PHOTOGRAPHY: Rhett Zyla

2022

ANNUAL SITE ENVIRONMENTAL REPORT

NEW MEXICO

ALBUQUERQUE

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. Approved for public release; further dissemination unlimited.

Sandia Report
SAND2023-07908O
Unlimited Release

U.S. DEPARTMENT OF ENERGY

NNSA
National Nuclear Security Administration

Issued by Sandia National Laboratories, operated for the United States Department of Energy by National Technology & Engineering Solutions of Sandia, LLC.

Available to DOE and DOE contractors from

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

Telephone: (865) 576-1188
Facsimile: (865) 576-2865
E-mail: comments@osti.gov
Online order: OSTI Search Tools

Available to the public from

U.S. Department of Commerce
National Technical Information Service
5301 Shawnee Rd
Alexandria, VA 22312

Telephone: (800) 363-3068
Facsimile: (703) 605-6880
E-mail: info@ntis.gov
Online order: National Technical Reports Library

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

2022 Annual Site Environmental Report
for Sandia National Laboratories, Albuquerque, New Mexico

Prepared by
Sandia National Laboratories
P.O. Box 5800
Albuquerque, New Mexico 87185-1512

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

Abstract
Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration. The National Nuclear Security Administration's Sandia Field Office administers the contract and oversees contractor operations at Sandia National Laboratories, New Mexico. Activities at the site support research and development programs with a wide variety of national security missions, resulting in technologies for nonproliferation, homeland security, energy and infrastructure, and defense systems and assessments.

The U.S. Department of Energy and its management and operating contractor are committed to safeguarding the environment, assessing sustainability practices, and ensuring the validity and accuracy of the monitoring data presented in this annual site environmental report. This report summarizes the environmental protection and monitoring programs in place at Sandia National Laboratories, New Mexico, during calendar year 2022. Environmental topics include cultural resource management, chemical management, air quality, ecology, environmental restoration, oil storage, site sustainability, terrestrial surveillance, waste management, water quality, and implementation of the National Environmental Policy Act. This report is prepared in accordance with and as required by DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*, and has been approved for public distribution.

Acknowledgments

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

Sandia National Laboratories Project Lead/Technical Reviewer
Amy Miller

DOE Project Lead/Technical Reviewer
Janet Forestier

Document Production and Technical Editing
Shirley Coe, Stacie Evelo, Casey Pirtle, Nancy White

Contributing Authors

Jacob Alexander
Penny Avery
Matt Baumann
Kelly Bowles
Mendy Brown
Benito Casaus
Dave Castillo
Christina Chavez
Sue Collins
Evan Fahy
Joe Fontana
Morgan Gerard
Kelly Green
Erin Greenlee
Stacy Griffith
Casey Hendricks
Benjamin Henning
Tim Jackson
Amanda Jones
John Kay
Kevin Lambert
Andrez Leyva
Jun Li
Ben Martinez
Amy Miller
Michael Mitchell
Jen Payne
Sam Poli
Anita Reiser
Sherry Ricketson
Jane Romero Kotovsky
Ryan Sarhan
Che Shu-Nyamboli
Michael Skelly
Rebecca Ullrich
Doug Vetter
Kelly Wiese
Nora Wintermute
Robert Ziock
Mark Zuverink
Rhett Zyla

Note to the Reader

This annual site environmental report for Sandia National Laboratories, New Mexico, presents summary data regarding environmental performance and compliance with environmental standards and requirements. In addition, the U.S. Department of Energy views this document as a valuable tool for maintaining a dialogue with the community about the environmental health of this site and a commitment to protect our nation's valuable resources. With the goal of continually improving the quality of the contents of this annual report and including information that is important to you, you are invited to provide feedback, comments, or questions to:

U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office
P.O. Box 5400
Albuquerque, NM 87185-5400
Attention: Tami Moore

This 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

Contents

List of Figures

List of Tables

Appendix Tables

Acronyms and Abbreviations

Term	Definition
A	
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
AD	anno Domini
AIM	Assessment, Inventory, and Monitoring
B	
BC	before Christ
BSG	Burn Site Groundwater
C	
$CaCO_3$	calcium carbonate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGP	Construction General Permit
CINT	Center for Integrated Nanotechnologies
COVID-19	Coronavirus Disease 2019
D	
DE	data excluded
DOE	United States Department of Energy
DOECAP	DOE Consolidated Audit Program
DP	discharge permit
DU	duplicate sample
E	
EB	equipment blank
E. coli	*Escherichia coli*
EEEJ	energy equity and environmental justice
EISA	Energy Independence and Security Act
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ES&H	Environment, Safety, and Health
F	
FFCA	Federal Facility Compliance Act
FFCO	Federal Facility Compliance Order
H	
HDRV	Historical Disposal Requests Validation
HMX	high melting explosive
HSWA	Hazardous and Solid Waste Amendment
I	
ISO	International Organization for Standardization
K	
KAFB	Kirtland Air Force Base

Term	Definition
L	
Lc	critical level
LC/MS/MS	liquid chromatography/mass spectrometry/mass spectrometry
LEED	Leadership in Energy and Environmental Design
M	
MAPS	Monitoring Avian Productivity and Survivorship
MCL	maximum contaminant level
MDA	minimal detectable activity or minimum measured activity
MDL	method detection limit
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Permit
N	
N	nitrogen
NA	not available
N/A	not applicable
ND	not detected
NE	not established
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
NPDES	National Pollutant Discharge Elimination System
NTESS	National Technology & Engineering Solutions of Sandia, LLC
NTU	nephelometric turbidity unit
P	
P	phosphorus
PCB	polychlorinated biphenyl
PFAS	polyfluoroalkyl substance
pH	potential of hydrogen
PL	Public Law
$PM_{2.5}$	particulate matter that has a diameter equal to or less than 2.5 microns
PM_{10}	particulate matter that has a diameter equal to or less than 10 microns
PQL	practical quantitation limit

Term	Definition
R	
RCRA	Resource Conservation and Recovery Act
RDX	rapid-detonating explosive
S	
SA	sample
Sandia	Sandia National Laboratories
SARA	Superfund Amendments and Reauthorization Act
SC Dome	Scale Compatibility Dome
SNL/NM	Sandia National Laboratories, New Mexico
sp.	unknown species, singular
spp.	unknown species, plural
ssp.	subspecies
SU	standard unit
SWSP	stormwater sampling point
T	
TA-I	Technical Area I
TA-II	Technical Area II
TA-III	Technical Area III
TA-IV	Technical Area IV
TA-V	Technical Area V
TAG	Tijeras Arroyo Groundwater
TAVG	Technical Area V Groundwater
TCLP	toxicity characteristic leaching procedure
U	
U.S.	United States

Units of Measure

Unit	Definition
°C	degree Celsius
°F	degrees Fahrenheit
Btu	British thermal unit
Ci	curie
Ci/year	curies per year
cm	centimeter
g	gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
µm	micrometer
m	meter
m^3	cubic meter
mb	millibar
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mg/sa	milligrams per sample
mL	milliliter
mm	millimeter
mrem	millirem
mrem/year	millirems per year
m/sec	meters per second
ng/L	nanograms per liter
pCi/g	picocuries per gram
pCi/L	picocuries per liter
pCi/m^3	picocuries per cubic meter
pCi/sa	picocuries per sample
person-rem	person-roentgen equivalent, man
person-rem/year	person-roentgen equivalent, man per year
pg/L	picogram per liter

Data Qualifiers

Laboratory Data Qualifier

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

Data Validation Qualifier

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

Executive Summary

Sandia National Laboratories, New Mexico

Sandia National Laboratories, hereinafter referred to as Sandia, is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration. This annual site environmental report was prepared in accordance with and as required by DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting*, and is approved for public release. The U.S. Department of Energy (DOE) and its management and operating contractor for Sandia are committed to safeguarding the environment, continually assessing sustainability practices, and ensuring the validity and accuracy of the monitoring data presented here. This report summarizes the environmental protection, restoration, and monitoring programs in place for Sandia National Laboratories, New Mexico (SNL/NM), located in Albuquerque, New Mexico, during calendar year 2022.

Environmental Management System

Sandia management takes environmental stewardship seriously. A robust environmental management system was established in 2005 as part of this commitment. This system ensures a structured approach to identifying environmental aspects, setting environmental objectives, and monitoring environmental performance. Designed to meet the requirements of the globally recognized International Organization for Standardization (ISO) 14001:2015 standard, Sandia's Environmental Management System is ISO 14001:2015 certified. SNL/NM personnel follow the system's requirements, as verified by an external, third-party audit in 2022. This environmental management system is Sandia's primary platform for implementing the environmental management programs that help achieve annual site sustainability goals. For fiscal year 2022, the significant aspects for Sandia operations were: greenhouse gas air emissions and hazardous air pollutants (asbestos); hazardous materials; hazardous, mixed, and radiologic waste; release of explosives and combustion byproducts to soil, surface, and groundwater; wastewater and process water discharge; and water use.

Site Sustainability

A site sustainability plan is prepared annually and identifies contributions toward meeting DOE sustainability goals and the broader sustainability program set forth in EO 14008, *Tackling the Climate Crisis at Home and Abroad*. Sandia's most recent plan, *Fiscal Year 2023 Site Sustainability Plan*, describes performance status for fiscal year 2022. Highlights for SNL/NM in 2022 include decreasing the year-over-year Scope 1 and Scope 2 greenhouse gas emissions relative to fiscal year 2021, completing a vulnerability assessment and resilience plan, decreasing potable water intensity by 32.8 percent relative to a fiscal year 2007 baseline, and designing and constructing three new LEED Gold buildings. Additionally, SNL/NM personnel diverted 62.9 percent of nonhazardous solid waste from treatment and disposal facilities and diverted 20.1 percent of construction and demolition waste from treatment and disposal facilities. Improvements to the ecomedes tool promoted sustainable acquisition and improvements to MAN-004, *Sandia National Laboratories/New Mexico Design Standards Manual*, promoted compliance with the *Guiding Principles for Sustainable Buildings*.

Though Scope 3 greenhouse gas emissions were reduced by 25.4 percent from the fiscal year 2008 baseline, these greenhouse gas emissions increased year-over-year by 9.5 percent relative to fiscal year 2021. In fiscal year 2022, energy intensity increased by 3.3 percent relative to fiscal year 2021. Also, SNL/NM personnel managed electronics stewardship, with 95.5 percent of acquisitions meeting environmentally sustainable electronics standards, 100 percent of operations using power management features during computer and monitor use, and 100 percent of end-of-life equipment being disposed of through government programs or certified recyclers.

Environmental Performance

DOE assesses environmental performance through the collection of data, measures, and indicators and then reports on this as part of an overall performance evaluation. During the most recent evaluation, Sandia earned an overall rating of very good. Additionally, during 2022, two occurrences met the criteria for reporting in this annual site environmental report.

All environmental monitoring in 2022 was conducted in accordance with program-specific plans that contain applicable quality assurance elements and meet appropriate federal, state, and local requirements for conducting sampling and analysis activities.

Environmental Programs

Air Quality Compliance Program. Program personnel support compliance with air quality regulations, permits, and other requirements. During 2022, potential emissions from permitted and registered stationary sources were 10.68 tons of hazardous air pollutants, 3.28 tons of volatile organic compounds, 10.64 tons of carbon monoxide, 8.02 tons of nitrogen oxide, 1.67 tons of particulate matter with a diameter $\leq$ 10 µm., and 0.09 tons of sulfur dioxide. These emissions were within permitted limits. During fiscal year 2022, SNL/NM operations directly emitted a total of 137,674 tons of carbon dioxide-equivalent emissions. Activities resulting in greenhouse gas emissions were below federal regulatory reporting thresholds. Twenty-two open burn permits and 10 figutive dust permits were in effect in 2022.

Ambient Air Surveillance Program. Ambient air quality is monitored for particulate matter and analyzed for metals and radiological constituents. Particulate matter that has a diameter equal to or less than 2.5 µm, or $PM_{2.5}$ was measured at two monitoring locations (CPMSTEOM and A3BAM). The 2022 annual average for one-hour $PM_{2.5}$ measurements was 3.42 µg/m^3 at A3BAM and 6.38 µg/m^3 at CPMSTEOM. The highest monthly average PM_{10} (particulate matter that has a diameter equal to or less than 10 µm) concentration in fiscal year 2022 was 83.75 µg/m^3, which occurred in the second quarter of fiscal year 2022. The PM_{10} samples are also analyzed for metals and radiological constituents, and the fiscal year 2022 averages were generally well below threshold limit values. The average result for gross alpha was measured at 1.54E-03 pCi/m^3, and the average result for gross beta was measured at 2.23E-02 pCi/m^3; both of these radiological constituents have a threshold limit value of zero.

Chemical Information System. In 2022, chemical containers at SNL/NM were tracked along with information about any related chemical hazards. Seventy-four chemicals were submitted to the Chemical Exchange Program in 2022, 145 chemicals were available to claim, and 16 chemicals were reapplied.

Cultural Resource Management Program. Program personnel review and document potential impacts on archaeological sites and historic properties. In 2022, 18 archaeological surveys were conducted; no cultural resources were affected by ongoing or proposed activities. DOE completed two consultations with the New Mexico State Historic Preservation Officer and one consultation with the Pueblo of Isleta.

The historian completed historic building assessments in response to 22 proposed actions at 29 properties in 2022. Consultation between DOE and the State Historic Preservation Officer is complete on 21 of the actions. Additionally, a memorandum of agreement was completed for demolition of two historic buildings, and four consultations are underway for projects at 10 buildings.

Ecology Program. Ecology Program personnel perform several monitoring, compliance, and staff support activities throughout each year, including vegetation monitoring and surveillance; ecological restoration and revegetation; herpetofauna, avian, and wildlife surveillance; passive bat monitoring using bioacoustic recordings; and Eco Ticket responses.

The Ecology Program revegetation subject matter expert supported five ecological restoration projects, participated in 37 Facilities Conceptual Location Analysis planning processes, reviewed 33 National Environmental Policy Act (NEPA) checklists, and monitored ongoing restoration projects.

During 2022 herpetofaunal field monitoring, 135 individuals representing 10 species were recorded: 3 snake species, 6 lizard species, and 1 amphibian species. Species diversity and species evenness at the Robotic Vehicle Range were above average in 2022, whereas species diversity and species evenness at the West of Technical Area-III area were below average in 2022.

In 2022, 21 species of bats were documented at SNL/NM using passive bioacoustic recordings of bat calls at two sites. The big brown bat (*Eptesicus fuscus*) and the silver-haired bat (*Lasionycteris noctivagans*) were among the most frequently detected bats at both sites. In 2022, a breeding bird survey was conducted in June and July. Forty-eight species and 461 individuals were detected across the transect. The 2022 winter bird survey was completed in January 2022. Twenty-six species and 275 individuals were detected. Monitoring Avian Productivity and Survivorship protocol banding sessions were run from May to August. Twenty-two species were captured, and 63 individuals were newly banded. Five fall migration banding events were run from October to November 2022 at a new location, Coyote Wetlands. Nine species were captured, and 13 individuals were banded this fall.

Ecology Program personnel maintain two wildlife water guzzlers: the Madera Canyon Guzzler and the Range Guzzler. Since June 2005, 70 species have been recorded and identified at the Madera Canyon Guzzler. Six of these species have been documented in each year since monitoring began, including the American black bear (*Ursus americanus*), common raven (*Corvus corax*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), mourning dove (*Zenaida macroura*), and mule deer (*Odocoileus hemionus*). In 2022, 25 different species were observed at the Madera Canyon Guzzler, including 6 mammal species and 19 bird species. Since monitoring began, 73 species have been recorded and identified at the Range Camera Station. Two species have been observed in images at the Range Guzzler in every year of monitoring: gray fox and mule deer. In 2022, 36 different species were observed at the Range Guzzler, including 7 mammal species, 20 bird species, and 2 reptile species.

Sandia personnel use Eco Ticket, a web-based ticketing system, for reporting wildlife issues or concerns and requesting biological surveys. In 2022, 204 wildlife issues or requests were received through Eco Ticket. The "Other" category was requested most often with 82 tickets; pest management requests and non-urgent wildlife sightings made up a large portion of this category. There were 36 snake removal tickets in 2022, a slight increase from 2021. Of the 36 tickets, 16 were for venomous snakes. Ecology Program personnel received 435 Eco Ticket requests for biological surveys in 2022. The majority of these tickets were part of "Facilities Work Orders." These are routine, small-scope requests; campus maintenance activities are included in this work order category. The remaining 97 requests were for projects that didn't fall under routine maintenance activities. Outdoor testing and large-scale construction activities made up the majority of these requests.

Environmental Education Outreach. Program personnel interact with the community through various events and information campaigns. Events conducted in 2022 included a virtual Earth Day and a virtual presentation of the annual Environmental Excellence Awards. Additionally, environmental professionals visited 40 public school classrooms in the Albuquerque area to complete a watershed model activity with students in support of the RiverXchange education program.

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 2022, no releases to the environment met the criteria for reporting to the New Mexico Environment Department or the U.S. Environmental Protection Agency (EPA). No releases met the criteria of a DOE-reportable occurrence. The chemical inventory report and the toxic release inventory report for 2022 were submitted to support compliance with the Emergency Planning and Community Right-to-Know Act.

Environmental Restoration Operations. Sandia personnel manage sites impacted by past spill, release, or disposal activities. In 2022, six sites continued to require corrective action, including three groundwater areas of concern and three active test facilities. In 2022, routine samples were collected for the three groundwater areas of concern. For the TA-V Groundwater area of concern, 18 monitoring wells were sampled in 2022. Several results exceeded the maximum contaminant levels for trichloroethene (six wells) and nitrate plus nitrite (three wells). For the Tijeras Arroyo Groundwater area of concern, 21 monitoring wells were sampled. In the perched groundwater system, the nitrate plus nitrite concentration exceeded the nitrate maximum contaminant level at five wells, tetrachloroethene exceeded the maximum contaminant level at one well, and trichloroethene exceeded the maximum contaminant level at one well. For the Burn Site Groundwater area of concern, 14 wells were sampled in 2022. Nitrate plus nitrite exceeded the maximum contaminant levels in six wells.

Long-Term Stewardship Program. Legacy sites continue to be managed by this program. In 2022, 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. At the Chemical Waste Landfill, semiannual groundwater monitoring was performed in January and August 2022 in accordance with post-closure care permit requirements. Groundwater samples were analyzed for volatile organic compounds (including trichloroethene), nickel, and chromium. The results were consistent with previous years; trichloroethene was the only volatile organic compound detected.

The 2022 Corrective Action Management Unit soil vapor monitoring results continue to show the edge of the residual soil vapor plume emanating from the nearby former Chemical Waste Landfill.

The volatile organic compound concentrations are not attributed to the material in the Corrective Action Management Unit. The 2022 soil moisture monitoring results remained consistent with the baseline data for the primary subliner and vertical sensor array monitoring subsystems with no trigger levels exceeded. In 2022, 218 gallons of leachate were removed from the leachate collection system compared to 219 gallons in 2021. The evapotranspirative cover continues to meet revegetation criteria and is in excellent condition with even coverage of mature, native perennial grasses.

In 2022, semiannual groundwater monitoring was performed at the Mixed Waste Landfill in May and October. 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. Additional groundwater samples were collected in October to analyze for perfluorohexane sulfonic acid, perfluorooctane sulfonic acid, and perfluorooctanoic acid in accordance with a New Mexico Environment Deparment request. There were no detections above laboratory method detection limits in any groundwater sample.

All Resource Conservation and Recovery Act Facility Operating Permit-required physical inspections were completed in 2022. The need for replacement of weathered signs was observed at one solid waste management unit in 2022. The replacement will be completed in the first quarter of 2023.

In addition, Groundwater Monitoring Program personnel sampled 16 wells and one spring in 2022. Groundwater samples were analyzed for the following parameters: Safe Water Drinking Act list volatile organic compounds, total organic halogens, total phenols, total alkalinity, nitrate plus nitrite, total cyanide, major anions, Target Analyte List metals, mercury, gamma spectroscopy, gross alpha and beta, radium-226, and radium-228. A subset of the locations were sampled for high explosive compounds, dissolved uranium (as mass), and isotopic uranium. Fluoride was detected above the maximum allowable concentration in three groundwater wells. Beryllium concentrations at Coyote Springs exceeded EPA maximum contaminant levels. The exceedance for each of these elements is attributable to the elevated natural concentrations associated with bedrock groundwater systems at the sampling locations. In one groundwater well, mercury was detected above the EPA maximum contaminant level in the environmental sample but below the method detection limit in the associated duplicate environmental sample.

Materials Sustainability and Pollution Prevention Programs. These programs are in place to help reduce the amount and toxicity of waste streams generated in office and lab settings throughout the campus. Materials Sustainability Program personnel educate, influence, and track compliance with Federal Acquisition Regulation and DOE Acquisition Regulation clauses in the Prime Contract, which outline the need to procure products that meet various environmental specifications, such as biobased and recycled content and energy and water efficiency standards. Pollution Prevention Program personnel provide educational materials and recycling receptacles, and conduct outreach and promotion to ensure that personnel can participate in recycling efforts, which are necessary to meet Sandia's Zero Waste by 2025 goal. Since establishing the goal of Zero Waste by 2025, the diversion rate has gone from 47 percent in the baseline year of 2008 to 64 percent in 2022.

To increase acquisition of sustainable products, a 2022 interdepartmental working group updated the "green language" clause (350APR clause) in subcontractor contracts and created an automated Oracle process to identify applicable contract categories that need to incorporate the 350APR clause. Sustainable acquisition requirements were also added to the Request for Information and Request for Quote process to further communicate requirements to interested subcontractors.

Meteorology Program. Meteorological monitoring is conducted through a network of meteorological observation towers located across Kirtland Air Force Base. Program personnel provided services, data, and analyses to support project planning decisions in 2022. Routine instrument calibrations and a preventive maintenance field program ensured data quality. In 2022, local conditions across SNL/NM were generally in line with the statewide pattern, with drought conditions improving as the year progressed but ending 2022 in a moderate drought condition.

National Environmental Policy Act Program. Program personnel coordinate with DOE to ensure NEPA compliance and to provide technical assistance in project planning at SNL/NM. In 2022, program personnel reviewed 318 proposed projects through the NEPA online tool, and an additional 354 maintenance activities were reviewed through the Routine Maintenance Criteria SharePoint site. NEPA Program personnel submitted 13 Air Force 813 forms on behalf of the Sandia Field Office. In addition, NEPA Program personnel assisted DOE in initiating a new site-wide environmental impact statement for SNL/NM and participated in process improvement activities with the DOE Sandia Field Office.

Oil Storage Program. Oil storage containers and equipment are managed, operated, and maintained to prevent inadvertent releases to the environment and to comply with applicable regulations. In 2022, the inventory of oil storage containers operating under the *Sandia National Laboratories Spill Prevention, Control, and Countermeasure Plan* included 45 stationary aboveground storage tanks. Additional oil storage capacity in 55-gallon drums, mobile and portable containers, mobile refuelers, and oil-filled operational equipment exists throughout the site. Two underground oil storage tanks were permanently closed and removed in 2022. There were no reportable oil spills in 2022.

Radionuclide National Emission Standards for Hazardous Air Pollutants. Radionuclide air emissions from Sandia facilities are reported each year. In 2022, the primary radionuclides released from Sandia facilities were argon-41 and tritium. Calculated doses were well below the 10 mrem/year dose limit set by the EPA and DOE.

Safe Drinking Water Protection Program. Drinking water is supplied by the Kirtland Air Force Base-owned system. Sandia personnel adhere to New Mexico Environment Department regulations when operating and maintaining the drinking water system. In 2022, Safe Drinking Water Protection Program personnel coordinated with Kirtland Air Force Base to support compliance activities.

Stormwater Program. Three EPA National Pollutant Discharge Elimination System permits are maintained, and compliance activities were conducted in 2022. In addition, monthly compliance inspections were conducted at 16 construction sites under the Construction General Permit and at 18 sites under the Multi-Sector General Permit. Water quality sampling was conducted at 16 locations under the Multi-Sector General Permit and at 5 locations under the Municipal Separate Storm Sewer System Permit.

Surface Discharge Program. All planned water-based discharges to the ground surface are reviewed to comply with regulations. In 2022, 25 individual discharge requests for SNL/NM met applicable standards and were approved. Approved releases complied with New Mexico Environment Department-applicable requirements. SNL/NM personnel continue to operate the two evaporative lagoons through Discharge Permit 530 issued by the New Mexico Environment Department Ground Water Quality Bureau. Samples were collected from Lagoon 1 and Lagoon 2 on August 22, 2022. Sample fractions were collected for major ions, total dissolved solids, and purgeable and extractable organics as specified in DP-530. Laboratory analysis results indicated that all detected constituents met the state standards, with the exception of fluoride at Lagoon 1. This is suspected to be due to a slightly higher concentration of anions in the sediment from evaporation.

Terrestrial Surveillance Program. The various environmental sample media that are collected by program personnel include surface soil, arroyo and river sediment samples, and vegetation at on-site, off-site, and perimeter locations. The statistical analysis methodology performed on sample results was revised in 2022. When the sample results at an on-site location are significantly different from and greater than the community and perimeter results and the sample results at the on-site location are trending upward, it is noted for further evaluation. The results of the statistical analysis for metals identified eight instances of statistical significance for the following metals: arsenic, beryllium, chromium, copper, nickel (soil and sediment), selenium, and thallium. The results from this group of metals was compared to reference values and to results from previous years; no 2022 sampling event results were outside the reference ranges. Radiological analyses were performed on soil and sediment samples. Statistical analyses of the 2022 results for the selected radionuclides revealed no statistically significant population differences nor any increasing trends in the on-site locations sample results.

Three on-site locations were analyzed for high explosive compounds. There was one detection for rapid-detonating explosive. One on-site location was analyzed for perchlorate. The estimated perchlorate result was below the New Mexico Environment Department soil screening level for residential use.

Environmental dosimeters used to measure the dose from ambient gamma radiation indicated levels within natural background values in 2022.

Waste Management Program. Wastes (including solid wastes, hazardous wastes, and radioactive wastes) are generated during ongoing operations. The wastes are collected and managed at SNL/NM (i.e., stored, treated, and packaged) before shipment to off-site permitted facilities. In 2022, the following amounts of waste were handled and shipped: low-level radioactive waste, 90,797 lb; mixed low-level radioactive waste, 26,782 lb; hazardous waste, 127,608 lb; polychlorinated biphenyl waste, 860 lb; other regulated waste (asbestos, chemical, and infectious waste), 424,105 lb; and solid waste, 5,291,474 lb. Recycled commercial, construction, and demolition solid waste totaled 8,743,988 lb and recycled regulated or chemical waste totaled 512,610 lb in 2022.

The New Mexico Environment Department has issued two permits for hazardous and mixed waste management activities, post-closure care, and long-term monitoring and maintenance at SNL/NM: the Resource Conservation and Recovery Act Facility Operating Permit and the Chemical Waste Landfill Post-Closure Care Permit. The Resource Conservation and Recovery Act Facility Operating Permit was modified three times during 2022.

During 2022, DOE and Sandia personnel met all regulatory deadlines, shipped no mixed transuranic waste to the Waste Isolation Pilot Plant for disposal, and provided an annual update of mixed waste activities during the previous year. In addition, during 2022, Sandia personnel managed 1.76 m^3 of mixed transuranic waste that was subject to the Federal Facility Compliance Order.

The fiscal year 2022 New Mexico Environment Department Hazardous Waste Bureau inspection was held December 7–9, 2021, and a notice of violation was issued in early 2022. The notice of violation included three findings related to container labels and one finding related to container closure. All findings were corrected during the inspection, and no further action was required.

Wastewater Discharge Program. Wastewater is discharged from six permitted on-site outfalls. In 2022, wastewater was monitored, and three permit-mandated split samplings were conducted with the Albuquerque Bernalillo County Water Utility Authority. All routine monitoring and split sampling events met the standards set by the Albuquerque Bernalillo County Water Utility Authority Sewer Use and Wastewater Control Ordinance requirements.

In April 2022, the Albuquerque Bernalillo County Water Utility Authority performed annual inspections of facilities that discharge within permitted flow basins. No issues or findings were identified during any of these inspections. The Albuquerque Bernalillo County Water Utility Authority presented DOE and Sandia with six Pretreatment Gold Awards in 2022. Gold awards are given for 100 percent compliance with wastewater discharge permit reporting requirements, zero notices of violation, and an exceptional level of permit compliance.

Chapter 1. Introduction to Sandia National Laboratories, Albuquerque, New Mexico

Sunrise over the 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 U.S. Department of Energy (DOE) per DOE O 231.1B, Admin Change 1, *Environment Safety and Health Reporting* (DOE O 231.1B, Admin Change 1 2012). This report describes the environmental protection programs currently in place at Sandia National Laboratories, New Mexico (SNL/NM), located in Albuquerque, New Mexico, and is made available to the public in electronic form at Sandia Environmental Reports (Sandia n.d.).

Sandia National Laboratories, hereinafter referred to as Sandia—with the exception of when using an acronym to represent the facility location, Sandia National Laboratories, New Mexico (SNL/NM)—is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC (NTESS), a wholly owned subsidiary of Honeywell International Inc., for the DOE National Nuclear Security Administration. The DOE National Nuclear Security Administration Sandia Field Office administers the contract and oversees contractor operations. Building on its original nuclear weapons mission, Sandia research and development programs support a wide variety of national security missions, resulting in technologies for nonproliferation, homeland security, energy and infrastructure, and defense systems and assessments.

While most 2022 program activities were performed continuously, they are reported on a calendar-year basis unless otherwise noted. Programs based on the fiscal year operate from October 1 through September 30, annually.

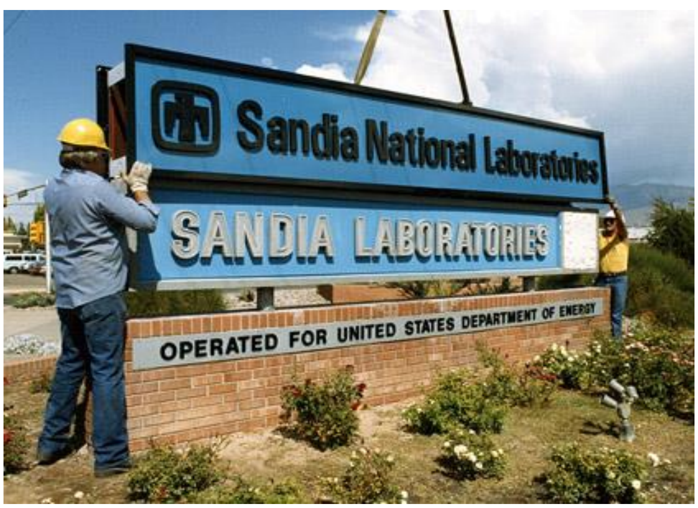
1.1 Purpose

Operating since 1949, Sandia's core purpose is to render exceptional service in the national interest. As a Federally Funded Research and Development Center, Sandia operates in the public interest with objectivity and independence, free from organizational conflicts of interest, maintaining core competencies in missions of national significance. Our principal mission is to deliver on commitments to nuclear deterrent, nuclear nonproliferation, and critical work for the national security community. Sandia personnel anticipate and resolve emerging national security challenges and inform the national debate for which technology policy is critical to preserving security and freedom throughout the world. Information about new technologies and accomplishments can be found at Sandia News (Sandia n.d.).

1.2 History

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 Kirtland Air Force Base [KAFB]), located on the perimeter of Albuquerque, to be near an airfield and to work closely with the military. In 1948, Z Division became a separate branch of the Los Alamos Scientific Laboratory and was renamed Sandia Laboratory. On November 1, 1949, Sandia Corporation, a wholly owned subsidiary of Western Electric, began managing and operating Sandia Laboratory. In 1979, Congress recognized the facility as a national laboratory. From 1993 to mid-2017, Sandia Corporation was a wholly owned subsidiary of Martin Marietta (merging with Lockheed Corporation in 1995 to form Lockheed Martin Corporation). In May 2017, the management and operating contractor changed its name to NTESS. For more details, see Chapter 2.

The Sandia workforce at all sites totaled approximately 15,530 employees and contractors in 2022, with 12,580 employees located at SNL/NM (Sandia n.d.).



Sandia recognized as a national laboratory

1.3 Location Description

Figure 1-1 shows the KAFB boundary, its land designations, and the agencies that operate within those boundaries. Located at the foot of the Manzanita Mountains, KAFB is a military installation that spans approximately 50,132 acres, including 20,486 acres that are withdrawn land (withheld from the public domain) from the Cibola National Forest through an agreement with the U.S. Forest Service (DOE 1999). More than 450 federal government and private sector tenants and associated units operate on KAFB (U.S. Air Force 2012). KAFB and SNL/NM are adjacent to Albuquerque, which borders KAFB on the base's north, northeast, west, and southwest boundaries. The Albuquerque International Sunport (airport) and Mesa del Sol—a 12,800-acre mixed-use urban area under development—are west of KAFB. The Pueblo of Isleta is south of the KAFB boundary.

Located at the foot of the Manzanita Mountains, Kirtland Air Force Base is a military installation that spans approximately 50,132 acres

Sandia conducts operations on DOE-owned property, non-DOE-owned property contracted from other federal and state agencies, and privately owned leased property. Sandia sites located on DOE-owned property comprise 2,938 acres and include five technical areas (DOE 1999). At non-DOE-owned property, Sandia personnel conduct operations on 5,637 acres of land permitted from the U.S. Air Force, a portion of which are on land withdrawn by the U.S. Forest Service (Sandia 2006). DOE leases approximately 2,750 acres from the New Mexico State Land Office (La Semilla Buffer Zone) west of the KAFB boundary. This area serves as a margin of safety and a sound buffer for testing operations. In addition, Sandia personnel conduct operations at off-site leased facilities. There are approximately 6.54 million gross square feet of existing facilities at SNL/NM (Sandia 2022).

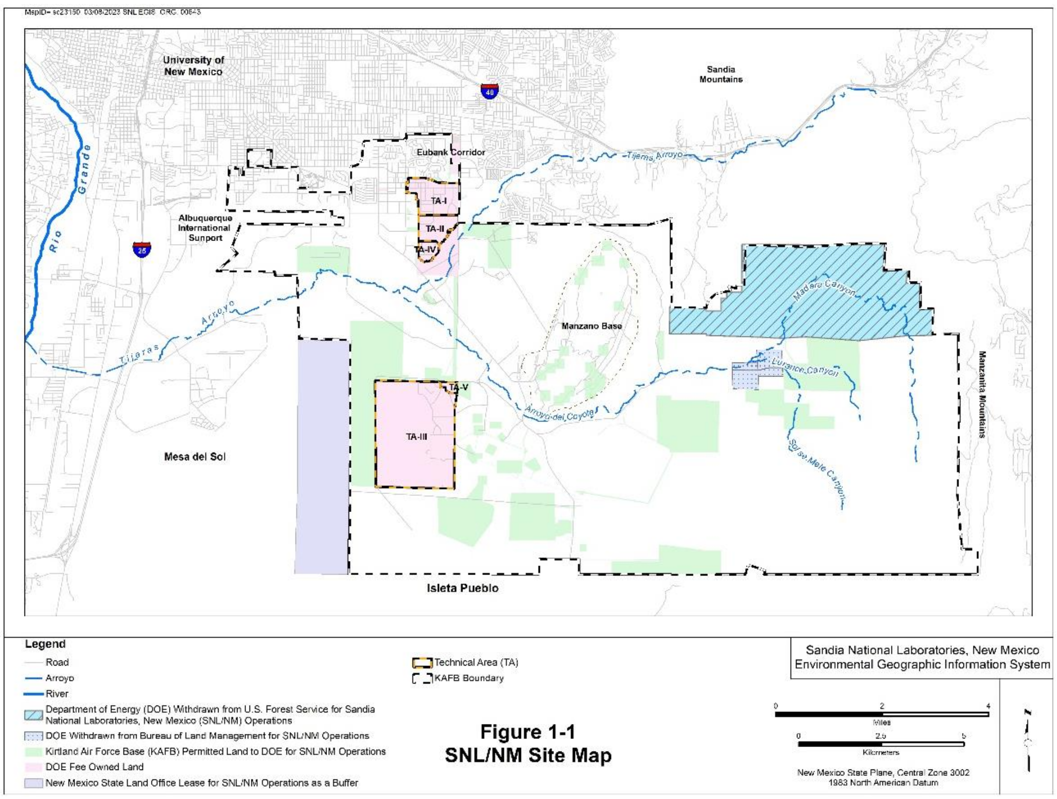


Figure 1-1. SNL/NM location, including technical areas and permitted areas

1.4 Demographics

New Mexico is the fifth-largest state in the United States, encompassing approximately 121,000 square miles. New Mexico's 2022 population was 2,113,344 (U.S. Census Bureau 2022).

Albuquerque is the largest city in the state, with an estimated population of 561,008 in 2022 (U.S. Census Bureau 2022). The estimated metropolitan area population within a 50-mile radius of Albuquerque (Figure 1-2) was 1,075,207 in 2022 (StatsAmerica n.d.).

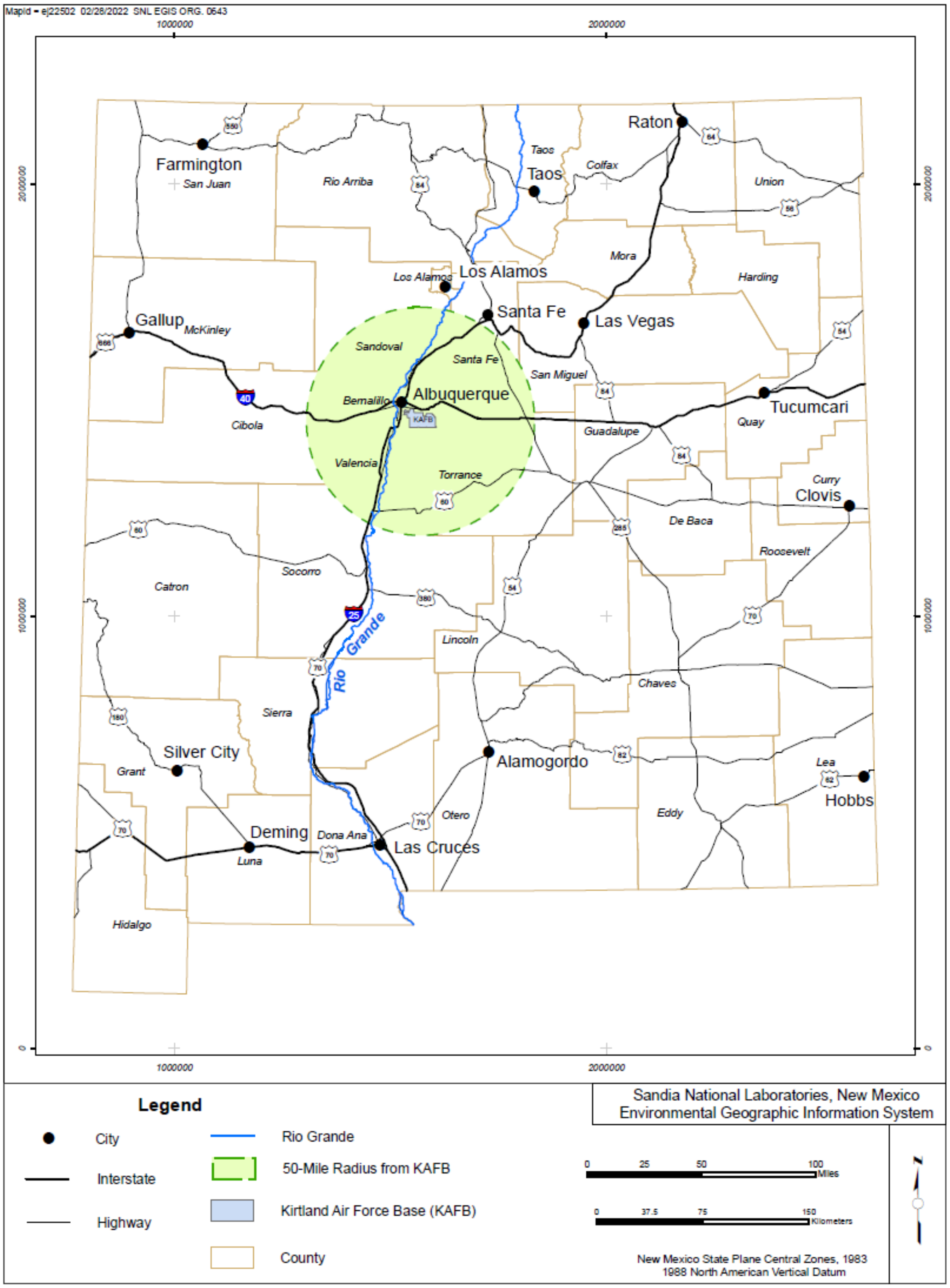


Figure 1-2. State of New Mexico, including counties

1.5 Activities and Facilities

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

1.5.1 The Technical Areas

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

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

TA-III, located in the south-central part of KAFB, is the largest and most remote of the technical areas. There are large outdoor test areas as well as facilities that can accommodate indoor testing. The area is used for engineering test activities that require large-scale safety and/or security buffers, (e.g., 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 Machine, the Radiographic Integrated Test Stand, the High-Energy Radiation Megavolt Electron Source III, the Saturn Accelerator, and the Short-Pulse High Intensity Nanosecond X-Radiator.

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

1.5.2 Other Facilities and Areas

Several remote test areas are located east and southeast of TA-III within the canyons and foothills of the U.S. Forest Service withdrawn area—Arroyo del Coyote, Lurance Canyon, Madera Canyon, and Sol se Mete Canyon—on the west side of the Manzano Mountains (Figure 1-1). The remote test areas directly to the east of TA-III are known collectively as Coyote Test Field. These areas are used for environmental and developmental testing, including explosive ordnance testing, impact testing, rocket firing experiments, and open-burn thermal testing.

Sandia personnel operate several facilities on a combination of properties leased or owned by DOE outside the boundaries of KAFB. The Center for Integrated Nanotechnologies; the Microsystems Engineering, Sciences and Applications Complex; the International Programs Office; 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 located in the high desert region of central New Mexico. The mountains on the east and the plateaus on the west create a diverse range of geological, hydrological, ecological, and climatic settings. A maximum elevation of 7,986 feet occurs on the eastern edges of KAFB; the mean elevation is 5,384 feet.

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

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

1.6.1 Geology and Hydrology

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

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

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

Several faults run through KAFB (Figure 1-3). The Tijeras Fault, which has been traced as far north as Madrid, New Mexico, trends southwesterly through Tijeras Canyon and across KAFB. The Tijeras

Fault is a strike-slip fault on which movement is horizontal and parallel to the strike of the fault. Early movement along the Tijeras Fault can be traced to the late Precambrian period, 570 million years ago, and traces of the fault 20 miles northeast of KAFB have been active as recently as the late Pleistocene epoch, 12,000 years ago. The system of minor faults associated with the Tijeras Fault on KAFB is collectively referred to as the Tijeras Fault Complex. The Tijeras Fault Complex marks a distinct boundary between the Precambrian and Paleozoic bedrock geology on the east and the Tertiary and Quaternary sediment-filled basin to the west. This geologic boundary also forms a boundary between the two major groundwater regimes at KAFB.

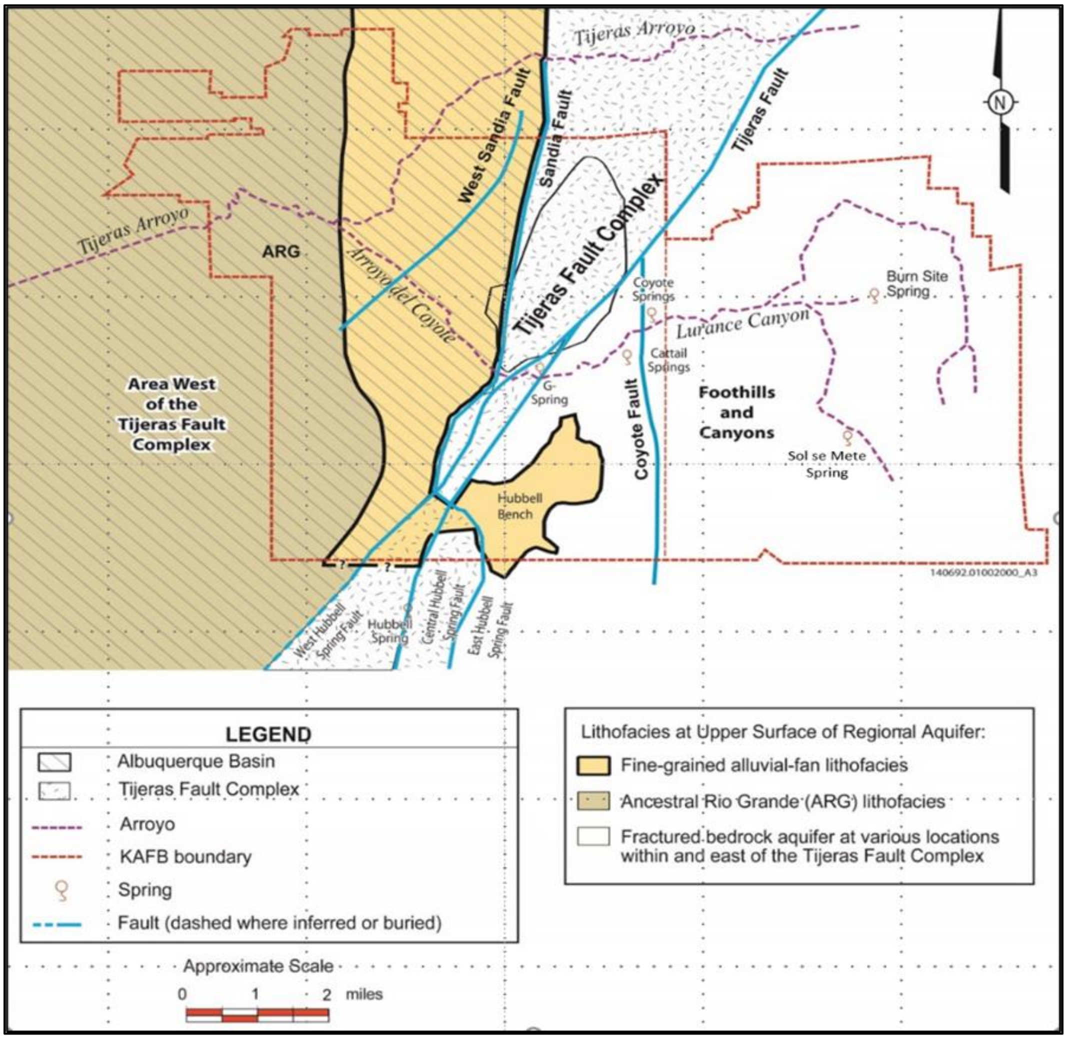


Figure 1-3. Faults and hydrogeologically distinct areas

The Sandia Fault establishes the eastern boundary of the Albuquerque Basin on KAFB. The up-thrown side of the fault is manifested as the Sandia and Manzanita mountains. The total vertical structural offset is on the order of 4.3 miles. South of KAFB, the basin's eastern boundary is the Hubbell Spring Fault. The Sandia Fault and Hubbell Spring Fault systems are north-trending, down-to-the-west, en echelon normal faults, which formed in the mid to late Tertiary Period (25 million years and younger) (Lozinsky and Tedford 1991, Woodward 1982). The Sandia Fault converges with the Tijeras Fault and the Hubbell Spring Fault in the region of KAFB identified as the Tijeras Fault Complex.

Surface Water

Three separate watersheds are located within portions of KAFB and SNL/NM:

- Tijeras Arroyo watershed
- Unnamed closed basin
- Hubbell Spring watershed

The Tijeras Arroyo watershed encompasses the northernmost portion of KAFB, including SNL/NM technical areas I, II, and IV, and Lurance Canyon. An unnamed closed basin encompasses the central portion of KAFB immediately south of the Tijeras Arroyo watershed along with TA-V, the majority of TA-III, and portions of Coyote Test Field to the east of TA-III. The Hubbell Spring watershed encompasses the southern portions of KAFB, including some portions of Coyote Test Field.

The primary surface water feature on KAFB and SNL/NM is the Tijeras Arroyo. The Tijeras Arroyo originates in the Manzano Mountains to the east of SNL/NM and flows through KAFB in a roughly northeast to southwest direction. The Tijeras Arroyo is a major tributary to the Rio Grande, which lies approximately six miles downstream and to the west of the KAFB boundary. The Tijeras Arroyo is an ephemeral stream, flowing only for short durations in response to rainfall and snowmelt.

There are no named or well-defined drainages in either the closed basin or Hubbell Spring Basin. Surface flow in these basins is limited to stormwater runoff as sheet flow (stormwater runoff that flows over the ground as a thin, even layer that is not concentrated in a channel) or in small gullies. Any stormwater flows that leave the boundary of KAFB and SNL/NM in these basins travel to unnamed playa lakes located immediately west of KAFB. Under extreme precipitation conditions, it may be possible for flows in the Hubbell Spring Basin to overfill the playa lakes and discharge into Hells Canyon, a tributary to the Rio Grande that flows southwest from the southern boundary of KAFB.

Red yucca (*Hesperaloe parviflora*) summer seed pods

Two perennial springs—Coyote Springs and Sol se Mete Spring—are located on KAFB. In addition, one perennial spring (Hubbell Spring) is located immediately south of the KAFB boundary on the Pueblo of Isleta. Numerous ephemeral springs occur in the foothills and in the eastern reach of Arroyo del Coyote. Surface water flowing from these springs infiltrate a short distance from the springs and do not contribute flow to Tijeras Arroyo.

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 (Sandia 1995)). To the east of the Tijeras Fault Complex, the hydrogeology is characterized by fractured and faulted bedrock covered by a thin layer of mostly dry alluvium. Depths to groundwater east of the Tijeras Fault Complex range from approximately 44 to 360 feet below ground surface. On the west side of the Tijeras Fault Complex, groundwater in the regional aquifer is contained in alluvial sediments, and depths to groundwater range from approximately 451 to 571 feet below ground surface.

A perched groundwater system overlies the regional aquifer in the north portion of KAFB. The system extends from TA-I south to the Tijeras Arroyo Golf Course. The western extent of the perched groundwater system lies between Wyoming Boulevard and the Albuquerque International Sunport's east–west runway. The eastern extent is just east of the KAFB landfill and may be bounded by the West Sandia Fault. The groundwater gradient within the perched groundwater system is to the southeast, and the depth to groundwater is approximately 269 feet below ground surface in the west and 350 feet below ground surface in the east. Groundwater recharge in the eastern portion of KAFB is primarily derived from precipitation on the mountain front and along the major arroyos; however, the amount of recharge occurring in the foothills and canyons is not well characterized.

The primary regional aquifer in the Albuquerque Basin is within the upper unit and, to a lesser degree, the middle unit of the Santa Fe Group Aquifer System. Albuquerque Bernalillo County Water Utility Authority (ABCWUA) water supply wells generally are located in the most productive portion of the aquifer on the east side of the Rio Grande. The highest-yield wells are screened in the sediments associated with Ancestral Rio Grande deposits (Figure 1-3). Prior to extensive urban development in the Albuquerque area beginning in the 1950s, regional groundwater in the KAFB area primarily flowed to the southwest. As a result of groundwater withdrawal, the local water table has dropped by as much as 141 feet (Thorn, McAda and Kernodle 1993); however, in the last 10 to 15 years the water table has recovered as ABCWUA has transitioned to using the Rio Grande as a water source. Groundwater withdrawal from KAFB and ABCWUA wells at the north end of KAFB have created a trough-like depression in the water table, causing flow to be diverted northeast in the direction of the well fields.

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

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

1.6.2 Ecology

An ecosystem is a network of living organisms and nonliving components that interact with one another to comprise an overall environment. The ecosystem at SNL/NM includes the interactions among many living components—such as humans, animals, insects, plants, and fungi—within several habitat types. Nonliving components within the ecosystem include air, water, mineral soil, buildings, structures, roads, and paved surfaces. The habitats in the SNL/NM ecosystem include grasslands, woodland, arroyo shrub, scattered piñon-juniper, and closed canopy piñon-juniper. This ecosystem is a dynamic entity that is impacted by external and internal factors. External factors include such influences as climate, time, topography, and biota. Internal factors include the introduction of non-native species to the ecosystem and human disturbance and interactions (through development) within the various habitats.

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

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

There are large tracts within the SNL/NM and KAFB area that are undeveloped, resulting in a considerable diversity of plant and animal communities. Table 1-1 lists some of the common species of birds, mammals, reptiles, amphibians, and plants that have been encountered on-site. Chapter 4 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	*Dryobates scalaris*
Black-chinned hummingbird	*Archilochus alexandri*	Loggerhead shrike	*Lanius ludovicianus*
Black-throated sparrow	*Amphispiza bilineata*	Northern mockingbird	*Mimus polyglottos*
Common raven	*Corvus corax*	Red-tailed hawk	*Buteo jamaicensis*
Dark-eyed junco	*Junco hyemalis*	Spotted towhee	*Pipilo maculatus*
Horned lark	*Eremophila alpestris*	Western kingbird	*Tyrannus verticalis*
House finch	*Haemorhous mexicanus*	Western meadowlark	*Sturnella neglecta*
Mammals			
American black bear	*Ursus americanus*	Deer mouse	*Peromyscus maniculatus*
Banner-tailed kangaroo rat	*Dipodomys spectabilis*	Desert cottontail	*Sylvilagus audubonii*
Black-tailed jackrabbit	*Lepus californicus*	Gray fox	*Urocyon cinereoargenteus*
Bobcat	*Felis rufus*	Gunnison’s prairie dog	*Cynomys gunnisoni*
Coyote	*Canis latrans*	Mule deer	*Odocoileus hemionus*
Reptiles and Amphibians			
Chihuahuan spotted whiptail	*Aspidoscelis exsanguis*	Great plains skink	*Eumeces obsoletus*
Desert side-blotched lizard	*Uta stansburiana*	Long-nosed snake	*Rhinocheilus lecontei*
Eastern collared lizard	*Crotaphytus collaris*	New Mexico spadefoot toad	*Spea multiplicata*
Gopher snake	*Pituophis catenifer*	New Mexico whiptail	*Aspidoscelis neomexicana*
Greater short-horned lizard	*Phrynosoma hernandesi*	Prairie rattlesnake	*Crotalus viridis*

Common Name	Scientific Name	Common Name	Scientific Name
Plants			
Apache plume	*Fallugia paradoxa*	New Mexico feathergrass	*Hesperostipa neomexicana*
Black grama	*Bouteloua eriopoda*	One-seed juniper	*Juniperus monosperma*
Blue grama	*Bouteloua gracilis*	Piñon pine	*Pinus edulis*
Bush muhly	*Muhlenbergia porteri*	Purple three-awn	*Aristida purpurea*
Intermediate yucca	*Yucca intermedia*	Ring muhly	*Muhlenbergia torreyi*
James' galleta	*Hilaria jamesii*	Shrub live oak	*Quercus turbinella*

1.6.3 Climate

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

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

Precipitation varies across the region, with many locations in the higher elevations of the mountains receiving annual precipitation in the form of rainfall and snowfall greater than 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 8.84 inches at Albuquerque International Sunport (National Climate Data Center n.d.).

Site-specific meteorology is influenced by proximity to topographic features, such as mountains, canyons, and arroyos. These features influence local wind patterns across the site. Canyons and arroyos tend to channel or funnel wind, whereas mountains create upslope and downslope diurnal wind-flow patterns. Winds tend to blow toward the mountains or up the Rio Grande Valley during the day, and nocturnal winds tend to blow down the mountain toward the Rio Grande Valley. These topographically induced wind flows can be enhanced or negated by weather systems that move across the southwestern United States. The strongest winds occur in the spring when monthly wind speeds average 10 miles per hour and wind gusts commonly reach 50 miles per hour. Chapter 6 provides more information on meteorological conditions.

1.7 Overview of the Environmental Management System

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

Sandia has established environmental programs at SNL/NM (listed in the next section) that are instrumental in the implementation, maintenance, and continual improvement of the Environmental

Management System at this site. For more information on the Environmental Management System, see Section 8.3.

1.8 Environmental Programs and Focus Areas

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

- Cultural Resource Management Program (Chapter 2)
- National Environmental Policy Act Program (Section 3.1)
- Environmental Education Outreach (Section 3.2)
- Chemical Information System and Chemical Exchange Program (Section 3.3)
- Materials Sustainability and Pollution Prevention programs (Section 3.4)
- Waste Management Program (Section 3.5)
- Environmental Restoration Operations (Section 3.6)
- Long-Term Stewardship Program (Section 3.7)
- Ecology Program (Chapter 4)
- Terrestrial Surveillance Program (Chapter 5)
- Air Quality Compliance Program and related programs (Chapter 6)
    - Ambient Air Surveillance Program (Section 6.2)
    - Meteorology Program (Section 6.3)
    - Radionuclide National Emission Standards for Hazardous Air Pollutants Program (Section 6.4)
- Water Quality Programs (Chapter 7)
    - Environmental, Release, Response, and Reporting Program (Section 7.1)
    - Oil Storage Program (Section 7.2)
    - Safe Drinking Water Protection Program (Section 7.3)
    - Stormwater Program (Section 7.4)
    - Surface Discharge Program (Section 7.5)
    - Wastewater Discharge Program (Section 7.6)

In addition, a summary of compliance efforts is provided in Chapter 8, and Chapter 9 details how quality assurance is implemented for environmental monitoring and sampling. Chapter 10 lists environmental-related permits held for Sandia programs at SNL/NM and summarizes the compliance history of mixed waste at SNL/NM.

Chapter 2. Cultural Resource Management Program

Historic Building 6590, the Sandia Pulsed Reactor (photograph by Norman Johnson, March 28, 2012)

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

The Cultural Resource Management Program is focused primarily on long-term preservation and protection of cultural resources and cultural resource compliance to ensure that the heritage of Sandia operating areas and their landscapes are maintained. Long-term preservation and protection also ensure that data are available to make proper land use decisions and to assist with environmental planning. Cultural resources are places and physical evidence of past human activity: a site, a structure, an object, or a natural feature of significance to a group of people traditionally associated with it. The Cultural Resource Management Program is focused on two main cultural resource categories: archaeological resources and historic buildings.

Between 1977 and 2022, 78 archaeological surveys—covering more than 6,000 acres of land—were conducted at KAFB, including on Sandia-controlled property. Currently, 2,150 historical sites (sites having cultural heritage value) at KAFB have been recommended as eligible for inclusion in the National Register of Historic Places; approximately 70 percent of those sites are on Sandia-controlled property.

Historic building surveys and assessments completed since 1997 identified 78 properties and the TA-II Historic District as eligible for inclusion in the National Register of Historic Places. Eight additional historic districts have been identified and are recommended as eligible. Fifty-three of the properties are still extant and retain their eligibility. The remainder have been demolished or undergone renovations that have undercut their integrity and are no longer eligible. In 1998, the TA-II Historic District facilities were slated for demolition and were documented, per agreement among the New Mexico State Historic Preservation Officer, DOE, and the Advisory Council on Historic Preservation. In succeeding years, the facilities were decontaminated and torn down.

2.1 Cultural History

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

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

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

Obsidian projectile point (arrowhead)

2.2 Historical Context

By the nineteenth century, the area along the Rio Grande between present-day Bernalillo and the Pueblo of Isleta, including the east side of the Sandia Mountains, was occupied primarily by ranchers and miners; however, a small community, Coyote Springs, was established in the vicinity of a natural spring along the Arroyo del Coyote. Mining began in the nineteenth century and extended well into the twentieth century. The Tijeras Mining District extended southward into the northern portion of what is now KAFB; the Coyote Canyon District was situated within the U.S. Forest withdrawn land in the eastern portion of KAFB (Fulp, et al. 1982), and the Hell Canyon District was located within the southern edge of KAFB (Lintz, et al. 1988). Between 1910 and 1923, and again during World War II, lead and fluorspar were mined in Coyote Canyon (Elston 1967); Tijeras Canyon was mined for gold into the 1930s (Northrop 1975)); and gold, silver, and copper were mined from Hell Canyon from about 1880 to 1910 and again in 1975 through 1976 (Fulp et al. 1982). Most of the mining at KAFB ended in the early 1930s (Lintz, et al. 1988).

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

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

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

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

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

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

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

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

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

2.3 Regulatory Criteria

Ensuring compliance with federal and state requirements supports the long-term preservation and protection of cultural resources, prevents mission delays, and maintains trust and a strong relationship with DOE, the New Mexico Historic Preservation Division, and tribal sovereign nations. See Chapter 8 for details on state and federal requirements related to cultural resources.

2.4 Archaeological Resources

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

The archaeological staff reviews projects through the Sandia National Environmental Policy Act (NEPA) module that involve land disturbances and provides recommendations for monitoring field activities so archaeological resources are not impacted adversely. The archaeological staff also makes site eligibility recommendations for inclusion in the National Register of Historic Places.

2.4.1 Field Methods

Archaeological personnel conduct pedestrian surveys (walking the natural landscape on foot) and record prehistoric and historic sites in accordance with New Mexico Archaeological Council guidelines (4.10.8 NMAC 2019, 4.10.15 NMAC 2006). The archaeological staff provides recommendations regarding the potential effect of proposed undertakings on prehistoric and historic properties. These include recommendations regarding a site's eligibility for nomination to the National Register of Historic Places for Cultural Properties and Historic Preservation and project mitigation. The archaeological sites are assessed in accordance with the American Indian Religious Freedom Act (42 U.S.C. 1996) to protect traditional religions.

A pedestrian survey lightly impacts surface soils. Survey transects are spaced 50 feet apart, with no more than 40 acres surveyed per person per day. All cultural resources that are at least 50 years old are recorded on field forms. Archaeological sites are defined by the presence of either a cultural feature or 10 or more artifacts that are at least 50 years old and are separated by no more than 66 feet. Areas where cultural materials are sparse (fewer than 10 items) and are at least 50 years old are recorded as isolated occurrences. The archaeological staff generates a New Mexico Laboratory of Anthropology Inventory Form for archaeological sites. Archaeological sites are mapped both manually on graph paper and digitally. Digital maps are created using a global positioning system unit with sub-meter accuracy. Each map includes the site boundary and the locations of the datum, any features identified, artifact concentrations, important or diagnostic artifacts, drainages or other landscape features, and topographic contours. Each site, including any cultural features or tools, are photographed. All artifacts are analyzed in the field unless more than 50 artifacts of a given class (e.g., lithic [stone], prehistoric ceramic, or historic) are present, in which case a sample of at least 50 is analyzed. Lithic and prehistoric ceramic artifacts are analyzed using standard in-field techniques. Ceramics, projectile points, and other diagnostic artifacts are identified by type and cultural affiliation when sufficient attributes for a reliable determination are present. Isolated occurrences and their location coordinates are recorded and analyzed. The archaeological staff write all reports of findings and associated documentation.

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

2.4.2 Program Activities and Results 2022: Archaeological Resources

In 2022, the archaeological staff completed 18 pedestrian surveys, reviewing more than 163 outdoor projects and surveying more than 54.3 acres. Proposed projects included utility work, building modifications, road grading, and ongoing operational activities. Multiple archaeological reviews were conducted for projects 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. These reviews resulted in more than 18 written memos provided to both DOE and project owners associated with the proposed work. The memos provided guidance regarding cultural resource concerns and mitigative measures. Archaeological staff provided a consultation letter and associated documents to DOE in 2021 for correspondence with the New Mexico State Historic Preservation Officer and the Pueblo of Isleta for the construction of a proposed new facility. Concurrence was received from the New Mexico State Historic Preservation Officer in 2021, and, in 2022, the Pueblo of Isleta acknowledged the consulation with a written response to DOE. Archaeological staff also participated in 13 conceptual analyses to support site planning. The support included research that identified any potential effects that might result from the proposed site plans.

Additionally in 2022, the archaeological staff invited the Pueblo of Isleta Tribal Historic Preservation Officer on-site to visit and assess archaeological sites and provide a windshield tour of various Sandia locations on KAFB. This visit helped to continue building realtionships with the Tribal Historic Preservation Officer of the Pueblo of Isleta and has allowed for further discussions regarding archaeological sites managed at SNL/NM and their potential significance. Knowledge received during the Pueblo of Isleta Tribal Historic Preservation Officer visit was shared and discussed with DOE.

2.5 Historic Buildings

The Sandia historian surveys and assesses historic buildings in support of the National Historic Preservation Act, Section 106, for all properties owned by DOE and used by Sandia personnel at SNL/NM, whether the properties are located on land owned by DOE or are permitted to it. This includes all elements of the built environment from the Historic Period but is primarily focused on properties built for and used by Sandia since 1945.

2.5.1 Methods

While a NEPA checklist is in subject matter expert review, the historian reviews the project details, visits the work site, reviews existing photographs of and documents about the facilities involved, conducts research in the archival and building drawing collections, and obtains new photographs if needed. The properties potentially affected by a proposed project are evaluated within the established Cold War themes (weapon design, field testing, environmental testing, weapon assembly, military liaison, stockpile surveillance, non-weapons research, and administration/community) defined by the 2010 context statement (Section 2.5.2), which provides the framework for evaluating a property for historical significance (Sandia 2010). Note is made of any previous surveys and resulting determinations as to the property's eligibility for the National Register of Historic Places.

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

Once a property is understood in context, the historian makes a recommendation as to whether it is eligible for inclusion in the National Register of Historic Places, summarizing past determinations and any subsequent changes to the property. The historian also makes a recommendation as to whether proposed work will have an adverse effect on any historic properties or districts, including the property where the work is occurring. Information regarding the property, photographs, maps, a description of the proposed work, any impacts, and the overall recommendation on eligibility as a historic property are captured on a New Mexico Historic Cultural Properties Inventory form. The Historic Cultural Properties Inventory form is submitted along with a draft letter and any related attachments to DOE to support consultation with the New Mexico State Historic Preservation Office. The historian's recommendation is also captured in the NEPA checklist subject matter expert review.

2.5.2 Previous Building Surveys, Assessments, and Determinations

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

In 2010, the context statement was updated and extended to reflect the site and its built environment in the post-Cold War period. That same year, Sandia personnel performed a site-wide survey and assessment to identify properties that might be eligible for the National Register of Historic Places. The final recommendation to DOE identified eight historic districts and three individually eligible buildings. DOE did not consult with the State Historic Preservation Office regarding the 2010 recommendation; however, the assessments have been used by DOE in National Historic Preservation Act, Section 106, consultations with the State Historic Preservation Office regarding proposed undertakings to individual properties. The site survey and assessment will be revised or completely redone prior to any future DOE consultations with the State Historic Preservation Office regarding the SNL/NM site as a whole. Table 2-1 provides a list of SNL/NM properties previously determined to be historic and their current status.

If a property previously determined to be eligible for the National Register of Historic Places faces adverse effects from a proposed project, DOE and the State Historic Preservation Office agree on what type of mitigation will occur. Often, the design of new or replaced building elements (e.g., doors, windows, or entrances) are in keeping with the building's original design and no further mitigation is required. If the adverse effect will harm the building's historic status—if the building will be torn down or significantly modified—DOE and the State Historic Preservation Office establish a memorandum of agreement specifying the actions needed to ensure that the building will be preserved. In most instances, the historian prepares Historic American Building Survey/Historic

American Engineering Record documentation, including large- and medium-format photographs, photographic descriptions, and a written historical and architectural summary of a property. All photography is completed prior to any demolition or other undertaking that threatens the property's integrity.

Table 2-1. Properties previously determined to be historic and their current status

Property	Facilities That Were Contributing Elements to the Historic Property Determination	State Historic Preservation Office Concurrence	Still Extant?	Still Considered Historic?	Documentation Needed?[a]
300-Foot Drop Tower (S6510)	S6510, S6510C (impact pool), 6510E, 6523B	01/12/2004	Yes	Yes	No
10,000-Foot Sled Track	S6740, 6741, 6742, 6743, 6744, 6745, 6746, 6751	12/17/2003	Yes	Yes	No
Aerial Cable Facility	9831, 9832, 9834	12/17/2003	Yes	Yes	Yes
Building 800		12/21/2000	Yes	Yes	No
Building 801		12/21/2000	Yes	Yes	No
Building 802		12/21/2000	Yes	Yes	No
Building 804		11/02/2006	Yes	Yes	No
Building 808		12/21/2000	Yes	Yes	No
Building 809		05/18/2017	Yes	Yes	No
Building 835		12/21/2000	Yes	Yes	No
Building 840		12/21/2000	Yes	Yes	No
Building 852		2002	No	No	Yes
Building 860		12/21/2000	Yes	Yes	No
Building 862		01/28/2022	Yes	Yes	Yes
Building 864		11/07/2017	Yes	Yes	No
Building 871		11/02/2006	Yes	Yes	No
Building 876		03/03/2022	Yes	Yes	No
Building 884		2005	No	No	Yes
Building 885		03/03/2022	Yes	Yes	No
Building 892		11/02/2006	Yes	Yes	No
Building 894		12/28/2021	Yes	Yes	No
Building 970		03/03/2022	Yes	Yes	No
Building 981		11/07/2017	Yes	Yes	No
Building 983		2012	Yes	Yes	No
Building 986		11/07/2017	Yes	Yes	No
Building 6501		03/03/2022	Yes	Yes	No
Building 6523	6523B	12/17/2003	Yes	Yes	No
Building 6560		12/17/2003	Yes	Yes	No
Building 6570		12/17/2003	Yes	Yes	No
Building 6588	6593, 6594	11/30/2017	Yes	Yes	No
Building 6590		05/28/2019	Yes	Yes	No
Building 6591		02/01/2022	Yes	Yes	No
Building 6592		01/28/2022	Yes	Yes	Yes
Building 6597		02/01/2022	Yes	Yes	No
Building 6610		12/17/2003	Yes	Yes	No
Building 6620	6620	11/7/2017	Yes	Yes	No

Property	Facilities That Were Contributing Elements to the Historic Property Determination	State Historic Preservation Office Concurrence	Still Extant?	Still Considered Historic?	Documentation Needed?[a]
Building 6631		03/03/2022	Yes	Yes	No
Building 8895		07/29/2008	No	No	Yes
Building 9920		06/03/2017	Yes	Yes	No
Building 9939		11/07/2017	Yes	Yes	No
Building 9990	9990, 9991, 9992, 9993, 9994	12/12/2005	Yes	No	Yes
Coronado Club		2011	No	No	Yes
Gun Site	S6624, 6625	2017	Yes	Yes	Yes
Hydraulic Centrifuge Facility	6520, 6526, 6527	12/17/2003	Yes	Yes	No
Old Centrifuge	Centrifuge and control shelter	2011	No	No	Yes
S9800B		2001	No	No	Yes
Solar Tower (National Solar Thermal Test Facility)	9980, 9981, 9982, 9984	01/05/2022	Yes	Yes	No
Technical Area II		1988	No	No	Complete
Telescope Facility—Laser Applications Facility	952, 952A, 952G, 952L	03/22/2017	Yes	Yes	No

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

2.5.3 Program Activities and Results 2022: Historic Buildings

In 2022, the historian completed historic building assessments in response to 22 proposed actions at 29 properties. Consultation between DOE and the State Historic Preservation Officer is complete on 21 of the proposed actions. Consultation is ongoing for three of the DOE-sponsored Roof Asset Management Project reroof proposals begun in 2021. The State Historic Preservation Office has asked for additional information regarding the effect of these reroofs on three historic buildings.

In addition to the reroof projects, other reviewed projects involving multiple properties included the TA-IV Distribution Chilled Water System Expansion, replacement of low-voltage electrical panels, and the demolition of four observation towers in TA-III. Consultation is complete with the State Historic Preservation Office's concurrence on determinations of no adverse effect for the first two projects. Consultation on the demolition of the four towers is ongoing; it is expected to be completed in 2023.

Consultation on the demolition of Building 862 and Building 6592, begun in 2021, was completed in 2022. DOE and the State Historic Preservation Officer signed a memorandum of agreement specifying mitigating actions Sandia personnel will take to address the adverse effects of demolishing these historic properties. The first requirement—to obtain State Historic Preservation Office approval of photographs and drawings of the buildings prior to demolition—was completed for both buildings. The proposal to demolish Building S6624 and Building 6625 remains in consultation between DOE and the New Mexico State Historic Preservation Officer.

2.6 Quality Check and Validation of Process

Each fiscal year, Cultural Resource Management Program personnel validate a minimum of 20 NEPA checklists from the previous fiscal year. The review focuses on archaeological concerns and requirements for at least 10 checklists and on historic buildings for at least 10 more. The validation activity verifies that cultural resources were addressed in each checklist, that the projects did not include an activity that should have but did not receive cultural resources review, and that projects that did receive cultural resources review were carried out as expected. The goal is to ensure that all projects needing cultural resources review are identified during the NEPA checklist review and that reviewed projects are keeping to their agreed-upon scope and impact. This is also an opportunity to verify that any mitigating actions were taken and/or are on schedule for completion. The review of 2022 checklists indicated no issues with the process.

2.7 Additional Activities

In 2022, Sandia's Cultural Resources Management Program personnel and DOE personnel hosted New Mexico State Historic Preservation Office staff on-site to discuss a plan to begin a Programmatic Agreement. The visit included a Sandia site tour of buildings, archaeological sites, and training areas. New Mexico State Historic Preservation Office staff provided input and ideas for a path forward.

Cultural Resource Management Personnel maintain a website to provide information to the public about cultural resources, including cultural history, historical information, and photographs of properties determined to be National Register of Historic Places-eligible that have been demolished. Building on the mitigation documentation prepared for the demolished sites, the website provides details regarding the origin, purpose, evolution, and reasons for disuse of properties and districts that were eligible for the National Register of Historic Places. Sandia personnel continue to add properties to the site at Sandia's Cultural Resources in New Mexico (Sandia n.d.).

Coyote Springs wetland

Chapter 3. Environmental Programs

Saltbush sootywing (*Hesperopsis alpheus*)

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 Environment, Safety, and Health (ES&H) activities, have expanded greatly. The current environmental programs and focus areas are presented in Figure 3-1.

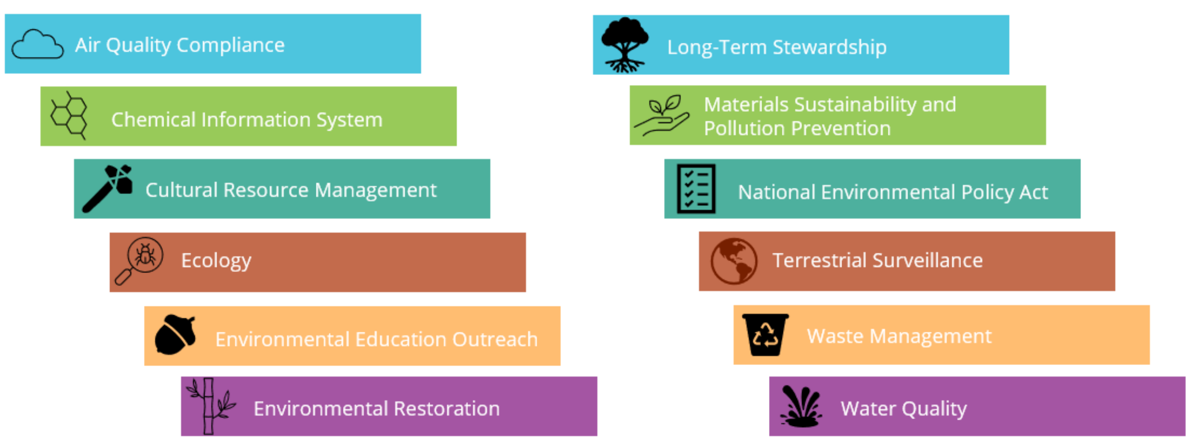


Figure 3-1. Environmental programs at SNL/NM

3.1 National Environmental Policy Act Program

NEPA Program personnel provide technical assistance to ensure that Sandia operations and activities are reviewed for NEPA compliance at all Sandia sites, including SNL/NM; Sandia California; the Kaua'i Test Facility in Hawai'i; the Tonopah Test Range in Nevada; and other remote locations. For all proposed projects and activities, project owners must complete a NEPA checklist using the online NEPA Module application. A NEPA checklist is an internal form that NEPA Program personnel use to review proposed projects and activities for compliance with NEPA.

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

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

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

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

DOE/EIS-0281*Final Site-Wide Environmental Impact Statement for Sandia National Laboratories/New Mexico* (DOE 1999) evaluated ongoing and proposed activities at SNL/NM. In 2006, a screening analysis was performed for each resource area evaluated in the 1999 site-wide environmental impact statement. The screening analysis evaluated new and/or modified projects or proposals, changed circumstances, and new regulations to determine whether impacts from SNL/NM activities remained within the envelope of consequences established in the 1999 site-wide environmental impact statement for SNL/NM. Following the screening analysis, a determination was published in a supplement analysis document (DOE 2006) indicating that the environmental impacts of current (circa 2006) and projected SNL/NM operations were within the envelope of consequences established in the 1999 site-wide environmental impact statement for SNL/NM. Sandia NEPA Program personnel continue to assist DOE in the development of a new site-wide environmental impact statement as described in Section 3.1.2.

3.1.1 NEPA Compliance Summary

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

In addition to reviewing checklists and supporting process improvement activities, NEPA Program personnel assisted DOE in the following efforts:

- Initiated a new site-wide environmental impact statement for SNL/NM. Once completed, the new site-wide environmental impact statement will replace the existing document published in 1999.
- Supported site cleanup of the Large-Scale Liquefied Natural Gas Test Facility by working closely with ecology and revegation subject matter experts to identify restoration requirements.
- Provided ongoing support for NEPA and related environmental documentation requirements for two capital line-item projects: Power Sources Capability and Combined Radiation Environments for Survivability Testing.
- Prepared NEPA documentation for the dismantlement and removal of the Radiographic Integrated Test Stand Accelerator.
- Reviewed 399 NEPA checklists for activities across all four primary sites and off-site locations.

3.1.2 Program Activities and Results 2022: National Environmental Policy Act

In 2022, NEPA Program personnel reviewed 318 NEPA checklists for proposed activities at SNL/NM. Of the checklists reviewed in 2022 for SNL/NM activities, 246 checklists described activities and operations that were analyzed in previously published NEPA documents (Table 3-1). The remaining 72 checklists described activities and/or operations that had not been previously analyzed in existing NEPA documents and were sent to the NEPA Compliance Officer at the Sandia Field Office for review and determination. The determinations made by the Sandia Field Office NEPA Compliance Officer often cited categorical exclusions, which are detailed in Table 3-2.

The following categorical exclusions were cited most often in DOE NEPA checklist determinations, highlighting ongoing routine maintenance needs and growth and development at SNL/NM:

- B1.3: Routine maintenance/custodial services for buildings, structures, infrastructures, equipment
- B2.1: Modifications to enhance workplace habitability
- B1.15: Siting/construction/operation of support buildings/support structures

Many maintenance activities performed at SNL/NM are routine in nature, have minimal to no environmental impact, and are consistent with activities described in the DOE-approved Routine Maintenance NEPA checklist. These activities do not require separate NEPA checklists, but are documented in the Routine Maintenance Criteria SharePoint tool. In 2022, Sandia personnel documented 354 routine maintenance activities in the Routine Maintenance Criteria SharePoint tool, which were reviewed and verified by NEPA Program personnel.

Because SNL/NM is located within the boundaries of KAFB, many activities performed by Sandia personnel are conducted on KAFB-owned land. In these instances, NEPA Program personnel coordinate with the Sandia Field Office to submit a Request for Environmental Analysis (AF Form 813) to KAFB. The U.S. Air Force uses the form to document the need for environmental analysis and to provide U.S. Air Force NEPA determinations for proposed actions. The form helps to narrow and focus the issues to potential environmental impacts. NEPA Program personnel submitted 13 AF Form 813 forms on behalf of the Sandia Field Office for work conducted on KAFB land in 2022.

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

NEPA Document Title	Documents Cited in Sandia Determinations	Number of Citations
Final Site-Wide Environmental Impact Statement for Sandia New Mexico (1999)	DOE/EIS-0281	154
Final Environmental Assessment for the Microsystems and Engineering Sciences Applications Complex (2000)	DOE/EA-1335	24
Final Environmental Assessment for the Center for Integrated Nanotechnologies at Sandia National Laboratories/New Mexico (2003)	DOE/EA-1457	5
Final Site-Wide Environmental Assessment for Sandia California (2003)[a]	DOE/SWEA-1422	2
Environmental Assessment for the Processing and Environmental Technology Laboratory (PETL) (1995)	DOE/EA-0945	2
Quality Assurance Review of Previously Determined Activities	Various	102

Note: Some determinations cited multiple NEPA documents.
[a] Some SNL/NM based checklists have activities at Sandia California, requiring a citation to an Sandia California NEPA document to provide complete NEPA coverage.

Table 3-2. Categorical exclusions cited by DOE NEPA Compliance Officer in DOE determinations for SNL/NM-managed NEPA Checklists in 2022

Categorical Exclusions	Number of Citations
B1.2 Training exercises and simulation	4
B1.3 Routine maintenance/custodial services for buildings, structures, infrastructures, equipment	18
B1.4 Installation/modification of air conditioning systems for existing equipment	3
B1.5 Improvements to cooling water systems within existing building, structure	2
B1.6 Installation/modification of retention tanks, small basins to control runoff, spills	1
B1.7 Acquisition/installation/operation/removal of communication systems, data processing equipment	4
B1.9 Placement of airway safety markings/painting (not lighting) of existing lines, antennas	1
B1.11 Fencing, no adverse effect on wildlife movement/surface water flow	2
B1.13 Construction/acquisition/relocation of onsite pathways, onsite access roads/railroads	1
B1.15 Siting/construction/operation of support buildings/support structures	9
B1.22 Relocation of buildings	1
B1.23 Demolition/disposal of buildings	6
B1.24 Transfer of structures/residential, commercial, industrial use	4
B1.30 Transfer actions	2
B1.31 Relocation/operation of machinery and equipment	5
B1.32 Traffic flow adjustments, existing roads	2
B1.33 Stormwater runoff control	2
B2.1 Modifications to enhance workplace habitability	11
B2.2 Installation of/improvements to building/equipment instrumentation (remote controls, emergency warning systems, monitors)	3
B2.4 Equipment Qualification Programs	2

Categorical Exclusions	Number of Citations
B2.5 Safety and environmental improvements of a facility, replacement/upgrade of facility components	2
B3.1 Site characterization/environmental monitoring	1
B3.2 Aviation activities for survey/monitoring/security	2
B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects	3
B3.10 Siting/construction/operation/decommissioning of particle accelerators, including electron beam accelerators, primary beam energy less than approximately 100 MeV	1
B3.11 Outdoor tests, experiments on materials and equipment components, no source, special nuclear, or byproduct materials involved	7
B3.12 Siting/construction/operation/decommissioning of microbiological and biomedical facilities	1
B3.15 Small-scale indoor research and development projects using nanoscale materials	2
B4.7 Adding/burying fiber optic cable	1
B4.11 Construction or modification of electric power substations.	1
B5.1 Actions to conserve energy	1
B5.2 Modifications to oil/gas/geothermal pumps and piping	1
B5.15 Small-scale renewable energy research and development and pilot projects	2
B5.17 Solar thermal systems	1
B6.1 Small-scale, short-term cleanup actions under RCRA, Atomic Energy Act, or other authorities	1

Note: Some determinations cited multiple categorical exclusions.
RCRA = Resource Conservation and Recovery Act

3.2 Environmental Education Outreach

Environmental Education Outreach personnel connected with the local community and Sandia personnel through organized events in 2022. 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. Sandia personnel and community members are encouraged to provide feedback and to ask questions about any of Sandia's environmental programs.

