPA 200.8
			104757-001	Selenium	0.00367	0.002	J	EPA 200.8
			104757-001	Silver	0.000616	0.0003	J	EPA 200.8
			104757-001	Zinc	0.136	0.0033		EPA 200.8
		25-Apr-18	104769-001	Aluminum	0.0687	0.0193		EPA 200.8
			104769-003	Ammonia	33.6	0.85		EPA 350.1
			104769-001	Arsenic	0.0032	0.002	J	EPA 200.8
			104769-001	Boron	0.249	0.026		EPA 200.8
			104769-001	Cadmium		0.0003	U	EPA 200.8
			104769-001	Chromium		0.003	U	EPA 200.8
			104769-001	Copper	0.0278	0.0003	N	EPA 200.8
			104769-002	Fluoride	0.516	0.033		EPA 300.0
			104769-001	Lead	0.000861	0.0005	J	EPA 200.8
			104769-001	Mercury		0.000067	U	EPA 245.1/245.2
			104769-001	Molybdenum	0.159	0.0002		EPA 200.8
			104769-001	Nickel	0.00208	0.0006		EPA 200.8
			104769-001	Selenium	0.00242	0.002	J	EPA 200.8
			104769-001	Silver		0.0003	U	EPA 200.8
			104769-001	Zinc	0.0675	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% confidence that the analyte is greater than zero; analyte is matrix specific

Laboratory Data Qualifier
B = analyte detected in the blank
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit
* = a replicate was outside limits

Table F-2. Radiological results for permitted sanitary outfalls, April 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	24-APR-2018	104767-002	Actinium-228	10.8 ± 16.3	16	U	EPA 901.1
			104767-001	Alpha, gross	2.75 ± 1.32	1.82		EPA 900.0/SW-846 9310
			104767-002	Americium-241	-6.76 ± 10.2	15.7	U	EPA 901.1
			104767-002	Beryllium-7	-0.928 ± 16.5	28.1	U	EPA 901.1
			104767-001	Beta, gross	1.02 ± 1.14	1.89	*U	EPA 900.0/SW-846 9310
			104767-002	Bismuth-212	0.325 ± 29	52.3	U	EPA 901.1
			104767-002	Bismuth-214	12.2 ± 8.63	6.54		EPA 901.1
			104767-002	Cesium-137	2.12 ± 2.13	3.65	U	EPA 901.1
			104767-002	Cobalt-60	1.79 ± 2.17	3.87	U	EPA 901.1
			104767-002	Lead-212	-1.52 ± 5.62	6.44	U	EPA 901.1
			104767-002	Lead-214	7.38 ± 8.94	8.48	U	EPA 901.1
			104767-002	Neptunium-237	2.67 ± 5.43	6.64	U	EPA 901.1
			104767-002	Potassium-40	53.8 ± 58.7	30.1	X	EPA 901.1
			104767-002	Radium-223	6.8 ± 38.1	66.4	U	EPA 901.1
			104767-002	Radium-224	-70.3 ± 48.7	59.9	U	EPA 901.1
			104767-002	Radium-226	-44 ± 77.1	81.7	U	EPA 901.1
			104767-002	Radium-228	10.8 ± 16.3	16	U	EPA 901.1
			104767-002	Sodium-22	-1.39 ± 1.91	2.98	U	EPA 901.1
			104767-002	Thorium-227	-4 ± 14.4	24.8	U	EPA 901.1
			104767-002	Thorium-231	6.36 ± 25.4	41.8	U	EPA 901.1
			104767-002	Thorium-234	-201 ± 167	156	U	EPA 901.1
			104767-003	Tritium	-35.7 ± 78.6	149	U	EPA 906.0 Modified
			104767-002	Uranium-235	-7.72 ± 18.6	20	U	EPA 901.1
			104767-002	Uranium-238	-201 ± 167	156	U	EPA 901.1
WW001	2069A	24-APR-2018	104763-004	Actinium-228	14.4 ± 11.2	18.3	U	EPA 901.1
			104763-003	Alpha, gross	3.28 ± 2.1	3.28		EPA 900.0/SW-846 9310
			104763-004	Americium-241	0.311 ± 3.01	4.84	U	EPA 901.1
			104763-004	Beryllium-7	-9.66 ± 17.3	28	U	EPA 901.1
			104763-003	Beta, gross	8.72 ± 1.68	2.51	*	EPA 900.0/SW-846 9310

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Table F-2. Radiological results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	24-APR-2018	104763-004	Bismuth-212	14.2 ± 32.5	59.7	U	EPA 901.1
			104763-004	Bismuth-214	5.14 ± 8.83	9.17	U	EPA 901.1
			104763-004	Cesium-137	0.339 ± 2.24	3.88	U	EPA 901.1
			104763-004	Cobalt-60	-0.389 ± 2.51	4.4	U	EPA 901.1
			104763-004	Lead-212	1.21 ± 6	4.98	U	EPA 901.1
			104763-004	Lead-214	7.48 ± 9.56	7	X	EPA 901.1
			104763-004	Neptunium-237	1.43 ± 3.36	6.01	U	EPA 901.1
			104763-004	Potassium-40	18.9 ± 45.9	34.8	U	EPA 901.1
			104763-004	Radium-223	-26.8 ± 36.7	58.9	U	EPA 901.1
			104763-004	Radium-224	-49.6 ± 54.1	53.8	U	EPA 901.1
			104763-004	Radium-226	28.6 ± 88.9	97.8	U	EPA 901.1
			104763-004	Radium-228	14.4 ± 11.2	18.3	U	EPA 901.1
			104763-004	Sodium-22	0.724 ± 2.45	4.04	U	EPA 901.1
			104763-004	Thorium-227	-5.94 ± 12.7	21.7	U	EPA 901.1
			104763-004	Thorium-231	-19.5 ± 27.5	30.5	U	EPA 901.1
			104763-004	Thorium-234	20.1 ± 63.8	93.3	U	EPA 901.1
			104763-005	Tritium	22.6 ± 86.1	153	U	EPA 906.0 Modified
			104763-004	Uranium-235	1.38 ± 16.1	19.1	U	EPA 901.1
			104763-004	Uranium-238	20.1 ± 63.8	93.3	U	EPA 901.1
WW006	2069F	24-APR-2018	104761-004	Actinium-228	9.71 ± 22	23.7	U	EPA 901.1
			104761-003	Alpha, gross	3.05 ± 1.31	1.67		EPA 900.0/SW-846 9310
			104761-004	Americium-241	12.3 ± 15.9	15.7	U	EPA 901.1
			104761-004	Beryllium-7	-11.4 ± 19.9	33.6	U	EPA 901.1
			104761-003	Beta, gross	19.4 ± 1.56	1.45	*	EPA 900.0/SW-846 9310
			104761-004	Bismuth-212	18.8 ± 34.2	63	U	EPA 901.1
			104761-004	Bismuth-214	-7.4 ± 14.4	12.5	U	EPA 901.1
			104761-004	Cesium-137	0.832 ± 2.89	5.25	U	EPA 901.1
			104761-004	Cobalt-60	-0.645 ± 2.67	4.87	U	EPA 901.1
			104761-004	Lead-212	-3.73 ± 7.31	8.12	U	EPA 901.1

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Table F-2. Radiological results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	24-APR-2018	104761-004	Lead-214	0.742 ± 13.7	8.36	U	EPA 901.1
			104761-004	Neptunium-237	2.28 ± 4.64	7.83	U	EPA 901.1
			104761-004	Potassium-40	-62 ± 65.1	78	U	EPA 901.1
			104761-004	Radium-223	3.86 ± 44.9	75.5	U	EPA 901.1
			104761-004	Radium-224	30.3 ± 46.9	77	U	EPA 901.1
			104761-004	Radium-226	-56.9 ± 84.4	93.3	U	EPA 901.1
			104761-004	Radium-228	9.71 ± 22	23.7	U	EPA 901.1
			104761-004	Sodium-22	-0.232 ± 2.43	4.59	U	EPA 901.1
			104761-004	Thorium-227	-2.49 ± 15.9	26.7	U	EPA 901.1
			104761-004	Thorium-231	22.2 ± 59.1	47.8	U	EPA 901.1
			104761-004	Thorium-234	-68.2 ± 175	174	U	EPA 901.1
			104761-005	Tritium	-22.8 ± 84.3	158	U	EPA 906.0 Modified
			104761-004	Uranium-235	-1.13 ± 19.1	23.3	U	EPA 901.1
			104761-004	Uranium-238	-68.2 ± 175	174	U	EPA 901.1
WW008	2069I	24-APR-2018	104759-004	Actinium-228	-4.44 ± 10.5	11.8	U	EPA 901.1
			104759-003	Alpha, gross	3.71 ± 1.45	1.89		EPA 900.0/SW-846 9310
			104759-004	Americium-241	-0.522 ± 5.84	10.2	U	EPA 901.1
			104759-004	Beryllium-7	2.62 ± 10.9	19.9	U	EPA 901.1
			104759-003	Beta, gross	18 ± 1.75	2.19	*	EPA 900.0/SW-846 9310
			104759-004	Bismuth-212	7.63 ± 19.7	35.6	U	EPA 901.1
			104759-004	Bismuth-214	-6.54 ± 7.25	6.28	U	EPA 901.1
			104759-004	Cesium-137	-0.408 ± 1.51	2.63	U	EPA 901.1
			104759-004	Cobalt-60	-0.759 ± 1.49	2.58	U	EPA 901.1
			104759-004	Lead-212	1.18 ± 4.89	5.15	U	EPA 901.1
			104759-004	Lead-214	5.57 ± 5.09	5.79	U	EPA 901.1
			104759-004	Neptunium-237	2.32 ± 2.73	4.77	U	EPA 901.1
			104759-004	Potassium-40	23.1 ± 48.7	27.8	U	EPA 901.1
			104759-004	Radium-223	-0.415 ± 26.7	48.5	U	EPA 901.1
			104759-004	Radium-224	11.3 ± 28	43.1	U	EPA 901.1

Table continued on next page

Table F-2. Radiological results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	24-APR-2018	104759-004	Radium-226	33.4 ± 62.3	64	U	EPA 901.1
			104759-004	Radium-228	-4.44 ± 10.5	11.8	U	EPA 901.1
			104759-004	Sodium-22	0.341 ± 1.46	2.81	U	EPA 901.1
			104759-004	Thorium-227	3.83 ± 10.9	18.2	U	EPA 901.1
			104759-004	Thorium-231	-25.5 ± 29.5	29.9	U	EPA 901.1
			104759-004	Thorium-234	-99.6 ± 108	108	U	EPA 901.1
			104759-005	Tritium	-23.9 ± 80.2	150	U	EPA 906.0 Modified
			104759-004	Uranium-235	6.41 ± 14.4	13.9	U	EPA 901.1
			104759-004	Uranium-238	-99.6 ± 108	108	U	EPA 901.1
WW011	2069K	24-APR-2018	104757-004	Actinium-228	-5.1 ± 10.7	12.2	U	EPA 901.1
			104757-003	Alpha, gross	4.25 ± 1.6	2.14		EPA 900.0/SW-846 9310
			104757-004	Americium-241	-3.98 ± 5.79	8.85	U	EPA 901.1
			104757-004	Beryllium-7	-4.06 ± 12.2	20.6	U	EPA 901.1
			104757-003	Beta, gross	34.3 ± 1.94	1.38	*	EPA 900.0/SW-846 9310
			104757-004	Bismuth-212	2.69 ± 23.1	40	U	EPA 901.1
			104757-004	Bismuth-214	6.43 ± 7.58	7.51	U	EPA 901.1
			104757-004	Cesium-137	0.548 ± 1.66	2.91	U	EPA 901.1
			104757-004	Cobalt-60	2.63 ± 2.03	3.17	U	EPA 901.1
			104757-004	Lead-212	0.161 ± 4.99	4.37	U	EPA 901.1
			104757-004	Lead-214	5.11 ± 5.43	6.16	U	EPA 901.1
			104757-004	Neptunium-237	-2.87 ± 3.03	4.58	U	EPA 901.1
			104757-004	Potassium-40	57.4 ± 47.5	28.8		EPA 901.1
			104757-004	Radium-223	9.46 ± 28.4	50.2	U	EPA 901.1
			104757-004	Radium-224	10.8 ± 29.3	46.8	U	EPA 901.1
			104757-004	Radium-226	44.7 ± 69.1	46.4	U	EPA 901.1
			104757-004	Radium-228	-5.1 ± 10.7	12.2	U	EPA 901.1
			104757-004	Sodium-22	0.9 ± 1.55	2.93	U	EPA 901.1
			104757-004	Thorium-227	2.77 ± 11	19.6	U	EPA 901.1
			104757-004	Thorium-231	-19.5 ± 30.3	31.6	U	EPA 901.1

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Table F-2. Radiological results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	24-APR-2018	104757-004	Thorium-234	-1.13 ± 97.7	116	U	EPA 901.1
			104757-005	Tritium	-27.3 ± 81.1	152	U	EPA 906.0 Modified
			104757-004	Uranium-235	3.79 ± 16.7	14.1	U	EPA 901.1
			104757-004	Uranium-238	-1.13 ± 97.7	116	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% probability that the measured activity is accurately quantified above the critical level