3.2.1 Program Activities and Results 2022: Environmental Education Outreach

Environmental Education Outreach activities include participating in or hosting several in-house and public outreach and awareness events annually. Events conducted in 2022 included a virtual Earth Day and a virtual presentation of the annual Environmental Excellence Awards. The annual Environmental Excellence Awards are presented in recognition of Sandia personnel who demonstrate environmental excellence in areas such as energy and water conservation, environmental protection, waste minimization, and recycling. Since the inception of the awards in 2006, there have been 291 nominations for contributions to the vision of environmental excellence across all of Sandia's sites.

Environmental education models are used in presentations and include topics such as air quality, landfills, groundwater, and watersheds. In 2022, environmental professionals visited 40 public school classrooms in Albuquerque and Rio Rancho to complete a watershed model activity with students in support of the RiverXchange education program.

3.3 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 (EPCRA). The Chemical Information System compiles information concerning chemical hazards and appropriate protective measures for Emergency Management Operations, other ES&H programs, and the workforce.

The 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 information system provides the chemical or product name, its location and quantity, and information about who is responsible for the chemical. Chemical hazards are reported on safety data sheets, and the Chemical Information System currently contains more than 127,000 safety data sheets in its library for use by any Sandia site. This electronic inventory helps chemical users and their managers assess and manage workplace hazards. Easy access to this inventory facilitates availability searches. It also improves the ability to share chemicals and thus reduces sources, which minimizes chemical purchases and waste disposal expenses.

A pre-procurement module, ChemPro, is used to request permission for new chemical purchases. The system runs a series of queries, comparing the requested purchasing information to regulatory limits, and determines whether the requested chemical and volume 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 at SNL/NM 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.

3.3.1 Program Activities and Results 2022: Chemical Information System and Chemical Exchange Program

In 2022, chemical containers were tracked along with information about any related chemical hazards listed in the Chemical Information System. SNL/NM staff continued to use the Chemical Exchange Program to utilize excess chemicals and used ChemPro to request permission for new chemical purchases in 2022. Seventy-four chemicals were submitted to the Chemical Exchange Program in 2022, 145 chemicals were available to claim, and 16 chemicals were reapplied.

3.4 Materials Sustainability and Pollution Prevention Programs

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

3.4.1 Waste Minimization

Waste is minimized 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. SNL/NM is striving to reach the Zero Waste by 2025 goal. The goal will be considered accomplished when operations meet the internationally accepted definition of Zero Waste. This means reducing waste by 90 percent from the baseline year (2008).

3.4.2 Sustainable Acquisition

Sustainable acquisitions are one way to reduce environmental impacts. This includes integrating products with reduced environmental impact into purchase agreements and ongoing operations and maintenance. Products containing recycled and biobased content, those designed with identified environmentally preferable attributes, and those with third-party-certified green labels are preferred. The 2021 pilot utilizing the modified Sustainable Facilities Tool is being evaluated and revised to further increase compliance with sustainable acquisition federal requirements.

3.4.3 Electronics Stewardship

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

3.4.4 Recycling of Solid Waste

Materials suitable for reuse and/or recycling are diverted from landfills, thereby minimizing the economic and environmental impacts of waste disposal. Rather than paying to throw away material in a landfill, avoided fees and any realized value are used to support diverse recycling and composting programs. This business model has created three permanent jobs at SNL/NM and supported numerous positions at local and regional companies. Recycling data for SNL/NM is presented in Section 3.5.1.

3.4.5 Awareness and Outreach

Materials Sustainability and Pollution Prevention programs personnel promote the use of green initiatives and available resources to decrease the environmental impact of existing operations. Various communication tools are used to increase awareness about and bolster participation in recycling, composting, and acquiring sustainable products. Major outreach efforts include the Zero Waste Challenge and the dedicated Zero Waste by 2025 website. Unfortunately, COVID-19 restrictions prevented Materials Sustainability and Pollution Prevention programs personnel from attending and hosting information tables during events such as Earth Day and Pollution Prevention Week in 2022. Sandia continues to sponsor the New Mexico Recycling Coalition.

3.4.6 Program Activities and Results 2022: Materials Sustainability and Pollution Prevention

Since establishing the goal of Zero Waste by 2025, the diversion rate has gone from 47 percent in the baseline year of 2008 to 64 percent in 2022. Zero Waste by 2025 will be achieved when waste is reduced by 90 percent from 2008. For SNL/NM, this means generating less than 23 pounds per person of commercial solid waste per year starting in 2025.

In 2022, an interdepartmental working group updated the "green language" clause (350APR clause) in subcontractor contracts and created an automated Oracle process to identify applicable contract categories that need to incorporate the 350APR clause with a goal of increasing acquisition of sustainable products. Materials Sustainability Program personnel are able to retrieve reports on the use of products that meet the various environmental specifications (e.g., recycled content and energy efficiency) that are submitted in the new online reporting platform (ecomedes). Materials Sustainability Program personnel can then compare these reports with a list of contracts from Oracle to identify which subcontractors still need to submit a report on the use of applicable products. An entity account is used to send emails to Sandia Delegated Representatives responsible for overseeing applicable contracts; these representatives are asked to encourage subcontractors to submit a report. Sustainable acquisition requirements were also added to the Request for Information and Request for Quote process to further communicate requirements to interested subcontractors.

Information on Materials Sustainability and Pollution Prevention program initiatives, events, and accomplishments can be found at Sandia Pollution Prevention (Sandia n.d.).

3.5 Waste Management Program

Sandia personnel follow the waste management hierarchy dictated in the Pollution Prevention Act of 1990 and reinforced in amendments to the Resource Conservation and Recovery Act (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 8.

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

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

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

3.5.1 Program Activities and Results 2022: Types and Amounts of Waste Handled and Shipped

Types of waste handled and shipped in 2022 at SNL/NM are summarized in Table 3-3. Wastes recycled in 2022 at SNL/NM are summarized in Table 3-4.

Table 3-3. Waste shipped by waste category, 2022

Waste Category	Waste Shipped (pounds)
Radioactive Waste	
Low-level radioactive waste	90,797
Transuranic waste	0
Subtotal	**90,797**
Mixed Radioactive and Hazardous Waste	
Mixed low-level radioactive waste	26,782
Mixed transuranic waste	0
Subtotal	**26,782**
RCRA Waste	
Hazardous waste	127,608
Subtotal	**127,608**
Toxic Substances Control Act	
PCBs	860
PCBs and hazardous waste mixture	0
Subtotal	**860**
Other Regulated Wastes	
Infectious waste	4,281
Asbestos waste	43,997
Chemical waste (includes special waste and industrial solid waste)	375,827
Used oil (not recycled)	0
Subtotal	**424,105**
Solid Waste	
Solid waste collection and recycling center dry waste	1,150,593
Off-site office waste (Sandia Science and Technology Park)	4,500
Construction and demolition waste	4,093,543
Other solid waste	42,838
Subtotal	**5,291,474**
Total Waste Shipped	**5,961,626**

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

PCB = polychlorinated biphenyl

Table 3-4. Waste recycled, 2022

Recycle Category	Waste Recycled (pounds)
Regulated or Chemical Waste Recycled	
Batteries	58,472
Capacitors	7,942
Computer electronics	310,000
Lead	1,921
Light bulbs	26,257
Toner and ink cartridges	20,654
Used oil	87,364
Subtotal	**512,610**
Commercial, Construction, and Demolition Solid Waste Recycled	
Asphalt/concrete	5,464,530
Batteries	
Cardboard	310,127
Carpet	0
Chairs	76,480
Compost (food, green waste, paper, and plywood)	400,434
Food grease	141,738
Metals	1,874,247
Nitrile gloves	281
Paper (mixed and white)	63,005
Plastics	33,229
Three-dimensional printer cartridges	6,357
Tires	93,680
Wood	279,880
Subtotal	**8,743,988**
Total Waste Recycled	**9,256,598**

3.5.2 Waste Management Locations

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

At each location, wastes are tracked, inspected, and managed at all times to protect human health and the environment. Wastes are not disposed of at SNL/NM.

Waste management activities at individual units during 2022 are summarized as follows:

- At the Auxiliary Hot Cell Unit, mixed and radioactive wastes were generated and stored.
- At the Hazardous Waste Handling Unit, hazardous and other regulated wastes were screened, sorted, repackaged, and stored.
- At the Manzano Storage Bunkers, hazardous, mixed, radioactive, and solid wastes were stored and repackaged. Five of the seven bunkers are included in the RCRA Facility Operating Permit (Section 3.5.3); hazardous and mixed waste management activities are limited to these five bunkers.

- At the Radioactive and Mixed Waste Management Unit, hazardous, mixed, and radioactive wastes were screened, sorted, repackaged, stored, and treated. Wastes were treated by one or more of the following methods: solidification and stabilization, chemical deactivation and neutralization, macroencapsulation, or physical treatment (volume reduction).
- At the Solid Waste Collection and Recycling Center, commercial waste was screened prior to shipment off-site for disposal. Other solid wastes and recyclable materials were collected and processed for shipment off site.
- At the Thermal Treatment Unit, small quantities of unique explosive hazardous waste generated by research and test activities at an adjacent facility were treated on-site.

3.5.3 Hazardous and Mixed Waste Permits in 2022

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

RCRA Facility Operating Permit

The following units and activities are subject to the RCRA Facility Operating Permit:

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

Program Activities and Results 2022: RCRA Facility Operating Permit

The RCRA Facility Operating Permit was modified three times during 2022 as follows:

- On February 16, 2022, NMED (NMED 2022) approved a December 21, 2021, modification request, authorizing specific changes to optimize soil vapor, groundwater, radon, and tritium monitoring at the Mixed Waste Landfill (Solid Waste Management Unit 76). The modified requirements are in the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan, which is incorporated by reference into Permit Attachment M, "Long-Term Monitoring and Maintenance Plan for Solid Waste Management Units and Areas of Concern Granted Corrective Action Complete with Controls."
- The contingency plan for emergency response at each hazardous and mixed waste management unit was modified to update the names and contact information in the rosters of personnel who can serve as emergency coordinators. The change was effective January 31, 2022 (DOE/NNSA/SFO and Sandia National Laboratories 2022).
- On December 12, 2022, NMED (NMED 2022) approved a request to add a second waste transfer line to the Thermal Treatment Unit from a planned additional area for research and testing in the adjacent building. The planned area will use the same silver acetylide silver nitrate explosive that is currently used.

The amount of RCRA hazardous waste handled and shipped in 2022 is reported in Section 3.5.1.

Chemical Waste Landfill Post-Closure Care Permit

The Chemical Waste Landfill post-closure care activities are subject to the Chemical Waste Landfill Post-Closure Care Permit. This is described in detail in Section 3.7.1.

3.5.4 Hazardous Waste

Hazardous waste generated at SNL/NM includes a wide variety of wastes from research and testing, together with larger quantities of wastes from decontamination and demolition, production, maintenance, and support operations, including waste management activities. Hazardous wastes that cannot be recycled or treated on-site are sent to off-site facilities for treatment, as needed, before disposal at permitted off-site facilities. Applicable regulations for hazardous waste handled at SNL/NM are listed in Chapter 10. The amounts and types of hazardous waste handled and shipped in 2022 are reported in Section 3.5.1.

Certain types of explosives waste generated at SNL/NM are treated at the Radioactive and Mixed Waste Management Unit or the Thermal Treatment Unit. Explosive waste is generally managed at the point of generation until it is shipped to an off-site facility for treatment in accordance with regulatory requirements.

In accordance with Section 2.5 of the RCRA Facility Operating Permit, DOE and Sandia personnel annually certify that there is a "program in place to reduce the volume and toxicity of hazardous waste generated by the facility's operation to the degree determined by the Permittee to be economically practicable" at SNL/NM. Many types of hazardous waste are recycled where feasible. Recycled hazardous waste includes various batteries, silver compounds, mercury compounds, lamps, capacitors, and toxic metals such as lead. Sandia personnel investigate and implement waste minimization efforts with support and technical assistance from Materials Sustainability and Pollution Prevention programs personnel (see Section 3.4). Hazardous and mixed waste minimization activities are described in an annual report to NMED (Sandia 2022), which is available to the public in hard copy at the University of New Mexico's Zimmerman Library. An index of the RCRA-related documents that are available in the Information Repository can be found at Sandia RCRA Facility Operating Permit Information Repository Index (Sandia n.d.).

3.5.5 Radioactive Waste and Mixed Waste

DOE and Sandia personnel manage low-level radioactive waste and low-level radioactive mixed waste that is generated through a variety of processes, including production, research, decontamination and demolition, and waste management activities. DOE and Sandia personnel also manage transuranic and mixed transuranic wastes that have been generated through research and waste management activities. High-level radioactive waste is not generated at SNL/NM. During 2022, legacy wastes (wastes originally generated between 1990 and 1998) were also managed at SNL/NM.

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

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

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

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

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

Sandia personnel manage mixed waste that is subject to the Federal Facility Compliance Order (NMED 1995). The compliance requirements include: (1) deadlines for processing and/or disposing of various types of waste as specified in the current site treatment plan (Sandia 2022) and (2) instructions for providing an annual update of activities and a current inventory of stored waste still on-site.

Program Activities and Results 2022: Radioactive Waste and Mixed Waste

During 2022, DOE and Sandia personnel met all regulatory deadlines, shipped no mixed transuranic waste to the Waste Isolation Pilot Plant for disposal, and provided an annual update of mixed waste activities during the previous year (Sandia 2022).

In addition, during 2022, Sandia personnel managed 1.76 cubic meters of mixed transuranic waste that was subject to the Federal Facility Compliance Order. Table 10-3 lists the quantities of mixed waste subject to the Federal Facility Compliance Order at the end of fiscal year 2022. These wastes are subject to a site treatment plan compliance deadline of December 31, 2024. The amounts and types of radioactive and mixed waste handled and shipped in 2022 are reported in Section 3.5.1.

3.5.6 Other Regulated Waste

Other regulated waste types at SNL/NM are managed in accordance with applicable regulatory requirements. The amounts and types of radioactive and mixed waste handled and shipped in 2022 are reported in Section 3.5.1.

Industrial Solid and Special Wastes

Industrial solid waste and special waste include a wide variety of wastes generated from research and testing, production, maintenance and support, decontamination and demolition, and waste management activities. Wastes that cannot be recycled or treated on-site are sent to off-site facilities for treatment as needed before disposal at permitted off-site facilities. Many categories of nonhazardous waste are recycled, including alkaline batteries, fluorescent lamps, oils, and ballasts not containing polychlorinated biphenyls (PCBs). Waste minimization efforts are also applicable to nonhazardous waste, as discussed in Section 3.4 and Section 3.7.

Polychlorinated Biphenyl Wastes

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

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

Table 3-3 summarizes the PCB waste shipped in 2022.

Asbestos Wastes

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

Table 3-3 summarizes the quantities of asbestos waste shipped in 2022.

3.5.7 Program Activities and Results 2022: Hazardous Waste Compliance Evaluation Inspections

Representatives of the NMED Hazardous Waste Bureau did not perform any no-notice hazardous waste compliance evaluation inspections of the entire SNL/NM site during calendar year 2022. The inspections are conducted according to the State of New Mexico fiscal year calendar, which starts on July 1 and ends June 30 each year. The fiscal year 2022 inspection was held December 7–9, 2021, and a notice of violation was issued in early 2022, which is a DOE reportable occurrence (Chapter 8). The notice of violation included three findings related to container labels and one finding related to container closure. All findings were corrected during the inspection, and no further action was required.

3.6 Environmental Restoration Operations

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

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

Sandia and DOE entered a “Compliance Order on Consent”with NMED pursuant to the NMSA 1978, § 74-4-10, New Mexico Hazardous Waste Act (NMSA 1978 § 74-4-1 through 74-4-14 1978), and NMSA 1978, § 74-9-36(D), New Mexico Solid Waste Act (NMSA 1978 § 74-9-1 through 74-9-43 1978), to address specific requirements for nitrate and perchlorate constituents. The Compliance Order on Consent became effective in 2004 (NMED 2004) and governs investigation and corrective action requirements at SNL/NM. In general, the Compliance Order on Consent will terminate upon receipt of written notice by NMED that the terms, with the exception of record preservation, have been completed satisfactorily. Sections of the Compliance Order of Consent on record preservation, State’s covenant not to sue, and State’s reservation of rights will survive the termination as an agreement between the parties.

3.6.1 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 Hazardous and Solid Waste Amendments Module of Permit NM5890110581-1 (EPA 1993).

All corrective action complete proposals and Class 3 permit modifications are available for review at the University of New Mexico Zimmerman Library.

Since 1993, additional sites (including those certified in the *Comprehensive Environmental Assessment and Response Program (CEARP) Phase I: Installation Assessment* (DOE/AL 1987), potential sites, or individual historical activities have been identified for investigation. In 1992, the Environmental Restoration Project was officially launched to implement assessment and remediation activities for sites that had been contaminated or potentially contaminated because of past Sandia operations. In addition to the SNL/NM sites, other Sandia sites included in the original scope of Environmental Restoration Operations were Sandia National Laboratories, California; the Kaua‘i Test Facility in Hawai‘i; the Tonopah Test Range in Nevada; and a few miscellaneous sites located in other areas nationally and internationally.

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

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

All corrective action complete proposals and Class 3 permit modifications are available in hard copy for review at the University of New Mexico Zimmerman Library.

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

- Solid waste management units and areas of concern for which corrective action is complete and controls are not required (286 sites)
- Solid waste management units and areas of concern for which corrective action is complete and controls are required (25 sites)
- Solid waste management units and areas of concern for which corrective action is required (6 sites)

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

- Three solid waste management units at active test facilities that 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 that require final remedies through public input and NMED process: TA-V Groundwater (TAVG), Tijeras Arroyo Groundwater (TAG), and Burn Site Groundwater (BSG).

3.6.2 Program Activities and Results 2022: Environmental Restoration Operations

In 2022, routine groundwater samples were collected for the three groundwater areas of concern (TAVG, TAG, and BSG). A summary of activities and results follows. Additional information can be found in Appendix A, "Summary of Groundwater Monitoring in 2022." Details of all the groundwater monitoring conducted at SNL/NM can be found in the *Annual Groundwater Monitoring Report, Calendar Year 2022* (Sandia 2023), which documents the results of all groundwater monitoring activities for 2022. The report is available at Sandia Environmental Reports (Sandia n.d.).

Groundwater samples were analyzed for the following parameters:

- TAVG wells—Target Analyte List metals (plus uranium), filtered metals, inorganics (including nitrate plus nitrite and major anions), total alkalinity, volatile organic compounds, gross alpha, gross beta, and selected radionuclides
- TAG wells—Target Analyte List metals (plus uranium), inorganics (including nitrate plus nitrite and major anions), total alkalinity, volatile organic compounds, gross alpha, gross beta, and selected radionuclides
- BSG wells—Target Analyte List metals, inorganics (including nitrate plus nitrite and major anions), 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), mercury, inorganics (including nitrate plus nitrite, major anions, and total cyanide), total phenols, total alkalinity, volatile organic compounds, total organic halogens, high explosive compounds (at select wells), gross alpha, gross beta, and selected radionuclides

For the TAVG area of concern, 18 monitoring wells were sampled in 2022. Several analytical results exceeded the maximum contaminant levels for trichloroethene and nitrate plus nitrite:

- Trichloroethene exceeded the maximum contaminant level of 5 µg/L in six wells with a maximum concentration of 12.4 µg/L.
- Nitrate plus nitrite exceeded the maximum contaminant level of 10 mg/L in three wells with a maximum concentration of 13.5 mg/L.

Perched groundwater is a body of groundwater that is separated from an underlying body of groundwater by unsaturated earth materials.

For the TAG area of concern, 21 monitoring wells were sampled in 2022:

- For the perched groundwater system, the nitrate plus nitrite concentration exceeded the nitrate maximum contaminant level (10 mg/L) at five wells with the maximum being 22.2 mg/L. None of the wells screened in the regional aquifer exceeded the maximum contaminant level; the maximum nitrate plus nitrite concentration was 3.92 mg/L. One monitoring well is screened in the groundwater merging zone between the perched groundwater system and the regional aquifer; this well had a maximum nitrate plus nitrite concentration of 34.4 mg/L.
- Tetrachloroethene exceeded the maximum contaminant level (5 µg/L) at one well in the perched groundwater system with a maximum concentration of 10.4 µg/L. Trichloroethene exceeded the maximum contaminant level (5 µg/L) at one well in the perched groundwater system with a maximum trichloroethene concentration in the perched groundwater system of 19.7 µg/L. The maximum trichloroethene concentration in the regional aquifer exclusive of the merging zone well was 0.650 µg/L. In the merging zone above the regional aquifer, trichloroethene was not detected (< 0.300 µg/L).

For the BSG area of concern, 14 wells were sampled in 2022. Nitrate plus nitrite exceeded the maximum contaminant levels in six wells, with a maximum concentration of 38.1 mg/L. All other analytical results for groundwater samples from the three areas of concern were below established maximum contaminant levels.

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

3.7 Long-Term Stewardship Program

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

Long-Term Stewardship Program personnel perform the following:

- Post-closure care for the Chemical Waste Landfill (including groundwater monitoring to satisfy post-closure care permit requirements)
- Post-closure care for the Corrective Action Management Unit (including leachate collection and vadose zone monitoring to satisfy RCRA Facility Operating Permit requirements)
- Long-term monitoring and maintenance for the Mixed Waste Landfill (including groundwater monitoring to satisfy RCRA Facility Operating Permit requirements)

- Long-term monitoring and maintenance for solid waste management units (other than the Mixed Waste Landfill) with Corrective Action Complete with Controls status (to satisfy RCRA Facility Operating Permit requirements)
- Sampling for the Groundwater Monitoring Program (to satisfy the Compliance Order on Consent, Section IV, "Background" (NMED 2004) and DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting* (DOE O 231.1B, Admin Change 1 2012), for groundwater surveillance)

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

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

Groundwater levels are measured in approximately 100 wells on a quarterly basis. Water-level data are used to generate a regional water table elevation contour map from which groundwater flow directions can be obtained. Groundwater elevation tables, hydrographs, and contour maps derived from the data are provided in the *Annual Groundwater Monitoring Report, Calendar Year 2022* (Sandia 2023).


Prickly pear cactus *(Opuntia species)* with fruit

3.7.1 Chemical Waste Landfill Post-Closure Care

The Chemical Waste Landfill is a 1.9-acre remediated hazardous waste landfill in the southeastern corner of TA-III undergoing post-closure care. From 1962 until 1985, the Chemical Waste Landfill was used for the disposal of hazardous, radioactive, and mixed waste; from 1981 through 1989, it was used as a hazardous waste drum storage facility. From 1997 to 2003, the Chemical Waste Landfill was remediated through a voluntary corrective action program, including the extraction of organic soil vapor and the complete excavation of waste. An at-grade evapotranspirative cover was installed in September 2005. In June 2011, NMED approved closure of the Chemical Waste Landfill (NMED 2011), and the Chemical Waste Landfill Post-Closure Care Permit (NMED 2009) took effect. An application to renew the post-closure care permit was submitted to NMED in December 2020. Until the permit renewal process is completed, the post-closure care permit remains in 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.

Program Activities and Results 2022: Chemical Waste Landfill

In 2022, semiannual groundwater monitoring was performed in January and August in accordance with post-closure care permit requirements. Groundwater samples were analyzed for volatile organic compounds (including trichloroethene), nickel, and chromium. January and August results were consistent with previous years; trichloroethene was the only volatile organic compound detected. No analytes were detected at concentrations exceeding EPA maximum contaminant levels or post-closure care permit-defined hazardous concentration limits.

In addition to semiannual groundwater monitoring, the post-closure care permit requires other monitoring, inspection, maintenance, and repair activities. Inspections conducted in 2022 confirm that the Chemical Waste Landfill evapotranspirative cover was in good condition, evenly covered by native perennial grasses, and performing as designed. Volatile organic compound soil-vapor-monitoring continues to confirm that the residual volatile organic compound soil vapor plume is stable, slowly dissipating through diffusion, and not a threat to groundwater. All post-closure care permit-required activities for 2022 are documented in the *Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2022* (Sandia 2023).

3.7.2 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 Corrective Action Management Unit monitoring system, which provides information on soil conditions under the containment cell for early detection of leaks, consists of three monitoring subsystems: a primary subliner, a vertical sensor array, and the Chemical Waste Landfill sanitary sewer line. All three monitoring subsystems are monitored quarterly for soil moisture content. The vertical sensor array and Chemical Waste Landfill sanitary sewer monitoring subsystems are sampled annually for volatile organic compound concentrations in the soil vapor at various depths.

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.

Program Activities and Results 2022: Corrective Action Management Unit

The 2022 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 (Sandia 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 2022 soil moisture monitoring results remained consistent with the baseline data for the primary subliner and vertical sensor array monitoring subsystems with no trigger levels exceeded. Increases at four of the six Chemical Waste Landfill sanitary sewer monitoring subsystem locations are most likely related to a sanitary sewer line leak. A visual inspection of a nearby domestic water main in 2022 showed it was not leaking. Sewer line camera surveys in 2020 and 2022 were inconclusive. Ongoing monitoring will be used to evaluate and determine any additional action if necessary. Soil moisture values did not exceed the trigger level at any Chemical Waste Landfill sanitary sewer monitoring subsystem locations.

In 2022, 218 gallons of leachate (a listed hazardous waste) were removed from the leachate collection system compared to 219 gallons of leachate removed in 2021. The evapotranspirative cover continues to meet successful revegetation criteria and is in excellent condition with even coverage of mature, native perennial grasses. Additional information on activities conducted—including inspection, monitoring, and sampling details—can be found in the *Corrective Action Management Unit Report of Post-Closure Care Activities Calendar Year 2022* (Sandia 2023).

3.7.3 Mixed Waste Landfill Long-Term Monitoring and Maintenance

The Mixed Waste Landfill is a 2.6-acre solid waste management unit with Corrective Action Complete with Controls status. The Mixed Waste Landfill is in the north-central portion of TA-III and is undergoing long-term monitoring and maintenance. The site consists of two distinct disposal areas: the classified area (occupying 0.6 acres) and the unclassified area (occupying 2.0 acres). From March 1959 through December 1988, the Mixed Waste Landfill was used for the disposal of low-level radioactive, hazardous, and mixed waste. The Mixed Waste Landfill has undergone corrective action in accordance with two NMED orders ((NMED 2004); (NMED 2005)) and 20.4.1 NMAC, *Hazardous Waste Management* (20.4.1 NMAC 2018). The NMED Final Order for Corrective Action Complete with Controls (NMED 2016) became effective in March 2016, granting a Class 3 Permit Modification to reflect that the Mixed Waste Landfill is Corrective Action Complete with Controls. All controls are defined in the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan (Sandia 2012), which was implemented upon NMED approval (NMED 2014) and included in the RCRA Facility Operating Permit.

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

Program Activities and Results 2022: Mixed Waste Landfill

In 2022, semiannual groundwater monitoring was performed at the Mixed Waste Landfill in May and October in accordance with the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan. All groundwater samples were analyzed for volatile organic compounds; metals including cadmium, chromium, nickel, and uranium; specific radionuclides by gamma spectroscopy; gross alpha and gross beta; tritium; and radon-222. Results were consistent with previous years, and no analytes were detected at concentrations exceeding EPA maximum contaminant levels or Long-Term Monitoring and Maintenance Plan-defined trigger levels. Additional groundwater samples were collected in October to analyze for perfluorohexane sulfonic acid, perfluorooctane sulfonic acid, and perfluorooctanoic acid in accordance with an NMED request (NMED 2021). There were no detections above laboratory method detection limits in any groundwater sample.

In addition to semiannual groundwater monitoring, the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan requires other monitoring, inspection, maintenance, and repair activities. Ongoing activities are documented comprehensively in a Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report submitted to NMED in June of each year. In 2022, the evapotranspirative cover was in good condition, evenly covered by mature native perennial grasses. Based on all monitoring, inspection, and maintenance results, the evapotranspirative cover and monitoring systems are functioning as designed, and site conditions remain protective of human health and the environment. Long-Term Monitoring and Maintenance Plan-required monitoring activities for 2022 are documented in the *Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report, April 2022 through March 2023* (Sandia 2023).

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

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

Program Activities and Results 2022: Solid Waste Management Units

All RCRA Facility Operating Permit-required physical inspections were completed in 2022. The need for replacement of weathered signs was observed at one solid waste management unit in 2022. The replacement was completed in the first quarter of 2023. The administrative and physical institutional controls in place at the 24 solid waste management units are effectively providing continued protection for human health and the environment. The *Solid Waste Management Unit and Areas of Concern Annual Long-Term Monitoring and Maintenance Report for Calendar Year 2022* (Sandia 2023) was submitted to NMED.

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

3.7.5 Groundwater Monitoring Program

Groundwater Monitoring Program personnel sampled 16 wells and one spring in 2022. Groundwater samples were analyzed for the following parameters: Safe Water Drinking Act list volatile organic compounds, total organic halogens, total phenols, total alkalinity, nitrate plus nitrite, total cyanide, major anions, Target Analyte List metals, mercury, gamma spectroscopy, gross alpha and beta, radium-226, and radium-228. A subset of the locations were sampled for high explosive compounds, dissolved uranium (as mass), and isotopic uranium.

Program Activities and Results 2022: Groundwater Monitoring

Fluoride was detected above the maximum allowable concentration in three groundwater wells. Beryllium concentrations at Coyote Springs exceeded EPA maximum contaminant levels. The exceedance for each of these elements is attributable to the elevated natural concentrations associated with bedrock groundwater systems at the sampling locations. In one groundwater well, mercury was detected above the EPA maximum contaminant level in the environmental sample but below the method detection limit in the associated duplicate environmental sample. All other analytical results for groundwater samples were below established maximum contaminant levels. The 2022 water quality results for this sampling were consistent with results from past years. Additional results discussion are found in Chapter 2 of the *Annual Groundwater Monitoring Report, Calendar Year 2022* (Sandia 2023).

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


Guadalupe and Mosca peaks in the Monzano Mountains

Chapter 4. Ecology Program

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

OVERVIEW ■ Ecology Program personnel support compliance with regulations and laws, land use decisions, and ecological and wildlife awareness campaigns to ensure safe work environments and sustainable decision-making strategies.

Ecology Program personnel monitor and surveil vegetation and wildlife to support operations. Ecological compliance promotes conservation through the protection of native wildlife and their habitats. Conducting routine monitoring activities promotes an understanding of local population dynamics and temporal shifts through time. This knowledge is important for local land use decisions on a precise scale. Ecological monitoring activities are conducted on a calendar-year basis on DOE-permitted and fee-owned land as follows:

- Collect biological inventory data to support site activities and maintain regulatory compliance. 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 4-1 lists some of the more common plant and animal species identified at SNL/NM. Data are collected on vegetation, reptile, amphibian, mammal, and bird species that currently inhabit DOE-controlled land:
    - Vegetation monitoring (Section 4.1)
    - Reptile and amphibian monitoring (Section 4.2)
    - Mammal monitoring (Section 4.3 and Section 4.5)
    - Bird monitoring (Section 4.4)
- 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 5 for details) during that time.

- Educate the Sandia workforce regarding ecological conservation.
- Provide support when biological issues arise (e.g., injured wildlife, nesting birds, snake relocation, or other wildlife encounter concerns).

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

Ecological monitoring and surveillance is conducted throughout the year for routine and nonroutine activities. Sampling locations and vegetation types or habitat descriptions are provided in Table 4-1.

Table 4-1. Sampling locations with vegetation type or habitat description

Sampling Site Name	Vegetation Type or Habitat Description
Grasslands	
Coyote Springs	Wetland
Grassland Shrub Woodland Plot-052	Grassland shrub woodland
Grassland Shrub Woodland Plot-060	Grassland shrub woodland
Golf Course	Urban area, ornamental landscaping
Robotic Vehicle Range	Grassland with sparse dwarf shrub
SC Dome	Shrub, open woodland, and grassland
West of TA-III	Large shrub grassland
Woodlands	
Madera Canyon Guzzler	Open woodland, shrub, and grassland
Range Wildlife Guzzler	Open woodland, shrub, and grassland

SC Dome = Scale Compatibility Dome

4.1 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 (Canadian National Vegetation Classification 2013).

Vegetation monitoring provides data to enhance understanding about various ecosystems and allow correlations to be examined between transformations in a vegetation habitat and other ecosystem changes. Vegetation monitoring is valuable in upholding compliance with EO 13751, *Safeguarding the Nation from the Impacts of Invasive Species* (EO 13751 2016), and EO 13112, *Invasive Species* (EO 13112 1999).

Vegetation type is a broad structural category of vegetation that dominates an area such as a grassland, woodland, desert, scrubland, or forest. The two main vegetation types at SNL/NM are grassland and woodland (Table 4-1). SNL/NM grasslands can have a shrub and/or scattered tree component to them and may be described in a variety of ways, such as a dwarf shrub grassland, a shrub-dominated grassland, a grassland containing shrubs and a scattered woodland component, or a meadow where a grassland area occurs as an opening within a woodland. Similarly, woodlands may be composed of tightly clustered trees dominated by piñon and juniper and described as closed piñon-juniper woodland, or the main structural vegetation type may be scattered piñon and juniper trees and described as a scattered piñon-juniper woodland.

Habitat is the environment that a plant or animal has adapted to and where it is normally found. The habitat for a species may be very broad, such as temperate North American grasslands, or the habitat for a species can be very narrow, such as a highly specific biotic composition with short, medium, or tall grassland that is composed of certain grass species with or without specific shrub components. Detecting invasive plant species is an important aspect of long-term monitoring across a variety of vegetation types. An invasive species is an organism that is not indigenous, or native, to an area. Of biota occurring at SNL/NM, invasive plants pose the greatest risk to the local ecology.

An *ecosystem* is a network of living organisms and nonliving components that interact to comprise an overall environment. An *environment* is the sum of all external conditions affecting an organism's life, development, and survival. *Habitat* is the place or environment where a plant or animal naturally or normally lives and grows.

The invasive plant of greatest concern at SNL/NM is cheatgrass (*Bromus tectorum*). It is able to maintain superiority over native plants through prolific seed production and the ability to germinate in autumn or spring, which gives it a competitive advantage over native warm season perennials. A hazardous aspect of cheatgrass is its ability to alter the local fire regime; wildfires occur more frequently—cheatgrass burns nearly four times more often than native vegetation types—and larger areas burn when cheatgrass is present. Cheatgrass was associated with 24 percent of the land area burned in the 50 largest fires in the 2000s in the western United States (Balch, et al. 2013).

4.1.1 Vegetation Monitoring Strategy

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

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 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 (Bureau of Land Management n.d.).

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

In 2022, two AIM plots were established and completed (Figure 4-1). Data collected at each of the AIM plots to date are important in providing baseline information; however, comparing plot assessments is not possible currently due to the variations between the plots. Each plot will be revisited on a rotating basis to monitor for changes, and data interpretation will become meaningful after each plot has been resampled multiple times, eventually providing insight into ongoing environmental conditions as indicators change or remain consistent across time.

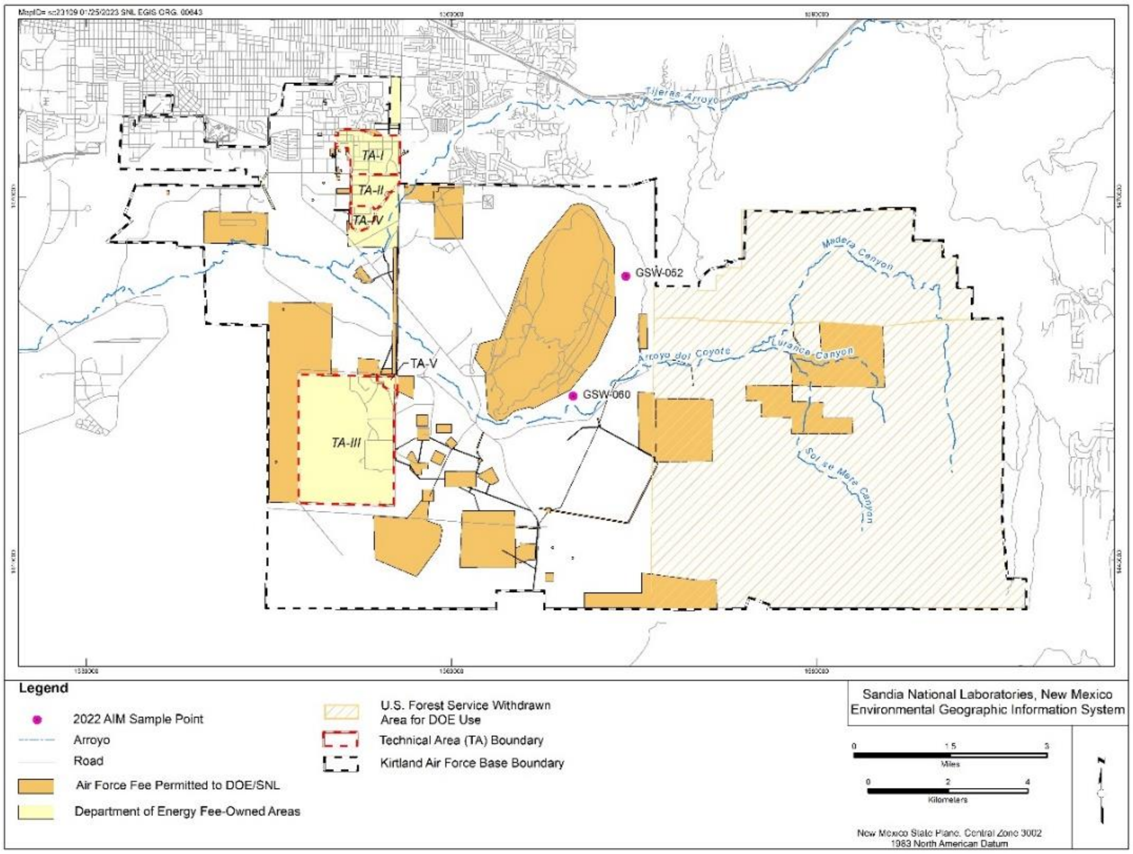


Figure 4-1. Two AIM monitoring plots established in 2022

4.1.2 Vegetation Monitoring

Each AIM plot covers approximately 0.7 acres, consisting of three 25 m-long transects arranged in a spoke design around the plot center. A vegetation transect is a path along which biologists count and record occurrences of plant species; a measuring tape is laid out on the ground surface to define the transect line. Data collected in each transect include all species of vegetation intercepted at a single, narrow 1 mm-wide point every 0.5 meters along a transect line (commonly referred to as a line-point intercept). Vegetation height, gaps between canopies of vegetation, gaps between vegetation bases (where vegetation emerges from the ground), and soil are tested to determine the vegetation's stability. A complete vegetation species inventory is also conducted throughout the entire AIM plot area.

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

Species richness, the simplest measure of species diversity, is the number of plant species inhabiting a plot area. Gap intercept measurements indicate how much soil is protected from the erosive effects of wind and water. Canopy gap is the proportion of each data collection line covered by large gaps between plant canopies. The plant canopy is the outermost perimeter of the natural spread of plant foliage. Large gaps between plant canopies are important indicators of potential wind erosion, weed invasion, and how protected the soil is from the erosive impact of high-energy monsoon raindrops. Basal gap is the proportion of each data collection line covered by large gaps between the bases of plants. Large gaps between plant bases, or a large proportion of the data collection line with basal gaps, are important indicators of stormwater runoff and associated water erosion (Herrick, et al. 2017).

Increases in the surface stability of soil reflects increased soil erosion resistance and resilience. The soil stability scale is a rating from 1 (very unstable) to 6 (highly stable). Sites with values of 5.5 or higher generally are very resistant to erosion, particularly if there is little bare background and few large gaps.

Both AIM plots were established in grasslands: Grassland Shrub Woodland Plot-052 (GSW-052) and Grassland Shrub Woodland Plot-060 (GSW-060).

Program Activities and Results 2022: Plot GSW-052 Vegetation Monitoring

Plot GSW-052 is dominated by an easterly aspect slope with gravelly soils and is bisected by a small, steep ephemeral drainage that carries runoff from Manzano Mountain. The plot has a dense cover of native grasses, widely scattered junipers, and interspersed shrubs within the larger overall landscape of grassland shrub woodland (Figure 4-2). This plot has experienced no obvious recent human impact.

Figure 4-2. Plot GSW-052 is sloped with gravelly soils and dense native grass cover

Foliar cover is the leaf area of a plant or a plant grouping.

The 38 plant species in Plot GSW-052 are indicative of moderately high grassland diversity (Table 4-2). Black grama (*Bouteloua eriopoda*), an important drought-tolerant native grass, is the dominant plant species in the plot with the highest foliar cover. Foliar cover is the leaf area a plant or of a plant grouping. Black grama provides excellent forage for wildlife and also provides excellent protection against erosion. The canopy produced by dense black grama stands, like those that occur in this plot, may enhance infiltration of rainfall by absorbing much of the energy of falling raindrops. All other dominant plant species in this plot are native species (Table 4-3).

Table 4-2. Foliar cover at Plot GSW-052

Plot Area	Percent
Average foliar cover	98.6
Foliar Cover by Vegetation Type	
Grasses	83.4
Shrubs	6.6
Trees	6
Forbs	2.6

Table 4-3. Foliar cover of dominant plant species at Plot GSW-052

Common Name	Scientific Name	Percent
Black grama	*Boutloua eriopoda*	60
Blue grama	*Bouteloua gracilis*	18.7
One-seed juniper	*Juniperus monosperma*	6
Sand dropseed	*Sporobolus cryptandrus*	4.7
Brown-spine prickly pear	*Opuntia phaeacantha*	3.3
Shrub live oak	*Quercus turbinella*	3.3
Lambsquarters	*Chenopodium album*	1.3
Threadstem sandmat	*Chamaesyce revoluta*	1.3

Canopy gap and basal gap data for Plot GSW-052 are shown in Table 4-4 and Table 4-5, respectively. Only 18 percent of the plot transects are not covered by the canopy of plants. Black grama grass canopies dominate the plot, providing excellent protection against the erosive effects of raindrops and wind erosion. Three-quarters of the transect length has basal gaps, but most basal gaps are 100 cm or less. Shorter stretches of gaps between plant bases aid to decrease the erosive effects of sheet flow.

Table 4-4. Canopy gaps between plants at Plot GSW-052

Size of Gap	Percent of Line
0–25 cm	2.6
25–50 cm	9.7
51–100 cm	5.7
101–200 cm	0.0
> 200 cm	0.0
Plot total	**18.0**

Table 4-5. Basal gaps between plants at Plot GSW-052

Size of Gap	Percent of Line
0–25 cm	6.0
25–50 cm	26.7
51–100 cm	27.4
101–200 cm	12.7
> 200 cm	2.9
Plot total	**75.7**

The surface soil stability of Plot GSW-052 is shown in Table 4-6. Soils protected by plant cover were much more stable than bare soils and, overall, the soils for the plot are moderately stable, scoring a stability class of 3.3. These scores combined with the very low percent of canopy gaps and low percent of large basal gaps indicate that the plot soils have high stability.

Table 4-6. Soil stability of Plot GSW-052

Soil Surface Stability	Score
Overall plot soil stability	3.3
Soil stability of protected soils	3.8
Soils not protected by plant cover	2.6

Plot GSW-052 contained nine one-seed juniper (*Juniperus monsperma*) trees and saplings, and one piñon pine (*Pinus edulis*) sapling. The number of trees and saplings and their density per hectare are shown in Table 4-7.

Table 4-7. Tree density of Plot GSW-052

Tree Characteristic	Number
Number of trees	5 within the plot
Number of saplings	5 within the plot
Tree density	74.7 trees per hectare
Sapling density	74.7 saplings per hectare

The standard measurement for trees is the diameter of the tree at breast height, which, in this case, is 4.5 feet above the tree's base. This measurement is effective for single-stemmed species of trees, such as most piñon pines. For multi-stemmed trees such as one-seed juniper, the standard measurement is the diameter of the root collar of each stem, which is then calculated for an overall diameter at the root collar for the tree. Whereas trees have a diameter at breast or a diameter at root collar greater than 5 inches, saplings have a diameter at breast height or a diameter at root collar between 1 inch and 5 inches. Saplings are not calculated into these average measurements for trees at the plot, but both trees and saplings are included in the average height and the height range measurements (Table 4-8).

Table 4-8. Tree measurements of Plot GSW-052

Tree Characteristic	Measurement
Average diameter at the root collar or breast height of trees	15.9 inches
Average height of juniper trees and saplings	7.9 feet
Height range of juniper trees and saplings	5.4–11.9 feet
Height of pine sapling	4.4 feet

Program Activities and Results 2022: Plot GSW-060 Vegetation Monitoring

Plot GSW-060 is characterized by rocky surface soils on an alluvial fan with a gradual, small ephemeral drainage in the grassland shrub woodland vegetation type. The plot has a southerly aspect and is dominated by native plant species, primarily grasses interspersed with one-seed junipers (*Juniperus monosperma*) and shrubs. This plot has experienced a low level of recent human impact (Figure 4-3).

Figure 4-3. Plot GSW-060 on a rocky alluvial fan, bisected by a small ephemeral drainage

The 46 plant species in Plot GSW-060 indicate very good species richness (Table 4-9). Black grama is the dominant plant species in the plot. As noted in the Plot GSW-052 description, black grama is an important drought-tolerant native grass that provides excellent forage for wildlife and also excellent protection against erosion. All the dominant plant species listed in Table 4-10 are native species.

Table 4-9. Foliar cover at Plot GSW-060

Area	Percent
Average foliar cover	56.1
Foliar Cover by Vegetation Type	
Grasses	46
Forbs	0.7
Shrubs	4.7
Trees	4.7

Table 4-10. Foliar cover of dominant plant species at Plot GSW-060

Common Name	Scientific Name	Percent
Black grama	*Bouteloua eriopoda*	32
New Mexico feathergrass	*Hesperostipa neomexicana*	6
One-seed juniper	*Juniperus monosperma*	4.7
Spike dropseed	*Sporobolus contractus*	4
Side-oats grama	*Bouteloua curtipendula*	2
Longleaf jointfir	*Ephedra trifurca*	2
Six-weeks threeawn	*Aristida adscensionis*	1.3
Indigobush	*Dalea formosa*	1.3

Canopy gap and basal gap data for Plot GSW-060 are shown in Table 4-11 and Table 4-12, respectively. Overall, a small to medium portion of the plot transects contain canopy gaps of any size. The plot contains a moderate percent of basal gaps between plants.

Table 4-11. Canopy gaps between plants at Plot GSW-060

Size of Gap	Percent of Line
0–25 cm	0.5
25–50 cm	6.5
51–100 cm	10.1
101–200 cm	10.5
> 200 cm	5.7
Plot total	**33.3**

Table 4-12. Basal gaps between plants at Plot GSW-060

Size of Gap	Percent of Line
0–25 cm	0.7
25–50 cm	3.1
51–100 cm	13.3
101–200 cm	13.8
> 200 cm	14.2
Plot total	**45.1**

Soil stability of the plot was moderate, with a consistent stability class of 3.0 on a scale of 1 to 6 (Table 4-13). The soil stability scores in combination with the low-moderate canopy and basal gaps indicate that the plot has moderate erosion resistance.

Table 4-13. Soil stability of Plot GSW-060

Soil Surface Stability	Score
Overall plot soil stability	3.0
Soil stability of protected soils	2.9
Soils not protected by plant cover	3.1

Plot GSW-060 contained only one-seed juniper trees. The number of trees and saplings and their density per hectare are shown in Table 4-14. The lack of saplings in the plot is of interest because recruitment of young trees is essential for continued forest development across time.

Table 4-14. Tree density of Plot GSW-060

Tree Characteristic	Number
Number of trees	5 within the plot
Number of saplings	0 within the plot
Tree density	74.7 trees per hectare

A discussion of tree and sapling measurements—including the diameter at breast height and diameter at the root collar—is provided in the previous section on Plot GSW-052. Juniper tree measurements for Plot GSW-060 are shown in Table 4-15.

Table 4-15. Tree measurements of Plot GSW-060

Tree Characteristic	Measurement
Average diameter at the root collar or breast height of trees	12.1 inches
Average height of juniper trees	9.5 feet
Height range of juniper trees	5.3–13.9 feet

4.1.3 Vegetation Establishment and 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 International Science and Polcy Working Group 2004).

Ecology Program personnel have provided ecological restoration guidance and support for 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 approach has since shifted, recognizing that all biotic components need to be assessed and addressed in order to reestablish the historic native community of each site successfully.

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

Ecological Restoration Projects

Ecological restoration projects are most often related to construction activities, commonly in support of the stormwater pollution prevention plan development process and, more specifically, the Construction General Permit (CGP), according to EPA guidelines. When possible, an area is evaluated to identify and document the native biological community prior to beginning activities that will disturb the earth. If an area cannot be evaluated prior to disturbance or if the area has existing disturbance, a reference ecosystem serves as a guide for planning the restoration work. The full scope of disturbance effects, either existing or planned, the anticipated final state of the site, and any other relevant factors are also assessed before planning the restoration work. Ecology Program personnel develop a detailed written restoration plan, or specification, for the project. This is provided to Infrastructure Operations personnel who oversee work contracts. Ecology Program personnel continue to provide support and guidance throughout the restoration project, including conducting post-restoration site monitoring and biological evaluations of the recovery.

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

Program Activities and Results 2022: Ecological Restoration and Revegetation

In 2022, Ecology Program personnel supported the following ecological restoration projects:

- **Energetic Manufacturing Science Technology Facility.** The plan is to build the Energetic Manufacturing Science Technology Facility on the west side of Building 905 in TA-II. It is anticipated that 2.15 acres will require revegetation. In March 2022, the project area was surveyed, and a seeding specification was written and provided to the Facilities project manager.
- **Liquified Natural Gas Cleanup.** The liquified natural gas cleanup project was surveyed in May 2022, and a seeding specification was written and provided to the project manager. An updated specification was written in November 2022 and provided to the project manager.

- **Lurance Canyon Burn Scar.** The Lurance Canyon burn scar was assessed in June 2022, an assessment document was written, and an action plan was proposed. The project goal is to identify erosion and vegetation issues within the burned area and propose treatments to reestablish the natural resources and protect the in situ cultural resources of the area. In August 2022, the burn scar was re-evaluated after the monsoon rains had begun. The Ecology Program vegetation subject matter expert wrote an erosion control treatment plan, which was implemented in August 2022 by Sandia, KAFB, and U.S. Fish and Wildlife Service personnel.
- **TA-V Waterline.** The TA-V Waterline project was seeded in 2019. In October 2022, the project area met the requirements for vegetative soil stabilization and the CGP was terminated.
- **TA-III East Gate.** The East Gate project is in TA-III, and it is anticipated that 6 acres will require revegetation. In November 2022, the project area was surveyed, and a seeding specification was written and provided to the Facilities project manager.

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

Additional 2022 activities included monitoring restoration projects that were installed in previous years and instituting recommendations as necessary to improve their ecological recovery trajectories. These projects were evaluated during prime vegetation growth periods for the best evaluation of native plant cover and weed presence and to observe any potential issues present during the warm growing season.

In 2022, the Ecology Program revegetation subject matter expert supported the Facilities Conceptual Location Analysis planning process by reviewing 37 proposed projects. The revegetation subject matter expert also reviewed 33 NEPA checklists in 2022.

4.2 Herpetofauna Surveillance

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

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

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

4.2.1 Drift Fence Trapping

Many different techniques are available to detect the presence of reptiles and amphibians in the environment. In 2012, the Ecology Program advanced from implementing night spotting (a type of visual encounter survey) and coverboard arrays to using drift fence arrays with funnel traps.

A single drift fence array consists of six funnel traps made of wire mesh boxes placed along a 100-foot linear drift fence. The boxes have one-way entrances, whereby animals can easily enter the trap but not exit. Each field monitoring site contains four linear drift fence trapping arrays. Annual monitoring currently consists of three separate two-week trapping periods during spring and summer months. The traps are checked twice daily, and all animals are released after processing.

Two field sites were initially established in 2012 to monitor reptiles and amphibians at one grassland field site and one shrubland field site. An additional field site was added in 2016 to monitor a herpetofaunal community in an open woodland setting.

4.2.2 Program Activities and Results 2022: Herpetofauna Surveillance

Herpetofaunal communities were monitored at two sites in 2022: the Robotic Vehicle Range and the West of Technical Area-III Site.

During 2022 herpetofaunal field monitoring, 135 individuals representing 10 species were recorded using drift fence arrays with funnel traps: 3 snake species, 6 lizard species, and 1 amphibian species (Table 4-16).

Table 4-16. Total herpetofaunal captures by site and trapping period, 2022

		Robotic Vehicle Range				West of Technical Area-III Site				
		Trapping Period				Trapping Period				
Common Name	Scientific Name	1	2	3	Total	1	2	3	Total	Total
Coachwhip	*Masticophis flagellum testaceus*	2		1	**3**		2	1	**3**	**6**
Common side-blotched lizard	*Uta stansburiana*	1	1	1	**3**	10	9	8	**27**	**30**
Great Plains skink	*Plestiodon obsoletus*	2	2		**4**		1		**1**	**5**
Greater Short-horned lizard (Figure 4-4)	*Phrynosoma hernandesi*					1		1	**2**	**2**
Little striped whiptail	*Aspidoscelis inornata*					1			**1**	**1**
Mexican spadefoot toad	*Spea multiplicata*						1		**1**	**1**
New Mexico whiptail	*Aspidoscelis neomexicana*	24	28	1	**53**	1	6		**7**	**60**
Prairie rattlesnake	*Crotalus viridis*			2	**2**			2	**2**	**4**
Sonoran gopher snake	*Pituophis catenifer affinis*	1	1		**2**	1			**1**	**3**
Southwestern fence lizard	*Sceloporus cowlesi*	10	5	6	**21**			2	**2**	**23**
Total		**40**	**37**	**11**	**88**	**14**	**19**	**14**	**47**	**135**

The following biodiversity measures were calculated using herpetofaunal monitoring data: species richness, species evenness, and the Shannon diversity index. Species richness is the number of unique species in a community, and species evenness (or equitability) is a description of species' distribution of abundance. The Shannon diversity index is a common index used by ecologists to summarize the diversity of a community. Together these measures can be used to compare diversity between sites and analyze changes in biodiversity at a monitoring site over time (Table 4-17). Additionally, these measures allow ecologists to track the directionality and magnitude of change. For example, prolonged depressed biodiversity measures would warrant further analyses and may result in natural resource management recommendations and actions.

Table 4-17. Herpetofaunal biodiversity monitoring data by site, 2022

Site	Total Number of Captures	Species Richness	Species Diversity	Species Evenness
Robotic Vehicle Range	88	7	1.19 *Average = 1.15* *Range = 0.45–1.79*	0.61 *Average = 0.56* *Range = 0.23–0.81*
West of Technical Area-III	47	10	1.51 *Average = 1.83* *Range = 1.47-2.16*	0.66 *Average = 0.80* *Range = 0.66-0.94*

Notes:

Averages and ranges were calculated from available 2012–2022 data.

Monitoring performed from 2012 to 2014 consisted of a single three-consecutive-week trapping session compared with the current spread trapping schedule.

Figure 4-4. Greater short-horned lizard (*Phrynosoma hernandesi*) inside a funnel trap at the West of Technical Area-III monitoring location in 2022

4.3 Bat Surveillance

There are many threats to bats across the United States, most notably wind energy operations and white-nose syndrome, a fungal disease. A study of population projection models showed that under even conservative estimates, the entire North America population of hoary bats (*Lasiurus cinereus*) could decline up to 90 percent in the next 50 years (Frick, et al. 2017). Deaths due to white-nose syndrome were reported in 5 to 6 million bats in 2015 (Leopardi, Blake and Puechmaille 2015), and the fungus that causes white-nose syndrome was recently detected in New Mexico caves and on potentially on bats (Grover 2021). On September 13, 2022, the U.S. Fish and Wildlife Service proposed to list the tri-colored bat (*Perimyotis subflavus*) as endangered (U.S. Fish and Wildlife Service, Department of the Interior 2022). Given these serious threats, it is imperative that bat populations be monitored at SNL/NM so potential threats to their survival can be mitigated.

4.3.1 Passive Bat Monitoring

Passive bioacoustic recordings were used to monitor bats from January 2022 through December 2022, although occasional equipment failure resulted in some data gaps. Bat activity in the southwest is most concentrated around water sources where bats drop in for a drink and has shown to account for 66 percent of variation in capture rates (Geluso and Geluso 2012). As no such permanent water sources exist on DOE-permitted or DOE-owned property, ultrasonic recorders are located at Coyote Springs and at the large pond at the KAFB Golf Course. Both are used with the KAFB Natural Resource Program manager's permission (Figure 4-5).

Once the digital cards were retrieved from the recorders, the data were processed using bioacoustic analysis software Kaleidoscope. The software suggests the species most likely to have been recorded according to the call amplitude, shape, length, and frequency. Calls are assigned a match ratio, which is the number of pulses matching the auto-classifier library over the number of pulses. Only calls that had a match ratio of 0.667 and above and a minimum of 8 pulses were included in species results.

It should be noted that 10 recordings do not necessarily represent 10 different bats, as one bat can make multiple passes. This caveat limits inferences that can be made from these data. Species-specific data are compiled as proportions of total number of calls that meet the above listed criteria.

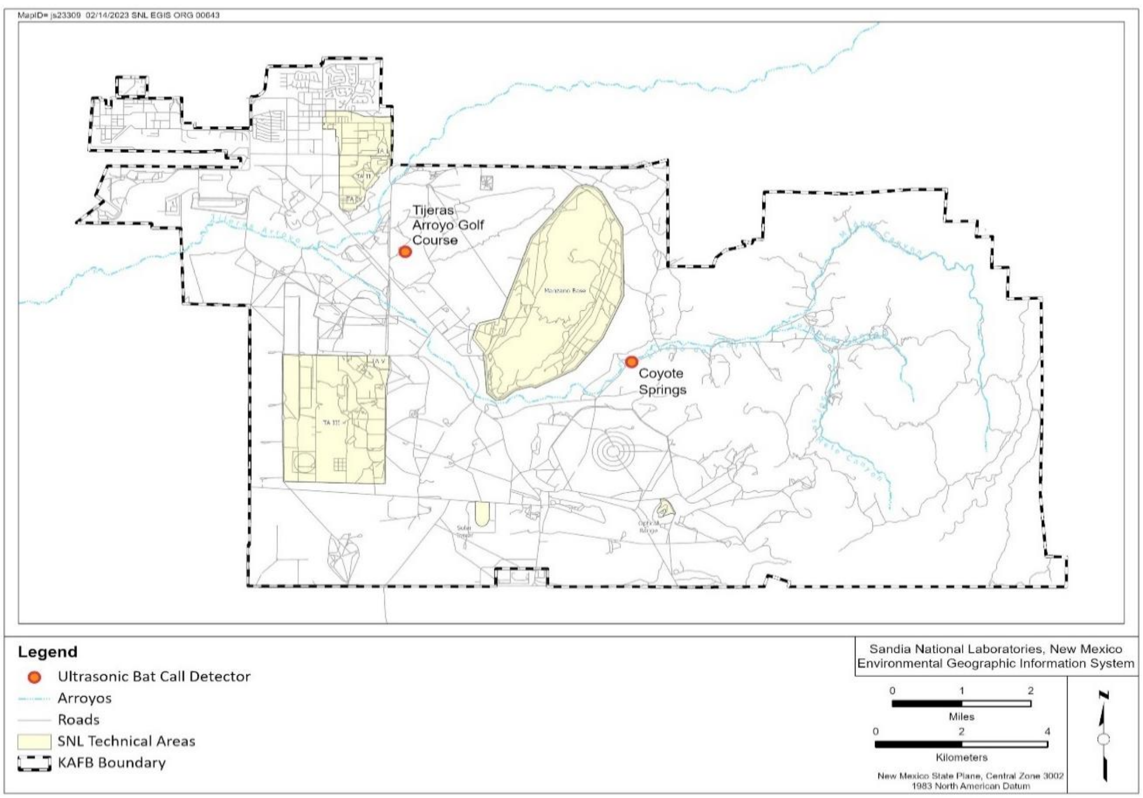


Figure 4-5. Locations of ultrasonic bat detectors

4.3.2 Program Activities and Results 2022: Bat Surveillance

In 2022, 21 species of bats were documented at SNL/NM using passive bioacoustic recordings of bat calls (Table 4-18). Due to their similarity in call variables, the big free-tailed bat (*Nyctinomops macrotis*) and pocketed free-tailed bat (*Nyctinomops femorosaccus*) are grouped together, as are the big brown bat (*Eptesicus fuscus)* and the silver-haired bat (*Lasionycteris noctivagans*), and the canyon bat (*Parastrellus hesperus*) with the tri-colored bat (*Perimyotis subflavus*) into species guilds for the analyses.

Table 4-18. Bat species detected using ultrasonic recorders, 2022

Common Name	Scientific Name
Family Vespertilionidae	
Arizona myotis	*Myotis occultus*
Big brown bat	*Eptesicus fuscus*
California myotis	*Myotis californicus*
Canyon bat	*Parastrellus hesperus*
Desert pallid bat	*Antrozous pallidus*
Eastern red bat	*Lasiurus borealis*
Fringed myotis	*Myotis thysanodes*
Hoary bat	*Lasiurus cinereus*
Little brown myotis	*Myotis lucifugus*
Long-eared myotis	*Myotis evotis*
Long-legged myotis	*Myotis volans*
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*
Silver-haired bat	*Lasionycteris noctivagans*
Tricolored bat	*Perimyotis subflavus*
Western red bat	*Lasiurus blossevillii*
Western small-footed bat	*Myotis ciliolabrum*
Western yellow bat	*Lasiurus xanthinus*
Yuma myotis	*Myotis yumanensis*
Family Molossidae	
Big free-tailed bat	*Nyctinomops macrotis*
Mexican free-tailed bat	*Tadarida brasiliensis*
Pocketed free-tailed bat	*Nyctinomops femorosaccus*

Detections by month at Coyote Springs and the KAFB Golf Course are shown in Figure 4-6 and Figure 4-7, respectively.

In 2022, one Mexican free-tailed bat (*Tadarida brasiliensis*) had to be relocated due to roosting inside a building, one unknown bat species was found inside a building but self-released, and one canyon bat (*Parastrellus hesperus*) was found inside a building but was deceased. Additionally, SNL/NM staff provided support to TTR in removing and relocating a desert pallid bat (*Antrozous pallidus)* and an unknown bat species.

The seasonality of bat activity is likely linked to migratory and hibernation-and-rousing patterns. This is most obvious in the big brown bat and silver-haired bat guild, with peak activity in spring and fall and a trough of activity in summer. This would indicate that they are residents that migrate north to have their pups, supported by Findley et al. (Findley, et al. 1975) and Cryan (Cryan 2003). The western small-footed bat and Yuma myotis seem to have the opposite pattern, with detections increasing in summer and few detections from October to March. The remaining species had much less of a seasonal pattern to their activity. The months with the most species detected were June to September; this was at the KAFB Golf Course.

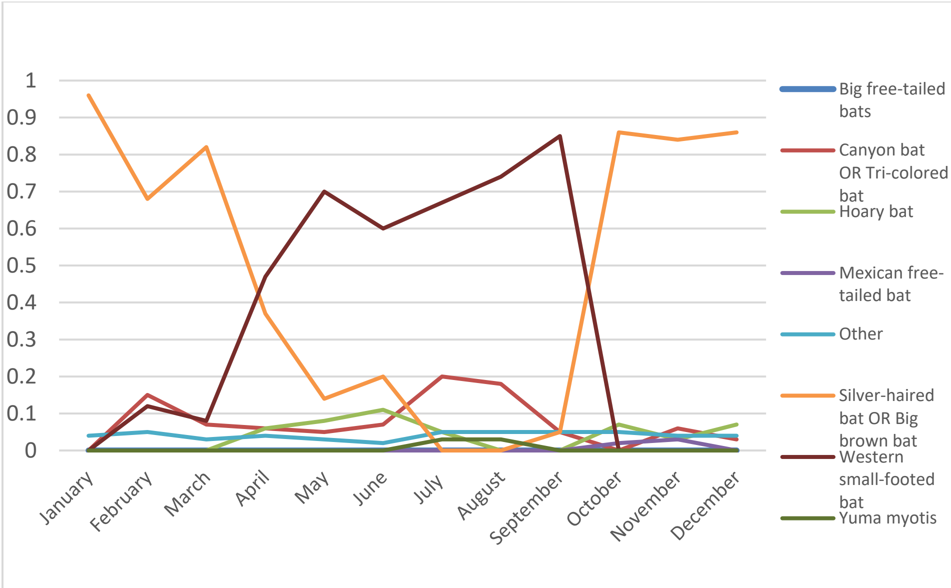


Figure 4-6. Proportion of total calls by bat species or species group at Coyote Springs by month, 2022

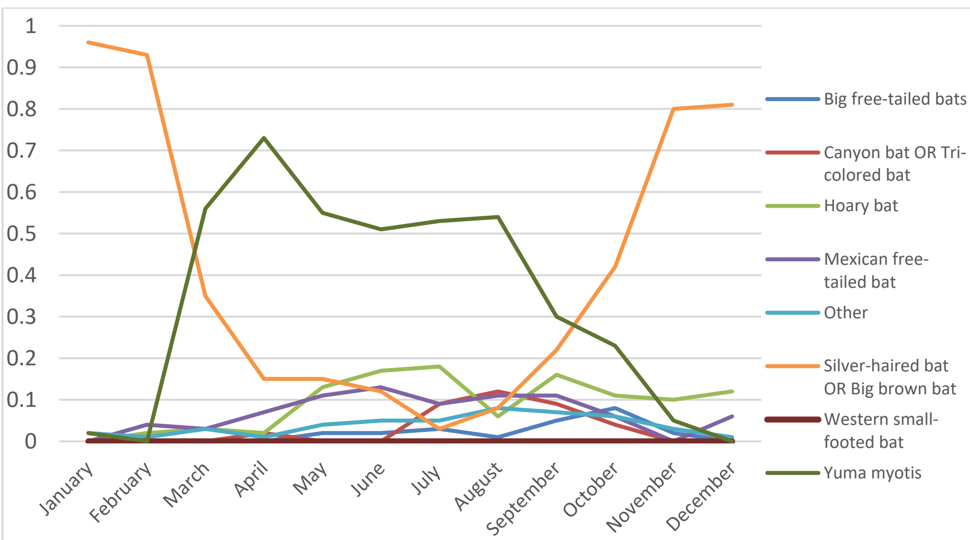


Figure 4-7. Proportion of total calls by bat species or species group at the KAFB Golf Course by month, 2022

The difference in species proportions at the two sites was explored using a simple paired t-test (Table 4-19). There is a significant difference in all species except the big brown bat and silver-haired bat guild. The big brown bat and silver-haired bat guild were among the most frequently detected bats at both sites. The KAFB Golf Course is urban area, ornamental landscaping bordered by grassland with sparse dwarf shrub. Coyote Springs is wetland and grassland shrub woodland. These differences in habitat types may account for the differences in species composition between the two sites; however, due to their high mobility, bats are not as tethered to habitat as are species that cannot fly.

Table 4-19. T-test between proportion of species calls from Coyote Springs and the KAFB Golf Course

Species	T-Test alpha
Big free-tailed bat and pocketed free-tailed bat	0.0209*
Canyon bat and tri-colored bat	0.0139*
Hoary bat	0.0005*
Mexican free-tailed bat	0.0009*
Big brown bat and silver-haired bat	0.3364
Western small-footed bat	0.0004*
Yuma myotis	0.0011*

Note: The p-value is 0.05.
* = significant differences in species representation between the two sites

4.4 Avian Surveillance

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

4.4.1 Bird Surveys Using Transects

In 2021, the bird survey transects were changed to reflect the standardized North American Breeding Bird Survey route with 50 survey points separated by one-half mile (Figure 4-8). At each point, the observer notes any bird species seen or heard within a quarter-mile radius in a three-minute period before moving on to the next point.

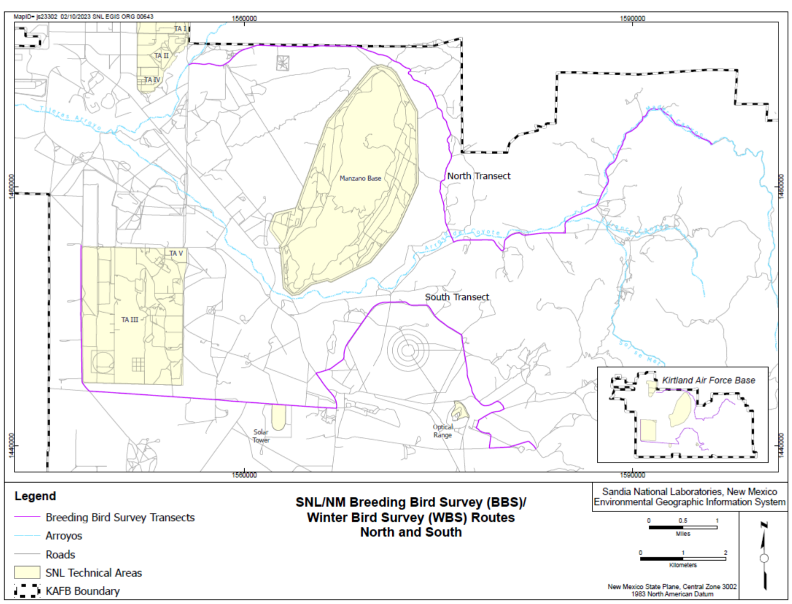


Figure 4-8. SNL/NM breeding and winter bird survey routes

Program Activities and Results 2022: Bird Surveys

In 2022, the breeding bird survey was conducted in June and July. Wildfire restrictions limited portions of the route from being completed during the preferred timeframe of early June. Forty-eight species and 461 individuals were detected across the transect in 2022 (Table 4-20). The 2022 winter bird survey was completed in January. Twenty-six species and 275 individuals were detected (Table 4-21).

Table 4-20. Species totals detected during the breeding bird survey, 2022

Common Name	Scientific Name	Number of Detections
Scaled quail	*Callipepla squamata*	1
Eurasian collared-dove	*Streptopelia decaocto*	4
White-winged dove	*Zenaida asiatica*	5
Mourning dove	*Zenaida macroura*	25
Black-chinned hummingbird	*Archilochus alexandri*	8
Turkey vulture	*Cathartes aura*	1
Swainson's hawk	*Buteo swainsoni*	2
Ladder-backed woodpecker	*Dryobates scalaris*	1
Hairy woodpecker	*Dryobates villosus*	1
American kestrel	*Falco sparverius*	2
Ash-throated flycatcher	*Myiarchus cinerascens*	11
Cassin's kingbird	*Tyrannus vociferans*	2
Western kingbird	*Tyrannus verticalis*	13
Gray flycatcher	*Empidonax wrightii*	1
Say's phoebe	*Sayornis saya*	4
Gray vireo	*Vireo vicinior*	28
Pinyon jay	*Gymnorhinus cyanocephalus*	2
Woodhouse’s scrub-jay	*Aphelocoma woodhouseii*	14
Common raven	*Corvus corax*	3
Juniper titmouse	*Baeolophus ridgwayi*	2
Horned lark	*Eremophila alpestris*	14
Barn swallow	*Hirundo rustica*	10
Cliff swallow	*Petrochelidon pyrrhonota*	2
Bushtit	*Psaltriparus minimus*	16
Blue-gray gnatcatcher	*Polioptila caerulea*	2
Rock wren	*Salpinctes obsoletus*	2
Bewick's wren	*Thryomanes bewickii*	3
Curve-billed thrasher	*Toxostoma curvirostre*	2
Northern mockingbird	*Mimus polyglottos*	66
Western bluebird	*Sialia mexicana*	2
American robin	*Turdus migratorius*	2
House sparrow	*Passer domesticus*	7
House finch	*Haemorhous mexicanus*	63
Lesser goldfinch	*Spinus psaltria*	5
Cassin's sparrow	*Peucaea cassinii*	3
Black-throated sparrow	*Amphispiza bilineata*	42
Lark sparrow	*Chondestes grammacus*	12
Black-chinned sparrow	*Spizella atrogularis*	3
Canyon towhee	*Melozone fusca*	2

Common Name	Scientific Name	Number of Detections
Spotted towhee	*Pipilo maculatus*	17
Chihuahuan meadowlark	*Sturnella lilianae*	14
Western meadowlark	*Sturnella neglecta*	18
Bullock’s oriole	*Icterus bullockii*	3
Scott’s oriole	*Icterus parisorum*	13
Hepatic tanager	*Piranga flava*	2
Western tanager	*Piranga ludoviciana*	1
Black-headed grosbeak	*Pheucticus melanocephalus*	1
Blue grosbeak	*Passerina caerulea*	4
Total		**461**

Table 4-21. Species totals detected during the winter bird survey, 2022

Common Name	Scientific Name	Number of Detections
Rock pigeon (feral pigeon)	*Columba livia*	2
Eurasian collared-dove	*Streptopelia decaocto*	7
White-winged dove	*Zenaida asiatica*	4
Red-tailed hawk	*Buteo jamaicensis*	1
Ladder-backed woodpecker	*Dryobates scalaris*	3
Northern flicker (red-shafted)	*Colaptes auratus*	5
American kestrel	*Falco sparverius*	2
Prairie falcon	*Falco mexicanus*	1
Loggerhead shrike	*Lanius ludovicianus*	3
Pinyon jay	*Gymnorhinus cyanocephalus*	1
Woodhouse’s scrub-jay	*Aphelocoma woodhouseii*	11
Common raven	*Corvus corax*	8
Raven sp.	*Corvus sp.*	3
Juniper titmouse	*Baeolophus ridgwayi*	9
Horned lark	*Eremophila alpestris*	9
Bushtit	*Psaltriparus minimus*	4
Curve-billed thrasher	*Toxostoma curvirostre*	1
Crissal thrasher	*Toxostoma crissale*	2
Sage thrasher	*Oreoscoptes montanus*	2
Mountain bluebird	*Sialia currucoides*	91
American robin	*Turdus migratorius*	1
House finch	*Haemorhous mexicanus*	46
Dark-eyed junco	*Junco hyemalis*	17
White-crowned sparrow	*Zonotrichia leucophrys*	37
Canyon towhee	*Melozone fusca*	4
Western meadowlark	*Sturnella neglecta*	1
Total		**275**

4.4.2 Bird Banding and Monitoring

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

To make comparisons among seasons, days, and net sites, personnel calculate birds captured per net hour (one standard mist net operated for one hour). 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.

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

Program Activities and Results 2022: Monitoring Avian Productivity and Survivorship Banding

In 2022, MAPS banding sessions were run from May to August with seven sessions completed in that timeframe. Twenty-two species were captured, and 63 individuals were newly banded (Table 4-22).

Table 4-22. Species composition and total number of birds banded during the MAPS season, 2022

Common Name	Scientific Name	Number Banded
Ladder-backed woodpecker	*Dryobates scalaris*	1
Ash-throated flycatcher	*Myiarchus cinerascens*	1
Willow flycatcher	*Empidonax traillii*	2
Gray flycatcher	*Empidonax wrightii*	4
Gray vireo	*Vireo vicinior*	8
Warbling vireo	*Vireo gilvus*	1
Woodhouse’s scrub-jay	*Aphelocoma woodhouseii*	1
Juniper titmouse	*Baeolophus ridgwayi*	3
Blue-gray gnatcatcher	*Polioptila caerulea*	1
Rock wren	*Salpinctes obsoletus*	1
Bewick’s wren	*Thryomanes bewickii*	1
Northern mockingbird	*Mimus polyglottos*	7
House finch	*Haemorhous mexicanus*	3
Black-throated sparrow	*Amphispiza bilineata*	18
Lark sparrow	*Chondestes grammacus*	1
Chipping sparrow	*Spizella passerina*	1
Canyon towhee	*Melozone fusca*	1
Rufous-crowned sparrow	*Aimophila ruficeps*	1
Scott’s oriole	*Icterus parisorum*	4
Brown-headed cowbird	*Molothrus ater*	1
Black-throated gray warbler	*Setophaga nigrescens*	1
Black-headed grosbeak	*Pheucticus melanocephalus*	1
Total		**63**

Figure 4-9. Scott's Oriole caught during the banding season, 2022

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.

Program Activities and Results 2022: Fall Migration Bird Banding

Ecology Program personnel monitor birds weekly from early August through early November. These annual monitoring activities are an effort to document breeding bird productivity and investigate fall migration patterns of songbirds in shrub, open woodland, and grassland habitats.

In 2022, five fall migration banding events were run from October to November at a new location, Coyote Wetlands. Nine species were captured and 13 individuals were banded this fall (Table 4-23; Figure 4-9).

Table 4-23. Species composition and total birds banded, fall 2022 season

Common Name	Scientific Name	Number Banded
Northern (red-shafted) flicker	*Colaptes auratus*	1
Dusky flycatcher	*Empidonax oberholseri*	1
Bewick's wren	*Thryomanes bewickii*	2
American robin	*Turdus migratorius*	1
Pine siskin	*Spinus pinus*	1
Chipping sparrow	*Spizella passerina*	3
White-crowned sparrow	*Zonotrichia leucophrys*	1
Song sparrow	*Melospiza melodia*	2
Lincoln's sparrow	*Melospiza lincolnii*	1
Total		**13**

4.5 Remote Camera Surveillance of Mammals and Other Wildlife

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

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

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

Ecology Program personnel maintain two wildlife water guzzlers: the Madera Canyon Guzzler, which is on DOE-permitted land withdrawn from the U.S. Forest Service, and the Range Guzzler, which is on land permitted to DOE from KAFB. The Madera Canyon Camera Station is set up at the Madera Canyon Guzzler, and the Range Camera Station is set up at the Range Guzzler. Because many mammal species use artificial water sources, remote-sensor cameras provide an excellent means of documenting the diversity and abundance of mammals at these locations.

4.5.1 Madera Canyon Camera Station

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

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

Program Activities and Results 2022: Madera Canyon Camera Station

In 2022, 25 different species were observed at the Madera Canyon Camera Station (Table 4-24), including 6 mammal species and 19 bird species. No reptiles, amphibians, or invertebrates were observed at the Madera Canyon Camera Station during 2022.

Table 4-24. Wildlife species observed at the Madera Canyon Camera Station, 2022

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mammals													
American black bear	*Ursus americanus*				●	●				●			
Bobcat	*Lynx rufus*					●	●						
Coyote	*Canis latrans*	●	●	●	●	●	●	●	●	●		●	●
Gray fox	*Urocyon cinereoargenteus*	●	●	●	●	●	●	●		●			●
Mountain lion	*Puma concolor*				●		●	●	●	●			
Mule deer	*Odocoileus hemionus*	●		●	●	●	●	●	●	●	●	●	●
Birds													
American robin	*Turdus migratorius*			●									
Black-headed grosbeak	*Pheucticus melanocephalus*					●	●						
Canyon towhee	*Melozone fusca*					●	●						
Common raven	*Corvus corax*				●	●	●	●					
Cooper's hawk	*Accipiter cooperii*					●							
Great horned owl	*Bubo virginianus*			●	●	●				●			●
House finch	*Haemorhous mexicanus*				●		●						
Juniper titmouse	*Baeolophus ridgwayi*					●							
Mourning dove	*Zenaida macroura*				●	●	●	●	●				
Northern mockingbird	*Mimus polyglottos*					●	●						
Pinyon jay	*Gymnorhinus cyanocephalus*				●	●							
Red-tailed hawk	*Buteo jamaicensis*					●				●			●
Say's phoebe	*Sayornis saya*				●	●							
Spotted towhee	*Pipilo maculatus*				●	●							
Turkey vulture	*Cathartes aura*				●	●							
Unidentified bird	*Unidentified*			●	●	●	●						
Western tanager	*Piranga ludoviciana*					●							
White-winged dove	*Zenaida asiatica*				●		●	●					
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*			●	●	●	●						●
Reptiles													
None													
Amphibians													
None													
Invertebrates													
None													

On August 13, 2022, a female mountain lion was documented at the Madera Guzzler with her three kittens (Figure 4-10). Mountain lions have been documented nearly every year since monitoring began at the Madera Canyon Guzzler. With that, most observations are during the early morning, late evening or, at night due to their crepuscular nature; additionally, most observations of this species have been made during the summer and early fall. Mountain lions are primarily solitary animals unless they are breeding or caring for young. In New Mexico, kittens are most often born between the months of May and October, with an average litter size of three. Kittens become independent between 11 and 18 months old. Due to the length of time kittens remain with their mother, female mountain lions typically breed every other year.

Figure 4-10. A female mountain lion and her three cubs, 2022

American black bears have been documented at the Madera Canyon Guzzler each year since monitoring began in 2005. In 2022, there was minimal bear activity at the Madera Canyon Guzzler. Bears were documented in the months of April, May, and September, with only one to two different observations each month. At least two different bears are believed to have visited the guzzler as identified in camera images. One of the bears was a large, dark brown-colored bear with a light brown muzzle; this bear did not have any ear tags. The second bear was also dark in color but did not have a light-colored muzzle; this bear also did not have any ear tags. Figure 4-11 and Figure 4-12 show the individual bears that visited the guzzler in 2022. No bear cubs were recorded visiting the guzzler in 2022. American black bear observation data helps to determine local population and behavioral trends. Additionally, this information helps to estimate relative species' abundance.