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

Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	25-Apr-2018	104774-002	Acenaphthene		0.3	U	EPA 625.1
			104774-002	Acenaphthylene		0.3	U	EPA 625.1
			104774-002	Anthracene		0.3	U	EPA 625.1
			104774-002	Benzidine		3.9	*U	EPA 625.1
			104774-002	Benzo(a)anthracene		0.3	U	EPA 625.1
			104774-002	Benzo(a)pyrene		0.3	U	EPA 625.1
			104774-002	Benzo(b)fluoranthene		0.3	U	EPA 625.1
			104774-002	Benzo(ghi)perylene		0.3	U	EPA 625.1
			104774-002	Benzo(k)fluoranthene		0.3	U	EPA 625.1
			104774-002	Bromophenyl phenyl ether, 4-		3	U	EPA 625.1
			104774-002	Butylbenzyl phthalate		0.3	U	EPA 625.1
			104774-002	Chloro-3-methylphenol, 4-		3	U	EPA 625.1
			104774-002	Chloroethoxy)methane, bis(2-		3	U	EPA 625.1
			104774-002	Chloroethyl)ether, bis(2-		3	U	EPA 625.1
			104774-002	Chloroisopropyl ether, bis-		3	U	EPA 625.1
			104774-002	Chloronaphthalene, 2-		0.41	U	EPA 625.1
			104774-002	Chlorophenol, 2-		3	U	EPA 625.1
			104774-002	Chlorophenyl phenyl ether, 4-		3	U	EPA 625.1
			104774-002	Chrysene		0.3	U	EPA 625.1
			104774-002	Di-n-butyl phthalate		0.3	U	EPA 625.1
			104774-002	Di-n-octyl phthalate		0.3	U	EPA 625.1
			104774-002	Dibenz[a,h]anthracene		0.3	U	EPA 625.1
			104774-002	Dichlorobenzidine, 3,3'-		3	U	EPA 625.1
			104774-002	Dichlorophenol, 2,4-		3	U	EPA 625.1
			104774-002	Diethylphthalate		0.3	U	EPA 625.1
			104774-002	Dimethylphenol, 2,4-		3	U	EPA 625.1
			104774-002	Dimethylphthalate		0.3	U	EPA 625.1
			104774-002	Dinitro-o-cresol		3	U	EPA 625.1
			104774-002	Dinitrophenol, 2,4-		5	U	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	25-Apr-2018	104774-002	Dinitrotoluene, 2,4-		3	U	EPA 625.1
			104774-002	Dinitrotoluene, 2,6-		3	U	EPA 625.1
			104774-002	Diphenyl amine		3	NU	EPA 625.1
			104774-002	Diphenylhydrazine, 1,2-		3	U	EPA 625.1
			104774-002	Ethylhexyl)phthalate, bis(2-		0.3	U	EPA 625.1
			104774-002	Fluoranthene		0.3	U	EPA 625.1
			104774-002	Fluorene		0.3	U	EPA 625.1
			104774-002	Hexachlorobenzene		3	U	EPA 625.1
			104774-002	Hexachlorobutadiene		3	U	EPA 625.1
			104774-002	Hexachlorocyclopentadiene		3	U	EPA 625.1
			104774-002	Hexachloroethane		3	U	EPA 625.1
			104774-002	Indeno(1,2,3-c,d)pyrene		0.3	U	EPA 625.1
			104774-002	Isophorone		3.5	U	EPA 625.1
			104774-002	Naphthalene		0.3	U	EPA 625.1
			104774-002	Nitro-benzene		3	U	EPA 625.1
			104774-002	Nitrophenol, 2-		3	U	EPA 625.1
			104774-002	Nitrophenol, 4-		3	U	EPA 625.1
			104774-002	Nitrosodimethylamine, n-		3	U	EPA 625.1
			104774-002	Nitrosodipropylamine, n-		3	U	EPA 625.1
			104774-002	Pentachlorophenol		3	U	EPA 625.1
			104774-002	Phenanthrene		0.3	U	EPA 625.1
			104774-002	Phenol		3	U	EPA 625.1
			104774-002	Pyrene		0.3	U	EPA 625.1
			104774-002	Trichlorobenzene, 1,2,4-		3	U	EPA 625.1
			104774-002	Trichlorophenol, 2,4,6-		3	U	EPA 625.1
WW001	2069A	25-Apr-2018	104771-004	Acenaphthene		0.3	U	EPA 625.1
			104771-004	Acenaphthylene		0.3	U	EPA 625.1
			104771-004	Anthracene		0.3	U	EPA 625.1
			104771-004	Benzidine		3.9	*NU	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	25-Apr-2018	104771-004	Benzo(a)anthracene		0.3	U	EPA 625.1
			104771-004	Benzo(a)pyrene		0.3	U	EPA 625.1
			104771-004	Benzo(b)fluoranthene		0.3	U	EPA 625.1
			104771-004	Benzo(ghi)perylene		0.3	U	EPA 625.1
			104771-004	Benzo(k)fluoranthene		0.3	U	EPA 625.1
			104771-004	Bromophenyl phenyl ether, 4-		3	U	EPA 625.1
			104771-004	Butylbenzyl phthalate	0.53	0.3	J	EPA 625.1
			104771-004	Chloro-3-methylphenol, 4-		3	U	EPA 625.1
			104771-004	Chloroethoxy)methane, bis(2-		3	U	EPA 625.1
			104771-004	Chloroethyl)ether, bis(2-		3	U	EPA 625.1
			104771-004	Chloroisopropyl ether, bis-		3	U	EPA 625.1
			104771-004	Chloronaphthalene, 2-		0.41	U	EPA 625.1
			104771-004	Chlorophenol, 2-		3	NU	EPA 625.1
			104771-004	Chlorophenyl phenyl ether, 4-		3	U	EPA 625.1
			104771-004	Chrysene		0.3	U	EPA 625.1
			104771-004	Di-n-butyl phthalate		0.3	U	EPA 625.1
			104771-004	Di-n-octyl phthalate		0.3	U	EPA 625.1
			104771-004	Dibenz[a,h]anthracene		0.3	U	EPA 625.1
			104771-004	Dichlorobenzidine, 3,3'-		3	NU	EPA 625.1
			104771-004	Dichlorophenol, 2,4-		3	NU	EPA 625.1
			104771-004	Diethylphthalate	0.34	0.3	J	EPA 625.1
			104771-004	Dimethylphenol, 2,4-		3	U	EPA 625.1
			104771-004	Dimethylphthalate		0.3	U	EPA 625.1
			104771-004	Dinitro-o-cresol		3	NU	EPA 625.1
			104771-004	Dinitrophenol, 2,4-		5	U	EPA 625.1
			104771-004	Dinitrotoluene, 2,4-		3	U	EPA 625.1
			104771-004	Dinitrotoluene, 2,6-		3	U	EPA 625.1
			104771-004	Diphenyl amine		3	NU	EPA 625.1
			104771-004	Diphenylhydrazine, 1,2-		3	U	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	25-Apr-2018	104771-004	Ethylhexyl)phthalate, bis(2-	0.43	0.3	J	EPA 625.1
			104771-004	Fluoranthene		0.3	U	EPA 625.1
			104771-004	Fluorene		0.3	U	EPA 625.1
			104771-004	Hexachlorobenzene		3	U	EPA 625.1
			104771-004	Hexachlorobutadiene		3	U	EPA 625.1
			104771-004	Hexachlorocyclopentadiene		3	U	EPA 625.1
			104771-004	Hexachloroethane		3	U	EPA 625.1
			104771-004	Indeno(1,2,3-c,d)pyrene		0.3	U	EPA 625.1
			104771-004	Isophorone		3.5	U	EPA 625.1
			104771-004	Naphthalene		0.3	U	EPA 625.1
			104771-004	Nitro-benzene		3	U	EPA 625.1
			104771-004	Nitrophenol, 2-		3	NU	EPA 625.1
			104771-004	Nitrophenol, 4-		3	U	EPA 625.1
			104771-004	Nitrosodimethylamine, n-		3	U	EPA 625.1
			104771-004	Nitrosodipropylamine, n-		3	U	EPA 625.1
			104771-004	Pentachlorophenol		3	U	EPA 625.1
			104771-004	Phenanthrene		0.3	U	EPA 625.1
			104771-004	Phenol		3	NU	EPA 625.1
			104771-004	Pyrene		0.3	U	EPA 625.1
			104771-004	Trichlorobenzene, 1,2,4-		3	U	EPA 625.1
			104771-004	Trichlorophenol, 2,4,6-		3	NU	EPA 625.1
WW006	2069F	25-Apr-2018	104772-004	Acenaphthene		0.273	U	EPA 625.1
			104772-004	Acenaphthylene		0.273	U	EPA 625.1
			104772-004	Anthracene		0.273	U	EPA 625.1
			104772-004	Benzidine		3.55	*NU	EPA 625.1
			104772-004	Benzo(a)anthracene		0.273	U	EPA 625.1
			104772-004	Benzo(a)pyrene		0.273	U	EPA 625.1
			104772-004	Benzo(b)fluoranthene		0.273	U	EPA 625.1
			104772-004	Benzo(ghi)perylene		0.273	U	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	25-Apr-2018	104772-004	Benzo(k)fluoranthene		0.273	U	EPA 625.1
			104772-004	Bromophenyl phenyl ether, 4-		2.73	U	EPA 625.1
			104772-004	Butylbenzyl phthalate	8.5	0.273	J	EPA 625.1
			104772-004	Chloro-3-methylphenol, 4-		2.73	U	EPA 625.1
			104772-004	Chloroethoxy)methane, bis(2-		2.73	U	EPA 625.1
			104772-004	Chloroethyl)ether, bis(2-		2.73	U	EPA 625.1
			104772-004	Chloroisopropyl ether, bis-		2.73	U	EPA 625.1
			104772-004	Chloronaphthalene, 2-		0.373	U	EPA 625.1
			104772-004	Chlorophenol, 2-		2.73	NU	EPA 625.1
			104772-004	Chlorophenyl phenyl ether, 4-		2.73	U	EPA 625.1
			104772-004	Chrysene		0.273	U	EPA 625.1
			104772-004	Di-n-butyl phthalate	0.382	0.273	J	EPA 625.1
			104772-004	Di-n-octyl phthalate		0.273	U	EPA 625.1
			104772-004	Dibenz[a,h]anthracene		0.273	U	EPA 625.1
			104772-004	Dichlorobenzidine, 3,3'-		2.73	NU	EPA 625.1
			104772-004	Dichlorophenol, 2,4-		2.73	NU	EPA 625.1
			104772-004	Diethylphthalate		0.273	U	EPA 625.1
			104772-004	Dimethylphenol, 2,4-		2.73	U	EPA 625.1
			104772-004	Dimethylphthalate		0.273	U	EPA 625.1
			104772-004	Dinitro-o-cresol		2.73	NU	EPA 625.1
			104772-004	Dinitrophenol, 2,4-		4.55	U	EPA 625.1
			104772-004	Dinitrotoluene, 2,4-		2.73	U	EPA 625.1
			104772-004	Dinitrotoluene, 2,6-		2.73	U	EPA 625.1
			104772-004	Diphenyl amine		2.73	NU	EPA 625.1
			104772-004	Diphenylhydrazine, 1,2-		2.73	U	EPA 625.1
			104772-004	Ethylhexyl)phthalate, bis(2-	9.79	0.273		EPA 625.1
			104772-004	Fluoranthene		0.273	U	EPA 625.1
			104772-004	Fluorene		0.273	U	EPA 625.1
			104772-004	Hexachlorobenzene		2.73	U	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	25-Apr-2018	104772-004	Hexachlorobutadiene		2.73	U	EPA 625.1
			104772-004	Hexachlorocyclopentadiene		2.73	U	EPA 625.1
			104772-004	Hexachloroethane		2.73	U	EPA 625.1
			104772-004	Indeno(1,2,3-c,d)pyrene		0.273	U	EPA 625.1
			104772-004	Isophorone		3.18	U	EPA 625.1
			104772-004	Naphthalene		0.273	U	EPA 625.1
			104772-004	Nitro-benzene		2.73	U	EPA 625.1
			104772-004	Nitrophenol, 2-		2.73	NU	EPA 625.1
			104772-004	Nitrophenol, 4-		2.73	U	EPA 625.1
			104772-004	Nitrosodimethylamine, n-		2.73	U	EPA 625.1
			104772-004	Nitrosodipropylamine, n-		2.73	U	EPA 625.1
			104772-004	Pentachlorophenol		2.73	U	EPA 625.1
			104772-004	Phenanthrene		0.273	U	EPA 625.1
			104772-004	Phenol		2.73	NU	EPA 625.1
			104772-004	Pyrene		0.273	U	EPA 625.1
			104772-004	Trichlorobenzene, 1,2,4-		2.73	U	EPA 625.1
			104772-004	Trichlorophenol, 2,4,6-		2.73	NU	EPA 625.1
WW007	2069G	25-Apr-2018	104773-004	Acenaphthene		0.28	UH	EPA 625.1
			104773-004	Acenaphthylene		0.28	UH	EPA 625.1
			104773-004	Anthracene		0.28	UH	EPA 625.1
			104773-004	Benzidine		3.64	*UH	EPA 625.1
			104773-004	Benzo(a)anthracene		0.28	UH	EPA 625.1
			104773-004	Benzo(a)pyrene		0.28	UH	EPA 625.1
			104773-004	Benzo(b)fluoranthene		0.28	UH	EPA 625.1
			104773-004	Benzo(ghi)perylene		0.28	UH	EPA 625.1
			104773-004	Benzo(k)fluoranthene		0.28	UH	EPA 625.1
			104773-004	Bromophenyl phenyl ether, 4-		2.8	UH	EPA 625.1
			104773-004	Butylbenzyl phthalate		0.28	UH	EPA 625.1
			104773-004	Chloro-3-methylphenol, 4-		2.8	UH	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	25-Apr-2018	104773-004	Chloroethoxy)methane, bis(2-		2.8	UH	EPA 625.1
			104773-004	Chloroethyl)ether, bis(2-		2.8	UH	EPA 625.1
			104773-004	Chloroisopropyl ether, bis-		2.8	UH	EPA 625.1
			104773-004	Chloronaphthalene, 2-		0.383	UH	EPA 625.1
			104773-004	Chlorophenol, 2-		2.8	UH	EPA 625.1
			104773-004	Chlorophenyl phenyl ether, 4-		2.8	UH	EPA 625.1
			104773-004	Chrysene		0.28	UH	EPA 625.1
			104773-004	Di-n-butyl phthalate		0.28	UH	EPA 625.1
			104773-004	Di-n-octyl phthalate		0.28	UH	EPA 625.1
			104773-004	Dibenz[a,h]anthracene		0.28	UH	EPA 625.1
			104773-004	Dichlorobenzidine, 3,3'-		2.8	UH	EPA 625.1
			104773-004	Dichlorophenol, 2,4-		2.8	UH	EPA 625.1
			104773-004	Diethylphthalate	0.963	0.28	JH	EPA 625.1
			104773-004	Dimethylphenol, 2,4-		2.8	UH	EPA 625.1
			104773-004	Dimethylphthalate		0.28	UH	EPA 625.1
			104773-004	Dinitro-o-cresol		2.8	UH	EPA 625.1
			104773-004	Dinitrophenol, 2,4-		4.67	UH	EPA 625.1
			104773-004	Dinitrotoluene, 2,4-		2.8	UH	EPA 625.1
			104773-004	Dinitrotoluene, 2,6-		2.8	UH	EPA 625.1
			104773-004	Diphenyl amine		2.8	UH	EPA 625.1
			104773-004	Diphenylhydrazine, 1,2-		2.8	UH	EPA 625.1
			104773-004	Ethylhexyl)phthalate, bis(2-	1.13	0.28	H	EPA 625.1
			104773-004	Fluoranthene		0.28	UH	EPA 625.1
			104773-004	Fluorene		0.28	UH	EPA 625.1
			104773-004	Hexachlorobenzene		2.8	UH	EPA 625.1
			104773-004	Hexachlorobutadiene		2.8	UH	EPA 625.1
			104773-004	Hexachlorocyclopentadiene		2.8	UH	EPA 625.1
			104773-004	Hexachloroethane		2.8	UH	EPA 625.1
			104773-004	Indeno(1,2,3-c,d)pyrene		0.28	UH	EPA 625.1

Table continued on next page

Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	25-Apr-2018	104773-004	Isophorone		3.27	UH	EPA 625.1
			104773-004	Naphthalene		0.28	UH	EPA 625.1
			104773-004	Nitro-benzene		2.8	UH	EPA 625.1
			104773-004	Nitrophenol, 2-		2.8	UH	EPA 625.1
			104773-004	Nitrophenol, 4-		2.8	UH	EPA 625.1
			104773-004	Nitrosodimethylamine, n-		2.8	UH	EPA 625.1
			104773-004	Nitrosodipropylamine, n-		2.8	UH	EPA 625.1
			104773-004	Pentachlorophenol		2.8	UH	EPA 625.1
			104773-004	Phenanthrene		0.28	UH	EPA 625.1
			104773-004	Phenol		2.8	UH	EPA 625.1
			104773-004	Pyrene		0.28	UH	EPA 625.1
			104773-004	Trichlorobenzene, 1,2,4-		2.8	UH	EPA 625.1
			104773-004	Trichlorophenol, 2,4,6-		2.8	UH	EPA 625.1
WW008	2069I	25-Apr-2018	104770-004	Acenaphthene		0.303	U	EPA 625.1
			104770-004	Acenaphthylene		0.303	U	EPA 625.1
			104770-004	Anthracene		0.303	U	EPA 625.1
			104770-004	Benzidine		3.94	*NU	EPA 625.1
			104770-004	Benzo(a)anthracene		0.303	U	EPA 625.1
			104770-004	Benzo(a)pyrene		0.303	U	EPA 625.1
			104770-004	Benzo(b)fluoranthene		0.303	U	EPA 625.1
			104770-004	Benzo(ghi)perylene		0.303	U	EPA 625.1
			104770-004	Benzo(k)fluoranthene		0.303	U	EPA 625.1
			104770-004	Bromophenyl phenyl ether, 4-		3.03	U	EPA 625.1
			104770-004	Butylbenzyl phthalate		0.303	U	EPA 625.1
			104770-004	Chloro-3-methylphenol, 4-		3.03	U	EPA 625.1
			104770-004	Chloroethoxy)methane, bis(2-		3.03	U	EPA 625.1
			104770-004	Chloroethyl)ether, bis(2-		3.03	U	EPA 625.1
			104770-004	Chloroisopropyl ether, bis-		3.03	U	EPA 625.1
			104770-004	Chloronaphthalene, 2-		0.414	U	EPA 625.1