Figure 4-11. A large, dark-colored American black bear (*Ursus americanus*) with a light brown muzzle

Figure 4-12. A dark-colored American black bear (*Ursus americanus*) after bathing in the Madera Canyon Guzzler

4.5.2 Range Camera Station

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

Two species have been observed in images at the Range Guzzler in every year of monitoring: gray fox and mule deer. At most, 36 species have been documented in a single calendar year. In addition, 16 species have been documented at the Range Guzzler that have not been documented at the Madera Canyon Guzzler. These include American badger (*Taxidea taxus*), ash-throated flycatcher (*Myiarchus cinerascens*), European starling (*Sturnus vulgaris*), gopher snake (*Pituophis catenifer*), greater roadrunner (*Geococcyx californianus*), hog-nosed skunk (*Conepatus leuconotus*), ladder-backed woodpecker (*Dryobates scalaris*), mountain chickadee (*Poecile gambeli*), ringtail (*Bassariscus astutus)*, rock wren (*Salpinctes obsoletus*), rufous-crowned sparrow (*Aimophila ruficeps*), scaled quail (*Callipepla squamata*), Texas antelope squirrel (*Ammospermophilus interpres),* western spotted skunk (*Spilogale gracilis)*, Williamson's sapsucker (*Sphyrapicus thyroideus*), and woodrat (*Neotoma* spp.).

Program Activities and Results 2022: Range Camera Station

In 2022, 36 different species were observed at the Range Camera Station (Table 4-25), including 7 mammal species, 20 bird species, and 2 reptile species. No amphibian or invertebrate species were observed.

Table 4-25. Wildlife species observed at the Range Camera Station, 2022

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mammals													
American badger	*Taxidea taxus*										●		
Black-tailed jackrabbit	*Lepus californicus*				●								
Bobcat	*Lynx rufus*				●	●	●	●					
Coyote	*Canis latrans*	●	●		●	●	●	●	●	●	●		●
Gray fox	*Urocyon cinereoargenteus*				●	●	●	●	●	●			●
Mountain lion	*Puma concolor*	●											
Mule deer	*Odocoileus hemionus*	●	●	●	●	●	●	●	●	●	●	●	●
Birds													
American robin	*Turdus migratorius*									●	●		
Black-headed grosbeak	*Pheucticus melanocephalus*						●						
Canyon towhee	*Melozone fusca*					●					●		
Common raven	*Corvus corax*									●	●	●	
Cooper's hawk	*Accipiter cooperii*						●						
Dark-eyed junco	*Junco hyemalis*	●									●		●
Golden eagle	*Aquila chrysaetos*				●	●	●			●	●	●	●
House finch	*Haemorhous mexicanus*				●	●	●		●	●	●		
Lark sparrow	*Chondestes grammacus*						●						
Mountain bluebird	*Sialia currucoides*	●									●	●	●
Mourning dove	*Zenaida macroura*					●	●	●	●	●			
Northern flicker	*Colaptes auratus*									●	●	●	●
Northern mockingbird	*Mimus polyglottos*	●				●	●		●				
Pinyon jay	*Gymnorhinus cyanocephalus*	●			●	●							
Red-tailed hawk	*Buteo jamaicensis*					●	●		●				
Scott's oriole	*Icterus parisorum*						●						

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Townsend's solitaire	*Myadestes townsendi*						●				●	●	
Unidentified bird	*Unidentified*	●			●	●			●		●		
Western bluebird	*Sialia mexicana*									●	●		●
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*					●		●	●	●	●		
Reptiles													
Unidentified snake					●	●							
Bullsnake	*Pituophis catenifer sayi*				●								
Amphibians													
None													
Invertebrates													
None													

ssp. = subspecies

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

Mule deer were documented at the Range Guzzler every month during 2022 (Figure 4-13). As with the Madera Canyon Guzzler, mule deer were detected and observed more than any other species at the Range Guzzler. Observations of this species indicate that they were most active at the Range Guzzler during January, followed by the month of November, and then April. There were 254 observations in the month of January, 209 in November, and 201 in April. It is likely that the increase in activity during the months of January and November coincided with the peak of the rut (i.e., breeding season) for mule deer in this area in 2022. During the breeding season, bucks will cover much larger distances in the search for does. With that, the amount of observations seen in April, May, and June may have corresponded to the number of pregnant females with an increased water demand. Additionally, mule deer seek out more water during the hot summer months as temperature and drought contribute to water stress.

Figure 4-13. A buck mule deer (*Odocoileus hemionus*) pursuing a doe at the guzzler

Bobcats (*Lynx rufus*) were documented at the Range Guzzler from April through July in 2022 (Figure 4-14). Ten observations were made during that time frame, with the most observations in the month of May (4), followed by June (3), July (2), and then April (1). Individual bobcats can be identified using trail camera images, as individual spot patterns and natural markings are unique (Heilbrun, et al. 2003). It appears as though two different individuals comprised all the bobcat observations at the Range Guzzler in 2022.

Figure 4-14. Two different bobcats (*Lynx rufus*), top versus bottom, visiting the Range Guzzler

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

As stated in Chapter 8, the Endangered Species Act is intended to protect all animal and plant species that are federally listed as endangered or threatened. Currently, no known federally listed as endangered or threatened species breed in or reside within DOE-permitted and fee-owned areas at SNL/NM. Several federally listed species are found in Bernalillo County, New Mexico (Table 4-26).

A few mammal species protected by the State of New Mexico have been encountered (Table 4-26). One bird species, the gray vireo (*Vireo vicinior*), well known as a breeding bird on DOE-permitted and fee-owned areas, is listed as threatened (New Mexico Deparmtent of Game and Fish 2018). The gray vireo's primary breeding habitat is open piñon-juniper woodlands within the foothills of the Manzano Mountains.

Table 4-26. Federally listed and state-listed endangered, threatened, and other species of concern potentially occurring in Bernalillo County, New Mexico

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed within KAFB and SNL/NM
Common Name	Scientific Name			
Mammals				
Arizona myotis	*Myotis occultus*	No designation	Sensitive	●
Big free-tailed bat	*Nyctinomops macrotis*	No designation	Sensitive	
Common hog-nosed skunk	*Conepatus leuconotus*	No designation	Sensitive	●

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed within KAFB and SNL/NM
Common Name	Scientific Name			
Fringed myotis	*Myotis thysanodes*	No designation	Sensitive	
Gunnison's prairie dog	*Cynomys gunnisoni zuniensis*	No designation	Sensitive	●
Long-legged myotis	*Myotis volans*	No designation	Sensitive	
Meadow jumping mouse	*Zapus luteus luteus*	Endangered and critical habitat*	Endangered	
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*	No designation	Species of greatest conservation need	●
Red fox	*Vulpes vulpes*	No designation	Sensitive	
Ringtail	*Bassariscus astutus*	No designation	Sensitive	●
Spotted bat	*Euderma maculatum*	No designation	Threatened	●
Tri-colored bat	*Perimyotis subflavus*	Candidate	No designation	
Western small-footed myotis	*Myotis ciliolabrum*	No designation	Sensitive	
Western spotted skunk	*Spilogale gracilis*	No designation	Sensitive	●
Yuma myotis	*Myotis yumanensis*	No designation	Sensitive	
Birds				
Baird's sparrow	*Ammodramus bairdii*	Species of concern	Threatened	
Bald eagle	*Haliaeetus leucocephalus*	No designation	Threatened	●
Bell's vireo	*Vireo bellii*	Species of concern	Threatened	●
Burrowing owl	*Athene cunicularia*	Species of concern	Species of greatest conservation need	●
Common black hawk	*Buteogallus anthracinus*	Species of concern	Threatened	●
Gray vireo	*Vireo vicinior*	No designation	Threatened	●
Least tern	*Sternula antillarum*	No designation	Endangered	
Loggerhead shrike	*Lanius ludovicianus*	No designation	Species of greatest conservation need	●
Mexican spotted owl	*Strix occidentalis lucida*	Threatened and critical habitat*	Species of greatest conservation need	
Mountain plover	*Charadrius montanus*	No designation	Species of greatest conservation need	
Neotropic cormorant	*Phalacrocorax brasilianus*	No designation	Threatened	
Northern goshawk	*Accipiter gentilis*	Species of concern	Sensitive	
Peregrine falcon	*Falco peregrinus*	Species of concern	Threatened	●
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered and critical habitat*	Endangered	●
Sprague's pipit	*Anthus spragueii*	No designation	Species of greatest conservation need	●
Western yellow-billed cuckoo	*Coccyzus americanus*	Threatened and critical habitat*	Species of greatest conservation need	

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed within KAFB and SNL/NM
Common Name	Scientific Name			
Reptiles				
Desert massasauga	*Sistrurus catenatus dewardsii*	Under review	Species of greatest conservation need	•
Southwestern fence lizard	*Sceloporus cowlesi*	No designation	Sensitive	•
Fish				
Rio Grande chub	*Gila pandora*	No designation	Species of greatest conservation need	
Rio Grande silvery minnow	*Hybognathus amarus*	Endangered and critical habitat*	Threatened	
Invertebrates				
Monarch butterfly	*Danaus plexippus*	Candidate	No designation	
Socorro mountainsnail	*Oreohelix neomexicana*	No designation	Sensitive	

Source: Biota Information System of New Mexico (New Mexico Department of Game and Fish n.d.).
Notes:
Federal Endangered Species Act Status:

- Endangered: Any species that is in danger of extinction throughout all or a significant portion of its range. Endangered species are protected by the take prohibitions of Section 9 under the Endangered Species Act.
- Threatened: Any species that is likely to become endangered in the foreseeable future throughout all or a significant portion of its range. Threatened species are protected by the take prohibitions of Section 9, consistent with any protective regulations finalized under Section 4(d), of the Endangered Species Act.
- Candidate: Any species for which the U.S. Fish and Wildlife Service has sufficient information on its biological status and threats to propose it as endangered or threatened under the Endangered Species Act, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. Candidate species are not protected by the take prohibitions of Section 9 of the Endangered Species Act.

New Mexico Status:

- Endangered: Any species of fish or wildlife whose prospects of survival or recruitment within the state are in jeopardy due to any of the following factors: (1) the present or threatened destruction, modification, or curtailment of its habitat; (2) overutilization for scientific, commercial, or sporting purposes; (3) the effect of disease or predation; (4) other natural or man-made factors affecting its prospects of survival or recruitment within the state; or (5) any combination of the foregoing factors. A species is categorized as endangered if it is in jeopardy of extinction or extirpation from the state.
- Threatened: Any species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico.

* KAFB and SNL/NM boundaries do not overlap critical habitat for these species.

4.7 Eco Ticket Request System

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

Using Eco Ticket, individuals can easily place a request that is sent to all Ecology Program personnel instantaneously. Requests are prioritized in a queue and then responded to accordingly. Once an action is completed, a biologist will close out the ticket, moving the request and associated data from the queue to a searchable database. The request database is used to track wildlife encounters and ultimately to inform decisions and practices aimed at managing human-wildlife interactions effectively.

4.7.1 Program Activities and Results 2022: General Eco Ticket Results

Ongoing outreach campaigns have increased awareness of the Eco Ticket tool since its inception. Infrastructure Operations personnel use the system most frequently, requesting biological surveys to support work orders. Requests have been split nearly evenly between biological survey requests and wildlife response calls until 2021, when survey requests were more than three times higher than wildlife response calls (Figure 4-15). The trend continued in 2022, with survey requests nearly doubling wildlife response calls. The rise in survey calls was due to continuous improvement activities. Sorting and analyzing ticket types aids understanding of the dynamics of ecology issues at SNL/NM as discussed below and displayed in Figure 4-16. Wildlife response tickets are described first followed by tickets for biological surveys required for facilities work orders and projects.

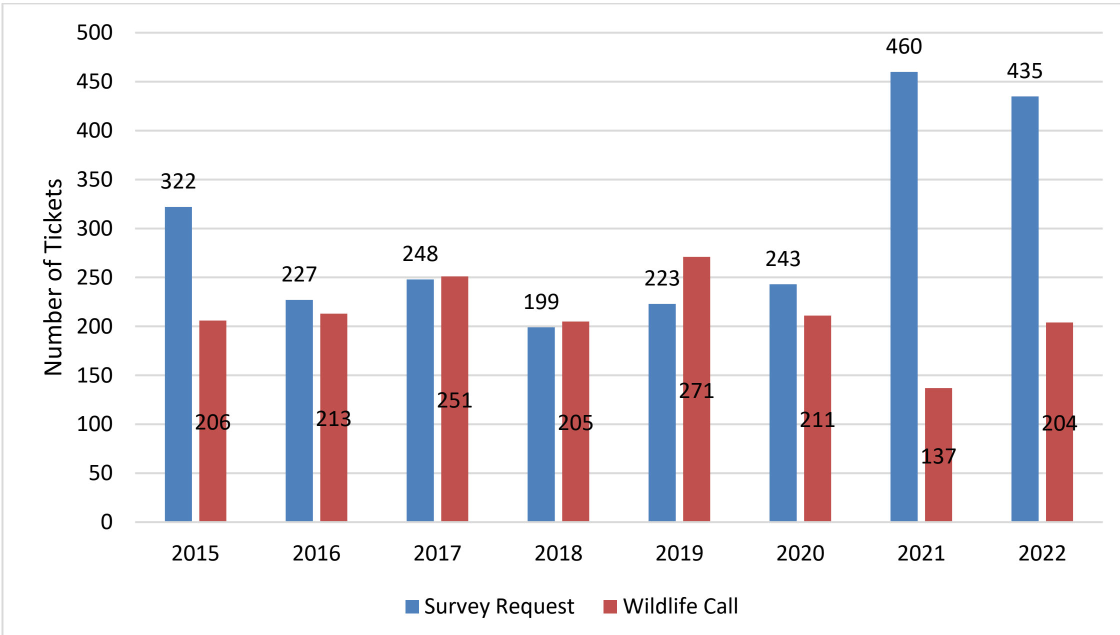


Figure 4-15. Two major categories of Eco Ticket requests, 2015–2022

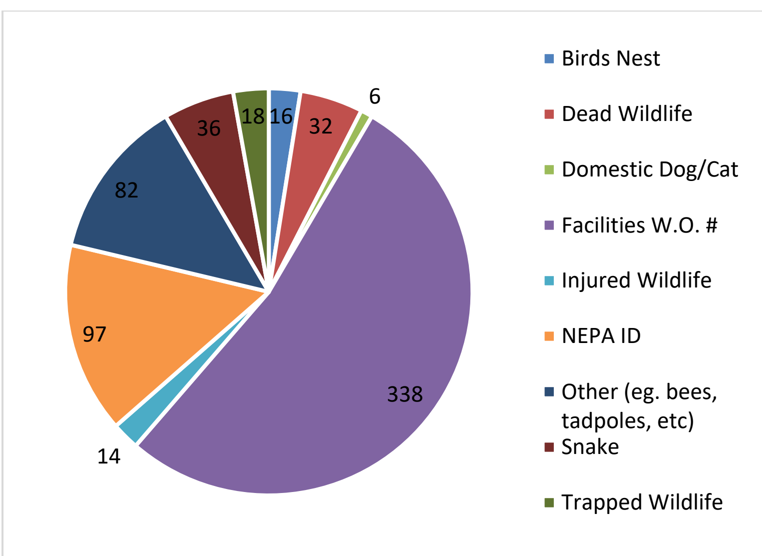


Figure 4-16. Eco Ticket requests by type, 2022

4.7.2 Wildlife Response

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

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

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

Program Activities and Results 2022: Eco Tickets for Wildlife Response

In 2022, 204 wildlife issues or requests were received through Eco Ticket. The "Other" category was requested most often with 82 tickets. Pest management requests and nonurgent wildlife sightings made up a large portion of this category. Nineteen invertebrate (e.g., centipede, wasp, cricket, or spider) and house mouse requests were rerouted through the Integrated Pest Management system when applicable, and all wildlife sightings were documented. There was one notable wildlife issue, spanning several months to resolve, involving a bee colony established within the wall of a building in TA-1. Honey bees (*Apis mellifora*) do not necessarily fall under Facilities' purview. Ecology Program personnel worked with a beekeeper, contractors, and Facilities personnel to successfully relocate the bees from the wall and close the opening (Figure 4-17).

Figure 4-17. Ecology Program personnel being lifted to the side of a building in TA-1 where a honey bee (*Apis mellifora*) colony had established (left); a healthy gray fox (*Urocyon cinereoargenteus*) sitting on a windowsill in TA-1 was left alone to self-release (right)

There were 36 snake removal tickets in 2022, a slight increase from 2021 (32 tickets). Of the 36 tickets, 16 were for venomous snakes. Prairie rattlesnakes (*Crotalus viridis*) continue to be the most common venomous snakes encountered with 14 removals, followed by bullsnakes (*Pituophis catenifer*) with 8 removals. Other snakes relocated include coachwhip (*Masticophis flagellum*), desert massasauga (*Sistrurus catenatus edwardsii*), ringneck snake (*Diadophis punctatus),* and Western diamondback rattlesnake (*Crotalus atrox*) (Table 4-27). Occasionally, Ecology Program personnel are unable to locate the snake when they arrive at the location to remove it. This was the case for eight snake removal tickets in 2022.

Table 4-27. Snake removal tickets, 2022

Common Name	Scientific Name	Number of Tickets
Prairie rattlesnake	*Crotalus viridis viridis*	14
Bullsnake	*Pituophis catenifer*	8
Unknown (snake not located)		8
Coachwhip	*Masticophis flagellum*	2
Western diamondback rattlesnake	*Crotalus atrox*	2
Desert massasauga	*Sistrurus catenatus edwardsii*	1
Ringneck snake	*Diadophis punctatus*	1
Total		**36**

Between 2020 and 2022, raccoons (*Procyon lotor*) were a commonly reported sight across TA-I. Lower levels of human traffic (with increased telecommuting in response to COVID-19 restrictions) likely drove this increase as animals appeared more comfortable foraging through outdoor trash receptacles during normal working hours. In response to this uptick, approximately 70 old-style trash receptacles were replaced with new wildlife-proof bins in 2022. Proactively removing attractants is the best way to reduce unwanted human interactions with urban wildlife.

4.7.3 Work Orders and Projects

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

Program Activities and Results 2022: Eco Tickets for Work Orders and Projects

In 2022, Ecology Program personnel received 435 Eco Ticket requests for biological surveys (Figure 4-16). That is a slight decrease from 460 in 2021. Of these 435 tickets, 338 tickets (over 70 percent), were part of "Facilities Work Orders." These are routine, small-scope requests generated by Infrastructure Operations personnel. Campus maintenance activities—such as tree trimming; building, walkway, and waterline repairs; and mowing—are included in this work order category. The remaining 97 requests were part of "NEPA ID" requests or projects that didn't fall under routine maintenance activities. Outdoor testing and large-scale construction activities made up the majority of the "NEPA ID" requests for biological surveys.

Chapter 5. Terrestrial Surveillance Program

Coyote (*Canis latrans*)

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

Terrestrial Surveillance Program personnel collect environmental media (soil, sediment, and vegetation) samples on a calendar-year basis, 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 (Sandia 1973). Nonradiological surveillance sampling began in 1993 with the implementation of the Terrestrial Surveillance Program and included the collection of samples for metal analyses.

5.1 Regulatory Criteria

The Terrestrial Surveillance Program is designed to address DOE O 458.1, Change 4 (LtdChg), *Radiation Protection of the Public and the Environment* (DOE O 458.1, Change 4 (LtdChg) 2020), which establishes standards and requirements to protect the public and the environment from undue risk from radiation associated with radiological activities under DOE control.

The Terrestrial Surveillance Program is also designed to satisfy Sandia's Environmental Management System objectives, and is certified to ISO 14001:2015 (ISO 14001:2015 2015). Reporting is done in accordance with DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting* (DOE O 231.1B, Admin Change 1 2012).

5.2 Sample Locations and Media

Terrestrial Surveillance Program personnel use three sample location classifications: on-site, perimeter, and off-site.

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

The on-site sampling locations (Figure 5-1) 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 5-1). The established off-site sample locations are in the Albuquereque area in central New Mexico (Figure 5-2).

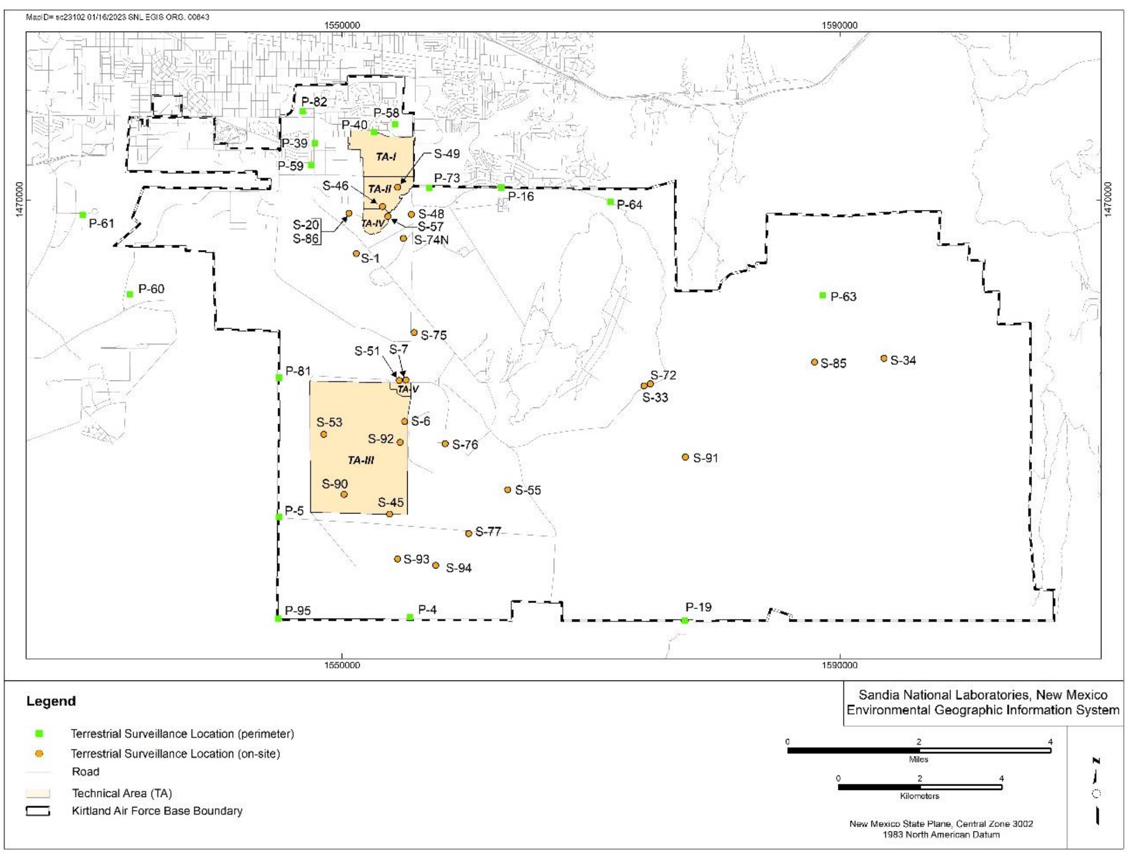


Figure 5-1. Terrestrial Surveillance Program on-site and perimeter sampling locations

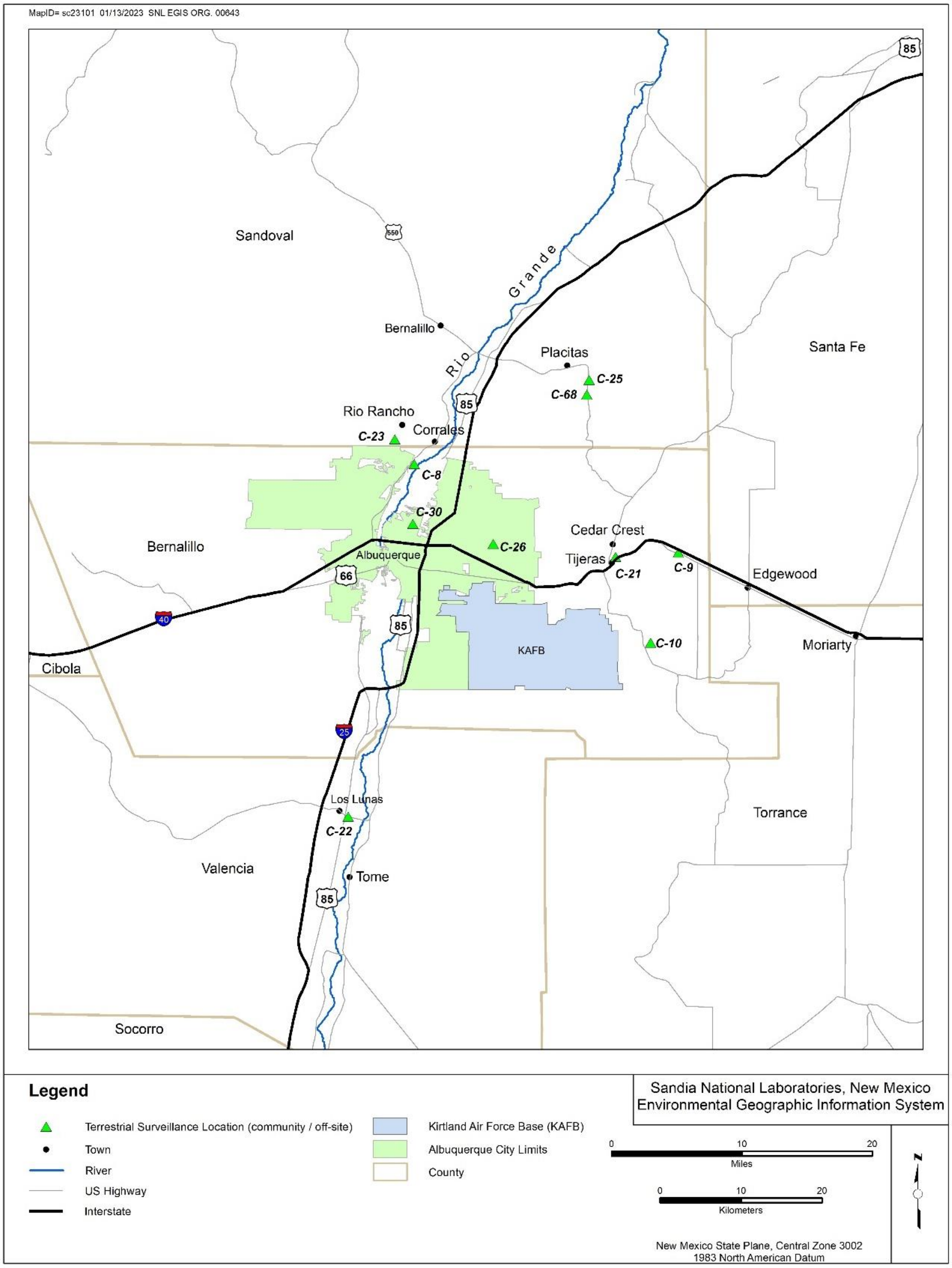


Figure 5-2. Terrestrial Surveillance Program off-site sampling locations

The various environmental sample media that are collected include surface soil (less than two inches deep), arroyo and river sediment samples, and vegetation. Vegetation samples, which are collected from small leafy plants, are used to monitor the potential uptake of radioactive and nonradiological materials from the soil. Environmental dosimeters, deployed and collected quarterly, are used to measure the cumulative ambient external radiation dose and to approximate the dose potentially received from natural and nonnatural sources. Table 5-1, Table 5-2, and Table 5-3 list the sampling locations, the type of media collected, and the analytical parameters sampled at the on-site, perimeter, and off-site locations, respectively.

Table 5-1. On-site terrestrial surveillance locations, sample media, and parameters

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

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

Table 5-2. Perimeter terrestrial surveillance locations, sample media, and parameters

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

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

Table 5-3. 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	X
C-21	Bernalillo Fire Station 10, Tijeras				X
C-22	Los Lunas Fire Station				X
C-23	Rio Rancho Fire Station, 19th Avenue				X
C-25	Placitas Fire Station	X		X	X
C-26	Albuquerque Fire Station 9, Menaul Boulevard Northeast				X
C-30	Albuquerque Fire Station 6, Griegos Road Northwest				X
C-68	Las Huertas Creek		X		

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

5.3 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* (Sandia 2022).

Contract 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* (Sandia 2020). Samples were analyzed for the following parameters: specific metals, high explosive compounds, perchlorate, and select radionuclides, as specified in Table 5-1, Table 5-2, and Table 5-3. The specific metals list includes the following: aluminum, antimony, arsenic, beryllium, cadmium, chromium (total), copper, iron, lead, magnesium, nickel, selenium, silver, thallium, uranium (total), and zinc. A select list of radionuclides compiled from process knowledge of operations at SNL/NM includes the following: actinium-228, americium-241, cesium-137, tritium, uranium-235, and uranium-238.

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

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

5.4 Data Analysis and Methodology

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

5.4.1 Statistical Analysis

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

The statistical analysis results are used to identify sample results for possible follow-up actions, such as resampling and additional investigation. When the sample results at an on-site location are significantly different than and greater than the community and perimeter results and the sample results at the on-site location are trending upward, it is noted for further evaluation. A discussion of these results (see Section 5.5) includes location, analyte, sample matrix, and summary statistics (number of samples, mean, median, standard deviation, maximum and minimum for the on-site location data set, and the value for the current year).

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

5.4.2 Other Reference Comparisons

Analytical results for metals in soil and sediment samples may also be compared to values in the following references (Table 5-4):

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

Table 5-4. Comparison reference values for metals in soil

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

[a] Source: Dragun and Chekiri 2005.
[b] Source: NMED 2022.
[c] Source: Kabata-Pendias 2000.
[d] Refers to uranium (soluble salts).
NA = not available
ND = not detected

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

Environmental dosimeter data is compared to established natural background (terrestrial and cosmic) radiation levels in the Albuquerque area. Levels in the Albuquerque area are elevated when compared to much of the United States due to the higher elevation and the presence of radionuclides in the soil and bedrock. The local annual radiation dose from natural background sources (indoor radon not included) is 89 mrem (Mauro and Briggs 2005).

5.5 Program Activities and Results 2022: Terrestrial Surveillance

The following Terrestrial Surveillance Program activities occurred in 2022:

- Annual soil and sediment sampling occurred in May 2022 at designated locations.
- The quarterly exchange (deployment and retrieval) of environmental dosimeters occurred at designated locations.

The full analytical results for radiological parameters (including environmental dosimeters) and nonradiological parameters for the 2022 sampling events are provided in Appendix B, "Terrestrial Surveillance Analytical Results in 2022."

5.5.1 Radiological Results

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

5.5.2 Dosimeter Results

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

The average dose rate summary statistics for 2022 are shown in Table 5-5. The average annual dose rates are below the local estimated value of 89 mrem from natural background sources (Mauro and Briggs 2005). The difference may be attributed to a variety of elevations, the proximity to bedrock, and the spontaneous nature of radioactivity.

Table 5-5. Dosimeter dose rate summary statistics by location classification, 2022

Location Classification	Number of Observations	Average (mrem/year)	Median (mrem/year)	Standard Deviation (mrem/year)	Minimum (mrem/year)	Maximum (mrem/year)
On-site	7	71	73	8.7	55	83
Perimeter	7	72	74	10.1	56	88
Off-site	7	64	70	10.5	46	73

5.5.3 Nonradiological Results

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

Metals

The results of the statistical analysis for metals identified eight instances of statistical significance (population difference and increasing trend). All metal results from this group were also compared to values referenced in Section 5.4 and provided in Table 5-4 and to results from previous years. Table 5-6 presents the metals results and summary statistics for the statistically significant metals.

Arsenic

One on-site location (S-91 sediment sample) was identified as statistically significant for arsenic with a result of 3.47 mg/kg. The result is below the NMED soil screening level for residential use, within the range of values for New Mexico surface soils (Table 5-4), and within the historical range for the dataset.

Beryllium

One on-site location (S-91 sediment sample) was identified as statistically significant for beryllium with a result of 0.366 mg/kg. The result is below the NMED soil screening level for residential use, below the range of values for New Mexico surface soils (Table 5-4), and within the historical range for the dataset at this location.

Chromium (Total)

One on-site location (S-34 soil sample) was identified as statistically significant for chromium (total) with a result of 16.6 J mg/kg. The J-qualified data indicates the result is an estimated value. The result is below the NMED soil screening level for residential use and is within the range of values for New Mexico surface soils (Table 5-4). The result represents a maximum for the dataset at this location.

Copper

One on-site location (S-33 soil sample) was identified as statistically significant for copper with a result of 11 J mg/kg. The J-qualified data indicates the result is an estimated value. The result is below the NMED soil screening level for residential use, within the range of values for New Mexico surface soils (Table 5-4), and within the historical range for the dataset at this location.

Nickel

Two on-site locations (S-72 sediment sample and S-34 soil sample) were identified as statistically significant for nickel with a result of 11.1 mg/kg for S-72 and 13.5 mg/kg for S-34. The results are below the NMED soil screening level for residential use, within the range of values for New Mexico surface soils (Table 5-4), and within the historical ranges for the dataset at these locations.

Selenium

One on-site location (S-91 sediment sample) was identified as statistically significant for selenium with a result of 1.59 mg/kg. The result is below the NMED soil screening level for residential use. The result is above the range of values for New Mexico surface soils, below the range of values for trace elements in soil (Table 5-4), and represents a maximum for the dataset at this location.

Thallium

One on-site location (S-34 soil sample) was identified as statistically significant for thallium with a result of 0.163 J mg/kg. The J-qualified data indicates the result is an estimated value. The result is below the NMED soil screening level for residential use, below the range of values for New Mexico surface soils (Table 5-4), and within the historical range for the dataset at this location.

No NMED soil screening levels for metals were met or exceeded; therefore, no further action is warranted. All other metals results for 2022 were not statistically significant in both tests (population and trend). Sampling will continue in the next calendar year.

High Explosive Compounds

Three on-site locations (S-90, S-93, and S-94; all soil samples) were analyzed for high explosive compounds (Figure 5-1). There was one detection (S-93) for rapid-detonating explosive with a result of 219 J μg/kg. The J-qualified data indicates the result is an estimated value. There were no detections above the method detection limit for any other high explosive compounds.

Perchlorate

One on-site location (S-53; soil sample) was analyzed for perchlorate (Figure 5-1). The result was 0.045 J mg/kg. The J-qualified data indicates the result is an estimated value due to the lack of matrix-specific accuracy data. The estimated result is below the NMED soil screening level of 54.8 mg/kg for residential use (NMED 2022).

Table 5-6. Statistically significant metals summary, 2022

Analyte	Location	Sample Matrix	Historical Dataset: Number of Samples	Mean (mg/kg)	Median (mg/kg)	Standard Deviation (mg/kg)	Minimum (mg/kg)	Maximum (mg/kg)	New Mexico Soil Screening Level[a]: Residential (mg/kg)	Industrial (mg/kg)	2022 Result (mg/kg)
Arsenic	S-91	Sediment	9	3.8	3.5	1.9	1.1	7.8	13.0	208	3.47
Beryllium	S-91	Sediment	9	0.377	0.371	0.098	0.181	0.548	156	2,580	0.366
Chromium (total)	S-34	Soil	13	13.4	13	2	10.5	16.6 J	45,200	314,000	16.6 J
Copper	S-33	Soil	13	9.9	10.2	1.3	7.9 J	11.6	3,130	51,900	11 J
Nickel	S-72	Sediment	13	10	9.2	2.8	7.1	17.7	1,560	25,700	11.1
Nickel	S-34	Soil	13	12.3	12.2	1.1	10.4 J-	14.2 J	1,560	25,700	13.5
Selenium	S-91	Sediment	9	1.199	1.08	0.258	0.298 UJ	1.59	391	6,490	1.59
Thallium	S-34	Soil	13	0.143	0.135	0.013	0.121 U	0.166 J	0.78	13.0	0.163 J

Note: Statistical data is from 2010 to 2022.
[a]Source: NMED 2022.
J = The associated numerical value was an estimated quantity.
J- = The associated numerical value is an estimated quantity with a suspected negative base.
UJ = The analyte was analyzed for but was not detected. The associated value was an estimate and might be inaccurate or imprecise.

5.5.4 Additional Activities and Variances

Terrestrial Surveillance Program sampling in 2022 was conducted with the following variance: due to ongoing drought conditions, there was insufficient vegetation for collection at any of the designated locations.

Chapter 6. Air Quality Compliance and Related Programs

Sandia sunset

OVERVIEW ■ Air quality personnel help Sandia operations maintain compliance with applicable air quality regulations and policies. Meteorological personnel provide decision support services, data, and analyses to all programs and operations that require meteorological information.

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

- Air Quality Compliance Program (Section 6.1)
- Ambient Air Surveillance Program (Section 6.2)
- Meteorology Program (Section 6.3)
- Radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAP) Program (Section 6.4)

6.1 Air Quality Compliance Program

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

6.1.1 Stationary Sources

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

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

Program Activities and Results 2022: Criteria Pollutant and Hazardous Air Pollutant Emissions from Permitted Stationary Sources

Most of the permitted stationary sources at SNL/NM are boilers used for comfort heat and emergency generators. Criteria pollutant emissions from combustion are monitored based on operation and/or fuel use. As required, *CY2022 Stationary Source Emissions Inventory Report for Sandia National Laboratories* (DOE/NNSA/SFO 2021), was submitted to the City of Albuquerque Air Quality Program. Emissions data for permitted and registered stationary sources in 2022 are provided in Table 6-1.

Table 6-1. Permitted and registered stationary source emission data, 2022

Carbon Monoxide	Hazardous Air Pollutant	Nitrogen Oxide	Particulate Matter with a Diameter ≤ 10 µm	Sulfur Dioxide	Volatile Organic Compound
10.64	10.68	8.02	1.67	0.09	3.28

Note: All units are in tons per year.

Program Activities and Results 2022: 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 2022, potential emissions were 10.68 tons of hazardous air pollutants and 3.28 tons of volatile organic compounds. These emissions were within permitted limits.

Program Activities and Results 2022: Title V Operating Permit

DOE submitted a Title V Operating Permit application (DOE/NNSA/SFO 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.

Program Activities and Results 2022: Greenhouse Gas Emissions

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

Major stationary sources that emit at least 100,000 tons per year of carbon dioxide equivalent will be required to include greenhouse gases in their Title V permit applications. The fugitive emissions are only included in the major source determination when the source belongs to a listed source category in Section 302(j) of the Clean Air Act. SNL/NM emissions are not from a listed source category, and stack greenhouse gas emissions are much less than 100,000 tons per year of carbon dioxide equivalent.

As of October 1, 2021, EPA began implementation of the hydrofluorocarbon phasedown requirements in the American Innovation and Manufacturing Act of 2020, which was enacted as Section 103 in Division S, Innovation for the Environment, of the Consolidated Appropriations Act, 2021. The act provides EPA new authority to address the phasedown of listed hydrofluorocarbons in consumption and production to 15 percent of a 2011–2013 baseline by 2036. Hydrofluorocarbons are greenhouse gases with very high global warming potentials and are used as refrigerants, in fire-suppression systems, and in certain scientific equipment. More information on the American Innovation and Manufacturing Act can be found at EPA Final Rule – Phasedown of Hydrofluorocarbons (EPA n.d.).

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

Hydrofluorocarbons are used at SNL/NM in applications such as refrigeration, semiconductor manufacturing, and material analysis. Sandia personnel participate in DOE's HFC Task Team, which is tasked with eliminating their use or emissions wherever feasible within the complex.

Greenhouse gas emissions are calculated on a fiscal year basis. During fiscal year 2022, Sandia operations directly emitted a total of 137,674 tons of carbon dioxide equivalent (including fugitive greenhouse gas emissions).

In 2009, EPA issued the Mandatory Greenhouse Gas Reporting Rule (codified in 40 CFR 98, *Mandatory Greenhouse Gas Reporting* (40 CFR 98 2012)), which requires reporting of greenhouse gas data from specific categories of large sources and from suppliers that meet designated emissions thresholds. Sandia activities resulting in greenhouse gas emissions were below reporting thresholds in 2022.

Sandia's annual site sustainability plan documents greenhouse gas reductions, projected performance, and current status (see Section 8.3.1).

6.1.2 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* (40 CFR 82 2021), which require the following: recycle ozone-depleting substances and other refrigerants when servicing equipment, establish requirements for recycling and recovering equipment, repair substantial leaks in refrigeration equipment containing more than 50 pounds of refrigerant, and establish safe disposal standards.

At SNL/NM, ozone-depleting substances are used for comfort cooling for some buildings and for some limited research and development applications. Halon is contained in some fire-suppression systems and fire extinguishers.

6.1.3 Vehicles

As required by 20.11.100 NMAC, *Motor Vehicle Inspection—Decentralized* (20.11.100 NMAC 1995), an annual vehicle inventory and inspection plan was submitted to the City of Albuquerque for applicable vehicles owned by Sandia.

6.1.4 Open-Burn Permits

As required by 20.11.21 NMAC, *Open Burning* (20.11.21 NMAC 1995), 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)

Program Activities and Results 2022: Air Quality Compliance, Open-Burn Permits

A list of open-burn permits obtained in 2022 can be found in Chapter 10.

6.1.5 Fugitive Dust

As required by 20.11.20 NMAC, *Fugitive Dust Control* (20.11.20 NMAC 2008), DOE obtains fugitive dust permits for each applicable Sandia construction project that will disturb more than three-quarters of an acre of soil.

Program Activities and Results 2022: Air Quality Compliance, Fugitive Dust

A list of open-burn permits obtained in 2022 is included in Chapter 10.

6.2 Ambient Air Surveillance Program

Ambient air is surveilled through a network of air monitoring stations located on or near Sandia property (Figure 6-1). Program activities are reported on a fiscal-year basis unless otherwise noted. In fiscal year 2022, the stations monitored ambient air for particulate matter that has a diameter equal to or less than 2.5 micrometers ($PM_{2.5}$) and particulate matter that has a diameter equal to or less than 10 micrometers (PM_{10}).

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

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

Ambient air quality data collected by the City of Albuquerque are available at City of Albuquerque Air Quality Monitoring (City of Albuquerque n.d.).

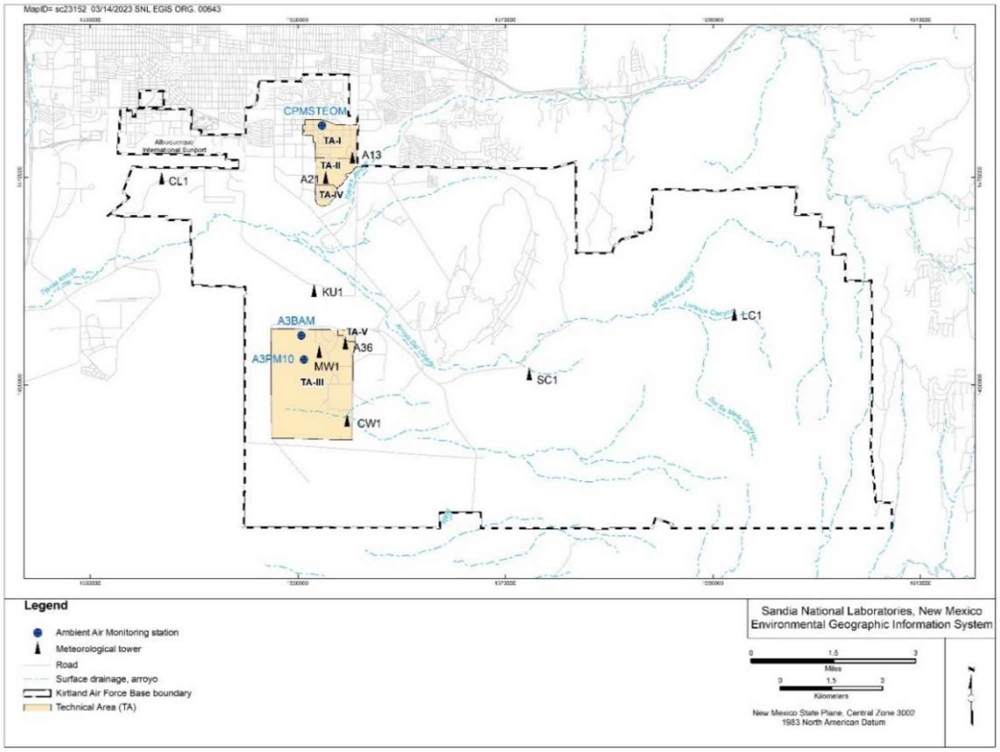


Figure 6-1. Clean air network of meteorological towers and ambient air monitoring stations

6.2.1 Monitoring Stations

Ambient air-monitoring stations used in fiscal year 2022 measured the following:

- $PM_{2.5}$ was measured at two monitoring locations (CPMSTEOM and A3BAM). These particulates were measured continuously and recorded in hourly concentrations 24 hours a day, 365 days per year, contingent on equipment functionality. The A3BAM replaced the malfunctioning A3TEOM unit in August 2022.
- PM_{10} was measured at one monitoring location (A3PM10). The air was sampled for a 24-hour period every quarter, contingent on equipment functionality.

6.2.2 Program Activities and Results 2022: Ambient Air Surveillance

Ambient air-monitoring data are presented here for fiscal year 2022. Laboratory data are available in Appendix C, "Ambient Air Surveillance Results in Fiscal Year 2022," and are summarized below.

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

The monthly and annual averages for one-hour $PM_{2.5}$ measurements in fiscal year 2022 are listed in Table 6-2.

Table 6-2. Monthly and annual averages for one-hour $PM_{2.5}$ measurements, fiscal year 2022

Sample Location	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Year Average
A3BAM [a]	---	---	---	---	---	---	---	---	---	---	3.54	3.30	**3.42**
CPMSTEOM	5.63	5.63	5.16	5.46	5.41	5.82	8.59	8.56	8.30	5.49	5.35	7.13	**6.38**

Note: All units are in µg/m³.
[a] A3BAM: This new beta attenuation mass monitor was installed in August 2022, replacing the malfunctioning tapered element oscillating microbalance monitor.

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

The highest monthly average PM_{10} concentration in fiscal year 2022 was 83.75 µg/m^3, which occurred in the second quarter of fiscal year 2022. The quarterly and annual averages for PM_{10} are provided in Table 6-3.

Table 6-3. Quarterly and annual averages for PM_{10}, fiscal year 2022

Sample Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year Average
A3PM10	1.38	83.75	0.74	19.98	**26.46**

Note: All units are in µg/m^3.

The PM_{10} samples are also analyzed for metals and radiological constituents, and the fiscal year 2022 averages are listed in Table 6-4. Most of the radionuclides are either naturally occurring or are short-lived decay daughter products detected during analysis and are not emitted from SNL/NM sources.

Table 6-4. Average results of PM_{10} analysis, fiscal year 2022

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Aluminum	µg/m^3	6.46E-02	2,000
Antimony	µg/m^3	DE	500
Arsenic	µg/m^3	DE	10
Barium	µg/m^3	1.45E-03	50
Beryllium	µg/m^3	DE	0.05
Cadmium	µg/m^3	2.24E-05	10
Calcium	µg/m^3	2.18E-01	2,000
Chromium	µg/m^3	1.76E-03	10
Cobalt	µg/m^3	4.10E-04	20
Copper	µg/m^3	2.17E-02	1,000
Iron	µg/m^3	7.41E-02	5,000
Lead	µg/m^3	6.73E-04	150
Magnesium	µg/m^3	2.69E-02	10,000
Manganese	µg/m^3	1.71E-03	200
Nickel	µg/m^3	2.79E-04	50
Potassium	µg/m^3	3.93E-02	2,000
Selenium	µg/m^3	DE	200
Silver	µg/m^3	DE	10
Sodium	µg/m^3	7.62E-02	5,000
Thallium	µg/m^3	DE	100
Uranium	µg/m^3	DE	200
Vanadium	µg/m^3	8.58E-05	50
Zinc	µg/m^3	3.86E-03	10
Actinium-228	pCi/m^3	DE	100
Alpha, gross	pCi/m^3	1.54E-03	0
Americium-241	pCi/m^3	DE	NE
Beryllium-7	pCi/m^3	1.38E-01	40,000
Beta, gross	pCi/m^3	2.23E-02	0
Bismuth-212	pCi/m^3	DE	700
Bismuth-214	pCi/m^3	DE	2,000

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Cesium-137	pCi/m^3	DE	400
Cobalt-60	pCi/m^3	DE	80
Lead-212	pCi/m^3	DE	80
Lead-214	pCi/m^3	DE	2,000
Neptunium-237	pCi/m^3	DE	0
Potassium-40	pCi/m^3	DE	900
Radium-223	pCi/m^3	DE	NE
Radium-224	pCi/m^3	DE	4
Radium-226	pCi/m^3	DE	1
Radium-228	pCi/m^3	DE	3
Sodium-22	pCi/m^3	DE	NE
Thorium-227	pCi/m^3	DE	0.7
Thorium-231	pCi/m^3	DE	NE
Thorium-234	pCi/m^3	DE	400
Uranium-235	pCi/m^3	DE	0.1
Uranium-238	pCi/m^3	DE	0.1

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

6.3 Meteorology Program

Meteorology Program personnel provide forecasts (e.g., wind speeds, precipitation percentages, and lightning possibilities) to inform go/no go decisions for future tests and analyses of past weather conditions (including wind gusts, average wind speed, and total precipitation values) to all Sandia programs and operations that require atmospheric information. Such parties include health and safety operations, emergency management and response, regulatory permitting and reporting programs, and general research and development groups. DOE directives and regulations applicable to the Meteorology Program are listed in "References."

6.3.1 Meteorological Monitoring Network

Meteorological monitoring at SNL/NM is conducted through a network of meteorological towers located throughout KAFB on or near Sandia property. The network includes seven 10-meter towers, one 30-meter tower, and one 60-meter tower (Table 6-5). Meteorological tower locations are shown in Figure 6-1. All towers are instrumented to measure temperature and wind velocity at 10 meters above the surface. Temperature and wind velocity are also measured at the top of the two tallest towers (30 meters and 60 meters).

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

Table 6-5. Meteorological towers

Tower	Height (m)
A13	30
A21	10
A36	60
CL1	10
CW1	10
KU1	10
LC1	10
MW1	10
SC1	10

6.3.2 Program Activities and Results 2022: Meteorological Monitoring

New Mexico's weather in 2022 was warmer and wetter than climatological means. The statewide temperature average was 54.6°F, 1.8 degrees above the normal of 52.8°F. Calendar year 2022 was the 17th-warmest year on record for New Mexico (National Weather Service n.d.). The statewide average precipitation was 14.19 inches, which was 0.20 inches above the normal of 13.99 inches. This made 2022 the 55th wettest year on record for New Mexico (National Weather Service n.d.). Local conditions across SNL/NM were generally in line with the statewide pattern, with drought conditions improving as the year progressed but ending 2022 in a moderate drought condition.

Tower A36 is a 60-meter tower used to describe general meteorology at SNL/NM owing to its central geographic position and the availability of all network measurements at this one location. In 2022, Tower A36 observations showed warmer and wetter conditions than the site's 1995–2019 climatological averages. Rainfall at Tower A36 totaled 9.84 inches, about an inch above the 8.86-inch average at that site. An early and active monsoon season with particularly impressive June totals more than offset a dry winter and spring. It is important to note that the Meteorological Program rain gauges do not have built-in heaters and can only measure snowfall when it melts. These measurements miss much of the actual snowfall total as the snow is blown off the top of the rain gauge. The annual mean temperature at Tower A36 was 58.1°F, 0.6°F above the 25-year average of 57.5°F. The months of April through September were all warmer than usual or near average. February, March, October, and November were cooler than their climatological averages.

The 2022 annual summary for Tower A36 is shown in Table 6-6.

Table 6-6. Annual climatic summary from Tower A36, 2022

Measurement	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Annual
Temperature (°C)													
Average daily low	−4.35	−5.75	0.07	5.41	10.80	16.50	19.30	17.40	14.20	6.54	−2.82	−2.84	6.20
Average daily high	10.10	10.20	15.90	23.20	29.10	30.90	33.60	30.50	29.70	19.40	12.10	9.65	21.20
Monthly mean	4.15	3.52	9.01	15.50	21.30	24.20	26.50	23.70	22.30	13.40	6.11	4.19	14.49
Extremes (°C)													
Low	−11.37	−15.20	−6.76	−3.29	1.87	13.08	15.50	14.59	9.71	−2.30	−7.65	−11.85	−15.20
High	15.28	18.49	26.26	29.23	33.71	37.70	38.33	35.22	33.72	27.31	21.49	15.64	38.33
Relative Humidity													
Humidity (percent)	46.80	40.40	34.40	18.90	15.00	37.70	40.10	50.50	42.60	55.10	42.40	53.00	39.74

Measurement	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Annual
Precipitation (cm)													
24-hour maximum	0.10	0.13	0.71	0.00	0.00	1.60	1.12	1.27	0.48	1.75	0.46	1.52	1.75
Monthly total	0.10	0.18	1.93	0.00	0.00	5.41	2.79	6.02	0.81	4.88	0.97	1.91	24.99
Wind Speed (m/sec)													
Highest 24-hour average	8.14	9.20	7.39	9.60	9.32	7.18	5.76	5.67	6.82	11.14	6.26	4.44	11.14
Monthly mean	3.12	3.44	3.67	5.00	5.29	3.90	3.42	3.59	3.47	3.54	3.34	2.83	3.72
Maximum gust	25.53	21.82	25.37	25.97	23.50	19.62	21.30	23.62	16.90	29.05	22.38	18.78	29.05
Barometric (mb)													
Pressure	837	836	833	832	831	834	837	837	837	837	835	835	835.08

Note: Winter precipitation that falls as snow is underestimated.

In general, the annual statistics for each of the monitoring towers were similar. However, daily conditions varied considerably across the meteorological network. This real-time variability of meteorological conditions has implications for the transport and dispersion of pollutants, which are important in atmospheric emergency release scenarios and air dispersion modeling. Table 6-7 shows some of the variations and extremes from the meteorological measurements throughout the year.

Table 6-7. Variations and extremes in meteorological measurements across the tower network, 2022

Meteorological Measurement	Minimum	Maximum	Spread
Temperature	**°C**	**°C**	**°C**
Average daily temperature range	14.38 Tower A21	16.19 Tower CW1	1.81
Average daily minimum temperature	5.02 Tower CW1	7.07 Tower CL1	2.05
Average daily maximum temperature	20.22 Tower SC1	21.61 Tower CL1	1.39
Average annual temperature	11.97 Tower LC1	14.67 Tower KU1	2.7
Annual temperature extremes	-16.20 Tower SC1	38.57 Tower MW1	54.77
Precipitation	**cm**	**cm**	**cm**
Maximum daily precipitation	1.55 Tower A21	3.05 Tower LC1	1.5
Greatest monthly precipitation variation	4.83 Tower A21	9.60 Tower LC1	4.78 October
Annual precipitation extremes	24.03 Tower A21	40.11 Tower LC1	16.08
Wind Speed	**m/sec**	**m/sec**	**m/sec**
Average daily maximum wind speed	9.25 Tower LC1	12.89 Tower A13	3.64
Average annual wind speed	3.56 Tower KU1	3.85 Tower CW1	0.29
Maximum annual wind gust	26.88 Tower LC1	30.09 Tower SC1	3.21

Note: Winter precipitation that falls as snow is underestimated.

6.3.3 Program Activities and Results 2022: Wind Monitoring

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 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 6-2. Typical diurnal variations and wind shifts cannot be seen in Figure 6-2.

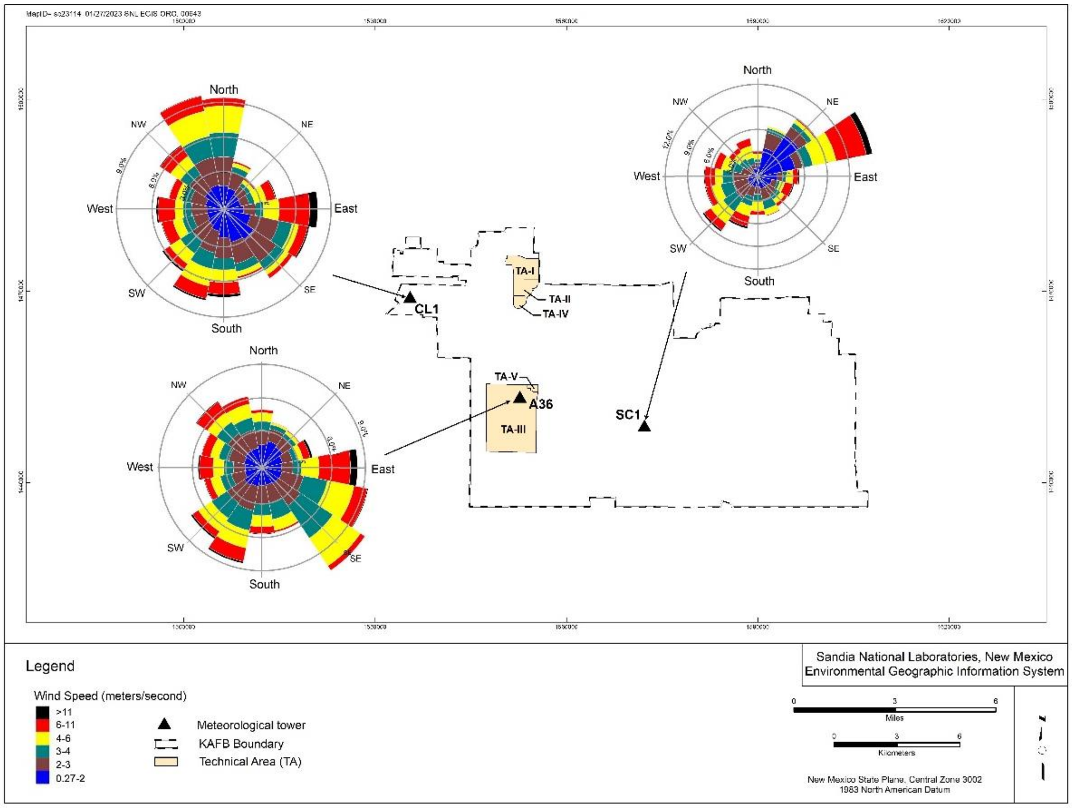


Figure 6-2. Annual wind roses at towers A36, CL1, and SC1

Figure 6-3 shows one example of the diurnal variations in wind speed and direction that occur across KAFB. Separate wind roses for day and night at Tower A36 show drastically different patterns.

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

Table 6-8 lists the predominant wind directions for daytime and nighttime periods for all towers in the network. Across the network, nighttime-predominant winds ranged from northerly to southeasterly. During the day, the predominant wind direction ranged from south-southwesterly to westerly.

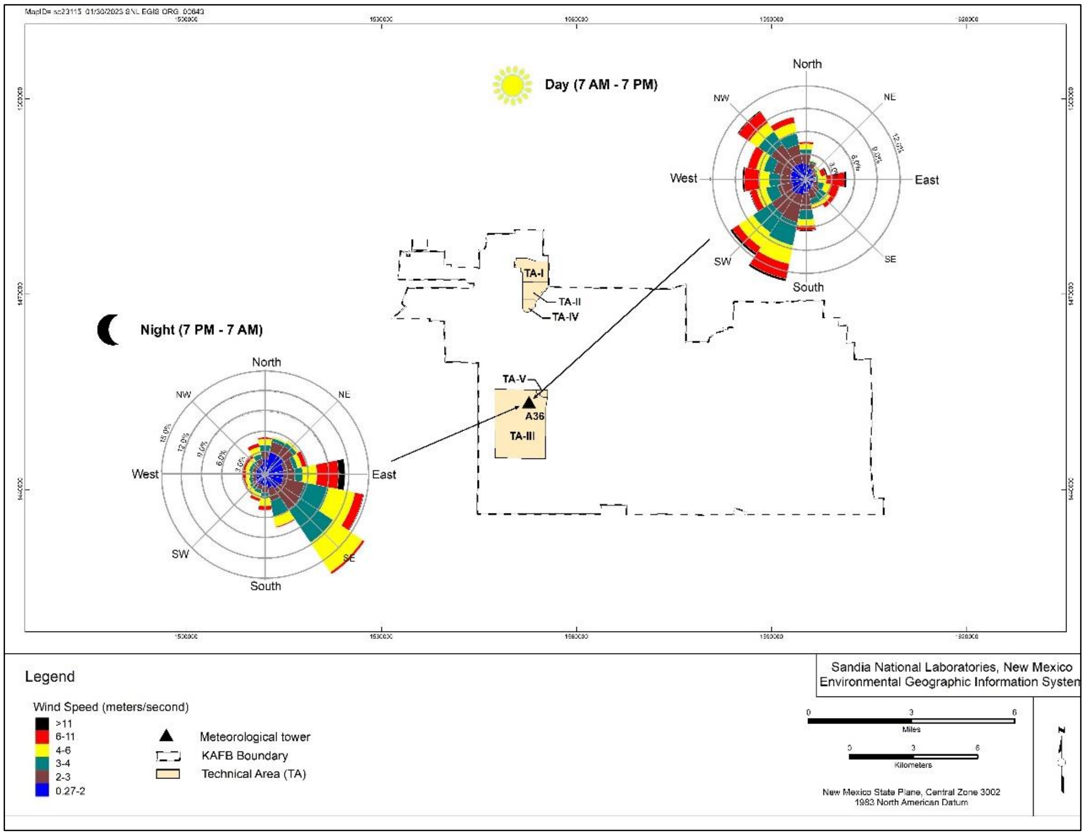


Figure 6-3. Annual wind roses for daytime and nighttime frequency at Tower A36

Table 6-8. Predominant wind directions for day and night periods by tower, 2022

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

6.4 Radionuclide National Emission Standards for Hazardous Air Pollutants Program

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

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

6.4.1 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 2022, SNL/NM* (Sandia 2022).

6.4.2 Program Activities and Results 2022: Facility Emissions

Point releases are emission sources that could potentially discharge material to the atmosphere through a facility's exhaust stack or rooftop vent. Table 6-9 lists the radionuclides and the total reported emissions from each of Sandia's radionuclide NESHAP sources in 2022, and Figure 6-4 shows the locations of facilities with the potential to emit radionuclides.

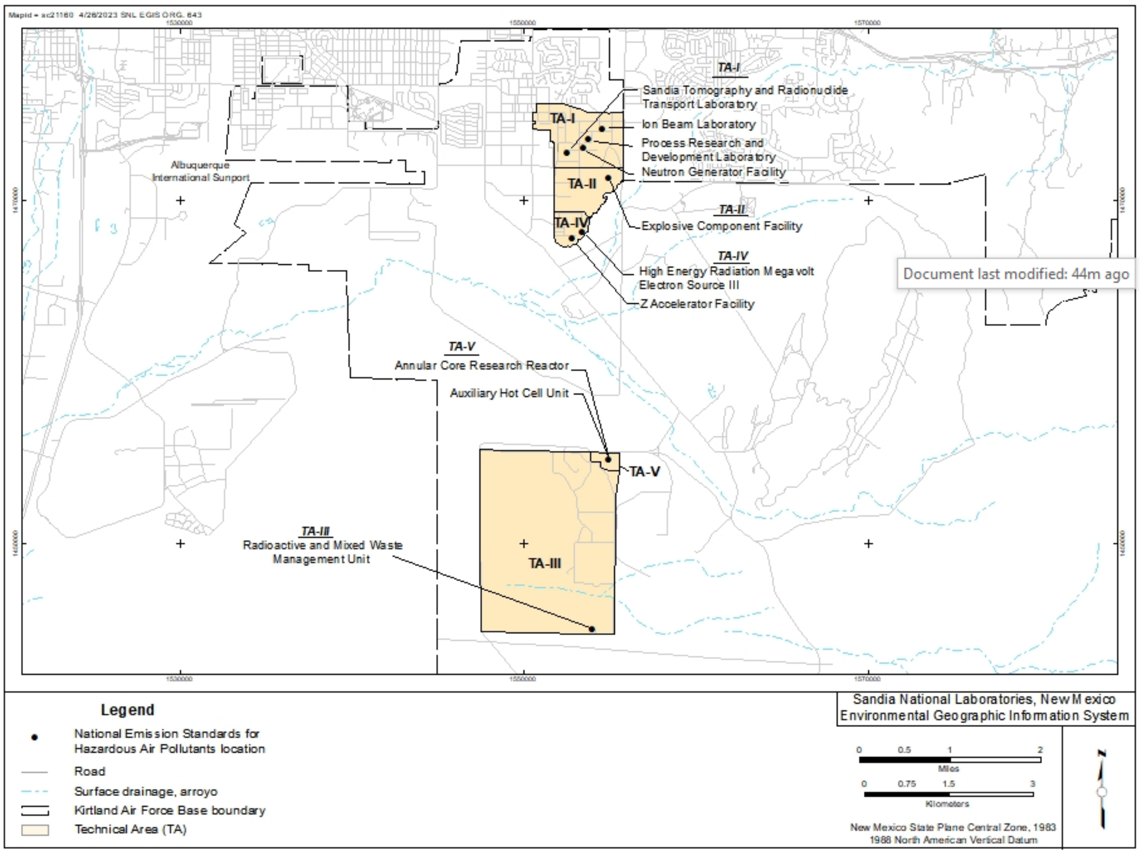


Figure 6-4. Locations of facilities with the potential to emit radionuclides

TA-I Sources

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

The Neutron Generator Facility is the nation's principal production facility for neutron generators. This facility currently emits only tritium. The facility has two stacks, but only the main stack in the Tritium Envelope North Wing is used. Although anticipated tritium releases do not exceed the regulatory threshold that requires 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. No emissions were reported from the Process Research and Development Laboratory in 2022.

The Sandia Tomography and Radionuclide Transport Laboratory is used to perform small-scale experiments. Activities at this laboratory could result in the occasional release of trace amounts of radionuclides. No emissions were reported from the Sandia Tomography and Radionuclide Transport Laboratory in 2022.

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 that requires continuous monitoring, monitoring is performed voluntarily at the Radioactive and Mixed Waste Management Unit as a best management practice.

TA-IV Sources

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

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

TA-V Sources

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

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

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.

Table 6-9. Radionuclide releases by NESHAP source, 2022

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	1.79
Auxiliary Hot Cell Unit, TA-V	Facility used to identify, sort, characterize, and repackage legacy nuclear materials for permanent removal; legacy material may include accountable nuclear material, spent nuclear fuel, and radiological material	Point	Periodic	Krypton-85 Strontium-90 Cesium-137 Tritium Samarium-151 Plutonium-241 Americium-241 Plutonium-238 Plutonium-239 Uranium-235m[a]	2.00E-08 1.50E-08 1.00E-08 1.30E-09 2.80E-10 2.10E-10 7.00E-11 2.80E-11 2.60E-11 2.60E-11
Explosives Components Facility, TA-II	Facility used to test neutron generator design and manufacturing	Point	Calculation	Tritium	3.00E-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	7.33E-04 7.30E-05
Ion Beam Laboratory, TA-I	Ion and electron accelerators used to study and modify materials systems	Point	Calculation	Tritium	13.3
Neutron Generator Facility, TA-I	Principal production facility used for neutron generators	Point	Continuous	Tritium	15.77
Radioactive and Mixed Waste Management Unit, TA-III	Facility used to handle radioactive and mixed waste	Point	Continuous and calculation	Tritium (oxide) Tritium (elemental) Plutonium-238 Plutonium-239 Plutonium-240 Plutonium-241 Plutonium-242 Americium-241 Uranium-234 Uranium-235 Uranium-238 Strontium-90 Cesium-137 Tritium (particulate)	7.34E-06 4.57E-06 6.91E-10 2.03E-06 7.50E-09 1.66E-08 4.34E-13 3.11E-09 3.70E-07 4.60E-08 1.18E-06 5.02E-06 5.02E-06 1.10E-03
Z Accelerator Facility, TA-IV	Experimental facility used to research light-ion inertial confinement fusion	Point	Calculation	Tritium	1.50E-03

Note: Monitoring methods include periodic, calculation, and continuous. Periodic is based on periodic measurements; calculation is based on known parameters; and continuous is based on continuous air-monitoring results.
[a] Uranium-235m is an excited nuclear isomer.

Emissions of Argon-41 and Tritium

In 2022, as with previous years, the highest emissions were from argon-41 and tritium. Historically, argon-41 and tritium have been the most significant contributors to the effective dose equivalent to the maximally exposed individual. Figure 6-5 shows the annual reported release of argon-41 and tritium for 2018 through 2022. 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.

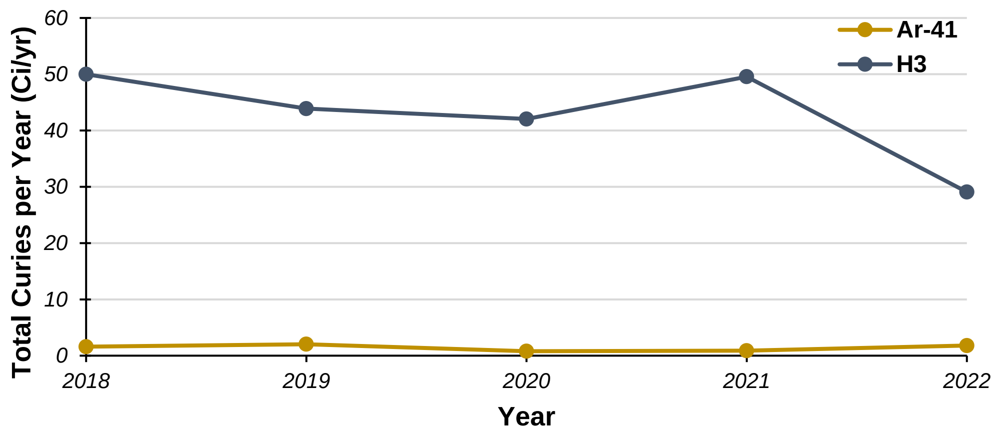


Figure 6-5. Atmospheric releases of argon-41 and tritium, 2018–2022

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 2022. 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.

6.4.3 Program Activities and Results 2022: Summary of Radionuclide Releases by Category

A summary of radionuclide releases by NESHAP source from SNL/NM operations in 2022 is provided in Table 6-9. Table 6-10 is a summary of activity releases in 2022 for specific radionuclides or groups of radionuclides by category. The quantities are associated with the listed release quantities from the facilities at SNL/NM as indicated in Table 6-9. The value for tritium is associated with all types of tritium released: elemental, oxide, and particulate. The values for noble gases are associated with argon-41 releases. Fission and activation products include radionuclides such as cesium-137, samarium-151, nitrogen-13, and oxygen-15. Radiostrontium is associated with strontium-90, and total uranium is the summation of all forms of uranium released. The actinides represent radionuclides, including americium-241 and various forms of plutonium. The other category includes krypton-85.

Table 6-10. Radiological releases by category, 2022

Summation of Radiological Atmospheric Releases (Curies/year)							
Tritium	Noble Gases (half-life < 40 days)	Fission and Activation Products (half-life < 3 hours)	Fission and Activation Products (half-life > 3 hours)	Total Radiostrontium	Total Uranium	Other Actinides	Other
2.91E+01	1.79E+00	8.06E-04	5.03E-06	5.04E-06	1.60E-06	2.06E-06	2.00E-08

6.4.4 Program Activities and Results 2022: Assessment of Potential Dose to the Public

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

To assess compliance, DOE facilities subject to Subpart H submit annual emission data. Emissions are modeled using version 4.1.1 of the EPA Clean Air Act Assessment Package-1988 (EPA 2022) to estimate the annual dose to each of the identified public receptors.

The radiologic dose information is provided in Table 6-11 for the on-site and off-site maximally exposed individuals. Population doses for the regional population as well as residents on Kirtland Air Force Base are provided based on the product of the collective dose and the population.

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 (U.S. Census Bureau 2022). The 2020 census data was used to create a new population file for 2022 reporting. In addition, the beef and dairy cattle numbers and the food crop area fraction were updated using 2017 and 2019 agricultural statistics. The New Mexico Department of Agriculture supplied the statistics ((U.S. Department of Agriculture National Agricultural Statistics Service 2017); (USDA and NMDOA 2019)).

6.4.5 Program Activities and Results 2022: Detailed 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 2022). Individual effective dose equivalents to on-site and off-site receptors from emission sources are presented along with collective regional and KAFB population dose in Table 6-11.

Table 6-11. Calculated dose assessment results for on-site and off-site receptors and for collective populations, 2022

Dose to Receptor	Location	Calculated Dose	EPA and DOE Dose Limit for Air Pathway
Individual Dose			
On-site receptor effective dose to the maximally exposed individual	Honeywell Systems Support Site	2.64E-03 mrem/year	10 mrem/year
Off-site receptor effective dose to the maximally exposed individual	Eubank Gate area	6.54E-03 mrem/year	10 mrem/year

Dose to Receptor	Location	Calculated Dose	EPA and DOE Dose Limit for Air Pathway
Collective Dose			
Collective regional population	Fifty-mile radius of KAFB	2.66E-02 person-rem/year	No standard available
Collective KAFB population	KAFB housing	1.58E-02 person-rem/year	No standard available

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

In 2022, as with previous years, the primary radionuclides released from SNL/NM facilities were tritium and argon-41. In 2022, the on-site maximally exposed individual was located on KAFB at the Honeywell Systems Support Site. The on-site maximally exposed individual dose of 2.64E-03 mrem/year resulted primarily from tritium releases at the Ion Beam Laboratory and the Neutron Generator Facility and from argon-41 releases at the Annular Core Research Reactor. The off-site maximally exposed individual dose of 6.54E-03 mrem/year was located at the KAFB Eubank Gate area and primarily resulted from tritium releases at the Ion Beam Laboratory and the Neutron Generator Facility. Both doses were well below the 10 mrem/year EPA NESHAP standard. By comparison, the average person in the United States receives 311 mrem/year from natural background radiation (NCRP 2009).

Collective Dose

The collective population dose resulting from all SNL/NM radiological emissions was calculated for both KAFB and the regional area (Table 6-11). Collective dose calculations are not required by NESHAP regulations; however, a collective calculation provides a useful numerical comparison with the public dose from year to year. Collective dose is calculated by multiplying a representative individual dose within a population by the total population. The collective population dose was calculated for both the KAFB housing areas and the general Albuquerque area population within a 50-mile radius of KAFB.

Regional

The Albuquerque regional collective population dose in 2022 was 2.66E-02 person-rem/year. This is comparable to the average over the past five years for regional collective population dose data.

Kirtland Air Force Base

The collective dose to the KAFB population is estimated by summing the products of the representative housing complex receptor dose value and the associated housing complex population. The 2022 calculation resulted in an estimated population dose of 1.58E-02 person-rem/year.

Unplanned Radionuclide Releases

SNL/NM facilities did not have any unplanned radionuclide releases in 2022.

SNL/NM, (3/23/15) IPOC, Cooper's hawk (*Accipiter cooperii*)

Chapter 7. Water Quality Programs

Coyote Springs

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

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

- Environmental Release, Response, and Reporting Program (Section 7.1)
- Oil Storage Program (Section 7.2)
- Safe Drinking Water Protection Program (Section 7.3)
- Stormwater Program (Section 7.4)
- Surface Discharge Program (Section 7.5)
- Wastewater Discharge Program (Section 7.6)

NMED and the ABCWUA implement EPA standards at the state and local levels. Currently, EPA Region 6 implements stormwater regulations under National Pollutant Discharge Elimination System (NPDES) permits. Sandia personnel adhere to these regulations and to the water quality guidelines in DOE O 458.1 Change 4 (LtdChg), *Radiation Protection of the Public and the Environment* (DOE O 458.1, Change 4 (LtdChg) 2020). Information is reported on a calendar-year basis unless otherwise noted.

7.1 Environmental Release, Response, and Reporting Program

Environmental Release, Response, and Reporting Program personnel are contacted in the event of any spilling, leaking, pouring, emitting, emptying, discharging, injecting, pumping, escaping, leaching, dumping, or disposing of material into the environment, which may include, but is not limited to, soil, water, air, and drain systems. A set of procedures provides specific instructions for reporting an environmental release and for developing an accurate report. Environmental Release, Response, and Reporting Program personnel implement the procedures for and document all aspects of an environmental release and report on chemical use to ensure compliance with federal, state, and local reporting requirements.

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

7.1.1 Program Activities and Results 2022: Environmental Release, Response, and Reporting

Events Reported to the New Mexico Environment Department

In 2022, there were no releases to the environment that required reporting to NMED.

Events Categorized as a DOE Reportable Occurrence

In 2022, no releases to the environment that were reported to outside agencies met the criteria for DOE-reportable occurrences under DOE O 232.2A, Chg1 (MinChg), *Occurrence Reporting and Processing of Operations Information* (DOE O 232.2A, Chg 1 (MinChg) 2017) (see Chapter 8).

Chemical Inventory and Toxic Release Inventory Reporting

The chemical inventory report and the toxic release inventory report for 2022 were submitted to EPA and support compliance with EPCRA. The chemical inventory report documents toxic chemicals in use and all chemical purchases. Chemical use at SNL/NM was above the reporting threshold for submitting a toxic release inventory report for lead and lead compounds.

7.2 Oil Storage Program

Oil Storage Program activities support regulatory compliance associated with the management, operation, and maintenance of oil storage containers and equipment. As required by 40 CFR 112, *Oil Pollution Prevention* (40 CFR 112 2011), Oil Storage Program personnel maintain and implement the site-wide *Sandia National Laboratories Spill Prevention, Control, and Countermeasure Plan* (Sandia 2016), which describes the oil storage facilities at SNL/NM and the mitigation controls in place to prevent inadvertent discharges of oil.

The oil storage capacity at SNL/NM is approximately 2.2 million gallons. The inventory of oil storage containers operating under the *Sandia National Laboratories Spill Prevention, Control, and Countermeasure Plan* includes 45 stationary aboveground storage tanks. Additional oil storage capacity in 55-gallon drums, mobile and portable containers, mobile refuelers, and oil-filled operational equipment (e.g., transformers, hydraulic elevators, and other hydraulic equipment) is used throughout the site on an as-needed basis. All oil storage locations with regulated containers are equipped with passive and/or active secondary containment. Passive secondary containment structures include concrete-lined basins, retaining walls, containment reservoirs, double-wall tanks, sloped pads, trenches, and containment pallets. Active secondary containment measures include sorbent materials, spill kits, and drain covers.

Nine of the 45 stationary aboveground storage tanks that were operational in 2022 are subject to NMED Petroleum Storage Tank Bureau regulation and registration. Registration numbers for the nine aboveground storage tanks regulated by the NMED Petroleum Storage Tank Bureau are provided in Table 10-1. The NMED Petroleum Storage Tank Bureau owner identification number for SNL/NM-registered tanks is 14109, and the operator identification number is 13476.

7.2.1 Program Activities and Results 2022: Oil Storage

In 2022, Oil Storage Program personnel performed an annual inspection of all stationary shop-built oil storage tanks in accordance with the Steel Tank Institute/Steel Plate Fabricators Association standard SP001, *Standard for the Inspection of Aboveground Storage Tanks* (STI/SPFA 2001). In addition, seven field-fabricated tanks were inspected in 2022 in accordance with the American Petroleum Institute Standard 653, *Tank Inspection, Repair, Alteration, and Reconstruction* (American Petroleum Institute 2014), for out-of-service inspections of tank bottoms.

Two 20,000-gallon underground oil storage tanks were operational at SNL/NM in the first half of 2022 and registered with the NMED Petroleum Storage Tank Bureau. In April and May of 2022, both underground storage tanks were permanently closed and removed. Closure and removal of the underground storage tanks was performed in accordance with the requirements of 20.5.115 NMAC, *Out-of-Service Storage Tank Systems and Closure* (20.5.115 NMAC 2018). Soil samples were collected from beneath the underground storage tanks and associated piping immediately following removal. Sample analysis results indicated that no release had occurred during the operational history of the tanks.

The two 20,000-gallon underground storage tanks removed during 2022 are being replaced by two new 20,000-gallon aboveground storage tanks. The tanks have double-wall construction and leak-detection monitoring equipment. The project to install the two new aboveground storage tanks remains ongoing and will be completed in early 2023. Upon completion of the installation, the two tanks will be registered with the NMED Petroleum Storage Tank Bureau.

Two new backup power generator installation projects were completed in 2022. The generators are equipped with diesel fuel storage tanks (i.e., base tanks) that have double-wall construction and are equipped with leak detection monitoring. The generator base tanks required registration with the NMED Petroleum Storage Tank Bureau (see Table 10-1).

7.3 Safe Drinking Water Protection Program

Safe Drinking Water Protection Program activities ensure the availability of safe drinking water for all people at Sandia-operated facilities. Program personnel work in conjunction with Infrastructure Operations personnel to maintain compliance with applicable federal, state, local, and DOE requirements. Program personnel coordinate operations that maintain, test, and inspect appropriate backflow-prevention activities, and submit the Annual Sandia Field Office Backflow/Cross Connection Certification to KAFB.

KAFB supplies water to the DOE-owned drinking water distribution system at SNL/NM. The KAFB water system is registered with the NMED Drinking Water Bureau as a Community Public Water System. Because KAFB is identified as the sole registered party, the NMED Drinking Water Bureau regulates the distribution system on KAFB. The distribution system on DOE property is operated and maintained by Sandia personnel as a component of the KAFB Public Water System. Safe Drinking Water Protection Program personnel coordinate with KAFB to support compliance activities such as sampling, inspections, or access to SNL/NM sites as agreed upon in a memorandum of understanding between the DOE National Nuclear Security Administration Sandia Field Office and the KAFB 377th Air Base Wing, which covers public water system operations (DOE and KAFB 2018).

KAFB publishes an annual summary of drinking water quality at Kirtland Air Force Base Environmental Assessments (Kirtland Air Force Base n.d.).

7.4 Stormwater Program

Stormwater Program personnel maintain regulatory compliance with federal, state, tribal, and local stormwater requirements via NPDES permit coverage consisting of the CGP, the Middle Rio Grande Municipal Separate Storm Sewer System (MS4) Permit, and the Multi-Sector General Permit (MSGP). Activities include preparing stormwater pollution prevention plans and stormwater management plans, conducting routine inspections, monitoring stormwater quality, and providing training on stormwater pollution prevention practices. Compliance with NPDES permits reduces the impact of construction, industrial, and municipal activities on the environment. EPA maintains administrative and enforcement authority for NPDES permits in New Mexico.

7.4.1 Regulatory Criteria

Stormwater is regulated because it can potentially discharge to "waters of the United States" as defined under the Clean Water Act. Surface water discharged from SNL/NM is required to meet the State of New Mexico requirements listed in 20.6.4 NMAC, *Standards for Interstate and Intrastate Surface Waters* (20.6.4 NMAC 2000), in addition to federal requirements specific to individual stormwater permits.

7.4.2 Surface Waters and Stormwater Drainage

The primary surface water features in the vicinity of SNL/NM are the Tijeras Arroyo and its named tributary, Arroyo del Coyote (Figure 7-1). Both are designated as "waters of the United States" and are ephemeral, flowing only for short durations in response to direct precipitation. The Tijeras Arroyo originates to the northeast of SNL/NM and flows roughly to the west from DOE lands to the Rio Grande. The majority of stormwater that originates in TA-I, TA-II, and TA-IV is discharged to the Tijeras Arroyo. Some of the stormwater originating within remote areas of SNL/NM is discharged to either the Tijeras Arroyo or Arroyo del Coyote as well.

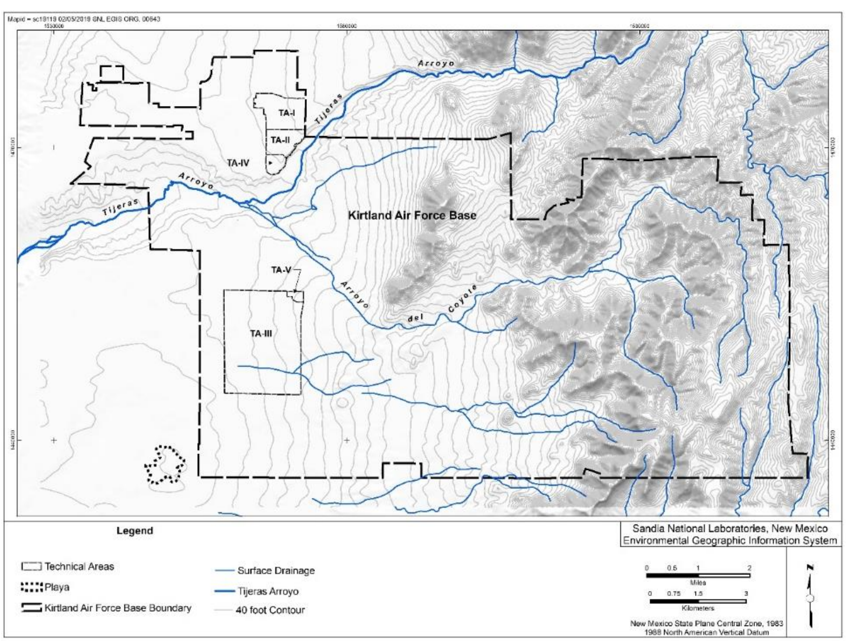


Figure 7-1. Location of primary surface water drainages and Waters of the United States that receive stormwater discharges from SNL/NM

7.4.3 Construction General Permit

The CGP regulates stormwater discharges associated with construction activities. Notices of Intent are submitted to EPA for coverage under the CGP every time it is anticipated that a construction project will disturb one or more acres of land. A site-specific stormwater pollution prevention plan is developed for each construction site, including details about installing best management practices, implementing pollution prevention measures, conducting site inspections on a routine basis and after storm events, and stabilizing all disturbed areas of a site upon completion of a project.

Stormwater Quality Monitoring per the Construction General Permit

Water quality monitoring has not been historically, and is not currently, required under the CGP at SNL/NM. Certain construction activities and conditions, such as dewatering shallow groundwater, can lead to water quality monitoring requirements; however, these conditions have not been encountered at SNL/NM.

Program Activities and Results 2022: Construction General Permit Coverage

On February 16, 2022, EPA issued a new CGP, which will remain active until February 16, 2027. Coverage for existing projects (previously covered under the 2017 CGP) was transfered to the new permit without interruption. Requirements under the new permit remain essentially unchaged for SNL/NM.

During 2022, SNL/NM held active permit coverage for 16 construction sites (see Chapter 10); DOE and NTESS held joint CGP coverage for one of these sites.

7.4.4 Middle Rio Grande Municipal Separate Storm Sewer System Permit

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

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

Compliance with the MS4 Permit is maintained by developing and updating a stormwater management plan, implementing control measures, conducting inspections, sampling stormwater, submitting discharge monitoring reports, and submitting annual reports. The *MS4 Stormwater Management Plan* and other associated documents are available to the public in the digital repository at the University of New Mexico Digital Repository, Municipal Separate Storm Sewer System (MS4) Permit (University of New Mexico n.d.).

Stormwater Quality Monitoring per the Middle Rio Grande Municipal Separate Storm Sewer System Permit

The stormwater sampling points (SWSPs) established for compliance with the MS4 Permit are located at the MS4 inflow (SWSP-02) and four MS4 outflows (SWSP-05, SWSP-24, SWSP-35, and SWSP-36) as indicated in Figure 7-2. Inflow at SWSP-02 comes from SNL/NM areas upgradient of the MS4 boundary and from areas owned by KAFB, primarily residential housing areas. Approximately 90 percent of the stormwater discharge from the MS4 occurs at SWSP-05, which flows directly to the Tijeras Arroyo. The remaining approximately 10 percent of discharge occurs at SWSP-24, SWSP-35, and SWSP-36, which flow directly into the KAFB storm drain system and then to a large detention basin located near the Gibson Gate. The volume of inflow that enters the MS4 at SWSP-02 is conveyed through the SNL/NM storm drain system and discharged at SWSP-05. It accounts for approximately 15 percent of the total stormwater discharged at SWSP-05.

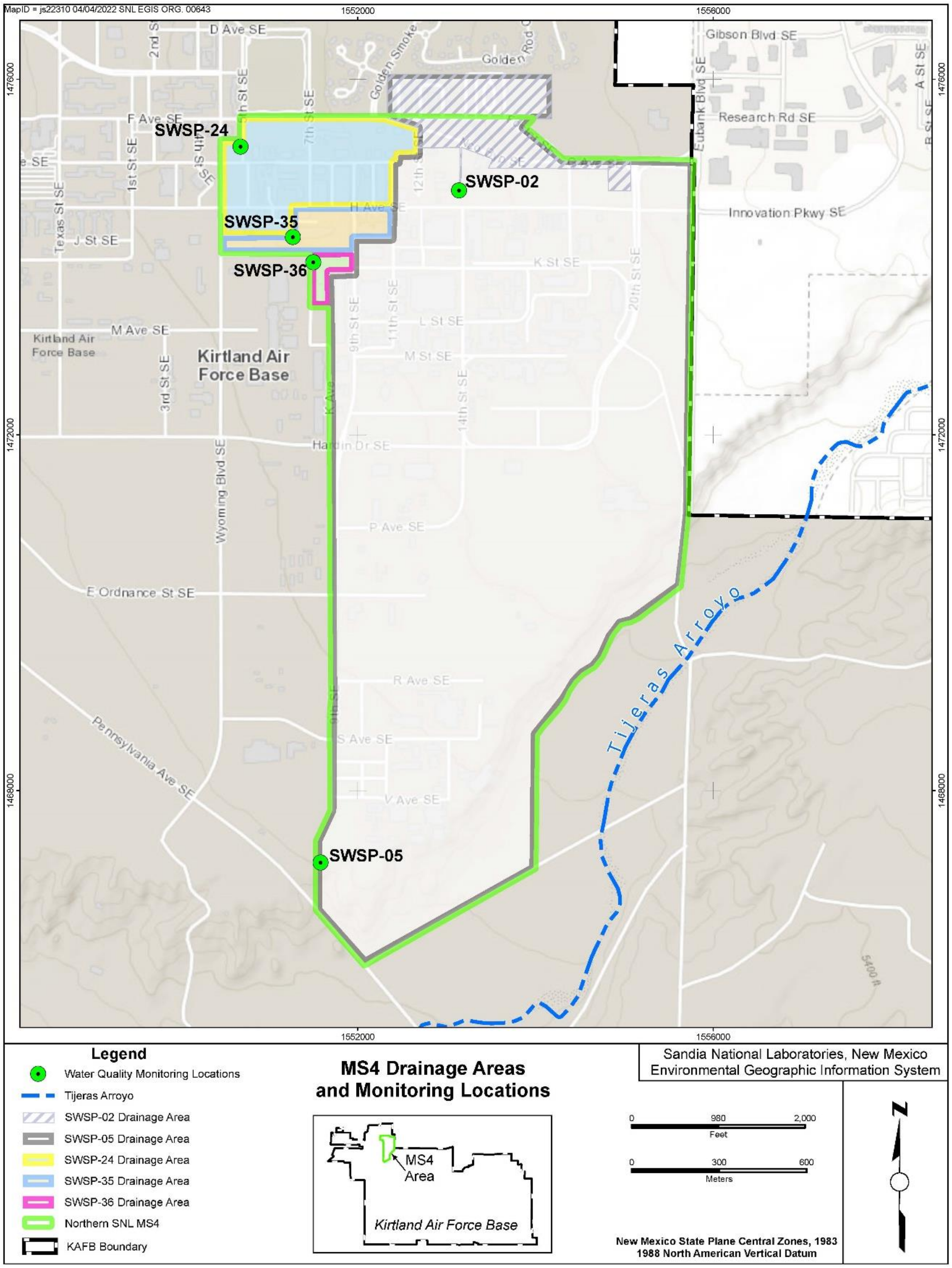


Figure 7-2. MS4 drainage areas and monitoring locations

MS4 Permit sampling can be conducted when a qualifying event occurs, which is specified as rainfall in excess of 0.25 inches during a 24-hour period. Required monitoring is to be conducted for a minimum of eight events during the permit term; at least four monitoring events must be conducted during the wet season (July 1 through October 31), and at least two events must be conducted during the dry season (November 1 through June 30). The permit term was initially five years (starting in December 2014), but EPA has extended it indefinitely because they have not issued a new permit. The requirement for eight samples has been met and exceeded at all monitoring locations, with between 9 and 16 samples collected at each site. Stormwater Program personnel continue to collect one dry season and one wet season sample per location each year, as precipitation allows, even though this is not a requirement of the permit. The monitoring constituents required by the MS4 Permit and associated water quality standards are listed in Appendix D.

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

PCBs and *E. coli* regularly exceed applicable water quality standards in stormwater at SNL/NM. Data collected since the inception of the MS4 Permit were used to evaluate potential sources of PCBs and *E. coli*. The investigation reports can be found in the 2021 MS4 *Stormwater Management Plan* and are available to the public in the digital repository at the University of New Mexico Digital Repository, Municipal Separate Storm Sewer System (MS4) Permit.

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

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

Program Activities and Results 2022: Stormwater Quality Monitoring per the Middle Rio Grande Municipal Separate Storm Sewer System Permit

Eleven samples were collected during 2022; one dry season and one wet season sample from each sampling location, plus one additional wet season sample from SWSP-02. There were no water quality exceedances, except for *E. coli* and PCBs; *E. coli* exceeded the water quality standard in 10 of the 11 samples, and PCBs exceeded the water quality standard in all 11 samples.

7.4.5 Multi-Sector General Permit

The MSGP regulates stormwater discharges associated with industrial activities that meet the criteria for one or more specific industrial sector as defined in the permit. In 2022, 18 facilities (also referred to as sites) at SNL/NM operated under the MSGP. The sites and the associated stormwater sampling points, located at the outfalls, are listed in Table 7-1 and shown in Figure 7-3.

In January 2021, a new MSGP was issued, replacing the previous MSGP that was issued in 2015. The same sites covered under the old permit are covered under the new permit. The permits are very similar, with two notable exceptions in the new permit:

- Additional Implementation Measures are included when a four-quarter annual average concentration exceeds the water quality standard.
- Per NMED, it is required to screen for polyfluoroalkyl substances (PFASs) in stormwater runoff from Sector K sites (Sector K sites at SNL/NM are listed in Table 7-1).

Compliance with the MSGP is maintained by developing and updating a stormwater pollution prevention plan that covers all eligible industrial activities at SNL/NM and documents permit requirements applicable to these activities. The annual MSGP stormwater pollution prevention plan and other MSGP associated documents are available to the public in the digital repository at the University of New Mexico Digital Repository, 2015 Multi-Sector General Permit (University of New Mexico n.d.).

Table 7-1. Sites with coverage under the MSGP and associated stormwater sampling points

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

Sector Title	Sector	Permitted Sites	Stormwater Sampling Point
Source-Separated Recycling	N2	Reapplication Yard	SWSP-41
		Solid Waste Collection and Recycling Center	SWSP-42
		Sprung Tent 11 (Material Sustainability and Pollution Prevention)	SWSP-57

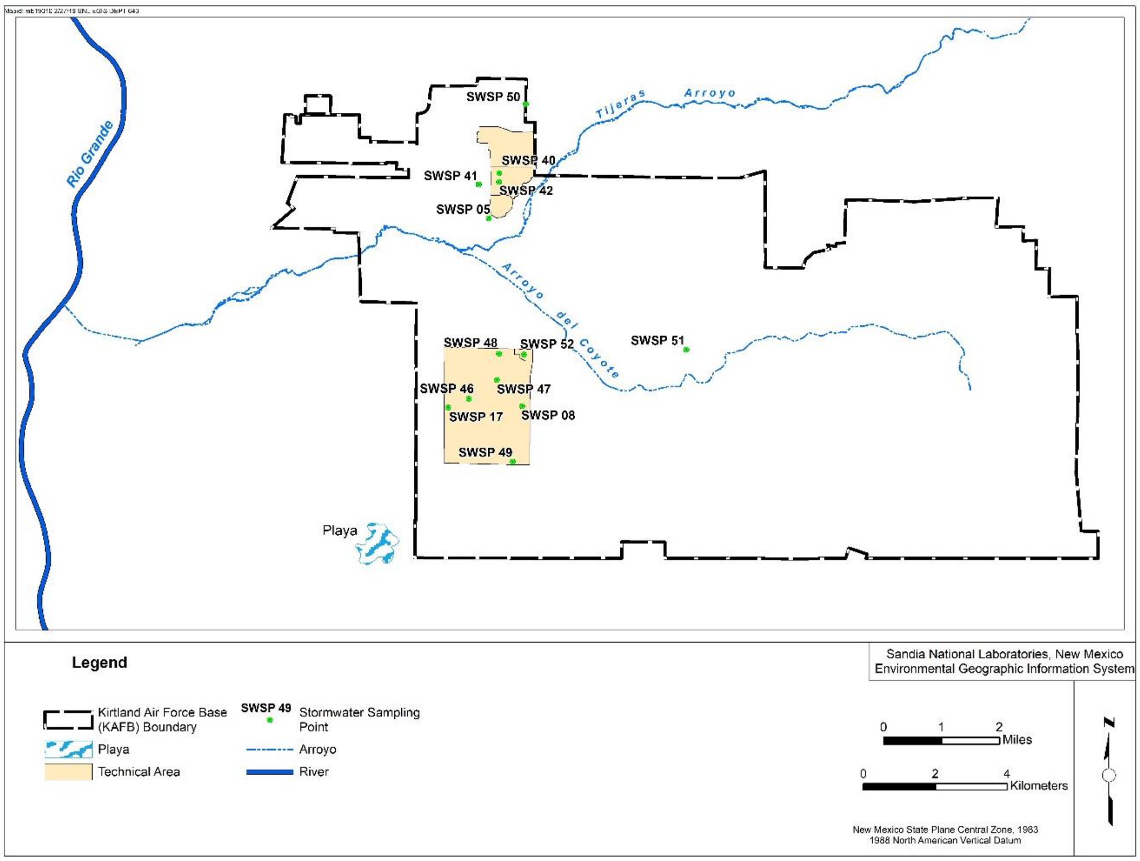


Figure 7-3. MSGP stormwater sampling point locations

Stormwater Quality Monitoring per the Multi-Sector General Permit

Quarterly sampling is required at the outfall of each facility or site permitted under the MSGP. The permit allows a monitoring quarter to be defined as one of the four months during the wet season; therefore, at SNL/NM, the four monitoring quarters are the months of July, August, September, and October. Monitoring is not required during the rest of the year (November through June). If the average of four consecutive samples is below the monitoring benchmark value, then monitoring of that constituent at that location is not required for the remainder of the permit term. During 2022, monitoring was required at all 16 permitted sites where monitoring is conducted.

The water quality constituents sampled for laboratory analysis for each applicable industry sector and the applicable New Mexico benchmark values are provided in Appendix D, "Stormwater Sampling Requirements and Results in 2022." 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.

Program Activities and Results 2022: Stormwater Quality Monitoring per the Multi-Sector General Permit

The analytical results for 2022, as submitted to EPA, are provided in Appendix D. One hundred and thirty-nine individual MSGP compliance parameters were analyzed, of which seven exceeded water quality standards:

- Selenium was detected above the water quality standard in two samples.
- Lead was detected above the water quality standard in five samples.

Additional Implementation Measures were triggered for two sites: the Long Sled Track (lead) and the TA-V Sandlot (lead and selenium). In compliance with Additional Implementation Measures requirements, the stormwater pollution prevention plan was reviewed to ensure proper control measures are being implemented at the sites. No current activities are contributing lead to the ground surface; however, historic activities may have dispersed lead at the sites. Additional controls were implemented at the sites to slow and spread stormwater in an effort to prevent discharges from the sites.

In addition to the MSGP compliance samples discussed here, 10 PFAS screening samples were collected at 5 of the 10 Sector K sites listed in Table 7-1 to comply with NMED state-specific requirements listed in the MSGP. PFASs above the screening level of 0.070 μg/L was detected at 1 of the 5 sites where samples were collected (Appendix D). PFAS sampling will continue for the duration of the permit at locations where the NMED screening level is exceeded. Section 9.6.2.1 of the MSGP states: "The screening level is not a standard of quality and purity for the surface waters of New Mexico but allows detection and further evaluation of the existence of PFASs in stormwater discharges to determine if more attention is warranted."

7.4.6 Stormwater Data Quality Assurance

Quality assurance, control, and assessment processes ensure that stormwater sampling produces reliable data to meet permit requirements and verify the effectiveness of implemented pollution control measures. Due to the heterogeneous nature of stormwater, there is a low expectation of reproducibility from one sample to the next; therefore, field duplicates are not collected. See Chapter 9 for more information on quality assurance.

7.5 Surface Discharge Program

Surface Discharge Program personnel evaluate all water and water-based compounds that discharge to the ground surface at SNL/NM for compliance with New Mexico Water Quality Control Commission regulations (20.6.2 NMAC 1995) as implemented by the NMED Ground Water Quality Bureau. These regulations are designed to protect the state's groundwater and surface water.

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

7.5.1 Surface Discharge Approvals

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

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

Program Activities and Results 2022: Surface Discharge Approvls

In 2022, 25 individual surface discharge requests were approved. Approved releases complied with applicable NMED requirements.

7.5.2 Activities at Evaporation Lagoons

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

The original DP-530 was issued on March 8, 1988, for discharges from the pulsed power facilities located in TA-IV to Lagoon 1 and Lagoon 2. DP-530 was submitted pursuant to 20.6.2.3106 NMAC, *Application for Discharge Permits, Renewals, and Modifications* (20.6.2.3106 NMAC 2018), and was approved pursuant to 20.6.2.3109 NMAC, *Secretary Approval, Disapproval, Modification or Termination of Discharge Permits, and Requirement for Abatement Plans* (20.6.2.3109 NMAC 2018). On September 5, 2014, a new DP-530 was issued, which expired on September 5, 2019. Sandia personnel submitted a renewal application for DP-530 to DOE for transmittal to NMED on February 21, 2019, in compliance with a request from NMED dated September 5, 2014. Additional information was submitted at the request of NMED on May 24, 2019. NMED issued a public notice of the application renewal on August 23, 2019. A renewed permit for DP-530 has not yet been issued. NMED has administratively extended the expired permit until a new permit is issued. The monitoring and reporting requirements associated with DP-530 are listed in Table 7-2.

Table 7-2. DP-530 monitoring and reporting requirements

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

An *ion* is an atom or molecule with a net electric charge due to the loss or gain of one or more electrons. A *cation* is a positively charged ion, and an *anion* is a negatively charted ion.

Program Activities and Results 2022: Evaporation Lagoon Sampling

Samples were collected from Lagoon 1 and Lagoon 2 on August 22, 2022. Sample fractions were collected for major ions, total dissolved solids, and purgeable and extractable organics as specified in DP-530. All samples were transported with sample custody documentation to the analytical laboratory. The analytical laboratory prepares and analyzes quality control samples as described in Section 9.1.3. See Chapter 9 for more information on quality assurance and quality control.

Although there were no discharges to Lagoon 2 in 2022, 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* (20.6.2 NMAC 1995), with the exception of fluoride at Lagoon 1. This is suspected to be due to a slightly higher concentration of anions in the sediment from evaporation; because the lagoon is an evaporation lagoon, the increase in cation and anion concentration over time would not be unexpected. A note of this was made in the most recent regulatory delieverable to NMED. In addition, both lagoons are inspected monthly to verify water levels and to ensure that no damage to the lagoons liners exist.

7.6 Wastewater Discharge Program

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

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

Federal and local regulations establish the standards for sanitary sewer releases. Discharged wastewater effluent must meet the ABCWUA Sewer Use and Wastewater Control Ordinance requirements. Information on the ABCWUA Sewer Use and Wastewater Control Ordinance can be found at ABCWUA Industrial Pretreatment Overview (ABCWUA n.d.).

Sanitary sewer releases must also meet requirements in DOE O 435.1, Change 1, *Radioactive Waste Management* (DOE O 435.1, Change 1 2001), and DOE O 458.1 Change 4 (LtdChg), *Radiation Protection of the Public and the Environment* (DOE O 458.1, Change 4 (LtdChg) 2020).

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.

7.6.1 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.

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

7.6.2 Requirements for Technical Area V Wastewater Discharges

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

TA-V wastewater samples are analyzed voluntarily for tritium, gross alpha, gross beta, and gamma spectroscopy to ensure that radionuclide levels meet regulatory standards established in the ABCWUA Sewer Use and Wastewater Control Ordinance. These analytical results are also provided to ABCWUA semiannually as part of the report for Permit 2069K (Table 7-3). If radionuclides are detected above regulatory limits, the water will not be released to the sanitary sewer system; an alternative disposal path will be found, or the radionuclides will be allowed to decay in place over a matter of days or weeks if determined to be appropriate. If the radioactivity level is determined to be at or below regulatory limits, the ABCWUA is notified at least 24 hours prior to the proposed discharge, and the batch is held until authorization to discharge is given. The ABCWUA may, at its discretion, request that the batch be held in order to conduct independent sampling of the tank. Once the ABCWUA has granted final approval, the water can be discharged safely to the public sewer system.

Table 7-3. Wastewater discharge permits and monitoring station characteristics

Permit	Station	Waste Stream Process
General Outfall		
2069A	WW001	All waste streams (includes effluent from Permit 2069G)
2069F	WW006	All waste streams (includes effluent from Permit 2238A)
2069G	WW007	Laboratory industrial process acid wastewater from Microsystems and Engineering Sciences Applications activities
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		
2238A	Center for Integrated Nanotechnologies	Laboratory industrial process acid wastewater from Center for Integrated Nanotechnologies activities

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

Program Activities and Results 2022: Wastewater Discharge, Technical Area V

Discharges to the sanitary sewer system from the Liquid Effluent Control System and all other TA-V activities did not exceed standards for radionuclides at any of the wastewater monitoring stations in 2022.

7.6.3 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 7-4). Wastewater effluent discharged from any of the six outfalls must meet the permit-specific ABCWUA Sewer Use and Wastewater Control Ordinance requirements (Table 7-3).

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

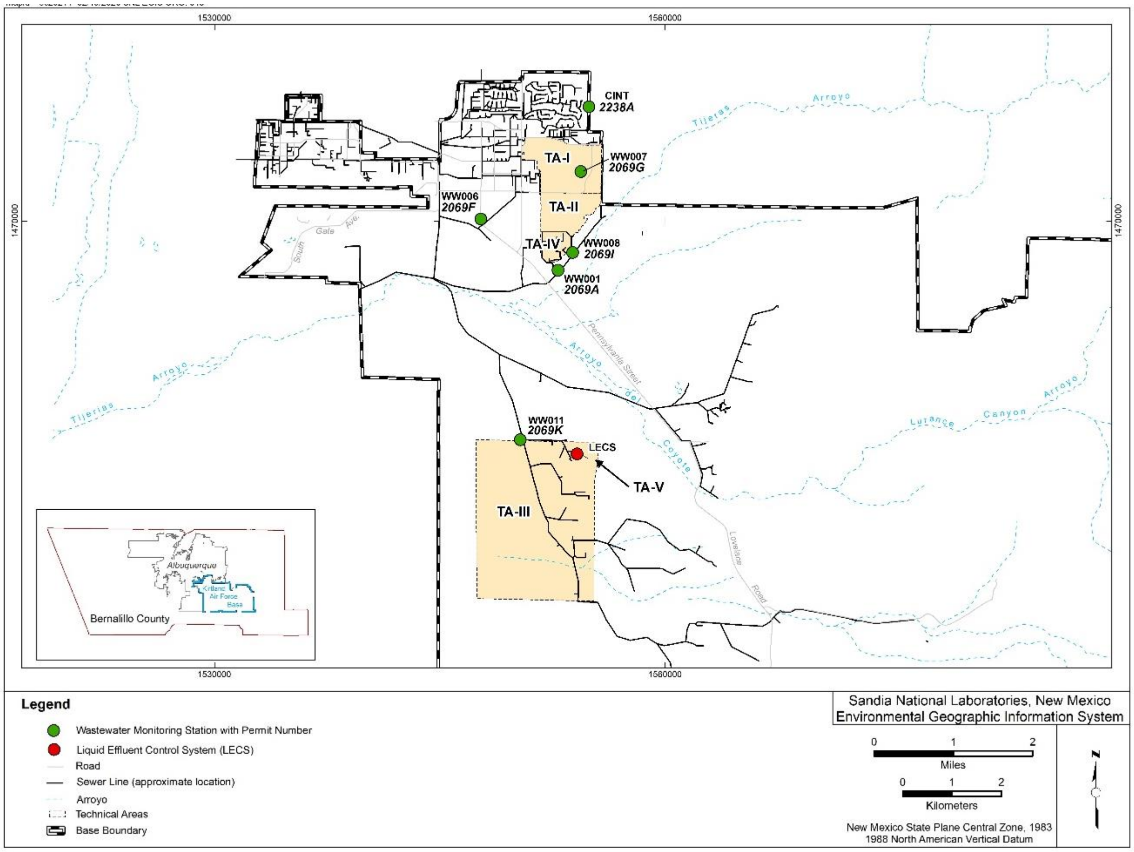


Figure 7-4. Wastewater monitoring station locations

Wastewater discharges resulting from ongoing chemical, manufacturing, and industrial processes conducted at Sandia facilities are tracked through the Wastewater Discharge Approval System before being discharged to the ABCWUA sanitary system. Facility processes are reviewed for contaminants, concentrations, and discharge frequencies to determine whether the effluent will meet regulatory criteria. Once approved, a facility is issued an internal permit, which is reviewed annually. Generally, processes are well characterized, and any constituents detected as being above the permit-specific limits at a wastewater monitoring station can be tracked back to the source facility. Corrective actions to mitigate further releases are implemented as necessary. One-time releases are approved on a case-by-case basis.

Program Activities and Results 2022: Wastewater Discharge Requests

In 2022, the ABCWUA approved 395 wastewater discharge requests. Wastewater discharge approvals are not required for buildings that only produce domestic sewage from restrooms, showers, sinks, and drinking fountains.

7.6.4 Wastewater Monitoring Stations and Sampling Parameters

There are six on-site wastewater monitoring stations permitted by the ABCWUA at SNL/NM (Figure 7-4). Wastewater monitoring station characteristics are listed in Table 7-3. Wastewater from the four permitted general outfall monitoring stations (WW001, WW006, WW008, and WW011) contains a mixture of sanitary and industrial wastewater, which discharges into the ABCWUA sanitary sewer system through the Tijeras Arroyo Intercept.

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 in the Microelectronics Development Laboratory in TA-I. Laboratory discharges from the Microsystems and Engineering Sciences Applications Complex may also be configured to discharge to this acid waste neutralization system. An acid waste neutralization system is used to pretreat process wastewater at the Center for Integrated Nanotechnologies categorical monitoring station.

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

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

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

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

Wastewater was collected in 2022 to monitor the following parameters:

- Total metals—aluminum, arsenic, boron, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, and zinc
- Radiological constituents (only Sandia personnel collect radiological samples during split sampling)—gamma spectroscopy, gross alpha, gross beta, and tritium
- General chemistry—ammonia, chemical oxygen demand, cyanide (for permits 2069F, 2069G, and 2238A only), fluoride, phosphorus, and total suspended solids

7.6.5 Program Activities and Results 2022: Wastewater Monitoring Results and Inspections

During 2022, three ABCWUA sampling events were conducted. At the request of the ABCWUA, one additional routine sampling event that had been planned for 2022 was not scheduled by ABCWUA and did not occur. Sandia personnel collected wastewater split samples in April, September, and November/December 2022 with ABCWUA and the NMED DOE Oversight

Bureau. Laboratory analytical results for these split samples confirmed that Sandia operations were in compliance with ABCWUA requirements for permits 2069A, 2069F, 2069G, 2069I, 2069K, and 2238A (Table 7-3). All water discharged from the Liquid Effluent Control System in 2022 met requirements for radiological levels in wastewater. All analytical results from sampling conducted in 2022 met ABCWUA Sewer Use and Wastewater Control Ordinance discharge requirements. Analytical results are provided in Appendix E, "Sanitary Outfalls Monitoring Results in 2022."

In April 2022, the ABCWUA performed annual inspections of facilities that discharge within permitted flow basins 2069A, 2069F, 2069G, 2069I, 2069K, and 2238A. No issues or findings were identified during any of these inspections.

7.6.6 Program Activities and Results 2022: Sanitary Sewer System Releases

In 2022, no events were reported to either the ABCWUA or DOE and accordingly, no notice of violations were received during 2022.

7.6.7 Program Activities and Results 2022: Pretreatment Gold Awards

The ABCWUA presented DOE and NTESS with six Pretreatment Gold Awards in 2022. Gold awards are given for 100 percent compliance with wastewater discharge permit reporting requirements, zero notices of violation, and an exceptional level of permit compliance. All of Sandia's wastewater discharge permits (2069A, 2069F, 2069G, 2069I, 2069K, and 2238A) were included in the awards.

Chapter 8. Compliance Summary

Perkysue (*Tetraneuris argentea*)

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

Sandia operations are required to comply with federal, state, and local environmental requirements, including DOE directives and presidential executive orders. As part of this compliance, personnel adhere to reporting and permitting requirements. Permits and registrations in effect in 2022 are listed in Chapter 10.

All operations and activities, including those that are part of environmental programs, are performed under Sandia's ES&H policy, which includes the following statement:

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

An integrated safety management system is used to incorporate safety into management and work practices at all levels so that missions are accomplished while protecting the worker, the public, and the environment. Thus, management of safety functions becomes an integral part of mission accomplishment and meets requirements outlined by DOE. 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.

8.1 Environmental Compliance

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

8.1.1 Federal Environmental Requirements

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

Environmental Planning

National Environmental Policy Act of 1969

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

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

DOE O 436.1, Departmental Sustainability

DOE O 436.1, *Departmental Sustainability* (DOE O 436.1 2011), places environmental management systems and site sustainability at the forefront of environmental excellence. This order requires development of a site sustainability plan for identification of contributions toward meeting DOE sustainability goals and an environmental management system for a continuing cycle of planning, implementing, evaluating, and improving processes to achieve environmental goals. Personnel comply with this order through implementation of an environmental management system, which is third-party certified to ISO 14001:2015 (ISO 14001:2015 2015) at SNL/NM (the primary operating location). This order also specifies requirements for compliance with EPCRA requirements. DOE O 436.1, *Departmental Sustainability* (DOE O 436.1 2011) was in effect during 2022, the time period covered by this annual site environmental report. This order was superseded by DOE O 436.1A in 2023 (DOE O 436.1A 2023). See "Chemical Management" and Table 8-4 for more details on Sandia's approach to compliance with these requirements.	Compliance activities: • Facilitate ISO 14001:2015 audits by a third-party registrar (ISO 14001:2015 2015) • Follow the environmental management system requirements, including identification of the environmental aspects and impacts of activities • Maintain an environmental management system and associated documentation • Establish and implement an annual site sustainability plan • Fulfill emergency planning and reporting requirements

Hazardous Waste and Environmental Restoration

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

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 (42 U.S.C. § 9601 1980), and amended in 1986, establishes liability compensation, cleanup, and emergency response requirements for inactive hazardous waste sites. In addition, CERCLA requires federal facilities to report hazardous substance spills to the National Response Center and perform any necessary response action. DOE performed a preliminary assessment and site inspection in 1988. This inspection confirmed that no sites qualify for the National Priorities List. Therefore, with respect to inactive hazardous waste sites, there are no CERCLA remediation requirements nor CERCLA-related assessments for natural resource damages. The Superfund Amendments and Reauthorization Act (SARA) Tille III of 1986 (42 U.S.C. § 9601 1986) establishes additional reporting requirements that are addressed under "Chemical Management."	Compliance activities: • See "Chemical Management" for compliance activities • Administer and monitor solid waste management units (Section 3.5)

Federal Facility Compliance Act of 1992

The Federal Facility Compliance Act of 1992 (42 U.S.C. § 6961 1992) 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. The act further provides requirements for achieving compliance with the requirements of 40 CFR 268.50, *Prohibitions on Storage of Restricted Wastes* (40 CFR 268.50 2021), for mixed waste. On October 4, 1995, NMED issued a Federal Facility Compliance Order to DOE and the management and operating contractor for Sandia National Laboratories (NMED 1995). Section 3.5 provides information on Sandia's Waste Management Program.	Compliance activities: • Maintain a site treatment plan (Sandia 2022), including its inventory of wastes subject to the Federal Facility Compliance Act and its schedule for processing the waste

Resource Conservation and Recovery Act enacted in 1976, as amended

The Resource Conservation and Recovery Act (RCRA), enacted in 1976, as amended (42 U.S.C. § 6901 et seq. 1976), sets forth the framework for managing hazardous solid waste, including the hazardous waste component of mixed waste. Wastes generated from ongoing activities and operations are collected and managed at several locations as described in Section 3.5. The Hazardous and Solid Waste Amendments (42 U.S.C. § 6901 et seq. 1984) amended RCRA, adding various requirements and deadlines, including requirements for corrective action for past releases of hazardous waste or hazardous constituents to the environment. The Federal Facility Compliance Act amended RCRA (see "Federal Facility Compliance Act of 1992"). In addition, underground storage tank requirements were added as Subtitle I to RCRA in 1984 (see "Oil Pollution Act of 1990"). See Section 8.1.2 for state requirements for solid and hazardous management and Section 3.6 for environmental restoration activities.	Compliance activities: • Operate hazardous and mixed waste management units under two permits issued by NMED • Collect and screen material and waste in preparation for treatment and shipment to off-site facilities for recycling, storage, treatment, or disposal • Adhere to closure and post-closure requirements for former waste management areas • Conduct investigations and remediation, when needed, for past releases of hazardous waste and hazardous constituents • Adhere to monitoring and maintenance requirements for past releases of hazardous waste and hazardous constituents

Radiation Protection

Atomic Energy Act of 1954

The Atomic Energy Act of 1954 (42 U.S.C. § 2011 1954) specifies proper management of source, special nuclear, and by-product material. DOE has the authority to manage operations based on applicable statutes, federal regulations, and DOE directives. Sandia personnel achieve compliance through adherence to these directives and applicable regulations in 10 CFR 830, *Nuclear Safety Management* (10 CFR 830 2016), and 10 CFR 835, *Occupational Radiation Protection* (10 CFR 835 2021). The regulations include radiation protection standards, limits, and program requirements for protecting individuals from radiation exposure as a result of DOE activities.	Compliance activities: • Manage materials and facilities in accordance with DOE requirements and oversight, including appropriate documentation • Ensure that training requirements are met

DOE O 435.1 Change 1, Radioactive Waste Management

DOE O 435.1, Change 1, *Radioactive Waste Management* (DOE O 435.1, Change 1 2001), ensures that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety, and of the environment. Personnel examine the lifecycle of radioactive waste, radioactive mixed waste, transuranic waste, and transuranic mixed waste before waste is generated to ensure appropriate management. DOE authorization is requested before generating radioactive waste streams with no identified disposal path. Information about the characteristics of each waste is used to manage the waste in a manner that is consistent with applicable requirements.	Compliance activities: • Characterize and manage on-site waste • Support inspections and audits • Ensure that training requirements are met

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

DOE O 458.1, *Radiation Protection of the Public and the Environment* (DOE O 458.1, Change 4 (LtdChg) 2020), establishes requirements to protect the public from undue radiation exposure, demonstrate compliance with public dose limits from air pathways, control releases of radioactive discharges, control radioactive waste, protect drinking water and groundwater, protect biota, control the release of property with residual radioactivity, and manage radiation-related records. DOE issued a moratorium in January 2000 that prohibited the clearance of volume-contaminated metals, and subsequently in July 2000 suspended the clearance of metals from DOE radiological areas for recycling purposes. Chapters 3 through 7 provide information on relevant compliance, as indicated in the Compliance Activities column.	Compliance activities: • Monitor emissions and provide dose assessments (Chapter 6). • Monitor radioactive releases to the sanitary sewer (Chapter 7). • Manage permitted radioactive waste units (Chapter 3). • Adhere to regulations during operation and maintenance of the drinking water system (Chapter 7). • Monitor groundwater (Chapter 3). • Monitor biota (Chapter 5 and Chapter 4).

	• Perform property clearances (during 2022, 240 personal property clearance surveys were processed, no metals subject to the moratorium or the suspension were cleared, and no real property was cleared). All personal property clearance surveys were evaluated against pre-approved authorized limits.

Air Quality

Clean Air Act of 1970, as amended

The Clean Air Act of 1970, as amended (42 U.S.C. § 7401 1970), governs the management of regulated emissions through adherence to the conditions of permits and applicable regulations.	Compliance activities: • Confirm that planned stationary sources of air pollutants (e.g., equipment) and potential emissions from operations meet applicable local and federal requirements • Maintain documentation that ensures that sources are in compliance with regulations and/or permitted operating conditions • Submit monitoring reports, annual emissions inventories, dose assessments, and other compliance assurance documentation to regulatory agencies

Water Quality

Clean Water Act of 1972 and amendments

The Clean Water Act of 1972 (33 U.S.C. § 1251 1972) and amendments establish a permitting structure and regulatory direction to protect the "waters of the United States" by restoring and maintaining the chemical, physical, and biological integrity of United States waters; protecting fish, wildlife, and recreation; and reducing pollutant discharges. Discharges to ground surface are regulated by NMED under 20.6.2 NMAC, *Ground and Surface Water Protection* (20.6.2 NMAC 1995). Sandia Surface Discharge Program personnel review all	Compliance activities: • Evaluate proposed water and water-based compounds being discharged to the ground surface for potential contaminants; obtain discharge permits from NMED when applicable

requests for discharge to the ground surface and obtain discharge permits from NMED when applicable. Sanitary sewer discharges are regulated by the ABCWUA. Discharges from Sandia are received at the ABCWUA treatment facility, which is permitted under NPDES. ABCWUA requires Sandia operations to meet all applicable NPDES permit requirements for discharges. Stormwater discharges are regulated by EPA Region 6 under NPDES. Stormwater discharges from SNL/NM are permitted under three NPDES permits: the MS4 Permit, the MSGP, and the CGP. See "Resource Conservation and Recovery Act." Chapter 7 provides information on compliance with surface water quality regulations. Chapter 1 and Chapter 3 provide information on groundwater.	• Monitor all wastewater discharges • Obtain NPDES permits, conduct routine assessments, and monitor stormwater • Develop and update stormwater pollution prevention plans, including control measures, site inspections, and annual reporting • Monitor sanitary sewer discharge at six on-site stations

Energy Independence and Security Act of 2007, Section 438

The Energy Independence and Security Act (EISA) of 2007 (42 U.S.C. § 17001 2007), Section 438, requires federal agencies to manage stormwater runoff from federal development projects for the protection of water resources. Sandia projects undergo a NEPA review (see "National Environmental Policy Act") and may identify the need to further address stormwater runoff under EISA § 438 in accordance with requirements in the CGP and MS4 Permit. Site planning, design, construction, and maintenance strategies are applied to maintain or restore predevelopment site hydrology. Section 7.4 provides information on the Stormwater Program.	Compliance activities: • Coordinate with a drainage engineer to obtain site drainage plans that meet EISA § 438 requirements • Develop Stormwater Pollution Prevention Plans that include EISA § 438 requirements and describe compliance measures • Inspect EISA drainage structures to ensure proper long-term maintenance and operation

Oil Pollution Act of 1990 (§ 311)

The Oil Pollution Act of 1990 (33 U.S.C. § 40 1990) (§ 311) establishes requirements for the prevention of, preparedness for, and response to oil discharges at specific non-transportation-related facilities. Implementing regulations are found in 40 CFR 112, *Oil Pollution Prevention* (40 CFR 112 2011). A site-wide spill prevention, control, and countermeasure plan is implemented and maintained for all applicable oil storage containers. Section 7.2 provides information on the Oil Storage Program.	Compliance activities: • Inspect bulk oil storage containers routinely • Train oil-handling personnel routinely • Maintain an oil storage container inventory • Incorporate oil spill prevention requirements and practices into processes, procedures, and new container installations

Resource Conservation and Recovery Act enacted in 1976, as amended

RCRA, enacted in 1976, as amended (42 U.S.C. § 6901 et seq. 1976), sets forth the framework for managing underground storage tanks to prevent leaks into the environment and contamination of groundwater. Underground storage tank requirements were added as Subtitle I to RCRA in 1984 and, since 1990, the U.S. Environmental Protection Agency (EPA) has authorized the State of New Mexico, through NMED, to administer and enforce a state-approved program in lieu of the federal program detailed in 40 CFR 280, *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)* (40 CFR 280 2021). SNL/NM personnel operate two 20,000-gallon underground storage tanks containing mineral oil. Section 7.2 provides invormation on the Oil Storage Program.	Compliance activities: • Adhere to the requirements in the New Mexico Administrative Code, Title 20, Chapter 5, "Petroleum Storage Tanks" • Performed required inspections and testing of underground storage tank systems • Permanently closed and removed two underground storage tanks

Safe Drinking Water Act of 1974, as amended

The Safe Drinking Water Act of 1974, as amended (42 U.S.C. § 300f 1974) was established to protect the quality of drinking water in the United States, focusing on all waters actually or potentially designed for drinking use, whether from aboveground or underground sources. The KAFB Public Water System provides potable water for Sandia facilities, and KAFB is responsible for meeting drinking water requirements as the supplier. Sandia personnel adhere to specific requirements from the State of New Mexico as NMED is authorized to administer and enforce safe drinking water requirements in lieu of the federal program detailed in 40 CFR 141, *National Primary Drinking Water Regulations* (40 CFR 141 1998), implementing regulations. Section 7.3 provides information on Sandia's safe drinking water program.	Compliance activities: • Sample drinking water quality parameters routinely • Inspect water quality associated with new construction water line disinfection and line repair activities

America's Water Infrastructure Act of 2018

America's Water Infrastructure Act of 2018 (33 U.S.C. § 2201 2018) is intended to improve drinking water and water quality, deepens infrastructure investments, enhances public health and quality of life, increases jobs, and bolsters the economy. This act's provisions represent changes to the Safe Drinking Water Act. The KAFB Public Water System provides the annual Consumer Confidence Report of drinking water quality for the KAFB Public Water System. Section 7.3 provides information on safe drinking water.	Compliance activities: • Sandia disseminates the KAFB Consumer Confidence Report

Chemical Management

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

EPCRA of 1986 (42 U.S.C. § 11001 et seq. 1986), also known as Title III of the Superfund Amendments and Reauthorization Act (SARA Title III), requires reporting of toxic chemicals used and released by federal, state, and local governments and industry. Per EPCRA, chemical hazard information is provided to the community for awareness and enhancement of emergency planning efforts. See Table 8-4 for more details.	Compliance activities: • Maintain and report on a chemical inventory • Report qualifying chemical releases

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

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

Toxic Substances Control Act, enacted in 1976 and later amended

The Toxic Substances Control Act, enacted in 1976 and later amended (15 U.S.C. § 2601 et seq. 1976), regulates the manufacture, processing, distribution, use, and disposal of specific chemical substances and/or mixtures. Compliance with this act involves managing asbestos and PCBs at SNL/NM. Chapter 3 provides information related to managing toxic substances.	Compliance activities: • Conduct asbestos abatement in accordance with applicable regulatory requirements • Evaluate electrical equipment for PCBs when they are taken out of service

Pollution Prevention

Pollution Prevention Act of 1990

The Pollution Prevention Act of 1990 (42 U.S.C. § 133 1990) declares as national policy that pollution should be prevented or reduced at the source wherever feasible and disposed of or released into the environment only as a last resort. A toxic chemical source reduction and recycling report is required for facilities that meet the reporting requirements under EPCRA, Section 313. See the previous EPCRA discussion under "Chemical Management."	Compliance activities: • Conduct database queries for chemical purchases annually • Compare environmental releases with EPCRA reporting thresholds • Prepare annual reports and submit them to federal, state, and local regulatory agencies • Follow green purchasing practices

Natural Resources

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

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

Endangered Species Act of 1973, amended in 1982

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

EO 11988 of 1977, Floodplain Management, as amended

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

EO 11990 of 1977, Protection of Wetlands, as amended

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

EO 13112, of 1999, Invasive Species

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

EO 13751, of 2016, Safeguarding the Nation from the Impacts of Invasive Species

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

Fish and Wildlife Conservation Act and Lacey Act Amendments of 1981

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

Migratory Bird Treaty Act of 1918 (and amendments)

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

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

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

The Tijeras Arroyo Wildlife Corridor Memorandum of Understanding

The Tijeras Arroyo Wildlife Corridor Memorandum of Understanding (DOE/NNSA/SFO 2007) seeks to preserve the natural habitat of the arroyo so that it remains a viable wildlife corridor and permits the free passage of wildlife through its entirety. Chapter 4 provides more information on the Ecology Program.	Compliance activities: • Conduct biological surveys • Collect ecological resource inventory data • Assess, inventory, and monitor vegetation • Preserve and protect ecological resources

Cultural Resources

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

The American Indian Religious Freedom Act of 1978, as amended in 1994 (PL 103-344 1994), a federal law and joint resolution of Congress, protects and preserves the traditional religious rights and cultural practices of American Indians, Eskimos, Aleuts, and native Hawaiʻians. Chapter 2 provides more information on the Cultural Resource Management Program.	Compliance activities: • Conduct cultural resource surveys and monitor construction activities • Prepare documentation to support planning activities and decisions • Review NEPA checklists to identify impacts on cultural resources • Support consultation with American Indian tribes

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

The Archaeological Resources Protection Act of 1979 (PL 96-95 1979) secures, for the present and future benefit of the American people, the protection of archaeological resources and sites that are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals. Section 4 of the statute and sections 16.5–16.12 of the regulations describe the requirements that must be met before federal authorities can issue a permit to excavate or remove any archaeological resource on federal or Indian lands. The curation requirements of artifacts, other materials excavated or removed, and the records related to the artifacts and materials are described in Section 5 of the act. These regulations affect all federally owned or administered archaeological collections. Chapter 2 provides more information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys and monitor construction activities • Prepare documentation to support planning activities and decisions • Review NEPA checklists to identify impacts on cultural resources

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

DOE O 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy* (DOE O 144.1 2009), sets forth the principles to be followed by DOE to ensure effective implementation of government-to-government relationships with American Indian and Alaska Native tribal governments. This order provides direction to all DOE officials, staff, and contractors regarding fulfillment of trust obligations and other responsibilities arising from DOE actions that may potentially impact American Indian and Alaska Native traditional, cultural and religious values and practices; natural resources; and treaty and other federally recognized and reserved rights. Chapter 2 provides more information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys and monitor construction activities • Prepare documentation to support planning activities and decisions • Review NEPA checklists to identify impacts on cultural resources • Support consultation with American Indian Tribes

DOE O 430.1C, Real Property Asset Management

DOE O 430.1C, *Real Property Asset Management* (DOE O 430.1C 2019), establishes an integrated corporate-level, performance-based approach to the life-cycle management of real property assets. It links real property asset planning, programming, budgeting, and evaluation to the multifaceted DOE missions. Successful implementation of this order will enable DOE to carry out stewardship responsibilities, and will ensure that facilities and infrastructure are properly sized and in a condition to meet mission requirements today and in the future. Chapter 2 provides more information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys and monitor construction activities • Survey property to determine eligibility for inclusion in the National Register of Historic Places • Prepare documentation to support planning activities and decisions • Review NEPA checklists to identify impacts on cultural resources

DOE P 141.1, Management of Cultural Resources

The purpose of DOE P 141.1, *Management of Cultural Resources* (DOE P 141.1 2011), is two-fold: (1) to ensure that all DOE programs and field elements integrate cultural resources management into their missions and activities and (2) to raise the level of awareness and accountability among DOE contractors concerning the importance of DOE cultural resource-related legal and trust responsibilities. Chapter 2 provides more information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys and monitor construction activities • Survey property to determine eligibility for inclusion in the National Register of Historic Places • Prepare documentation to support planning activities and decisions

	• Review NEPA checklists to identify impacts on cultural resources
National Historic Preservation Act, enacted in 1966 and amended in 2000, Section 106	
The National Historic Preservation Act of 1966 (PL 89-665 1966), as amended and codified in 16 U.S.C., *Conservation* (16 U.S.C. 2016), is intended to preserve historical and archaeological sites in the United States. The act sets federal policy for preserving our nation's heritage by establishing a federal government and tribal government partnership, establishing the National Register of Historic Places and National Historic Landmarks Programs, mandating the selection of qualified State Historic Preservation Officers, establishing the Advisory Council on Historic Preservation, charging federal agencies with responsible stewardship, and establishing the role of certified local governments within the states. The National Register of Historic Places (36 CFR 60 2012) is authorized by the National Histori Preservcation Act of 1966. It is the federal government's official list of districts, sites, buildings, structures, and objects deemed worthy of preservation for their historical significance. Chapter 2 provides more information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys to determine eligibility for inclusion in the National Register of Historic Places • Prepare documentation to support planning activities and decisions • Review NEPA checklists to identify impacts on cultural resources • Conduct cultural resource surveys and the monitoring of construction activities
Native American Graves Protection and Repatriation Act, enacted in 1990	
The Native American Graves Protection and Repatriation Act (PL 101-601 1990) developed a systematic process for determining the rights of Indian tribe and Native Hawai'ian lineal descendants and their representative organizations to protect certain Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony with which they are affiliated. Chapter 2 provides more information on the Cultural Resource Management Program.	Compliance activities: • Develop internal management plans • Conduct cultural resource surveys and monitor construction activities • Prepare documentation to support planning activities and decisions • Review NEPA checklists to identify impacts on cultural resources

Reporting

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

DOE O 231.1B, *Admin Change 1, Environment, Safety and Health Reporting* (DOE O 231.1B, Admin Change 1 2012), ensures that DOE receives information about events that have affected or could adversely affect the health, safety, and security of the public or workers, the environment, the operation of DOE facilities, or DOE credibility. It enhances mission safety and promotes the sharing of effective practices to support continuous improvement and adaptation to change. Environmental program personnel report on environmental program activities, monitoring results, accidental releases, and waste management operations. Information on property clearance activities can be found in DOE O 458.1 Chg 4 (LtdChg), *Radiation Protection of the Public and the Environment*.	Compliance activities: • Produce an annual site environmental report

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

DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information* (DOE O 232.2A, Chg 1 (MinChg) 2017), requires timely notification to DOE about events that could adversely affect the health and safety of the public or workers, the environment, DOE missions, or DOE credibility. Sandia personnel promote organizational learning through investigation and analysis of reported events and conditions that adversely affect or may adversely affect personnel, the public, property, the environment, or the DOE mission. Section 8.4 provides further information.	Compliance activities: • Track all environmental events

Quality Assurance

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

DOE O 414.E, *Quality Assurance* (DOE O 414.1D, Change 2 (LtdChg) 2020), is intended to achieve quality in all work and ensure that products and services meet or exceed customer requirements and expectations. Environmental sampling and analyses at SNL/NM conform to applicable quality assurance plans, sampling plans, and field operations. Chapter 9 provides information on quality assurance.	Compliance activities: • Develop quality assurance plans, operating plans, and sampling plans • Provide a statement of work for contract laboratories • Participate in quality assurance audits of contract laboratories

8.1.2 New Mexico State and Local Environmental Requirements

New Mexico state and local environmental requirements applicable to Sandia operations are described below.

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

The EPA program for attaining and maintaining National Ambient Air Quality Standards requires local agencies to develop a comprehensive permitting program. In accordance with the Air Quality Control Act (NMSA 1978 § 74-2-1 to 74-2-17 1978), 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* (20.11.20 NMAC 2008), to ensure that every person uses reasonably available control measures or other effective measures on an ongoing basis to prevent or abate fugitive dust if the fugitive dust may, with reasonable probability, injure human health or animal or plant life, or may unreasonably interfere with public welfare, visibility, or the reasonable use of property.
- **National Emission Standards for Hazardous Air Pollutants (NESHAP).** EPA develops and implements NESHAPs to limit the release of air pollutants that are known to cause or are suspected of causing cancer, birth defects, reproduction problems, and other serious illnesses. These standards are authorized by Section 112 of the Clean Air Act, and the regulations are published in 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants* (40 CFR 61 2021), and 40 CFR 63 *National Emission Standards for Hazardous Air Pollutants for Source Categories*, (40 CFR 63 2012), which the City of Albuquerque implements in Bernalillo County. NESHAPs initially were established for seven pollutants, including asbestos, radionuclides, and beryllium. EPA changed the approach to NESHAPs with the 1990 Clean Air Act Amendments to focus the requirements on source categories rather than on individual hazardous air pollutants. Since then, NESHAPs have been implemented for a number of sources, including halogenated solvent cleaning, semiconductor manufacturing, surface coating operations, and stationary engines.
- **New Source Performance Standards and New Source Review requirements.** As part of an effort to control pollution in the United States, New Source Performance Standards and New Source Review permitting requirements identify the minimum level of air pollution controls for a new stationary source. The performance standards are authorized by Section 111 of the Clean Air Act, and the regulations are published in 40 CFR 60, *Standards of Performance for New Stationary Sources* (40 CFR 60 2021). The New Source Review preconstruction permitting requirements include criteria pollutants as authorized by Section 110 of the Clean Air Act. In addition, sources may be subject to siting requirements found in Part C, *Prevention of Significant Deterioration of Air Quality*, and Part D, *Plan Requirements for Nonattainment Areas*, of Title I of the Clean Air Act. The permitting regulations are codified in 40 CFR 51, *Requirements for Preparation, Adoption, and Submittal of Implementation Plans* (40 CFR 51 2013), and 40 CFR 52, *Approval and Promulgation of Implementation Plans* (40 CFR 52 2021). Both the performance standards and permitting requirements are administered and enforced by the City of Albuquerque, as delegated by the EPA. New Source Performance Standards are established for a number of source categories, including boilers and stationary engines. New Source Review requirements provide assurance to the public that any new or modified source of air pollutants will be protective of human health and the environment, and that advances in pollution control will occur concurrently with industrial expansion.
- **Open burn permitting.** The City of Albuquerque established 20.11.21 NMAC, *Open Burning* (20.11.21 NMAC 1995), to ensure that all persons conduct open burning in a manner that prevents or abates emissions.

- **Ozone-depleting substances requirements.** Based on the requirements of Title VI of the Clean Air Act, EPA has established regulations to protect the stratospheric ozone layer by managing ozone-depleting substances.

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

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

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

- 4.10.8 NMAC, *Permits to Conduct Archaeological Investigations on State Land* (4.10.8 NMAC 2019)
- 4.10.15 NMAC, *Standards for Survey and Inventory* (4.10.15 NMAC 2006)
- 4.10.17 NMAC, *Standards for Monitoring* (4.10.17 NMAC 2005)
- NMSA 1978 § 17-2-13 through 17-2-15, protecting songbirds; hawks, vultures, and owls; and horned toads, respectively, *Hunting and Fishing Regulations* (NMSA 1978 § 17-2-13 through 17-2-15 1978)
- NMSA 1978 § 17-2-37 through 17-2-46, *Wildlife Conservation Act* (NMSA 1978 § 17-2-37 through 17-2-46 1978)
- NMSA 1978 § 17-6-1 through 17-6-11, *Habitat Protection Act* (NMSA 1978 § 17-6-1 through 17-6-11 1978)
- NMSA 1978 § 75-6-1, *Endangered Plants* (NMSA 1978 § 75-6-1 1978)
- NMSA 1978 § 76-8-1 through 76-8-4, *Protection of Native New Mexico Plants* (NMSA 1978 § 76-8-1 through 76-8-4 1978)

New Mexico State Statutes and Regulations Related to Petroleum Storage Tanks

Under the authority of NMSA 1978 § 74-4-1 through 74-4-14, *New Mexico Hazardous Waste Act* (NMSA 1978 § 74-4-1 through 74-4-14 1978), and NMSA 1978 § 74 6B 1, *New Mexico Groundwater Protection Act* (NMSA 1978 § 74 6B 1 1978), as well as with delegated authority from EPA under RCRA, NMED administers and enforces the underground storage tank regulatory program in New Mexico. Applicable underground and aboveground storage tanks at SNL/NM are regulated under 20.5 NMAC, *Petroleum Storage Tanks* (20.5 NMAC 2018). See Chapter 7 for more information.

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

Under RCRA, EPA delegates authority to state programs for nonhazardous solid waste and hazardous solid waste, also referred to as hazardous waste. NMED administers and enforces the solid waste program in New Mexico under the authority of NMSA 1978 § 74-9-1 through 74-9-43, *New Mexico Solid Waste Act* (NMSA 1978 § 74-9-1 through 74-9-43 1978). Solid waste management activities at SNL/NM are conducted pursuant to 20.9 NMAC, *Solid Waste* (20.9 NMAC 2007). See Chapter 3 for more information.

NMED administers the hazardous waste program in New Mexico under the authority of the New Mexico Hazardous Waste Act. Hazardous waste management activities at SNL/NM are conducted pursuant to 20.4 NMAC*, Hazardous Waste* (20.4.1 NMAC 2018). See Chapter 3 for more information.

NMED, DOE, and the management and operating contractor for Sandia National Laboratories entered a Compliance Order on Consent in 2004 (NMED 2004). This Compliance Order on Consent requires corrective action for releases of hazardous waste or hazardous constituents as well as for releases of nitrate and perchlorate from activities and operations.

New Mexico Water Quality Control Commission

The *New Mexico Water Quality Act*, NMSA 1978 § 74-6-1 through 74-6 (NMSA 1978 § 74-6-1 through 74-6-17 1978), establishes a Water Quality Control Commission and defines its authority to adopt water quality standards and direct programs consistent with the Clean Water Act. All discharges made to the ground or to surface water must be evaluated for compliance with standards adopted for the protection of groundwater and surface water quality prior to discharge (20.6.2 NMAC 1995). See Chapter 7 for more information.

8.2 Energy Equity and Environmental Justice

Making a difference in society, especially in overburdened and underserved communities, has been a key part of Sandia's commitment to deliver exceptional service in the national interest. Sandia's energy equity and environmental justice (EEEJ) efforts focus on (1) improving the health, safety, and resilience of communities and (2) addressing the threat of climate change. Three executive orders address environmental justice: EO 12898*, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, Section 1-1 (EO 12898 1994); EO 14008, *Tackling the Climate Crisis at Home and Abroad*, Section 219 (EO 17008 2021); and EO 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*, Section 402 (EO 14057 2021).

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

8.3 Environmental Management System

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

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

DOE O 436.1, *Departmental Sustainability* (DOE O 436.1 2011), presents requirements for managing sustainability practices. Sandia personnel implement this order through an ISO 14001-certified environmental management system. Sandia National Laboratories received initial ISO 14001:2015 certification in June 2009 (ISO 14001:2015 2015). In 2015, the Sandia site-specific certifications for primary operating locations in New Mexico and California were integrated into a multi-site ISO 14001:2004 certification. In 2018, the environmental management system was recertified under the new ISO 14001:2015. To maintain this certification, audits by a third-party registrar are required annually to ensure continued conformance with the standard. Additional information can be found at Sandia Environmental Management (Sandia n.d.).

The Environmental Management System provides the following benefits:

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

For fiscal year 2022, the significant aspects for Sandia operations were: greenhouse gas air emissions and hazardous air pollutants (asbestos); hazardous materials; hazardous, mixed, and radiologic waste; release of explosives and combustion byproducts to soil, surface, and groundwater; wastewater and process water discharge; and water use. When significant aspects and negative impacts have been identified, environmental objectives—at all operating levels—are established to guide efforts toward minimizing those aspects and impacts.

8.3.1 Site Sustainability Plan

A site sustainability plan is prepared annually and identifies contributions toward meeting DOE sustainability goals and the broader sustainability program set forth in EO 14008, *Tackling the Climate Crisis at Home and Abroad* (EO 14008 2021). The most recent plan, *Fiscal Year 2023 Site Sustainability Plan* (Sandia 2022), describes the performance status for fiscal year 2022.

Table 8-1 presents performance status for several selected key areas at SNL/NM (Sandia 2022).

Table 8-1. Site Sustainability Plan performance status for key areas for SNL/NM in 2022

DOE Goal/Sandia Objective	Sandia Performance Status in Fiscal Year 2022
Electronic Stewardship	
Manage electronics stewardship from acquisition, operations, to end of life.	Managed electronics stewardship, with 95.5 percent of acquisitions meeting environmentally sustainable electronics standards, 100 percent of operations using power management features during computer and monitor use, and 100 percent of end-of-life equipment being disposed of through government programs or certified recyclers.
Greenhouse Gas Reduction	
Reduce Scope 1, Scope 2, and Scope 3 greenhouse gas emissions.	• Reduced Scope 1 and Scope 2 greenhouse gas emissions by 70.8 percent from the fiscal year 2008 baseline, and decreased year-over-year emissions by 30.1 percent relative to fiscal year 2021. • Reduced Scope 3 greenhouse gas emissions by 25.4 percent from the fiscal year 2008 baseline, but increased year-over-year by 9.5 percent relative to fiscal year 2021.

DOE Goal/Sandia Objective	Sandia Performance Status in Fiscal Year 2022
Organizational Resilience	
Implement climate adaptation and resilience measures.	Completed a vulnerability assessment and resilience plan.
Waste Management	
Reduce nonhazardous solid waste sent to treatment and disposal facilities. Reduce construction and demolition materials and debris sent to treatment and disposal facilities.	Diverted 62.9 percent of nonhazardous solid waste from treatment and disposal facilities. Diverted 20.1 percent of construction and demolition waste from treatment and disposal facilities.
Acquisition and Procurement	
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring that all sustainability clauses are included as appropriate.	Completed modifications to the ecomedes tool, conducted user testing and feedback, and launched the tool. Provided subcontractors with a user's guide, training, and a video tutorial on the new reporting mechanism.
Sustainable Buildings	
Increase the number of owned buildings that are compliant with the *Guiding Principles for Sustainable Federal Buildings* (Council on Environmental Quality 2020).	Improved MAN-004, *Sandia National Laboratories/New Mexico Design Standards Manual* (Sandia 2022). Designed and constructed three new LEED Gold buildings.
Energy Management	
Reduce energy use intensity (Btu per gross square foot) in goal-subject buildings.	In fiscal year 2022, increased energy intensity by 3.3 percent relative to fiscal year 2021.
Water Management	
Reduce potable water use intensity (gallons per gross square foot).	Reduced potable water intensity by 32.8 percent in fiscal year 2022 relative to a fiscal year 2007 baseline and increased it by 8.5 percent relative to fiscal year 2021.

Guiding Principles = *Guiding Principles for Sustainable Federal Buildings*
LEED = Leadership in Energgency and Environmental Design

8.3.2 Sustainability Awards in 2022

The DOE Sustainability Performance Division sponsors the DOE Sustainability Awards, which recognize outstanding sustainability contributions by individuals and teams at DOE facilities across the country. The awards celebrate excellence in energy, water, and fleet management projects and practices. Each year, environmental management system personnel select nominees from that year's Environmental Excellence Awards winners. In 2022, SNL/NM personnel submitted 14 nominations for the internal Environmental Excellence Awards, and of those, two nominations were selected for the DOE Sustainability Awards.

8.3.3 Vulnerability Assessment and Resilience Plan

In fiscal year 2022, Sandia personnel completed a climate vulnerability assessment and resilience plan. The plan assessed anticipated changes in climate by the year 2050 and the climate hazards that would result from such changes (Table 8-2). The following hazards were projected to be "almost certain" with climate change: strong winds, droughts, increase in precipitation, increase in riverine flooding, and increase in the mean number of days with a maximum temperature greater than or equal to 95°F.

Table 8-2. Climate hazards and projected annual likelihood and frequencies at SNL/NM

Regional Hazards Impacting the Site	Hazard Description	Current Hazard Likelihood	Projected Climate Change Effect	Projected Hazard Likelihood with Climate Change
Cold wave	A three-day period where temperatures do not get above 32°F	Anticipated	No change	Anticipated
Ice storm	A storm that results in the accumulation of at least 0.25 inches of ice on exposed surfaces	Extremely unlikely	No change	Extremely unlikely
Hail	Hail with a diameter greater than or equal to 0.75 inches occurring in the vicinity of Bernalillo County	Likely	No change	Likely
Winter weather		Almost certain	Decrease	Likely
Strong wind	Wind gusts that are greater than or equal to 58 miles an hour, including thunderstorm and non-thunderstorm winds	Almost certain	No change	Almost certain
Drought		Almost certain	Increase	Almost certain
Wildfire	Wildfires where response is needed for fires greater than 100 acres	Anticipated	Increase	Likely
Heat wave	Site-specific for SNL/NM: A three-day period where the average high is greater than or equal to 100°F	Anticipated	Increase	Likely
Precipitation	For semiarid locations, a one-inch day that is over 10 percent of annual rainfall	Likely	Increase	Almost certain
Riverine flooding	Streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow	Almost certain	Increase	Almost certain
Other	A six-hour, 100-year precipitation event	Anticipated	Increase	Likely
Other	Mean number of days with minimum temperature less than 32°F	Almost certain	Decrease	Likely
Other	Mean number days with maximum temperature greater than or equal to 95°F	Almost certain	Increase	Almost certain

The climate vulnerability assessment and resilience plan also assessed potential risks posed by the anticipated climate hazards and recommends solutions to increase resilience at SNL/NM. Details on climate hazard risks by asset and infrastructure type at SNL/NM can be found in Appendix F. Table 8-3 displays the resilience solution portfolio identified in the plan. These solutions are focused on addressing resilience planning gaps. On-site generation and storage of electricity is limited at SNL/NM, especially clean and renewable energy. This puts multiple assets and infrastructure systems at high risk of power disruptions from brownouts associated with rising temperatures and the increasing energy demand for cooling. Additionally, several critical assets and infrastructure systems lack adequate protection against floods, droughts, and wildfires. This has also resulted in high risk to multiple assets and infrastructure types and should be addressed by resilience solutions.

Table 8-3. Resilience solutions portfolio for SNL/NM

Solution	Hazard(s) Addressed	Priority Rank (High, Medium, or Low)
Install microgrid[a]	Heat wave, cold wave, wildfires causing power outages	High
Install photovoltaic-covered parking	Heat, drought, and wildfires causing power outages	Medium
Install open land photovoltaic systems	Heat, drought, and wildfires causing power outages	Medium
Install concentrated solar power system	Heat, drought, and wildfires causing power outages	Medium
Improve Building 6570 east side and south drainage	Floods	Medium
Improve Buildings 6505, 6505A, and 6509 flood control	Floods	Medium
Improve Building 6742 areas sled track drainage	Floods	High
Improve Building 6640 drainage	Floods	Medium
Improve Building 6620 drainage	Floods	High
Upgrade Building 857 East drainage overflow	Floods	High
Upgrade Radioactive Mixed Waste Management Facility stormwater pond	Floods	High
Improve Building 6922 drainage	Floods	Medium
Replace Building 855 south side storm drain	Floods	Medium
Upgrade 6000 Igloos southwest diversion channel	Floods	High

[a] A microgrid is an area of hardened electrical infrastructure that connects multiple buildings through a system of localized power generation and automatic control, ensuring access to electricity for these buildings even if the bulk of a city's power grid goes down.

8.4 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.

Additionally, criteria for Sandia performance evaluation were set forth in the *Fiscal Year 2022 DOE/NNSA Strategic Performance Evaluation Measurement Plan (PEMP)* (DOE/NNSA/SFO 2022). Subsequently, the DOE National Nuclear Security Administration Sandia Field Office prepared the *FY2022 Performance Evaluation Summary* (DOE/NNSA/SFO 2022), assessing the management and operating contractor performance—including environment, health, and safety—for October 1, 2021, through September 30, 2022. The performance evaluation is the annual DOE National Nuclear Security Administration report card that ascribes a rating for six key performance goals and an overall rating. Sandia received a rating of excellent in three of the six categories: Mission Execution: Global Nuclear Security; DOE and Strategic Partnership Projects Mission Objectives; and Science, Technology and Engineering. A rating of very good was received in the three remaining categories: Mission Execution: Nuclear Weapons, Mission Enablement, and Mission Leadership. Sandia received an overall rating of very good.

8.4.1 Audits, Assessments, and Inspections in 2022

Environmental programs are routinely subjected to audits, assessments, inspections, and/or verifications by external agencies and authorities. Table 8-4 summarizes the 2022 audits, including any findings, notices of violation, or other environmental occurrences. The Sandia Internal Audit group also conducts assessments, including reviews of the implementation of applicable policies, processes, or procedures; evaluations of corrective action validation assessments; and surveillances and walk-throughs. Self-assessments evaluate performance and compliance and identify deficiencies and opportunities for improvement as well as noteworthy practices and lessons learned.

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 input to DOE for prioritizing 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 2022, this included air, water, vegetation, and soil and sediment sampling programs. The samples were analyzed by independent laboratories under contract to the NMED DOE Oversight Bureau. More information can be found at NMED Department of Energy Oversight Bureau (NMED n.d.).

Table 8-4. Environmental-related external audits, assessments, inspections, and results, 2022

Appraising Agency/Authority	Title/Description	Date	Summary
City of Albuquerque Air Quality Program	Compliance inspections for Fugitive Dust Control Permits	10/27/2022	No violations
Albuquerque Bernaillo County Water Utility Authority	ABCWUA Quarterly Sampling	9/26/2022–9/30/2022	No violations
City of Albuquerque Air Quality Program	New emergency generator site inspection; site closure inspection; site assessment of fugitive dust control permits	7/19/2022	No violations
City of Albuquerque Air Quality Program	Pre-disturbance site inspection	5/20/2022	No violations
City of Albuquerque Air Quality Program	Pre-disturbance site inspection	4/27/2022	Permit issued
Albuquerque Bernaillo County Water Utility Authority	Annual inpsections, ABCWUA quarterly sampling	4/22/2022	No violations
City of Albuquerque Air Quality Program	Inspection of two new stationary sources	3/24/2022	No violations

Appraising Agency/Authority	Title/Description	Date	Summary
Orion Registrar, Inc.	FY 2022 Environmental Management System ISO 14001:2015 Surveillance Audit	3/7/2022–3/18/2022	7 observations, 2 findings, 6 noteworthy practices

8.4.2 Occurrence Reporting in 2022

Under DOE O 232.2A, Chg 1 (MinChg), *Occurrence Reporting and Processing of Operations Information* (DOE O 232.2A, Chg 1 (MinChg) 2017), the current order for occurrence reporting, *occurrences* are defined as "events or conditions that adversely affect, or may adversely affect, DOE (including the National Nuclear Security Administration) or contractor personnel, the public, property, the environment, or the DOE mission." Events or conditions meeting the criteria thresholds identified in this order are occurrences. Whereas some environmental releases may not meet DOE O 232.2A, Chg 1 (MinChg1) reporting thresholds, they may still be reportable to outside agencies.

Occurrences that met DOE O 232.2A, Chg 1 (MinChg1) criteria were entered into the DOE Occurrence Reporting and Processing System database. For this annual site environmental report, the Occurrence Reporting and Processing System database was queried for occurrences in the following reporting criteria groups (as defined by DOE O 232.2A Chg 1 [MinCh1]):

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

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

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

During 2022, the two occurrences shown in Table 8-5 met the criteria for reporting in this annual site environmental report.

Table 8-5. Occurrence reports per DOE O 232.2A, 2022

Reporting Criteria	Month	Report Level	Report Number and Title
Group 9 – Noncompliance Notifications 9(1) - Any written notification from an outside regulatory agency that a site/facility is considered to be in noncompliance with a schedule or requirement. See *2021 Annual Site Environmental Report for Sandia National Laboratories, New Mexico*, Section 5.1.5 (Sandia 2022).	Work performed April 2021 Notice of Violation issued December 2021 Occurrence report filed January 2022	Informational	**NA--SS-SNL-4000-2021-0006**, *Post Inspection Notification (PIN) issued for Failing to Obtain Fugitive Dust Control Permit (FDCP)*

Reporting Criteria	Month	Report Level	Report Number and Title
Group 9 – Noncompliance Notifications **9(1)** - Any written notification from an outside regulatory agency that a site/facility is considered to be in noncompliance with a schedule or requirement. See Section 3.5.7	Inspection performed December 2021 Notice of Violation issued February 2022	Informational	**NA--SS-SNL-NMSITE-2022-0002**, *Notice of Violation (NOV) Issued for Noncompliance with New Mexico Hazardous Waste Management Regulations*

8.5 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 8-6 summarizes the primary reporting requirements for qualifying releases. EPCRA reporting requirements are also included.

Table 8-6. Reporting requirements to outside agencies (other than DOE)

Report	Description	Agency and Regulation	Required Reporting in 2022?
Accidental Slug Discharge Notification	ABCWUA requires notification to its Wastewater Utility Division of any accidental release or slug discharge to the sanitary sewer that may cause potential problems for publicly owned treatment works. The user shall report to the ABCWUA as follows: • Immediate verbal notification to the ABCWUA Industrial Pretreatment Engineer • Written notification to the ABCWUA Industrial Pretreatment Engineer within five days following such occurrence describing the cause of the discharge and measures to be taken to prevent similar future occurrences	Albuquerque Bernalillo County Water Utility Authority Sewer Use and Wastewater Control Ordinance	No
Annual NESHAP Dose Assessment Report	EPA requires reporting on a dose assessment of the calculated effective dose equivalent to the maximally exposed individual based on the assumption that an exposed individual resides 24 hours per day at an area of highest incident radiation.	EPA 40 CFR 61, Subpart H	No
EPCRA Emergency Planning	Sections 301–303 of EPCRA require an annual report that lists the chemical inventories above the reportable threshold planning quantities, including the location of the chemicals and the emergency contacts.	EPA 40 CFR 350, 40 CFR 355, 40 CFR 370, and 40 CFR 372	Yes
EPCRA Emergency Notification	Section 304 of EPCRA requires immediate notification about the accidental release of a reportable quantity of extremely hazardous substances.		No
EPCRA Community-Right-to-Know: Hazardous Chemical Storage Reporting	Sections 311–312 of EPCRA provide requirements for maintaining safety data sheets for hazardous chemicals and for submitting inventory forms for these chemicals. Maintenance of safety data sheets is discussed in Chapter 3.		Yes

Report	Description	Agency and Regulation	Required Reporting in 2022?
EPCRA Community-Right-to-Know: Toxic Chemical Release Inventory Reporting	Section 313 of EPCRA requires that a Toxic Release Inventory report be submitted for facilities that release toxic chemicals listed in SARA Title III over a threshold value.		Yes
Notification of Environmental Release	NMED requires reporting of any discharge from any facility of oil or other water contaminants in such quantity as may with reasonable probability (1) injure or be detrimental to human health, animal life, or plant life or (2) be harmful to property or unreasonably interfere with the public welfare or use of the property. The owner/operator shall report to the appropriate agency within NMED as follows: • Verbal notification as soon as possible after learning of such a discharge, but in no event more than 24 hours thereafter • Written notification within one week verifying the prior verbal notification • Written notification within 15 days describing any corrective actions taken and/or to be taken relative to the discharge	NMED 20.6.2.1203 NMAC	No
Notification of Environmental Release	NMED requires reporting of any newly identified or suspected solid waste management unit or area of concern, with all available information regarding contaminants released to environmental media as follows: • Written notification within 15 days after discovery • Written report of follow-up investigation within 60 days after the initial notification	Compliance Order on Consent	No
Notification of Unauthorized Non-Stormwater Discharge	EPA requires reporting of unauthorized non-stormwater discharges that may endanger human health or the environment. The owner/operator shall report to 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 the EPA Region 6 Office for the NPDES Stormwater Program	EPA NPDES Multi-Sector General Permit Part 7.7	No
Petroleum Storage Tanks Reporting and Investigation of Suspected and Confirmed Releases	NMED requires reporting of any suspected or confirmed release from a storage tank system. The system owner shall report a suspected or confirmed release as follows: • Verbal notification within 24 hours describing conditions and other pertinent information • Written notification within 7 days, including additional information on source and cause of release, estimated volume, and any actions taken to mitigate immediate damage	NMED 20.5.118 NMAC	No

Chapter 9. Quality Assurance

House finch (*Haemorhous mexicanus*)

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

Sandia personnel are responsible for implementing quality assurance for operations—as specified in ISO 9001:2015, *Quality Management Systems–Requirements* (ISO 9001:2015 2015); DOE O 414.1D, Change 2 (LtdChg), *Quality Assurance*, Attachment 1, "Contractor Requirements Document" (DOE O 414.1D, Change 2 (LtdChg) 2020); and 10 CFR 830, *Nuclear Safety Management*, Subpart A, "Quality Assurance Requirements" (10 CFR 830 2016)—via policy statements and processes and by executing the actions specified in those policies and processes. Sandia management is responsible for ensuring the quality of the company's products; for assessing its operations, programs, projects, and business systems; and for identifying deficiencies and effecting continuous improvements.

9.1 Environmental Monitoring for Quality Assurance

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

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

9.1.1 Sample Management Office

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

9.1.2 Contract Laboratory Selection

All off-site commercial laboratories under contract are selected based on performance objectives, licenses and accreditations, and appraisals (pre-award assessments) as described in the *Quality Assurance Project Plan for the Sample Management Office* (Sandia 2022). All contract 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 (Sandia 2020). All calibrations and detection limits must be verified before analyzing samples and reporting data. Once a laboratory has passed an initial appraisal and has been awarded a contract, Sample Management Office personnel are responsible for continuously monitoring laboratory performance to ensure that the laboratory meets its contractual requirements during annual audits.

Contract laboratories perform work in compliance with the 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 Institute, The 2009).

9.1.3 Quality Control for Samples

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

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

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

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

9.1.4 Data Validation and Records Management

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

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

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

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

All analytical data packages, analysis request and chain-of-custody documents, and data validation reports are submitted to a Sandia record depository for cataloging and storage in accordance with internal procedures, DOE requirements, and the document control requirements of ISO 9001, *Quality Management* (ISO 9001:2015 2015), and ISO 14001, *Environmental Management Systems* (ISO 14001:2015 2015).

9.2 Sample Management Office Activities

Sample Management Office activities in 2022 included sample packaging, shipping, and tracking to off-site contracted laboratories, and reviewing all data deliverables for compliance with contract and data quality requirements.

In 2022, Sample Management Office personnel processed 3,869 samples in support of programs and projects at SNL/NM.

9.2.1 Sample Handling and Analyses

In 2022, Sample Management Office personnel processed 3,869 samples in support of programs and projects at SNL/NM. Of the 3,869 samples, 945 were submitted as field and analytical quality control samples to assist with data validation and decision-making. The following programs and projects were supported in 2022:

- Air Quality Compliance
- Decontamination and Demolition

- Environmental Restoration Operations
- Long-Term Stewardship
- Terrestrial Surveillance
- Waste Management
- Water Quality

During 2022, the following contract laboratories were employed to analyze samples:

- ALS Environmental in Salt Lake City, Utah
- Cape Fear Analytical, LLC, in Wilmington, North Carolina
- Eurofins in West Sacramento, California, Knoxville, Tennessee, and St. Louis, Missouri
- General Engineering Laboratories in Charleston, South Carolina
- Hall Environmental Analysis Laboratory in Albuquerque, New Mexico
- Landauer, Inc., in Glenwood, Illinois
- Pace Analytical Gulf Coast Laboratory in Baton Rouge, Louisiana
- Radonova Laboratories in Westmont, Illinois
- Southwest Research Institute in San Antonio, Texas
- Trace Analytics, LLC, in Austin, Texas

9.2.2 Laboratory Quality Assurance Assessments and Validation

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

9.2.3 Quality Assurance Audits

The Sample Management Office participates in the DOE Consolidated Audit Program (DOECAP), which ensures that subcontracted commercial analytical environmental laboratories are audited on their ability to provide data results that are valid, reliable, and defensible. Commercial laboratories are to use the assessment process provided by one of three approved third-party accrediting bodies unless separate arrangements are made with DOECAP. The accrediting bodies conduct assessments using the requirements of the *DOD/DOE Consolidated Quality Systems Manual (QSM) for Environmental Laboratories* (DoD/DOE 2021), which guides DOECAP audits.

In 2022, DOECAP and/or the accrediting bodies conducted assessments at six contracted 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 2022 in DOECAP assessment reports or other applicable DOE programs.

Chapter 10. Environmental Permits and Mixed Waste History

Apache plume (*Fallugia paradoxa*)

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

Table 10-1 presents environmental-related permits held for Sandia programs at SNL/NM. Table 10-2 summarizes the compliance history of mixed waste at SNL/NM, and Table 10-3 lists the quantity of mixed waste subject to the Federal Facility Compliance Order at the end fiscal year 2022.