Table continued on next page

Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	25-Apr-2018	104770-004	Chlorophenol, 2-		3.03	NU	EPA 625.1
			104770-004	Chlorophenyl phenyl ether, 4-		3.03	U	EPA 625.1
			104770-004	Chrysene		0.303	U	EPA 625.1
			104770-004	Di-n-butyl phthalate		0.303	U	EPA 625.1
			104770-004	Di-n-octyl phthalate		0.303	U	EPA 625.1
			104770-004	Dibenz[a,h]anthracene		0.303	U	EPA 625.1
			104770-004	Dichlorobenzidine, 3,3'-		3.03	NU	EPA 625.1
			104770-004	Dichlorophenol, 2,4-		3.03	NU	EPA 625.1
			104770-004	Diethylphthalate		0.303	U	EPA 625.1
			104770-004	Dimethylphenol, 2,4-		3.03	U	EPA 625.1
			104770-004	Dimethylphthalate		0.303	U	EPA 625.1
			104770-004	Dinitro-o-cresol		3.03	NU	EPA 625.1
			104770-004	Dinitrophenol, 2,4-		5.05	U	EPA 625.1
			104770-004	Dinitrotoluene, 2,4-		3.03	U	EPA 625.1
			104770-004	Dinitrotoluene, 2,6-		3.03	U	EPA 625.1
			104770-004	Diphenyl amine		3.03	NU	EPA 625.1
			104770-004	Diphenylhydrazine, 1,2-		3.03	U	EPA 625.1
			104770-004	Ethylhexyl)phthalate, bis(2-		0.303	U	EPA 625.1
			104770-004	Fluoranthene		0.303	U	EPA 625.1
			104770-004	Fluorene		0.303	U	EPA 625.1
			104770-004	Hexachlorobenzene		3.03	U	EPA 625.1
			104770-004	Hexachlorobutadiene		3.03	U	EPA 625.1
			104770-004	Hexachlorocyclopentadiene		3.03	U	EPA 625.1
			104770-004	Hexachloroethane		3.03	U	EPA 625.1
			104770-004	Indeno(1,2,3-c,d)pyrene		0.303	U	EPA 625.1
			104770-004	Isophorone		3.54	U	EPA 625.1
			104770-004	Naphthalene		0.303	U	EPA 625.1
			104770-004	Nitro-benzene		3.03	U	EPA 625.1
			104770-004	Nitrophenol, 2-		3.03	NU	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	25-Apr-2018	104770-004	Nitrophenol, 4-		3.03	U	EPA 625.1
			104770-004	Nitrosodimethylamine, n-		3.03	U	EPA 625.1
			104770-004	Nitrosodipropylamine, n-		3.03	U	EPA 625.1
			104770-004	Pentachlorophenol		3.03	U	EPA 625.1
			104770-004	Phenanthrene		0.303	U	EPA 625.1
			104770-004	Phenol		3.03	NU	EPA 625.1
			104770-004	Pyrene		0.303	U	EPA 625.1
			104770-004	Trichlorobenzene, 1,2,4-		3.03	U	EPA 625.1
			104770-004	Trichlorophenol, 2,4,6-		3.03	NU	EPA 625.1
WW011	2069K	25-Apr-2018	104769-004	Acenaphthene		0.297	U	EPA 625.1
			104769-004	Acenaphthylene		0.297	U	EPA 625.1
			104769-004	Anthracene		0.297	U	EPA 625.1
			104769-004	Benzidine		3.86	*U	EPA 625.1
			104769-004	Benzo(a)anthracene		0.297	U	EPA 625.1
			104769-004	Benzo(a)pyrene		0.297	U	EPA 625.1
			104769-004	Benzo(b)fluoranthene		0.297	U	EPA 625.1
			104769-004	Benzo(ghi)perylene		0.297	U	EPA 625.1
			104769-004	Benzo(k)fluoranthene		0.297	U	EPA 625.1
			104769-004	Bromophenyl phenyl ether, 4-		2.97	U	EPA 625.1
			104769-004	Butylbenzyl phthalate		0.297	U	EPA 625.1
			104769-004	Chloro-3-methylphenol, 4-	3.69	2.97	J	EPA 625.1
			104769-004	Chloroethoxy)methane, bis(2-		2.97	U	EPA 625.1
			104769-004	Chloroethyl)ether, bis(2-		2.97	U	EPA 625.1
			104769-004	Chloroisopropyl ether, bis-		2.97	U	EPA 625.1
			104769-004	Chloronaphthalene, 2-		0.406	U	EPA 625.1
			104769-004	Chlorophenol, 2-		2.97	U	EPA 625.1
			104769-004	Chlorophenyl phenyl ether, 4-		2.97	U	EPA 625.1
			104769-004	Chrysene		0.297	U	EPA 625.1
			104769-004	Di-n-butyl phthalate		0.297	U	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	25-Apr-2018	104769-004	Di-n-octyl phthalate		0.297	U	EPA 625.1
			104769-004	Dibenz[a,h]anthracene		0.297	U	EPA 625.1
			104769-004	Dichlorobenzidine, 3,3'-		2.97	U	EPA 625.1
			104769-004	Dichlorophenol, 2,4-		2.97	U	EPA 625.1
			104769-004	Diethylphthalate		0.297	U	EPA 625.1
			104769-004	Dimethylphenol, 2,4-		2.97	U	EPA 625.1
			104769-004	Dimethylphthalate		0.297	U	EPA 625.1
			104769-004	Dinitro-o-cresol		2.97	U	EPA 625.1
			104769-004	Dinitrophenol, 2,4-		4.95	U	EPA 625.1
			104769-004	Dinitrotoluene, 2,4-		2.97	U	EPA 625.1
			104769-004	Dinitrotoluene, 2,6-		2.97	U	EPA 625.1
			104769-004	Diphenyl amine		2.97	NU	EPA 625.1
			104769-004	Diphenylhydrazine, 1,2-		2.97	U	EPA 625.1
			104769-004	Ethylhexyl)phthalate, bis(2-	0.683	0.297	J	EPA 625.1
			104769-004	Fluoranthene		0.297	U	EPA 625.1
			104769-004	Fluorene		0.297	U	EPA 625.1
			104769-004	Hexachlorobenzene		2.97	U	EPA 625.1
			104769-004	Hexachlorobutadiene		2.97	U	EPA 625.1
			104769-004	Hexachlorocyclopentadiene		2.97	U	EPA 625.1
			104769-004	Hexachloroethane		2.97	U	EPA 625.1
			104769-004	Indeno(1,2,3-c,d)pyrene		0.297	U	EPA 625.1
			104769-004	Isophorone		3.47	U	EPA 625.1
			104769-004	Naphthalene		0.297	U	EPA 625.1
			104769-004	Nitro-benzene		2.97	U	EPA 625.1
			104769-004	Nitrophenol, 2-		2.97	U	EPA 625.1
			104769-004	Nitrophenol, 4-		2.97	U	EPA 625.1
			104769-004	Nitrosodimethylamine, n-		2.97	U	EPA 625.1
			104769-004	Nitrosodipropylamine, n-		2.97	U	EPA 625.1
			104769-004	Pentachlorophenol		2.97	U	EPA 625.1

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Table F-3. Semivolatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	25-Apr-2018	104769-004	Phenanthrene		0.297	U	EPA 625.1
			104769-004	Phenol		2.97	U	EPA 625.1
			104769-004	Pyrene		0.297	U	EPA 625.1
			104769-004	Trichlorobenzene, 1,2,4-		2.97	U	EPA 625.1
			104769-004	Trichlorophenol, 2,4,6-		2.97	U	EPA 625.1

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

Laboratory Data Qualifier
H = analytical holding time was exceeded
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit
* = a replicate was outside limits

Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	24-Apr-2018	104767-004	Acrolein		1.67	U	EPA 624.1
			104767-004	Acrylonitrile		1.67	U	EPA 624.1
			104767-004	Benzene		0.333	U	EPA 624.1
			104767-004	Bromodichloromethane	2.69	0.333		EPA 624.1
			104767-004	Bromoform	7.45	0.333		EPA 624.1
			104767-004	Bromomethane		0.337	U	EPA 624.1
			104767-004	Carbon tetrachloride		0.333	U	EPA 624.1
			104767-004	Chlorobenzene		0.333	U	EPA 624.1
			104767-004	Chloroethane		0.333	U	EPA 624.1
			104767-004	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			104767-004	Chloroform	1	0.333		EPA 624.1
			104767-004	Chloromethane		0.333	U	EPA 624.1
			104767-004	Dibromochloromethane	5.47	0.333		EPA 624.1
			104767-004	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			104767-004	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			104767-004	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			104767-004	Dichlorodifluoromethane		0.355	U	EPA 624.1
			104767-004	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			104767-004	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			104767-004	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			104767-004	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			104767-004	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			104767-004	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			104767-004	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			104767-004	Ethyl benzene		0.333	U	EPA 624.1
			104767-004	Methylene chloride		1.67	U	EPA 624.1
			104767-004	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			104767-004	Tetrachloroethene		0.333	U	EPA 624.1
			104767-004	Toluene		0.333	U	EPA 624.1

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Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	24-Apr-2018	104767-004	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			104767-004	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			104767-004	Trichloroethene		0.333	U	EPA 624.1
			104767-004	Trichlorofluoromethane		0.333	U	EPA 624.1
			104767-004	Vinyl chloride		0.333	U	EPA 624.1
WW001	2069A	24-Apr-2018	104763-006	Acrolein		1.67	U	EPA 624.1
			104763-006	Acrylonitrile		1.67	U	EPA 624.1
			104763-006	Benzene		0.333	U	EPA 624.1
			104763-006	Bromodichloromethane		0.333	U	EPA 624.1
			104763-006	Bromoform	1.39	0.333		EPA 624.1
			104763-006	Bromomethane		0.337	U	EPA 624.1
			104763-006	Carbon tetrachloride		0.333	U	EPA 624.1
			104763-006	Chlorobenzene		0.333	U	EPA 624.1
			104763-006	Chloroethane		0.333	U	EPA 624.1
			104763-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			104763-006	Chloroform		0.333	U	EPA 624.1
			104763-006	Chloromethane		0.333	U	EPA 624.1
			104763-006	Dibromochloromethane	0.51	0.333	J	EPA 624.1
			104763-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			104763-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			104763-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			104763-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			104763-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			104763-006	Dichloroethane, 1,2-	2.59	0.333		EPA 624.1
			104763-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			104763-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			104763-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			104763-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			104763-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1

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Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	24-Apr-2018	104763-006	Ethyl benzene		0.333	U	EPA 624.1
			104763-006	Methylene chloride	2.01	1.67		EPA 624.1
			104763-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			104763-006	Tetrachloroethene		0.333	U	EPA 624.1
			104763-006	Toluene		0.333	U	EPA 624.1
			104763-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			104763-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			104763-006	Trichloroethene		0.333	U	EPA 624.1
			104763-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			104763-006	Vinyl chloride		0.333	U	EPA 624.1
WW006	2069F	24-Apr-18	104761-006	Acrolein		1.67	U	EPA 624.1
			104761-006	Acrylonitrile		1.67	U	EPA 624.1
			104761-006	Benzene		0.333	U	EPA 624.1
			104761-006	Bromodichloromethane		0.333	U	EPA 624.1
			104761-006	Bromoform	0.98	0.333	J	EPA 624.1
			104761-006	Bromomethane		0.337	U	EPA 624.1
			104761-006	Carbon tetrachloride		0.333	U	EPA 624.1
			104761-006	Chlorobenzene		0.333	U	EPA 624.1
			104761-006	Chloroethane		0.333	U	EPA 624.1
			104761-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			104761-006	Chloroform		0.333	U	EPA 624.1
			104761-006	Chloromethane		0.333	U	EPA 624.1
			104761-006	Dibromochloromethane		0.333	U	EPA 624.1
			104761-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			104761-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			104761-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			104761-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			104761-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			104761-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1

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Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	24-Apr-18	104761-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			104761-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			104761-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			104761-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			104761-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			104761-006	Ethyl benzene		0.333	U	EPA 624.1
			104761-006	Methylene chloride		1.67	U	EPA 624.1
			104761-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			104761-006	Tetrachloroethene		0.333	U	EPA 624.1
			104761-006	Toluene		0.333	U	EPA 624.1
			104761-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			104761-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			104761-006	Trichloroethene		0.333	U	EPA 624.1
			104761-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			104761-006	Vinyl chloride		0.333	U	EPA 624.1
WW007	2069G	24-Apr-18	104765-003	Acrolein		1.67	U	EPA 624.1
			104765-003	Acrylonitrile		1.67	U	EPA 624.1
			104765-003	Benzene		0.333	U	EPA 624.1
			104765-003	Bromodichloromethane		0.333	U	EPA 624.1
			104765-003	Bromoform		0.333	U	EPA 624.1
			104765-003	Bromomethane		0.337	U	EPA 624.1
			104765-003	Carbon tetrachloride		0.333	U	EPA 624.1
			104765-003	Chlorobenzene		0.333	U	EPA 624.1
			104765-003	Chloroethane		0.333	U	EPA 624.1
			104765-003	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			104765-003	Chloroform		0.333	U	EPA 624.1
			104765-003	Chloromethane		0.333	U	EPA 624.1
			104765-003	Dibromochloromethane		0.333	U	EPA 624.1
			104765-003	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1

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Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	24-Apr-18	104765-003	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			104765-003	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			104765-003	Dichlorodifluoromethane		0.355	U	EPA 624.1
			104765-003	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			104765-003	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			104765-003	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			104765-003	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			104765-003	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			104765-003	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			104765-003	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			104765-003	Ethyl benzene		0.333	U	EPA 624.1
			104765-003	Methylene chloride		1.67	U	EPA 624.1
			104765-003	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			104765-003	Tetrachloroethene		0.333	U	EPA 624.1
			104765-003	Toluene		0.333	U	EPA 624.1
			104765-003	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			104765-003	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			104765-003	Trichloroethene		0.333	U	EPA 624.1
			104765-003	Trichlorofluoromethane		0.333	U	EPA 624.1
			104765-003	Vinyl chloride		0.333	U	EPA 624.1
WW008	2069I	24-Apr-18	104759-006	Acrolein		1.67	U	EPA 624.1
			104759-006	Acrylonitrile		1.67	U	EPA 624.1
			104759-006	Benzene		0.333	U	EPA 624.1
			104759-006	Bromodichloromethane		0.333	U	EPA 624.1
			104759-006	Bromoform		0.333	U	EPA 624.1
			104759-006	Bromomethane		0.337	U	EPA 624.1
			104759-006	Carbon tetrachloride		0.333	U	EPA 624.1
			104759-006	Chlorobenzene		0.333	U	EPA 624.1
			104759-006	Chloroethane		0.333	U	EPA 624.1