Table 10-1. Summary of environmental permits and registrations in effect, 2022

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Sewer Wastewater					
General	WW001 Station Manhole, south of TA-IV at Tijeras Arroyo	2069A	2/2/2023	12/31/2027	ABCWUA
General	WW006 Station Manhole, at Pennsylvania Avenue	2069F	8/12/2019	7/1/2024	ABCWUA
Microsystems and Engineering Sciences Applications Complex	WW007 Station Manhole, TA-I	2069G	2/19/2020	12/31/2024	ABCWUA
General	WW008 Station Manhole, south of TA-II at Tijeras Arroyo	2069I	8/12/2019	7/1/2024	ABCWUA
General	WW011 Station Manhole, north of TA-III (includes TA-III and TA-V sewer lines and Coyote Test Field sewer lines)	2069K	9/27/2019	8/31/2024	ABCWUA
Center for Integrated Nanotechnologies	Center for Integrated Nanotechnologies	2238A	5/1/2021	3/31/2026	ABCWUA

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Surface Discharge					
Pulsed Power Development Facilities (Discharge Permit)	TA-IV, Lagoon I and Lagoon II	DP-530	9/5/2014	9/5/2019[a]	NMED
Ground Water (Discharge Permit)	TA-V	DP-1845	5/20/2017	5/29/2022[b]	NMED
Aboveground Storage Tanks					
Aboveground Storage Tank (3,020 gallons)	TA-I	1758	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (2,119 gallons)	TA-I	1759	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (2,000 gallons)	TA-I	1760	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (5,000 gallons)	TA-III	1763	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (5,500 gallons)	Coyote Test Field	1764	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (4,500 gallons)	TA-IV	1765	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (1,500 gallons)	TA-I	1766	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (10,760 gallons)	TA-I	2592	7/1/2022	6/30/2023	NMED
Aboveground Storage Tank (13,760 gallons)	TA-I	2591	7/1/2022	6/30/2023	NMED
NPDES Rio Grande Watershed-Based Municipal Separate Storm Sewer System Permit					
NPDES Municipal Separate Storm Sewer System Permit	TA-I, TA-II, and TA-IV	NTESS: NMR04A012 DOE: NMR04A011	12/22/2015 11/18/2015	12/19/2019 (the permit has entered into administrative continuance and remains in effect until EPA issues a new permit)	EPA
NPDES Multi-Sector General Permit					
NPDES Multi-Sector General Permit	SNL/NM industrial discharge locations	NTESS: NMR04A012 DOE: NMR04A011	5/31/2021	5/31/2026	EPA
NPDES Construction General Permit					
Battery Test Facility	TA-II	NTESS: NMR1000XA	11/27/2017	Permit coverage terminated 2/18/2022	EPA
TA-III to TA-V Waterline Replacement	TA-III and TA-V	NTESS: NMR1001BR	5/16/2018	Permit coverage terminated 9/21/2022	EPA
TA-IV Escarpment	TA-IV	NTESS: NMR1001X4	2/27/2019	CGP expires 2/16/2027	EPA
Building 812	TA-I	NTESS: NMR1002DJ	9/12/2019	CGP expires 2/16/2027	EPA
20th and G Intersection	TA-I	NTESS: NMR1002F3 DOE: NMR1002EY	9/26/2019	Permit coverage terminated 5/16/2022	EPA
TA-II Escarpment	TA-II	NTESS: NMR1002LR	12/9/2019	CGP expires 2/16/2027	EPA
Contractor Laydown Yards	TA-I and TA-II	NTESS: NMR1003CF	9/12/2020	CGP expires 2/16/2027	EPA

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
825 Parking Lot	TA-I	NTESS: NMR1003X1	8/12/2021	Permit coverage terminated 7/25/2022	EPA
TA-IV Chilled Water Loop	TA-IV	NTESS: NMR1003X4	5/27/2021	Permit coverage terminated 5/16/2022	EPA
Building 814	TA-I	NTESS: NMR10042Y	7/30/2021	CGP expires 2/16/2027	EPA
960 Parking Lot	TA-II	NTESS: NMR10047F	9/30/2021	Permit coverage terminated 3/31/2022	EPA
897 Parking Lot	TA-I	NTESS: NMR10047G	9/30/2021	Permit coverage terminated 7/25/2022	EPA
Liquified Natural Gas Dome Decomanitation and Demolition	TA-III	NTESS: NMR1004NB	4/14/2022	CGP expires 2/16/2027	EPA
KAFB West Gas Pipeline	KAFB/TA-I	NTESS: NMR1004NC	4/14/2022	CGP expires 2/16/2027	EPA
T-City D&D	TA-I	NTESS: NMR1004RQ	5/31/22	Permit coverage terminated 9/27/2022	EPA
Ecological					
New Mexico Department of Game and Fish Nuisance Permit	Site-wide ecological monitoring activity	119	12/1/2022	3/31/2024	New Mexico Department of Game and Fish
New Mexico Department of Game and Fish Authorization For Taking Protected Wildlife For Scientific Purposes	Site-wide ecological monitoring activity	3749	11/22/2019	12/31/2022	New Mexico Department of Game and Fish
New Mexico Department of Game and Fish for Scientific/Educational Purposes Authorization for Taking of Protected Wildlife	Site-wide ecological monitoring activity	3757	1/16/2020	12/31/2022	New Mexico Department of Game and Fish
United States Department of the Interior Federal Bird Banding Permit	Site-wide ecological monitoring activity	24206	7/2/2019	9/30/2022	United States Department of the Interior
United States Fish and Wildlife Service Special Purpose-Salvage	Site-wide ecological monitoring activity	MB40881D	5/16/2019	3/31/2022 renewal application submitted 1/2022	United States Fish and Wildlife
United States Fish and Wildlife Service Special Purpose-Miscellaneous	Site-wide ecological monitoring activity	MB47978D	8/13/2020	8/31/2023	United States Fish and Wildlife

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Resource Conservation and Recovery Act					
Hazardous Waste Permit (Post-Closure Care)	Chemical Waste Landfill	NM5890110518	Issued 10/15/2009; effective 6/2/2011	6/2/2021; remains in effect until permit is renewed	NMED
RCRA Facility Operating Permit	• Auxiliary Hot Cell Unit • Corrective Action Management Unit • Hazardous Waste Handling Unit • Manzano Storage Bunkers (five bunkers) • Radioactive and Mixed Waste Management Unit • Thermal Treatment Unit	NM5890110518	Issued 1/27/2015; effective 2/26/2015	2/26/2025	NMED
Open Burning and/or Detonation					
Multiple Event Open Burn Permit	9920 Test Site	22-0001	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	9930 Test Site	22-0002	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	9939 Test Site	22-0003	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Aerial Cable Facility	22-0004	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Burn Site	22-0005	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Dynamic Explosive Test Site Complex	22-0006	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Rocket Sled Track Complex	22-0007	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	National Solar Thermal Test Facility	22-0008	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	22-0009	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Thermal Treatment Unit	22-0010	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Thunder Range Test Site	22-0011	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	22-0012	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	22-0013	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	22-0014	1/1/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Water Impact Complex	22-0024	2/15/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Rocket Sled Track	22-0025	2/11/2022	12/31/2022	City of Albuquerque
Multiple Event Open Burn Permit	Terminal Ballistics Facility	22-0028	3/25/2022	12/31/2022	City of Albuquerque

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Stationary Source (Air)					
Document Disintegrator	TA-III	Permit 144-M1	9/28/2006	N/A	City of Albuquerque
Neutron Generator Facility	TA-I	Permit 374-M2-1TR	9/25/2017	N/A	City of Albuquerque
Standby Diesel Generators at Substation 41	TA-I	Permit 402-M1	10/27/2017	N/A	City of Albuquerque
Radioactive and Mixed Waste Management Unit	TA-III	Permit 415-M2-RV1	9/23/2011	N/A	City of Albuquerque
Title V Operating Permit	Site-wide	Permit 515 (pending)	Submitted 3/1/1996	N/A	City of Albuquerque
Emergency Generator at Building 702	TA-I	Permit 924-RV1	2/8/2012	N/A	City of Albuquerque
Processing and Environmental Technology Laboratory Emergency Generator	TA-I	Permit 925-M2	4/11/2012	N/A	City of Albuquerque
Thermal Test Complex	TA-III	Permit 1712-RV2	5/20/2016	N/A	City of Albuquerque
Center for Integrated Nanotechnologies	Sandia Science and Technology Park	Permit 1725-M1	4/12/2012	N/A	City of Albuquerque
Microsystems and Engineering Sciences Applications Facility Boilers and Generators	TA-I	Permit 1820-M2	2/18/2021	N/A	City of Albuquerque
Southeast TA-I Generator	TA-I	Permit 1828	9/28/2006	N/A	City of Albuquerque
Strategic Defense Facility, Building 963	TA-IV	Permit 1900	1/11/2008	N/A	City of Albuquerque
Site-Wide Chemical Use	Site-wide	Permit 1901-M1	10/10/2016	N/A	City of Albuquerque
Building 962 Generator	TA-IV	Permit 1930-RV1	2/3/2012	N/A	City of Albuquerque
Building 833 Generator	TA-I	Permit 2097-M3	12/4/2019	N/A	City of Albuquerque
Building 880 Boiler and Generator	TA-I	Permit 2116-M1	9/10/2015	N/A	City of Albuquerque
Lurance Canyon Burn Site Igloo and Fire Laboratory for Accreditation of Modeling by Experiment	Remote	Permit 3216-M1	7/1/2016	N/A	City of Albuquerque
Building 726 Generator	TA-1	Permit 3435	8/18/2021	N/A	City of Albuquerque
Building 810 Generator	TA-1	Permit 3436	8/4/2021	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

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
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 823 Boiler	TA-I	Registration 2112	11/8/2010	N/A	City of Albuquerque
Building 840 Boiler	TA-I	Registration 2113	11/8/2010	N/A	City of Albuquerque
Building 857 Boiler	TA-I	Registration 2114	11/8/2010	N/A	City of Albuquerque
Building 860 Boiler	TA-I	Registration 2115	11/8/2010	N/A	City of Albuquerque
Building 890 Boiler	TA-I	Registration 2117	11/29/2010	N/A	City of Albuquerque
Building 887 Boiler	TA-I	Registration 2118	11/29/2010	N/A	City of Albuquerque
Building 891 Boiler	TA-I	Registration 2119	11/29/2010	N/A	City of Albuquerque
Building 892 Boiler	TA-I	Registration 2120	11/30/2010	N/A	City of Albuquerque
Building 894 Boiler	TA-I	Registration 2121	11/30/2010	N/A	City of Albuquerque
Building 897 Boiler	TA-I	Registration 2122	11/30/2010	N/A	City of Albuquerque
Building 960 Boiler	TA-IV	Registration 2169	9/27/2011	N/A	City of Albuquerque
Building 895 Boiler	TA-I	Registration 2170	9/27/2011	N/A	City of Albuquerque
Building 800 Boiler	TA-I	Registration 2171	9/27/2011	N/A	City of Albuquerque
Building 6585 Boiler	TA-V	Registration 2172-RV1	1/26/2012	N/A	City of Albuquerque
Building 6597 Boiler	TA-V	Registration 2173	2/10/2012	N/A	City of Albuquerque
Building 6580 Boiler	TA-V	Registration 2174-RV1	2/26/2012	N/A	City of Albuquerque
Building 981 Boiler	TA-IV	Registration 2175	9/22/2011	N/A	City of Albuquerque
Building 983 Boiler	TA-IV	Registration 3111	9/13/2013	N/A	City of Albuquerque
Building 963 Boiler	TA-IV	Registration 3211	2/15/2015	N/A	City of Albuquerque
Building 970 Boiler	TA-IV	Registration 3302	12/29/2016	N/A	City of Albuquerque
Fugitive Dust Control Construction, Demolition, and Programmatic, as of 12/31/2022					
Building 812	TA-I	0059-C	9/18/2019	9/18/2023	City of Albuquerque
TA-IV Chilled Water Loop	TA-IV	1069-C	4/28/2021	4/28/2023	City of Albuquerque
Building 814	TA-I	1248-C	8/13/2021	8/13/2026	City of Albuquerque
897 Parking Lot	TA-I	1325-C	10/4/2021	10/4/2024	City of Albuquerque
960 Parking Lot	TA-IV	1342-C	10/4/2021	10/4/2024	City of Albuquerque

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
KAFB West Natural Gas Line Supply	TA I	1639-C	5/3/2022	5/3/2027	City of Albuquerque
Fugitive Dust Control Programmatic Permit	Site-wide	1702-P	6/7/2022	6/7/2027	City of Albuquerque
TA-IV Distribution Chilled Water System Expansion	TA IV	2015-C	12/9/2022	12/9/2027	City of Albuquerque
Building 6035 Transshipment Facility	SNL/Igloo	2016-C	12/9/2022	12/9/2027	City of Albuquerque
Fugitive Dust Control Programmatic Permit	Site-wide	8683-P	6/12/2017	6/12/2022	City of Albuquerque

[a] Renewal for Surface Discharge Permit DP-530 was submitted to DOE for transmittal to NMED on February 21, 2019, in compliance with a request from NMED dated September 5, 2014. Additional information was submitted at the request of NMED on May 24, 2019. NMED issued a public notice of the application renewal on August 23, 2019. A new permit for DP-530 has not yet been issued. DP-530 continues to operate under an administrative extension per NMED.

[b] Renewal was not sought for Surface Discharge Permit DP-1845 because the associated project was concluded and discharge was terminated.

N/A = not applicable

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

Date	Milestone	Comment
November 1984	1984 HSWA to RCRA	• Experienced an issue with extended storage after HSWA established land disposal restrictions and a prohibition on storage of wastes for more than one year
August 1990	RCRA Part A interim status permit application submitted	• Submitted the RCRA Part A interim status permit application to NMED for mixed waste storage • Added later revisions to the interim status application, including proposed mixed waste treatment processes
October 1992	FFCA passed	The FFCA allows storage of mixed waste that does not meet the applicable treatment standard beyond the one-year RCRA time limit. This required DOE to submit a site treatment plan for mixed waste.
December 1992	Notice of Noncompliance issued	EPA issued a Notice of Noncompliance for storage of RCRA-regulated mixed waste over the one-year maximum period.
October 1993	Conceptual site treatment plan submitted	DOE submitted a conceptual site treatment plan for mixed waste to NMED; subsequent drafts followed.
March 1995	Final site treatment plan submitted	DOE submitted a final site treatment plan for mixed waste to NMED.
June 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.
October 1995	FFCO signed	The FFCO—an agreement between NMED, DOE, and Sandia personnel—detailed specific actions required with regard to mixed waste management, including the requirement to develop a site treatment plan to be updated annually.
March 1996	Site treatment plan milestones met	• Updated the site treatment plan to reflect fiscal year 1995 activities
September 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.
December 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.
December 1997	On-site mixed waste treatment	On-site treatment of mixed waste began at the Radioactive and Mixed Waste Management Unit in compliance with regulatory requirements.
1997–2001	Site treatment plan milestones met	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones • Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies NMED approved revisions 1 through 5 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
May 2001	FFCO Amendment No. 3	The FFCO was amended.
February 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. The permit application for mixed waste management units was combined with permit renewal requests for hazardous waste management units.

Date	Milestone	Comment
2002–2003	Site treatment plan milestones met	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones • Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies NMED approved revisions 6 and 7 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
April 2003, November 2003	N/A	DOE and Sandia personnel revised the RCRA Part A and Part B permit application in response to NMED comments.
April 2004	FFCO Amendment No. 4	The FFCO was amended.
November 2004	N/A	DOE and Sandia personnel revised the RCRA Part A and Part B permit application in response to NMED comments.
2004–2007	Site treatment plan milestones met	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones • Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies NMED approved revisions 8 through 11 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
June 2005, October 2005, May 2006, March 2007	N/A	DOE and Sandia personnel revised the RCRA Part A and Part B permit application to reflect changes in waste management operations.
August 2007	N/A	NMED issued a draft RCRA permit to DOE and Sandia personnel and made it available for public comment.
January 2008	N/A	DOE and Sandia personnel submitted extensive comments on the draft permit to NMED and requested resolution of comments.
2008–2010	Site treatment plan milestones met	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones • Updated the site treatment plan annually to reflect activities and changes to proposed treatment technologies NMED approved Revision 12 to the site treatment plan, which revised waste volumes, revised treatment and disposal technologies, and established new deadlines.
October 2009, November 2010	N/A	DOE and Sandia personnel revised the RCRA Part B permit application to reflect changes in waste management operations.
December 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
October 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.
September 2012	N/A	NMED issued a draft RCRA permit to DOE and Sandia personnel and made it available for public comment.

Date	Milestone	Comment
November 2012	N/A	DOE and Sandia personnel submitted comments on the draft permit to NMED and requested resolution of comments.
2012–2014	N/A	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements • Updated the site treatment plan annually to reflect waste management activities and waste volumes • Requested approval of Revision 14 to the site treatment plan to revise waste volumes, establish new deadlines, and provide continuity
December 2014	N/A	NMED approved Revision 14 to the site treatment plan, which revised waste volumes and established new deadlines.
January 2015	N/A	NMED issued the RCRA Facility Operating Permit for SNL/NM. The permit includes mixed waste storage and treatment units.
2015–2016	N/A	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements • Updated the site treatment plan annually to reflect waste management activities and waste volumes • Requested approval of Revision 15 to the site treatment plan to establish new deadlines, update waste management technologies, and provide continuity
October 2016	N/A	NMED approved Revision 15 to the site treatment plan, which revised waste volumes and technologies, and established new deadlines.
2017–2020	N/A	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements • Updated the site treatment plan to reflect waste management activities and waste volumes • Requested approval of Revision 16 to the site treatment plan to revise waste volumes, update waste management technologies, establish new deadlines, and provide continuity
January 2021	N/A	NMED approved Revision 16 to the site treatment plan, which revised waste volumes and technologies, and established new deadlines.
2021-2022		• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements • Updated the site treatment plan to reflect waste management activities and waste volumes

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

Table 10-3. Quantity of mixed waste subject to the Federal Facility Compliance Order, end of fiscal year 2022

Waste Category	Volume (m^3)	Description	Status and Plans
TG 1	0	Inorganic debris with an explosives component	No waste currently in inventory
TG 2	0	Inorganic debris with a water-reactive component	No waste currently in inventory
TG 3	0	Reactive metals	No waste currently in inventory
TG 4	0	Elemental lead	No waste currently in inventory
TG 5	0	Aqueous liquids (corrosive)	No waste currently in inventory
TG 6	0	Elemental mercury	No waste currently in inventory
TG 7	0	Organic liquids I	No waste currently in inventory
TG 8	0	Organic debris with organic contaminants	No waste currently in inventory
TG 9	0	Inorganic debris with TCLP metals	No waste currently in inventory
TG 10	0	Heterogeneous debris	No waste currently in inventory
TG 11	0	Organic liquids II	No waste currently in inventory
TG 12	0	Organic debris with TCLP metals	No waste currently in inventory
TG 13	0	Oxidizers	No waste currently in inventory
TG 14	0	Aqueous liquids with organic contaminants	No waste currently in inventory
TG 15	0	Soils < 50 percent debris and particulates with TCLP metals	No waste currently in inventory
TG 16	0	Cyanide waste	No waste currently in inventory
TG 17	0	Liquid or solid with organic and/or metal contaminants	No waste currently in inventory
TG 18	0	Particulates with organic contaminants	No waste currently in inventory
TG 19	0	Liquids with metals	No waste currently in inventory
TG 20	0	Propellant with TCLP metals	No waste currently in inventory
TG 21	0	Sealed sources with TCLP metals	No waste currently in inventory
TG 22	0	Reserved	N/A
TG 23	0	Thermal batteries	No waste currently in inventory
TG 24	0	Spark gap tubes with TCLP metals	No waste currently in inventory
TG 25	0	Classified items with TCLP metals	No waste currently in inventory
TG 26	0	Debris items with reactive compounds and TCLP metals	No waste currently in inventory
TG 27	0	High mercury solids and liquids	No waste currently in inventory
MTRU	1.76	Mixed transuranic waste	Stored at SNL/NM; awaiting shipment to the Waste Isolation Pilot Plant

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

Gray fox (*Urocyon cinereoargenteus*)

Appendix A. Summary of Groundwater Monitoring in 2022

Yellow aphids (*Aphis spp.*) on milkweed (*Asclepias spp.*)

Table A-1. Sample collection events for groundwater quality monitoring at SNL/NM, January through December 2022

Sampling Event	Groundwater Monitoring Program	Chemical Waste Landfill	Mixed Waste Landfill	TA-V Groundwater Area of Concern	Tijeras Arroyo Groundwater Area of Concern	Burn Site Groundwater Area of Concern
January		√		√		
February				√	√	
March	√				√	
April						√
May	√		√	√		√
June				√		
July				√	√	
August		√		√	√	
September					√	
October			√			√
November				√	√	√
December					√	

Table A-2. SNL/NM groundwater monitoring analytical results, 2022

Analyte	Number of Detects	Number of Non-Detects	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Summary of Field Water Quality Parameters Prior to Sample Collection (units as indicated below)						
pH in SU	157	0	5.44	8.18	7.42	NE
Specific Conductivity in µmhos/cm	157	0	37.9	4,245.3	695.5	NE
Temperature in °C	157	0	10.07	24.30	19.51	NE
Turbidity in NTU	157	0	0.08	439	3.94	NE
Detected Organic Compounds in µg/L						
Acetone	3	139	1.82	2.15	1.99	NE
Chloroform	14	155	0.520	1.11	0.736	80.0[a]
Dichloroethane, 1,1-	13	151	0.360	7.06	3.680	NE
Dichloroethene, 1,1-	10	159	1.01	3.02	2.104	7.0
Dichloroethene, cis-1,2-	44	121	0.350	6.22	1.674	70.0
Diesel range organics	1	35	91.2	91.2	91.2	NE
Naphthalene	1	20	0.380	0.380	0.380	NE
Tetrachloroethene	13	156	0.440	10.4	5.37	5.0
Toluene	15	147	0.340	1.88	0.733	1000
Trichlorobenzene, 1,2,3-	1	151	0.380	0.380	0.380	NE
Trichloroethene	77	98	0.420	19.7	5.52	5.0
Detected Inorganic Parameters in mg/L						
Alkalinity as CaCO3	73	0	60.6	1,010	205.9	NE
Bromide	71	2	0.147	2.94	0.536	NE
Chloride	73	0	9.50	457	54.15	NE
Fluoride	73	0	0.168	2.75	0.924	4.0
Nitrate plus nitrite	176	1	0.146	38.1	7.888	10.0
Sulfate	73	0	16.1	1,940	118	NE
Total organic halogens	10	11	0.00370	0.133	0.03240	NE
Total phenols	1	20	0.00393	0.00393	0.00393	NE
Detected Metals in mg/L						
Aluminum	11	62	0.0239	0.762	0.1818	NE
Antimony	6	67	0.00108	0.00182	0.00134	0.006
Arsenic	72	63	0.00202	0.00724	0.00280	0.010
Barium	73	0	0.00849	0.231	0.06947	2.0
Beryllium	4	69	0.000220	0.00703	0.002580	0.004
Cadmium	2	81	0.000352	0.000395	0.000374	0.005
Calcium	73	0	35.3	312	88.2	NE
Chromium	10	83	0.00307	0.0419	0.00974	0.100
Cobalt	4	69	0.000310	0.00949	0.002850	NE
Copper	22	51	0.000324	0.00377	0.000808	NE
Iron	17	118	0.0350	0.581	0.1238	NE
Lead	2	71	0.000592	0.000731	0.000661	NE
Magnesium	73	0	3.80	62.9	20.22	NE
Manganese	30	104	0.00110	1.44	0.0536	NE
Mercury	1	93	0.00201	0.00201	0.00201	0.002
Molybdenum	18	75	0.000600	0.0232	0.002550	NE

Analyte	Number of Detects	Number of Non-Detects	Minimum Detected Value	Maximum Detected Value	Mean Detected Value	MCL
Nickel	73	0	1.23	31.4	3.62	NE
Potassium	56	17	0.00154	0.0286	0.00470	0.050
Selenium	73	0	15.5	974	60.5	NE
Sodium	1	72	0.00132	0.00132	0.00132	0.002
Thallium	59	0	0.00103	0.00933	0.00385	0.030
Uranium	55	18	0.00362	0.0105	0.00629	NE
Vanadium	18	55	0.00400	0.179	0.04100	NE
Zinc	11	62	0.0239	0.762	0.1818	NE
Detected Radiological Parameters in pCi/L						
Alpha, gross (corrected)	83	0	−4.722	8.348	2.364	15.0[b]
Beta, gross	74	7	2.050	20.5	5.147	4 mrem/yr
Potassium-40	1	71	64.5	64.5	64.5	NE
Radium-226	12	9	0.446	3.04	1.135	5.0[c]
Radium-228	7	14	0.865	1.43	1.033	5.0[c]
Radon-222	10	0	95.4	470	275.2	4000
Tritium	1	61	158	158	158	NE
Uranium-233/234	24	0	0.40	33.5	12.66	NE
Uranium-235/236	22	2	0.109	0.710	0.231	NE
Uranium-238	24	0	0.104	6.40	2.567	NE

Note: The number of active wells sampled was 78, the number of analyses performed was 12,222, and the percent of non-detected results was 85 percent.

[a]The 80.0 μg/L MCL is for combined trihalomethanes.

[b]The 15.0 pCi/L MCL is for corrected gross alpha activity.

[c]The 5.0 pCi/L MCL is for combined radium-226 and radium-228.

4 mrem/yr = any combination of beta- and/or gamma-emitting radionuclides (as dose rate)

$CaCO_3$ = calcium as carbon carbonate

corrected = gross alpha results reported as corrected values (uranium activities subtracted out)

MCL = maximum contaminant level. Established by the U.S. Environmental Protection Agency Primary Drinking Water Regulations (40 CFR 141.11[b]), National Primary Drinking Water Standards (EPA March 2018)

N = nitrogen

NE = not established

NTU = nephelometric turbidity unit

pH = potential of hydrogen (negative logarithm of the hydrogen ion concentration)

SU = standard unit

Table A-3. Exceedances for SNL/NM groundwater monitoring wells and springs sampled, 2022

Analyte	Well	Exceedance	Date
Beryllium MCL = 0.004 mg/L	Coyote Springs	0.00703 mg/L[a]	March 2022
Nitrate plus nitrite (as nitrogen) MCL = 10.0 mg/L	AVN-1	10.2 mg/L	July 2022
	CYN-MW9	38.1 mg/L	May 2022
		37.7 mg/L	November 2022
	CYN-MW10	10.2 mg/L	April 2022
		16.8 mg/L	October 2022
	CYN-MW10 (duplicate)	16.8 mg/L	October 2022
	CYN-MW12	15.9 mg/L	May 2022
		15.8 mg/L	November 2022
	CYN-MW12 (duplicate)	16.0 mg/L	November 2022
	CYN-MW13	29.5 mg/L	May 2022
		27.8 mg/L	November 2022
	CYN-MW14A	11.0 mg/L	May 2022
		11.6 mg/L	November 2022
	CYN-MW14A (duplicate)	10.9 mg/L	May 2022
	CYN-MW15	17.6 mg/L	May 2022
		18.2 mg/L	November 2022
	LWDS-MW1	12.2 mg/L	February 2022
		12.2 mg/L	June 2022
		13.1 mg/L	August 2022
		12.1 mg/L	November 2022
	LWDS-MW1 (duplicate)	12.4 mg/L	November 2022
	TA2-W-19	12.3 mg/L	February 2022
		11.2 mg/L	July 2022
		12.7 mg/L	August 2022
		12.1 mg/L	December 2022
	TA2-W-28	17.8 mg/L	February 2022
		15.5 mg/L	July 2022
		18.8 mg/L	August 2022
		14.4 mg/L	December 2022
	TA2-W-28 (duplicate)	15.4 mg/L	July 2022
	TAV-MW10	12.5 mg/L	February 2022
		12.6 mg/L	June 2022
		13.5 mg/L	August 2022
		12.7 mg/L	November 2022
	TAV-MW10 (duplicate)	12.6 mg/L	February 2022
	TJA-2	11.9 mg/L	February 2022
		11.3 mg/L	July 2022
		12.6 mg/L	August 2022
		13.2 mg/L	December 2022
	TJA-2 (duplicate)	12.9 mg/L	December 2022

Analyte	Well	Exceedance	Date
Nitrate plus nitrite (as nitrogen) MCL = 10.0 mg/L	TJA-4	32.2 mg/L	March 2022
		29.8 mg/L	July 2022
		32.8 mg/L	August 2022
		34.4 mg/L	December 2022
	TJA-5	16.4 mg/L	August 2022
	TJA-7	22.2 mg/L	March 2022
		21.4 mg/L	July 2022
		21.9 mg/L	August 2022
		21.7 mg/L	December 2022
Mercury MCL = 0.002 mg/L	PL-4	0.00201 mg/L	March 2022
Tetrachloroethene MCL = 5.0 µg/L	TA2-W-26	7.44 µg/L	March 2022
		7.18 µg/L	August 2022
		10.4 µg/L	August 2022
		8.10 µg/L	December 2022
	TA2-W-26 (duplicate)	8.05 µg/L	March 2022
		7.43 µg/L	August 2022
		9.37 µg/L	August 2022
		7.48 µg/L	December 2022
Trichloroethene MCL = 5.0 µg/L	LWDS-MW1	10.1 µg/L	February 2022
		11.5 µg/L	June 2022
		12.4 µg/L	August 2022
		7.11 µg/L	November 2022
	LWDS-MW1 (duplicate)	6.04 µg/L	November 2022
	TA2-W-26	15.0 µg/L	March 2022
		16.3 µg/L	August 2022
		19.7 µg/L	August 2022
		17.7 µg/L	December 2022
	TA2-W-26 (duplicate)	16.0 µg/L	March 2022
		16.2 µg/L	August 2022
		18.1 µg/L	August 2022
		15.1 µg/L	December 2022
	TAV-MW4	5.21 µg/L	February 2022
		5.77 µg/L	June 2022
		5.76 µg/L	August 2022
		6.37 µg/L	November 2022
	TAV-MW6	8.36 µg/L	August 2022
		8.97 µg/L	November 2022
	TAV-MW8	5.21 µg/L	February 2022
		5.04 µg/L	June 2022
		5.07 µg/L	August 2022
		5.27 µg/L	November 2022
	TAV-MW8 (duplicate)	5.17 µg/L	August 2022

Analyte	Well	Exceedance	Date
Trichloroethene MCL = 5.0 µg/L	TAV-MW10	11.1 µg/L	February 2022
		10.7 µg/L	June 2022
		9.52 µg/L	August 2022
		10.0 µg/L	November 2022
	TAV-MW10 (duplicate)	10.8 µg/L	February 2022
	TAV-MW14	5.04 µg/L	November 2022

[a]Analytical result for filtered groundwater sample. All other analytical results are for unfiltered groundwater samples.
MCL = maximum contaminant level

Appendix B. Terrestrial Surveillance Analytical Results in 2022


Sandia Mountains crest

Table B-1. Radiological results in soil, 2022

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-9	Actinium-228	pCi/g	0.972	±0.169	0.106	0.0506		None	SA	HASL 300
	Americium-241	pCi/g	0.00309	±0.0287	0.0382	0.0188	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0999	±0.0374	0.0286	0.0137	X	R	SA	HASL 300
	Uranium-235	pCi/g	0.031	±0.115	0.118	0.0579	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.31	±0.591	0.371	0.182		None	SA	HASL 300
C-10	Actinium-228	pCi/g	1.1	±0.188	0.105	0.0494		None	SA	HASL 300
	Americium-241	pCi/g	-0.0128	±0.065	0.12	0.0582	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.233	±0.0458	0.0289	0.0138		None	SA	HASL 300
	Tritium	pCi/L	59.6	±129	230	102	U	BD	SA	GL-RAD-A-002
	Uranium-235	pCi/g	0.0349	±0.0897	0.136	0.0665	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.577	±1.21	0.948	0.461	U	BD	SA	HASL 300
C-25	Actinium-228	pCi/g	0.837	±0.164	0.0964	0.0456		None	SA	HASL 300
	Americium-241	pCi/g	-0.0188	±0.0797	0.141	0.0685	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.11	±0.0262	0.0242	0.0115		None	SA	HASL 300
	Uranium-235	pCi/g	0.106	±0.115	0.125	0.0606	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.97	±1.32	1.12	0.543		J	SA	HASL 300
S-1	Actinium-228	pCi/g	1.05	±0.171	0.083	0.0393		None	SA	HASL 300
	Americium-241	pCi/g	0.0326	±0.0777	0.134	0.0654	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.11	±0.0269	0.0233	0.0111		None	SA	HASL 300
	Uranium-235	pCi/g	0.0766	±0.12	0.117	0.0572	U	BD	SA	HASL 300
	Uranium-238	pCi/g	2.8	±1.38	1.01	0.492		J	SA	HASL 300
S-6	Actinium-228	pCi/g	0.683	±0.132	0.0853	0.04		None	SA	HASL 300
	Americium-241	pCi/g	0.00336	±0.014	0.0257	0.0125	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.04	±0.0271	0.0221	0.0105		J	SA	HASL 300
	Uranium-235	pCi/g	0.0158	±0.0883	0.0887	0.0431	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.389	±0.348	0.249	0.122		J	SA	HASL 300
S-33	Actinium-228	pCi/g	0.887	±0.192	0.115	0.0538		None	SA	HASL 300
	Actinium-228	pCi/g	0.902	±0.151	0.0839	0.0399		None	DU	HASL 300
	Actinium-228	pCi/g	0.885	±0.182	0.104	0.0494		None	DU	HASL 300
	Americium-241	pCi/g	-0.0212	±0.0421	0.0616	0.0302	U	BD	DU	HASL 300

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-33	Americium-241	pCi/g	-0.0039	±0.0676	0.113	0.0549	U	BD	SA	HASL 300
	Americium-241	pCi/g	-0.0193	±0.0497	0.0739	0.0361	U	BD	DU	HASL 300
	Cesium-137	pCi/g	0.238	±0.0381	0.0264	0.0125		None	DU	HASL 300
	Cesium-137	pCi/g	0.221	±0.0422	0.0322	0.0152		None	SA	HASL 300
	Cesium-137	pCi/g	0.227	±0.0348	0.0223	0.0107		None	DU	HASL 300
	Tritium	pCi/L	60.1	±128	228	101	U	BD	SA	GL-RAD-A-002
	Tritium	pCi/L	31	±126	231	102	U	BD	DU	GL-RAD-A-002
	Tritium	pCi/L	77.2	±132	230	102	U	BD	DU	GL-RAD-A-002
	Uranium-235	pCi/g	0.147	±0.147	0.145	0.07	X	R	SA	HASL 300
	Uranium-235	pCi/g	0.0539	±0.0837	0.128	0.0629	U	BD	DU	HASL 300
	Uranium-235	pCi/g	0.0948	±0.125	0.137	0.0669	U	BD	DU	HASL 300
	Uranium-238	pCi/g	1.75	±1.5	0.946	0.459		J	SA	HASL 300
	Uranium-238	pCi/g	1.12	±0.702	0.57	0.28		J	DU	HASL 300
	Uranium-238	pCi/g	0.863	±0.763	0.655	0.32		J	DU	HASL 300
S-34	Actinium-228	pCi/g	1.2	±0.177	0.0781	0.0367		None	SA	HASL 300
	Americium-241	pCi/g	0.0565	±0.0411	0.0277	0.0135	X	R	SA	HASL 300
	Cesium-137	pCi/g	0.0469	±0.0206	0.0212	0.0101		J	SA	HASL 300
	Uranium-235	pCi/g	0.116	±0.13	0.106	0.0518	X	R	SA	HASL 300
	Uranium-238	pCi/g	1.33	±0.572	0.291	0.142		None	SA	HASL 300
S-45	Actinium-228	pCi/g	0.852	±0.163	0.0885	0.0419		None	SA	HASL 300
	Americium-241	pCi/g	-0.0236	±0.0692	0.11	0.0536	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0299	±0.0343	0.0235	0.0112	X	R	SA	HASL 300
	Uranium-235	pCi/g	0.0895	±0.124	0.118	0.0575	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.611	±1.02	0.899	0.439	U	BD	SA	HASL 300
S-46	Actinium-228	pCi/g	0.976	±0.144	0.0783	0.0372		None	SA	HASL 300
	Americium-241	pCi/g	0.0102	±0.0893	0.144	0.0703	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.108	±0.0267	0.0205	0.00977		None	SA	HASL 300
	Uranium-235	pCi/g	0.0542	±0.135	0.117	0.0574	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.878	±1.46	1.15	0.563	U	BD	SA	HASL 300
S-49	Actinium-228	pCi/g	0.833	±0.157	0.108	0.051		None	SA	HASL 300
	Americium-241	pCi/g	0.00524	±0.0273	0.0402	0.0197	U	BD	SA	HASL 300

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-49	Cesium-137	pCi/g	0.148	±0.0382	0.0271	0.0129		None	SA	HASL 300
	Uranium-235	pCi/g	0.0477	±0.116	0.127	0.0621	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.19	±0.557	0.388	0.19		None	SA	HASL 300
S-51	Actinium-228	pCi/g	0.819	±0.135	0.0812	0.0386		None	SA	HASL 300
	Americium-241	pCi/g	-0.0049	±0.0674	0.119	0.0579	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0445	±0.0205	0.0198	0.00946		J	SA	HASL 300
	Uranium-235	pCi/g	0.00584	±0.0728	0.11	0.0539	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.16	±1.24	0.883	0.43	X	R	SA	HASL 300
S-53	Actinium-228	pCi/g	0.805	±0.165	0.1	0.0467		None	SA	HASL 300
	Actinium-228	pCi/g	0.699	±0.149	0.0858	0.0408		None	DU	HASL 300
	Actinium-228	pCi/g	0.742	±0.14	0.076	0.0358		None	DU	HASL 300
	Americium-241	pCi/g	-0.0188	±0.0646	0.12	0.0583	U	BD	DU	HASL 300
	Americium-241	pCi/g	0.00394	±0.0756	0.132	0.0641	U	BD	DU	HASL 300
	Americium-241	pCi/g	0.00299	±0.0495	0.0956	0.0464	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.00366	±0.029	0.0307	0.0146	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0364	±0.0207	0.0223	0.0107		J	DU	HASL 300
	Cesium-137	pCi/g	0.00903	±0.0171	0.0238	0.0114	U	BD	DU	HASL 300
	Uranium-235	pCi/g	0.128	±0.118	0.119	0.0578	X	R	SA	HASL 300
	Uranium-235	pCi/g	0.0216	±0.0791	0.113	0.0553	U	BD	DU	HASL 300
	Uranium-235	pCi/g	0.0857	±0.116	0.106	0.0515	U	BD	DU	HASL 300
	Uranium-238	pCi/g	1.52	±1.38	1.01	0.493		J	DU	HASL 300
	Uranium-238	pCi/g	0.509	±1.07	0.797	0.387	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.23	±1.21	0.925	0.451		J	DU	HASL 300
S-55	Actinium-228	pCi/g	0.987	±0.143	0.0613	0.029		None	SA	HASL 300
	Americium-241	pCi/g	-0.0004	±0.0131	0.0237	0.0116	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.131	±0.0253	0.0179	0.00858		None	SA	HASL 300
	Uranium-235	pCi/g	0.0488	±0.107	0.0833	0.0407	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.647	±0.403	0.236	0.116		J	SA	HASL 300
S-57	Actinium-228	pCi/g	0.919	±0.137	0.081	0.0384		None	SA	HASL 300
	Americium-241	pCi/g	-0.0024	±0.0165	0.0295	0.0145	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.019	±0.0189	0.0213	0.0102	U	BD	SA	HASL 300

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-57	Uranium-235	pCi/g	0.163	±0.116	0.108	0.0526	X	R	SA	HASL 300
	Uranium-238	pCi/g	1.51	±0.643	0.286	0.14		None	SA	HASL 300
S-76	Actinium-228	pCi/g	0.859	±0.167	0.109	0.0507		None	SA	HASL 300
	Americium-241	pCi/g	0.0269	±0.0515	0.0833	0.0405	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0628	±0.0267	0.0306	0.0145		J	SA	HASL 300
	Uranium-235	pCi/g	0.0231	±0.0907	0.16	0.0777	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.912	±0.841	0.764	0.372		J	SA	HASL 300
S-77	Actinium-228	pCi/g	1	±0.177	0.0939	0.0438		None	SA	HASL 300
	Americium-241	pCi/g	0.0162	±0.0574	0.107	0.052	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.32	±0.0439	0.0282	0.0134		None	SA	HASL 300
	Uranium-235	pCi/g	0.0232	±0.0773	0.138	0.0671	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.85	±1.06	0.87	0.423	U	BD	SA	HASL 300
S-86	Actinium-228	pCi/g	0.971	±0.207	0.114	0.0529		None	SA	HASL 300
	Americium-241	pCi/g	0.0052	±0.0661	0.125	0.0603	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0318	±0.0317	0.0325	0.0153	U	BD	SA	HASL 300
	Uranium-235	pCi/g	0.0924	±0.172	0.162	0.0781	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.916	±1.27	1	0.485	U	BD	SA	HASL 300
S-90	Actinium-228	pCi/g	0.763	±0.146	0.116	0.0548		None	SA	HASL 300
	Americium-241	pCi/g	0.0314	±0.048	0.0784	0.0381	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.165	±0.0326	0.0298	0.0141		None	SA	HASL 300
	Uranium-235	pCi/g	0.178	±0.173	0.144	0.0697		J	SA	HASL 300
	Uranium-238	pCi/g	0.8	±0.915	0.693	0.337	X	R	SA	HASL 300
S-92	Actinium-228	pCi/g	0.754	±0.148	0.0874	0.0406		None	SA	HASL 300
	Americium-241	pCi/g	0.0352	±0.0656	0.117	0.0564	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.086	±0.0344	0.0244	0.0115		None	SA	HASL 300
	Uranium-235	pCi/g	0.0142	±0.109	0.12	0.0578	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.36	±1.23	0.882	0.427		J	SA	HASL 300
P-4	Actinium-228	pCi/g	0.854	±0.159	0.089	0.0423		None	SA	HASL 300
	Americium-241	pCi/g	-0.0322	±0.0853	0.143	0.0697	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.165	±0.0262	0.0223	0.0106		None	SA	HASL 300
	Uranium-235	pCi/g	0.136	±0.113	0.121	0.0593		J	SA	HASL 300

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-4	Uranium-238	pCi/g	0.34	±1.39	1.1	0.538	U	BD	SA	HASL 300
P-5	Actinium-228	pCi/g	0.531	±0.105	0.0659	0.0313		None	SA	HASL 300
	Americium-241	pCi/g	-0.0051	±0.0119	0.0208	0.0102	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.186	±0.028	0.0147	0.00695		None	SA	HASL 300
	Uranium-235	pCi/g	0.0763	±0.0952	0.0765	0.0373	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.813	±0.372	0.21	0.103		None	SA	HASL 300
P-16	Actinium-228	pCi/g	1.39	±0.216	0.107	0.0511		None	SA	HASL 300
	Americium-241	pCi/g	0.071	±0.0929	0.142	0.0696	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0716	±0.0385	0.0286	0.0137		J	SA	HASL 300
	Uranium-235	pCi/g	0.125	±0.163	0.144	0.0707	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.76	±1.33	1.14	0.557		J	SA	HASL 300
P-19	Actinium-228	pCi/g	1.16	±0.184	0.0999	0.0474		None	SA	HASL 300
	Americium-241	pCi/g	0.034	±0.106	0.197	0.0961	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.181	±0.0423	0.0294	0.0141		None	SA	HASL 300
	Uranium-235	pCi/g	0.00511	±0.1	0.148	0.0722	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.309	±1.79	1.49	0.726	U	BD	SA	HASL 300
P-58	Actinium-228	pCi/g	1.11	±0.187	0.0934	0.0441		None	SA	HASL 300
	Americium-241	pCi/g	-0.0174	±0.0688	0.113	0.0553	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0816	±0.0301	0.0267	0.0128		None	SA	HASL 300
	Uranium-235	pCi/g	0.0761	±0.119	0.116	0.0562	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.08	±1.02	0.901	0.44		J	SA	HASL 300
P-59	Actinium-228	pCi/g	0.983	±0.15	0.0705	0.0335		None	SA	HASL 300
	Americium-241	pCi/g	-0.0231	±0.047	0.0695	0.034	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.207	±0.0349	0.0202	0.00968		None	SA	HASL 300
	Uranium-235	pCi/g	-0.0336	±0.0671	0.102	0.0501	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.19	±0.781	0.585	0.286		J	SA	HASL 300
P-61	Actinium-228	pCi/g	0.692	±0.122	0.0911	0.0432		None	SA	HASL 300
	Americium-241	pCi/g	0.00051	±0.0493	0.0826	0.0403	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0256	±0.0162	0.0236	0.0113		J	SA	HASL 300
	Uranium-235	pCi/g	-0.0672	±0.0785	0.124	0.0602	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.551	±0.788	0.72	0.352	U	BD	SA	HASL 300

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-63	Actinium-228	pCi/g	1.03	±0.204	0.0988	0.0466		None	SA	HASL 300
	Americium-241	pCi/g	-0.006	±0.0637	0.105	0.0513	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.153	±0.036	0.0249	0.0118		None	SA	HASL 300
	Uranium-235	pCi/g	0.0484	±0.117	0.132	0.0643	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.977	±1.12	0.914	0.446	X	R	SA	HASL 300
P-64	Actinium-228	pCi/g	1.73	±0.224	0.103	0.0488		None	SA	HASL 300
	Actinium-228	pCi/g	1.63	±0.227	0.116	0.0542		None	DU	HASL 300
	Actinium-228	pCi/g	1.66	±0.252	0.104	0.0499		None	DU	HASL 300
	Americium-241	pCi/g	-0.0168	±0.0269	0.0391	0.0192	U	BD	SA	HASL 300
	Americium-241	pCi/g	-0.0073	±0.0907	0.161	0.0789	U	BD	DU	HASL 300
	Americium-241	pCi/g	0.0567	±0.0864	0.143	0.0697	U	BD	DU	HASL 300
	Cesium-137	pCi/g	0.1	±0.0328	0.0304	0.0146		None	SA	HASL 300
	Cesium-137	pCi/g	0.164	±0.0391	0.029	0.014		None	DU	HASL 300
	Cesium-137	pCi/g	0.122	±0.0359	0.0335	0.0159		None	DU	HASL 300
	Uranium-235	pCi/g	0.151	±0.139	0.127	0.0622		J	SA	HASL 300
	Uranium-235	pCi/g	0.103	±0.112	0.129	0.063	U	BD	DU	HASL 300
	Uranium-235	pCi/g	0.309	±0.198	0.195	0.0953	X	R	DU	HASL 300
	Uranium-238	pCi/g	1.08	±1.35	1.19	0.584	U	BD	DU	HASL 300
	Uranium-238	pCi/g	1.57	±0.683	0.383	0.188		None	SA	HASL 300
	Uranium-238	pCi/g	1.48	±1.41	1.18	0.573		J	DU	HASL 300
P-81	Actinium-228	pCi/g	0.863	±0.161	0.0907	0.0427		None	SA	HASL 300
	Americium-241	pCi/g	0.0394	±0.0469	0.0726	0.0354	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0764	±0.0265	0.0256	0.0122		J	SA	HASL 300
	Uranium-235	pCi/g	-0.0069	±0.0819	0.139	0.0676	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.4	±0.853	0.632	0.309		J	SA	HASL 300
P-82	Actinium-228	pCi/g	0.974	±0.159	0.0819	0.0388		None	SA	HASL 300
	Americium-241	pCi/g	-0.0095	±0.0498	0.0979	0.0476	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0477	±0.0185	0.0212	0.0101		J	SA	HASL 300
	Uranium-235	pCi/g	0.0077	±0.0677	0.108	0.0528	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.53	±1.16	0.778	0.379		J	SA	HASL 300
P-95	Actinium-228	pCi/g	0.75	±0.124	0.0606	0.0287		None	SA	HASL 300

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-95	Americium-241	pCi/g	0.00487	±0.0347	0.0613	0.0299	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.255	±0.0324	0.0168	0.00803		None	SA	HASL 300
	Uranium-235	pCi/g	0.0199	±0.0929	0.0863	0.0422	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.761	±0.678	0.525	0.257		J	SA	HASL 300

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

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

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

Sample Type
DU = duplicate sample
SA = sample

Analytical Method
GL-RAD-A-002 (GL-RAD-A-002 2010)
HASL 300 (DOE 1997)

Table B-2. Radiological results in sediment, 2022

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-8	Actinium-228	pCi/g	0.962	±0.164	0.0946	0.0448		None	SA	HASL 300
	Americium-241	pCi/g	0.00827	±0.0155	0.0285	0.014	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0948	±0.026	0.0236	0.0113		None	SA	HASL 300
	Tritium	pCi/L	-7.85	±125	239	106	U	BD	SA	GL-RAD-A-002
	Uranium-235	pCi/g	0.0106	±0.115	0.1	0.0489	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.979	±0.476	0.285	0.14		None	SA	HASL 300
C-68	Actinium-228	pCi/g	0.786	±0.137	0.0759	0.0359		None	SA	HASL 300
	Americium-241	pCi/g	-0.0277	±0.0688	0.112	0.0543	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.053	±0.0226	0.0187	0.0089		J	SA	HASL 300
	Uranium-235	pCi/g	0.189	±0.156	0.124	0.0604	X	R	SA	HASL 300
	Uranium-238	pCi/g	0.28	±1.15	0.929	0.454	U	BD	SA	HASL 300
S-72	Actinium-228	pCi/g	0.89	±0.172	0.0838	0.04		None	SA	HASL 300
	Americium-241	pCi/g	0.0511	±0.0733	0.131	0.0638	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0714	±0.0293	0.0209	0.01		None	SA	HASL 300
	Uranium-235	pCi/g	0.0262	±0.106	0.101	0.0492	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.413	±1.27	0.957	0.467	U	BD	SA	HASL 300
S-74	Actinium-228	pCi/g	1.39	±0.196	0.074	0.035		None	SA	HASL 300
	Actinium-228	pCi/g	0.972	±0.168	0.093	0.0436		None	DU	HASL 300
	Actinium-228	pCi/g	0.988	±0.178	0.0957	0.0446		None	DU	HASL 300
	Americium-241	pCi/g	-0.0021	±0.0581	0.105	0.0511	U	BD	DU	HASL 300
	Americium-241	pCi/g	-0.0689	±0.0913	0.166	0.0807	U	BD	SA	HASL 300
	Americium-241	pCi/g	0.00625	±0.0627	0.124	0.0599	U	BD	DU	HASL 300
	Cesium-137	pCi/g	0.0112	±0.0157	0.0255	0.0121	U	BD	DU	HASL 300
	Cesium-137	pCi/g	-0.00175	±0.0135	0.0245	0.0115	U	BD	DU	HASL 300
	Cesium-137	pCi/g	0.0018	±0.0122	0.0223	0.0107	U	BD	SA	HASL 300
	Uranium-235	pCi/g	0.0133	±0.0704	0.127	0.0617	U	BD	DU	HASL 300
	Uranium-235	pCi/g	0.0634	±0.166	0.126	0.0615	U	BD	SA	HASL 300
	Uranium-235	pCi/g	0.135	±0.142	0.138	0.0668	U	BD	DU	HASL 300
	Uranium-238	pCi/g	1.39	±1.42	0.864	0.419	X	R	DU	HASL 300
	Uranium-238	pCi/g	1.39	±1.61	1.27	0.62	X	R	SA	HASL 300

Location	Analyte	Units	Activity	Total Propagated Uncertainty	Minimum Detectable Activity	Critical Level	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-74	Uranium-238	pCi/g	1.06	±1.06	0.984	0.478		J	DU	HASL 300
S-75	Actinium-228	pCi/g	0.742	±0.159	0.0936	0.0433		None	SA	HASL 300
	Americium-241	pCi/g	0.0113	±0.0596	0.108	0.0523	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.114	±0.0368	0.0291	0.0138		None	SA	HASL 300
	Uranium-235	pCi/g	0.272	±0.152	0.153	0.0742	X	R	SA	HASL 300
	Uranium-238	pCi/g	0.864	±1.41	0.9	0.436	U	BD	SA	HASL 300
S-85	Actinium-228	pCi/g	0.62	±0.155	0.1	0.046		None	SA	HASL 300
	Americium-241	pCi/g	-0.00172	±0.0695	0.138	0.0666	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0149	±0.0291	0.0262	0.0122	U	BD	SA	HASL 300
	Uranium-235	pCi/g	0.0751	±0.12	0.126	0.0606	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.78	±1.15	1.07	0.514	U	BD	SA	HASL 300
S-91	Actinium-228	pCi/g	0.943	±0.174	0.103	0.048		None	SA	HASL 300
	Americium-241	pCi/g	-0.0289	±0.0603	0.113	0.0549	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.0501	±0.0243	0.0275	0.0129		J	SA	HASL 300
	Uranium-235	pCi/g	0.0577	±0.168	0.146	0.0705	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.28	±1.16	0.987	0.48		J	SA	HASL 300
P-60	Actinium-228	pCi/g	0.777	±0.144	0.075	0.0355		None	SA	HASL 300
	Americium-241	pCi/g	0.0602	±0.0594	0.0593	0.029	X	R	SA	HASL 300
	Cesium-137	pCi/g	-0.00801	±0.0126	0.0213	0.0102	U	BD	SA	HASL 300
	Uranium-235	pCi/g	-0.0353	±0.075	0.115	0.0562	U	BD	SA	HASL 300
	Uranium-238	pCi/g	0.536	±0.619	0.543	0.266	U	BD	SA	HASL 300
P-73	Actinium-228	pCi/g	1.39	±0.196	0.103	0.0488		None	SA	HASL 300
	Americium-241	pCi/g	-0.011	±0.0492	0.0818	0.04	U	BD	SA	HASL 300
	Cesium-137	pCi/g	0.00741	±0.0169	0.0279	0.0133	U	BD	SA	HASL 300
	Uranium-235	pCi/g	-0.0168	±0.0883	0.161	0.0786	U	BD	SA	HASL 300
	Uranium-238	pCi/g	1.15	±0.949	0.737	0.361		J	SA	HASL 300

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

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

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

Sample Type
DU = duplicate sample
SA = sample

Analytical Method
GL-RAD-A-002 (GL-RAD-A-002 2010)
HASL 300 (DOE 1997)

Table B-3. Dosimeter measurements, 2022

Location Number	First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)	Gross Exposure (ambient dose mrem)	Net Exposure (ambient dose mrem)
C-10	41	16.4	40.2	17.7	37.6	17.8	42.3	19.8
C-21	38.1	13.5	42.9	20.4	36.9	17.1	43.2	20.8
C-22	38	13.4	37.8	15.3	35.3	15.5	38.6	16.2
C-23	34.2	9.6	33.7	11.2	29.8	10	37.1	14.7
C-25	36.7	12.1	38.1	15.6	30.8	11	39.4	16.9
C-26	39.5	14.9	39	16.5	39.9	20.1	40.8	18.4
C-30	43.2	18.6	37.8	15.3	38.2	18.4	43.4	21
S-1	42.5	17.9	41.7	19.2	34.4	14.6	43.4	21
S-6	34.5	9.9	36.9	14.4	31.6	11.8	41.2	18.8
S-7	41.8	17.2	42.2	19.7	34.2	14.4	41.4	19
S-20	41.1	16.5	42.1	19.6	36.1	16.3	45.5	23.1
S-45	37.8	13.2	39.9	17.4	36.3	16.5	42.8	20.4
S-46	40.6	16	41.5	19	36	16.2	46.4	24
S-48	42.7	18.2	45.8	23.3	35.8	16	47.7	25.3
P-4	40.5	15.9	41.9	19.4	42.7	22.9	41.5	19.1
P-5	37	12.4	35.7	13.2	33.8	14	39	16.6
P-16	43.2	18.6	49	26.5	39.2	19.4	45.4	23
P-19	42.4	17.8	43.2	20.7	36.4	16.6	41.7	19.3
P-39	40.1	15.5	39.4	16.9	37.3	17.5	41.8	19.4
P-40	38.8	14.2	38.4	15.9	33.9	14.1	41.3	18.9
P-81	41.2	16.6	39.8	17.3	36.8	17	45.4	23

Table B-4. Nonradiological results in soil, 2022

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-9	Aluminum	16,100	21.5	47.2		J	SA	SW-846 3050B/6020B
	Antimony	0.566	0.322	1.95	JB	1.95U	SA	SW-846 3050B/6010D
	Arsenic	4.26	0.319	0.943		None	SA	SW-846 3050B/6020B
	Beryllium	0.696	0.0189	0.0943		None	SA	SW-846 3050B/6020B
	Cadmium	0.234	0.0189	0.189		J-	SA	SW-846 3050B/6020B
	Chromium	16.2	0.189	0.566		None	SA	SW-846 3050B/6020B
	Copper	12.5	0.0623	0.377		None	SA	SW-846 3050B/6020B
	Iron	16,600	31.1	94.3		J	SA	SW-846 3050B/6020B
	Lead	15.7	0.0943	0.377		None	SA	SW-846 3050B/6020B
	Magnesium	4,610	1.89	5.66		None	SA	SW-846 3050B/6020B
	Nickel	13.3	0.0943	0.377		None	SA	SW-846 3050B/6020B
	Selenium	1.35	0.34	0.943		None	SA	SW-846 3050B/6020B
	Silver	0.118	0.0975	0.487	J	None	SA	SW-846 3050B/6010D
	Thallium	0.132	0.132	0.377	U	None	SA	SW-846 3050B/6020B
	Uranium	0.481	0.0128	0.0387		None	SA	SW-846 3050B/6020B
	Zinc	47.6	0.755	3.77		J	SA	SW-846 3050B/6020B
P-4	Aluminum	8,580	4.23	9.29		J	SA	SW-846 3050B/6020B
	Antimony	0.726	0.31	1.88	JB	1.88U	SA	SW-846 3050B/6010D
	Arsenic	2.12	0.314	0.929		None	SA	SW-846 3050B/6020B
	Beryllium	0.322	0.0186	0.0929		None	SA	SW-846 3050B/6020B
	Cadmium	0.137	0.0186	0.186	J	None	SA	SW-846 3050B/6020B
	Chromium	7.91	0.186	0.558		None	SA	SW-846 3050B/6020B
	Copper	5.69	0.0613	0.372		None	SA	SW-846 3050B/6020B
	Iron	8,570	6.13	18.6		J	SA	SW-846 3050B/6020B
	Lead	8.2	0.0929	0.372		None	SA	SW-846 3050B/6020B
	Magnesium	2,740	1.86	5.58		None	SA	SW-846 3050B/6020B
	Nickel	6.31	0.0929	0.372		None	SA	SW-846 3050B/6020B
	Selenium	1.04	0.335	0.929		None	SA	SW-846 3050B/6020B
	Silver	0.368	0.0938	0.469	J	None	SA	SW-846 3050B/6010D
	Thallium	0.13	0.13	0.372	U	None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-4	Uranium	0.328	0.0129	0.0391		None	SA	SW-846 3050B/6020B
	Zinc	25.8	0.743	3.72		J	SA	SW-846 3050B/6020B
P-5	Aluminum	6,870	4.02	8.83		J	SA	SW-846 3050B/6020B
	Antimony	0.527	0.315	1.91	JB	1.91U	SA	SW-846 3050B/6010D
	Arsenic	1.51	0.299	0.883		None	SA	SW-846 3050B/6020B
	Beryllium	0.303	0.0177	0.0883		None	SA	SW-846 3050B/6020B
	Cadmium	0.123	0.0177	0.177	J	None	SA	SW-846 3050B/6020B
	Chromium	6.35	0.177	0.53		None	SA	SW-846 3050B/6020B
	Copper	4.92	0.0583	0.353		None	SA	SW-846 3050B/6020B
	Iron	6,890	5.83	17.7		J	SA	SW-846 3050B/6020B
	Lead	7.23	0.0883	0.353		None	SA	SW-846 3050B/6020B
	Magnesium	1,690	1.77	5.3		None	SA	SW-846 3050B/6020B
	Nickel	4.99	0.0883	0.353		None	SA	SW-846 3050B/6020B
	Selenium	0.866	0.318	0.883	J	None	SA	SW-846 3050B/6020B
	Silver	0.45	0.0954	0.477	J	None	SA	SW-846 3050B/6010D
	Thallium	0.124	0.124	0.353	U	None	SA	SW-846 3050B/6020B
	Uranium	0.245	0.0129	0.0391		None	SA	SW-846 3050B/6020B
	Zinc	23.9	0.707	3.53		J	SA	SW-846 3050B/6020B
P-16	Aluminum	6,930	4.28	9.4		J	SA	SW-846 3050B/6020B
	Antimony	0.314	0.314	1.9	U	None	SA	SW-846 3050B/6010D
	Arsenic	1.3	0.318	0.94		None	SA	SW-846 3050B/6020B
	Beryllium	0.302	0.0188	0.094		None	SA	SW-846 3050B/6020B
	Cadmium	0.0806	0.0188	0.188	J	None	SA	SW-846 3050B/6020B
	Chromium	4.69	0.188	0.564		None	SA	SW-846 3050B/6020B
	Copper	6.75	0.062	0.376		None	SA	SW-846 3050B/6020B
	Iron	9,150	6.2	18.8		J	SA	SW-846 3050B/6020B
	Lead	5.59	0.094	0.376		None	SA	SW-846 3050B/6020B
	Magnesium	2,820	1.88	5.64		None	SA	SW-846 3050B/6020B
	Nickel	5.16	0.094	0.376		None	SA	SW-846 3050B/6020B
	Selenium	1.26	0.338	0.94		None	SA	SW-846 3050B/6020B
	Silver	0.807	0.0951	0.475		None	SA	SW-846 3050B/6010D

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-16	Thallium	0.132	0.132	0.376	U	None	SA	SW-846 3050B/6020B
	Uranium	0.864	0.0129	0.0391		None	SA	SW-846 3050B/6020B
	Zinc	30.3	0.752	3.76		J	SA	SW-846 3050B/6020B
P-19	Aluminum	12,200	19.9	43.7		J	SA	SW-846 3050B/6020B
	Antimony	0.479	0.314	1.9	JB	1.90U	SA	SW-846 3050B/6010D
	Arsenic	2.73	0.295	0.874		None	SA	SW-846 3050B/6020B
	Beryllium	0.462	0.0175	0.0874		None	SA	SW-846 3050B/6020B
	Cadmium	0.202	0.0175	0.175		None	SA	SW-846 3050B/6020B
	Chromium	13.9	0.175	0.524		None	SA	SW-846 3050B/6020B
	Copper	11.8	0.0577	0.35		None	SA	SW-846 3050B/6020B
	Iron	12,800	28.8	87.4		J	SA	SW-846 3050B/6020B
	Lead	15.8	0.0874	0.35		None	SA	SW-846 3050B/6020B
	Magnesium	4,360	1.75	5.24		None	SA	SW-846 3050B/6020B
	Nickel	12.6	0.0874	0.35		None	SA	SW-846 3050B/6020B
	Selenium	1.37	0.315	0.874		None	SA	SW-846 3050B/6020B
	Silver	0.714	0.0951	0.475		None	SA	SW-846 3050B/6010D
	Thallium	0.131	0.122	0.35	J	None	SA	SW-846 3050B/6020B
	Uranium	0.411	0.0128	0.0388		None	SA	SW-846 3050B/6020B
	Zinc	67.1	0.699	3.5		J	SA	SW-846 3050B/6020B
P-58	Aluminum	10,100	8.46	18.6		J	SA	SW-846 3050B/6020B
	Antimony	0.606	0.298	1.81	JB	1.81U	SA	SW-846 3050B/6010D
	Arsenic	3.01	0.314	0.929		None	SA	SW-846 3050B/6020B
	Beryllium	0.484	0.0186	0.0929		None	SA	SW-846 3050B/6020B
	Cadmium	0.275	0.0186	0.186		J-	SA	SW-846 3050B/6020B
	Chromium	10.6	0.186	0.558		None	SA	SW-846 3050B/6020B
	Copper	10	0.0613	0.372		None	SA	SW-846 3050B/6020B
	Iron	11,100	12.3	37.2		J	SA	SW-846 3050B/6020B
	Lead	25.8	0.0929	0.372		None	SA	SW-846 3050B/6020B
	Magnesium	4,260	1.86	5.58		None	SA	SW-846 3050B/6020B
	Nickel	8.3	0.0929	0.372		None	SA	SW-846 3050B/6020B
	Selenium	1.15	0.335	0.929		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-58	Silver	0.0904	0.0904	0.452	U	None	SA	SW-846 3050B/6010D
	Thallium	0.13	0.13	0.372	U	None	SA	SW-846 3050B/6020B
	Uranium	0.993	0.0128	0.0387		None	SA	SW-846 3050B/6020B
	Zinc	47.5	0.743	3.72		J	SA	SW-846 3050B/6020B
P-61	Aluminum	7,160	4.23	9.29		J	SA	SW-846 3050B/6020B
	Antimony	0.535	0.314	1.9	JB	1.90U	SA	SW-846 3050B/6010D
	Arsenic	3.18	0.314	0.929		None	SA	SW-846 3050B/6020B
	Beryllium	0.279	0.0186	0.0929		None	SA	SW-846 3050B/6020B
	Cadmium	0.143	0.0186	0.186	J	J-	SA	SW-846 3050B/6020B
	Chromium	5.98	0.186	0.558		None	SA	SW-846 3050B/6020B
	Copper	5.99	0.0613	0.372		None	SA	SW-846 3050B/6020B
	Iron	7,300	6.13	18.6		J	SA	SW-846 3050B/6020B
	Lead	6.52	0.0929	0.372		None	SA	SW-846 3050B/6020B
	Magnesium	3,100	1.86	5.58		None	SA	SW-846 3050B/6020B
	Nickel	5.56	0.0929	0.372		None	SA	SW-846 3050B/6020B
	Selenium	0.895	0.335	0.929	J	None	SA	SW-846 3050B/6020B
	Silver	0.0951	0.0951	0.475	U	None	SA	SW-846 3050B/6010D
	Thallium	0.13	0.13	0.372	U	None	SA	SW-846 3050B/6020B
	Uranium	0.437	0.0119	0.036		None	SA	SW-846 3050B/6020B
	Zinc	25.2	0.743	3.72		J	SA	SW-846 3050B/6020B
P-63	Aluminum	14,900	22.3	49		J	SA	SW-846 3050B/6020B
	Antimony	0.726	0.292	1.77	JB	1.77U	SA	SW-846 3050B/6010D
	Arsenic	3.15	0.331	0.98		None	SA	SW-846 3050B/6020B
	Beryllium	0.616	0.0196	0.098		None	SA	SW-846 3050B/6020B
	Cadmium	0.267	0.0196	0.196		J-	SA	SW-846 3050B/6020B
	Chromium	14.4	0.196	0.588		None	SA	SW-846 3050B/6020B
	Copper	10.3	0.0647	0.392		None	SA	SW-846 3050B/6020B
	Iron	15,100	32.4	98		J	SA	SW-846 3050B/6020B
	Lead	11.3	0.098	0.392		None	SA	SW-846 3050B/6020B
	Magnesium	3,990	1.96	5.88		None	SA	SW-846 3050B/6020B
	Nickel	12.4	0.098	0.392		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-63	Selenium	1.29	0.353	0.98		None	SA	SW-846 3050B/6020B
	Silver	0.29	0.0885	0.442	J	None	SA	SW-846 3050B/6010D
	Thallium	0.137	0.137	0.392	U	None	SA	SW-846 3050B/6020B
	Uranium	0.579	0.0127	0.0384		None	SA	SW-846 3050B/6020B
	Zinc	43.1	0.784	3.92		J	SA	SW-846 3050B/6020B
P-64	Aluminum	7,400	4.17	9.17		J	SA	SW-846 3050B/6020B
	Aluminum	16,600	41.4	90.9		J	DU	SW-846 3050B/6020B
	Aluminum	14,800	44.4	97.7		J	DU	SW-846 3050B/6020B
	Antimony	0.375	0.297	1.8	JB	1.80UJ	SA	SW-846 3050B/6010D
	Antimony	0.531	0.292	1.77	JB	1.77UJ	DU	SW-846 3050B/6010D
	Antimony	0.425	0.316	1.92	JB	1.92UJ	DU	SW-846 3050B/6010D
	Arsenic	1.5	0.31	0.917		None	SA	SW-846 3050B/6020B
	Arsenic	3.3	0.307	0.909		None	DU	SW-846 3050B/6020B
	Arsenic	3.12	0.33	0.977		None	DU	SW-846 3050B/6020B
	Beryllium	0.299	0.0183	0.0917		None	SA	SW-846 3050B/6020B
	Beryllium	0.67	0.0182	0.0909		None	DU	SW-846 3050B/6020B
	Beryllium	0.58	0.0195	0.0977		None	DU	SW-846 3050B/6020B
	Cadmium	1.94	0.0183	0.183		None	SA	SW-846 3050B/6020B
	Cadmium	0.291	0.0182	0.182		J-	DU	SW-846 3050B/6020B
	Cadmium	0.559	0.0195	0.195		J-	DU	SW-846 3050B/6020B
	Chromium	3.76	0.183	0.55		None	SA	SW-846 3050B/6020B
	Chromium	9.71	0.182	0.545		None	DU	SW-846 3050B/6020B
	Chromium	9.69	0.195	0.586		None	DU	SW-846 3050B/6020B
	Copper	8.41	0.0606	0.367		None	SA	SW-846 3050B/6020B
	Copper	16.7	0.06	0.364		None	DU	SW-846 3050B/6020B
	Copper	15.3	0.0645	0.391		None	DU	SW-846 3050B/6020B
	Iron	13,400	30.3	91.7		J	SA	SW-846 3050B/6020B
	Iron	30,600	60	182		J	DU	SW-846 3050B/6020B
	Iron	25,600	64.5	195		J	DU	SW-846 3050B/6020B
	Lead	6.67	0.0917	0.367		None	SA	SW-846 3050B/6020B
	Lead	11.4	0.0909	0.364		None	DU	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-64	Lead	10.2	0.0977	0.391		None	DU	SW-846 3050B/6020B
	Magnesium	4740	1.83	5.5		None	SA	SW-846 3050B/6020B
	Magnesium	10,400	18.2	54.5		None	DU	SW-846 3050B/6020B
	Magnesium	8,290	1.95	5.86		None	DU	SW-846 3050B/6020B
	Nickel	5.87	0.0917	0.367		None	SA	SW-846 3050B/6020B
	Nickel	11.9	0.0909	0.364		None	DU	SW-846 3050B/6020B
	Nickel	10.8	0.0977	0.391		None	DU	SW-846 3050B/6020B
	Selenium	2.41	0.33	0.917		None	SA	SW-846 3050B/6020B
	Selenium	4.36	0.327	0.909		None	DU	SW-846 3050B/6020B
	Selenium	4.44	0.352	0.977		None	DU	SW-846 3050B/6020B
	Silver	0.887	0.0901	0.45		J+	SA	SW-846 3050B/6010D
	Silver	0.836	0.0883	0.442		J+	DU	SW-846 3050B/6010D
	Silver	1.14	0.0958	0.479		J+	DU	SW-846 3050B/6010D
	Thallium	0.128	0.128	0.367	U	None	SA	SW-846 3050B/6020B
	Thallium	0.167	0.127	0.364	J	None	DU	SW-846 3050B/6020B
	Thallium	0.137	0.137	0.391	U	None	DU	SW-846 3050B/6020B
	Uranium	0.875	0.0131	0.0398		None	SA	SW-846 3050B/6020B
	Uranium	0.772	0.0123	0.0372		None	DU	SW-846 3050B/6020B
	Uranium	0.687	0.0125	0.038		None	DU	SW-846 3050B/6020B
	Zinc	43.3	0.734	3.67		J	SA	SW-846 3050B/6020B
	Zinc	93.2	0.727	3.64		J	DU	SW-846 3050B/6020B
	Zinc	75.9	0.781	3.91		J	DU	SW-846 3050B/6020B
P-81	Aluminum	15,900	43.5	95.6		J	SA	SW-846 3050B/6020B
	Antimony	0.39	0.317	1.92	JB	1.92U	SA	SW-846 3050B/6010D
	Arsenic	2.78	0.323	0.956		None	SA	SW-846 3050B/6020B
	Beryllium	0.607	0.0191	0.0956		None	SA	SW-846 3050B/6020B
	Cadmium	0.108	0.0191	0.191	J	None	SA	SW-846 3050B/6020B
	Chromium	12.1	0.191	0.574	N	J	SA	SW-846 3050B/6020B
	Copper	8.3	0.0631	0.382		J	SA	SW-846 3050B/6020B
	Iron	13,000	63.1	191		J	SA	SW-846 3050B/6020B
	Lead	8.64	0.0956	0.382		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-81	Magnesium	3,150	1.91	5.74		None	SA	SW-846 3050B/6020B
	Nickel	10.4	0.0956	0.382		None	SA	SW-846 3050B/6020B
	Selenium	0.567	0.344	0.956	J	None	SA	SW-846 3050B/6020B
	Silver	0.501	0.0962	0.481		J-	SA	SW-846 3050B/6010D
	Thallium	0.185	0.134	0.382	J	None	SA	SW-846 3050B/6020B
	Uranium	0.677	0.0126	0.0382	*	J	SA	SW-846 3050B/6020B
	Zinc	31.4	0.765	3.82		None	SA	SW-846 3050B/6020B
P-82	Aluminum	8,640	4.24	9.31		J	SA	SW-846 3050B/6020B
	Antimony	0.525	0.326	1.98	JB	1.98UJ	SA	SW-846 3050B/6010D
	Arsenic	2.96	0.315	0.931		None	SA	SW-846 3050B/6020B
	Beryllium	0.353	0.0186	0.0931		None	SA	SW-846 3050B/6020B
	Cadmium	0.142	0.0186	0.186	J	None	SA	SW-846 3050B/6020B
	Chromium	7.34	0.186	0.559	N	J	SA	SW-846 3050B/6020B
	Copper	7.82	0.0615	0.372		J	SA	SW-846 3050B/6020B
	Iron	11,200	61.5	186		J	SA	SW-846 3050B/6020B
	Lead	16.6	0.0931	0.372		None	SA	SW-846 3050B/6020B
	Magnesium	3,170	1.86	5.59		None	SA	SW-846 3050B/6020B
	Nickel	6.38	0.0931	0.372		None	SA	SW-846 3050B/6020B
	Selenium	0.589	0.335	0.931	J	None	SA	SW-846 3050B/6020B
	Silver	0.608	0.0988	0.494		J	SA	SW-846 3050B/6010D
	Thallium	0.13	0.13	0.372	U	None	SA	SW-846 3050B/6020B
	Uranium	0.703	0.0123	0.0372	*	J	SA	SW-846 3050B/6020B
	Zinc	31.9	0.745	3.72		None	SA	SW-846 3050B/6020B
P-95	Aluminum	11,700	41.9	92.1		J	SA	SW-846 3050B/6020B
	Antimony	0.649	0.306	1.85	JB	1.85U	SA	SW-846 3050B/6010D
	Arsenic	1.9	0.311	0.921		None	SA	SW-846 3050B/6020B
	Beryllium	0.408	0.0184	0.0921		None	SA	SW-846 3050B/6020B
	Cadmium	0.158	0.0184	0.184	J	None	SA	SW-846 3050B/6020B
	Chromium	9.87	0.184	0.552	N	J	SA	SW-846 3050B/6020B
	Copper	6.73	0.0608	0.368		J	SA	SW-846 3050B/6020B
	Iron	10,400	60.8	184		J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-95	Lead	10	0.0921	0.368		None	SA	SW-846 3050B/6020B
	Magnesium	2,990	1.84	5.52		None	SA	SW-846 3050B/6020B
	Nickel	7.69	0.0921	0.368		None	SA	SW-846 3050B/6020B
	Selenium	0.573	0.331	0.921	J	None	SA	SW-846 3050B/6020B
	Silver	0.393	0.0926	0.463	J	J-	SA	SW-846 3050B/6010D
	Thallium	0.129	0.129	0.368	U	None	SA	SW-846 3050B/6020B
	Uranium	0.351	0.0122	0.0368	*	J	SA	SW-846 3050B/6020B
	Zinc	28.3	0.737	3.68		None	SA	SW-846 3050B/6020B
S-1	Aluminum	14,700	44.4	97.7		J	SA	SW-846 3050B/6020B
	Antimony	0.751	0.32	1.94	JB	1.94U	SA	SW-846 3050B/6010D
	Arsenic	2.8	0.33	0.977		None	SA	SW-846 3050B/6020B
	Beryllium	0.569	0.0195	0.0977		None	SA	SW-846 3050B/6020B
	Cadmium	0.241	0.0195	0.195		None	SA	SW-846 3050B/6020B
	Chromium	12.3	0.195	0.586	N	J	SA	SW-846 3050B/6020B
	Copper	12.1	0.0645	0.391		J	SA	SW-846 3050B/6020B
	Iron	16,300	64.5	195		J	SA	SW-846 3050B/6020B
	Lead	13.1	0.0977	0.391		None	SA	SW-846 3050B/6020B
	Magnesium	5,050	1.95	5.86		None	SA	SW-846 3050B/6020B
	Nickel	12.1	0.0977	0.391		None	SA	SW-846 3050B/6020B
	Selenium	0.99	0.352	0.977		None	SA	SW-846 3050B/6020B
	Silver	0.419	0.0971	0.485	J	J-	SA	SW-846 3050B/6010D
	Thallium	0.189	0.137	0.391	J	None	SA	SW-846 3050B/6020B
	Uranium	0.769	0.0129	0.0391	*	J	SA	SW-846 3050B/6020B
	Zinc	48	0.781	3.91		None	SA	SW-846 3050B/6020B
S-6	Aluminum	6,580	4.44	9.77		J	SA	SW-846 3050B/6020B
	Antimony	0.327	0.327	1.98	U	None	SA	SW-846 3050B/6010D
	Arsenic	1.97	0.33	0.977		None	SA	SW-846 3050B/6020B
	Beryllium	0.263	0.0195	0.0977		None	SA	SW-846 3050B/6020B
	Cadmium	0.102	0.0195	0.195	J	None	SA	SW-846 3050B/6020B
	Chromium	6.17	0.195	0.586	N	J	SA	SW-846 3050B/6020B
	Copper	13.9	0.0645	0.391		J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-6	Iron	6,780	6.45	19.5		J	SA	SW-846 3050B/6020B
	Lead	4.64	0.0977	0.391		None	SA	SW-846 3050B/6020B
	Magnesium	2,110	1.95	5.86		None	SA	SW-846 3050B/6020B
	Nickel	6.49	0.0977	0.391		None	SA	SW-846 3050B/6020B
	Selenium	0.428	0.352	0.977	J	None	SA	SW-846 3050B/6020B
	Silver	0.0992	0.0992	0.496	U	0.496UJ	SA	SW-846 3050B/6010D
	Thallium	0.137	0.137	0.391	U	None	SA	SW-846 3050B/6020B
	Uranium	0.343	0.0129	0.0391	*	J	SA	SW-846 3050B/6020B
	Zinc	27.3	0.781	3.91		None	SA	SW-846 3050B/6020B
S-33	Aluminum	14,200	42.4	93.3		J	SA	SW-846 3050B/6020B
	Aluminum	11,200	42.8	94.2		J	DU	SW-846 3050B/6020B
	Aluminum	13,700	43	94.5		J	DU	SW-846 3050B/6020B
	Antimony	0.863	0.317	1.92	JB	1.92UJ	SA	SW-846 3050B/6010D
	Antimony	0.633	0.325	1.97	JB	1.97U	DU	SW-846 3050B/6010D
	Antimony	0.506	0.304	1.85	JB	1.85UJ	DU	SW-846 3050B/6010D
	Arsenic	5.04	0.315	0.933		None	SA	SW-846 3050B/6020B
	Arsenic	4.18	0.318	0.942		None	DU	SW-846 3050B/6020B
	Arsenic	4.88	0.319	0.945		None	DU	SW-846 3050B/6020B
	Beryllium	0.843	0.0187	0.0933		None	SA	SW-846 3050B/6020B
	Beryllium	0.711	0.0188	0.0942		None	DU	SW-846 3050B/6020B
	Beryllium	0.847	0.0189	0.0945		None	DU	SW-846 3050B/6020B
	Cadmium	1.12	0.0187	0.187		None	SA	SW-846 3050B/6020B
	Cadmium	0.465	0.0188	0.188		None	DU	SW-846 3050B/6020B
	Cadmium	0.403	0.0189	0.189		None	DU	SW-846 3050B/6020B
	Chromium	14.4	0.187	0.56	N	J	SA	SW-846 3050B/6020B
	Chromium	10.8	0.188	0.565	N	J	DU	SW-846 3050B/6020B
	Chromium	13.5	0.189	0.567	N	J	DU	SW-846 3050B/6020B
	Copper	11	0.0616	0.373		J	SA	SW-846 3050B/6020B
	Copper	10.1	0.0621	0.377		J	DU	SW-846 3050B/6020B
	Copper	11.4	0.0624	0.378		J	DU	SW-846 3050B/6020B
	Iron	14,300	61.6	187		J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-33	Iron	11,700	62.1	188		J	DU	SW-846 3050B/6020B
	Iron	13,600	62.4	189		J	DU	SW-846 3050B/6020B
	Lead	14.2	0.0933	0.373		None	SA	SW-846 3050B/6020B
	Lead	13.5	0.0942	0.377		None	DU	SW-846 3050B/6020B
	Lead	13.7	0.0945	0.378		None	DU	SW-846 3050B/6020B
	Magnesium	5,660	1.87	5.6		None	SA	SW-846 3050B/6020B
	Magnesium	4,090	1.88	5.65		None	DU	SW-846 3050B/6020B
	Magnesium	4,820	1.89	5.67		None	DU	SW-846 3050B/6020B
	Nickel	14.1	0.0933	0.373		None	SA	SW-846 3050B/6020B
	Nickel	10.8	0.0942	0.377		None	DU	SW-846 3050B/6020B
	Nickel	13.6	0.0945	0.378		None	DU	SW-846 3050B/6020B
	Selenium	0.822	0.336	0.933	J	None	SA	SW-846 3050B/6020B
	Selenium	1.13	0.339	0.942		None	DU	SW-846 3050B/6020B
	Selenium	0.757	0.34	0.945	J	None	DU	SW-846 3050B/6020B
	Silver	0.481	0.481	2.4	U	2.40UJ	SA	SW-846 3050B/6010D
	Silver	0.0986	0.0986	0.493	U	0.493UJ	DU	SW-846 3050B/6010D
	Silver	0.461	0.461	2.31	U	2.31UJ	DU	SW-846 3050B/6010D
	Thallium	0.166	0.131	0.373	J	None	SA	SW-846 3050B/6020B
	Thallium	0.132	0.132	0.377	U	None	DU	SW-846 3050B/6020B
	Thallium	0.153	0.132	0.378	J	None	DU	SW-846 3050B/6020B
	Uranium	0.936	0.0123	0.0373	*	J	SA	SW-846 3050B/6020B
	Uranium	1.33	0.0124	0.0377	*	J	DU	SW-846 3050B/6020B
	Uranium	0.901	0.0125	0.0378	*	J	DU	SW-846 3050B/6020B
	Zinc	61.5	0.746	3.73		None	SA	SW-846 3050B/6020B
	Zinc	48.8	0.753	3.77		None	DU	SW-846 3050B/6020B
	Zinc	57.5	0.756	3.78		None	DU	SW-846 3050B/6020B
S-34	Aluminum	18,900	41.7	91.7		J	SA	SW-846 3050B/6020B
	Antimony	0.656	0.304	1.84	JB	1.84U	SA	SW-846 3050B/6010D
	Arsenic	4.64	0.31	0.917		None	SA	SW-846 3050B/6020B
	Beryllium	0.681	0.0183	0.0917		None	SA	SW-846 3050B/6020B
	Cadmium	0.149	0.0183	0.183	J	None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-34	Chromium	16.6	0.183	0.55	N	J	SA	SW-846 3050B/6020B
	Copper	9.37	0.0606	0.367		J	SA	SW-846 3050B/6020B
	Iron	16,700	60.6	183		J	SA	SW-846 3050B/6020B
	Lead	11.3	0.0917	0.367		None	SA	SW-846 3050B/6020B
	Magnesium	3,880	1.83	5.5		None	SA	SW-846 3050B/6020B
	Nickel	13.5	0.0917	0.367		None	SA	SW-846 3050B/6020B
	Selenium	0.727	0.33	0.917	J	None	SA	SW-846 3050B/6020B
	Silver	0.439	0.0921	0.46	J	J-	SA	SW-846 3050B/6010D
	Thallium	0.163	0.128	0.367	J	None	SA	SW-846 3050B/6020B
	Uranium	0.583	0.0121	0.0367	*	J	SA	SW-846 3050B/6020B
	Zinc	42.1	0.734	3.67		None	SA	SW-846 3050B/6020B
S-45	Aluminum	11,200	43.1	94.7		J	SA	SW-846 3050B/6020B
	Antimony	0.753	0.316	1.92	JB	1.92U	SA	SW-846 3050B/6010D
	Arsenic	2.84	0.32	0.947		None	SA	SW-846 3050B/6020B
	Beryllium	0.405	0.0189	0.0947		None	SA	SW-846 3050B/6020B
	Cadmium	0.11	0.0189	0.189	J	None	SA	SW-846 3050B/6020B
	Chromium	8.93	0.189	0.568	N	J	SA	SW-846 3050B/6020B
	Copper	5.81	0.0625	0.379		J	SA	SW-846 3050B/6020B
	Iron	9,150	6.25	18.9		J	SA	SW-846 3050B/6020B
	Lead	7.67	0.0947	0.379		None	SA	SW-846 3050B/6020B
	Magnesium	2,860	1.89	5.68		None	SA	SW-846 3050B/6020B
	Nickel	6.9	0.0947	0.379		None	SA	SW-846 3050B/6020B
	Selenium	0.447	0.341	0.947	J	None	SA	SW-846 3050B/6020B
	Silver	0.189	0.0958	0.479	J	J-	SA	SW-846 3050B/6010D
	Thallium	0.133	0.133	0.379	U	None	SA	SW-846 3050B/6020B
	Uranium	0.383	0.0125	0.0379	*	J	SA	SW-846 3050B/6020B
	Zinc	28.9	0.758	3.79		None	SA	SW-846 3050B/6020B
S-51	Aluminum	14,400	43.8	96.3		J	SA	SW-846 3050B/6020B
	Antimony	0.6	0.327	1.98	JB	1.98U	SA	SW-846 3050B/6010D
	Arsenic	3.06	0.326	0.963		None	SA	SW-846 3050B/6020B
	Beryllium	0.571	0.0193	0.0963		None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-51	Cadmium	0.122	0.0193	0.193	J	None	SA	SW-846 3050B/6020B
	Chromium	46	0.193	0.578	N	J	SA	SW-846 3050B/6020B
	Copper	9.7	0.0636	0.385		J	SA	SW-846 3050B/6020B
	Iron	12,200	63.6	193		J	SA	SW-846 3050B/6020B
	Lead	10	0.0963	0.385		None	SA	SW-846 3050B/6020B
	Magnesium	3,460	1.93	5.78		None	SA	SW-846 3050B/6020B
	Nickel	9.66	0.0963	0.385		None	SA	SW-846 3050B/6020B
	Selenium	0.568	0.347	0.963	J	None	SA	SW-846 3050B/6020B
	Silver	0.134	0.0992	0.496	J	J-	SA	SW-846 3050B/6010D
	Thallium	0.135	0.135	0.385	U	None	SA	SW-846 3050B/6020B
	Uranium	0.536	0.0127	0.0385	*	J	SA	SW-846 3050B/6020B
	Zinc	78.2	0.771	3.85		None	SA	SW-846 3050B/6020B
S-53	Aluminum	18,000	45.4	99.8		J	SA	SW-846 3050B/6020B
	Aluminum	16,500	43.2	94.9		J	DU	SW-846 3050B/6020B
	Aluminum	18,900	44.1	96.9		J	DU	SW-846 3050B/6020B
	Antimony	0.694	0.308	1.87	JB	1.87U	SA	SW-846 3050B/6010D
	Antimony	0.519	0.304	1.85	JB	1.85U	DU	SW-846 3050B/6010D
	Antimony	0.681	0.314	1.9	JB	1.90U	DU	SW-846 3050B/6010D
	Arsenic	3.24	0.337	0.998		None	SA	SW-846 3050B/6020B
	Arsenic	2.95	0.321	0.949		None	DU	SW-846 3050B/6020B
	Arsenic	3.36	0.328	0.969		None	DU	SW-846 3050B/6020B
	Beryllium	0.627	0.02	0.0998		None	SA	SW-846 3050B/6020B
	Beryllium	0.551	0.019	0.0949		None	DU	SW-846 3050B/6020B
	Beryllium	0.623	0.0194	0.0969		None	DU	SW-846 3050B/6020B
	Cadmium	0.127	0.02	0.2	J	None	SA	SW-846 3050B/6020B
	Cadmium	0.102	0.019	0.19	J	None	DU	SW-846 3050B/6020B
	Cadmium	0.114	0.0194	0.194	J	None	DU	SW-846 3050B/6020B
	Chromium	12	0.2	0.599	N	J-	SA	SW-846 3050B/6020B
	Chromium	10.7	0.19	0.569	N	J-	DU	SW-846 3050B/6020B
	Chromium	12.6	0.194	0.581	N	J-	DU	SW-846 3050B/6020B
	Copper	8.29	0.0659	0.399		J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-53	Copper	7.7	0.0626	0.38		J	DU	SW-846 3050B/6020B
	Copper	8.26	0.064	0.388		J	DU	SW-846 3050B/6020B
	Iron	13,100	65.9	200		J	SA	SW-846 3050B/6020B
	Iron	12,000	62.6	190		J	DU	SW-846 3050B/6020B
	Iron	13,400	64	194		J	DU	SW-846 3050B/6020B
	Lead	9.04	0.0998	0.399		None	SA	SW-846 3050B/6020B
	Lead	7.95	0.0949	0.38		None	DU	SW-846 3050B/6020B
	Lead	9.04	0.0969	0.388		None	DU	SW-846 3050B/6020B
	Magnesium	3,100	2	5.99		None	SA	SW-846 3050B/6020B
	Magnesium	2,880	1.9	5.69		None	DU	SW-846 3050B/6020B
	Magnesium	3,210	1.94	5.81		None	DU	SW-846 3050B/6020B
	Nickel	9.2	0.0998	0.399		J-	SA	SW-846 3050B/6020B
	Nickel	8.38	0.0949	0.38		J-	DU	SW-846 3050B/6020B
	Nickel	9.37	0.0969	0.388		J-	DU	SW-846 3050B/6020B
	Selenium	0.533	0.359	0.998	J	None	SA	SW-846 3050B/6020B
	Selenium	0.48	0.342	0.949	J	None	DU	SW-846 3050B/6020B
	Selenium	0.474	0.349	0.969	J	None	DU	SW-846 3050B/6020B
	Silver	0.356	0.0933	0.466	J	J-	SA	SW-846 3050B/6010D
	Silver	0.448	0.0923	0.461	J	J-	DU	SW-846 3050B/6010D
	Silver	0.533	0.0951	0.475		J-	DU	SW-846 3050B/6010D
	Thallium	0.147	0.14	0.399	J	None	SA	SW-846 3050B/6020B
	Thallium	0.133	0.133	0.38	U	None	DU	SW-846 3050B/6020B
	Thallium	0.15	0.136	0.388	J	None	DU	SW-846 3050B/6020B
	Uranium	0.394	0.0132	0.0399	*	J	SA	SW-846 3050B/6020B
	Uranium	0.361	0.0125	0.038	*	J	DU	SW-846 3050B/6020B
	Uranium	0.429	0.0128	0.0388	*	J	DU	SW-846 3050B/6020B
	Zinc	31.4	0.798	3.99		None	SA	SW-846 3050B/6020B
	Zinc	28.2	0.759	3.8		None	DU	SW-846 3050B/6020B
	Zinc	34.4	0.775	3.88		None	DU	SW-846 3050B/6020B
S-55	Aluminum	11,700	43.6	95.8		J	SA	SW-846 3050B/6020B
	Antimony	0.652	0.31	1.88	JB	1.88U	SA	SW-846 3050B/6010D