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Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	24-Apr-18	104759-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			104759-006	Chloroform		0.333	U	EPA 624.1
			104759-006	Chloromethane	0.35	0.333	J	EPA 624.1
			104759-006	Dibromochloromethane		0.333	U	EPA 624.1
			104759-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			104759-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			104759-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			104759-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			104759-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			104759-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			104759-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			104759-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			104759-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			104759-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			104759-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			104759-006	Ethyl benzene		0.333	U	EPA 624.1
			104759-006	Methylene chloride		1.67	U	EPA 624.1
			104759-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			104759-006	Tetrachloroethene		0.333	U	EPA 624.1
			104759-006	Toluene		0.333	U	EPA 624.1
			104759-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			104759-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			104759-006	Trichloroethene		0.333	U	EPA 624.1
			104759-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			104759-006	Vinyl chloride		0.333	U	EPA 624.1
WW011	2069K	24-Apr-18	104757-006	Acrolein		1.67	U	EPA 624.1
			104757-006	Acrylonitrile		1.67	U	EPA 624.1
			104757-006	Benzene		0.333	U	EPA 624.1
			104757-006	Bromodichloromethane		0.333	U	EPA 624.1

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Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	24-Apr-18	104757-006	Bromoform	0.95	0.333	J	EPA 624.1
			104757-006	Bromomethane		0.337	U	EPA 624.1
			104757-006	Carbon tetrachloride		0.333	U	EPA 624.1
			104757-006	Chlorobenzene		0.333	U	EPA 624.1
			104757-006	Chloroethane		0.333	U	EPA 624.1
			104757-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			104757-006	Chloroform		0.333	U	EPA 624.1
			104757-006	Chloromethane		0.333	U	EPA 624.1
			104757-006	Dibromochloromethane		0.333	U	EPA 624.1
			104757-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			104757-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			104757-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			104757-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			104757-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			104757-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			104757-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			104757-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			104757-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			104757-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			104757-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			104757-006	Ethyl benzene		0.333	U	EPA 624.1
			104757-006	Methylene chloride		1.67	U	EPA 624.1
			104757-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			104757-006	Tetrachloroethene		0.333	U	EPA 624.1
			104757-006	Toluene		0.333	U	EPA 624.1
			104757-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			104757-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			104757-006	Trichloroethene		0.333	U	EPA 624.1

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Table F-4. Volatile organic compound results for permitted sanitary outfalls, April 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	24-Apr-18	104757-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			104757-006	Vinyl chloride		0.333	U	EPA 624.1

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

Laboratory Data Qualifier
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit

Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	29-Oct-2018	106390-001	Cyanide, total		0.00167	U	EPA 335.4
			106391-001	Cyanide, total		0.00167	U	EPA 335.4
		30-Oct-2018	106360-001	Aluminum		0.0193	U	EPA 200.8
			106360-007	Ammonia	0.776	0.017	BN	EPA 350.1
			106360-001	Arsenic	0.00314	0.002	J	EPA 200.8
			106360-001	Boron	0.0425	0.0052		EPA 200.8
			106360-001	Cadmium		0.0003	U	EPA 200.8
			106360-001	Chromium		0.003	U	EPA 200.8
			106360-001	Copper	0.00479	0.0003		EPA 200.8
			106393-001	Cyanide, total		0.00167	U	EPA 335.4
			106392-001	Cyanide, total		0.00167	U	EPA 335.4
			106360-002	Fluoride	4.77	0.033		EPA 300.0
			106360-001	Lead		0.0005	U	EPA 200.8
			106360-001	Mercury		0.000067	U	EPA 245.1/245.2
			106360-001	Molybdenum	0.0758	0.0002		EPA 200.8
			106360-001	Nickel		0.0006	U	EPA 200.8
			106360-001	Selenium		0.002	U	EPA 200.8
			106360-001	Silver		0.0003	U	EPA 200.8
			106360-001	Zinc		0.0033	U	EPA 200.8
		31-Oct-2018	106551-001	Cyanide, total		0.00167	U	EPA 335.4
			106549-001	Cyanide, total		0.00167	U	EPA 335.4
			106550-001	Cyanide, total		0.00167	U	EPA 335.4
		1-Nov-2018	106369-001	Aluminum		0.0193	U	EPA 200.8
			106369-003	Ammonia	0.309	0.017	BN	EPA 350.1
			106369-001	Arsenic	0.00557	0.002		EPA 200.8
			106369-001	Boron	0.0386	0.0052		EPA 200.8
			106369-001	Cadmium		0.0003	U	EPA 200.8
			106369-001	Chromium		0.003	U	EPA 200.8
			106369-001	Copper	0.00336	0.0003		EPA 200.8

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Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	1-Nov-2018	106552-001	Cyanide, total	0.00404	0.00167	J	EPA 335.4
			106369-002	Fluoride	0.947	0.033		EPA 300.0
			106369-001	Lead		0.0005	U	EPA 200.8
			106369-001	Mercury		0.000067	U	EPA 245.1/245.2
			106369-001	Molybdenum	0.0662	0.0002		EPA 200.8
			106369-001	Nickel		0.0006	U	EPA 200.8
			106369-001	Selenium		0.002	U	EPA 200.8
			106369-001	Silver		0.0003	U	EPA 200.8
			106369-001	Zinc		0.0033	U	EPA 200.8
WW001	2069A	30-Oct-2018	106350-001	Aluminum	0.0573	0.0193		EPA 200.8
			106350-007	Ammonia	15.1	0.425	BN	EPA 350.1
			106350-001	Arsenic	0.00393	0.002	J	EPA 200.8
			106350-001	Boron	0.0649	0.0052		EPA 200.8
			106350-001	Cadmium		0.0003	U	EPA 200.8
			106350-001	Chromium	0.00349	0.003	J	EPA 200.8
			106350-001	Copper	0.0218	0.0003		EPA 200.8
			106350-002	Fluoride	1.66	0.033		EPA 300.0
			106350-001	Lead	0.000887	0.0005	J	EPA 200.8
			106350-001	Mercury		0.000067	U	EPA 245.1/245.2
			106350-001	Molybdenum	0.0105	0.0002		EPA 200.8
			106350-001	Nickel	0.00186	0.0006	J	EPA 200.8
			106350-001	Selenium	0.0022	0.002	J	EPA 200.8
			106350-001	Silver		0.0003	U	EPA 200.8
			106350-001	Zinc	0.0543	0.0033		EPA 200.8
		1-Nov-2018	106362-001	Aluminum	0.0512	0.0193		EPA 200.8
			106362-003	Ammonia	17.9	0.425	BN	EPA 350.1
			106362-001	Arsenic	0.00471	0.002	J	EPA 200.8
			106362-001	Boron	0.0643	0.0052		EPA 200.8
			106362-001	Cadmium		0.0003	U	EPA 200.8

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Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	1-Nov-2018	106362-001	Chromium	0.00308	0.003	J	EPA 200.8
			106362-001	Copper	0.017	0.0003		EPA 200.8
			106362-002	Fluoride	2.42	0.033		EPA 300.0
			106362-001	Lead	0.000905	0.0005	J	EPA 200.8
			106362-001	Mercury		0.000067	U	EPA 245.1/245.2
			106362-001	Molybdenum	0.0109	0.0002		EPA 200.8
			106362-001	Nickel	0.00131	0.0006	J	EPA 200.8
			106362-001	Selenium	0.00227	0.002	J	EPA 200.8
			106362-001	Silver		0.0003	U	EPA 200.8
			106362-001	Zinc	0.0429	0.0033		EPA 200.8
WW006	2069F	29-Oct-2018	106378-001	Cyanide, total		0.00167	U	EPA 335.4
			106379-001	Cyanide, total		0.00167	U	EPA 335.4
			106380-001	Cyanide, total	0.00376	0.00167	J	EPA 335.4
		30-Oct-2018	106352-001	Aluminum	0.0712	0.0193		EPA 200.8
			106352-007	Ammonia	32.5	0.425	BN	EPA 350.1
			106352-001	Arsenic	0.00288	0.002	J	EPA 200.8
			106352-001	Boron	0.0924	0.0052		EPA 200.8
			106352-001	Cadmium		0.0003	U	EPA 200.8
			106352-001	Chromium		0.003	U	EPA 200.8
			106352-001	Copper	0.0304	0.0003		EPA 200.8
			106381-001	Cyanide, total		0.00167	U	EPA 335.4
			106352-002	Fluoride	0.67	0.033		EPA 300.0
			106352-001	Lead	0.000575	0.0005	J	EPA 200.8
			106352-001	Mercury		0.000067	U	EPA 245.1/245.2
			106352-001	Molybdenum	0.0703	0.0002		EPA 200.8
			106352-001	Nickel	0.00124	0.0006	J	EPA 200.8
			106352-001	Selenium		0.002	U	EPA 200.8
			106352-001	Silver	0.000632	0.0003	J	EPA 200.8
			106352-001	Zinc	0.043	0.0033		EPA 200.8

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Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	31-Oct-2018	106382-001	Cyanide, total	0.00206	0.00167	J	EPA 335.4
			106383-001	Cyanide, total		0.00167	U	EPA 335.4
			106384-001	Cyanide, total		0.00167	U	EPA 335.4
		1-Nov-2018	106363-001	Aluminum	0.197	0.0193		EPA 200.8
			106363-003	Ammonia	41.7	0.85	BN	EPA 350.1
			106363-001	Arsenic	0.0032	0.002	J	EPA 200.8
			106363-001	Boron	0.0812	0.0052		EPA 200.8
			106363-001	Cadmium		0.0003	U	EPA 200.8
			106363-001	Chromium		0.003	U	EPA 200.8
			106363-001	Copper	0.0229	0.0003		EPA 200.8
			106385-001	Cyanide, total	0.00361	0.00167	J	EPA 335.4
			106363-002	Fluoride	0.559	0.033		EPA 300.0
			106363-001	Lead	0.000697	0.0005	J	EPA 200.8
			106363-001	Mercury		0.000067	U	EPA 245.1/245.2
			106363-001	Molybdenum	0.0679	0.0002		EPA 200.8
			106363-001	Nickel	0.00153	0.0006	J	EPA 200.8
			106363-001	Selenium		0.002	U	EPA 200.8
			106363-001	Silver	0.000898	0.0003	J	EPA 200.8
			106363-001	Zinc	0.105	0.0033		EPA 200.8
WW007	2069G	29-Oct-2018	106387-001	Cyanide, total		0.00167	U	EPA 335.4
			106386-001	Cyanide, total		0.00167	U	EPA 335.4
		30-Oct-2018	106354-001	Aluminum		0.0193	U	EPA 200.8
			106354-004	Ammonia	2.5	0.085	BN	EPA 350.1
			106354-001	Arsenic		0.002	U	EPA 200.8
			106354-001	Boron	0.0265	0.0052		EPA 200.8
			106354-001	Cadmium		0.0003	U	EPA 200.8
			106354-001	Chromium		0.003	U	EPA 200.8
			106354-001	Copper	0.00495	0.0003		EPA 200.8
			106388-001	Cyanide, total		0.00167	U	EPA 335.4

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Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	30-Oct-2018	106389-001	Cyanide, total		0.00167	U	EPA 335.4
			106354-002	Fluoride	1.85	0.033		EPA 300.0
			106354-001	Lead		0.0005	U	EPA 200.8
			106354-001	Mercury		0.000067	U	EPA 245.1/245.2
			106354-001	Molybdenum	0.0117	0.0002		EPA 200.8
			106354-001	Nickel	0.000882	0.0006	J	EPA 200.8
			106354-001	Selenium		0.002	U	EPA 200.8
			106354-001	Silver		0.0003	U	EPA 200.8
			106354-001	Zinc		0.0033	U	EPA 200.8
		31-Oct-2018	106545-001	Cyanide, total		0.00167	U	EPA 335.4
			106546-001	Cyanide, total		0.00167	U	EPA 335.4
			106547-001	Cyanide, total		0.00167	U	EPA 335.4
		1-Nov-2018	106368-001	Aluminum		0.0193	U	EPA 200.8
			106368-003	Ammonia	1.78	0.017	BN	EPA 350.1
			106368-001	Arsenic	0.00211	0.002	J	EPA 200.8
			106368-001	Boron	0.0241	0.0052		EPA 200.8
			106368-001	Cadmium		0.0003	U	EPA 200.8
			106368-001	Chromium		0.003	U	EPA 200.8
			106368-001	Copper	0.005	0.0003		EPA 200.8
			106548-001	Cyanide, total		0.00167	U	EPA 335.4
			106368-002	Fluoride	3.62	0.033		EPA 300.0
			106368-001	Lead		0.0005	U	EPA 200.8
			106368-001	Mercury		0.000067	U	EPA 245.1/245.2
			106368-001	Molybdenum	0.0129	0.0002		EPA 200.8
			106368-001	Nickel	0.00087	0.0006	J	EPA 200.8
			106368-001	Selenium		0.002	U	EPA 200.8
			106368-001	Silver		0.0003	U	EPA 200.8
			106368-001	Zinc		0.0033	U	EPA 200.8

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Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	30-Oct-2018	106356-001	Aluminum	0.0898	0.0193		EPA 200.8
			106356-007	Ammonia	38	0.425	BN	EPA 350.1
			106356-001	Arsenic	0.0038	0.002	J	EPA 200.8
			106356-001	Boron	0.0781	0.0052		EPA 200.8
			106356-001	Cadmium		0.0003	U	EPA 200.8
			106356-001	Chromium		0.003	U	EPA 200.8
			106356-001	Copper	0.0348	0.0003		EPA 200.8
			106356-002	Fluoride	0.721	0.033		EPA 300.0
			106356-001	Lead	0.00134	0.0005	J	EPA 200.8
			106356-001	Mercury		0.000067	U	EPA 245.1/245.2
			106356-001	Molybdenum	0.00391	0.0002		EPA 200.8
			106356-001	Nickel	0.0061	0.0006		EPA 200.8
			106356-001	Selenium		0.002	U	EPA 200.8
			106356-001	Silver		0.0003	U	EPA 200.8
			106356-001	Zinc	0.0725	0.0033		EPA 200.8
		1-Nov-2018	106367-001	Aluminum	0.0617	0.0193		EPA 200.8
			106367-003	Ammonia	74.5	0.85	BN	EPA 350.1
			106367-001	Arsenic	0.00312	0.002	J	EPA 200.8
			106367-001	Boron	0.0709	0.0052		EPA 200.8
			106367-001	Cadmium		0.0003	U	EPA 200.8
			106367-001	Chromium		0.003	U	EPA 200.8
			106367-001	Copper	0.0253	0.0003		EPA 200.8
			106367-002	Fluoride	0.547	0.033		EPA 300.0
			106367-001	Lead		0.0005	U	EPA 200.8
			106367-001	Mercury		0.000067	U	EPA 245.1/245.2
			106367-001	Molybdenum	0.00317	0.0002		EPA 200.8
			106367-001	Nickel	0.00395	0.0006		EPA 200.8
			106367-001	Selenium		0.002	U	EPA 200.8