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-55	Arsenic	2.43	0.324	0.958		None	SA	SW-846 3050B/6020B
	Beryllium	0.418	0.0192	0.0958		None	SA	SW-846 3050B/6020B
	Cadmium	0.177	0.0192	0.192	J	None	SA	SW-846 3050B/6020B
	Chromium	9.77	0.192	0.575	N	J-	SA	SW-846 3050B/6020B
	Copper	5.59	0.0632	0.383		J	SA	SW-846 3050B/6020B
	Iron	10,300	63.2	192		J	SA	SW-846 3050B/6020B
	Lead	8.12	0.0958	0.383		None	SA	SW-846 3050B/6020B
	Magnesium	2,990	1.92	5.75		None	SA	SW-846 3050B/6020B
	Nickel	7.55	0.0958	0.383		J-	SA	SW-846 3050B/6020B
	Selenium	0.557	0.345	0.958	J	None	SA	SW-846 3050B/6020B
	Silver	0.307	0.094	0.47	J	J-	SA	SW-846 3050B/6010D
	Thallium	0.134	0.134	0.383	U	None	SA	SW-846 3050B/6020B
	Uranium	0.584	0.0126	0.0383	*	J	SA	SW-846 3050B/6020B
	Zinc	31.1	0.766	3.83		None	SA	SW-846 3050B/6020B
S-57	Aluminum	7,490	4.38	9.63		J	SA	SW-846 3050B/6020B
	Antimony	0.497	0.301	1.82	JB	1.82U	SA	SW-846 3050B/6010D
	Arsenic	2.89	0.326	0.963		None	SA	SW-846 3050B/6020B
	Beryllium	0.321	0.0193	0.0963		None	SA	SW-846 3050B/6020B
	Cadmium	0.108	0.0193	0.193	J	None	SA	SW-846 3050B/6020B
	Chromium	6.93	0.193	0.578	N	J	SA	SW-846 3050B/6020B
	Copper	6.98	0.0636	0.385		J	SA	SW-846 3050B/6020B
	Iron	9,490	6.36	19.3		J	SA	SW-846 3050B/6020B
	Lead	5.87	0.0963	0.385		None	SA	SW-846 3050B/6020B
	Magnesium	3,720	1.93	5.78		None	SA	SW-846 3050B/6020B
	Nickel	6.51	0.0963	0.385		None	SA	SW-846 3050B/6020B
	Selenium	0.704	0.347	0.963	J	None	SA	SW-846 3050B/6020B
	Silver	0.0912	0.0912	0.456	U	0.456UJ	SA	SW-846 3050B/6010D
	Thallium	0.135	0.135	0.385	U	None	SA	SW-846 3050B/6020B
	Uranium	1.23	0.0127	0.0385	*	J	SA	SW-846 3050B/6020B
	Zinc	52.5	0.771	3.85		None	SA	SW-846 3050B/6020B
S-90	Aluminum	9,380	4.36	9.58	*	J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-90	Antimony	0.322	0.322	1.95	NU	1.95UJ	SA	SW-846 3050B/6010D
	Arsenic	1.99	0.324	0.958		None	SA	SW-846 3050B/6020B
	Beryllium	0.363	0.0192	0.0958		None	SA	SW-846 3050B/6020B
	Cadmium	0.145	0.0192	0.192	J	None	SA	SW-846 3050B/6020B
	Chromium	8.04	0.192	0.575	*N	J	SA	SW-846 3050B/6020B
	Copper	6.15	0.0632	0.383	*	J	SA	SW-846 3050B/6020B
	Iron	7,730	6.32	19.2	*	J	SA	SW-846 3050B/6020B
	Lead	9.29	0.0958	0.383	*N	J	SA	SW-846 3050B/6020B
	Magnesium	2,120	1.92	5.75	*	J	SA	SW-846 3050B/6020B
	Nickel	5.92	0.0958	0.383	*	J	SA	SW-846 3050B/6020B
	Selenium	0.737	0.345	0.958	J	None	SA	SW-846 3050B/6020B
	Silver	0.0977	0.0977	0.488	U	None	SA	SW-846 3050B/6010D
	Thallium	0.134	0.134	0.383	U	None	SA	SW-846 3050B/6020B
	Uranium	0.37	0.0126	0.0383	*B	J	SA	SW-846 3050B/6020B
	Zinc	29.9	0.766	3.83	*N	J	SA	SW-846 3050B/6020B
S-92	Aluminum	13,500	44.3	97.5	*	J	SA	SW-846 3050B/6020B
	Antimony	0.32	0.32	1.94	NU	1.94UJ	SA	SW-846 3050B/6010D
	Arsenic	2.3	0.329	0.975		None	SA	SW-846 3050B/6020B
	Beryllium	0.493	0.0195	0.0975		None	SA	SW-846 3050B/6020B
	Cadmium	0.129	0.0195	0.195	J	None	SA	SW-846 3050B/6020B
	Chromium	9.6	0.195	0.585	*N	J	SA	SW-846 3050B/6020B
	Copper	7.27	0.0643	0.39	*	J	SA	SW-846 3050B/6020B
	Iron	9,420	6.43	19.5	*	J	SA	SW-846 3050B/6020B
	Lead	8.6	0.0975	0.39	*N	J	SA	SW-846 3050B/6020B
	Magnesium	2,570	1.95	5.85	*	J	SA	SW-846 3050B/6020B
	Nickel	7.55	0.0975	0.39	*	J	SA	SW-846 3050B/6020B
	Selenium	0.91	0.351	0.975	J	None	SA	SW-846 3050B/6020B
	Silver	0.0969	0.0969	0.484	U	None	SA	SW-846 3050B/6010D
	Thallium	0.136	0.136	0.39	U	None	SA	SW-846 3050B/6020B
	Uranium	0.432	0.0129	0.039	*B	J	SA	SW-846 3050B/6020B
	Zinc	32.9	0.78	3.9	*N	J	SA	SW-846 3050B/6020B

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

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

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

Sample Type
DU = duplicate sample
SA = sample

Analytical Method
SW-846 (EPA 1986)

Table B-5. Nonradiological results in sediment, 2022

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
C-68	Aluminum	6,660	4.4	9.67		J	SA	SW-846 3050B/6020B
	Antimony	1.18	0.295	1.79	JB	1.79UJ	SA	SW-846 3050B/6010D
	Arsenic	10.9	0.327	0.967		None	SA	SW-846 3050B/6020B
	Beryllium	0.357	0.0193	0.0967		None	SA	SW-846 3050B/6020B
	Cadmium	0.306	0.0193	0.193		J-	SA	SW-846 3050B/6020B
	Chromium	8.45	0.193	0.58		None	SA	SW-846 3050B/6020B
	Copper	6.52	0.0638	0.387		None	SA	SW-846 3050B/6020B
	Iron	8,500	6.38	19.3		J	SA	SW-846 3050B/6020B
	Lead	9.87	0.0967	0.387		None	SA	SW-846 3050B/6020B
	Magnesium	2,820	1.93	5.8		None	SA	SW-846 3050B/6020B
	Nickel	9.58	0.0967	0.387		None	SA	SW-846 3050B/6020B
	Selenium	1.74	1.74	4.84	U	None	SA	SW-846 3050B/6020B
	Silver	0.446	0.446	2.23	U	None	SA	SW-846 3050B/6010D
	Thallium	0.135	0.135	0.387	U	None	SA	SW-846 3050B/6020B
	Uranium	0.864	0.0115	0.0348		None	SA	SW-846 3050B/6020B
	Zinc	32.4	0.774	3.87		J	SA	SW-846 3050B/6020B
P-60	Aluminum	5,370	4.2	9.23		J	SA	SW-846 3050B/6020B
	Antimony	0.479	0.302	1.83	JB	1.83U	SA	SW-846 3050B/6010D
	Arsenic	1.94	0.312	0.923		None	SA	SW-846 3050B/6020B
	Beryllium	0.338	0.0185	0.0923		None	SA	SW-846 3050B/6020B
	Cadmium	0.0797	0.0185	0.185	J	J-	SA	SW-846 3050B/6020B
	Chromium	6.3	0.185	0.554		None	SA	SW-846 3050B/6020B
	Copper	6.15	0.0609	0.369		None	SA	SW-846 3050B/6020B
	Iron	9,990	12.2	36.9		J	SA	SW-846 3050B/6020B
	Lead	5	0.0923	0.369		None	SA	SW-846 3050B/6020B
	Magnesium	2,390	1.85	5.54		None	SA	SW-846 3050B/6020B
	Nickel	5.68	0.0923	0.369		None	SA	SW-846 3050B/6020B
	Selenium	1.26	0.332	0.923		None	SA	SW-846 3050B/6020B
	Silver	0.588	0.0914	0.457		None	SA	SW-846 3050B/6010D
	Thallium	0.129	0.129	0.369	U	None	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
P-60	Uranium	0.666	0.0118	0.0358		None	SA	SW-846 3050B/6020B
	Zinc	22.2	0.738	3.69		J	SA	SW-846 3050B/6020B
P-73	Aluminum	3,020	4.39	9.65		J	SA	SW-846 3050B/6020B
	Antimony	0.293	0.293	1.78	U	None	SA	SW-846 3050B/6010D
	Arsenic	1.07	0.326	0.965		None	SA	SW-846 3050B/6020B
	Beryllium	0.251	0.0193	0.0965		None	SA	SW-846 3050B/6020B
	Cadmium	0.182	0.0193	0.193	J	J-	SA	SW-846 3050B/6020B
	Chromium	2.73	0.193	0.579		None	SA	SW-846 3050B/6020B
	Copper	81	0.0637	0.386		None	SA	SW-846 3050B/6020B
	Iron	6,530	6.37	19.3		J	SA	SW-846 3050B/6020B
	Lead	3.46	0.0965	0.386		None	SA	SW-846 3050B/6020B
	Magnesium	2,180	1.93	5.79		None	SA	SW-846 3050B/6020B
	Nickel	116	0.0965	0.386		None	SA	SW-846 3050B/6020B
	Selenium	1.74	1.74	4.83	U	None	SA	SW-846 3050B/6020B
	Silver	0.0888	0.0888	0.444	U	None	SA	SW-846 3050B/6010D
	Thallium	0.135	0.135	0.386	U	None	SA	SW-846 3050B/6020B
	Uranium	0.55	0.0126	0.0381		None	SA	SW-846 3050B/6020B
	Zinc	18	0.772	3.86		J	SA	SW-846 3050B/6020B
S-72	Aluminum	12,700	39	85.6		J	SA	SW-846 3050B/6020B
	Antimony	0.978	0.317	1.92	JB	1.92U	SA	SW-846 3050B/6010D
	Arsenic	3.03	0.289	0.856		None	SA	SW-846 3050B/6020B
	Beryllium	0.458	0.0171	0.0856		None	SA	SW-846 3050B/6020B
	Cadmium	0.168	0.0171	0.171	J	None	SA	SW-846 3050B/6020B
	Chromium	13.2	0.171	0.514	N	J	SA	SW-846 3050B/6020B
	Copper	10.1	0.0565	0.342		J	SA	SW-846 3050B/6020B
	Iron	14,200	56.5	171		J	SA	SW-846 3050B/6020B
	Lead	12.9	0.0856	0.342		None	SA	SW-846 3050B/6020B
	Magnesium	4,170	1.71	5.14		None	SA	SW-846 3050B/6020B
	Nickel	11.1	0.0856	0.342		None	SA	SW-846 3050B/6020B
	Selenium	0.692	0.308	0.856	J	None	SA	SW-846 3050B/6020B
	Silver	0.097	0.0962	0.481	J	J-	SA	SW-846 3050B/6010D

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-72	Thallium	0.12	0.12	0.342	U	None	SA	SW-846 3050B/6020B
	Uranium	0.93	0.0113	0.0342	*	J	SA	SW-846 3050B/6020B
	Zinc	35.6	0.685	3.42		None	SA	SW-846 3050B/6020B
S-74	Aluminum	3,280	4.17	9.16	*	J	SA	SW-846 3050B/6020B
	Aluminum	3,400	4.19	9.21	*	J	DU	SW-846 3050B/6020B
	Aluminum	3,880	4.37	9.6	*	J	DU	SW-846 3050B/6020B
	Antimony	2.92	2.92	17.7	NU	17.7UJ	SA	SW-846 3050B/6010D
	Antimony	3.13	3.13	18.9	NU	18.9UJ	DU	SW-846 3050B/6010D
	Antimony	3.11	3.11	18.8	NU	18.8UJ	DU	SW-846 3050B/6010D
	Arsenic	1.04	0.31	0.916		None	SA	SW-846 3050B/6020B
	Arsenic	1.43	0.311	0.921		None	DU	SW-846 3050B/6020B
	Arsenic	1.42	0.324	0.96		None	DU	SW-846 3050B/6020B
	Beryllium	0.227	0.0183	0.0916		None	SA	SW-846 3050B/6020B
	Beryllium	0.239	0.0184	0.0921		None	DU	SW-846 3050B/6020B
	Beryllium	0.267	0.0192	0.096		None	DU	SW-846 3050B/6020B
	Cadmium	0.0795	0.0183	0.183	J	J+	SA	SW-846 3050B/6020B
	Cadmium	0.122	0.0184	0.184	J	J+	DU	SW-846 3050B/6020B
	Cadmium	0.122	0.0192	0.192	J	J+	DU	SW-846 3050B/6020B
	Chromium	2.6	0.183	0.549	*N	J	SA	SW-846 3050B/6020B
	Chromium	4.17	0.184	0.552	*N	J	DU	SW-846 3050B/6020B
	Chromium	5.32	0.192	0.576	*N	J	DU	SW-846 3050B/6020B
	Copper	4.24	0.0604	0.366	*	J	SA	SW-846 3050B/6020B
	Copper	5.4	0.0608	0.368	*	J	DU	SW-846 3050B/6020B
	Copper	6.42	0.0633	0.384	*	J	DU	SW-846 3050B/6020B
	Iron	6,490	6.04	18.3	*	J	SA	SW-846 3050B/6020B
	Iron	11,400	60.8	184	*	J	DU	SW-846 3050B/6020B
	Iron	14,200	63.3	192	*	J	DU	SW-846 3050B/6020B
	Lead	6.63	0.0916	0.366	*N	J	SA	SW-846 3050B/6020B
	Lead	3.67	0.0921	0.368	*N	J	DU	SW-846 3050B/6020B
	Lead	4.67	0.096	0.384	*N	J	DU	SW-846 3050B/6020B
	Magnesium	1,880	1.83	5.49	*	J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-74	Magnesium	1,950	1.84	5.52	*	J	DU	SW-846 3050B/6020B
	Magnesium	2,460	1.92	5.76	*	J	DU	SW-846 3050B/6020B
	Nickel	3.32	0.0916	0.366	*	J	SA	SW-846 3050B/6020B
	Nickel	4.02	0.0921	0.368	*	J	DU	SW-846 3050B/6020B
	Nickel	4.84	0.096	0.384	*	J	DU	SW-846 3050B/6020B
	Selenium	0.835	0.33	0.916	J	None	SA	SW-846 3050B/6020B
	Selenium	1.12	0.331	0.921		None	DU	SW-846 3050B/6020B
	Selenium	1.26	0.345	0.96		None	DU	SW-846 3050B/6020B
	Silver	0.883	0.883	4.42	U	None	SA	SW-846 3050B/6010D
	Silver	0.947	0.947	4.73	U	None	DU	SW-846 3050B/6010D
	Silver	0.942	0.942	4.71	U	None	DU	SW-846 3050B/6010D
	Thallium	0.128	0.128	0.366	U	None	SA	SW-846 3050B/6020B
	Thallium	0.129	0.129	0.368	U	None	DU	SW-846 3050B/6020B
	Thallium	0.134	0.134	0.384	U	None	DU	SW-846 3050B/6020B
	Uranium	0.693	0.0121	0.0366	*B	J	SA	SW-846 3050B/6020B
	Uranium	0.761	0.0122	0.0368	*B	J	DU	SW-846 3050B/6020B
	Uranium	1.09	0.0127	0.0384	*B	J	DU	SW-846 3050B/6020B
	Zinc	18.3	0.733	3.66	*N	J	SA	SW-846 3050B/6020B
	Zinc	22.3	0.737	3.68	*N	J	DU	SW-846 3050B/6020B
	Zinc	26.2	0.768	3.84	*N	J	DU	SW-846 3050B/6020B
S-75	Aluminum	5,040	4.15	9.12	*	J	SA	SW-846 3050B/6020B
	Antimony	0.325	0.325	1.97	NU	1.97UJ	SA	SW-846 3050B/6010D
	Arsenic	1.62	0.308	0.912		None	SA	SW-846 3050B/6020B
	Beryllium	0.331	0.0182	0.0912		None	SA	SW-846 3050B/6020B
	Cadmium	0.0974	0.0182	0.182	J	J+	SA	SW-846 3050B/6020B
	Chromium	5.42	0.182	0.547	*N	J	SA	SW-846 3050B/6020B
	Copper	5.72	0.0602	0.365	*	J	SA	SW-846 3050B/6020B
	Iron	5,500	6.02	18.2	*	J	SA	SW-846 3050B/6020B
	Lead	3.99	0.0912	0.365	*N	J	SA	SW-846 3050B/6020B
	Magnesium	2,510	1.82	5.47	*	J	SA	SW-846 3050B/6020B
	Nickel	6.6	0.0912	0.365	*	J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-75	Selenium	1.25	0.328	0.912		None	SA	SW-846 3050B/6020B
	Silver	0.0986	0.0986	0.493	U	None	SA	SW-846 3050B/6010D
	Thallium	0.128	0.128	0.365	U	None	SA	SW-846 3050B/6020B
	Uranium	0.561	0.012	0.0365	*B	J	SA	SW-846 3050B/6020B
	Zinc	18.2	0.73	3.65	*N	J	SA	SW-846 3050B/6020B
S-85	Aluminum	7,190	4.17	9.16	*	J	SA	SW-846 3050B/6020B
	Antimony	0.314	0.314	1.9	NU	1.90UJ	SA	SW-846 3050B/6010D
	Arsenic	2.69	0.31	0.916		None	SA	SW-846 3050B/6020B
	Beryllium	0.312	0.0183	0.0916		None	SA	SW-846 3050B/6020B
	Cadmium	0.146	0.0183	0.183	J	J+	SA	SW-846 3050B/6020B
	Chromium	8.66	0.183	0.549	*N	J	SA	SW-846 3050B/6020B
	Copper	6.54	0.0604	0.366	*	J	SA	SW-846 3050B/6020B
	Iron	8,620	6.04	18.3	*	J	SA	SW-846 3050B/6020B
	Lead	6.08	0.0916	0.366	*N	J	SA	SW-846 3050B/6020B
	Magnesium	2,830	1.83	5.49	*	J	SA	SW-846 3050B/6020B
	Nickel	8.67	0.0916	0.366	*	J	SA	SW-846 3050B/6020B
	Selenium	0.76	0.33	0.916	J	None	SA	SW-846 3050B/6020B
	Silver	0.238	0.0952	0.476	JB	0.476U	SA	SW-846 3050B/6010D
	Thallium	0.128	0.128	0.366	U	None	SA	SW-846 3050B/6020B
	Uranium	0.566	0.0121	0.0366	*B	J	SA	SW-846 3050B/6020B
	Zinc	22.9	0.733	3.66	*N	J	SA	SW-846 3050B/6020B
S-91	Aluminum	6,260	4.47	9.82	*	J	SA	SW-846 3050B/6020B
	Antimony	0.308	0.308	1.87	NU	1.87UJ	SA	SW-846 3050B/6010D
	Arsenic	3.47	0.332	0.982		None	SA	SW-846 3050B/6020B
	Beryllium	0.366	0.0196	0.0982		None	SA	SW-846 3050B/6020B
	Cadmium	0.248	0.0196	0.196		J+	SA	SW-846 3050B/6020B
	Chromium	6.8	0.196	0.589	*N	J	SA	SW-846 3050B/6020B
	Copper	6.52	0.0648	0.393	*	J	SA	SW-846 3050B/6020B
	Iron	8,590	6.48	19.6	*	J	SA	SW-846 3050B/6020B
	Lead	10	0.0982	0.393	*N	J	SA	SW-846 3050B/6020B
	Magnesium	2,170	1.96	5.89	*	J	SA	SW-846 3050B/6020B

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-91	Nickel	7.01	0.0982	0.393	*	J	SA	SW-846 3050B/6020B
	Selenium	1.59	0.354	0.982		None	SA	SW-846 3050B/6020B
	Silver	0.0935	0.0935	0.467	U	None	SA	SW-846 3050B/6010D
	Thallium	0.138	0.138	0.393	U	None	SA	SW-846 3050B/6020B
	Uranium	0.553	0.013	0.0393	*B	J	SA	SW-846 3050B/6020B
	Zinc	25.3	0.786	3.93	*N	J	SA	SW-846 3050B/6020B

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

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

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

Sample Type
DU = duplicate sample
SA = sample

Analytical Method
SW-846 (EPA 1986)

Table B-6. Perchlorate results in soil, 2022

Location	Analyte	Result (mg/kg)	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-53	Perchlorate	0.0448	0.00049	0.00196		J	SA	SW-846 6850 Modified
S-53	Perchlorate	0.0606	0.000485	0.00194		J	DU	SW-846 6850 Modified
S-53	Perchlorate	0.0321	0.000478	0.00191		J	DU	SW-846 6850 Modified

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

Data Validation Qualifier
J = The associated value was an estimated quantity.

Sample Type
DU = duplicate sample
SA = sample

Analytical Method
SW-846 (EPA 1986)

Table B-7. High explosive compound results in soil, 2022

Location	Analyte	Result (µg/kg)	Method Detection Limit (µg/kg)	Practical Quantitation Limit (µg/kg)	Laboratory Data Qualifier	Data Validation Qualifier	Sample Type	Analytical Method
S-90	Amino-2,6-dinitrotoluene, 4-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Amino-4,6-dinitrotoluene, 2-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrobenzene, 1,3-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrotoluene, 2,4-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrotoluene, 2,6-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	HMX	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitro-benzene	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 2-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 3-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 4-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Pentaerythritol tetranitrate	207	207	830	U	None	SA	SW-846 8330B by LC/MS/MS
	RDX	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Tetryl	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Trinitrobenzene, 1,3,5-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
	Trinitrotoluene, 2,4,6-	124	124	415	U	None	SA	SW-846 8330B by LC/MS/MS
S-93	Amino-2,6-dinitrotoluene, 4-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS

Location	Analyte	Result (µg/kg)	Method Detection Limit (µg/kg)	Practical Quantitation Limit (µg/kg)	Laboratory Data Qualifier	Data Validation Qualifier	Sample Type	Analytical Method
S-93	Amino-4,6-dinitrotoluene, 2-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrobenzene, 1,3-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrotoluene, 2,4-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrotoluene, 2,6-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	HMX	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitro-benzene	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 2-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 3-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 4-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Pentaerythritol tetranitrate	243	243	971	U	None	SA	SW-846 8330B by LC/MS/MS
	RDX	219	146	485	J	None	SA	SW-846 8330B by LC/MS/MS
	Tetryl	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Trinitrobenzene, 1,3,5-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
	Trinitrotoluene, 2,4,6-	146	146	485	U	None	SA	SW-846 8330B by LC/MS/MS
S-94	Amino-2,6-dinitrotoluene, 4-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Amino-4,6-dinitrotoluene, 2-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrobenzene, 1,3-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS

Location	Analyte	Result (µg/kg)	Method Detection Limit (µg/kg)	Practical Quantitation Limit (µg/kg)	Laboratory Data Qualifier	Data Validation Qualifier	Sample Type	Analytical Method
S-94	Dinitrotoluene, 2,4-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Dinitrotoluene, 2,6-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	HMX	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitro-benzene	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 2-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 3-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Nitrotoluene, 4-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Pentaerythritol tetranitrate	223	223	893	U	None	SA	SW-846 8330B by LC/MS/MS
	RDX	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Tetryl	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Trinitrobenzene, 1,3,5-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS
	Trinitrotoluene, 2,4,6-	134	134	446	U	None	SA	SW-846 8330B by LC/MS/MS

HMX = high melting explosive
LC/MS/MS = liquid chromatography/mass spectrometry/mass spectrometry
RDX = rapid-detonating explosive

Laboratory Data Qualifier
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.
U = The analyte was absent or below the method detection limit.

Data Validation Qualifier
None = There was no data validation assigned.

Sample Type
SA = sample

Analytical Method
SW-846 (EPA 1986)

Table B-8. Equipment blank detections, 2022

Sample Identification	Analyte	Result (mg/L)	Method Detection Limit (mg/L)	Practical Quantitation Limit (mg/L)	Laboratory Data Qualifier[a]	Data Validation Qualifier	Sample Type	Analytical Method
S-EB-DAY1	Aluminum	0.0324	0.0193	0.05	J	None	EB	SW-846 3005A/6020B
S-EB-DAY1	Cadmium	0.0274	0.0003	0.001		None	EB	SW-846 3005A/6020B
S-EB-DAY1	Iron	0.0364	0.033	0.1	J	None	EB	SW-846 3005A/6020B
S-EB-DAY1	Magnesium	0.0179	0.01	0.03	J	None	EB	SW-846 3005A/6020B
S-EB-DAY2	Cadmium	0.0327	0.0003	0.001		None	EB	SW-846 3005A/6020B
S-EB-DAY2	Magnesium	0.0174	0.01	0.03	J	None	EB	SW-846 3005A/6020B
S-EB-DAY3	Aluminum	0.0235	0.0193	0.05	J	None	EB	SW-846 3005A/6020B
S-EB-DAY3	Cadmium	0.127	0.0003	0.001		None	EB	SW-846 3005A/6020B
S-EB-DAY3	Magnesium	0.0195	0.01	0.03	J	None	EB	SW-846 3005A/6020B
S-EB-DAY4	Aluminum	0.0442	0.0193	0.05	J	None	EB	SW-846 3005A/6020B
S-EB-DAY4	Cadmium	0.0482	0.0003	0.001		None	EB	SW-846 3005A/6020B
S-EB-DAY4	Iron	0.0382	0.033	0.1	J	None	EB	SW-846 3005A/6020B
S-EB-DAY4	Magnesium	0.0209	0.01	0.03	J	None	EB	SW-846 3005A/6020B
S-EB-DAY4	Zinc	0.00439	0.0033	0.02	J	None	EB	SW-846 3005A/6020B

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

Laboratory Data Qualifier
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.

Data Validation Qualifier
None = There was no data validation assigned.

Sample Type
EB = equipment blank

Analytical Method
SW-846 (EPA 1986)

Table B-9. Coefficient of variance results, 2022

Location	Analyte	Calculation[a]	Result (mg/kg)	Laboratory Data Qualifier[b]	Data Validation Qualifier	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Sample Type
S-33	Cadmium	N/A	1.12		None	0.0187	0.187	SA
		N/A	0.465		None	0.0188	0.188	DU
		N/A	0.403		None	0.0189	0.189	DU
		Average	0.66					
		Standard deviation	0.40					
		Coefficient of variance (%)	59.95					
P-64	Arsenic	N/A	1.5		None	0.31	0.917	SA
		N/A	3.3		None	0.307	0.909	DU
		N/A	3.12		None	0.33	0.977	DU
		Average	2.64					
		Standard deviation	0.99					
		Coefficient of variance (%)	37.55					
	Beryllium	N/A	0.299		None	0.0183	0.0917	SA
		N/A	0.67		None	0.0182	0.0909	DU
		N/A	0.58		None	0.0195	0.0977	DU
		Average	0.52					
		Standard deviation	0.19					
		Coefficient of variance (%)	37.48					
	Chromium	N/A	3.76		None	0.183	0.55	SA
		N/A	9.71		None	0.182	0.545	DU
		N/A	9.69		None	0.195	0.586	DU
		Average	7.72					
		Standard deviation	3.43					
		Coefficient of variance (%)	44.42					

Location	Analyte	Calculation[a]	Result (mg/kg)	Laboratory Data Qualifier[b]	Data Validation Qualifier	Method Detection Limit (mg/kg)	Practical Quantitation Limit (mg/kg)	Sample Type
	Magnesium	N/A	4,740		None	1.83	5.5	SA
		N/A	10,400		None	18.2	54.5	DU
		N/A	8,290		None	1.95	5.86	DU
		Average	7,810.00					
		Standard deviation	2,860.37					
		Coefficient of variance (%)	36.62					

[a]Coefficient of variance reported for duplicate sets that exceeded 35 percent.
[b]Blank cells indicate that the laboratory did not qualify the data.

Data Validation Qualifier
None = There was no data validation assigned.

Sample Type
DU = duplicate sample
SA = sample

Appendix C. Ambient Air Surveillance Results in Fiscal Year 2022

Orange sulphur (*Colias eurytheme*)

Table C-1. Ambient air metals analysis, fiscal year 2022

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
BKPM 10	6-Oct-21	Aluminum	0.0272	0.0272	0.08	J
		Antimony	0.00211	0.00132	0.008	J
		Arsenic	<0.002	0.002	0.012	U
		Barium	0.000846	0.0004	0.002	J
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	<0.0004	0.0004	0.002	U
		Calcium	0.341	0.032	0.1	
		Chromium	0.00198	0.0006	0.004	J
		Cobalt	<0.0006	0.0006	0.002	U
		Copper	0.00863	0.0012	0.008	
		Iron	<0.032	0.032	0.1	U
		Lead	0.00163	0.00132	0.008	J
		Magnesium	0.0379	0.034	0.12	J
		Manganese	<0.0008	0.0008	0.004	U
		Nickel	<0.0006	0.0006	0.002	U
		Potassium	<0.0256	0.0256	0.1	U
		Selenium	<0.002	0.002	0.012	U
		Silver	0.00103	0.0004	0.002	JB
		Sodium	0.649	0.028	0.1	
		Thallium	<0.002	0.002	0.008	U
		Uranium	<0.0000264	0.0000264	0.00008	U
		Vanadium	<0.0004	0.0004	0.002	U
		Zinc	0.0111	0.0016	0.008	
	22-Mar-22	Aluminum	<0.0272	0.0272	0.08	U
		Antimony	0.00303	0.00132	0.008	J
		Arsenic	<0.002	0.002	0.012	U
		Barium	0.000724	0.0004	0.002	J
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	0.000524	0.0004	0.002	J
		Calcium	0.516	0.032	0.1	
		Chromium	0.00313	0.0006	0.004	J

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
BKPM 10	22-Mar-22	Cobalt	<0.0006	0.0006	0.002	U
		Copper	<0.0012	0.0012	0.008	U
		Iron	<0.032	0.032	0.1	U
		Lead	0.00306	0.00132	0.008	J
		Magnesium	0.055	0.034	0.12	J
		Manganese	<0.0008	0.0008	0.004	U
		Nickel	<0.0006	0.0006	0.002	U
		Potassium	0.0469	0.0256	0.1	J
		Selenium	0.00216	0.002	0.012	J
		Silver	<0.0004	0.0004	0.002	U
		Sodium	0.871	0.028	0.1	
		Thallium	0.00345	0.002	0.008	JB
		Uranium	<0.0000264	0.0000264	0.00008	U
		Vanadium	<0.0004	0.0004	0.002	U
		Zinc	0.0195	0.0016	0.008	
	7-Jun-22	Aluminum	<0.0272	0.0272	0.08	U
		Antimony	0.00514	0.00132	0.008	JB
		Arsenic	<0.002	0.002	0.012	U
		Barium	<0.0004	0.0004	0.002	U
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	<0.0004	0.0004	0.002	U
		Calcium	<0.032	0.032	0.1	U
		Chromium	<0.0006	0.0006	0.004	U
		Cobalt	<0.0006	0.0006	0.002	U
		Copper	<0.0012	0.0012	0.008	U
		Iron	<0.032	0.032	0.1	U
		Lead	0.00403	0.00132	0.008	JB
		Magnesium	<0.034	0.034	0.12	U
		Manganese	<0.0008	0.0008	0.004	U
		Nickel	<0.0006	0.0006	0.002	U
		Potassium	0.0314	0.0256	0.1	J
		Selenium	0.00357	0.002	0.012	JB

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
BKPM 10	7-Jun-22	Silver	<0.0004	0.0004	0.002	U
		Sodium	0.0756	0.028	0.1	JB
		Thallium	<0.002	0.002	0.008	U
		Uranium	<0.0000264	0.0000264	0.00008	U
		Vanadium	<0.0004	0.0004	0.002	U
		Zinc	0.00436	0.0016	0.008	J
	2-Aug-22	Aluminum	<0.0272	0.0272	0.08	U
		Antimony	0.00244	0.00132	0.008	JB
		Arsenic	<0.002	0.002	0.012	U
		Barium	0.000536	0.0004	0.002	J
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	<0.0004	0.0004	0.002	U
		Calcium	0.281	0.032	0.1	
		Chromium	0.00259	0.0006	0.004	J
		Cobalt	0.00133	0.0006	0.002	J
		Copper	0.0053	0.0012	0.008	J
		Iron	<0.032	0.032	0.1	U
		Lead	<0.00132	0.00132	0.008	U
		Magnesium	0.0526	0.034	0.12	J
		Manganese	<0.0008	0.0008	0.004	U
		Nickel	0.000776	0.0006	0.002	J
		Potassium	0.0358	0.0256	0.1	J
		Selenium	<0.002	0.002	0.012	U
		Silver	<0.0004	0.0004	0.002	U
		Sodium	0.861	0.028	0.1	
		Thallium	<0.002	0.002	0.008	U
		Uranium	<0.0000033	0.0000033	0.00001	U
		Vanadium	<0.0004	0.0004	0.002	U
		Zinc	0.00713	0.0016	0.008	J
TA-3 PM 10	6-Oct-21	Aluminum	0.0398	0.0272	0.08	J
		Antimony	<0.00132	0.00132	0.008	U
		Arsenic	<0.002	0.002	0.012	U

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
TA-3 PM 10	6-Oct-21	Barium	0.00245	0.0004	0.002	
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	<0.0004	0.0004	0.002	U
		Calcium	0.466	0.032	0.1	
		Chromium	0.0111	0.0006	0.004	
		Cobalt	<0.0006	0.0006	0.002	U
		Copper	0.024	0.0012	0.008	
		Iron	0.0655	0.032	0.1	J
		Lead	0.00186	0.00132	0.008	J
		Magnesium	0.0597	0.034	0.12	J
		Manganese	0.00181	0.0008	0.004	J
		Nickel	0.000857	0.0006	0.002	J
		Potassium	0.119	0.0256	0.1	
		Selenium	<0.002	0.002	0.012	U
		Silver	0.000466	0.0004	0.002	JB
		Sodium	0.731	0.028	0.1	
		Thallium	<0.002	0.002	0.008	U
		Uranium	<0.0000264	0.0000264	0.00008	U
		Vanadium	<0.0004	0.0004	0.002	U
		Zinc	0.0116	0.0016	0.008	
	22-Mar-22	Aluminum	0.105	0.0272	0.08	
		Antimony	0.00228	0.00132	0.008	J
		Arsenic	<0.002	0.002	0.012	U
		Barium	0.00253	0.0004	0.002	
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	0.000665	0.0004	0.002	J
		Calcium	0.678	0.032	0.1	
		Chromium	0.00321	0.0006	0.004	J
		Cobalt	<0.0006	0.0006	0.002	U
		Copper	0.104	0.0012	0.008	
		Iron	0.11	0.032	0.1	
		Lead	0.00297	0.00132	0.008	J

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
TA-3 PM 10	22-Mar-22	Magnesium	0.0895	0.034	0.12	J
		Manganese	0.00243	0.0008	0.004	J
		Nickel	<0.0006	0.0006	0.002	U
		Potassium	0.0944	0.0256	0.1	J
		Selenium	<0.002	0.002	0.012	U
		Silver	<0.0004	0.0004	0.002	U
		Sodium	1.06	0.028	0.1	
		Thallium	<0.002	0.002	0.008	U
		Uranium	<0.0000264	0.0000264	0.00008	U
		Vanadium	<0.0004	0.0004	0.002	U
		Zinc	0.0192	0.0016	0.008	
	7-Jun-22	Aluminum	0.0394	0.0272	0.08	J
		Antimony	0.00306	0.00132	0.008	JB
		Arsenic	<0.002	0.002	0.012	U
		Barium	0.000614	0.0004	0.002	J
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	<0.0004	0.0004	0.002	U
		Calcium	0.113	0.032	0.1	
		Chromium	0.00104	0.0006	0.004	J
		Cobalt	<0.0006	0.0006	0.002	U
		Copper	0.00551	0.0012	0.008	J
		Iron	0.0354	0.032	0.1	J
		Lead	0.00523	0.00132	0.008	JB
		Magnesium	<0.034	0.034	0.12	U
		Manganese	0.000917	0.0008	0.004	J
		Nickel	<0.0006	0.0006	0.002	U
		Potassium	0.0529	0.0256	0.1	J
		Selenium	<0.002	0.002	0.012	U
		Silver	<0.0004	0.0004	0.002	U
		Sodium	0.187	0.028	0.1	B
		Thallium	<0.002	0.002	0.008	U
		Uranium	<0.0000264	0.0000264	0.00008	U

Sample Location	Sample Date	Analyte	Result (mg/sa)	MDL (mg/sa)	PQL (mg/sa)	Laboratory Data Qualifier[a]
TA-3 PM 10	7-Jun-22	Vanadium	<0.0004	0.0004	0.002	U
		Zinc	0.0126	0.0016	0.008	
	2-Aug-22	Aluminum	0.261	0.0272	0.08	
		Antimony	0.00207	0.00132	0.008	JB
		Arsenic	<0.002	0.002	0.012	U
		Barium	0.00588	0.0004	0.002	
		Beryllium	<0.0004	0.0004	0.002	U
		Cadmium	<0.0004	0.0004	0.002	U
		Calcium	1.29	0.032	0.1	
		Chromium	0.00368	0.0006	0.004	J
		Cobalt	0.00398	0.0006	0.002	
		Copper	0.0193	0.0012	0.008	
		Iron	0.267	0.032	0.1	
		Lead	0.0031	0.00132	0.008	J
		Magnesium	0.169	0.034	0.12	
		Manganese	0.00589	0.0008	0.004	
		Nickel	0.00171	0.0006	0.002	J
		Potassium	0.101	0.0256	0.1	
		Selenium	<0.002	0.002	0.012	U
		Silver	<0.0004	0.0004	0.002	U
		Sodium	0.974	0.028	0.1	
		Thallium	<0.002	0.002	0.008	U
		Uranium	<0.0000033	0.0000033	0.00001	U
		Vanadium	0.000555	0.0004	0.002	J
		Zinc	0.0243	0.0016	0.008	

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

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

Laboratory Data Qualifier
B = The analyte was detected in the blank.
J = An estimated value, the analyte concentration was above the effective MDL and below the effective PQL.
U = The analyte was absent or below the method detection limit.

Table C-2. Ambient air radiological analysis, fiscal year 2022

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiersa
BKPM 10	6-Oct-21	Actinium-228	5.34	36.9	16.3	34.2	U
		Alpha, gross	1.47	3.09	2.51	5.33	U
		Americium-241	10.1	17.5	15.5	32	U
		Beryllium-7	4.35	39.3	29.8	62.5	U
		Beta, gross	0.948	1.71	1.4	2.9	U
		Bismuth-212	8.45	56.4	45.9	97.2	U
		Bismuth-214	−6.84	19	8.54	17.8	U
		Cesium-137	1.77	4.44	3.66	7.7	U
		Cobalt-60	−1.61	4.7	3.65	7.91	U
		Lead-212	1.38	13.2	6.08	12.5	U
		Lead-214	25.3	17.9	7.72	25.3	U
		Neptunium-237	−5.57	7.27	5.74	12	U
		Potassium-40	−1.53	48.4	41.3	88.6	U
		Radium-223	32.3	65.6	56.9	119	U
		Radium-224	−65.7	76.2	54.2	112	U
		Radium-226	123	179	50.7	105	X
		Radium-228	5.34	36.9	16.3	34.2	U
		Sodium-22	−0.448	4.35	3.53	7.64	U
		Thorium-227	10.3	28.2	22.8	47.2	U
		Thorium-231	24.9	69.2	34.1	70.4	U
		Thorium-234	−132	324	152	312	U
		Uranium-235	−15.4	37.1	16.8	34.6	U
		Uranium-238	−132	324	152	312	U
	22-Mar-22	Actinium-228	−47.3	48.7	18.4	38.4	U
		Alpha, gross	42.6	11.2	4.45	10.6	
		Americium-241	−12.4	26.5	20.6	42.5	U
		Beryllium-7	−31.2	43.3	31.6	66.2	U
		Beta, gross	10.3	22.6	18.6	38.2	U
		Bismuth-212	−80.2	138	56.5	119	U
		Bismuth-214	8.73	22.3	7.49	15.7	U
		Cesium-137	−3.5	8.85	4.58	9.56	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiersa
BKPM 10	22-Mar-22	Cobalt-60	2.78	4.93	4.27	9.16	U
		Lead-212	−6.79	15.3	8.32	17	U
		Lead-214	10.5	22.2	7.89	16.4	U
		Neptunium-237	8.13	9.21	7.31	15.1	U
		Potassium-40	−26.5	100	52.7	111	U
		Radium-223	35.5	82.4	68.6	142	U
		Radium-224	−242	143	69.7	144	U
		Radium-226	158	231	66.2	136	X
		Radium-228	−47.3	48.7	18.4	38.4	U
		Sodium-22	1.29	4.62	4.03	8.65	U
		Thorium-227	13	33.6	28.3	58.4	U
		Thorium-231	3.4	125	46	94.5	U
		Thorium-234	−10.5	401	209	426	U
		Uranium-235	35.7	60.2	20.6	42.4	U
		Uranium-238	−10.5	401	209	426	U
	7-Jun-22	Actinium-228	34	34.9	10.4	21.7	X
		Alpha, gross	2.3	1.61	1.17	2.56	U
		Americium-241	11.2	21.7	18.1	37.1	U
		Beryllium-7	26.5	32.5	26.7	55.1	U
		Beta, gross	−3.7	1.65	1.49	3.06	U
		Bismuth-212	2.53	115	41.9	86.7	U
		Bismuth-214	4.79	21.6	5.3	11	U
		Cesium-137	−0.982	8.04	3.13	6.46	U
		Cobalt-60	1.12	3.75	3.24	6.79	U
		Lead-212	1.17	15.1	4.41	9.05	U
		Lead-214	−7.84	14.7	7.16	14.7	U
		Neptunium-237	−0.629	6.36	5.23	10.8	U
		Potassium-40	−29.8	96.5	43.2	89.5	U
		Radium-223	−7.9	63.2	51.8	107	U
		Radium-224	81.7	99.1	52.2	107	U
		Radium-226	−208	182	70.4	143	U
		Radium-228	34	34.9	10.4	21.7	X

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiersa
BKPM 10	7-Jun-22	Sodium-22	0.0844	4.41	3.13	6.56	U
		Thorium-227	−6.27	23.5	19.4	39.9	U
		Thorium-231	20.5	102	37.3	76.4	U
		Thorium-234	−64.9	345	153	313	U
		Uranium-235	36.9	40.9	16.6	37	U
		Uranium-238	−64.9	345	153	313	U
	2-Aug-22	Actinium-228	−25.8	44.4	17.3	36.1	U
		Alpha, gross	4.22	4.34	3.34	7.24	U
		Americium-241	−7.51	27.7	21.9	45.1	U
		Beryllium-7	−31.1	40.1	28.9	60.4	U
		Beta, gross	1.2	3.63	3	6.24	U
		Bismuth-212	8.34	59.2	50.4	106	U
		Bismuth-214	10.6	26.8	7.39	15.4	U
		Cesium-137	−1.16	4.5	3.75	7.86	U
		Cobalt-60	−0.835	4.32	3.62	7.79	U
		Lead-212	22.1	20.6	7.57	22.1	U
		Lead-214	9.2	22.1	8.18	16.9	U
		Neptunium-237	−4.69	8.02	6.25	13	U
		Potassium-40	−39.5	101	52.2	110	U
		Radium-223	66.1	83.9	67.2	139	U
		Radium-224	43.6	80.7	60.6	125	U
		Radium-226	−77.2	201	105	214	U
		Radium-228	−25.8	44.4	17.3	36.1	U
		Sodium-22	0.403	4.01	3.47	7.47	U
		Thorium-227	−7.71	30.3	25	51.6	U
		Thorium-231	52.3	118	44.4	91.2	U
		Thorium-234	−190	404	217	444	U
		Uranium-235	42.4	53.3	22.3	45.6	U
		Uranium-238	−190	404	217	444	U
TA-3 PM 10	6-Oct-21	Actinium-228	−32.2	32.1	13.3	27.4	U
		Alpha, gross	6.95	1.94	0.929	2.14	
		Americium-241	9.44	22.2	17.4	35.6	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiersa
TA-3 PM 10	6-Oct-21	Beryllium-7	284	63.5	25.1	51.9	
		Beta, gross	43.2	3.31	1.42	2.94	
		Bismuth-212	65	97.6	35.1	73	U
		Bismuth-214	31	22.1	7.82	31	U
		Cesium-137	−10.1	8.69	2.79	5.79	U
		Cobalt-60	0.568	3.48	2.89	6.09	U
		Lead-212	4.25	13.3	6.2	12.6	U
		Lead-214	4.71	19.8	7.36	15.1	U
		Neptunium-237	1.9	6.34	5.27	10.8	U
		Potassium-40	164	86.5	41.9	164	U
		Radium-223	−27.9	64	51.1	105	U
		Radium-224	99.5	77.9	51	104	U
		Radium-226	−134	153	71.5	146	U
		Radium-228	−32.2	32.1	13.3	27.4	U
		Sodium-22	1.63	3.22	2.69	5.67	U
		Thorium-227	7.33	24	20.3	41.6	U
		Thorium-231	117	72.7	34.9	71.6	X
		Thorium-234	253	424	134	275	U
		Uranium-235	−6.82	33.7	16.6	34	U
		Uranium-238	253	424	134	275	U
	22-Mar-22	Actinium-228	19.9	33.1	13	26.8	U
		Alpha, gross	30.4	11.7	6.38	14.5	
		Americium-241	−11.9	21.1	16.9	34.8	U
		Beryllium-7	100	51.8	24.7	51	
		Beta, gross	50.4	20.7	15.8	32.6	
		Bismuth-212	−60.5	96.4	40.2	83.2	U
		Bismuth-214	−22	18.4	7.83	16	U
		Cesium-137	3.48	8.3	2.75	5.71	U
		Cobalt-60	1.02	3.64	3.03	6.37	U
		Lead-212	1.8	12.2	6.01	12.2	U
		Lead-214	−10.4	17.9	7.12	14.6	U
		Neptunium-237	−3.48	6.46	5.1	10.5	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiersa
TA-3 PM 10	22-Mar-22	Potassium-40	74.8	124	27.7	58.5	X
		Radium-223	−21.1	70.7	51	105	U
		Radium-224	105	82.3	53.7	110	U
		Radium-226	71.9	189	48.9	100	U
		Radium-228	19.9	33.1	13	26.8	U
		Sodium-22	1.07	3.31	2.77	5.83	U
		Thorium-227	9.63	24.8	20.8	42.7	U
		Thorium-231	55	81.8	35	71.8	U
		Thorium-234	67.2	367	162	330	U
		Uranium-235	0.79	37.4	14.5	29.7	U
		Uranium-238	67.2	367	162	330	U
	7-Jun-22	Actinium-228	-7.33	34	15	31.6	U
		Alpha, gross	3.13	1.9	1.37	2.97	
		Americium-241	6.15	14.1	11.8	24.4	U
		Beryllium-7	199	72.3	27.4	57.6	
		Beta, gross	23.7	2.37	1.38	2.86	
		Bismuth-212	48.4	56.6	45.7	96.2	U
		Bismuth-214	1.02	19.8	6.1	12.8	U
		Cesium-137	−3.96	6.21	3.13	6.61	U
		Cobalt-60	2.39	4.01	3.46	7.46	U
		Lead-212	7.13	14.5	8.49	17.3	U
		Lead-214	17.1	15.2	7.04	17.1	U
		Neptunium-237	−2.94	6.42	5.34	11.1	U
		Potassium-40	42.5	128	29.2	63.9	U
		Radium-223	−10.8	62.6	53.7	112	U
		Radium-224	7.7	107	59.2	122	U
		Radium-226	−86.2	148	71	145	U
		Radium-228	−7.33	34	15	31.6	U
		Sodium-22	0.023	3.78	3.21	6.94	U
		Thorium-227	5.55	24.1	21.2	44	U
		Thorium-231	24.4	40.6	33.2	68.3	U
		Thorium-234	34.4	270	94.8	196	U

Sample Location	Sample Date	Analyte	Result (pCi/sa)	Error (pCi/sa)	Lc (pCi/sa)	MDA (pCi/sa)	Laboratory Data Qualifiers[a]
TA-3 PM 10	7-Jun-22	Uranium-235	−13.3	37.2	16.6	34.2	U
		Uranium-238	34.4	270	94.8	196	U
	2-Aug-22	Actinium-228	14	45.9	13.7	29.1	U
		Alpha, gross	2.37	4.14	3.3	7.15	U
		Americium-241	11.6	24.3	18	37	U
		Beryllium-7	317	81	30.2	63.2	
		Beta, gross	26.7	4.57	2.97	6.17	
		Bismuth-212	8.69	60.5	49.7	105	U
		Bismuth-214	−4.86	17	9.07	18.8	U
		Cesium-137	2.2	13	3.65	7.7	U
		Cobalt-60	0.483	4.73	4.04	8.67	U
		Lead-212	4.72	16.6	7.57	15.5	U
		Lead-214	2.24	24.2	8.7	18	U
		Neptunium-237	0.334	8.15	6.93	14.3	U
		Potassium-40	9.33	139	32.3	70.5	U
		Radium-223	3.25	78.6	66.7	138	U
		Radium-224	−235	135	63.3	130	U
		Radium-226	87.7	206	65.5	135	U
		Radium-228	14	45.9	13.7	29.1	U
		Sodium-22	6.02	5.13	4.04	8.66	U
		Thorium-227	−3.44	31.2	26.6	54.8	U
		Thorium-231	−47	127	49.7	102	U
		Thorium-234	181	474	148	304	U
		Uranium-235	−41.1	43.8	21.9	44.9	U
		Uranium-238	181	474	148	304	U

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

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

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

Appendix D. Stormwater Sampling Requirements and Results in 2022

Summer rain runoff

Table D-1. MSGP stormwater sampling results, calendar year 2022

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-05	28-Jul-2022	Chemical oxygen demand	135	8.95	20	Unfiltered
		Solids, total suspended	85.7	2.48	10.9	Unfiltered
	10-Aug-2022	Chemical oxygen demand	66.4	8.95	20	Unfiltered
		Solids, total suspended	186	4.07	17.9	Unfiltered
	14-Sep-2022	Chemical oxygen demand	145	8.95	20	Unfiltered
		Solids, total suspended	97.4	2.11	9.26	Unfiltered
	4-Oct-2022	Chemical oxygen demand	46.4	8.95	20	Unfiltered
		Solids, total suspended	62.8	1.43	6.25	Unfiltered
SWSP-17	28-Jul-2022	Ammonia	1.84	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	<0.003	0.003	0.01	Unfiltered
		Chemical oxygen demand	66.3	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.13	0.005	0.02	Unfiltered
		Mercury	0.000231	0.000067	0.0002	Unfiltered
		Selenium	0.0168	0.015	0.05	Unfiltered
		Silver	<0.003	0.003	0.01	Unfiltered
	10-Aug-2022	Ammonia	1.03	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	0.000824	0.0003	0.001	Unfiltered
SWSP-17	10-Aug-2022	Chemical oxygen demand	66.4	8.95	20	Unfiltered

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.0406	0.0005	0.002	Unfiltered
		Mercury	0.000104	0.000067	0.0002	Unfiltered
		Selenium	0.00403	0.0015	0.005	Unfiltered
		Silver	0.000432	0.0003	0.001	Unfiltered
	6-Oct-2022	Ammonia	0.522	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	<0.0003	0.0003	0.001	Unfiltered
		Chemical oxygen demand	59.2	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.00747	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
SWSP-40	12-Jul-2022	Ammonia	0.243	0.017	0.05	Unfiltered
		Arsenic	0.00405	0.002	0.005	Filtered
		Cadmium	<0.0003	0.0003	0.001	Unfiltered
		Chemical oxygen demand	95.2	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.000599	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
	11-Aug-2022	Ammonia	0.179	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	<0.0003	0.0003	0.001	Unfiltered
		Chemical oxygen demand	78.4	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	<0.0005	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
	6-Oct-2022	Ammonia	0.208	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	<0.0003	0.0003	0.001	Unfiltered
		Chemical oxygen demand	62.5	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.000577	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
SWSP-42	22-Aug-2022	Chemical oxygen demand	54.1	8.95	20	Unfiltered
		Solids, total suspended	202	3.8	16.7	Unfiltered
	6-Oct-2022	Chemical oxygen demand	62.5	8.95	20	Unfiltered
		Solids, total suspended	968	14.3	62.5	Unfiltered
SWSP-47	10-Aug-2022	Ammonia	0.689	0.017	0.05	Unfiltered

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-47	10-Aug-2022	Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	0.000759	0.0003	0.001	Unfiltered
		Chemical oxygen demand	70.4	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.0288	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	0.000306	0.0003	0.001	Unfiltered
SWSP-49	14-Sep-2022	Ammonia	0.088	0.017	0.05	Unfiltered
		Arsenic	0.00219	0.002	0.005	Filtered
		Cadmium	<0.0003	0.0003	0.001	Unfiltered
		Chemical oxygen demand	83.6	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	<0.0005	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
SWSP-50	11-Jul-2022	Chemical oxygen demand	60.2	8.95	20	Unfiltered
		Solids, total suspended	17	1.31	5.75	Unfiltered
	18-Aug-2022	Chemical oxygen demand	19.4	8.95	20	Unfiltered
		Solids, total suspended	23.4	1.21	5.32	Unfiltered
	9-Oct-2022	Chemical oxygen demand	35.3	8.95	20	Unfiltered
		Solids, total suspended	16.2	0.974	4.27	Unfiltered
SWSP-51	16-Aug-2022	Ammonia	0.358	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	<0.0003	0.0003	0.001	Unfiltered
		Chemical oxygen demand	43.8	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.0126	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
	5-Oct-2022	Ammonia	0.181	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	0.00106	0.0003	0.001	Unfiltered
		Chemical oxygen demand	72.4	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.00398	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
SWSP-52	28-Jul-2022	Ammonia	0.629	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	0.00059	0.0003	0.001	Unfiltered
		Chemical oxygen demand	50.5	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered

Sampling Point	Sample Date	Analyte	Result (mg/L)	MDL (mg/L)	PQL (mg/L)	Sample Preparation
SWSP-52	28-Jul-2022	Lead	0.0195	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	0.00208	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
	10-Aug-2022	Ammonia	0.304	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	0.000757	0.0003	0.001	Unfiltered
		Chemical oxygen demand	30.4	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.0262	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	0.00181	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
	6-Oct-2022	Ammonia	0.165	0.017	0.05	Unfiltered
		Arsenic	<0.002	0.002	0.005	Filtered
		Cadmium	<0.0003	0.0003	0.001	Unfiltered
		Chemical oxygen demand	19.2	8.95	20	Unfiltered
		Cyanide, total	<0.00167	0.00167	0.005	Unfiltered
		Lead	0.00576	0.0005	0.002	Unfiltered
		Mercury	<0.000067	0.000067	0.0002	Unfiltered
		Selenium	<0.0015	0.0015	0.005	Unfiltered
		Silver	<0.0003	0.0003	0.001	Unfiltered
SWSP-57	11-Jul-2022	Chemical oxygen demand	70.2	8.95	20	Unfiltered
		Solids, total suspended	638	9.5	41.7	Unfiltered
	22-Aug-2022	Chemical oxygen demand	47.7	8.95	20	Unfiltered
		Solids, total suspended	91	2.85	12.5	Unfiltered

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

PQL = practical quantitation limit; the lowest concentration of analytes in a sample that can be determined reliably within specified limits of precision and accuracy by that indicated method under routine laboratory operating conditions

Table D-2. Polyfluoroalkyl substances screening results for NMED, calendar year 2022

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-40	Aqueous	12-Jul-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<1.43	1.43	4.15	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<1.43	1.43	4.07	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<7.14	7.14	20.6	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.43	1.43	4.33	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.43	1.43	4.33	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.43	1.43	4.33	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	2.11	0.714	1.93	Unfiltered
			Perfluorobutanoic acid (PFBA)	33.2	4.33	10.8	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	<0.714	0.714	2.1	Unfiltered
			Perfluorodecanoic acid (PFDA)	1.28	0.844	2.16	Unfiltered
			Perfluorododecanoic acid (PFDOA)	<0.714	0.714	2.16	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	<0.714	0.714	2.06	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	1.93	0.714	2.16	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	<0.714	0.714	1.97	Unfiltered
			Perfluorohexanoic acid (PFHxA)	3.46	0.865	2.16	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	<0.757	0.757	2.08	Unfiltered
			Perfluorononanoic acid (PFNA)	1.18	0.714	2.16	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	<0.714	0.714	2.16	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	2.3	0.865	2.16	Unfiltered
			Perfluorooctanoic acid (PFOA)	2.41	0.865	2.16	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	<0.714	0.714	2.03	Unfiltered
			Perfluoropentanoic acid (PFPeA)	<0.714	0.714	2.16	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<0.865	0.865	2.16	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<0.714	0.714	2.16	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	<0.714	0.714	2.16	Unfiltered
		11-Aug-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<33.8	33.8	98.4	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<33.8	33.8	96.4	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<33.8	33.8	97.4	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.35	1.35	4.1	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-40	Aqueous	11-Aug-22	N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.35	1.35	4.1	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.35	1.35	4.1	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	<0.677	0.677	1.82	Unfiltered
			Perfluorobutanoic acid (PFBA)	<4.1	4.1	10.3	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	<.677	0.677	1.99	Unfiltered
			Perfluorodecanoic acid (PFDA)	<0.8	0.8	2.05	Unfiltered
			Perfluorododecanoic acid (PFDOA)	<0.677	0.677	2.05	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	<0.677	0.677	1.95	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	<0.677	0.677	2.05	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	<0.677	0.677	1.87	Unfiltered
			Perfluorohexanoic acid (PFHxA)	<0.82	0.82	2.05	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	<0.718	0.718	1.97	Unfiltered
			Perfluorononanoic acid (PFNA)	0.822	0.677	2.05	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	<0.677	0.677	2.05	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	1.15	0.82	2.05	Unfiltered
			Perfluorooctanoic acid (PFOA)	1.01	0.82	2.05	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	<0.677	0.677	1.93	Unfiltered
			Perfluoropentanoic acid (PFPeA)	<0.677	0.677	2.05	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<0.82	0.82	2.05	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<0.677	0.677	2.05	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	<0.677	0.677	2.05	Unfiltered
		6-Oct-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<1.41	1.41	4.1	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<1.41	1.41	4.02	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<7.05	7.05	20.3	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.41	1.41	4.27	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.41	1.41	4.27	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.41	1.41	4.27	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	1.61	0.705	1.9	Unfiltered
			Perfluorobutanoic acid (PFBA)	28.6	21.4	53.4	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	<0.705	0.705	2.07	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-40	Aqueous	6-Oct-22	Perfluorodecanoic acid (PFDA)	0.971	0.833	2.14	Unfiltered
			Perfluorododecanoic acid (PFDOA)	<0.705	0.705	2.14	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	<0.705	0.705	2.03	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	1.6	0.705	2.14	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	<0.705	0.705	1.94	Unfiltered
			Perfluorohexanoic acid (PFHxA)	2.14	0.854	2.14	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	<0.748	0.748	2.05	Unfiltered
			Perfluorononanoic acid (PFNA)	1.49	0.705	2.14	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	<0.705	0.705	2.14	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	1.06	0.854	2.14	Unfiltered
			Perfluorooctanoic acid (PFOA)	1.69	0.854	2.14	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	<0.705	0.705	2.01	Unfiltered
			Perfluoropentanoic acid (PFPeA)	<17.6	17.6	53.4	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<0.854	0.854	2.14	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<0.705	0.705	2.14	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	<0.705	0.705	2.14	Unfiltered
SWSP-47		10-Aug-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<6.92	6.92	20.1	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<34.6	34.6	98.6	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<34.6	34.6	99.6	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.38	1.38	4.2	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.38	1.38	4.2	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.38	1.38	4.2	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	<0.692	0.692	1.87	Unfiltered
			Perfluorobutanoic acid (PFBA)	3.42	0.839	2.1	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	<0.692	0.692	2.03	Unfiltered
			Perfluorodecanoic acid (PFDA)	2.08	0.818	2.1	Unfiltered
			Perfluorododecanoic acid (PFDOA)	<0.692	0.692	2.1	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	<0.692	0.692	1.99	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	<0.692	0.692	2.1	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	<0.692	0.692	1.91	Unfiltered
			Perfluorohexanoic acid (PFHxA)	<0.839	0.839	2.1	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-47	Aqueous	10-Aug-22	Perfluorononane sulfonic acid (PFNS)	<0.734	0.734	2.01	Unfiltered
			Perfluorononanoic acid (PFNA)	4.2	0.692	2.1	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	<0.692	0.692	2.1	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	18	0.839	2.1	Unfiltered
			Perfluorooctanoic acid (PFOA)	1.55	0.839	2.1	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	<0.692	0.692	1.97	Unfiltered
			Perfluoropentanoic acid (PFPeA)	1.21	0.692	2.1	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<0.839	0.839	2.1	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<0.692	0.692	2.1	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	0.767	0.692	2.1	Unfiltered
SWSP-49		14-Sep-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<1.45	1.45	4.21	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<36.2	36.2	103	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<7.23	7.23	20.8	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.45	1.45	4.38	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.45	1.45	4.38	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.45	1.45	4.38	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	<0.723	0.723	1.95	Unfiltered
			Perfluorobutanoic acid (PFBA)	25.5	0.877	2.19	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	<0.723	0.723	2.13	Unfiltered
			Perfluorodecanoic acid (PFDA)	<0.855	0.855	2.19	Unfiltered
			Perfluorododecanoic acid (PFDOA)	<0.723	0.723	2.19	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	<0.723	0.723	2.08	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	2.4	0.723	2.19	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	<0.723	0.723	1.99	Unfiltered
			Perfluorohexanoic acid (PFHxA)	3.15	0.877	2.19	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	<0.767	0.767	2.1	Unfiltered
			Perfluorononanoic acid (PFNA)	1.94	0.723	2.19	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	<0.723	0.723	2.19	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	1.74	0.877	2.19	Unfiltered
			Perfluorooctanoic acid (PFOA)	1.99	0.877	2.19	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	<0.723	0.723	2.06	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-49	Aqueous	14-Sep-22	Perfluoropentanoic acid (PFPeA)	2.01	0.723	2.19	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<4.38	4.38	11	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<3.62	3.62	11	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	<0.723	0.723	2.19	Unfiltered
SWSP-51		16-Aug-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<1.29	1.29	3.74	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<1.29	1.29	3.66	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<6.43	6.43	18.5	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<6.43	6.43	19.5	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.29	1.29	3.9	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.29	1.29	3.9	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	<0.643	0.643	1.73	Unfiltered
			Perfluorobutanoic acid (PFBA)	19.7	3.9	9.75	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	<0.643	0.643	1.89	Unfiltered
			Perfluorodecanoic acid (PFDA)	3.11	0.76	1.95	Unfiltered
			Perfluorododecanoic acid (PFDOA)	1	0.643	1.95	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	<0.643	0.643	1.85	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	1.92	0.643	1.95	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	0.659	0.643	1.77	Unfiltered
			Perfluorohexanoic acid (PFHxA)	1.92	0.78	1.95	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	<0.682	0.682	1.87	Unfiltered
			Perfluorononanoic acid (PFNA)	2.43	0.643	1.95	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	<0.643	0.643	1.95	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	9.27	0.78	1.95	Unfiltered
			Perfluorooctanoic acid (PFOA)	1.4	0.78	1.95	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	<0.643	0.643	1.83	Unfiltered
			Perfluoropentanoic acid (PFPeA)	<0.643	0.643	1.95	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<3.9	3.9	9.75	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<3.22	3.22	9.75	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	1.61	0.643	1.95	Unfiltered
		5-Oct-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<1.29	1.29	3.76	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<6.46	6.46	18.4	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-51	Aqueous	5-Oct-22	1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<6.46	6.46	18.6	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.29	1.29	3.92	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.29	1.29	3.92	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.29	1.29	3.92	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	0.943	0.646	1.74	Unfiltered
			Perfluorobutanoic acid (PFBA)	<97.9	97.9	245	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	<0.646	0.646	1.9	Unfiltered
			Perfluorodecanoic acid (PFDA)	1.86	0.764	1.96	Unfiltered
			Perfluorododecanoic acid (PFDOA)	<0.646	0.646	1.96	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	<0.646	0.646	1.86	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	1.26	0.646	1.96	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	0.931	0.646	1.78	Unfiltered
			Perfluorohexanoic acid (PFHxA)	3.76	0.784	1.96	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	<0.686	0.686	1.88	Unfiltered
			Perfluorononanoic acid (PFNA)	1.93	0.646	1.96	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	<0.646	0.646	1.96	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	11.6	0.784	1.96	Unfiltered
			Perfluorooctanoic acid (PFOA)	1.91	0.784	1.96	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	<0.646	0.646	1.84	Unfiltered
			Perfluoropentanoic acid (PFPeA)	0.996	0.646	1.96	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<0.784	0.784	1.96	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<0.646	0.646	1.96	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	1.15	0.646	1.96	Unfiltered
SWSP-52		28-Jul-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	<12.7	12.7	36.8	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<12.7	12.7	36.1	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<12.7	12.7	36.4	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.27	1.27	3.84	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.27	1.27	3.84	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.27	1.27	3.84	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	2.21	0.633	1.71	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-52	Aqueous	28-Jul-22	Perfluorobutanoic acid (PFBA)	19	0.767	1.92	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	3.23	0.633	1.86	Unfiltered
			Perfluorodecanoic acid (PFDA)	29.2	0.748	1.92	Unfiltered
			Perfluorododecanoic acid (PFDOA)	6.22	0.633	1.92	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	4.27	0.633	1.82	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	1.75	0.633	1.92	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	14.1	0.633	1.75	Unfiltered
			Perfluorohexanoic acid (PFHxA)	4.45	0.767	1.92	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	1.26	0.671	1.84	Unfiltered
			Perfluorononanoic acid (PFNA)	9.1	0.633	1.92	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	1.55	0.633	1.92	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	829	7.67	19.2	Unfiltered
			Perfluorooctanoic acid (PFOA)	13.3	0.767	1.92	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	0.872	0.633	1.8	Unfiltered
			Perfluoropentanoic acid (PFPeA)	0.957	0.633	1.92	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<0.767	0.767	1.92	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	0.717	0.633	1.92	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	13.6	0.633	1.92	Unfiltered
		10-Aug-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	3.81	1.36	3.95	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<13.6	13.6	38.7	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<13.6	13.6	39.1	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.36	1.36	4.11	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.36	1.36	4.11	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.36	1.36	4.11	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	2.27	0.679	1.83	Unfiltered
			Perfluorobutanoic acid (PFBA)	14	0.823	2.06	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	2.39	0.679	2	Unfiltered
			Perfluorodecanoic acid (PFDA)	17.4	0.802	2.06	Unfiltered
			Perfluorododecanoic acid (PFDOA)	4.15	0.679	2.06	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	20.7	0.679	1.95	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	2.01	0.679	2.06	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-52	Aqueous	10-Aug-22	Perfluorohexane sulfonic acid (PFHxS)	95.4	0.679	1.87	Unfiltered
			Perfluorohexanoic acid (PFHxA)	2.14	0.823	2.06	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	0.847	0.72	1.98	Unfiltered
			Perfluorononanoic acid (PFNA)	16.7	0.679	2.06	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	2.26	0.679	2.06	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	1,240	8.23	20.6	Unfiltered
			Perfluorooctanoic acid (PFOA)	76.8	0.823	2.06	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	1.26	0.679	1.93	Unfiltered
			Perfluoropentanoic acid (PFPeA)	<0.679	0.679	2.06	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	<0.823	0.823	2.06	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	<0.679	0.679	2.06	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	9.15	0.679	2.06	Unfiltered
		6-Oct-22	1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid (8:2 FTS)	6.27	1.4	4.08	Unfiltered
			1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid (4:2 FTS)	<1.4	1.4	3.99	Unfiltered
			1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid (6:2 FTS)	<7.01	7.01	20.2	Unfiltered
			N-Methylperfluorooctane sulfonamide (NMeFOSA)	<1.4	1.4	4.25	Unfiltered
			N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	<1.4	1.4	4.25	Unfiltered
			N-ethylperfluoro-1-octanesulfonamidoacet	<1.4	1.4	4.25	Unfiltered
			Perfluorobutane sulfonic acid (PFBS)	2.17	0.701	1.89	Unfiltered
			Perfluorobutanoic acid (PFBA)	26.8	0.85	2.12	Unfiltered
			Perfluorodecane sulfonic acid (PFDS)	5.16	0.701	2.06	Unfiltered
			Perfluorodecanoic acid (PFDA)	33.5	0.829	2.12	Unfiltered
			Perfluorododecanoic acid (PFDOA)	10.2	0.701	2.12	Unfiltered
			Perfluoroheptane sulfonic acid (PFHpS)	8.08	0.701	2.02	Unfiltered
			Perfluoroheptanoic acid (PFHpA)	1.87	0.701	2.12	Unfiltered
			Perfluorohexane sulfonic acid (PFHxS)	20.7	0.701	1.93	Unfiltered
			Perfluorohexanoic acid (PFHxA)	2.82	0.85	2.12	Unfiltered
			Perfluorononane sulfonic acid (PFNS)	1.57	0.744	2.04	Unfiltered
			Perfluorononanoic acid (PFNA)	17.7	0.701	2.12	Unfiltered
			Perfluorooctane sulfonamide (PFOSA)	2.33	0.701	2.12	Unfiltered
			Perfluorooctane sulfonic acid (PFOS)	1,230	4.25	10.6	Unfiltered

Sampling Point	Matrix	Sample Date	Analyte	Result	MDL (ng/L)	PQL ng/L)	Sample Preparation
SWSP-52	Aqueous	6-Oct-22	Perfluorooctanoic acid (PFOA)	14.5	0.85	2.12	Unfiltered
			Perfluoropentane sulfonic acid (PFPeS)	1.07	0.701	2	Unfiltered
			Perfluoropentanoic acid (PFPeA)	<0.701	0.701	2.12	Unfiltered
			Perfluorotetradecanoic acid (PFTeDA)	1.09	0.85	2.12	Unfiltered
			Perfluorotridecanoic acid (PFTrDA)	1.45	0.701	2.12	Unfiltered
			Perfluoroundecanoic acid (PFUnDA)	16.5	0.701	2.12	Unfiltered

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

Table D-3. MS4 Permit sampling results, calendar year 2022

Sampling Point	Sample Date	Analyte	Result	MDL[a]	PQL	Sample Preparation	Units
SWSP-02	22-Mar-22	Alpha, gross	3.13	0.531	1.18	Unfiltered	pCi/L
		Beta, gross	18.3	1.8	3.97	Unfiltered	pCi/L
		Biochemical oxygen demand	17		2	Unfiltered	mg/L
		Chemical oxygen demand	89.5	8.95	20	Unfiltered	mg/L
		E. coli	41		10	Unfiltered	MPN/100 mL
		Nitrate plus nitrite as N	0.745	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	2.63	0.033	0.1	Unfiltered	mg/L
		Oil and grease	<1.21	1.21	4.31	Unfiltered	mg/L
		Phosphorus, total as P	0.48	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.175	0.02	0.05	Filtered	mg/L
		Solids, total dissolved	131	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	229	5.7	25	Unfiltered	mg/L
	22-Jun-22	Alpha, gross	1.27	0.366	0.98	Unfiltered	pCi/L
		Beta, gross	2.72	0.433	0.969	Unfiltered	pCi/L
		Chemical oxygen demand	52.7	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.301	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	0.723	0.033	0.1	Unfiltered	mg/L
		Oil and grease	1.39	1.39	4.95	Unfiltered	mg/L
		Phosphorus, total as P	0.171	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.249	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	54.3	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	25.1	1.21	5.32	Unfiltered	mg/L
		Total PCB congeners	5,230		119	Unfiltered	pg/L
	4-Oct-22	Alpha, gross	8.85	0.585	1.27	Unfiltered	pCi/L
		Beta, gross	18.9	0.398	0.825	Unfiltered	pCi/L
		Chemical oxygen demand	39	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.484	0.017	0.05	Unfiltered	mg/L
		Nitrogen, kjeldahl	0.969	0.033	0.1	Unfiltered	mg/L
		Oil and grease	2	1.33	4.76	Unfiltered	mg/L
		Phosphorus, total as P	0.194	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.425	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	68	2.38	10	Unfiltered	mg/L

Sampling Point	Sample Date	Analyte	Result	MDL[a]	PQL	Sample Preparation	Units
SWSP-02	4-Oct-22	Solids, total suspended	220	5.7	25	Unfiltered	mg/L
SWSP-05	22-Jun-22	Alpha, gross	2.67	0.329	0.738	Unfiltered	pCi/L
		Beta, gross	3.44	0.568	1.17	Unfiltered	pCi/L
		Chemical oxygen demand	68.1	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.28	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	0.44	0.033	0.1	Unfiltered	mg/L
		Oil and grease	1.49	1.39	4.95	Unfiltered	mg/L
		Phosphorus, total as P	0.101	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.123	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	28.6	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	43.2	1.68	7.35	Unfiltered	mg/L
		Total PCB congeners	2,740		105	Unfiltered	pg/L
	10-Aug-22	Alpha, gross	13.4	0.574	1.27	Unfiltered	pCi/L
		Beta, gross	19.8	0.667	1.37	Unfiltered	pCi/L
		Chemical oxygen demand	46.4	8.95	20	Unfiltered	mg/L
		Chemical oxygen demand	66.4	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.885	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	1.99	0.033	0.1	Unfiltered	mg/L
		Oil and grease	<1.4	1.4	5	Unfiltered	mg/L
		Phosphorus, total as P	0.494	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.126	0.02	0.05	Filtered	mg/L
		Solids, total dissolved	81	2.38	10	Unfiltered	mg/L
		Solids, total suspended	186	4.07	17.9	Unfiltered	mg/L
		Solids, total suspended	392	5.7	25	Unfiltered	mg/L
		Total PCB congeners	20,300		120	Unfiltered	pg/L
SWSP-24	22-Jun-22	Alpha, gross	0.799	0.313	0.93	Unfiltered	pCi/L
		Beta, gross	4.87	0.445	0.996	Unfiltered	pCi/L
		Chemical oxygen demand	110	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.985	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	1.2	0.033	0.1	Unfiltered	mg/L
		Oil and grease	1.52	1.25	4.46	Unfiltered	mg/L
		Phosphorus, total as P	0.107	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.141	0.02	0.05	Unfiltered	mg/L

Sampling Point	Sample Date	Analyte	Result	MDL[a]	PQL	Sample Preparation	Units
SWSP-24	22-Jun-22	Solids, total dissolved	81.4	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	12.7	1.48	6.49	Unfiltered	mg/L
		Total PCB congeners	859		110	Unfiltered	pg/L
	11-Jul-22	Alpha, gross	2.99	0.653	1.38	Unfiltered	pCi/L
		Beta, gross	9.88	0.884	1.81	Unfiltered	pCi/L
		Chemical oxygen demand	40.2	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.561	0.017	0.05	Unfiltered	mg/L
		Nitrogen, kjeldahl	1.08	0.033	0.1	Unfiltered	mg/L
		Oil and grease	<1.33	1.33	4.76	Unfiltered	mg/L
		Phosphorus, total as P	0.117	0.02	0.05	Filtered	mg/L
		Phosphorus, total as P	0.255	0.02	0.05	Unfiltered	mg/L
		Solids, total dissolved	84.3	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	48	2.53	11.1	Unfiltered	mg/L
		Total PCB congeners	7,900		105	Unfiltered	pg/L
SWSP-35	22-Jun-22	Alpha, gross	1.67	0.344	0.941	Unfiltered	pCi/L
		Beta, gross	2.47	0.434	0.954	Unfiltered	pCi/L
		Chemical oxygen demand	14.3	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.119	0.017	0.05	Unfiltered	mg/L
		Nitrogen, kjeldahl	0.351	0.033	0.1	Unfiltered	mg/L
		Oil and grease	<1.35	1.35	4.81	Unfiltered	mg/L
		Phosphorus, total as P	0.137	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.132	0.02	0.05	Filtered	mg/L
		Solids, total dissolved	38.6	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	15.6	1.04	4.55	Unfiltered	mg/L
		Total PCB congeners	2,970		105	Unfiltered	pg/L
	10-Aug-22	Alpha, gross	5.92	0.361	0.773	Unfiltered	pCi/L
		Beta, gross	14.6	0.308	0.635	Unfiltered	pCi/L
		Chemical oxygen demand	38.4	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.825	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	1.48	0.033	0.1	Unfiltered	mg/L
		Oil and grease	<1.4	1.4	5	Unfiltered	mg/L
		Phosphorus, total as P	0.248	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.159	0.02	0.05	Filtered	mg/L

Sampling Point	Sample Date	Analyte	Result	MDL[a]	PQL	Sample Preparation	Units
SWSP-35	10-Aug-22	Solids, total dissolved	35	2.38	10	Unfiltered	mg/L
		Solids, total suspended	155	2.11	9.26	Unfiltered	mg/L
		Total PCB congeners	7,750		114	Unfiltered	pg/L
SWSP-36	22-Jun-22	Alpha, gross	3.08	0.354	0.781	Unfiltered	pCi/L
		Beta, gross	6.27	0.418	0.861	Unfiltered	pCi/L
		Chemical oxygen demand	52.7	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	0.301	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	0.498	0.033	0.1	Unfiltered	mg/L
		Oil and grease	<1.39	1.39	4.95	Unfiltered	mg/L
		Phosphorus, total as P	0.161	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.0927	0.02	0.05	Filtered	mg/L
		Solids, total dissolved	88.6	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	107	3.17	13.9	Unfiltered	mg/L
		Total PCB congeners	52,700		107	Unfiltered	pg/L
	11-Jul-22	Alpha, gross	7.72	0.862	1.96	Unfiltered	pCi/L
		Beta, gross	24.5	1.48	3.03	Unfiltered	pCi/L
		Chemical oxygen demand	450	8.95	20	Unfiltered	mg/L
		Nitrate plus nitrite as N	1.89	0.085	0.25	Unfiltered	mg/L
		Nitrogen, kjeldahl	6.65	0.165	0.5	Unfiltered	mg/L
		Oil and grease	1.22	1.22	4.35	Unfiltered	mg/L
		Phosphorus, total as P	0.572	0.02	0.05	Unfiltered	mg/L
		Phosphorus, total as P	0.241	0.02	0.05	Filtered	mg/L
		Solids, total dissolved	459	3.4	14.3	Unfiltered	mg/L
		Solids, total suspended	159	3.45	15.2	Unfiltered	mg/L
		Total PCB congeners	16,600		104	Unfiltered	pg/L

[a] Blank cells indicate that an MDL was not reported by the lab.