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Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	1-Nov-2018	106367-001	Silver		0.0003	U	EPA 200.8
			106367-001	Zinc	0.055	0.0033		EPA 200.8
WW011	2069K	30-Oct-2018	106358-001	Aluminum	0.0761	0.0193		EPA 200.8
			106358-007	Ammonia	46.4	0.85	BN	EPA 350.1
			106358-001	Arsenic	0.00218	0.002	J	EPA 200.8
			106358-001	Boron	0.145	0.0052		EPA 200.8
			106358-001	Cadmium		0.0003	U	EPA 200.8
			106358-001	Chromium		0.003	U	EPA 200.8
			106358-001	Copper	0.0275	0.0003		EPA 200.8
			106358-002	Fluoride	0.689	0.033		EPA 300.0
			106358-001	Lead	0.000894	0.0005	J	EPA 200.8
			106358-001	Mercury		0.000067	U	EPA 245.1/245.2
			106358-001	Molybdenum	0.0268	0.0002		EPA 200.8
			106358-001	Nickel	0.00337	0.0006		EPA 200.8
			106358-001	Selenium	0.00206	0.002	J	EPA 200.8
			106358-001	Silver	0.000698	0.0003	J	EPA 200.8
			106358-001	Zinc	0.0548	0.0033		EPA 200.8
		1-Nov-2018	106366-001	Aluminum	0.0661	0.0193		EPA 200.8
			106366-003	Ammonia	19.9	0.425	BN	EPA 350.1
			106366-001	Arsenic	0.003	0.002	J	EPA 200.8
			106366-001	Boron	0.107	0.0052		EPA 200.8
			106366-001	Cadmium		0.0003	U	EPA 200.8
			106366-001	Chromium		0.003	U	EPA 200.8
			106366-001	Copper	0.0203	0.0003		EPA 200.8
			106366-002	Fluoride	0.648	0.033		EPA 300.0
			106366-001	Lead	0.000813	0.0005	J	EPA 200.8
			106366-001	Mercury		0.000067	U	EPA 245.1/245.2
			106366-001	Molybdenum	0.0171	0.0002		EPA 200.8
			106366-001	Nickel	0.00162	0.0006	J	EPA 200.8

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Table F-5. Inorganic results for permitted sanitary outfalls, October and November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	1-Nov-2018	106366-001	Selenium		0.002	U	EPA 200.8
			106366-001	Silver		0.0003	U	EPA 200.8
			106366-001	Zinc	0.0499	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% confidence that the analyte is greater than zero; analyte is matrix specific

Laboratory Data Qualifier
B = analyte detected in the blank
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit

Table F-6. Radiological results for permitted sanitary outfalls, October 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	30-OCT-2018	106360-003	Actinium-228	-16.1 ± 15.6	16.6	U	EPA 901.1
			106360-004	Alpha, gross	2.6 ± 3.51	5.97	U	EPA 900.0/SW-846 9310
			106360-003	Americium-241	4.15 ± 13.3	21.3	U	EPA 901.1
			106360-003	Beryllium-7	10.4 ± 16.3	28.1	U	EPA 901.1
			106360-004	Beta, gross	3.85 ± 2.05	3.32	*	EPA 900.0/SW-846 9310
			106360-003	Bismuth-212	9.29 ± 26.7	49.1	U	EPA 901.1
			106360-003	Bismuth-214	9.02 ± 9.3	6.7	X	EPA 901.1
			106360-003	Cesium-137	1.21 ± 2	3.65	U	EPA 901.1
			106360-003	Cobalt-60	-2.1 ± 4.3	3.59	U	EPA 901.1
			106360-003	Lead-212	-3.77 ± 6.55	7.42	U	EPA 901.1
			106360-003	Lead-214	4.28 ± 9.97	8.23	U	EPA 901.1
			106360-003	Neptunium-237	0.0824 ± 3.49	6.18	U	EPA 901.1
			106360-003	Potassium-40	11.6 ± 45.9	57.6	U	EPA 901.1
			106360-003	Radium-223	9.68 ± 35.7	63.1	U	EPA 901.1
			106360-003	Radium-224	-98.2 ± 58.6	60	U	EPA 901.1
			106360-003	Radium-226	1.84 ± 97.6	95.1	U	EPA 901.1
			106360-003	Radium-228	-16.1 ± 15.6	16.6	U	EPA 901.1
			106360-003	Sodium-22	-0.323 ± 1.98	3.49	U	EPA 901.1
			106360-003	Thorium-227	-0.598 ± 14.1	25	U	EPA 901.1
			106360-003	Thorium-231	-23 ± 43.6	47.4	U	EPA 901.1
			106360-003	Thorium-234	8.54 ± 80.5	212	U	EPA 901.1
			106360-005	Tritium	20.6 ± 82.3	149	U	EPA 906.0 Modified
			106360-003	Uranium-235	-5.81 ± 19	21.7	U	EPA 901.1
			106360-003	Uranium-238	8.54 ± 80.5	212	U	EPA 901.1
WW001	2069A	30-OCT-2018	106350-003	Actinium-228	2.06 ± 17.8	16.7	U	EPA 901.1
			106350-004	Alpha, gross	5.41 ± 1.65	1.95		EPA 900.0/SW-846 9310
			106350-003	Americium-241	1.72 ± 3.1	4.89	U	EPA 901.1
			106350-003	Beryllium-7	11.6 ± 16.9	28.7	U	EPA 901.1
			106350-004	Beta, gross	10.5 ± 1.41	1.81	*	EPA 900.0/SW-846 9310

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Table F-6. Radiological results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	30-OCT-2018	106350-003	Bismuth-212	28.3 ± 46.7	50.7	U	EPA 901.1
			106350-003	Bismuth-214	8.85 ± 11.7	7.09	X	EPA 901.1
			106350-003	Cesium-137	0.59 ± 2.04	3.74	U	EPA 901.1
			106350-003	Cobalt-60	0.65 ± 2.08	3.94	U	EPA 901.1
			106350-003	Lead-212	-2.98 ± 6.11	6.44	U	EPA 901.1
			106350-003	Lead-214	2.66 ± 9.39	8.83	U	EPA 901.1
			106350-003	Neptunium-237	4.35 ± 4.94	6.6	U	EPA 901.1
			106350-003	Potassium-40	24.7 ± 73.8	35	U	EPA 901.1
			106350-003	Radium-223	-14.3 ± 35.2	59.5	U	EPA 901.1
			106350-003	Radium-224	-106 ± 69	57.9	U	EPA 901.1
			106350-003	Radium-226	2.49 ± 94.9	59.5	U	EPA 901.1
			106350-003	Radium-228	2.06 ± 17.8	16.7	U	EPA 901.1
			106350-003	Sodium-22	1.13 ± 2.26	4.07	U	EPA 901.1
			106350-003	Thorium-227	-0.216 ± 13.9	24.6	U	EPA 901.1
			106350-003	Thorium-231	30.3 ± 22.8	25.3	X	EPA 901.1
			106350-003	Thorium-234	1.31 ± 77.5	48.2	U	EPA 901.1
			106350-005	Tritium	34.7 ± 84.1	149	U	EPA 906.0 Modified
			106350-003	Uranium-235	-7.27 ± 18	18.8	U	EPA 901.1
			106350-003	Uranium-238	1.31 ± 77.5	48.2	U	EPA 901.1
WW006	2069F	30-OCT-2018	106352-003	Actinium-228	9.66 ± 9.82	10.7	U	EPA 901.1
			106352-004	Alpha, gross	2.66 ± 2.41	3.9	U	EPA 900.0/SW-846 9310
			106352-003	Americium-241	3.54 ± 5.93	10.2	U	EPA 901.1
			106352-003	Beryllium-7	2.31 ± 10.8	19.7	U	EPA 901.1
			106352-004	Beta, gross	26.1 ± 2.66	3.05	*	EPA 900.0/SW-846 9310
			106352-003	Bismuth-212	19.6 ± 22	38.1	U	EPA 901.1
			106352-003	Bismuth-214	1.95 ± 7.89	6.7	U	EPA 901.1
			106352-003	Cesium-137	-2.56 ± 2.41	2.22	U	EPA 901.1
			106352-003	Cobalt-60	0.162 ± 1.58	2.98	U	EPA 901.1
			106352-003	Lead-212	0.315 ± 6.41	5.01	U	EPA 901.1

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Table F-6. Radiological results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	30-OCT-2018	106352-003	Lead-214	4.23 ± 8.62	6.4	U	EPA 901.1
			106352-003	Neptunium-237	-1.95 ± 2.59	4.28	U	EPA 901.1
			106352-003	Potassium-40	54.3 ± 43.9	26.8		EPA 901.1
			106352-003	Radium-223	0.526 ± 25	45.7	U	EPA 901.1
			106352-003	Radium-224	-7.78 ± 28.4	42.3	U	EPA 901.1
			106352-003	Radium-226	-42.7 ± 53.1	58.5	U	EPA 901.1
			106352-003	Radium-228	9.66 ± 9.82	10.7	U	EPA 901.1
			106352-003	Sodium-22	0.227 ± 1.45	2.77	U	EPA 901.1
			106352-003	Thorium-227	-0.416 ± 10.6	17.5	U	EPA 901.1
			106352-003	Thorium-231	38.4 ± 26.8	26.7	X	EPA 901.1
			106352-003	Thorium-234	2.73 ± 88.8	108	U	EPA 901.1
			106352-005	Tritium	52.7 ± 86.1	148	U	EPA 906.0 Modified
			106352-003	Uranium-235	-3.28 ± 12.5	14.5	U	EPA 901.1
			106352-003	Uranium-238	2.73 ± 88.8	108	U	EPA 901.1
WW008	2069I	30-OCT-2018	106356-003	Actinium-228	1.39 ± 15.7	12.2	U	EPA 901.1
			106356-004	Alpha, gross	3.4 ± 1.47	2.08		EPA 900.0/SW-846 9310
			106356-003	Americium-241	-0.314 ± 15.5	24.4	U	EPA 901.1
			106356-003	Beryllium-7	9.92 ± 15.2	26.3	U	EPA 901.1
			106356-004	Beta, gross	16.9 ± 1.62	1.79	*	EPA 900.0/SW-846 9310
			106356-003	Bismuth-212	7.1 ± 23.9	44.3	U	EPA 901.1
			106356-003	Bismuth-214	8.44 ± 9.28	6.4	X	EPA 901.1
			106356-003	Cesium-137	-0.416 ± 1.84	3.09	U	EPA 901.1
			106356-003	Cobalt-60	0.428 ± 2.1	3.83	U	EPA 901.1
			106356-003	Lead-212	4.37 ± 7.12	6.97	U	EPA 901.1
			106356-003	Lead-214	7.42 ± 8.75	8.11	U	EPA 901.1
			106356-003	Neptunium-237	5.94 ± 4.52	6.03	U	EPA 901.1
			106356-003	Potassium-40	62.6 ± 48	62.6	U	EPA 901.1
			106356-003	Radium-223	23.9 ± 42.6	58.1	U	EPA 901.1
			106356-003	Radium-224	35.6 ± 45.7	51.3	U	EPA 901.1

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Table F-6. Radiological results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	30-OCT-2018	106356-003	Radium-226	-56.9 ± 75.7	97	U	EPA 901.1
			106356-003	Radium-228	1.39 ± 15.7	12.2	U	EPA 901.1
			106356-003	Sodium-22	1.26 ± 1.92	3.56	U	EPA 901.1
			106356-003	Thorium-227	35.1 ± 28.6	35.2	U	EPA 901.1
			106356-003	Thorium-231	-2.37 ± 44.2	49.4	U	EPA 901.1
			106356-003	Thorium-234	121 ± 272	186	U	EPA 901.1
			106356-005	Tritium	24.3 ± 82.7	149	U	EPA 906.0 Modified
			106356-003	Uranium-235	-10.2 ± 19.2	20.9	U	EPA 901.1
			106356-003	Uranium-238	121 ± 272	186	U	EPA 901.1
WW011	2069K	30-OCT-2018	106358-003	Actinium-228	-9.88 ± 14.6	15.2	U	EPA 901.1
			106358-004	Alpha, gross	1.44 ± 2.11	3.64	U	EPA 900.0/SW-846 9310
			106358-003	Americium-241	5.03 ± 10.2	15.7	U	EPA 901.1
			106358-003	Beryllium-7	11.5 ± 18.2	30.9	U	EPA 901.1
			106358-004	Beta, gross	28.4 ± 2.93	3.43	*	EPA 900.0/SW-846 9310
			106358-003	Bismuth-212	1.22 ± 28.7	52	U	EPA 901.1
			106358-003	Bismuth-214	-2.33 ± 7.04	7.75	U	EPA 901.1
			106358-003	Cesium-137	-0.31 ± 2.02	3.39	U	EPA 901.1
			106358-003	Cobalt-60	-1.07 ± 2.38	3.43	U	EPA 901.1
			106358-003	Lead-212	-0.839 ± 6.04	6.68	U	EPA 901.1
			106358-003	Lead-214	1.89 ± 7.73	7.68	U	EPA 901.1
			106358-003	Neptunium-237	1.39 ± 4.11	6.46	U	EPA 901.1
			106358-003	Potassium-40	36.1 ± 54	29.2	X	EPA 901.1
			106358-003	Radium-223	-29.7 ± 39.4	62.2	U	EPA 901.1
			106358-003	Radium-224	-58.4 ± 45.5	61.3	U	EPA 901.1
			106358-003	Radium-226	-27 ± 76.2	78.5	U	EPA 901.1
			106358-003	Radium-228	-9.88 ± 14.6	15.2	U	EPA 901.1
			106358-003	Sodium-22	0.455 ± 1.86	3.43	U	EPA 901.1
			106358-003	Thorium-227	-17.3 ± 16.9	24.8	U	EPA 901.1
			106358-003	Thorium-231	7.85 ± 35.4	40.3	U	EPA 901.1

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Table F-6. Radiological results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	30-OCT-2018	106358-003	Thorium-234	-95.8 ± 142	146	U	EPA 901.1
			106358-005	Tritium	-16.8 ± 77.6	148	U	EPA 906.0 Modified
			106358-003	Uranium-235	-2.79 ± 18.3	20.2	U	EPA 901.1
			106358-003	Uranium-238	-95.8 ± 142	146	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% probability that the measured activity is accurately quantified above the critical level

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

Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	30-Oct-2018	106360-006	Acrolein		1.67	U	EPA 624.1
			106360-006	Acrylonitrile		1.67	U	EPA 624.1
			106360-006	Benzene		0.333	U	EPA 624.1
			106360-006	Bromodichloromethane		0.333	U	EPA 624.1
			106360-006	Bromoform	2.42	0.333		EPA 624.1
			106360-006	Bromomethane		0.337	U	EPA 624.1
			106360-006	Carbon tetrachloride		0.333	U	EPA 624.1
			106360-006	Chlorobenzene		0.333	U	EPA 624.1
			106360-006	Chloroethane		0.333	U	EPA 624.1
			106360-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			106360-006	Chloroform		0.333	U	EPA 624.1
			106360-006	Chloromethane		0.333	U	EPA 624.1
			106360-006	Dibromochloromethane		0.333	U	EPA 624.1
			106360-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			106360-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			106360-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			106360-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			106360-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			106360-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			106360-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			106360-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			106360-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			106360-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			106360-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			106360-006	Ethyl benzene		0.333	U	EPA 624.1
			106360-006	Methylene chloride		1.67	U	EPA 624.1
			106360-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			106360-006	Tetrachloroethene		0.333	U	EPA 624.1
			106360-006	Toluene		0.333	U	EPA 624.1

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Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	30-Oct-2018	106360-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			106360-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			106360-006	Trichloroethene		0.333	U	EPA 624.1
			106360-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			106360-006	Vinyl chloride		0.333	U	EPA 624.1
WW001	2069A	30-Oct-2018	106350-006	Acrolein		1.67	U	EPA 624.1
			106350-006	Acrylonitrile		1.67	U	EPA 624.1
			106350-006	Benzene		0.333	U	EPA 624.1
			106350-006	Bromodichloromethane		0.333	U	EPA 624.1
			106350-006	Bromoform	1.32	0.333		EPA 624.1
			106350-006	Bromomethane		0.337	U	EPA 624.1
			106350-006	Carbon tetrachloride		0.333	U	EPA 624.1
			106350-006	Chlorobenzene		0.333	U	EPA 624.1
			106350-006	Chloroethane		0.333	U	EPA 624.1
			106350-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			106350-006	Chloroform		0.333	U	EPA 624.1
			106350-006	Chloromethane		0.333	U	EPA 624.1
			106350-006	Dibromochloromethane	0.44	0.333	J	EPA 624.1
			106350-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			106350-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			106350-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			106350-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			106350-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			106350-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			106350-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			106350-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			106350-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			106350-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			106350-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1

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Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	30-Oct-2018	106350-006	Ethyl benzene		0.333	U	EPA 624.1
			106350-006	Methylene chloride		1.67	U	EPA 624.1
			106350-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			106350-006	Tetrachloroethene		0.333	U	EPA 624.1
			106350-006	Toluene		0.333	U	EPA 624.1
			106350-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			106350-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			106350-006	Trichloroethene		0.333	U	EPA 624.1
			106350-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			106350-006	Vinyl chloride		0.333	U	EPA 624.1
WW006	2069F	30-Oct-2018	106352-006	Acrolein		1.67	U	EPA 624.1
			106352-006	Acrylonitrile		1.67	U	EPA 624.1
			106352-006	Benzene		0.333	U	EPA 624.1
			106352-006	Bromodichloromethane		0.333	U	EPA 624.1
			106352-006	Bromoform		0.333	U	EPA 624.1
			106352-006	Bromomethane		0.337	U	EPA 624.1
			106352-006	Carbon tetrachloride		0.333	U	EPA 624.1
			106352-006	Chlorobenzene		0.333	U	EPA 624.1
			106352-006	Chloroethane		0.333	U	EPA 624.1
			106352-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			106352-006	Chloroform		0.333	U	EPA 624.1
			106352-006	Chloromethane		0.333	U	EPA 624.1
			106352-006	Dibromochloromethane		0.333	U	EPA 624.1
			106352-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			106352-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			106352-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			106352-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			106352-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			106352-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1

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Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW006	2069F	30-Oct-2018	106352-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			106352-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			106352-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			106352-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			106352-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			106352-006	Ethyl benzene		0.333	U	EPA 624.1
			106352-006	Methylene chloride		1.67	U	EPA 624.1
			106352-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			106352-006	Tetrachloroethene		0.333	U	EPA 624.1
			106352-006	Toluene		0.333	U	EPA 624.1
			106352-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			106352-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			106352-006	Trichloroethene		0.333	U	EPA 624.1
			106352-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			106352-006	Vinyl chloride		0.333	U	EPA 624.1
WW007	2069G	30-Oct-2018	106354-003	Acrolein		1.67	U	EPA 624.1
			106354-003	Acrylonitrile		1.67	U	EPA 624.1
			106354-003	Benzene		0.333	U	EPA 624.1
			106354-003	Bromodichloromethane		0.333	U	EPA 624.1
			106354-003	Bromoform		0.333	U	EPA 624.1
			106354-003	Bromomethane		0.337	U	EPA 624.1
			106354-003	Carbon tetrachloride		0.333	U	EPA 624.1
			106354-003	Chlorobenzene		0.333	U	EPA 624.1
			106354-003	Chloroethane		0.333	U	EPA 624.1
			106354-003	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			106354-003	Chloroform		0.333	U	EPA 624.1
			106354-003	Chloromethane		0.333	U	EPA 624.1
			106354-003	Dibromochloromethane		0.333	U	EPA 624.1
			106354-003	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1

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Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	30-Oct-2018	106354-003	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			106354-003	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			106354-003	Dichlorodifluoromethane		0.355	U	EPA 624.1
			106354-003	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			106354-003	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			106354-003	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			106354-003	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			106354-003	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			106354-003	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			106354-003	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			106354-003	Ethyl benzene		0.333	U	EPA 624.1
			106354-003	Methylene chloride		1.67	U	EPA 624.1
			106354-003	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			106354-003	Tetrachloroethene		0.333	U	EPA 624.1
			106354-003	Toluene		0.333	U	EPA 624.1
			106354-003	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			106354-003	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			106354-003	Trichloroethene		0.333	U	EPA 624.1
			106354-003	Trichlorofluoromethane		0.333	U	EPA 624.1
			106354-003	Vinyl chloride		0.333	U	EPA 624.1
WW008	2069I	30-Oct-2018	106356-006	Acrolein		1.67	U	EPA 624.1
			106356-006	Acrylonitrile		1.67	U	EPA 624.1
			106356-006	Benzene		0.333	U	EPA 624.1
			106356-006	Bromodichloromethane		0.333	U	EPA 624.1
			106356-006	Bromoform		0.333	U	EPA 624.1
			106356-006	Bromomethane		0.337	U	EPA 624.1
			106356-006	Carbon tetrachloride		0.333	U	EPA 624.1
			106356-006	Chlorobenzene		0.333	U	EPA 624.1
			106356-006	Chloroethane		0.333	U	EPA 624.1

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Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	30-Oct-2018	106356-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			106356-006	Chloroform		0.333	U	EPA 624.1
			106356-006	Chloromethane		0.333	U	EPA 624.1
			106356-006	Dibromochloromethane		0.333	U	EPA 624.1
			106356-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			106356-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			106356-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			106356-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			106356-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			106356-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			106356-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			106356-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			106356-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			106356-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			106356-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			106356-006	Ethyl benzene		0.333	U	EPA 624.1
			106356-006	Methylene chloride		1.67	U	EPA 624.1
			106356-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			106356-006	Tetrachloroethene		0.333	U	EPA 624.1
			106356-006	Toluene		0.333	U	EPA 624.1
			106356-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			106356-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			106356-006	Trichloroethene		0.333	U	EPA 624.1
			106356-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			106356-006	Vinyl chloride		0.333	U	EPA 624.1
WW011	2069K	30-Oct-2018	106358-006	Acrolein		1.67	U	EPA 624.1
			106358-006	Acrylonitrile		1.67	U	EPA 624.1
			106358-006	Benzene		0.333	U	EPA 624.1
			106358-006	Bromodichloromethane		0.333	U	EPA 624.1

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Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	30-Oct-2018	106358-006	Bromoform		0.333	U	EPA 624.1
			106358-006	Bromomethane		0.337	U	EPA 624.1
			106358-006	Carbon tetrachloride		0.333	U	EPA 624.1
			106358-006	Chlorobenzene		0.333	U	EPA 624.1
			106358-006	Chloroethane		0.333	U	EPA 624.1
			106358-006	Chloroethyl vinyl ether, 2-		1.67	NU	EPA 624.1
			106358-006	Chloroform		0.333	U	EPA 624.1
			106358-006	Chloromethane		0.333	U	EPA 624.1
			106358-006	Dibromochloromethane		0.333	U	EPA 624.1
			106358-006	Dichlorobenzene, 1,2-		0.333	U	EPA 624.1
			106358-006	Dichlorobenzene, 1,3-		0.333	U	EPA 624.1
			106358-006	Dichlorobenzene, 1,4-		0.333	U	EPA 624.1
			106358-006	Dichlorodifluoromethane		0.355	U	EPA 624.1
			106358-006	Dichloroethane, 1,1-		0.333	U	EPA 624.1
			106358-006	Dichloroethane, 1,2-		0.333	U	EPA 624.1
			106358-006	Dichloroethene, 1,1-		0.333	U	EPA 624.1
			106358-006	Dichloroethene, trans-1,2-		0.333	U	EPA 624.1
			106358-006	Dichloropropane, 1,2-		0.333	U	EPA 624.1
			106358-006	Dichloropropene, cis-1,3-		0.333	U	EPA 624.1
			106358-006	Dichloropropene, trans-1,3-		0.333	U	EPA 624.1
			106358-006	Ethyl benzene		0.333	U	EPA 624.1
			106358-006	Methylene chloride		1.67	U	EPA 624.1
			106358-006	Tetrachloroethane, 1,1,2,2-		0.333	U	EPA 624.1
			106358-006	Tetrachloroethene		0.333	U	EPA 624.1
			106358-006	Toluene		0.333	U	EPA 624.1
			106358-006	Trichloroethane, 1,1,1-		0.333	U	EPA 624.1
			106358-006	Trichloroethane, 1,1,2-		0.333	U	EPA 624.1
			106358-006	Trichloroethene		0.333	U	EPA 624.1

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Table F-7. Volatile organic compound results for permitted sanitary outfalls, October 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	30-Oct-2018	106358-006	Trichlorofluoromethane		0.333	U	EPA 624.1
			106358-006	Vinyl chloride		0.333	U	EPA 624.1

CINT = Center for Integrated Nanotechnologies
MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific
PQL = practical quantitation limit; the lowest concentration of analytes in a sample that can be determined reliably within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions

Laboratory Data Qualifier
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit

Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	1-Nov-2018	106369-004	Acenaphthene		0.306	U	EPA 625.1
			106369-004	Acenaphthylene		0.306	U	EPA 625.1
			106369-004	Anthracene		0.306	U	EPA 625.1
			106369-004	Benzidine		3.98	*NU	EPA 625.1
			106369-004	Benzo(a)anthracene		0.306	U	EPA 625.1
			106369-004	Benzo(a)pyrene		0.306	U	EPA 625.1
			106369-004	Benzo(b)fluoranthene		0.306	U	EPA 625.1
			106369-004	Benzo(ghi)perylene		0.306	U	EPA 625.1
			106369-004	Benzo(k)fluoranthene		0.306	U	EPA 625.1
			106369-004	Bromophenyl phenyl ether, 4-		3.06	U	EPA 625.1
			106369-004	Butylbenzyl phthalate		0.306	U	EPA 625.1
			106369-004	Chloro-3-methylphenol, 4-		3.06	U	EPA 625.1
			106369-004	Chloroethoxy)methane, bis(2-		3.06	U	EPA 625.1
			106369-004	Chloroethyl)ether, bis(2-		3.06	U	EPA 625.1
			106369-004	Chloroisopropyl ether, bis-		3.06	U	EPA 625.1
			106369-004	Chloronaphthalene, 2-		0.418	U	EPA 625.1
			106369-004	Chlorophenol, 2-		3.06	U	EPA 625.1
			106369-004	Chlorophenyl phenyl ether, 4-		3.06	U	EPA 625.1
			106369-004	Chrysene		0.306	U	EPA 625.1
			106369-004	Di-n-butyl phthalate		0.306	U	EPA 625.1
			106369-004	Di-n-octyl phthalate		0.306	U	EPA 625.1
			106369-004	Dibenz[a,h]anthracene		0.306	U	EPA 625.1
			106369-004	Dichlorobenzidine, 3,3'-		3.06	*NU	EPA 625.1
			106369-004	Dichlorophenol, 2,4-		3.06	U	EPA 625.1
			106369-004	Diethylphthalate		0.306	U	EPA 625.1
			106369-004	Dimethylphenol, 2,4-		3.06	U	EPA 625.1
			106369-004	Dimethylphthalate		0.306	U	EPA 625.1
			106369-004	Dinitro-o-cresol		3.06	U	EPA 625.1
			106369-004	Dinitrophenol, 2,4-		5.1	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
CINT	2238A	1-Nov-2018	106369-004	Dinitrotoluene, 2,4-		3.06	U	EPA 625.1
			106369-004	Dinitrotoluene, 2,6-		3.06	U	EPA 625.1
			106369-004	Diphenyl amine		3.06	U	EPA 625.1
			106369-004	Diphenylhydrazine, 1,2-		3.06	U	EPA 625.1
			106369-004	Ethylhexyl)phthalate, bis(2-		0.306	U	EPA 625.1
			106369-004	Fluoranthene		0.306	U	EPA 625.1
			106369-004	Fluorene		0.306	U	EPA 625.1
			106369-004	Hexachlorobenzene		3.06	U	EPA 625.1
			106369-004	Hexachlorobutadiene		3.06	U	EPA 625.1
			106369-004	Hexachlorocyclopentadiene		3.06	NU	EPA 625.1
			106369-004	Hexachloroethane		3.06	U	EPA 625.1
			106369-004	Indeno(1,2,3-c,d)pyrene		0.306	U	EPA 625.1
			106369-004	Isophorone		3.57	U	EPA 625.1
			106369-004	Naphthalene		0.306	U	EPA 625.1
			106369-004	Nitro-benzene		3.06	U	EPA 625.1
			106369-004	Nitrophenol, 2-		3.06	U	EPA 625.1
			106369-004	Nitrophenol, 4-		3.06	U	EPA 625.1
			106369-004	Nitrosodimethylamine, n-		3.06	U	EPA 625.1
			106369-004	Nitrosodipropylamine, n-		3.06	U	EPA 625.1
			106369-004	Pentachlorophenol		3.06	U	EPA 625.1
			106369-004	Phenanthrene		0.306	U	EPA 625.1
			106369-004	Phenol		3.06	U	EPA 625.1
			106369-004	Pyrene		0.306	U	EPA 625.1
			106369-004	Trichlorobenzene, 1,2,4-		3.06	U	EPA 625.1
			106369-004	Trichlorophenol, 2,4,6-		3.06	U	EPA 625.1
WW001	2069A	1-Nov-2018	106362-004	Acenaphthene		0.3	U	EPA 625.1
			106362-R04	Acenaphthene		0.3	UH	EPA 625.1
			106362-004	Acenaphthylene		0.3	U	EPA 625.1
			106362-R04	Acenaphthylene		0.3	UH	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	1-Nov-2018	106362-004	Anthracene		0.3	U	EPA 625.1
			106362-R04	Anthracene		0.3	UH	EPA 625.1
			106362-004	Benzidine		3.9	*NU	EPA 625.1
			106362-R04	Benzidine		3.9	NUH	EPA 625.1
			106362-004	Benzo(a)anthracene		0.3	U	EPA 625.1
			106362-R04	Benzo(a)anthracene		0.3	UH	EPA 625.1
			106362-004	Benzo(a)pyrene		0.3	U	EPA 625.1
			106362-R04	Benzo(a)pyrene		0.3	UH	EPA 625.1
			106362-004	Benzo(b)fluoranthene		0.3	U	EPA 625.1
			106362-R04	Benzo(b)fluoranthene		0.3	UH	EPA 625.1
			106362-004	Benzo(ghi)perylene		0.3	U	EPA 625.1
			106362-R04	Benzo(ghi)perylene		0.3	UH	EPA 625.1
			106362-004	Benzo(k)fluoranthene		0.3	U	EPA 625.1
			106362-R04	Benzo(k)fluoranthene		0.3	UH	EPA 625.1
			106362-004	Bromophenyl phenyl ether, 4-		3	U	EPA 625.1
			106362-R04	Bromophenyl phenyl ether, 4-		3	UH	EPA 625.1
			106362-004	Butylbenzyl phthalate	1.79	0.3	J	EPA 625.1
			106362-R04	Butylbenzyl phthalate	2.27	0.3	JH	EPA 625.1
			106362-004	Chloro-3-methylphenol, 4-		3	U	EPA 625.1
			106362-R04	Chloro-3-methylphenol, 4-		3	UH	EPA 625.1
			106362-004	Chloroethoxy)methane, bis(2-		3	U	EPA 625.1
			106362-R04	Chloroethoxy)methane, bis(2-		3	UH	EPA 625.1
			106362-004	Chloroethyl)ether, bis(2-		3	U	EPA 625.1
			106362-R04	Chloroethyl)ether, bis(2-		3	UH	EPA 625.1
			106362-004	Chloroisopropyl ether, bis-		3	U	EPA 625.1
			106362-R04	Chloroisopropyl ether, bis-		3	UH	EPA 625.1
			106362-004	Chloronaphthalene, 2-		0.41	U	EPA 625.1
			106362-R04	Chloronaphthalene, 2-		0.41	UH	EPA 625.1
			106362-004	Chlorophenol, 2-		3	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	1-Nov-2018	106362-R04	Chlorophenol, 2-		3	UH	EPA 625.1
			106362-004	Chlorophenyl phenyl ether, 4-		3	U	EPA 625.1
			106362-R04	Chlorophenyl phenyl ether, 4-		3	UH	EPA 625.1
			106362-004	Chrysene		0.3	U	EPA 625.1
			106362-R04	Chrysene		0.3	UH	EPA 625.1
			106362-004	Di-n-butyl phthalate		0.3	U	EPA 625.1
			106362-R04	Di-n-butyl phthalate		0.3	UH	EPA 625.1
			106362-004	Di-n-octyl phthalate		0.3	U	EPA 625.1
			106362-R04	Di-n-octyl phthalate		0.3	UH	EPA 625.1
			106362-004	Dibenz[a,h]anthracene		0.3	U	EPA 625.1
			106362-R04	Dibenz[a,h]anthracene		0.3	UH	EPA 625.1
			106362-004	Dichlorobenzidine, 3,3'-		3	*NU	EPA 625.1
			106362-R04	Dichlorobenzidine, 3,3'-		3	*NUH	EPA 625.1
			106362-004	Dichlorophenol, 2,4-		3	U	EPA 625.1
			106362-R04	Dichlorophenol, 2,4-		3	UH	EPA 625.1
			106362-004	Diethylphthalate		0.3	U	EPA 625.1
			106362-R04	Diethylphthalate	0.43	0.3	JH	EPA 625.1
			106362-004	Dimethylphenol, 2,4-		3	U	EPA 625.1
			106362-R04	Dimethylphenol, 2,4-		3	UH	EPA 625.1
			106362-004	Dimethylphthalate		0.3	U	EPA 625.1
			106362-R04	Dimethylphthalate		0.3	UH	EPA 625.1
			106362-004	Dinitro-o-cresol		3	U	EPA 625.1
			106362-R04	Dinitro-o-cresol		3	UH	EPA 625.1
			106362-004	Dinitrophenol, 2,4-		5	U	EPA 625.1
			106362-R04	Dinitrophenol, 2,4-		5	*UH	EPA 625.1
			106362-004	Dinitrotoluene, 2,4-		3	U	EPA 625.1
			106362-R04	Dinitrotoluene, 2,4-		3	UH	EPA 625.1
			106362-004	Dinitrotoluene, 2,6-		3	U	EPA 625.1
			106362-R04	Dinitrotoluene, 2,6-		3	UH	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	1-Nov-2018	106362-004	Diphenyl amine		3	U	EPA 625.1
			106362-R04	Diphenyl amine		3	UH	EPA 625.1
			106362-004	Diphenylhydrazine, 1,2-		3	U	EPA 625.1
			106362-R04	Diphenylhydrazine, 1,2-		3	UH	EPA 625.1
			106362-004	Ethylhexyl)phthalate, bis(2-	0.46	0.3	J	EPA 625.1
			106362-R04	Ethylhexyl)phthalate, bis(2-	0.5	0.3	JH	EPA 625.1
			106362-004	Fluoranthene		0.3	U	EPA 625.1
			106362-R04	Fluoranthene		0.3	UH	EPA 625.1
			106362-004	Fluorene		0.3	U	EPA 625.1
			106362-R04	Fluorene		0.3	UH	EPA 625.1
			106362-004	Hexachlorobenzene		3	U	EPA 625.1
			106362-R04	Hexachlorobenzene		3	UH	EPA 625.1
			106362-004	Hexachlorobutadiene		3	U	EPA 625.1
			106362-R04	Hexachlorobutadiene		3	UH	EPA 625.1
			106362-004	Hexachlorocyclopentadiene		3	NU	EPA 625.1
			106362-R04	Hexachlorocyclopentadiene		3	UH	EPA 625.1
			106362-004	Hexachloroethane		3	U	EPA 625.1
			106362-R04	Hexachloroethane		3	UH	EPA 625.1
			106362-004	Indeno(1,2,3-c,d)pyrene		0.3	U	EPA 625.1
			106362-R04	Indeno(1,2,3-c,d)pyrene		0.3	UH	EPA 625.1
			106362-004	Isophorone		3.5	U	EPA 625.1
			106362-R04	Isophorone		3.5	UH	EPA 625.1
			106362-004	Naphthalene		0.3	U	EPA 625.1
			106362-R04	Naphthalene		0.3	UH	EPA 625.1
			106362-004	Nitro-benzene		3	U	EPA 625.1
			106362-R04	Nitro-benzene		3	UH	EPA 625.1
			106362-004	Nitrophenol, 2-		3	U	EPA 625.1
			106362-R04	Nitrophenol, 2-		3	UH	EPA 625.1
			106362-004	Nitrophenol, 4-		3	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	1-Nov-2018	106362-R04	Nitrophenol, 4-		3	UH	EPA 625.1
			106362-004	Nitrosodimethylamine, n-		3	U	EPA 625.1
			106362-R04	Nitrosodimethylamine, n-		3	UH	EPA 625.1
			106362-004	Nitrosodipropylamine, n-		3	U	EPA 625.1
			106362-R04	Nitrosodipropylamine, n-		3	UH	EPA 625.1
			106362-004	Pentachlorophenol		3	U	EPA 625.1
			106362-R04	Pentachlorophenol		3	UH	EPA 625.1
			106362-004	Phenanthrene		0.3	U	EPA 625.1
			106362-R04	Phenanthrene		0.3	UH	EPA 625.1
			106362-004	Phenol		3	U	EPA 625.1
			106362-R04	Phenol		3	UH	EPA 625.1
			106362-004	Pyrene		0.3	U	EPA 625.1
			106362-R04	Pyrene		0.3	UH	EPA 625.1
			106362-004	Trichlorobenzene, 1,2,4-		3	U	EPA 625.1
			106362-R04	Trichlorobenzene, 1,2,4-		3	UH	EPA 625.1
			106362-004	Trichlorophenol, 2,4,6-		3	U	EPA 625.1
			106362-R04	Trichlorophenol, 2,4,6-		3	UH	EPA 625.1
WW006	2069F	1-Nov-2018	106363-004	Acenaphthene		0.319	U	EPA 625.1
			106363-004	Acenaphthylene		0.319	U	EPA 625.1
			106363-004	Anthracene		0.319	U	EPA 625.1
			106363-004	Benzidine		4.15	*NU	EPA 625.1
			106363-004	Benzo(a)anthracene		0.319	U	EPA 625.1
			106363-004	Benzo(a)pyrene		0.319	U	EPA 625.1
			106363-004	Benzo(b)fluoranthene		0.319	U	EPA 625.1
			106363-004	Benzo(ghi)perylene		0.319	U	EPA 625.1
			106363-004	Benzo(k)fluoranthene		0.319	U	EPA 625.1
			106363-004	Bromophenyl phenyl ether, 4-		3.19	U	EPA 625.1
			106363-004	Butylbenzyl phthalate	14.5	0.319		EPA 625.1
			106363-004	Chloro-3-methylphenol, 4-		3.19	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	1-Nov-2018	106363-004	Chloroethoxy)methane, bis(2-		3.19	U	EPA 625.1
			106363-004	Chloroethyl)ether, bis(2-		3.19	U	EPA 625.1
			106363-004	Chloroisopropyl ether, bis-		3.19	U	EPA 625.1
			106363-004	Chloronaphthalene, 2-		0.436	U	EPA 625.1
			106363-004	Chlorophenol, 2-		3.19	U	EPA 625.1
			106363-004	Chlorophenyl phenyl ether, 4-		3.19	U	EPA 625.1
			106363-004	Chrysene		0.319	U	EPA 625.1
			106363-004	Di-n-butyl phthalate		0.319	U	EPA 625.1
			106363-004	Di-n-octyl phthalate		0.319	U	EPA 625.1
			106363-004	Dibenz[a,h]anthracene		0.319	U	EPA 625.1
			106363-004	Dichlorobenzidine, 3,3'-		3.19	*NU	EPA 625.1
			106363-004	Dichlorophenol, 2,4-		3.19	U	EPA 625.1
			106363-004	Diethylphthalate		0.319	U	EPA 625.1
			106363-004	Dimethylphenol, 2,4-		3.19	U	EPA 625.1
			106363-004	Dimethylphthalate		0.319	U	EPA 625.1
			106363-004	Dinitro-o-cresol		3.19	U	EPA 625.1
			106363-004	Dinitrophenol, 2,4-		5.32	U	EPA 625.1
			106363-004	Dinitrotoluene, 2,4-		3.19	U	EPA 625.1
			106363-004	Dinitrotoluene, 2,6-		3.19	U	EPA 625.1
			106363-004	Diphenyl amine		3.19	U	EPA 625.1
			106363-004	Diphenylhydrazine, 1,2-		3.19	U	EPA 625.1
			106363-004	Ethylhexyl)phthalate, bis(2-	69.1	0.319		EPA 625.1
			106363-004	Fluoranthene		0.319	U	EPA 625.1
			106363-004	Fluorene		0.319	U	EPA 625.1
			106363-004	Hexachlorobenzene		3.19	U	EPA 625.1
			106363-004	Hexachlorobutadiene		3.19	U	EPA 625.1
			106363-004	Hexachlorocyclopentadiene		3.19	NU	EPA 625.1
			106363-004	Hexachloroethane		3.19	U	EPA 625.1
			106363-004	Indeno(1,2,3-c,d)pyrene		0.319	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW001	2069A	1-Nov-2018	106363-004	Isophorone		3.72	U	EPA 625.1
			106363-004	Naphthalene		0.319	U	EPA 625.1
			106363-004	Nitro-benzene		3.19	U	EPA 625.1
			106363-004	Nitrophenol, 2-		3.19	U	EPA 625.1
			106363-004	Nitrophenol, 4-		3.19	U	EPA 625.1
			106363-004	Nitrosodimethylamine, n-		3.19	U	EPA 625.1
			106363-004	Nitrosodipropylamine, n-		3.19	U	EPA 625.1
			106363-004	Pentachlorophenol		3.19	U	EPA 625.1
			106363-004	Phenanthrene		0.319	U	EPA 625.1
			106363-004	Phenol		3.19	U	EPA 625.1
			106363-004	Pyrene		0.319	U	EPA 625.1
			106363-004	Trichlorobenzene, 1,2,4-		3.19	U	EPA 625.1
			106363-004	Trichlorophenol, 2,4,6-		3.19	U	EPA 625.1
WW007	2069G	1-Nov-2018	106368-004	Acenaphthene		0.297	U	EPA 625.1
			106368-R04	Acenaphthene		0.309	UH	EPA 625.1
			106368-004	Acenaphthylene		0.297	U	EPA 625.1
			106368-R04	Acenaphthylene		0.309	UH	EPA 625.1
			106368-004	Anthracene		0.297	U	EPA 625.1
			106368-R04	Anthracene		0.309	UH	EPA 625.1
			106368-004	Benzidine		3.86	*NU	EPA 625.1
			106368-R04	Benzidine		4.02	NUH	EPA 625.1
			106368-004	Benzo(a)anthracene		0.297	U	EPA 625.1
			106368-R04	Benzo(a)anthracene		0.309	UH	EPA 625.1
			106368-004	Benzo(a)pyrene		0.297	U	EPA 625.1
			106368-R04	Benzo(a)pyrene		0.309	UH	EPA 625.1
			106368-004	Benzo(b)fluoranthene		0.297	U	EPA 625.1
			106368-R04	Benzo(b)fluoranthene		0.309	UH	EPA 625.1
			106368-004	Benzo(ghi)perylene		0.297	U	EPA 625.1
			106368-R04	Benzo(ghi)perylene		0.309	UH	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	1-Nov-2018	106368-004	Benzo(k)fluoranthene		0.297	U	EPA 625.1
			106368-R04	Benzo(k)fluoranthene		0.309	UH	EPA 625.1
			106368-004	Bromophenyl phenyl ether, 4-		2.97	U	EPA 625.1
			106368-R04	Bromophenyl phenyl ether, 4-		3.09	UH	EPA 625.1
			106368-004	Butylbenzyl phthalate		0.297	U	EPA 625.1
			106368-R04	Butylbenzyl phthalate		0.309	UH	EPA 625.1
			106368-004	Chloro-3-methylphenol, 4-		2.97	U	EPA 625.1
			106368-R04	Chloro-3-methylphenol, 4-		3.09	UH	EPA 625.1
			106368-004	Chloroethoxy)methane, bis(2-		2.97	U	EPA 625.1
			106368-R04	Chloroethoxy)methane, bis(2-		3.09	UH	EPA 625.1
			106368-004	Chloroethyl)ether, bis(2-		2.97	U	EPA 625.1
			106368-R04	Chloroethyl)ether, bis(2-		3.09	UH	EPA 625.1
			106368-004	Chloroisopropyl ether, bis-		2.97	U	EPA 625.1
			106368-R04	Chloroisopropyl ether, bis-		3.09	UH	EPA 625.1
			106368-004	Chloronaphthalene, 2-		0.406	U	EPA 625.1
			106368-R04	Chloronaphthalene, 2-		0.423	UH	EPA 625.1
			106368-004	Chlorophenol, 2-		2.97	U	EPA 625.1
			106368-R04	Chlorophenol, 2-		3.09	UH	EPA 625.1
			106368-004	Chlorophenyl phenyl ether, 4-		2.97	U	EPA 625.1
			106368-R04	Chlorophenyl phenyl ether, 4-		3.09	UH	EPA 625.1
			106368-004	Chrysene		0.297	U	EPA 625.1
			106368-R04	Chrysene		0.309	UH	EPA 625.1
			106368-004	Di-n-butyl phthalate	0.337	0.297	J	EPA 625.1
			106368-R04	Di-n-butyl phthalate		0.309	UH	EPA 625.1
			106368-004	Di-n-octyl phthalate		0.297	U	EPA 625.1
			106368-R04	Di-n-octyl phthalate		0.309	UH	EPA 625.1
			106368-004	Dibenz[a,h]anthracene		0.297	U	EPA 625.1
			106368-R04	Dibenz[a,h]anthracene		0.309	UH	EPA 625.1
			106368-004	Dichlorobenzidine, 3,3'-		2.97	*NU	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	1-Nov-2018	106368-R04	Dichlorobenzidine, 3,3'-		3.09	*NUH	EPA 625.1
			106368-004	Dichlorophenol, 2,4-		2.97	U	EPA 625.1
			106368-R04	Dichlorophenol, 2,4-		3.09	UH	EPA 625.1
			106368-004	Diethylphthalate	2.13	0.297	J	EPA 625.1
			106368-R04	Diethylphthalate	1.58	0.309	JH	EPA 625.1
			106368-004	Dimethylphenol, 2,4-		2.97	U	EPA 625.1
			106368-R04	Dimethylphenol, 2,4-		3.09	UH	EPA 625.1
			106368-004	Dimethylphthalate	0.604	0.297	J	EPA 625.1
			106368-R04	Dimethylphthalate	0.443	0.309	JH	EPA 625.1
			106368-004	Dinitro-o-cresol		2.97	U	EPA 625.1
			106368-R04	Dinitro-o-cresol		3.09	UH	EPA 625.1
			106368-004	Dinitrophenol, 2,4-		4.95	U	EPA 625.1
			106368-R04	Dinitrophenol, 2,4-		5.15	*UH	EPA 625.1
			106368-004	Dinitrotoluene, 2,4-		2.97	U	EPA 625.1
			106368-R04	Dinitrotoluene, 2,4-		3.09	UH	EPA 625.1
			106368-004	Dinitrotoluene, 2,6-		2.97	U	EPA 625.1
			106368-R04	Dinitrotoluene, 2,6-		3.09	UH	EPA 625.1
			106368-004	Diphenyl amine		2.97	U	EPA 625.1
			106368-R04	Diphenyl amine		3.09	UH	EPA 625.1
			106368-004	Diphenylhydrazine, 1,2-		2.97	U	EPA 625.1
			106368-R04	Diphenylhydrazine, 1,2-		3.09	UH	EPA 625.1
			106368-004	Ethylhexyl)phthalate, bis(2-	0.743	0.297	J	EPA 625.1
			106368-R04	Ethylhexyl)phthalate, bis(2-	0.536	0.309	JH	EPA 625.1
			106368-004	Fluoranthene		0.297	U	EPA 625.1
			106368-R04	Fluoranthene		0.309	UH	EPA 625.1
			106368-004	Fluorene		0.297	U	EPA 625.1
			106368-R04	Fluorene		0.309	UH	EPA 625.1
			106368-004	Hexachlorobenzene		2.97	U	EPA 625.1
			106368-R04	Hexachlorobenzene		3.09	UH	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	1-Nov-2018	106368-004	Hexachlorobutadiene		2.97	U	EPA 625.1
			106368-R04	Hexachlorobutadiene		3.09	UH	EPA 625.1
			106368-004	Hexachlorocyclopentadiene		2.97	NU	EPA 625.1
			106368-R04	Hexachlorocyclopentadiene		3.09	UH	EPA 625.1
			106368-004	Hexachloroethane		2.97	U	EPA 625.1
			106368-R04	Hexachloroethane		3.09	UH	EPA 625.1
			106368-004	Indeno(1,2,3-c,d)pyrene		0.297	U	EPA 625.1
			106368-R04	Indeno(1,2,3-c,d)pyrene		0.309	UH	EPA 625.1
			106368-004	Isophorone		3.47	U	EPA 625.1
			106368-R04	Isophorone		3.61	UH	EPA 625.1
			106368-004	Naphthalene		0.297	U	EPA 625.1
			106368-R04	Naphthalene		0.309	UH	EPA 625.1
			106368-004	Nitro-benzene		2.97	U	EPA 625.1
			106368-R04	Nitro-benzene		3.09	UH	EPA 625.1
			106368-004	Nitrophenol, 2-		2.97	U	EPA 625.1
			106368-R04	Nitrophenol, 2-		3.09	UH	EPA 625.1
			106368-004	Nitrophenol, 4-		2.97	U	EPA 625.1
			106368-R04	Nitrophenol, 4-		3.09	UH	EPA 625.1
			106368-004	Nitrosodimethylamine, n-		2.97	U	EPA 625.1
			106368-R04	Nitrosodimethylamine, n-		3.09	UH	EPA 625.1
			106368-004	Nitrosodipropylamine, n-		2.97	U	EPA 625.1
			106368-R04	Nitrosodipropylamine, n-		3.09	UH	EPA 625.1
			106368-004	Pentachlorophenol		2.97	U	EPA 625.1
			106368-R04	Pentachlorophenol		3.09	UH	EPA 625.1
			106368-004	Phenanthrene		0.297	U	EPA 625.1
			106368-R04	Phenanthrene		0.309	UH	EPA 625.1
			106368-004	Phenol		2.97	U	EPA 625.1
			106368-R04	Phenol		3.09	UH	EPA 625.1
			106368-004	Pyrene		0.297	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW007	2069G	1-Nov-2018	106368-R04	Pyrene		0.309	UH	EPA 625.1
			106368-004	Trichlorobenzene, 1,2,4-		2.97	U	EPA 625.1
			106368-R04	Trichlorobenzene, 1,2,4-		3.09	UH	EPA 625.1
			106368-004	Trichlorophenol, 2,4,6-		2.97	U	EPA 625.1
			106368-R04	Trichlorophenol, 2,4,6-		3.09	UH	EPA 625.1
WW008	2069I	1-Nov-2018	106367-004	Acenaphthene		0.316	U	EPA 625.1
			106367-004	Acenaphthylene		0.316	U	EPA 625.1
			106367-004	Anthracene		0.316	U	EPA 625.1
			106367-004	Benzidine		4.11	*NU	EPA 625.1
			106367-004	Benzo(a)anthracene		0.316	U	EPA 625.1
			106367-004	Benzo(a)pyrene		0.316	U	EPA 625.1
			106367-004	Benzo(b)fluoranthene		0.316	U	EPA 625.1
			106367-004	Benzo(ghi)perylene		0.316	U	EPA 625.1
			106367-004	Benzo(k)fluoranthene		0.316	U	EPA 625.1
			106367-004	Bromophenyl phenyl ether, 4-		3.16	U	EPA 625.1
			106367-004	Butylbenzyl phthalate		0.316	U	EPA 625.1
			106367-004	Chloro-3-methylphenol, 4-		3.16	U	EPA 625.1
			106367-004	Chloroethoxy)methane, bis(2-		3.16	U	EPA 625.1
			106367-004	Chloroethyl)ether, bis(2-		3.16	U	EPA 625.1
			106367-004	Chloroisopropyl ether, bis-		3.16	U	EPA 625.1
			106367-004	Chloronaphthalene, 2-		0.432	U	EPA 625.1
			106367-004	Chlorophenol, 2-		3.16	U	EPA 625.1
			106367-004	Chlorophenyl phenyl ether, 4-		3.16	U	EPA 625.1
			106367-004	Chrysene		0.316	U	EPA 625.1
			106367-004	Di-n-butyl phthalate		0.316	U	EPA 625.1
			106367-004	Di-n-octyl phthalate		0.316	U	EPA 625.1
			106367-004	Dibenz[a,h]anthracene		0.316	U	EPA 625.1
			106367-004	Dichlorobenzidine, 3,3'-		3.16	*NU	EPA 625.1
			106367-004	Dichlorophenol, 2,4-		3.16	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	1-Nov-2018	106367-004	Diethylphthalate		0.316	U	EPA 625.1
			106367-004	Dimethylphenol, 2,4-		3.16	U	EPA 625.1
			106367-004	Dimethylphthalate		0.316	U	EPA 625.1
			106367-004	Dinitro-o-cresol		3.16	U	EPA 625.1
			106367-004	Dinitrophenol, 2,4-		5.26	U	EPA 625.1
			106367-004	Dinitrotoluene, 2,4-		3.16	U	EPA 625.1
			106367-004	Dinitrotoluene, 2,6-		3.16	U	EPA 625.1
			106367-004	Diphenyl amine		3.16	U	EPA 625.1
			106367-004	Diphenylhydrazine, 1,2-		3.16	U	EPA 625.1
			106367-004	Ethylhexyl)phthalate, bis(2-		0.316	U	EPA 625.1
			106367-004	Fluoranthene		0.316	U	EPA 625.1
			106367-004	Fluorene		0.316	U	EPA 625.1
			106367-004	Hexachlorobenzene		3.16	U	EPA 625.1
			106367-004	Hexachlorobutadiene		3.16	U	EPA 625.1
			106367-004	Hexachlorocyclopentadiene		3.16	NU	EPA 625.1
			106367-004	Hexachloroethane		3.16	U	EPA 625.1
			106367-004	Indeno(1,2,3-c,d)pyrene		0.316	U	EPA 625.1
			106367-004	Isophorone		3.68	U	EPA 625.1
			106367-004	Naphthalene		0.316	U	EPA 625.1
			106367-004	Nitro-benzene		3.16	U	EPA 625.1
			106367-004	Nitrophenol, 2-		3.16	U	EPA 625.1
			106367-004	Nitrophenol, 4-		3.16	U	EPA 625.1
			106367-004	Nitrosodimethylamine, n-		3.16	U	EPA 625.1
			106367-004	Nitrosodipropylamine, n-		3.16	U	EPA 625.1
			106367-004	Pentachlorophenol		3.16	U	EPA 625.1
			106367-004	Phenanthrene		0.316	U	EPA 625.1
			106367-004	Phenol		3.16	U	EPA 625.1
			106367-004	Pyrene		0.316	U	EPA 625.1
			106367-004	Trichlorobenzene, 1,2,4-		3.16	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW008	2069I	1-Nov-2018	106367-004	Trichlorophenol, 2,4,6-		3.16	U	EPA 625.1
WW011	2069K	1-Nov-2018	106366-004	Acenaphthene		0.323	U	EPA 625.1
			106366-004	Acenaphthylene		0.323	U	EPA 625.1
			106366-004	Anthracene		0.323	U	EPA 625.1
			106366-004	Benzidine		4.19	*NU	EPA 625.1
			106366-004	Benzo(a)anthracene		0.323	U	EPA 625.1
			106366-004	Benzo(a)pyrene		0.323	U	EPA 625.1
			106366-004	Benzo(b)fluoranthene		0.323	U	EPA 625.1
			106366-004	Benzo(ghi)perylene		0.323	U	EPA 625.1
			106366-004	Benzo(k)fluoranthene		0.323	U	EPA 625.1
			106366-004	Bromophenyl phenyl ether, 4-		3.23	U	EPA 625.1
			106366-004	Butylbenzyl phthalate	0.409	0.323	J	EPA 625.1
			106366-004	Chloro-3-methylphenol, 4-		3.23	U	EPA 625.1
			106366-004	Chloroethoxy)methane, bis(2-		3.23	U	EPA 625.1
			106366-004	Chloroethyl)ether, bis(2-		3.23	U	EPA 625.1
			106366-004	Chloroisopropyl ether, bis-		3.23	U	EPA 625.1
			106366-004	Chloronaphthalene, 2-		0.441	U	EPA 625.1
			106366-004	Chlorophenol, 2-		3.23	U	EPA 625.1
			106366-004	Chlorophenyl phenyl ether, 4-		3.23	U	EPA 625.1
			106366-004	Chrysene		0.323	U	EPA 625.1
			106366-004	Di-n-butyl phthalate		0.323	U	EPA 625.1
			106366-004	Di-n-octyl phthalate		0.323	U	EPA 625.1
			106366-004	Dibenz[a,h]anthracene		0.323	U	EPA 625.1
			106366-004	Dichlorobenzidine, 3,3'-		3.23	*NU	EPA 625.1
			106366-004	Dichlorophenol, 2,4-		3.23	U	EPA 625.1
			106366-004	Diethylphthalate		0.323	U	EPA 625.1
			106366-004	Dimethylphenol, 2,4-		3.23	U	EPA 625.1
			106366-004	Dimethylphthalate		0.323	U	EPA 625.1
			106366-004	Dinitro-o-cresol		3.23	U	EPA 625.1