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

Appendix E. Sanitary Outfalls Monitoring Results in 2022

Greater roadrunner (*Geococcyx californianus*)

Table E-1. Inorganic results for permitted sanitary outfalls, second quarter of calendar year 2022

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	18-Apr-2022	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		19-Apr-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.208	0.017	B	EPA 350.1
			Arsenic	0.00514	0.002		EPA 200.8
			Boron	0.0332	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	135	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00839	0.0003		EPA 200.8
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Fluoride	2.56	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00397	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.122	0.02		EPA 365.4
			Selenium	0.00233	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.588	U	SM 2540D
			Zinc	0.00347	0.0033	J	EPA 200.8
		20-Apr-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.0493	0.017	JB	EPA 350.1
			Arsenic	0.0034	0.002	J	EPA 200.8
			Boron	0.0388	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand		8.95	U	EPA 410.4
			Chromium	0.00323	0.003	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	20-Apr-2022	Copper	0.00147	0.0003	J	EPA 200.8
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Fluoride	0.971	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00411	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.141	0.02		EPA 365.4
			Selenium	0.00275	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.594	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		21-Apr-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.0638	0.017	B	EPA 350.1
			Arsenic	0.00333	0.002	J	EPA 200.8
			Boron	0.0421	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	62.8	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00613	0.0003		EPA 200.8
			Fluoride	0.848	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0046	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.142	0.02		EPA 365.4
			Selenium	0.00314	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.606	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		22-Apr-2022	Aluminum		0.0193	*U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	22-Apr-2022	Ammonia	0.999	0.017		EPA 350.1
			Arsenic	0.00337	0.002	J	EPA 200.8
			Boron	0.0397	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	30.6	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00134	0.0003	J	EPA 200.8
			Fluoride	2.72	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0039	0.0002	B	EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.496	0.02		EPA 365.4
			Selenium	0.00219	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.576	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
WW001	2069A	19-Apr-2022	Aluminum	0.0356	0.0193	J	EPA 200.8
			Ammonia	8.15	0.085	B	EPA 350.1
			Arsenic	0.00297	0.002	J	EPA 200.8
			Boron	0.0577	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	55.3	8.95		EPA 410.4
			Chromium	0.00309	0.003	J	EPA 200.8
			Copper	0.0243	0.0003		EPA 200.8
			Fluoride	2.31	0.033		EPA 300.0
			Lead	0.0106	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00868	0.0002		EPA 200.8
			Nickel	0.00128	0.0006	J	EPA 200.8
			Phosphorus, total as P	1.96	0.02		EPA 365.4
			Selenium	0.00261	0.0015	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	19-Apr-2022	Silver		0.0003	U	EPA 200.8
			Solids, total suspended	27.2	2.28		SM 2540D
			Zinc	0.0357	0.0033		EPA 200.8
		20-Apr-2022	Aluminum	0.0494	0.0193	J	EPA 200.8
			Ammonia	9.85	0.085	B	EPA 350.1
			Arsenic	0.00344	0.002	J	EPA 200.8
			Boron	0.0604	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	80.3	8.95		EPA 410.4
			Chromium	0.00361	0.003	J	EPA 200.8
			Copper	0.0356	0.0003		EPA 200.8
			Fluoride	2.98	0.033		EPA 300.0
			Lead	0.0857	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0103	0.0002		EPA 200.8
			Nickel	0.0034	0.0006		EPA 200.8
			Phosphorus, total as P	1.71	0.02		EPA 365.4
			Selenium	0.00244	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	28	2.28		SM 2540D
			Zinc	0.0391	0.0033		EPA 200.8
		21-Apr-2022	Aluminum	0.114	0.0193		EPA 200.8
			Ammonia	10.6	0.425	B	EPA 350.1
			Arsenic	0.00273	0.002	J	EPA 200.8
			Boron	0.0622	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	62.8	8.95		EPA 410.4
			Chromium	0.00369	0.003	J	EPA 200.8
			Copper	0.0316	0.0003		EPA 200.8
			Fluoride	2.21	0.033		EPA 300.0
			Lead	0.0281	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	21-Apr-2022	Molybdenum	0.0104	0.0002		EPA 200.8
			Nickel	0.00247	0.0006		EPA 200.8
			Phosphorus, total as P	2.03	0.02		EPA 365.4
			Selenium	0.00296	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	52	2.28		SM 2540D
			Zinc	0.0508	0.0033		EPA 200.8
		22-Apr-2022	Aluminum	0.426	0.0193	*	EPA 200.8
			Ammonia	10.6	0.425		EPA 350.1
			Arsenic	0.00245	0.002	J	EPA 200.8
			Boron	0.0639	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	83.1	8.95		EPA 410.4
			Chromium	0.00368	0.003	J	EPA 200.8
			Copper	0.0251	0.0003		EPA 200.8
			Fluoride	2.74	0.033		EPA 300.0
			Lead	0.0166	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0106	0.0002	B	EPA 200.8
			Nickel	0.0019	0.0006	J	EPA 200.8
			Phosphorus, total as P	1.94	0.02		EPA 365.4
			Selenium	0.00264	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	26	2.28		SM 2540D
			Zinc	0.0313	0.0033		EPA 200.8
WW006	2069F	18-Apr-2022	Cyanide, total	0.00176	0.00167	J	EPA 335.4
			Cyanide, total	0.00195	0.00167	J	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		19-Apr-2022	Aluminum	0.0874	0.0193		EPA 200.8
			Ammonia	35	0.425	B	EPA 350.1
			Arsenic	0.00314	0.002	J	EPA 200.8
			Boron	0.103	0.0052	B	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	19-Apr-2022	Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	153	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0169	0.0003		EPA 200.8
			Cyanide, total	0.00241	0.00167	JN	EPA 335.4
			Cyanide, total	0.00266	0.00167	JN	EPA 335.4
			Cyanide, total	0.0037	0.00167	JN	EPA 335.4
			Cyanide, total	0.0023	0.00167	J	EPA 335.4
			Fluoride	0.949	0.033		EPA 300.0
			Lead	0.000696	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00198	0.0002		EPA 200.8
			Nickel	0.00167	0.0006	J	EPA 200.8
			Phosphorus, total as P	4.73	0.1		EPA 365.4
			Selenium	0.00194	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	90	5.18		SM 2540D
			Zinc	0.0806	0.0033		EPA 200.8
		20-Apr-2022	Aluminum	0.053	0.0193		EPA 200.8
			Ammonia	34	0.425	B	EPA 350.1
			Arsenic	0.00317	0.002	J	EPA 200.8
			Boron	0.0699	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	133	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.014	0.0003		EPA 200.8
			Cyanide, total	0.00263	0.00167	JN	EPA 335.4
			Fluoride	0.869	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00183	0.0002		EPA 200.8
			Nickel	0.00132	0.0006	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	20-Apr-2022	Phosphorus, total as P	3.54	0.1		EPA 365.4
			Selenium	0.00191	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	57.3	3.8		SM 2540D
			Zinc	0.0797	0.0033		EPA 200.8
		21-Apr-2022	Aluminum	0.0537	0.0193		EPA 200.8
			Ammonia	30.8	0.425	B	EPA 350.1
			Arsenic	0.00228	0.002	J	EPA 200.8
			Boron	0.0946	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	138	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0162	0.0003		EPA 200.8
			Fluoride	0.81	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00265	0.0002		EPA 200.8
			Nickel	0.00116	0.0006	J	EPA 200.8
			Phosphorus, total as P	3.51	0.1		EPA 365.4
			Selenium	0.00219	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	60	5.7		SM 2540D
			Zinc	0.0498	0.0033		EPA 200.8
		22-Apr-2022	Aluminum	0.08	0.0193	*	EPA 200.8
			Ammonia	28.8	0.425		EPA 350.1
			Arsenic	0.00233	0.002	J	EPA 200.8
			Boron	0.0884	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	131	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0267	0.0003		EPA 200.8
			Fluoride	1.29	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	22-Apr-2022	Lead	0.000835	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00447	0.0002	B	EPA 200.8
			Nickel	0.00166	0.0006	J	EPA 200.8
			Phosphorus, total as P	3.62	0.1		EPA 365.4
			Selenium	0.00234	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	57	5.7		SM 2540D
			Zinc	0.141	0.0033		EPA 200.8
WW007	2069G	18-Apr-2022	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		19-Apr-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	3.09	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0188	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	30.3	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00487	0.0003		EPA 200.8
			Cyanide, total	0.002	0.00167	JN	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	2.84	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0108	0.0002		EPA 200.8
			Nickel	0.000886	0.0006	J	EPA 200.8
			Phosphorus, total as P	0.642	0.02		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	19-Apr-2022	Solids, total suspended		0.62	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		20-Apr-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	3.7	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.018	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	12.8	8.95	J	EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00411	0.0003		EPA 200.8
			Cyanide, total	0.00197	0.00167	JN	EPA 335.4
			Fluoride	4.68	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0107	0.0002		EPA 200.8
			Nickel	0.00095	0.0006	J	EPA 200.8
			Phosphorus, total as P	0.289	0.02		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.62	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		21-Apr-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	2.46	0.085	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0215	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	30.3	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00449	0.0003		EPA 200.8
			Fluoride	2.54	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	21-Apr-2022	Molybdenum	0.0106	0.0002		EPA 200.8
			Nickel	0.00102	0.0006	J	EPA 200.8
			Phosphorus, total as P	0.355	0.02		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.606	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		22-Apr-2022	Aluminum		0.0193	*U	EPA 200.8
			Ammonia	3.34	0.085		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0164	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	30.6	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.006	0.0003		EPA 200.8
			Fluoride	3.48	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00983	0.0002	B	EPA 200.8
			Nickel	0.000901	0.0006	J	EPA 200.8
			Phosphorus, total as P	0.392	0.02		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.613	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
WW008	2069I	19-Apr-2022	Aluminum	0.0487	0.0193	J	EPA 200.8
			Ammonia	22.3	0.425	B	EPA 350.1
			Arsenic	0.00324	0.002	J	EPA 200.8
			Boron	0.114	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	95.3	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	19-Apr-2022	Copper	0.0316	0.0003		EPA 200.8
			Fluoride	0.754	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00468	0.0002		EPA 200.8
			Nickel	0.02	0.0006		EPA 200.8
			Phosphorus, total as P	3.28	0.1		EPA 365.4
			Selenium	0.00195	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	69	2.85		SM 2540D
			Zinc	0.0424	0.0033		EPA 200.8
		20-Apr-2022	Aluminum	0.0419	0.0193	J	EPA 200.8
			Ammonia	25.3	0.425	B	EPA 350.1
			Arsenic	0.00259	0.002	J	EPA 200.8
			Boron	0.0874	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	70.3	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0221	0.0003		EPA 200.8
			Fluoride	0.745	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00456	0.0002		EPA 200.8
			Nickel	0.0162	0.0006		EPA 200.8
			Phosphorus, total as P	3.12	0.1		EPA 365.4
			Selenium	0.00367	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	66	2.28		SM 2540D
			Zinc	0.0403	0.0033		EPA 200.8
		21-Apr-2022	Aluminum	0.0271	0.0193	J	EPA 200.8
			Ammonia	18.9	0.425	B	EPA 350.1
			Arsenic	0.00209	0.002	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	21-Apr-2022	Boron	0.0635	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	65.3	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0163	0.0003		EPA 200.8
			Fluoride	0.817	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00403	0.0002		EPA 200.8
			Nickel	0.012	0.0006		EPA 200.8
			Phosphorus, total as P	2.3	0.02		EPA 365.4
			Selenium	0.00186	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	28.8	2.28		SM 2540D
			Zinc	0.0235	0.0033		EPA 200.8
		22-Apr-2022	Aluminum	0.0445	0.0193	*J	EPA 200.8
			Ammonia	25.8	0.425		EPA 350.1
			Arsenic	0.00204	0.002	J	EPA 200.8
			Boron	0.0641	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	88.1	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0233	0.0003		EPA 200.8
			Fluoride	0.824	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0045	0.0002	B	EPA 200.8
			Nickel	0.019	0.0006		EPA 200.8
			Phosphorus, total as P	2.83	0.02		EPA 365.4
			Selenium	0.00224	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	78.8	2.28		SM 2540D

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	22-Apr-2022	Zinc	0.041	0.0033		EPA 200.8
WW011	2069K	19-Apr-2022	Aluminum	0.0541	0.0193		EPA 200.8
			Ammonia	20	0.425	B	EPA 350.1
			Arsenic	0.00212	0.002	J	EPA 200.8
			Boron	0.052	0.0052	B	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	173	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0273	0.0003		EPA 200.8
			Fluoride	0.636	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00383	0.0002		EPA 200.8
			Nickel	0.00215	0.0006		EPA 200.8
			Phosphorus, total as P	6.5	0.1		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	102	5.18		SM 2540D
			Zinc	0.0603	0.0033		EPA 200.8
		20-Apr-2022	Aluminum	0.0617	0.0193		EPA 200.8
			Ammonia	18.6	0.425	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0552	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	255	8.95		EPA 410.4
			Chromium	0.00316	0.003	J	EPA 200.8
			Copper	0.0223	0.0003		EPA 200.8
			Fluoride	0.608	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00275	0.0002		EPA 200.8
			Nickel	0.00193	0.0006	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	20-Apr-2022	Phosphorus, total as P	9.39	0.2		EPA 365.4
			Selenium	0.00152	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	116	5.7		SM 2540D
			Zinc	0.0635	0.0033		EPA 200.8
		21-Apr-2022	Aluminum	0.0873	0.0193		EPA 200.8
			Ammonia	16.5	0.425	B	EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0544	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	87.8	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0173	0.0003		EPA 200.8
			Fluoride	0.751	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00253	0.0002		EPA 200.8
			Nickel	0.00176	0.0006	J	EPA 200.8
			Phosphorus, total as P	8.17	0.2		EPA 365.4
			Selenium	0.00163	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	85	5.7		SM 2540D
			Zinc	0.0595	0.0033		EPA 200.8
		22-Apr-2022	Aluminum	0.053	0.0193	*	EPA 200.8
			Ammonia	17.4	0.425		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0533	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	116	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0223	0.0003		EPA 200.8
			Fluoride	0.754	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	22-Apr-2022	Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0045	0.0002	B	EPA 200.8
			Nickel	0.00148	0.0006	J	EPA 200.8
			Phosphorus, total as P	9.78	0.2		EPA 365.4
			Selenium	0.00174	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	84	5.7		SM 2540D
			Zinc	0.0417	0.0033		EPA 200.8

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

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

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

Analytical Method
EPA 200.8 (EPA 1994)
EPA 245.1/245.2 (EPA 1994) (EPA 1974)
EPA 300.0 (EPA 1993)
EPA 335.4 (EPA 1993)
EPA 350.1 (EPA 1993)
EPA 365.4 (EPA 1974)
EPA 410.4 (EPA 1993)
SM 2540D (Standard Methods Committee of the American Public Health Association, American Water Works Association, and Water Environment Federation 2018)

Table E-2. Inorganic results for permitted sanitary outfalls, third quarter of calendar year 2022

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	26-Sep-2022	Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
		27-Sep-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.0502	0.017		EPA 350.1
			Arsenic	0.00234	0.002	J	EPA 200.8
			Boron	0.0286	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	14.6	8.95	J	EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00298	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	0.723	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00277	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.0487	0.02	JN	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.616	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		28-Sep-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.131	0.017		EPA 350.1
			Arsenic	0.00274	0.002	J	EPA 200.8
			Boron	0.0307	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	83	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	28-Sep-2022	Copper	0.00187	0.0003	J	EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	1.15	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00308	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.244	0.02	B	EPA 365.4
			Selenium	0.00175	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.613	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		29-Sep-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.151	0.017		EPA 350.1
			Arsenic	0.00249	0.002	J	EPA 200.8
			Boron	0.0269	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	51.9	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00359	0.0003		EPA 200.8
			Fluoride	0.579	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00298	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.0936	0.02		EPA 365.4
			Selenium	0.00175	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.6	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		30-Sep-2022	Aluminum		0.0193	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	30-Sep-2022	Ammonia	0.076	0.017		EPA 350.1
			Arsenic	0.00232	0.002	J	EPA 200.8
			Boron	0.0579	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	18.6	8.95	J	EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00296	0.0003		EPA 200.8
			Fluoride	0.905	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00344	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.15	0.02		EPA 365.4
			Selenium	0.00174	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.582	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
WW001	2069A	27-Sep-2022	Aluminum	0.0325	0.0193	J	EPA 200.8
			Ammonia	8.1	0.085		EPA 350.1
			Arsenic	0.00221	0.002	J	EPA 200.8
			Boron	0.0486	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	130	8.95		EPA 410.4
			Chromium	0.0044	0.003	J	EPA 200.8
			Copper	0.0225	0.0003		EPA 200.8
			Fluoride	2.37	0.033		EPA 300.0
			Lead	0.000955	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.011	0.0002		EPA 200.8
			Nickel	0.00219	0.0006		EPA 200.8
			Phosphorus, total as P	1.61	0.02	N	EPA 365.4
			Selenium	0.00205	0.0015	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	27-Sep-2022	Silver		0.0003	U	EPA 200.8
			Solids, total suspended	36.3	3.56		SM 2540D
			Zinc	0.0214	0.0033		EPA 200.8
		28-Sep-2022	Aluminum	0.0338	0.0193	J	EPA 200.8
			Ammonia	9.48	0.425		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0532	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	141	8.95		EPA 410.4
			Chromium	0.00403	0.003	J	EPA 200.8
			Copper	0.017	0.0003		EPA 200.8
			Fluoride	2.39	0.033		EPA 300.0
			Lead	0.00281	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0227	0.0002		EPA 200.8
			Nickel	0.00218	0.0006		EPA 200.8
			Phosphorus, total as P	1.85	0.02	N	EPA 365.4
			Selenium	0.00202	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	25.5	1.84		SM 2540D
			Zinc	0.024	0.0033		EPA 200.8
		29-Sep-2022	Aluminum	0.114	0.0193		EPA 200.8
			Ammonia	12.9	0.425		EPA 350.1
			Arsenic	0.00226	0.002	J	EPA 200.8
			Boron	0.0762	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	174	8.95		EPA 410.4
			Chromium	0.00465	0.003	J	EPA 200.8
			Copper	0.041	0.0003		EPA 200.8
			Fluoride	1.74	0.033		EPA 300.0
			Lead	0.0162	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	29-Sep-2022	Molybdenum	0.0105	0.0002		EPA 200.8
			Nickel	0.00289	0.0006		EPA 200.8
			Phosphorus, total as P	2.36	0.02		EPA 365.4
			Selenium	0.0028	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	49.3	1.9		SM 2540D
			Zinc	0.0799	0.0033		EPA 200.8
		30-Sep-2022	Aluminum	0.029	0.0193	J	EPA 200.8
			Ammonia	8.35	0.425		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0579	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	135	8.95		EPA 410.4
			Chromium	0.00337	0.003	J	EPA 200.8
			Copper	0.0165	0.0003		EPA 200.8
			Fluoride	2.05	0.033		EPA 300.0
			Lead	0.00184	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0103	0.0002		EPA 200.8
			Nickel	0.00198	0.0006	J	EPA 200.8
			Phosphorus, total as P	2.09	0.02		EPA 365.4
			Selenium	0.00257	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	34.2	1.93		SM 2540D
			Zinc	0.0224	0.0033		EPA 200.8
WW006	2069F	26-Sep-2022	Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
		27-Sep-2022	Aluminum	0.12	0.0193		EPA 200.8
			Ammonia	45.3	0.85		EPA 350.1
			Arsenic	0.00259	0.002	J	EPA 200.8
			Boron	0.0886	0.0052		EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	27-Sep-2022	Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	194	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0386	0.0003		EPA 200.8
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Fluoride	0.855	0.033		EPA 300.0
			Lead	0.000666	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00455	0.0002		EPA 200.8
			Nickel	0.00216	0.0006		EPA 200.8
			Phosphorus, total as P	4.73	0.1	N	EPA 365.4
			Selenium	0.0022	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	104	7.13		SM 2540D
			Zinc	0.106	0.0033		EPA 200.8
		28-Sep-2022	Aluminum	0.105	0.0193		EPA 200.8
			Ammonia	40.7	0.85		EPA 350.1
			Arsenic	0.00226	0.002	J	EPA 200.8
			Boron	0.243	0.026		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	183	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0327	0.0003		EPA 200.8
			Cyanide, total		0.00167	NU	EPA 335.4
			Fluoride	0.882	0.033		EPA 300.0
			Lead	0.000755	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00428	0.0002		EPA 200.8
			Nickel	0.00177	0.0006	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	28-Sep-2022	Phosphorus, total as P	4.21	0.1	N	EPA 365.4
			Selenium	0.00189	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	72.9	4.07		SM 2540D
			Zinc	0.0737	0.0033		EPA 200.8
		29-Sep-2022	Aluminum	0.134	0.0193		EPA 200.8
			Ammonia	37.4	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.097	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	219	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0306	0.0003		EPA 200.8
			Fluoride	0.795	0.033		EPA 300.0
			Lead	0.00129	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00401	0.0002		EPA 200.8
			Nickel	0.00175	0.0006	J	EPA 200.8
			Phosphorus, total as P	4.92	0.1		EPA 365.4
			Selenium	0.00233	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	74.9	3.26		SM 2540D
			Zinc	0.0955	0.0033		EPA 200.8
		30-Sep-2022	Aluminum	0.088	0.0193		EPA 200.8
			Ammonia	37.4	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.104	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	258	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.026	0.0003		EPA 200.8
			Fluoride	0.894	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	30-Sep-2022	Lead	0.000659	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00403	0.0002		EPA 200.8
			Nickel	0.00158	0.0006	J	EPA 200.8
			Phosphorus, total as P	5.3	0.1		EPA 365.4
			Selenium	0.00205	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	81.4	3.93		SM 2540D
			Zinc	0.114	0.0033		EPA 200.8
WW007	2069G	26-Sep-2022	Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
		27-Sep-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	5.2	0.085		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.02	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	56.7	8.95		EPA 410.4
			Chromium	0.00331	0.003	J	EPA 200.8
			Copper	0.00301	0.0003		EPA 200.8
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Fluoride	3.72	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0138	0.0002		EPA 200.8
			Nickel	0.00241	0.0006		EPA 200.8
			Phosphorus, total as P	0.104	0.02	N	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.582	U	SM 2540D

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	27-Sep-2022	Zinc		0.0033	U	EPA 200.8
		28-Sep-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	3.71	0.085		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0209	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	56.7	8.95		EPA 410.4
			Chromium	0.00336	0.003	J	EPA 200.8
			Copper	0.00301	0.0003		EPA 200.8
			Cyanide, total		0.00167	NU	EPA 335.4
			Cyanide, total		0.00167	NU	EPA 335.4
			Fluoride	3.72	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0539	0.0002		EPA 200.8
			Nickel	0.00231	0.0006		EPA 200.8
			Phosphorus, total as P	0.136	0.02	B	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.576	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		29-Sep-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	2.47	0.085		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0378	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	24.2	8.95		EPA 410.4
			Chromium	0.00307	0.003	J	EPA 200.8
			Copper	0.00271	0.0003		EPA 200.8
			Fluoride	3.58	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	29-Sep-2022	Molybdenum	0.0155	0.0002		EPA 200.8
			Nickel	0.00236	0.0006		EPA 200.8
			Phosphorus, total as P	0.157	0.02		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	0.6	0.57	J	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		30-Sep-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	2.49	0.085		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0209	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	35.3	8.95		EPA 410.4
			Chromium	0.00343	0.003	J	EPA 200.8
			Copper	0.00301	0.0003		EPA 200.8
			Fluoride	3.41	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0165	0.0002		EPA 200.8
			Nickel	0.00242	0.0006		EPA 200.8
			Phosphorus, total as P	0.2	0.02		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.585	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
WW008	2069I	27-Sep-2022	Aluminum	0.0736	0.0193		EPA 200.8
			Ammonia	29.4	0.85		EPA 350.1
			Arsenic	0.00257	0.002	J	EPA 200.8
			Boron	0.0788	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	125	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	27-Sep-2022	Copper	0.0363	0.0003		EPA 200.8
			Fluoride	0.909	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00548	0.0002		EPA 200.8
			Nickel	0.0103	0.0006		EPA 200.8
			Phosphorus, total as P	2.93	0.1	N	EPA 365.4
			Selenium	0.00257	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	57.7	4.38		SM 2540D
			Zinc	0.0549	0.0033		EPA 200.8
		28-Sep-2022	Aluminum	0.0466	0.0193	J	EPA 200.8
			Ammonia	31.3	0.425		EPA 350.1
			Arsenic	0.00207	0.002	J	EPA 200.8
			Boron	0.0811	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	83	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.028	0.0003		EPA 200.8
			Fluoride	0.903	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00461	0.0002		EPA 200.8
			Nickel	0.00664	0.0006		EPA 200.8
			Phosphorus, total as P	3.19	0.1	N	EPA 365.4
			Selenium	0.00219	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	37	1.87		SM 2540D
			Zinc	0.0373	0.0033		EPA 200.8
		29-Sep-2022	Aluminum	0.041	0.0193	J	EPA 200.8
			Ammonia	23.6	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	29-Sep-2022	Boron	0.0923	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	102	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0748	0.0003		EPA 200.8
			Fluoride	0.824	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00594	0.0002		EPA 200.8
			Nickel	0.00542	0.0006		EPA 200.8
			Phosphorus, total as P	3.3	0.1		EPA 365.4
			Selenium	0.00183	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	44.6	2.19		SM 2540D
			Zinc	0.0407	0.0033		EPA 200.8
		30-Sep-2022	Aluminum	0.0528	0.0193		EPA 200.8
			Ammonia	27.9	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0831	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	124	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0821	0.0003		EPA 200.8
			Fluoride	0.811	0.033		EPA 300.0
			Lead	0.000617	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00455	0.0002		EPA 200.8
			Nickel	0.00618	0.0006		EPA 200.8
			Phosphorus, total as P	3.54	0.1		EPA 365.4
			Selenium	0.00172	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	54.7	2.53		SM 2540D

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	30-Sep-2022	Zinc	0.0463	0.0033		EPA 200.8
WW011	2069K	27-Sep-2022	Aluminum	0.0489	0.0193	J	EPA 200.8
			Ammonia	21.3	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0495	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	120	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0196	0.0003		EPA 200.8
			Fluoride	0.585	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00278	0.0002		EPA 200.8
			Nickel	0.00208	0.0006		EPA 200.8
			Phosphorus, total as P	10.8	0.2	N	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	41.8	3.45		SM 2540D
			Zinc	0.045	0.0033		EPA 200.8
		28-Sep-2022	Aluminum	0.0469	0.0193	J	EPA 200.8
			Ammonia	18.9	0.425		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0553	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	172	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0181	0.0003		EPA 200.8
			Fluoride	0.733	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00291	0.0002		EPA 200.8
			Nickel	0.00182	0.0006	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	28-Sep-2022	Phosphorus, total as P	10.8	0.2	N	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	60.6	3.35		SM 2540D
			Zinc	0.0573	0.0033		EPA 200.8
		29-Sep-2022	Aluminum	0.0398	0.0193	J	EPA 200.8
			Ammonia	16.4	0.425		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0517	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	169	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0157	0.0003		EPA 200.8
			Fluoride	0.646	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00276	0.0002		EPA 200.8
			Nickel	0.00171	0.0006	J	EPA 200.8
			Phosphorus, total as P	8.72	0.2		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	71	2.85		SM 2540D
			Zinc	0.0405	0.0033		EPA 200.8
		30-Sep-2022	Aluminum	0.0395	0.0193	J	EPA 200.8
			Ammonia	16.8	0.425		EPA 350.1
			Arsenic	0.00201	0.002	J	EPA 200.8
			Boron	0.061	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	113	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0139	0.0003		EPA 200.8
			Fluoride	0.613	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	30-Sep-2022	Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00238	0.0002		EPA 200.8
			Nickel	0.00171	0.0006	J	EPA 200.8
			Phosphorus, total as P	9.07	0.2		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	77.1	4.07		SM 2540D
			Zinc	0.0464	0.0033		EPA 200.8

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

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

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

Analytical Method
EPA 200.8 (EPA 1994)
EPA 245.1/245.2 (EPA 1994)
EPA 300.0 (EPA 1993)
EPA 335.4 (EPA 1993)
EPA 350.1 (EPA 1993)
SM 2540D (Standard Methods Committee of the American Public Health Association, American Water Works Association, and Water Environment Federation 2018)

Table E-3. Inorganic results for permitted sanitary outfalls, fourth quarter of calendar year 2022

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	28-Nov-2022	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		29-Nov-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.0251	0.017	J	EPA 350.1
			Arsenic	0.00306	0.002	J	EPA 200.8
			Boron	0.0292	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	98.5	8.95		EPA 410.4
			Chromium	0.00306	0.003	J	EPA 200.8
			Copper	0.00556	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	0.846	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00368	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.136	0.02	B	EPA 365.4
			Selenium	0.00345	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.57	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		30-Nov-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	1.24	0.017		EPA 350.1
			Arsenic	0.00278	0.002	J	EPA 200.8
			Boron	0.0333	0.0052	N	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	31.8	8.95		EPA 410.4

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	30-Nov-2022	Chromium		0.003	U	EPA 200.8
			Copper	0.00108	0.0003	J	EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	3.5	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00339	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.0768	0.02	B	EPA 365.4
			Selenium	0.00267	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.57	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		1-Dec-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	0.093	0.017		EPA 350.1
			Arsenic	0.00443	0.002	J	EPA 200.8
			Boron	0.031	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	43	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00532	0.0003		EPA 200.8
			Fluoride	0.972	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00338	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.113	0.02	B	EPA 365.4
			Selenium	0.00275	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	0.9	0.57	J	SM 2540D
			Zinc		0.0033	NU	EPA 200.8
		2-Dec-2022	Aluminum		0.0193	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	2-Dec-2022	Ammonia	0.0411	0.017	J	EPA 350.1
			Arsenic	0.00399	0.002	J	EPA 200.8
			Boron	0.0898	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	126	8.95		EPA 410.4
			Chromium	0.00311	0.003	J	EPA 200.8
			Copper	0.00337	0.0003		EPA 200.8
			Fluoride	0.875	0.165		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00403	0.0002		EPA 200.8
			Nickel		0.0006	U	EPA 200.8
			Phosphorus, total as P	0.127	0.02		EPA 365.4
			Selenium	0.00212	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.57	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
WW001	2069A	29-Nov-2022	Aluminum	0.0304	0.0193	J	EPA 200.8
			Ammonia	6.65	0.085		EPA 350.1
			Arsenic	0.0031	0.002	J	EPA 200.8
			Boron	0.0723	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	110	8.95		EPA 410.4
			Chromium	0.00385	0.003	J	EPA 200.8
			Copper	0.0162	0.0003		EPA 200.8
			Fluoride	2.81	0.033		EPA 300.0
			Lead	0.00541	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0127	0.0002		EPA 200.8
			Nickel	0.00132	0.0006	J	EPA 200.8
			Phosphorus, total as P	1.43	0.02	B	EPA 365.4
			Selenium	0.00247	0.0015	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	29-Nov-2022	Silver		0.0003	U	EPA 200.8
			Solids, total suspended	22.1	1.18		SM 2540D
			Zinc	0.0178	0.0033	J	EPA 200.8
		30-Nov-2022	Aluminum	0.0356	0.0193	J	EPA 200.8
			Ammonia	10.3	0.17		EPA 350.1
			Arsenic	0.00301	0.002	J	EPA 200.8
			Boron	0.0631	0.0052	N	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	129	8.95		EPA 410.4
			Chromium	0.0043	0.003	J	EPA 200.8
			Copper	0.0188	0.0003		EPA 200.8
			Fluoride	2.51	0.033		EPA 300.0
			Lead	0.0369	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0139	0.0002		EPA 200.8
			Nickel	0.00242	0.0006		EPA 200.8
			Phosphorus, total as P	2.89	0.1	B	EPA 365.4
			Selenium	0.00265	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	30	1.9		SM 2540D
			Zinc	0.0282	0.0033		EPA 200.8
		1-Dec-2022	Aluminum	0.0376	0.0193	J	EPA 200.8
			Ammonia	13.1	0.17		EPA 350.1
			Arsenic	0.00291	0.002	J	EPA 200.8
			Boron	0.0584	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	105	8.95		EPA 410.4
			Chromium	0.00439	0.003	J	EPA 200.8
			Copper	0.0199	0.0003		EPA 200.8
			Fluoride	3.38	0.033		EPA 300.0
			Lead	0.0181	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	1-Dec-2022	Molybdenum	0.014	0.0002		EPA 200.8
			Nickel	0.00222	0.0006		EPA 200.8
			Phosphorus, total as P	2.3	0.02	B	EPA 365.4
			Selenium	0.00289	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	37.3	2.59		SM 2540D
			Zinc	0.0283	0.0033	N	EPA 200.8
		2-Dec-2022	Aluminum	0.0341	0.0193	J	EPA 200.8
			Ammonia	13.1	0.17		EPA 350.1
			Arsenic	0.00393	0.002	J	EPA 200.8
			Boron	0.073	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	126	8.95		EPA 410.4
			Chromium	0.00426	0.003	J	EPA 200.8
			Copper	0.0182	0.0003		EPA 200.8
			Fluoride	3.24	0.165		EPA 300.0
			Lead	0.00994	0.0005		EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0154	0.0002		EPA 200.8
			Nickel	0.00177	0.0006	J	EPA 200.8
			Phosphorus, total as P	2.06	0.02		EPA 365.4
			Selenium	0.00281	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	28.5	2.11		SM 2540D
			Zinc	0.0441	0.0033		EPA 200.8
WW006	2069F	28-Nov-2022	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Aluminum	0.0573	0.0193		EPA 200.8
			Ammonia	25.4	0.85		EPA 350.1
			Arsenic	0.00331	0.002	J	EPA 200.8
			Boron	0.123	0.0052		EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	29-Nov-2022	Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	346	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0242	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	0.673	0.066		EPA 300.0
			Lead	0.000518	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00504	0.0002		EPA 200.8
			Nickel	0.00126	0.0006	J	EPA 200.8
			Phosphorus, total as P	2.95	0.02	B	EPA 365.4
			Selenium	0.00273	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	47.8	2.11		SM 2540D
			Zinc	0.0548	0.0033		EPA 200.8
		30-Nov-2022	Aluminum	0.0916	0.0193		EPA 200.8
			Ammonia	47	0.85		EPA 350.1
			Arsenic	0.00278	0.002	J	EPA 200.8
			Boron	0.324	0.026	N	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	223	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0264	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	0.859	0.033		EPA 300.0
			Lead	0.000674	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00434	0.0002		EPA 200.8
			Nickel	0.00219	0.0006		EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	30-Nov-2022	Phosphorus, total as P	3.83	0.1	B	EPA 365.4
			Selenium	0.0025	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	111	5.7		SM 2540D
			Zinc	0.0835	0.0033		EPA 200.8
		1-Dec-2022	Aluminum	0.118	0.0193		EPA 200.8
			Ammonia	45.3	0.85		EPA 350.1
			Arsenic	0.00257	0.002	J	EPA 200.8
			Boron	0.103	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	297	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0403	0.0003		EPA 200.8
			Fluoride	0.876	0.033		EPA 300.0
			Lead	0.002	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00446	0.0002		EPA 200.8
			Nickel	0.00288	0.0006		EPA 200.8
			Phosphorus, total as P	4.63	0.1	B	EPA 365.4
			Selenium	0.00218	0.0015	J	EPA 200.8
			Silver	0.00047	0.0003	J	EPA 200.8
			Solids, total suspended	91	5.7		SM 2540D
			Zinc	0.178	0.0033	N	EPA 200.8
		2-Dec-2022	Aluminum	0.123	0.0193		EPA 200.8
			Ammonia	58.5	0.85		EPA 350.1
			Arsenic	0.00334	0.002	J	EPA 200.8
			Boron	0.199	0.0104		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	185	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0353	0.0003		EPA 200.8
			Fluoride	0.979	0.165		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	2-Dec-2022	Lead	0.00119	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0046	0.0002		EPA 200.8
			Nickel	0.0024	0.0006		EPA 200.8
			Phosphorus, total as P	5.4	0.1		EPA 365.4
			Selenium	0.00215	0.0015	J	EPA 200.8
			Silver	0.000326	0.0003	J	EPA 200.8
			Solids, total suspended	103	5.7		SM 2540D
			Zinc	0.2	0.0033		EPA 200.8
WW007	2069G	28-Nov-2022	Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
		29-Nov-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	3.9	0.17		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.02	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	65.1	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00244	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	4.04	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0171	0.0002		EPA 200.8
			Nickel	0.00163	0.0006	J	EPA 200.8
			Phosphorus, total as P	0.402	0.02	B	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	29-Nov-2022	Solids, total suspended		0.57	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		30-Nov-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	3.57	0.17		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.025	0.0052	N	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	40.1	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00235	0.0003		EPA 200.8
			Cyanide, total		0.00167	U	EPA 335.4
			Fluoride	3.84	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0172	0.0002		EPA 200.8
			Nickel	0.00145	0.0006	J	EPA 200.8
			Phosphorus, total as P	2.22	0.02	B	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.57	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
		1-Dec-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	4.69	0.17		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.021	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	18	8.95	J	EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00296	0.0003		EPA 200.8
			Fluoride	4.95	0.066		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	1-Dec-2022	Molybdenum	0.0178	0.0002		EPA 200.8
			Nickel	0.00136	0.0006	J	EPA 200.8
			Phosphorus, total as P	0.578	0.02	B	EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.57	U	SM 2540D
			Zinc		0.0033	NU	EPA 200.8
		2-Dec-2022	Aluminum		0.0193	U	EPA 200.8
			Ammonia	5.68	0.17		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0239	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	13.8	8.95	J	EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.00521	0.0003		EPA 200.8
			Fluoride	5.08	0.165		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.0179	0.0002		EPA 200.8
			Nickel	0.00133	0.0006	J	EPA 200.8
			Phosphorus, total as P	0.425	0.02		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended		0.57	U	SM 2540D
			Zinc		0.0033	U	EPA 200.8
WW008	2069I	29-Nov-2022	Aluminum	0.0492	0.0193	J	EPA 200.8
			Ammonia	16	0.85		EPA 350.1
			Arsenic	0.0024	0.002	J	EPA 200.8
			Boron	0.0474	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	123	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	29-Nov-2022	Copper	0.0296	0.0003		EPA 200.8
			Fluoride	0.643	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00305	0.0002		EPA 200.8
			Nickel	0.0448	0.0006		EPA 200.8
			Phosphorus, total as P	2.23	0.02	B	EPA 365.4
			Selenium	0.0023	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	42.8	2.28		SM 2540D
			Zinc	0.0369	0.0033		EPA 200.8
		30-Nov-2022	Aluminum	0.0515	0.0193		EPA 200.8
			Ammonia	26.9	0.85		EPA 350.1
			Arsenic	0.00257	0.002	J	EPA 200.8
			Boron	0.0738	0.0052	N	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	126	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0277	0.0003		EPA 200.8
			Fluoride	0.77	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00382	0.0002		EPA 200.8
			Nickel	0.0502	0.0006		EPA 200.8
			Phosphorus, total as P	3.48	0.1	B	EPA 365.4
			Selenium	0.0026	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	52	2.85		SM 2540D
			Zinc	0.0435	0.0033		EPA 200.8
		1-Dec-2022	Aluminum	0.0697	0.0193		EPA 200.8
			Ammonia	36.7	0.85		EPA 350.1
			Arsenic	0.00234	0.002	J	EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	1-Dec-2022	Boron	0.0708	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	139	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0322	0.0003		EPA 200.8
			Fluoride	0.889	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00373	0.0002		EPA 200.8
			Nickel	0.0555	0.0006		EPA 200.8
			Phosphorus, total as P	3.97	0.1	B	EPA 365.4
			Selenium	0.00204	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	69.5	2.85		SM 2540D
			Zinc	0.0535	0.0033	N	EPA 200.8
		2-Dec-2022	Aluminum	0.0762	0.0193		EPA 200.8
			Ammonia	40.6	0.85		EPA 350.1
			Arsenic	0.00327	0.002	J	EPA 200.8
			Boron	0.105	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	264	8.95		EPA 410.4
			Chromium		0.003	U	EPA 200.8
			Copper	0.0316	0.0003		EPA 200.8
			Fluoride	0.867	0.165		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00418	0.0002		EPA 200.8
			Nickel	0.0569	0.0006		EPA 200.8
			Phosphorus, total as P	4.14	0.1		EPA 365.4
			Selenium	0.0023	0.0015	J	EPA 200.8
			Silver		0.0003	U	EPA 200.8
			Solids, total suspended	82.3	4.38		SM 2540D

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	2-Dec-2022	Zinc	0.0649	0.0033		EPA 200.8
WW011	2069K	29-Nov-2022	Aluminum	0.0669	0.0193		EPA 200.8
			Ammonia	30.8	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0831	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	215	8.95		EPA 410.4
			Chromium	0.00385	0.003	J	EPA 200.8
			Copper	0.0451	0.0003		EPA 200.8
			Fluoride	0.78	0.033		EPA 300.0
			Lead		0.0005	U	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00344	0.0002		EPA 200.8
			Nickel	0.00263	0.0006		EPA 200.8
			Phosphorus, total as P	10.8	0.2	B	EPA 365.4
			Selenium	0.00184	0.0015	J	EPA 200.8
			Silver	0.000604	0.0003	J	EPA 200.8
			Solids, total suspended	98	5.7		SM 2540D
			Zinc	0.199	0.0033		EPA 200.8
		30-Nov-2022	Aluminum	0.106	0.0193		EPA 200.8
			Ammonia	38.1	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0991	0.0052	N	EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	354	8.95		EPA 410.4
			Chromium	0.00504	0.003	J	EPA 200.8
			Copper	0.0477	0.0003		EPA 200.8
			Fluoride	0.742	0.033		EPA 300.0
			Lead	0.000766	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00386	0.0002		EPA 200.8
			Nickel	0.00371	0.0006		EPA 200.8

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	30-Nov-2022	Phosphorus, total as P	16.5	0.2	B	EPA 365.4
			Selenium	0.00216	0.0015	J	EPA 200.8
			Silver	0.00109	0.0003		EPA 200.8
			Solids, total suspended	144	5.7		SM 2540D
			Zinc	0.159	0.0033		EPA 200.8
		1-Dec-2022	Aluminum	0.101	0.0193		EPA 200.8
			Ammonia	32	0.85		EPA 350.1
			Arsenic		0.002	U	EPA 200.8
			Boron	0.0668	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	339	8.95		EPA 410.4
			Chromium	0.00475	0.003	J	EPA 200.8
			Copper	0.042	0.0003		EPA 200.8
			Fluoride	0.732	0.033		EPA 300.0
			Lead	0.000796	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00359	0.0002		EPA 200.8
			Nickel	0.00329	0.0006		EPA 200.8
			Phosphorus, total as P	16.3	0.2	B	EPA 365.4
			Selenium	0.00204	0.0015	J	EPA 200.8
			Silver	0.00245	0.0003		EPA 200.8
			Solids, total suspended	108	5.7		SM 2540D
			Zinc	0.13	0.0033	N	EPA 200.8
		2-Dec-2022	Aluminum	0.102	0.0193		EPA 200.8
			Ammonia	30.2	0.85		EPA 350.1
			Arsenic	0.00247	0.002	J	EPA 200.8
			Boron	0.0893	0.0052		EPA 200.8
			Cadmium		0.0003	U	EPA 200.8
			Chemical oxygen demand	260	8.95		EPA 410.4
			Chromium	0.00503	0.003	J	EPA 200.8
			Copper	0.0442	0.0003		EPA 200.8
			Fluoride	0.68	0.033		EPA 300.0

Station	Permit Number	Date Collected	Analyte	Result (mg/L)	MDL (mg/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	2-Dec-2022	Lead	0.000747	0.0005	J	EPA 200.8
			Mercury		0.000067	U	EPA 245.1/245.2
			Molybdenum	0.00431	0.0002		EPA 200.8
			Nickel	0.00334	0.0006		EPA 200.8
			Phosphorus, total as P	17.9	0.2		EPA 365.4
			Selenium		0.0015	U	EPA 200.8
			Silver	0.00122	0.0003		EPA 200.8
			Solids, total suspended	135	5.7		SM 2540D
			Zinc	0.106	0.0033		EPA 200.8

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

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

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

Analytical Method
EPA 200.8 (EPA 1994)
EPA 245.1/245.2 (EPA 1994)
EPA 300.0 (EPA 1993)
EPA 335.4 (EPA 1993)
EPA 350.1 (EPA 1993)
SM 2540D (American Public Health Association, American Water Work Association, and Water Environment Federation. 2018.)

Table E-4. Radiological results for permitted sanitary outfalls, second quarter of calendar year 2022

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	19-Apr-2022	Actinium-228	8.23 ± 14.1	11.9	U	EPA 901.1
			Alpha, gross	−1.07 ± 6.77	13.2	NU	EPA 900.0/SW-846 9310
			Americium-241	7.86 ± 9.08	15.2	U	EPA 901.1
			Beryllium-7	−4.89 ± 14.4	25	U	EPA 901.1
			Beta, gross	15.5 ± 6.56	10.5	*	EPA 900.0/SW-846 9310
			Bismuth-212	−5.85 ± 26.6	45.6	U	EPA 901.1
			Bismuth-214	15 ± 11.3	6.14		EPA 901.1
			Cesium-137	0.909 ± 3.11	3.3	U	EPA 901.1
			Cobalt-60	1.9 ± 1.94	3.54	U	EPA 901.1
			Lead-212	−2.47 ± 6.89	6.71	U	EPA 901.1
			Lead-214	23.8 ± 10	8.73	X	EPA 901.1
			Neptunium-237	−3.36 ± 3.63	5.71	U	EPA 901.1
			Potassium-40	36 ± 51.6	35.4	X	EPA 901.1
			Radium-223	4.7 ± 34.1	61.8	U	EPA 901.1
			Radium-224	−71.4 ± 49.6	56.4	U	EPA 901.1
			Radium-226	17.6 ± 86.7	57.8	U	EPA 901.1
			Radium-228	8.23 ± 14.1	11.9	U	EPA 901.1
			Sodium-22	1.86 ± 2.58	3.06	U	EPA 901.1
			Thorium-227	−18.5 ± 17.3	23.2	U	EPA 901.1
			Thorium-231	−11 ± 34.6	38.1	U	EPA 901.1
			Thorium-234	−64 ± 141	149	U	EPA 901.1
			Tritium	−62.3 ± 92.7	185	U	EPA 906.0 Modified
			Uranium-235	−0.452 ± 17.5	18.8	U	EPA 901.1
			Uranium-238	−64 ± 141	149	U	EPA 901.1
		20-Apr-2022	Actinium-228	−8.51 ± 14.4	15.7	U	EPA 901.1
			Alpha, gross	3.23 ± 1.26	1.61	N	EPA 900.0/SW-846 9310
			Americium-241	0.968 ± 7.8	14.2	U	EPA 901.1
			Beryllium-7	−2.99 ± 13.3	23	U	EPA 901.1
			Beta, gross	1.71 ± .882	1.4		EPA 900.0/SW-846 9310
			Bismuth-212	25.5 ± 25.4	44.2	U	EPA 901.1
			Bismuth-214	1.12 ± 8.09	7.37	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	20-Apr-2022	Cesium-137	−0.788 ± 1.85	3.02	U	EPA 901.1
			Cobalt-60	−0.289 ± 1.85	3.23	U	EPA 901.1
			Lead-212	4.48 ± 6.24	4.85	U	EPA 901.1
			Lead-214	8.41 ± 8.41	6.33	X	EPA 901.1
			Neptunium-237	0.513 ± 2.95	5.35	U	EPA 901.1
			Potassium-40	−15.8 ± 37.5	46.5	U	EPA 901.1
			Radium-223	−22.5 ± 32	52.8	U	EPA 901.1
			Radium-224	23.6 ± 35	52.6	U	EPA 901.1
			Radium-226	29.1 ± 92.4	53	U	EPA 901.1
			Radium-228	−8.51 ± 14.4	15.7	U	EPA 901.1
			Sodium-22	−0.176 ± 1.82	3.21	U	EPA 901.1
			Thorium-227	−2.55 ± 13	21.2	U	EPA 901.1
			Thorium-231	−78.6 ± 60.6	36.1	U	EPA 901.1
			Thorium-234	−1,100 ± 608	149	U	EPA 901.1
			Tritium	25.1 ± 110	198	U	EPA 906.0 Modified
			Uranium-235	0.987 ± 19.1	17.2	U	EPA 901.1
			Uranium-238	−1,100 ± 608	149	U	EPA 901.1
		21-Apr-2022	Actinium-228	−11.4 ± 11.3	11.9	U	EPA 901.1
			Alpha, gross	5.54 ± 4.32	6.84	NU	EPA 900.0/SW-846 9310
			Americium-241	−1.57 ± 6.06	9.66	U	EPA 901.1
			Beryllium-7	−0.164 ± 11.1	19.9	U	EPA 901.1
			Beta, gross	8.37 ± 3.43	5.41		EPA 900.0/SW-846 9310
			Bismuth-212	11.4 ± 30.4	38	U	EPA 901.1
			Bismuth-214	14 ± 6.48	5.08		EPA 901.1
			Cesium-137	−1.02 ± 2.34	2.6	U	EPA 901.1
			Cobalt-60	−0.866 ± 1.44	2.41	U	EPA 901.1
			Lead-212	4.35 ± 5.48	5.38	U	EPA 901.1
			Lead-214	1.47 ± 7.73	6.68	U	EPA 901.1
			Neptunium-237	1.41 ± 2.79	5.04	U	EPA 901.1
			Potassium-40	−25.2 ± 34.8	43.9	U	EPA 901.1
			Radium-223	−9.3 ± 26.8	47.2	U	EPA 901.1
			Radium-224	9.55 ± 28.7	44.1	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	21-Apr-2022	Radium-226	6.27 ± 74.4	43.5	U	EPA 901.1
			Radium-228	−11.4 ± 11.3	11.9	U	EPA 901.1
			Sodium-22	−3.01 ± 2.98	2.66	U	EPA 901.1
			Thorium-227	−1.12 ± 10.9	17.9	U	EPA 901.1
			Thorium-231	1.48 ± 29.9	29.7	U	EPA 901.1
			Thorium-234	41.8 ± 107	106	U	EPA 901.1
			Tritium	−38.4 ± 100	194	U	EPA 906.0 Modified
			Uranium-235	2.98 ± 15.3	14.2	U	EPA 901.1
			Uranium-238	41.8 ± 107	106	U	EPA 901.1
		22-Apr-2022	Actinium-228	−12.5 ± 13.3	15	U	EPA 901.1
			Alpha, gross	2.73 ± 1.16	1.72	N	EPA 900.0/SW-846 9310
			Americium-241	13.4 ± 18.6	22.5	U	EPA 901.1
			Beryllium-7	0.0552 ± 26.6	27.7	U	EPA 901.1
			Beta, gross	1.37 ± .775	1.27		EPA 900.0/SW-846 9310
			Bismuth-212	−17.3 ± 27.4	42.9	U	EPA 901.1
			Bismuth-214	3.05 ± 7.43	7.44	U	EPA 901.1
			Cesium-137	1.41 ± 1.82	3.16	U	EPA 901.1
			Cobalt-60	0.149 ± 1.94	3.58	U	EPA 901.1
			Lead-212	0.343 ± 7.04	6.72	U	EPA 901.1
			Lead-214	0.983 ± 6.02	7.31	U	EPA 901.1
			Neptunium-237	−0.00441 ± 3.22	5.75	U	EPA 901.1
			Potassium-40	11.9 ± 56	30.4	U	EPA 901.1
			Radium-223	9.33 ± 33.6	59.9	U	EPA 901.1
			Radium-224	18.6 ± 33.2	53.6	U	EPA 901.1
			Radium-226	9.26 ± 95.6	55.9	U	EPA 901.1
			Radium-228	−12.5 ± 13.3	15	U	EPA 901.1
			Sodium-22	−0.103 ± 1.53	2.83	U	EPA 901.1
			Thorium-227	−7.05 ± 14.4	21.9	U	EPA 901.1
			Thorium-231	−34.1 ± 50.6	47.9	U	EPA 901.1
			Thorium-234	67.9 ± 219	168	U	EPA 901.1
			Tritium	−38.7 ± 94.4	179	U	EPA 906.0 Modified
			Uranium-235	7.37 ± 21.4	17.4	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	22-Apr-2022	Uranium-238	67.9 ± 219	168	U	EPA 901.1
WW001	2069A	19-Apr-2022	Actinium-228	10.2 ± 15	13.1	U	EPA 901.1
			Alpha, gross	6.64 ± 3.98	6.31	N	EPA 900.0/SW-846 9310
			Americium-241	4.62 ± 6.17	9.45	U	EPA 901.1
			Beryllium-7	3.35 ± 12.7	22.2	U	EPA 901.1
			Beta, gross	10.1 ± 1.47	1.96	*	EPA 900.0/SW-846 9310
			Bismuth-212	42.9 ± 32	36	X	EPA 901.1
			Bismuth-214	−5.38 ± 7.43	5.98	U	EPA 901.1
			Cesium-137	1.91 ± 2.16	2.62	U	EPA 901.1
			Cobalt-60	2.51 ± 3.25	3.02	U	EPA 901.1
			Lead-212	6 ± 5.79	4		EPA 901.1
			Lead-214	0.141 ± 4.9	5.95	U	EPA 901.1
			Neptunium-237	−4.6 ± 4.81	4.96	U	EPA 901.1
			Potassium-40	43.9 ± 38.4	28.5		EPA 901.1
			Radium-223	−17.7 ± 28.2	46.1	U	EPA 901.1
			Radium-224	58.5 ± 41.4	42.8	X	EPA 901.1
			Radium-226	68 ± 79.6	47.2	X	EPA 901.1
			Radium-228	10.2 ± 15	13.1	U	EPA 901.1
			Sodium-22	−0.632 ± 1.76	2.6	U	EPA 901.1
			Thorium-227	−4.54 ± 11	18.7	U	EPA 901.1
			Thorium-231	−25.2 ± 33.6	31.7	U	EPA 901.1
			Thorium-234	1.97 ± 89.6	80.3	U	EPA 901.1
			Tritium	−7.63 ± 95.1	178	U	EPA 906.0 Modified
			Uranium-235	8.21 ± 15.2	14.5	U	EPA 901.1
			Uranium-238	1.97 ± 89.6	80.3	U	EPA 901.1
		20-Apr-2022	Actinium-228	5.78 ± 20.1	16.5	U	EPA 901.1
			Alpha, gross	2.77 ± 1.37	1.92	N	EPA 900.0/SW-846 9310
			Americium-241	−1.51 ± 16.4	29.1	U	EPA 901.1
			Beryllium-7	8.57 ± 16.2	29.1	U	EPA 901.1
			Beta, gross	8.19 ± 1.51	2.21		EPA 900.0/SW-846 9310
			Bismuth-212	22.1 ± 44.8	47.5	U	EPA 901.1
			Bismuth-214	1.14 ± 9.47	7.1	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	20-Apr-2022	Cesium-137	1.41 ± 1.96	3.51	U	EPA 901.1
			Cobalt-60	−0.737 ± 2.1	3.72	U	EPA 901.1
			Lead-212	−1.62 ± 6.89	6.86	U	EPA 901.1
			Lead-214	−2.23 ± 8.56	8.64	U	EPA 901.1
			Neptunium-237	−2.53 ± 4.02	6.81	U	EPA 901.1
			Potassium-40	9.29 ± 49.9	34.3	U	EPA 901.1
			Radium-223	−15.5 ± 37.3	65.4	U	EPA 901.1
			Radium-224	−66.1 ± 51.3	63.3	U	EPA 901.1
			Radium-226	45.6 ± 88.5	61.3	U	EPA 901.1
			Radium-228	5.78 ± 20.1	16.5	U	EPA 901.1
			Sodium-22	0.322 ± 2.02	3.84	U	EPA 901.1
			Thorium-227	15.5 ± 17.3	27.4	U	EPA 901.1
			Thorium-231	24 ± 32	53.9	U	EPA 901.1
			Thorium-234	−103 ± 220	252	U	EPA 901.1
			Tritium	−19 ± 103	194	U	EPA 906.0 Modified
			Uranium-235	3.07 ± 26	20.9	U	EPA 901.1
			Uranium-238	−103 ± 220	252	U	EPA 901.1
		21-Apr-2022	Actinium-228	−11.6 ± 16.9	16.3	U	EPA 901.1
			Alpha, gross	1.73 ± 1.34	2.11	NU	EPA 900.0/SW-846 9310
			Americium-241	−3.29 ± 17.2	26.1	U	EPA 901.1
			Beryllium-7	2.32 ± 16.9	28.8	U	EPA 901.1
			Beta, gross	7.37 ± 1.16	1.53		EPA 900.0/SW-846 9310
			Bismuth-212	27.9 ± 31.3	54.1	U	EPA 901.1
			Bismuth-214	−0.318 ± 6.86	8.38	U	EPA 901.1
			Cesium-137	2.77 ± 2.34	3.85	U	EPA 901.1
			Cobalt-60	0.16 ± 2.03	3.81	U	EPA 901.1
			Lead-212	4 ± 9.14	7.32	U	EPA 901.1
			Lead-214	4.77 ± 12.5	8.33	U	EPA 901.1
			Neptunium-237	0.975 ± 3.83	6.64	U	EPA 901.1
			Potassium-40	1.91 ± 52.8	56	U	EPA 901.1
			Radium-223	−37.6 ± 41.8	62.5	U	EPA 901.1
			Radium-224	18 ± 48.5	60.9	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	21-Apr-2022	Radium-226	40.2 ± 96.7	61.8	U	EPA 901.1
			Radium-228	−11.6 ± 16.9	16.3	U	EPA 901.1
			Sodium-22	−1.8 ± 2.28	3.65	U	EPA 901.1
			Thorium-227	6.44 ± 16.4	25.6	U	EPA 901.1
			Thorium-231	1.83 ± 49.7	50.7	U	EPA 901.1
			Thorium-234	85 ± 279	199	U	EPA 901.1
			Tritium	29.5 ± 106	191	U	EPA 906.0 Modified
			Uranium-235	0.27 ± 22	18.9	U	EPA 901.1
			Uranium-238	85 ± 279	199	U	EPA 901.1
		22-Apr-2022	Actinium-228	−5.87 ± 12	14.4	U	EPA 901.1
			Alpha, gross	2.62 ± 1.26	1.77	N	EPA 900.0/SW-846 9310
			Americium-241	7.42 ± 10.2	17.7	U	EPA 901.1
			Beryllium-7	4.02 ± 13.3	24.4	U	EPA 901.1
			Beta, gross	7.54 ± 1.54	2.3		EPA 900.0/SW-846 9310
			Bismuth-212	14.4 ± 21.7	39.3	U	EPA 901.1
			Bismuth-214	2.24 ± 5.19	6.56	U	EPA 901.1
			Cesium-137	1.02 ± 1.73	3.13	U	EPA 901.1
			Cobalt-60	0.595 ± 1.74	3.36	U	EPA 901.1
			Lead-212	0.773 ± 5.67	4.54	U	EPA 901.1
			Lead-214	−4.7 ± 6.22	5.96	U	EPA 901.1
			Neptunium-237	−1.97 ± 3.27	5.04	U	EPA 901.1
			Potassium-40	−0.298 ± 47.4	51.9	U	EPA 901.1
			Radium-223	−2.57 ± 30.2	50	U	EPA 901.1
			Radium-224	11.3 ± 30.8	48.3	U	EPA 901.1
			Radium-226	−51.3 ± 66.6	69.9	U	EPA 901.1
			Radium-228	−5.87 ± 12	14.4	U	EPA 901.1
			Sodium-22	0.0702 ± 1.56	2.99	U	EPA 901.1
			Thorium-227	4.73 ± 11.6	19.7	U	EPA 901.1
			Thorium-231	13.9 ± 42.7	32.5	U	EPA 901.1
			Thorium-234	11 ± 189	133	U	EPA 901.1
			Tritium	−44.4 ± 92.9	178	U	EPA 906.0 Modified
			Uranium-235	7.78 ± 15.3	16.7	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	22-Apr-2022	Uranium-238	11 ± 189	133	U	EPA 901.1
WW006	2069F	19-Apr-2022	Actinium-228	3.54 ± 21.1	11.6	U	EPA 901.1
			Alpha, gross	1.97 ± 3.56	6.16	NU	EPA 900.0/SW-846 9310
			Americium-241	2.53 ± 12.9	23.4	U	EPA 901.1
			Beryllium-7	16.2 ± 24.9	20.8	U	EPA 901.1
			Beta, gross	15.7 ± 1.89	2.53	*	EPA 900.0/SW-846 9310
			Bismuth-212	22.1 ± 27.5	46.7	U	EPA 901.1
			Bismuth-214	10.2 ± 8.32	10.2	U	EPA 901.1
			Cesium-137	−0.986 ± 1.9	3.07	U	EPA 901.1
			Cobalt-60	−0.12 ± 1.71	3.09	U	EPA 901.1
			Lead-212	2.26 ± 6.12	4.58	U	EPA 901.1
			Lead-214	0.494 ± 8.43	5.88	U	EPA 901.1
			Neptunium-237	0.575 ± 2.92	5.33	U	EPA 901.1
			Potassium-40	13.4 ± 53.1	34.9	U	EPA 901.1
			Radium-223	15.8 ± 70.4	53.5	U	EPA 901.1
			Radium-224	−28.1 ± 50.1	52.6	U	EPA 901.1
			Radium-226	1.11 ± 78.1	53.4	U	EPA 901.1
			Radium-228	3.54 ± 21.1	11.6	U	EPA 901.1
			Sodium-22	0.906 ± 1.87	3.47	U	EPA 901.1
			Thorium-227	3.5 ± 13	21.6	U	EPA 901.1
			Thorium-231	8.88 ± 24.8	43.6	U	EPA 901.1
			Thorium-234	29.2 ± 183	220	U	EPA 901.1
			Tritium	−25.5 ± 102	195	U	EPA 906.0 Modified
			Uranium-235	−11.7 ± 15.5	18.6	U	EPA 901.1
			Uranium-238	29.2 ± 183	220	U	EPA 901.1
		20-Apr-2022	Actinium-228	21.8 ± 20.1	21.8	U	EPA 901.1
			Alpha, gross	−0.247 ± 1.52	2.7	NU	EPA 900.0/SW-846 9310
			Americium-241	0.422 ± 7.86	12.8	U	EPA 901.1
			Beryllium-7	−3.42 ± 12.9	22.5	U	EPA 901.1
			Beta, gross	9.03 ± 2	2.85		EPA 900.0/SW-846 9310
			Bismuth-212	−10.3 ± 39.5	48.4	U	EPA 901.1
			Bismuth-214	5.79 ± 9.88	7.35	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	20-Apr-2022	Cesium-137	0.333 ± 1.66	2.98	U	EPA 901.1
			Cobalt-60	0.204 ± 1.59	3.03	U	EPA 901.1
			Lead-212	−4.17 ± 5.41	7.56	U	EPA 901.1
			Lead-214	−2.82 ± 6.19	6.47	U	EPA 901.1
			Neptunium-237	1.46 ± 3.02	5.46	U	EPA 901.1
			Potassium-40	33.4 ± 47.8	28.4	X	EPA 901.1
			Radium-223	−17 ± 31.1	53.1	U	EPA 901.1
			Radium-224	−233 ± 124	55.6	U	EPA 901.1
			Radium-226	3.74 ± 69.1	48.9	U	EPA 901.1
			Radium-228	21.8 ± 20.1	21.8	U	EPA 901.1
			Sodium-22	0.0054 ± 1.67	3.12	U	EPA 901.1
			Thorium-227	−3.11 ± 12.1	21.6	U	EPA 901.1
			Thorium-231	−11.8 ± 33.1	36.3	U	EPA 901.1
			Thorium-234	84.8 ± 77.2	104	U	EPA 901.1
			Tritium	35.4 ± 106	189	U	EPA 906.0 Modified
			Uranium-235	−10.1 ± 15.7	16	U	EPA 901.1
			Uranium-238	84.8 ± 77.2	104	U	EPA 901.1
		21-Apr-2022	Actinium-228	7.52 ± 19.8	13	U	EPA 901.1
			Alpha, gross	0.51 ± 1.48	2.7	NU	EPA 900.0/SW-846 9310
			Americium-241	4.53 ± 13.1	22	U	EPA 901.1
			Beryllium-7	−4.56 ± 16.9	28.2	U	EPA 901.1
			Beta, gross	16.1 ± 2.54	3.48		EPA 900.0/SW-846 9310
			Bismuth-212	19.3 ± 28.1	50.4	U	EPA 901.1
			Bismuth-214	5.36 ± 10.5	7.72	U	EPA 901.1
			Cesium-137	3.6 ± 3.21	3.66	U	EPA 901.1
			Cobalt-60	0.384 ± 2.03	3.86	U	EPA 901.1
			Lead-212	4.88 ± 7.25	5.82	U	EPA 901.1
			Lead-214	−10.8 ± 9.35	8.23	U	EPA 901.1
			Neptunium-237	0.196 ± 3.81	6.64	U	EPA 901.1
			Potassium-40	20 ± 53.3	39.3	U	EPA 901.1
			Radium-223	13.5 ± 40.2	63	U	EPA 901.1
			Radium-224	39.5 ± 42.3	63.3	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	21-Apr-2022	Radium-226	72.5 ± 105	61.7	X	EPA 901.1
			Radium-228	7.52 ± 19.8	13	U	EPA 901.1
			Sodium-22	0.222 ± 2.06	3.88	U	EPA 901.1
			Thorium-227	−7.1 ± 15.3	25.6	U	EPA 901.1
			Thorium-231	5.89 ± 48.4	49.8	U	EPA 901.1
			Thorium-234	−70.2 ± 195	224	U	EPA 901.1
			Tritium	17.3 ± 106	193	U	EPA 906.0 Modified
			Uranium-235	0.0505 ± 20	22.2	U	EPA 901.1
			Uranium-238	−70.2 ± 195	224	U	EPA 901.1
		22-Apr-2022	Actinium-228	6.48 ± 24.6	22	U	EPA 901.1
			Alpha, gross	0.731 ± 1.13	1.91	NU	EPA 900.0/SW-846 9310
			Americium-241	0.953 ± 3.95	6.08	U	EPA 901.1
			Beryllium-7	−1.66 ± 21.3	36.9	U	EPA 901.1
			Beta, gross	12.1 ± 1.74	2.15		EPA 900.0/SW-846 9310
			Bismuth-212	−44.3 ± 79.2	67.4	U	EPA 901.1
			Bismuth-214	−3.37 ± 9.05	9.88	U	EPA 901.1
			Cesium-137	0.716 ± 7.27	4.3	U	EPA 901.1
			Cobalt-60	−0.33 ± 2.89	5.17	U	EPA 901.1
			Lead-212	1.51 ± 7.66	5.77	U	EPA 901.1
			Lead-214	0.117 ± 8.97	9.48	U	EPA 901.1
			Neptunium-237	−1.92 ± 4.11	6.89	U	EPA 901.1
			Potassium-40	110 ± 60.1	47.2		EPA 901.1
			Radium-223	22.7 ± 43.3	75.4	U	EPA 901.1
			Radium-224	−26.7 ± 54.8	64.8	U	EPA 901.1
			Radium-226	26.5 ± 83.6	61	U	EPA 901.1
			Radium-228	6.48 ± 24.6	22	U	EPA 901.1
			Sodium-22	−0.887 ± 2.77	4.83	U	EPA 901.1
			Thorium-227	−4.72 ± 15.1	26	U	EPA 901.1
			Thorium-231	26.8 ± 34.5	27.8	U	EPA 901.1
			Thorium-234	39.7 ± 74.1	81.1	U	EPA 901.1
			Tritium	−81.4 ± 86.5	173	U	EPA 906.0 Modified
			Uranium-235	1.55 ± 20.8	18.1	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	22-Apr-2022	Uranium-238	39.7 ± 74.1	81.1	U	EPA 901.1
WW007	2069G	19-Apr-2022	Actinium-228	4.6 ± 17.4	11.3	U	EPA 901.1
			Alpha, gross	2.74 ± 1.09	1.35	N	EPA 900.0/SW-846 9310
			Americium-241	−1.28 ± 14	21.9	U	EPA 901.1
			Beryllium-7	−20.1 ± 16.7	22.2	U	EPA 901.1
			Beta, gross	1.14 ± .612	0.977	*	EPA 900.0/SW-846 9310
			Bismuth-212	6.51 ± 25.1	44	U	EPA 901.1
			Bismuth-214	4.37 ± 8.95	5.74	U	EPA 901.1
			Cesium-137	0.926 ± 1.83	3.23	U	EPA 901.1
			Cobalt-60	−1.67 ± 1.9	2.85	U	EPA 901.1
			Lead-212	4.82 ± 7.61	7.03	U	EPA 901.1
			Lead-214	0.336 ± 8.43	7.29	U	EPA 901.1
			Neptunium-237	0.541 ± 3.01	5.41	U	EPA 901.1
			Potassium-40	−24.8 ± 40.9	47.8	U	EPA 901.1
			Radium-223	2.18 ± 35.9	57.5	U	EPA 901.1
			Radium-224	25.4 ± 35	55.5	U	EPA 901.1
			Radium-226	31.5 ± 88.5	56.8	U	EPA 901.1
			Radium-228	4.6 ± 17.4	11.3	U	EPA 901.1
			Sodium-22	−0.711 ± 1.65	2.86	U	EPA 901.1
			Thorium-227	13.8 ± 14.9	22.8	U	EPA 901.1
			Thorium-231	−26.4 ± 42.5	47.5	U	EPA 901.1
			Thorium-234	97.9 ± 239	232	U	EPA 901.1
			Tritium	−25.4 ± 98.4	188	U	EPA 906.0 Modified
			Uranium-235	−0.934 ± 16.8	20.5	U	EPA 901.1
			Uranium-238	97.9 ± 239	232	U	EPA 901.1
		20-Apr-2022	Actinium-228	−11.6 ± 17.4	17.5	U	EPA 901.1
			Alpha, gross	3.59 ± 1.29	1.59	N	EPA 900.0/SW-846 9310
			Americium-241	5.67 ± 14.5	22.6	U	EPA 901.1
			Beryllium-7	8.69 ± 15.6	26.9	U	EPA 901.1
			Beta, gross	1.49 ± .801	1.27		EPA 900.0/SW-846 9310
			Bismuth-212	24.7 ± 44.8	48.4	U	EPA 901.1
			Bismuth-214	5.7 ± 9.91	9	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	20-Apr-2022	Cesium-137	−0.556 ± 3.03	3.78	U	EPA 901.1
			Cobalt-60	−1.36 ± 2.19	3.67	U	EPA 901.1
			Lead-212	4.8 ± 7.76	5.67	U	EPA 901.1
			Lead-214	9.83 ± 9.68	9.83	U	EPA 901.1
			Neptunium-237	0.846 ± 3.71	6.49	U	EPA 901.1
			Potassium-40	−8.26 ± 41	52.2	U	EPA 901.1
			Radium-223	−14.7 ± 39.9	66.8	U	EPA 901.1
			Radium-224	54.2 ± 44.4	62.4	U	EPA 901.1
			Radium-226	5.05 ± 107	66.9	U	EPA 901.1
			Radium-228	−11.6 ± 17.4	17.5	U	EPA 901.1
			Sodium-22	0.702 ± 2	3.82	U	EPA 901.1
			Thorium-227	1.22 ± 14.5	25.5	U	EPA 901.1
			Thorium-231	−11.6 ± 48.7	50.6	U	EPA 901.1
			Thorium-234	109 ± 257	224	U	EPA 901.1
			Tritium	23.7 ± 107	193	U	EPA 906.0 Modified
			Uranium-235	7.52 ± 22.6	20.9	U	EPA 901.1
			Uranium-238	109 ± 257	224	U	EPA 901.1
		21-Apr-2022	Actinium-228	1.91 ± 14.1	14.2	U	EPA 901.1
			Alpha, gross	4.9 ± 1.32	1.36	N	EPA 900.0/SW-846 9310
			Americium-241	23 ± 5.36	22.3	X	EPA 901.1
			Beryllium-7	6.08 ± 15.8	27.4	U	EPA 901.1
			Beta, gross	1.26 ± .95	1.57	U	EPA 900.0/SW-846 9310
			Bismuth-212	20.2 ± 56.9	44.6	U	EPA 901.1
			Bismuth-214	4.09 ± 10.2	8.53	U	EPA 901.1
			Cesium-137	−1.54 ± 4.62	5.25	U	EPA 901.1
			Cobalt-60	2.26 ± 3.08	3.73	U	EPA 901.1
			Lead-212	2.81 ± 8.33	5.03	U	EPA 901.1
			Lead-214	5.76 ± 4.85	7.52	U	EPA 901.1
			Neptunium-237	−2.58 ± 3.45	5.44	U	EPA 901.1
			Potassium-40	−4.04 ± 37.4	45.2	U	EPA 901.1
			Radium-223	17.9 ± 35.6	61.6	U	EPA 901.1
			Radium-224	29.9 ± 88.6	53.8	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	21-Apr-2022	Radium-226	5.01 ± 67.4	87.4	U	EPA 901.1
			Radium-228	1.91 ± 14.1	14.2	U	EPA 901.1
			Sodium-22	−0.185 ± 1.81	3.29	U	EPA 901.1
			Thorium-227	3.42 ± 12.8	22.5	U	EPA 901.1
			Thorium-231	9.44 ± 52.5	50.8	U	EPA 901.1
			Thorium-234	176 ± 244	186	U	EPA 901.1
			Tritium	−19.1 ± 101	191	U	EPA 906.0 Modified
			Uranium-235	3.27 ± 20.9	20.8	U	EPA 901.1
			Uranium-238	176 ± 244	186	U	EPA 901.1
		22-Apr-2022	Actinium-228	2.62 ± 18.6	17.5	U	EPA 901.1
			Alpha, gross	2.16 ± .889	1.17	N	EPA 900.0/SW-846 9310
			Americium-241	−2.93 ± 12.7	21.3	U	EPA 901.1
			Beryllium-7	10.3 ± 24.2	29.8	U	EPA 901.1
			Beta, gross	0.976 ± 1.1	1.85	U	EPA 900.0/SW-846 9310
			Bismuth-212	−1.07 ± 27	48.2	U	EPA 901.1
			Bismuth-214	−7.18 ± 8.24	8.33	U	EPA 901.1
			Cesium-137	−3.56 ± 4.35	4.92	U	EPA 901.1
			Cobalt-60	0.695 ± 2.29	4.25	U	EPA 901.1
			Lead-212	−0.348 ± 5.82	7.01	U	EPA 901.1
			Lead-214	1.62 ± 8.06	7.87	U	EPA 901.1
			Neptunium-237	2.1 ± 3.6	6.34	U	EPA 901.1
			Potassium-40	−35.8 ± 51.7	55.1	U	EPA 901.1
			Radium-223	−13.3 ± 36.9	62.9	U	EPA 901.1
			Radium-224	−77.9 ± 49.9	56.8	U	EPA 901.1
			Radium-226	54.8 ± 89	55.3	U	EPA 901.1
			Radium-228	2.62 ± 18.6	17.5	U	EPA 901.1
			Sodium-22	−0.34 ± 2.32	4.14	U	EPA 901.1
			Thorium-227	2.83 ± 13.3	23.9	U	EPA 901.1
			Thorium-231	20.7 ± 25.1	42.6	U	EPA 901.1
			Thorium-234	192 ± 257	158	X	EPA 901.1
			Tritium	−54.2 ± 92.6	179	U	EPA 906.0 Modified
			Uranium-235	3.2 ± 15.8	16.7	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	22-Apr-2022	Uranium-238	192 ± 257	158	X	EPA 901.1
WW008	2069I	19-Apr-2022	Actinium-228	−20.4 ± 14.2	13.1	U	EPA 901.1
			Alpha, gross	2.09 ± 1.15	1.65	N	EPA 900.0/SW-846 9310
			Americium-241	−0.0947 ± 3.71	6.75	U	EPA 901.1
			Beryllium-7	−10.3 ± 13	21.3	U	EPA 901.1
			Beta, gross	10.8 ± .833	0.81	*	EPA 900.0/SW-846 9310
			Bismuth-212	−39.4 ± 46.8	42.6	U	EPA 901.1
			Bismuth-214	−7.82 ± 7.83	7.31	U	EPA 901.1
			Cesium-137	0.899 ± 1.59	2.91	U	EPA 901.1
			Cobalt-60	1.22 ± 1.93	3.47	U	EPA 901.1
			Lead-212	3.93 ± 7.52	7.08	U	EPA 901.1
			Lead-214	−4.16 ± 6.86	6.53	U	EPA 901.1
			Neptunium-237	−1.96 ± 3.14	4.91	U	EPA 901.1
			Potassium-40	−12.9 ± 42.5	58.4	U	EPA 901.1
			Radium-223	−16.6 ± 30.5	48.4	U	EPA 901.1
			Radium-224	−10.7 ± 42.6	48.9	U	EPA 901.1
			Radium-226	−28 ± 62.9	65.8	U	EPA 901.1
			Radium-228	−20.4 ± 14.2	13.1	U	EPA 901.1
			Sodium-22	0.06 ± 1.67	2.84	U	EPA 901.1
			Thorium-227	6.08 ± 11.9	20.2	U	EPA 901.1
			Thorium-231	−26.3 ± 33.2	30.1	U	EPA 901.1
			Thorium-234	−40 ± 76.2	78.2	U	EPA 901.1
			Tritium	−6.14 ± 104	194	U	EPA 906.0 Modified
			Uranium-235	0.207 ± 15.1	17.7	U	EPA 901.1
			Uranium-238	−40 ± 76.2	78.2	U	EPA 901.1
		20-Apr-2022	Actinium-228	−8.63 ± 14.7	15	U	EPA 901.1
			Alpha, gross	0.465 ± 1.53	2.64	NU	EPA 900.0/SW-846 9310
			Americium-241	−9.97 ± 17.5	24.5	U	EPA 901.1
			Beryllium-7	−3 ± 14.6	24.7	U	EPA 901.1
			Beta, gross	14.3 ± 1.55	1.87		EPA 900.0/SW-846 9310
			Bismuth-212	33.4 ± 25.8	40.7	U	EPA 901.1
			Bismuth-214	1.21 ± 8.63	7.59	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	20-Apr-2022	Cesium-137	2.1 ± 5.48	3.37	U	EPA 901.1
			Cobalt-60	0.846 ± 2.03	3.78	U	EPA 901.1
			Lead-212	7.62 ± 8.39	7.62	U	EPA 901.1
			Lead-214	9.06 ± 6.59	9.06	U	EPA 901.1
			Neptunium-237	0.189 ± 3.51	6.12	U	EPA 901.1
			Potassium-40	18.3 ± 61	32.9	U	EPA 901.1
			Radium-223	18.4 ± 33.2	57.6	U	EPA 901.1
			Radium-224	23.3 ± 34.6	53.7	U	EPA 901.1
			Radium-226	−59.4 ± 79.9	82.8	U	EPA 901.1
			Radium-228	−8.63 ± 14.7	15	U	EPA 901.1
			Sodium-22	1.14 ± 1.98	3.67	U	EPA 901.1
			Thorium-227	−4.68 ± 12.9	22	U	EPA 901.1
			Thorium-231	−14.8 ± 48.4	54.2	U	EPA 901.1
			Thorium-234	113 ± 266	237	U	EPA 901.1
			Tritium	91.4 ± 115	192	U	EPA 906.0 Modified
			Uranium-235	5.06 ± 22	19.8	U	EPA 901.1
			Uranium-238	113 ± 266	237	U	EPA 901.1
		21-Apr-2022	Actinium-228	−13.1 ± 11.9	11	U	EPA 901.1
			Alpha, gross	1.66 ± 1.47	2.39	NU	EPA 900.0/SW-846 9310
			Americium-241	0.749 ± 3.62	6.01	U	EPA 901.1
			Beryllium-7	4.49 ± 11.9	21.8	U	EPA 901.1
			Beta, gross	10.6 ± 1.38	1.74		EPA 900.0/SW-846 9310
			Bismuth-212	−5.09 ± 38.7	43.2	U	EPA 901.1
			Bismuth-214	7.51 ± 6.44	7.51		EPA 901.1
			Cesium-137	−0.477 ± 1.51	2.64	U	EPA 901.1
			Cobalt-60	0.489 ± 1.52	2.95	U	EPA 901.1
			Lead-212	1.38 ± 5.8	6.65	U	EPA 901.1
			Lead-214	−3.31 ± 6.11	6.21	U	EPA 901.1
			Neptunium-237	0.878 ± 2.86	4.82	U	EPA 901.1
			Potassium-40	−26.9 ± 36.2	47.1	U	EPA 901.1
			Radium-223	2.11 ± 28.2	47.2	U	EPA 901.1
			Radium-224	−19 ± 38.9	45.5	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	21-Apr-2022	Radium-226	3.53 ± 68.4	43.4	U	EPA 901.1
			Radium-228	−13.1 ± 11.9	11	U	EPA 901.1
			Sodium-22	−0.201 ± 1.55	2.7	U	EPA 901.1
			Thorium-227	−4.08 ± 10.4	16.8	U	EPA 901.1
			Thorium-231	−21 ± 29.8	27.6	U	EPA 901.1
			Thorium-234	34.5 ± 89	75.3	U	EPA 901.1
			Tritium	70.7 ± 115	197	U	EPA 906.0 Modified
			Uranium-235	8.43 ± 17.2	13.5	U	EPA 901.1
			Uranium-238	34.5 ± 89	75.3	U	EPA 901.1
		22-Apr-2022	Actinium-228	5.78 ± 7.5	9.32	U	EPA 901.1
			Alpha, gross	4.26 ± 1.36	1.73	N	EPA 900.0/SW-846 9310
			Americium-241	−0.464 ± 3.47	6.13	U	EPA 901.1
			Beryllium-7	9.54 ± 12.8	23.1	U	EPA 901.1
			Beta, gross	13.8 ± 1.51	1.89		EPA 900.0/SW-846 9310
			Bismuth-212	27.6 ± 27	33.7	U	EPA 901.1
			Bismuth-214	3.29 ± 8.04	5.51	U	EPA 901.1
			Cesium-137	−0.148 ± 1.56	2.8	U	EPA 901.1
			Cobalt-60	−0.229 ± 1.38	2.6	U	EPA 901.1
			Lead-212	0.464 ± 6.95	4.2	U	EPA 901.1
			Lead-214	−1.99 ± 5.36	5.83	U	EPA 901.1
			Neptunium-237	−0.131 ± 2.73	4.56	U	EPA 901.1
			Potassium-40	−18.5 ± 41.4	50.7	U	EPA 901.1
			Radium-223	−10.8 ± 28.5	45.7	U	EPA 901.1
			Radium-224	16.3 ± 30.1	46.7	U	EPA 901.1
			Radium-226	13.9 ± 73.6	45.8	U	EPA 901.1
			Radium-228	5.78 ± 7.5	9.32	U	EPA 901.1
			Sodium-22	−0.475 ± 1.56	2.65	U	EPA 901.1
			Thorium-227	0.609 ± 10.5	17.7	U	EPA 901.1
			Thorium-231	−13.3 ± 25.8	26.9	U	EPA 901.1
			Thorium-234	−25.4 ± 65.8	74.5	U	EPA 901.1
			Tritium	−53.6 ± 90.7	175	U	EPA 906.0 Modified
			Uranium-235	−4.28 ± 14.5	14.8	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	22-Apr-2022	Uranium-238	−25.4 ± 65.8	74.5	U	EPA 901.1
WW011	2069K	19-Apr-2022	Actinium-228	−4.69 ± 12.9	16.8	U	EPA 901.1
			Alpha, gross	−0.942 ± 1.76	3.53	NU	EPA 900.0/SW-846 9310
			Americium-241	28.3 ± 23.8	27.5	X	EPA 901.1
			Beryllium-7	6.85 ± 15.3	27.5	U	EPA 901.1
			Beta, gross	17.8 ± 1.68	1.86	*	EPA 900.0/SW-846 9310
			Bismuth-212	22.1 ± 56.1	47.3	U	EPA 901.1
			Bismuth-214	2.82 ± 9.37	7.2	U	EPA 901.1
			Cesium-137	0.0339 ± 1.99	3.52	U	EPA 901.1
			Cobalt-60	1.64 ± 2.14	4.03	U	EPA 901.1
			Lead-212	0.741 ± 6.79	8.66	U	EPA 901.1
			Lead-214	2.78 ± 9.41	8.16	U	EPA 901.1
			Neptunium-237	1.3 ± 3.69	6.71	U	EPA 901.1
			Potassium-40	−4.37 ± 48.4	69.3	U	EPA 901.1
			Radium-223	−4.93 ± 35.5	63.8	U	EPA 901.1
			Radium-224	−274 ± 139	60.1	U	EPA 901.1
			Radium-226	2.91 ± 95.2	62.6	U	EPA 901.1
			Radium-228	−4.69 ± 12.9	16.8	U	EPA 901.1
			Sodium-22	0.0135 ± 2.06	3.83	U	EPA 901.1
			Thorium-227	−9.65 ± 15.6	23.7	U	EPA 901.1
			Thorium-231	18.3 ± 29.5	50.1	U	EPA 901.1
			Thorium-234	162 ± 232	199	U	EPA 901.1
			Tritium	−56.4 ± 94.2	187	U	EPA 906.0 Modified
			Uranium-235	−7.75 ± 18.9	21.1	U	EPA 901.1
			Uranium-238	162 ± 232	199	U	EPA 901.1
		20-Apr-2022	Actinium-228	2.74 ± 16.7	9.25	U	EPA 901.1
			Alpha, gross	0.479 ± 1.43	2.27	NU	EPA 900.0/SW-846 9310
			Americium-241	4.74 ± 9.62	17.1	U	EPA 901.1
			Beryllium-7	−7.75 ± 12.6	21.1	U	EPA 901.1
			Beta, gross	16.7 ± 1.72	2.21		EPA 900.0/SW-846 9310
			Bismuth-212	−9.58 ± 36.2	40.6	U	EPA 901.1
			Bismuth-214	−5.65 ± 6.76	6.68	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	20-Apr-2022	Cesium-137	1.13 ± 4.37	2.72	U	EPA 901.1
			Cobalt-60	1.29 ± 1.59	3.1	U	EPA 901.1
			Lead-212	4.03 ± 6.45	4.46	U	EPA 901.1
			Lead-214	−3.06 ± 5.78	6.48	U	EPA 901.1
			Neptunium-237	−0.135 ± 3.08	5.13	U	EPA 901.1
			Potassium-40	2.92 ± 46	31.8	U	EPA 901.1
			Radium-223	−9.42 ± 30.5	49.3	U	EPA 901.1
			Radium-224	16.4 ± 30.5	47.6	U	EPA 901.1
			Radium-226	35.3 ± 65.7	47.8	U	EPA 901.1
			Radium-228	2.74 ± 16.7	9.25	U	EPA 901.1
			Sodium-22	0.591 ± 1.83	3.19	U	EPA 901.1
			Thorium-227	−4.64 ± 12.2	19.8	U	EPA 901.1
			Thorium-231	−16.5 ± 35	37.6	U	EPA 901.1
			Thorium-234	−98.5 ± 131	159	U	EPA 901.1
			Tritium	31.9 ± 111	199	U	EPA 906.0 Modified
			Tritium	679 ± 207	188		EPA 906.0 Modified
			Uranium-235	−13.9 ± 17.2	16.3	U	EPA 901.1
			Uranium-238	−98.5 ± 131	159	U	EPA 901.1
		21-Apr-2022	Actinium-228	−11 ± 13.5	14.1	U	EPA 901.1
			Actinium-228	−4.32 ± 12.5	13.6	U	EPA 901.1
			Alpha, gross	1.32 ± 1.27	2.08	NU	EPA 900.0/SW-846 9310
			Americium-241	0.303 ± 6.25	9.41	U	EPA 901.1
			Americium-241	5.28 ± 6.65	10.5	U	EPA 901.1
			Beryllium-7	19.5 ± 37.1	60.2	U	EPA 901.1
			Beryllium-7	1.03 ± 13.9	25.1	U	EPA 901.1
			Beta, gross	14.4 ± 1.55	1.95		EPA 900.0/SW-846 9310
			Bismuth-212	17.3 ± 23.3	40.8	U	EPA 901.1
			Bismuth-212	15.1 ± 24.1	42.6	U	EPA 901.1
			Bismuth-214	−1.27 ± 7.1	7.63	U	EPA 901.1
			Bismuth-214	5.13 ± 7.21	5.29	U	EPA 901.1
			Cesium-137	5.44 ± 3.64	3.12		EPA 901.1
			Cesium-137	1.1 ± 1.63	2.87	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	21-Apr-2022	Cobalt-60	−2.71 ± 4.12	3.52	U	EPA 901.1
			Cobalt-60	0.00113 ± 1.8	3.31	U	EPA 901.1
			Lead-212	−2.96 ± 5.08	5.69	U	EPA 901.1
			Lead-212	0.623 ± 5.57	5.93	U	EPA 901.1
			Lead-214	−2.82 ± 6.25	6.71	U	EPA 901.1
			Lead-214	−0.601 ± 6.45	6.16	U	EPA 901.1
			Neptunium-237	−0.0555 ± 3.13	5.34	U	EPA 901.1
			Neptunium-237	−0.361 ± 3.61	4.68	U	EPA 901.1
			Potassium-40	22.9 ± 46.6	29.2	U	EPA 901.1
			Potassium-40	−27.6 ± 34.7	43.3	U	EPA 901.1
			Radium-223	−11.1 ± 33.4	55.3	U	EPA 901.1
			Radium-223	−14.3 ± 27.9	47.9	U	EPA 901.1
			Radium-224	−64 ± 43.3	50.7	U	EPA 901.1
			Radium-224	−18.2 ± 46.4	48.4	U	EPA 901.1
			Radium-226	10.2 ± 77.7	53.6	U	EPA 901.1
			Radium-226	−57.9 ± 64.1	64.1	U	EPA 901.1
			Radium-228	−4.32 ± 12.5	13.6	U	EPA 901.1
			Radium-228	−11 ± 13.5	14.1	U	EPA 901.1
			Sodium-22	0.3 ± 1.64	3.09	U	EPA 901.1
			Sodium-22	0.502 ± 1.72	3.21	U	EPA 901.1
			Thorium-227	−12.8 ± 13.8	20.4	U	EPA 901.1
			Thorium-227	−4.93 ± 12	18.9	U	EPA 901.1
			Thorium-231	10.5 ± 39.1	30.7	U	EPA 901.1
			Thorium-231	−8.3 ± 28.7	32	U	EPA 901.1
			Thorium-234	24.8 ± 132	117	U	EPA 901.1
			Thorium-234	18.4 ± 109	81.2	U	EPA 901.1
			Tritium	29.4 ± 106	190	U	EPA 906.0 Modified
			Uranium-235	−12.4 ± 14.5	14.6	U	EPA 901.1
			Uranium-235	1.67 ± 16	17.4	U	EPA 901.1
			Uranium-238	18.4 ± 109	81.2	U	EPA 901.1
			Uranium-238	24.8 ± 132	117	U	EPA 901.1
		22-Apr-2022	Actinium-228	16.5 ± 14.4	16.5	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	22-Apr-2022	Alpha, gross	2.75 ± 1.35	1.98	N	EPA 900.0/SW-846 9310
			Americium-241	−3.49 ± 5.79	9.5	U	EPA 901.1
			Beryllium-7	0.64 ± 12	21.6	U	EPA 901.1
			Beta, gross	17.3 ± 1.82	2.36		EPA 900.0/SW-846 9310
			Bismuth-212	17.4 ± 20.4	32.2	U	EPA 901.1
			Bismuth-214	1.62 ± 7.5	6.41	U	EPA 901.1
			Cesium-137	−0.559 ± 1.49	2.54	U	EPA 901.1
			Cobalt-60	−3.05 ± 3.24	3.08	U	EPA 901.1
			Lead-212	−2.84 ± 4.59	4.98	U	EPA 901.1
			Lead-214	1.47 ± 6.16	5.87	U	EPA 901.1
			Neptunium-237	−0.713 ± 2.44	4.35	U	EPA 901.1
			Potassium-40	25.7 ± 48.1	23.3	X	EPA 901.1
			Radium-223	−29.1 ± 28.5	43.2	U	EPA 901.1
			Radium-224	−64 ± 41.5	43.3	U	EPA 901.1
			Radium-226	22.1 ± 73.9	42.2	U	EPA 901.1
			Radium-228	16.5 ± 14.4	16.5	U	EPA 901.1
			Sodium-22	1.39 ± 1.69	3.15	U	EPA 901.1
			Thorium-227	−9.46 ± 11.5	16.7	U	EPA 901.1
			Thorium-231	10.8 ± 24.6	29.7	U	EPA 901.1
			Thorium-234	1.86 ± 98.6	109	U	EPA 901.1
			Tritium	−23.1 ± 97	181	U	EPA 906.0 Modified
			Uranium-235	5.76 ± 16.8	13	U	EPA 901.1
			Uranium-238	1.86 ± 98.6	109	U	EPA 901.1