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Table F-8. Semivolatile organic compound results for permitted sanitary outfalls, November 2018 (continued)

Station	Permit Number	Date Collected	Sample Identifier	Analyte	Result (µg/L)	MDL (µg/L)	Laboratory Data Qualifiers	Analytical Method
WW011	2069K	1-Nov-2018	106366-004	Dinitrophenol, 2,4-		5.38	U	EPA 625.1
			106366-004	Dinitrotoluene, 2,4-		3.23	U	EPA 625.1
			106366-004	Dinitrotoluene, 2,6-		3.23	U	EPA 625.1
			106366-004	Diphenyl amine		3.23	U	EPA 625.1
			106366-004	Diphenylhydrazine, 1,2-		3.23	U	EPA 625.1
			106366-004	Ethylhexyl)phthalate, bis(2-		0.323	U	EPA 625.1
			106366-004	Fluoranthene		0.323	U	EPA 625.1
			106366-004	Fluorene		0.323	U	EPA 625.1
			106366-004	Hexachlorobenzene		3.23	U	EPA 625.1
			106366-004	Hexachlorobutadiene		3.23	U	EPA 625.1
			106366-004	Hexachlorocyclopentadiene		3.23	NU	EPA 625.1
			106366-004	Hexachloroethane		3.23	U	EPA 625.1
			106366-004	Indeno(1,2,3-c,d)pyrene		0.323	U	EPA 625.1
			106366-004	Isophorone		3.76	U	EPA 625.1
			106366-004	Naphthalene		0.323	U	EPA 625.1
			106366-004	Nitro-benzene		3.23	U	EPA 625.1
			106366-004	Nitrophenol, 2-		3.23	U	EPA 625.1
			106366-004	Nitrophenol, 4-		3.23	U	EPA 625.1
			106366-004	Nitrosodimethylamine, n-		3.23	U	EPA 625.1
			106366-004	Nitrosodipropylamine, n-		3.23	U	EPA 625.1
			106366-004	Pentachlorophenol		3.23	U	EPA 625.1
			106366-004	Phenanthrene		0.323	U	EPA 625.1
			106366-004	Phenol		3.23	U	EPA 625.1
			106366-004	Pyrene		0.323	U	EPA 625.1
			106366-004	Trichlorobenzene, 1,2,4-		3.23	U	EPA 625.1
			106366-004	Trichlorophenol, 2,4,6-		3.23	U	EPA 625.1

CINT = Center for Integrated Nanotechnologies
MDL = method detection limit; the minimum concentration or activity that can be measured and reported with 99% confidence that the analyte is greater than zero; analyte is matrix specific
PQL = 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 = analytical holding time was exceeded
J = estimated value, the analyte concentration fell above the effective MDL and below the effective PQL
N = a spike was outside limits
U = analyte is absent or below the method detection limit
* = a replicate was outside limits

Glossary

Short-horned Lizard (*Phrynosoma hernandesi*)

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). Sandia's aboveground storage tanks are metal construction, field erected or shop-built, and include integral generator base tanks.

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 harmful 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 into any land or 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.

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, and visitors and the public.

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

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

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

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

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

environmental release Any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing 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.

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

L

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

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 Wastes less hazardous than most of those 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 Facilitates 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, reducing waste and toxicity, recovering more of the materials that are used, slowing climate change, and assuring 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 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, or, where delegated, a tribal government on an Indian reservation.

natural resource Resource (actual and 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 illness in infants and domestic animals. A plant nutrient and inorganic fertilizer, nitrate is found in septic systems, animal feedlots, agricultural fertilizers, manure, industrial wastewaters, sanitary landfills, and garbage dumps.

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 or product compound or contaminant that is reportable to a regulatory agency when released to the environment.

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

S

sample management office A Sandia office 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.

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 and 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 grade, covered with earth, and used to contain oil of any kind (petroleum, non-petroleum, synthetic, animal, or vegetable). Sandia's underground storage tanks are double-wall, fiberglass-reinforced plastic construction.

upstream (1) In the direction opposite to 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 U 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 zone 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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20.11.2 NMAC, *Fees.*

20.11.8 NMAC, *New Mexico Ambient Air Quality Standards.*

20.11.20 NMAC, *Fugitive Dust Control.*

20.11.21 NMAC, *Open Burning.*

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Oil Storage and Spill Containment
20.5 NMAC, *Petroleum Storage Tanks*.

- 20.5.118 NMAC, *Reporting and Investigation of Suspected and Confirmed Releases*.

Solid Waste
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- 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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