[a] Blank cells indicate that the data did not require a data qualifier.
CINT = Center for Integrated Nanotechnologies
MDA = minimal detectable activity or minimum measured activity in a sample required to ensure a 95 percent probability that the measured activity is accurately quantified above the critical level

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

Analytical Method
EPA 900.0/SW-846 9310 (EPA 1980) (EPA 1986)
EPA 901.1 (EPA 1980)
EPA 906.0 Modified (EPA 1980)

Table E-5. Radiological results for permitted sanitary outfalls, third quarter of calendar year 2022

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	27-Sep-2022	Actinium-228	−5.36 ± 11.4	11.8	U	EPA 901.1
			Alpha, gross	1.14 ± .763	1.19	U	EPA 900.0/SW-846 9310
			Americium-241	−0.423 ± 3.73	6.12	U	EPA 901.1
			Beryllium-7	−4.66 ± 11.8	20.7	U	EPA 901.1
			Beta, gross	2.5 ± .715	1.07		EPA 900.0/SW-846 9310
			Bismuth-212	−45.1 ± 47.8	42	U	EPA 901.1
			Bismuth-214	11.3 ± 8.18	5.09		EPA 901.1
			Cesium-137	−1.19 ± 1.6	2.55	U	EPA 901.1
			Cobalt-60	1.42 ± 1.65	3.14	U	EPA 901.1
			Lead-212	7.01 ± 5.4	3.75		EPA 901.1
			Lead-214	1.13 ± 6.49	5.39	U	EPA 901.1
			Neptunium-237	0.245 ± 2.78	4.66	U	EPA 901.1
			Potassium-40	−31.9 ± 37.3	41.4	U	EPA 901.1
			Radium-223	8.94 ± 26.9	45.3	U	EPA 901.1
			Radium-224	55.9 ± 41.9	40.2	X	EPA 901.1
			Radium-226	−50.5 ± 57.9	60.1	U	EPA 901.1
			Radium-228	−5.36 ± 11.4	11.8	U	EPA 901.1
			Sodium-22	−0.823 ± 1.55	2.48	U	EPA 901.1
			Thorium-227	−0.962 ± 11	18.3	U	EPA 901.1
			Thorium-231	−7.24 ± 24	27.6	U	EPA 901.1
			Thorium-234	6.22 ± 83	58.3	U	EPA 901.1
			Tritium	97.8 ± 109	179	U	EPA 906.0 Modified
			Uranium-235	0.709 ± 17.8	14.9	U	EPA 901.1
			Uranium-238	6.22 ± 83	58.3	U	EPA 901.1
		28-Sep-2022	Actinium-228	−1.62 ± 12.7	17.1	U	EPA 901.1
			Alpha, gross	0.497 ± .708	1.2	U	EPA 900.0/SW-846 9310
			Americium-241	−1.1 ± 5.68	9	U	EPA 901.1
			Beryllium-7	16.7 ± 17.9	30.5	U	EPA 901.1
			Beta, gross	5 ± 1.1	1.68		EPA 900.0/SW-846 9310
			Bismuth-212	51.9 ± 42	42		EPA 901.1
			Bismuth-214	7.35 ± 9.02	6.87	X	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	28-Sep-2022	Cesium-137	1.16 ± 2.02	3.56	U	EPA 901.1
			Cobalt-60	3.03 ± 2.46	4.27	U	EPA 901.1
			Lead-212	8.36 ± 7.53	5.32		EPA 901.1
			Lead-214	1.71 ± 7.9	6.61	U	EPA 901.1
			Neptunium-237	3.88 ± 5.07	6	U	EPA 901.1
			Potassium-40	−15.9 ± 40.3	56.9	U	EPA 901.1
			Radium-223	−25.4 ± 40.1	58.7	U	EPA 901.1
			Radium-224	11.8 ± 33.9	55.7	U	EPA 901.1
			Radium-226	24.6 ± 74.7	56.8	U	EPA 901.1
			Radium-228	−1.62 ± 12.7	17.1	U	EPA 901.1
			Sodium-22	0.168 ± 1.91	3.55	U	EPA 901.1
			Thorium-227	2.27 ± 13.3	24	U	EPA 901.1
			Thorium-231	4.83 ± 44.7	32.3	U	EPA 901.1
			Thorium-234	42.7 ± 124	114	U	EPA 901.1
			Tritium	40.4 ± 102	185	U	EPA 906.0 Modified
			Uranium-235	0.954 ± 19.3	16.6	U	EPA 901.1
			Uranium-238	42.7 ± 124	114	U	EPA 901.1
		29-Sep-2022	Actinium-228	6.89 ± 20	24.4	U	EPA 901.1
			Alpha, gross	4.83 ± 4.4	7.21	NU	EPA 900.0/SW-846 9310
			Americium-241	0.297 ± 3.56	6.54	U	EPA 901.1
			Beryllium-7	−3.84 ± 30.2	53.9	U	EPA 901.1
			Beta, gross	7.56 ± 3.86	6.29		EPA 900.0/SW-846 9310
			Bismuth-212	39 ± 57.1	102	U	EPA 901.1
			Bismuth-214	−3.89 ± 10.3	14.1	U	EPA 901.1
			Cesium-137	−1.5 ± 3.76	6.28	U	EPA 901.1
			Cobalt-60	1.38 ± 3.89	7.54	U	EPA 901.1
			Lead-212	2.93 ± 7.34	10.1	U	EPA 901.1
			Lead-214	1.83 ± 13.7	13.8	U	EPA 901.1
			Neptunium-237	−1.76 ± 5.15	9.19	U	EPA 901.1
			Potassium-40	20.5 ± 72.2	68	U	EPA 901.1
			Radium-223	−15.3 ± 51	91.3	U	EPA 901.1
			Radium-224	−85.6 ± 67.2	82.3	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	29-Sep-2022	Radium-226	1.22 ± 101	76.5	U	EPA 901.1
			Radium-228	6.89 ± 20	24.4	U	EPA 901.1
			Sodium-22	−0.531 ± 3.38	6.23	U	EPA 901.1
			Thorium-227	−0.467 ± 20.8	32.3	U	EPA 901.1
			Thorium-231	5.7 ± 36.8	34	U	EPA 901.1
			Thorium-234	49.5 ± 74.2	98.2	U	EPA 901.1
			Tritium	20.7 ± 112	197	U	EPA 906.0 Modified
			Uranium-235	9.27 ± 23.6	24.7	U	EPA 901.1
			Uranium-238	49.5 ± 74.2	98.2	U	EPA 901.1
		30-Sep-2022	Actinium-228	1.7 ± 24.5	21	U	EPA 901.1
			Alpha, gross	0.645 ± 1.03	1.77	NU	EPA 900.0/SW-846 9310
			Americium-241	1.73 ± 5.58	10.3	U	EPA 901.1
			Beryllium-7	−4.71 ± 21	38.5	U	EPA 901.1
			Beta, gross	2.44 ± .923	1.48		EPA 900.0/SW-846 9310
			Bismuth-212	3.52 ± 41.7	65.4	U	EPA 901.1
			Bismuth-214	3.4 ± 12.5	13.2	U	EPA 901.1
			Cesium-137	0.13 ± 2.41	4.49	U	EPA 901.1
			Cobalt-60	3.6 ± 3.67	5.49	U	EPA 901.1
			Lead-212	3.84 ± 9.2	6.42	U	EPA 901.1
			Lead-214	−6.87 ± 7.61	10.2	U	EPA 901.1
			Neptunium-237	3.23 ± 4.56	7.81	U	EPA 901.1
			Potassium-40	26.2 ± 53.2	40	U	EPA 901.1
			Radium-223	−50.2 ± 57.4	66.4	U	EPA 901.1
			Radium-224	21.7 ± 45.6	73.6	U	EPA 901.1
			Radium-226	−91.4 ± 83.5	96.1	U	EPA 901.1
			Radium-228	1.7 ± 24.5	21	U	EPA 901.1
			Sodium-22	0.3 ± 2.66	4.9	U	EPA 901.1
			Thorium-227	3.55 ± 17.4	30.3	U	EPA 901.1
			Thorium-231	−25.5 ± 38.2	43.5	U	EPA 901.1
			Thorium-234	−56.9 ± 81.7	116	U	EPA 901.1
			Tritium	8.69 ± 111	198	U	EPA 906.0 Modified
			Uranium-235	−4.49 ± 19.6	25.6	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	30-Sep-2022	Uranium-238	−56.9 ± 81.7	116	U	EPA 901.1
WW001	2069A	27-Sep-2022	Actinium-228	−11.9 ± 18.3	22.7	U	EPA 901.1
			Alpha, gross	3.61 ± 2.01	2.99		EPA 900.0/SW-846 9310
			Americium-241	−1.73 ± 3.04	4.86	U	EPA 901.1
			Beryllium-7	76.5 ± 58.4	33.6	X	EPA 901.1
			Beta, gross	5.66 ± 1.54	2.38		EPA 900.0/SW-846 9310
			Bismuth-212	0.697 ± 38.5	66.7	U	EPA 901.1
			Bismuth-214	−1.02 ± 11.2	10.6	U	EPA 901.1
			Cesium-137	0.712 ± 4.44	5.49	U	EPA 901.1
			Cobalt-60	1.63 ± 3.12	5.8	U	EPA 901.1
			Lead-212	2.2 ± 6.93	5.61	U	EPA 901.1
			Lead-214	1.25 ± 8.08	9.99	U	EPA 901.1
			Neptunium-237	−3.84 ± 4.23	6.66	U	EPA 901.1
			Potassium-40	43.9 ± 65.4	48.9	U	EPA 901.1
			Radium-223	0.503 ± 39.9	72.5	U	EPA 901.1
			Radium-224	7.08 ± 38.3	59.4	U	EPA 901.1
			Radium-226	−87.7 ± 76	81.5	U	EPA 901.1
			Radium-228	−11.9 ± 18.3	22.7	U	EPA 901.1
			Sodium-22	−0.448 ± 3.05	5.43	U	EPA 901.1
			Thorium-227	3.39 ± 16.7	28	U	EPA 901.1
			Thorium-231	1.48 ± 33.7	24.8	U	EPA 901.1
			Thorium-234	11.4 ± 46.2	72.8	U	EPA 901.1
			Tritium	71.2 ± 103	177	U	EPA 906.0 Modified
			Uranium-235	5.3 ± 19.4	19.4	U	EPA 901.1
			Uranium-238	11.4 ± 46.2	72.8	U	EPA 901.1
		28-Sep-2022	Actinium-228	−12.9 ± 14.8	15.3	U	EPA 901.1
			Alpha, gross	3.66 ± 1.84	2.59		EPA 900.0/SW-846 9310
			Americium-241	−2.15 ± 17.3	28	U	EPA 901.1
			Beryllium-7	−1.06 ± 17.8	28.5	U	EPA 901.1
			Beta, gross	5.79 ± 1.09	1.5		EPA 900.0/SW-846 9310
			Bismuth-212	13.5 ± 46.5	58.3	U	EPA 901.1
			Bismuth-214	−0.275 ± 7.76	8.55	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	28-Sep-2022	Cesium-137	0.829 ± 1.89	3.41	U	EPA 901.1
			Cobalt-60	0.542 ± 1.99	3.79	U	EPA 901.1
			Lead-212	2.33 ± 7.44	6.23	U	EPA 901.1
			Lead-214	7.01 ± 10.8	7.22	U	EPA 901.1
			Neptunium-237	2.06 ± 3.65	6.57	U	EPA 901.1
			Potassium-40	−29.8 ± 51.9	61.9	U	EPA 901.1
			Radium-223	−20.8 ± 36.7	62.4	U	EPA 901.1
			Radium-224	6.87 ± 42.3	64.6	U	EPA 901.1
			Radium-226	47.9 ± 109	65.7	U	EPA 901.1
			Radium-228	−12.9 ± 14.8	15.3	U	EPA 901.1
			Sodium-22	0.412 ± 2.19	3.69	U	EPA 901.1
			Thorium-227	−1.69 ± 15.9	26	U	EPA 901.1
			Thorium-231	29.9 ± 31.8	51.3	U	EPA 901.1
			Thorium-234	235 ± 307	192	X	EPA 901.1
			Tritium	16.8 ± 98.1	185	U	EPA 906.0 Modified
			Uranium-235	8.63 ± 23.6	19.8	U	EPA 901.1
			Uranium-238	235 ± 307	192	X	EPA 901.1
		29-Sep-2022	Actinium-228	0.841 ± 12.8	8.72	U	EPA 901.1
			Alpha, gross	2.7 ± 1.71	2.5	N	EPA 900.0/SW-846 9310
			Americium-241	−4.75 ± 5.76	8.95	U	EPA 901.1
			Beryllium-7	9.93 ± 13.1	22.9	U	EPA 901.1
			Beta, gross	11.5 ± 1.6	2.24		EPA 900.0/SW-846 9310
			Bismuth-212	−14.6 ± 38	34.9	U	EPA 901.1
			Bismuth-214	−0.773 ± 5.84	6.18	U	EPA 901.1
			Cesium-137	−1.5 ± 2.19	2.58	U	EPA 901.1
			Cobalt-60	−1.06 ± 1.53	2.48	U	EPA 901.1
			Lead-212	1.84 ± 5.25	3.78	U	EPA 901.1
			Lead-214	1.83 ± 7.01	5.86	U	EPA 901.1
			Neptunium-237	0.953 ± 2.41	4.36	U	EPA 901.1
			Potassium-40	−14 ± 35.2	40.8	U	EPA 901.1
			Radium-223	−31.1 ± 39.3	42.3	U	EPA 901.1
			Radium-224	−4.89 ± 27.4	40.8	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	29-Sep-2022	Radium-226	−29.1 ± 50.6	57.7	U	EPA 901.1
			Radium-228	0.841 ± 12.8	8.72	U	EPA 901.1
			Sodium-22	0.274 ± 1.4	2.63	U	EPA 901.1
			Thorium-227	−3.89 ± 9.36	16.4	U	EPA 901.1
			Thorium-231	−5.16 ± 24.9	27.4	U	EPA 901.1
			Thorium-234	−97.6 ± 120	101	U	EPA 901.1
			Tritium	41.8 ± 113	197	U	EPA 906.0 Modified
			Uranium-235	2.2 ± 14.2	13.6	U	EPA 901.1
			Uranium-238	−97.6 ± 120	101	U	EPA 901.1
		30-Sep-2022	Actinium-228	2.54 ± 11.8	10.3	U	EPA 901.1
			Alpha, gross	6.75 ± 2.1	2.81	N	EPA 900.0/SW-846 9310
			Americium-241	1.22 ± 8.1	14.7	U	EPA 901.1
			Beryllium-7	0.424 ± 9.72	16.3	U	EPA 901.1
			Beta, gross	12.6 ± 1.76	2.46		EPA 900.0/SW-846 9310
			Bismuth-212	−11.9 ± 35.9	30.2	U	EPA 901.1
			Bismuth-214	−2.21 ± 5.49	5.24	U	EPA 901.1
			Cesium-137	1.03 ± 1.31	2.19	U	EPA 901.1
			Cobalt-60	0.438 ± 1.11	2.23	U	EPA 901.1
			Lead-212	−5.05 ± 4.7	4.45	U	EPA 901.1
			Lead-214	−3.99 ± 6.05	4.4	U	EPA 901.1
			Neptunium-237	1.6 ± 2.19	3.68	U	EPA 901.1
			Potassium-40	−45.1 ± 34.4	31	U	EPA 901.1
			Radium-223	−15.1 ± 20.9	30.9	U	EPA 901.1
			Radium-224	−41.5 ± 52.7	32.4	U	EPA 901.1
			Radium-226	6.92 ± 84.1	34.3	U	EPA 901.1
			Radium-228	2.54 ± 11.8	10.3	U	EPA 901.1
			Sodium-22	−0.626 ± 1.05	1.79	U	EPA 901.1
			Thorium-227	−0.234 ± 8.34	14.1	U	EPA 901.1
			Thorium-231	42.3 ± 38.5	26.1	X	EPA 901.1
			Thorium-234	91.7 ± 214	152	U	EPA 901.1
			Tritium	−64.2 ± 105	197	U	EPA 906.0 Modified
			Uranium-235	7.56 ± 17.3	10.3	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	30-Sep-2022	Uranium-238	91.7 ± 214	152	U	EPA 901.1
WW006	2069F	27-Sep-2022	Actinium-228	0.567 ± 12.6	16.7	U	EPA 901.1
			Alpha, gross	3.39 ± 1.71	2.46		EPA 900.0/SW-846 9310
			Americium-241	−13.1 ± 22.2	23.9	U	EPA 901.1
			Beryllium-7	8.05 ± 18.5	32	U	EPA 901.1
			Beta, gross	16.3 ± 1.69	2.04		EPA 900.0/SW-846 9310
			Bismuth-212	6.92 ± 28.9	52.1	U	EPA 901.1
			Bismuth-214	7.11 ± 8.69	9.02	U	EPA 901.1
			Cesium-137	3.63 ± 2.74	4.3	U	EPA 901.1
			Cobalt-60	0.569 ± 2.11	3.95	U	EPA 901.1
			Lead-212	0.0807 ± 9.04	5.15	U	EPA 901.1
			Lead-214	−10.4 ± 10.3	7.96	U	EPA 901.1
			Neptunium-237	2.77 ± 3.67	6.35	U	EPA 901.1
			Potassium-40	37.5 ± 65.1	42.1	U	EPA 901.1
			Radium-223	1.13 ± 36.6	64.6	U	EPA 901.1
			Radium-224	23.7 ± 33.6	58.9	U	EPA 901.1
			Radium-226	−2.99 ± 67	79.6	U	EPA 901.1
			Radium-228	0.567 ± 12.6	16.7	U	EPA 901.1
			Sodium-22	−0.47 ± 2.11	3.75	U	EPA 901.1
			Thorium-227	−15.3 ± 14.7	21.7	U	EPA 901.1
			Thorium-231	25.1 ± 33.4	39.8	U	EPA 901.1
			Thorium-234	9.1 ± 225	177	U	EPA 901.1
			Tritium	39.4 ± 99.2	180	U	EPA 906.0 Modified
			Uranium-235	−7.42 ± 17.4	18.1	U	EPA 901.1
			Uranium-238	9.1 ± 225	177	U	EPA 901.1
		28-Sep-2022	Actinium-228	8.55 ± 14.2	12.3	U	EPA 901.1
			Alpha, gross	3.8 ± 2.29	3.44		EPA 900.0/SW-846 9310
			Americium-241	−1.24 ± 15.4	25.4	U	EPA 901.1
			Beryllium-7	5.68 ± 14.2	25.6	U	EPA 901.1
			Beta, gross	20.3 ± 3.38	4.99		EPA 900.0/SW-846 9310
			Beta, gross	16.2 ± 1.93	2.5		EPA 900.0/SW-846 9310
			Bismuth-212	−2.73 ± 24.5	42.4	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	28-Sep-2022	Bismuth-214	−5.27 ± 8.41	8.19	U	EPA 901.1
			Cesium-137	0.503 ± 1.94	3.44	U	EPA 901.1
			Cobalt-60	0.385 ± 1.89	3.54	U	EPA 901.1
			Lead-212	5.88 ± 8.12	6.36	U	EPA 901.1
			Lead-214	−4.73 ± 7.36	7.15	U	EPA 901.1
			Neptunium-237	2.34 ± 3.34	5.95	U	EPA 901.1
			Potassium-40	3.05 ± 47	25.8	U	EPA 901.1
			Radium-223	8.65 ± 32.8	59.8	U	EPA 901.1
			Radium-224	−12 ± 35.8	53	U	EPA 901.1
			Radium-226	6.96 ± 77.9	54	U	EPA 901.1
			Radium-228	8.55 ± 14.2	12.3	U	EPA 901.1
			Sodium-22	−0.209 ± 1.89	3.43	U	EPA 901.1
			Thorium-227	−0.525 ± 13.9	22.9	U	EPA 901.1
			Thorium-228	−0.216 ± .417	1.37	U	DOE EML HASL-300, Th
			Thorium-230	−0.0239 ± .444	1.29	U	DOE EML HASL-300, Th
			Thorium-231	21.2 ± 26.3	44.2	U	EPA 901.1
			Thorium-232	0.079 ± .242	0.86	U	DOE EML HASL-300, Th
			Thorium-234	87.3 ± 269	213	U	EPA 901.1
			Tritium	88.5 ± 108	180	U	EPA 906.0 Modified
			Uranium-233/234	1.97 ± .654	0.697		DOE EML HASL-300, U-
			Uranium-235	5.01 ± 22	17.2	U	EPA 901.1
			Uranium-235/236	0.26 ± .295	0.681	U	DOE EML HASL-300, U-
			Uranium-238	87.3 ± 269	213	U	EPA 901.1
			Uranium-238	1.02 ± .438	0.734		DOE EML HASL-300, U-
		29-Sep-2022	Actinium-228	−12.5 ± 13.3	13.6	U	EPA 901.1
			Alpha, gross	8.66 ± 2.2	2.26	N	EPA 900.0/SW-846 9310
			Americium-241	2.07 ± 14.8	26.1	U	EPA 901.1
			Beryllium-7	−20.6 ± 33.2	30.8	U	EPA 901.1
			Beta, gross	17.8 ± 2.43	3.29		EPA 900.0/SW-846 9310
			Bismuth-212	−6.84 ± 45.3	49.9	U	EPA 901.1
			Bismuth-214	0.0341 ± 8.82	7.77	U	EPA 901.1
			Cesium-137	1.04 ± 1.87	3.31	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	29-Sep-2022	Cobalt-60	1.03 ± 1.98	3.73	U	EPA 901.1
			Lead-212	1.96 ± 6.81	5.39	U	EPA 901.1
			Lead-214	−2.47 ± 6.83	7.89	U	EPA 901.1
			Neptunium-237	2.01 ± 3.49	6.23	U	EPA 901.1
			Potassium-40	−74.6 ± 61.4	60.7	U	EPA 901.1
			Radium-223	−6.82 ± 33.5	59.7	U	EPA 901.1
			Radium-224	40.4 ± 48.1	57.7	U	EPA 901.1
			Radium-226	−52.3 ± 72.1	71.8	U	EPA 901.1
			Radium-228	−12.5 ± 13.3	13.6	U	EPA 901.1
			Sodium-22	0.237 ± 1.75	3.29	U	EPA 901.1
			Thorium-227	0.934 ± 14.3	23.5	U	EPA 901.1
			Thorium-231	−31 ± 48	45.4	U	EPA 901.1
			Thorium-234	8.93 ± 245	222	U	EPA 901.1
			Tritium	−91.9 ± 104	198	U	EPA 906.0 Modified
			Uranium-235	−14.8 ± 22.3	19.9	U	EPA 901.1
			Uranium-238	8.93 ± 245	222	U	EPA 901.1
		30-Sep-2022	Actinium-228	11.3 ± 14.4	13.5	U	EPA 901.1
			Alpha, gross	3.32 ± 1.92	2.77	N	EPA 900.0/SW-846 9310
			Americium-241	−3.85 ± 7.55	13.1	U	EPA 901.1
			Beryllium-7	4.16 ± 14.7	26	U	EPA 901.1
			Beta, gross	17 ± 2.46	3.49		EPA 900.0/SW-846 9310
			Bismuth-212	14.4 ± 22	39.9	U	EPA 901.1
			Bismuth-214	3.39 ± 7.85	5.97	U	EPA 901.1
			Cesium-137	0.73 ± 1.85	2.88	U	EPA 901.1
			Cobalt-60	0.33 ± 1.76	3.15	U	EPA 901.1
			Lead-212	−1.89 ± 5.11	5.51	U	EPA 901.1
			Lead-214	−4.33 ± 7.5	6.46	U	EPA 901.1
			Neptunium-237	0.497 ± 2.79	5.05	U	EPA 901.1
			Potassium-40	0.193 ± 34.9	48.2	U	EPA 901.1
			Radium-223	16.1 ± 33	53.3	U	EPA 901.1
			Radium-224	16.8 ± 30.1	50.5	U	EPA 901.1
			Radium-226	−106 ± 78.2	65.4	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	30-Sep-2022	Radium-228	11.3 ± 14.4	13.5	U	EPA 901.1
			Sodium-22	−0.921 ± 2.1	2.98	U	EPA 901.1
			Thorium-227	−4.62 ± 12.7	20.2	U	EPA 901.1
			Thorium-231	−20.7 ± 32.4	33.4	U	EPA 901.1
			Thorium-234	−85.8 ± 137	136	U	EPA 901.1
			Tritium	9.97 ± 110	196	U	EPA 906.0 Modified
			Uranium-235	−8.66 ± 13.8	15.5	U	EPA 901.1
			Uranium-238	−85.8 ± 137	136	U	EPA 901.1
WW007	2069G	27-Sep-2022	Actinium-228	4.41 ± 15.2	15.3	U	EPA 901.1
			Alpha, gross	2.14 ± 1.18	1.82		EPA 900.0/SW-846 9310
			Americium-241	−10 ± 11.4	13.3	U	EPA 901.1
			Beryllium-7	−3.95 ± 14.4	25.3	U	EPA 901.1
			Beta, gross	1.44 ± .575	0.885		EPA 900.0/SW-846 9310
			Bismuth-212	7 ± 26	46.6	U	EPA 901.1
			Bismuth-214	15 ± 9.22	6.44		EPA 901.1
			Cesium-137	−0.459 ± 1.88	3.25	U	EPA 901.1
			Cobalt-60	−0.478 ± 1.88	3.4	U	EPA 901.1
			Lead-212	6.81 ± 6.95	8.19	U	EPA 901.1
			Lead-214	5.35 ± 8.98	7.63	U	EPA 901.1
			Neptunium-237	−0.173 ± 3.17	5.78	U	EPA 901.1
			Potassium-40	−35.4 ± 41.2	48	U	EPA 901.1
			Radium-223	−12.6 ± 31.9	56	U	EPA 901.1
			Radium-224	38.3 ± 66.7	51.6	U	EPA 901.1
			Radium-226	45.3 ± 80	54.2	U	EPA 901.1
			Radium-228	4.41 ± 15.2	15.3	U	EPA 901.1
			Sodium-22	0.754 ± 1.87	3.59	U	EPA 901.1
			Thorium-227	−7.49 ± 13.5	20.8	U	EPA 901.1
			Thorium-231	−1.46 ± 33.6	41.8	U	EPA 901.1
			Thorium-234	66.1 ± 153	167	U	EPA 901.1
			Tritium	33.2 ± 99.1	182	U	EPA 906.0 Modified
			Uranium-235	−8.16 ± 13.5	18.7	U	EPA 901.1
			Uranium-238	66.1 ± 153	167	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	28-Sep-2022	Actinium-228	20.4 ± 19.8	12.8		EPA 901.1
			Alpha, gross	2.22 ± 1.43	2.24	U	EPA 900.0/SW-846 9310
			Americium-241	−3.77 ± 10	17	U	EPA 901.1
			Beryllium-7	1.76 ± 16.6	29.9	U	EPA 901.1
			Beta, gross	1.28 ± 1.07	1.77	U	EPA 900.0/SW-846 9310
			Bismuth-212	−21.3 ± 38.8	46.6	U	EPA 901.1
			Bismuth-214	4.99 ± 9.87	6.46	U	EPA 901.1
			Cesium-137	0.0179 ± 1.89	3.36	U	EPA 901.1
			Cobalt-60	−0.54 ± 2.03	3.66	U	EPA 901.1
			Lead-212	3 ± 7.24	5.49	U	EPA 901.1
			Lead-214	−0.783 ± 6.14	8.12	U	EPA 901.1
			Neptunium-237	−0.531 ± 3.63	6.53	U	EPA 901.1
			Potassium-40	−23.1 ± 48.1	62.6	U	EPA 901.1
			Radium-223	−6.59 ± 36.1	64.6	U	EPA 901.1
			Radium-224	−19.2 ± 41.2	59.1	U	EPA 901.1
			Radium-226	69.3 ± 91.1	63.4	X	EPA 901.1
			Radium-228	20.4 ± 19.8	12.8		EPA 901.1
			Sodium-22	1.48 ± 2.12	4.02	U	EPA 901.1
			Thorium-227	3.53 ± 15.4	25.6	U	EPA 901.1
			Thorium-231	−10 ± 38.2	45.8	U	EPA 901.1
			Thorium-234	−140 ± 164	174	U	EPA 901.1
			Tritium	6.74 ± 97.2	187	U	EPA 906.0 Modified
			Uranium-235	−26.2 ± 20.8	21.2	U	EPA 901.1
			Uranium-238	−140 ± 164	174	U	EPA 901.1
		29-Sep-2022	Actinium-228	−13.1 ± 14.2	17.2	U	EPA 901.1
			Alpha, gross	2.99 ± 1.16	1.58	N	EPA 900.0/SW-846 9310
			Americium-241	−.235 ± 6.37	10.3	U	EPA 901.1
			Beryllium-7	3.72 ± 20.2	37.1	U	EPA 901.1
			Beta, gross	1.99 ± .898	1.44		EPA 900.0/SW-846 9310
			Bismuth-212	14.3 ± 36.5	66.1	U	EPA 901.1
			Bismuth-214	16 ± 13	16	U	EPA 901.1
			Cesium-137	0.261 ± 2.35	4.27	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	29-Sep-2022	Cobalt-60	0.185 ± 2.32	4.47	U	EPA 901.1
			Lead-212	1.63 ± 7.71	9.44	U	EPA 901.1
			Lead-214	5.5 ± 7.77	9.76	U	EPA 901.1
			Neptunium-237	1.24 ± 3.87	7.15	U	EPA 901.1
			Potassium-40	−32.4 ± 45.9	64.4	U	EPA 901.1
			Radium-223	9.2 ± 39.5	72.6	U	EPA 901.1
			Radium-224	20 ± 41.8	69.7	U	EPA 901.1
			Radium-226	−41.4 ± 59	88.2	U	EPA 901.1
			Radium-228	−13.1 ± 14.2	17.2	U	EPA 901.1
			Sodium-22	−.145 ± 2.3	4.35	U	EPA 901.1
			Thorium-227	−4.41 ± 14.1	25.3	U	EPA 901.1
			Thorium-231	15.4 ± 32.4	43.1	U	EPA 901.1
			Thorium-234	89.1 ± 135	123	U	EPA 901.1
			Tritium	23.7 ± 113	199	U	EPA 906.0 Modified
			Uranium-235	1.12 ± 15.9	21.1	U	EPA 901.1
			Uranium-238	89.1 ± 135	123	U	EPA 901.1
		30-Sep-2022	Actinium-228	12.2 ± 17.6	17.4	U	EPA 901.1
			Alpha, gross	3.77 ± 1.35	1.87	N	EPA 900.0/SW-846 9310
			Americium-241	2.25 ± 5.35	9.05	U	EPA 901.1
			Beryllium-7	−0.536 ± 19	35.4	U	EPA 901.1
			Beta, gross	5.17 ± 1.24	1.9		EPA 900.0/SW-846 9310
			Bismuth-212	48.7 ± 54.5	51.1	U	EPA 901.1
			Bismuth-214	−2.03 ± 6.9	9.55	U	EPA 901.1
			Cesium-137	−0.0945 ± 2.25	4.13	U	EPA 901.1
			Cobalt-60	−0.795 ± 2.37	4.37	U	EPA 901.1
			Lead-212	−3.43 ± 5.87	9.43	U	EPA 901.1
			Lead-214	0.993 ± 6.02	9.1	U	EPA 901.1
			Neptunium-237	1.35 ± 4.01	6.93	U	EPA 901.1
			Potassium-40	44 ± 62.5	48.5	U	EPA 901.1
			Radium-223	57.3 ± 56.2	73.9	U	EPA 901.1
			Radium-224	−108 ± 72.4	71	U	EPA 901.1
			Radium-226	7.49 ± 98	65.7	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	30-Sep-2022	Radium-228	12.2 ± 17.6	17.4	U	EPA 901.1
			Sodium-22	−0.305 ± 2.26	4.06	U	EPA 901.1
			Thorium-227	−0.975 ± 15.5	24.3	U	EPA 901.1
			Thorium-231	−12.2 ± 31.5	38.6	U	EPA 901.1
			Thorium-234	17.6 ± 117	103	U	EPA 901.1
			Tritium	16.2 ± 112	198	U	EPA 906.0 Modified
			Uranium-235	−3.57 ± 16	19.5	U	EPA 901.1
			Uranium-238	17.6 ± 117	103	U	EPA 901.1
WW008	2069I	27-Sep-2022	Actinium-228	−7.26 ± 13.2	14.1	U	EPA 901.1
			Alpha, gross	2.82 ± 1.45	2.13		EPA 900.0/SW-846 9310
			Americium-241	2.79 ± 7.8	12.8	U	EPA 901.1
			Beryllium-7	−0.973 ± 14	24.7	U	EPA 901.1
			Beta, gross	20.6 ± 1.7	1.91		EPA 900.0/SW-846 9310
			Beta, gross	15 ± 1.34	1.36		EPA 900.0/SW-846 9310
			Bismuth-212	−21 ± 35.5	41.2	U	EPA 901.1
			Bismuth-214	4.54 ± 8.25	5.85	U	EPA 901.1
			Cesium-137	0.376 ± 1.84	3.25	U	EPA 901.1
			Cobalt-60	0.563 ± 1.77	3.34	U	EPA 901.1
			Lead-212	3.22 ± 6.02	7.68	U	EPA 901.1
			Lead-214	0.432 ± 7.45	6.05	U	EPA 901.1
			Neptunium-237	1.29 ± 3.02	5.46	U	EPA 901.1
			Potassium-40	32.4 ± 64	33.2	U	EPA 901.1
			Radium-223	−6.19 ± 28.7	51.1	U	EPA 901.1
			Radium-224	30.9 ± 68.8	45.4	U	EPA 901.1
			Radium-226	52.7 ± 63.4	49.8	X	EPA 901.1
			Radium-228	−7.26 ± 13.2	14.1	U	EPA 901.1
			Sodium-22	−1.17 ± 1.82	2.98	U	EPA 901.1
			Thorium-227	0.606 ± 11.6	21.1	U	EPA 901.1
			Thorium-228	0.418 ± .479	1.81	U	DOE EML HASL-300, Th
			Thorium-230	1.01 ± .795	1.71	U	DOE EML HASL-300, Th
			Thorium-231	32 ± 22.7	32.3	U	EPA 901.1
			Thorium-232	0.0447 ± .391	1.14	U	DOE EML HASL-300, Th

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	27-Sep-2022	Thorium-234	81.6 ± 153	131	U	EPA 901.1
			Tritium	38.5 ± 96.6	175	U	EPA 906.0 Modified
			Uranium-233/234	2.39 ± .662	0.689		DOE EML HASL-300, U-
			Uranium-235	0.805 ± 14	16.1	U	EPA 901.1
			Uranium-235/236	0.128 ± .222	0.673	U	DOE EML HASL-300, U-
			Uranium-238	1.32 ± .512	0.725		DOE EML HASL-300, U-
			Uranium-238	81.6 ± 153	131	U	EPA 901.1
		28-Sep-2022	Actinium-228	−4.52 ± 10.6	13.5	U	EPA 901.1
			Alpha, gross	8.79 ± 2.41	3.2		EPA 900.0/SW-846 9310
			Americium-241	1 ± 3.85	7.01	U	EPA 901.1
			Beryllium-7	−9.05 ± 14.9	22.7	U	EPA 901.1
			Beta, gross	15.7 ± 1.44	1.5		EPA 900.0/SW-846 9310
			Bismuth-212	−19 ± 44	45	U	EPA 901.1
			Bismuth-214	−3.58 ± 7.41	7.81	U	EPA 901.1
			Cesium-137	−0.0317 ± 1.61	2.93	U	EPA 901.1
			Cobalt-60	−3.63 ± 3.13	3.11	U	EPA 901.1
			Lead-212	2.54 ± 6.88	4.83	U	EPA 901.1
			Lead-214	−3.51 ± 6.19	6.89	U	EPA 901.1
			Neptunium-237	0.12 ± 2.95	5.01	U	EPA 901.1
			Potassium-40	11.3 ± 48.6	28.3	U	EPA 901.1
			Radium-223	4.14 ± 30.6	51.9	U	EPA 901.1
			Radium-224	0.228 ± 30.7	48.5	U	EPA 901.1
			Radium-226	9.88 ± 79.2	50.1	U	EPA 901.1
			Radium-228	−4.52 ± 10.6	13.5	U	EPA 901.1
			Sodium-22	0.843 ± 1.79	3.24	U	EPA 901.1
			Thorium-227	5.04 ± 12.1	20.7	U	EPA 901.1
			Thorium-231	0.673 ± 37.7	28.6	U	EPA 901.1
			Thorium-234	−6.99 ± 59.8	79.1	U	EPA 901.1
			Tritium	66 ± 104	181	U	EPA 906.0 Modified
			Uranium-235	13.6 ± 23.7	15.2	U	EPA 901.1
			Uranium-238	−6.99 ± 59.8	79.1	U	EPA 901.1
		29-Sep-2022	Actinium-228	2.57 ± 13.8	13.8	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	29-Sep-2022	Alpha, gross	2.35 ± 1.34	2.01	N	EPA 900.0/SW-846 9310
			Americium-241	−0.501 ± 4.58	7.86	U	EPA 901.1
			Beryllium-7	7.64 ± 15.5	27.2	U	EPA 901.1
			Beta, gross	13.9 ± 1.77	2.47		EPA 900.0/SW-846 9310
			Bismuth-212	10.4 ± 32.7	42.8	U	EPA 901.1
			Bismuth-214	5.11 ± 7.88	5.53	U	EPA 901.1
			Cesium-137	0.113 ± 1.69	2.91	U	EPA 901.1
			Cobalt-60	3.87 ± 2.72	3.87	U	EPA 901.1
			Lead-212	2.1 ± 5.92	4.4	U	EPA 901.1
			Lead-214	−1.78 ± 5.84	6.46	U	EPA 901.1
			Neptunium-237	0.526 ± 2.89	5.16	U	EPA 901.1
			Potassium-40	−14.2 ± 40	50.1	U	EPA 901.1
			Radium-223	−19.3 ± 42.5	50.1	U	EPA 901.1
			Radium-224	17.6 ± 30	48.1	U	EPA 901.1
			Radium-226	1.01 ± 69.9	50.5	U	EPA 901.1
			Radium-228	2.57 ± 13.8	13.8	U	EPA 901.1
			Sodium-22	0.992 ± 1.93	3.17	U	EPA 901.1
			Thorium-227	−2.24 ± 11	19.5	U	EPA 901.1
			Thorium-231	−17.9 ± 28.7	30.1	U	EPA 901.1
			Thorium-234	−1.22 ± 79.3	93.5	U	EPA 901.1
			Tritium	−55.9 ± 107	199	U	EPA 906.0 Modified
			Uranium-235	5.8 ± 19	14.4	U	EPA 901.1
			Uranium-238	−1.22 ± 79.3	93.5	U	EPA 901.1
		30-Sep-2022	Actinium-228	−7.87 ± 12.3	12	U	EPA 901.1
			Alpha, gross	4.63 ± 1.4	1.64	N	EPA 900.0/SW-846 9310
			Americium-241	1.87 ± 8.83	14.6	U	EPA 901.1
			Beryllium-7	−5.83 ± 25.5	26.8	U	EPA 901.1
			Beta, gross	13.5 ± 1.78	2.31		EPA 900.0/SW-846 9310
			Bismuth-212	7.52 ± 22.4	39.6	U	EPA 901.1
			Bismuth-214	−5.31 ± 7.07	6.8	U	EPA 901.1
			Cesium-137	1.43 ± 1.81	3.12	U	EPA 901.1
			Cobalt-60	−1.41 ± 1.8	2.82	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	30-Sep-2022	Lead-212	1.21 ± 5.21	4.4	U	EPA 901.1
			Lead-214	−2.29 ± 5.94	6.16	U	EPA 901.1
			Neptunium-237	−2.76 ± 3.02	4.74	U	EPA 901.1
			Potassium-40	51.5 ± 46.1	28		EPA 901.1
			Radium-223	−7.78 ± 26.8	47.5	U	EPA 901.1
			Radium-224	40.6 ± 36.4	51.2	U	EPA 901.1
			Radium-226	2.06 ± 78.6	47.9	U	EPA 901.1
			Radium-228	−7.87 ± 12.3	12	U	EPA 901.1
			Sodium-22	0.0518 ± 1.56	2.88	U	EPA 901.1
			Thorium-227	−3.03 ± 12.4	20	U	EPA 901.1
			Thorium-231	7.76 ± 37.2	34.1	U	EPA 901.1
			Thorium-234	56.5 ± 145	113	U	EPA 901.1
			Tritium	36.7 ± 113	198	U	EPA 906.0 Modified
			Uranium-235	−9.3 ± 15.3	16.4	U	EPA 901.1
			Uranium-238	56.5 ± 145	113	U	EPA 901.1
WW011	2069K	27-Sep-2022	Actinium-228	−12.7 ± 17.8	18.9	U	EPA 901.1
			Alpha, gross	2.98 ± 1.57	2.3		EPA 900.0/SW-846 9310
			Americium-241	−4.56 ± 12.5	21.2	U	EPA 901.1
			Beryllium-7	−16 ± 19.9	30.8	U	EPA 901.1
			Beta, gross	17.9 ± 1.82	2.43		EPA 900.0/SW-846 9310
			Bismuth-212	46.3 ± 57.5	49.2	U	EPA 901.1
			Bismuth-214	8.64 ± 10.5	7.71	X	EPA 901.1
			Cesium-137	0.524 ± 2.26	3.91	U	EPA 901.1
			Cobalt-60	0.556 ± 2.44	4.41	U	EPA 901.1
			Lead-212	2.14 ± 7.32	7.27	U	EPA 901.1
			Lead-214	4.51 ± 10.1	9.25	U	EPA 901.1
			Neptunium-237	−0.445 ± 3.97	7.02	U	EPA 901.1
			Potassium-40	−45.6 ± 50.9	70.2	U	EPA 901.1
			Radium-223	−5.73 ± 38	66.9	U	EPA 901.1
			Radium-224	8.03 ± 39.1	63.8	U	EPA 901.1
			Radium-226	82 ± 117	66.1	X	EPA 901.1
			Radium-228	−12.7 ± 17.8	18.9	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	27-Sep-2022	Sodium-22	−0.563 ± 2.46	3.73	U	EPA 901.1
			Thorium-227	−8.66 ± 15.6	26.5	U	EPA 901.1
			Thorium-231	13 ± 74.5	50.6	U	EPA 901.1
			Thorium-234	−198 ± 200	246	U	EPA 901.1
			Tritium	32.7 ± 97.5	179	U	EPA 906.0 Modified
			Uranium-235	−8.55 ± 21.6	23.8	U	EPA 901.1
			Uranium-238	−198 ± 200	246	U	EPA 901.1
		28-Sep-2022	Actinium-228	−7.14 ± 11.4	12.1	U	EPA 901.1
			Alpha, gross	−0.743 ± 1.35	2.52	U	EPA 900.0/SW-846 9310
			Americium-241	−2.14 ± 4.15	6.81	U	EPA 901.1
			Beryllium-7	−19.6 ± 23.8	22.8	U	EPA 901.1
			Beta, gross	14.7 ± 1.69	2.25		EPA 900.0/SW-846 9310
			Bismuth-212	−15.6 ± 39.9	45.5	U	EPA 901.1
			Bismuth-214	3.33 ± 7.06	5.52	U	EPA 901.1
			Cesium-137	1.37 ± 1.72	2.99	U	EPA 901.1
			Cobalt-60	0.0573 ± 1.53	2.85	U	EPA 901.1
			Lead-212	5.66 ± 6.26	4.17	X	EPA 901.1
			Lead-214	−6.79 ± 6.43	6.56	U	EPA 901.1
			Neptunium-237	2.14 ± 2.89	5.06	U	EPA 901.1
			Potassium-40	6.53 ± 44.2	29.9	U	EPA 901.1
			Radium-223	7.54 ± 60.6	46.3	U	EPA 901.1
			Radium-224	−9.22 ± 27.9	44.2	U	EPA 901.1
			Radium-226	−27.4 ± 54.1	63	U	EPA 901.1
			Radium-228	−7.14 ± 11.4	12.1	U	EPA 901.1
			Sodium-22	−2.09 ± 2.19	2.87	U	EPA 901.1
			Thorium-227	−6.51 ± 14.2	17.3	U	EPA 901.1
			Thorium-231	−0.484 ± 26.3	30.9	U	EPA 901.1
			Thorium-234	−15.3 ± 79.6	84.2	U	EPA 901.1
			Tritium	65.2 ± 103	179	U	EPA 906.0 Modified
			Uranium-235	13.4 ± 17	15.5	U	EPA 901.1
			Uranium-238	−15.3 ± 79.6	84.2	U	EPA 901.1
		29-Sep-2022	Actinium-228	12.7 ± 18.4	15.2	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	29-Sep-2022	Alpha, gross	2.85 ± 1.34	1.85	N	EPA 900.0/SW-846 9310
			Americium-241	−5.04 ± 9.54	14.5	U	EPA 901.1
			Beryllium-7	−10.8 ± 15.9	25.8	U	EPA 901.1
			Beta, gross	18.1 ± 2.05	2.63		EPA 900.0/SW-846 9310
			Bismuth-212	−29.5 ± 41.7	37.1	U	EPA 901.1
			Bismuth-214	1.31 ± 8.39	5.89	U	EPA 901.1
			Cesium-137	−0.14 ± 1.78	2.77	U	EPA 901.1
			Cobalt-60	0.644 ± 1.65	3.11	U	EPA 901.1
			Lead-212	1.11 ± 6.61	6.22	U	EPA 901.1
			Lead-214	0.29 ± 8.93	7.1	U	EPA 901.1
			Neptunium-237	0.755 ± 3.02	5.46	U	EPA 901.1
			Potassium-40	48.1 ± 48.9	28.7	X	EPA 901.1
			Radium-223	1.51 ± 29.1	52.5	U	EPA 901.1
			Radium-224	36.3 ± 36.7	52.2	U	EPA 901.1
			Radium-226	−36.9 ± 69.9	75	U	EPA 901.1
			Radium-228	12.7 ± 18.4	15.2	U	EPA 901.1
			Sodium-22	−0.957 ± 1.68	2.85	U	EPA 901.1
			Thorium-227	−4.48 ± 12.5	19.9	U	EPA 901.1
			Thorium-231	21.9 ± 45.4	36	U	EPA 901.1
			Thorium-234	14.6 ± 158	119	U	EPA 901.1
			Tritium	−47.5 ± 107	197	U	EPA 906.0 Modified
			Uranium-235	6.67 ± 19.7	18.5	U	EPA 901.1
			Uranium-238	14.6 ± 158	119	U	EPA 901.1
		30-Sep-2022	Actinium-228	11.3 ± 17.7	16.3	U	EPA 901.1
			Alpha, gross	2.32 ± 1.38	1.84	N	EPA 900.0/SW-846 9310
			Americium-241	3.92 ± 12.9	22.2	U	EPA 901.1
			Beryllium-7	3.97 ± 17.1	30.3	U	EPA 901.1
			Beta, gross	17.6 ± 2.1	2.74		EPA 900.0/SW-846 9310
			Bismuth-212	48.1 ± 53.2	40.7	X	EPA 901.1
			Bismuth-214	4.12 ± 8.36	6.22	U	EPA 901.1
			Cesium-137	0.226 ± 1.75	3.08	U	EPA 901.1
			Cobalt-60	0.136 ± 1.84	3.4	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	30-Sep-2022	Lead-212	1.86 ± 7.32	6.85	U	EPA 901.1
			Lead-214	11.1 ± 8.76	11.1	U	EPA 901.1
			Neptunium-237	1.57 ± 3.29	5.85	U	EPA 901.1
			Potassium-40	−46.6 ± 42.2	49.7	U	EPA 901.1
			Radium-223	7.46 ± 32.3	57.9	U	EPA 901.1
			Radium-224	12.3 ± 34.4	55.9	U	EPA 901.1
			Radium-226	10.7 ± 93.1	59.7	U	EPA 901.1
			Radium-228	11.3 ± 17.7	16.3	U	EPA 901.1
			Sodium-22	0.292 ± 1.92	3.32	U	EPA 901.1
			Thorium-227	1.92 ± 13.7	22.3	U	EPA 901.1
			Thorium-231	46.6 ± 62.6	42.7	X	EPA 901.1
			Thorium-234	−48 ± 195	236	U	EPA 901.1
			Tritium	7.57 ± 111	197	U	EPA 906.0 Modified
			Uranium-235	−7.73 ± 18.9	20.5	U	EPA 901.1
			Uranium-238	−48 ± 195	236	U	EPA 901.1

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

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

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

Analytical Method
DOE EML HASL-300, Th (Environmental Measurement Laboratory, U.S. Department of Energy 1997)
EPA 900.0/SW-846 9310 (EPA 1980) (EPA 1986)
EPA 901.1 (EPA 1980)
EPA 906.0 Modified (EPA 1980)

Table E-6. Radiological results for permitted sanitary outfalls, fourth quarter of calendar year 2022

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	29-Nov-2022	Actinium-228	44.9 ± 26.4	44.9	U	EPA 901.1
			Alpha, gross	1.34 ± 4.41	7.95	U	EPA 900.0/SW-846 9310
			Americium-241	1.33 ± 16.2	25.6	U	EPA 901.1
			Beryllium-7	−1.56 ± 15.5	26.1	U	EPA 901.1
			Beta, gross	4.85 ± 5.05	8.43	U	EPA 900.0/SW-846 9310
			Bismuth-212	19.1 ± 26.8	48	U	EPA 901.1
			Bismuth-214	9.74 ± 10.5	7.07	X	EPA 901.1
			Cesium-137	0.765 ± 1.95	3.56	U	EPA 901.1
			Cobalt-60	1.53 ± 1.97	3.64	U	EPA 901.1
			Lead-212	7.02 ± 7.94	7.02	U	EPA 901.1
			Lead-214	11.8 ± 11.8	11.9	U	EPA 901.1
			Neptunium-237	−4.65 ± 4.2	5.77	U	EPA 901.1
			Potassium-40	55.5 ± 49.8	37		EPA 901.1
			Radium-223	−27.5 ± 38.7	59.8	U	EPA 901.1
			Radium-224	33.6 ± 40.4	59.5	U	EPA 901.1
			Radium-226	22.9 ± 89.2	59.9	U	EPA 901.1
			Radium-228	44.9 ± 26.4	44.9	U	EPA 901.1
			Sodium-22	−2.43 ± 2.81	3.45	U	EPA 901.1
			Thorium-227	−16.6 ± 15.8	22	U	EPA 901.1
			Thorium-231	16.1 ± 56	56.5	U	EPA 901.1
			Thorium-234	147 ± 240	202	U	EPA 901.1
			Tritium	26.8 ± 109	198	U	EPA 906.0 Modified
			Uranium-235	−29.5 ± 23.7	20.8	U	EPA 901.1
			Uranium-238	147 ± 240	202	U	EPA 901.1
		30-Nov-2022	Actinium-228	−5.09 ± 13.8	17.3	U	EPA 901.1
			Alpha, gross	−0.461 ± .658	1.3	U	EPA 900.0/SW-846 9310
			Americium-241	−4.06 ± 12.4	20.8	U	EPA 901.1
			Beryllium-7	−10.1 ± 15.6	24.7	U	EPA 901.1
			Beta, gross	1.26 ± .587	0.93		EPA 900.0/SW-846 9310
			Bismuth-212	20.5 ± 28.8	51.8	U	EPA 901.1
			Bismuth-214	7.86 ± 11.8	6.84	X	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	30-Nov-2022	Cesium-137	0.837 ± 2.01	3.71	U	EPA 901.1
			Cobalt-60	0.0438 ± 2.51	4.11	U	EPA 901.1
			Lead-212	2.93 ± 6.39	7.23	U	EPA 901.1
			Lead-214	6.24 ± 9.79	7.31	U	EPA 901.1
			Neptunium-237	−2.8 ± 3.87	6.2	U	EPA 901.1
			Potassium-40	4.2 ± 41.1	59.4	U	EPA 901.1
			Radium-223	−37.7 ± 39.9	59.8	U	EPA 901.1
			Radium-224	36.3 ± 57.8	56	U	EPA 901.1
			Radium-226	−57.8 ± 84	95.5	U	EPA 901.1
			Radium-228	−5.09 ± 13.8	17.3	U	EPA 901.1
			Sodium-22	0.31 ± 2.01	3.66	U	EPA 901.1
			Thorium-227	−1.99 ± 14.4	25.5	U	EPA 901.1
			Thorium-231	−25.1 ± 43.9	48.3	U	EPA 901.1
			Thorium-234	−117 ± 185	219	U	EPA 901.1
			Tritium	31.9 ± 104	187	U	EPA 906.0 Modified
			Uranium-235	−14.2 ± 24	21.4	U	EPA 901.1
			Uranium-238	−117 ± 185	219	U	EPA 901.1
		01-Dec-2022	Actinium-228	−6.38 ± 10.7	11.3	U	EPA 901.1
			Alpha, gross	1.49 ± 2.98	5.14	U	EPA 900.0/SW-846 9310
			Americium-241	0.325 ± 4.2	6.73	U	EPA 901.1
			Beryllium-7	2.96 ± 12	21.6	U	EPA 901.1
			Beta, gross	3.56 ± 2.22	3.64	U	EPA 900.0/SW-846 9310
			Bismuth-212	104 ± 61	36.2	X	EPA 901.1
			Bismuth-214	10.9 ± 8.44	5.57	X	EPA 901.1
			Cesium-137	−0.207 ± 1.51	2.67	U	EPA 901.1
			Cobalt-60	0.381 ± 1.61	3.07	U	EPA 901.1
			Lead-212	2.33 ± 5.11	6.25	U	EPA 901.1
			Lead-214	15.4 ± 7.66	7.85	X	EPA 901.1
			Neptunium-237	1.01 ± 2.69	4.9	U	EPA 901.1
			Potassium-40	0.714 ± 43	25.7	U	EPA 901.1
			Radium-223	5.41 ± 26.8	48.7	U	EPA 901.1
			Radium-224	11 ± 51.6	42	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	01-Dec-2022	Radium-226	17.6 ± 61.6	45.4	U	EPA 901.1
			Radium-228	−6.38 ± 10.7	11.3	U	EPA 901.1
			Sodium-22	0.00983 ± 1.41	2.68	U	EPA 901.1
			Thorium-227	1.21 ± 10.5	18.5	U	EPA 901.1
			Thorium-231	2.11 ± 33.7	27.4	U	EPA 901.1
			Thorium-234	12.1 ± 82.3	61.9	U	EPA 901.1
			Tritium	−0.0475 ± 102	191	U	EPA 906.0 Modified
			Uranium-235	9.47 ± 16.8	13.8	U	EPA 901.1
			Uranium-238	12.1 ± 82.3	61.9	U	EPA 901.1
		02-Dec-2022	Actinium-228	0.43 ± 18.6	13.2	U	EPA 901.1
			Alpha, gross	0.173 ± .922	1.65	U	EPA 900.0/SW-846 9310
			Americium-241	0.387 ± 5.74	9.13	U	EPA 901.1
			Beryllium-7	8.11 ± 12.6	22.1	U	EPA 901.1
			Beta, gross	0.975 ± .779	1.29	U	EPA 900.0/SW-846 9310
			Bismuth-212	−9.45 ± 33.6	37	U	EPA 901.1
			Bismuth-214	2.53 ± 8.04	5.3	U	EPA 901.1
			Cesium-137	2.56 ± 2.06	3.22	U	EPA 901.1
			Cobalt-60	1.54 ± 1.87	3.42	U	EPA 901.1
			Lead-212	0.752 ± 5.26	4.2	U	EPA 901.1
			Lead-214	4.93 ± 7.33	5.41	U	EPA 901.1
			Neptunium-237	−0.967 ± 2.74	4.75	U	EPA 901.1
			Potassium-40	−16.1 ± 37.4	40.3	U	EPA 901.1
			Radium-223	−21.2 ± 28.3	45.5	U	EPA 901.1
			Radium-224	8.54 ± 28.1	45.8	U	EPA 901.1
			Radium-226	62.3 ± 68.3	46.1	X	EPA 901.1
			Radium-228	0.43 ± 18.6	13.2	U	EPA 901.1
			Sodium-22	0.632 ± 1.5	2.83	U	EPA 901.1
			Thorium-227	0.352 ± 11.2	18.2	U	EPA 901.1
			Thorium-231	−8.89 ± 26.3	29.4	U	EPA 901.1
			Thorium-234	−45.9 ± 91.5	117	U	EPA 901.1
			Tritium	58.1 ± 108	187	U	EPA 906.0 Modified
			Uranium-235	10.3 ± 19.3	13.7	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
CINT	2238A	02-Dec-2022	Uranium-238	−45.9 ± 91.5	117	U	EPA 901.1
WW001	2069A	29-Nov-2022	Actinium-228	−0.769 ± 14.7	16.5	U	EPA 901.1
			Alpha, gross	5.3 ± 1.68	2.22		EPA 900.0/SW-846 9310
			Americium-241	0.858 ± 8.93	16.3	U	EPA 901.1
			Beryllium-7	13.8 ± 25.9	23.9	U	EPA 901.1
			Beta, gross	9.71 ± 1.3	1.64		EPA 900.0/SW-846 9310
			Bismuth-212	1.29 ± 26.6	46.2	U	EPA 901.1
			Bismuth-214	4.53 ± 11.2	8.82	U	EPA 901.1
			Cesium-137	1.21 ± 2.05	3.59	U	EPA 901.1
			Cobalt-60	−0.511 ± 2.06	3.6	U	EPA 901.1
			Lead-212	3.89 ± 6.79	6.63	U	EPA 901.1
			Lead-214	1.92 ± 8.02	7.76	U	EPA 901.1
			Neptunium-237	−2.02 ± 3.12	5.25	U	EPA 901.1
			Potassium-40	−1.14 ± 36.8	54.3	U	EPA 901.1
			Radium-223	−11.4 ± 33.7	59.3	U	EPA 901.1
			Radium-224	−10.6 ± 33.8	50.2	U	EPA 901.1
			Radium-226	−49.6 ± 67.9	75.6	U	EPA 901.1
			Radium-228	−0.769 ± 14.7	16.5	U	EPA 901.1
			Sodium-22	−0.623 ± 2.12	3.69	U	EPA 901.1
			Thorium-227	4.13 ± 13.5	22.6	U	EPA 901.1
			Thorium-231	12.8 ± 41.1	35.9	U	EPA 901.1
			Thorium-234	−95.1 ± 148	154	U	EPA 901.1
			Tritium	30 ± 109	197	U	EPA 906.0 Modified
			Uranium-235	−8.29 ± 16.8	18.6	U	EPA 901.1
			Uranium-238	−95.1 ± 148	154	U	EPA 901.1
		30-Nov-2022	Actinium-228	7.06 ± 18.6	17.7	U	EPA 901.1
			Alpha, gross	3.91 ± 2.26	3.43		EPA 900.0/SW-846 9310
			Americium-241	9.34 ± 16.3	26.2	U	EPA 901.1
			Beryllium-7	−1.52 ± 17	26.7	U	EPA 901.1
			Beta, gross	5.87 ± 1.65	2.57		EPA 900.0/SW-846 9310
			Bismuth-212	34.2 ± 42.9	43.6	U	EPA 901.1
			Bismuth-214	−7.67 ± 9.82	8.69	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	30-Nov-2022	Cesium-137	−0.471 ± 3.76	3.88	U	EPA 901.1
			Cobalt-60	−0.481 ± 2.16	3.85	U	EPA 901.1
			Lead-212	6.32 ± 9.11	7.64	U	EPA 901.1
			Lead-214	−2.78 ± 7.16	8	U	EPA 901.1
			Neptunium-237	−0.803 ± 4	6.68	U	EPA 901.1
			Potassium-40	64.3 ± 75.3	33	X	EPA 901.1
			Radium-223	16.2 ± 40.7	62.1	U	EPA 901.1
			Radium-224	48.5 ± 44.5	62.7	U	EPA 901.1
			Radium-226	25.1 ± 91	62.6	U	EPA 901.1
			Radium-228	7.06 ± 18.6	17.7	U	EPA 901.1
			Sodium-22	−3.28 ± 2.61	3.31	U	EPA 901.1
			Thorium-227	−2.81 ± 15	25.3	U	EPA 901.1
			Thorium-231	−71.4 ± 62.4	52.3	U	EPA 901.1
			Thorium-234	−152 ± 233	246	U	EPA 901.1
			Tritium	62.4 ± 112	194	U	EPA 906.0 Modified
			Uranium-235	−0.6 ± 19.5	22	U	EPA 901.1
			Uranium-238	−152 ± 233	246	U	EPA 901.1
		01-Dec-2022	Actinium-228	11.8 ± 15	12.3	U	EPA 901.1
			Alpha, gross	1.59 ± 2.28	3.88	U	EPA 900.0/SW-846 9310
			Americium-241	2.55 ± 6.98	11.5	U	EPA 901.1
			Beryllium-7	10.2 ± 12.6	21.9	U	EPA 901.1
			Beta, gross	9.36 ± 1.57	2.15		EPA 900.0/SW-846 9310
			Bismuth-212	37.9 ± 28	33.8		EPA 901.1
			Bismuth-214	2.53 ± 7.44	5.13	U	EPA 901.1
			Cesium-137	−1.51 ± 1.72	2.58	U	EPA 901.1
			Cobalt-60	1.56 ± 1.7	3.1	U	EPA 901.1
			Lead-212	2.35 ± 5.43	6.18	U	EPA 901.1
			Lead-214	0.414 ± 4.78	6.36	U	EPA 901.1
			Neptunium-237	2.94 ± 2.85	4.8	U	EPA 901.1
			Potassium-40	−12.9 ± 39.1	47.4	U	EPA 901.1
			Radium-223	−13.8 ± 26.4	45.4	U	EPA 901.1
			Radium-224	6.44 ± 29	44.5	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	01-Dec-2022	Radium-226	−56 ± 64.5	73.4	U	EPA 901.1
			Radium-228	11.8 ± 15	12.3	U	EPA 901.1
			Sodium-22	−1.52 ± 1.6	2.37	U	EPA 901.1
			Thorium-227	2.62 ± 11.5	17.6	U	EPA 901.1
			Thorium-231	−8.96 ± 27.1	33.3	U	EPA 901.1
			Thorium-234	57 ± 141	138	U	EPA 901.1
			Tritium	40.2 ± 106	189	U	EPA 906.0 Modified
			Uranium-235	12.8 ± 18.6	16.4	U	EPA 901.1
			Uranium-238	57 ± 141	138	U	EPA 901.1
		02-Dec-2022	Actinium-228	10.4 ± 10.1	18.1	U	EPA 901.1
			Alpha, gross	1.64 ± 1.82	3.04	U	EPA 900.0/SW-846 9310
			Americium-241	−2.29 ± 5.97	10.1	U	EPA 901.1
			Beryllium-7	1.41 ± 15.9	29.4	U	EPA 901.1
			Beta, gross	6.76 ± 1.27	1.8		EPA 900.0/SW-846 9310
			Bismuth-212	−41.7 ± 44.8	57.3	U	EPA 901.1
			Bismuth-214	1.51 ± 9.56	10.3	U	EPA 901.1
			Cesium-137	−0.561 ± 1.99	3.48	U	EPA 901.1
			Cobalt-60	0.753 ± 2.25	4.11	U	EPA 901.1
			Lead-212	7.36 ± 8	9.36	U	EPA 901.1
			Lead-214	6.54 ± 10.6	9.78	U	EPA 901.1
			Neptunium-237	0.15 ± 3.83	7.05	U	EPA 901.1
			Potassium-40	32.7 ± 49.2	45.1	U	EPA 901.1
			Radium-223	−40.2 ± 40.5	61	U	EPA 901.1
			Radium-224	−1.42 ± 38	63.1	U	EPA 901.1
			Radium-226	79.8 ± 100	63.5	X	EPA 901.1
			Radium-228	10.4 ± 10.1	18.1	U	EPA 901.1
			Sodium-22	0.0472 ± 1.92	3.78	U	EPA 901.1
			Thorium-227	−2.97 ± 13.3	24.1	U	EPA 901.1
			Thorium-231	−2.1 ± 33.9	44.1	U	EPA 901.1
			Thorium-234	9.76 ± 84.7	116	U	EPA 901.1
			Tritium	30.9 ± 105	189	U	EPA 906.0 Modified
			Uranium-235	18.4 ± 23.5	20.4	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW001	2069A	02-Dec-2022	Uranium-238	9.76 ± 84.7	116	U	EPA 901.1
WW006	2069F	29-Nov-2022	Actinium-228	−3.28 ± 11.5	14	U	EPA 901.1
			Alpha, gross	−1.65 ± 9	17	U	EPA 900.0/SW-846 9310
			Americium-241	0.796 ± 7.15	12.6	U	EPA 901.1
			Beryllium-7	−0.238 ± 13	23.1	U	EPA 901.1
			Beta, gross	12.1 ± 7	11.2		EPA 900.0/SW-846 9310
			Bismuth-212	35.4 ± 29.7	47.6	U	EPA 901.1
			Bismuth-214	8.88 ± 6.32	5.84	X	EPA 901.1
			Cesium-137	−1.92 ± 4.12	3.61	U	EPA 901.1
			Cobalt-60	−0.977 ± 1.68	2.78	U	EPA 901.1
			Lead-212	0.838 ± 6.58	4.48	U	EPA 901.1
			Lead-214	5.64 ± 8.44	7.36	U	EPA 901.1
			Neptunium-237	0.965 ± 2.95	5.35	U	EPA 901.1
			Potassium-40	−29.1 ± 45	59	U	EPA 901.1
			Radium-223	−4.06 ± 31.8	51.1	U	EPA 901.1
			Radium-224	−24.4 ± 48.1	52.8	U	EPA 901.1
			Radium-226	−17.5 ± 55.2	63.9	U	EPA 901.1
			Radium-228	−3.28 ± 11.5	14	U	EPA 901.1
			Sodium-22	−1.31 ± 1.94	3.15	U	EPA 901.1
			Thorium-227	−3.36 ± 11	19.6	U	EPA 901.1
			Thorium-231	54.6 ± 28.2	31.7	X	EPA 901.1
			Thorium-234	−5.83 ± 101	128	U	EPA 901.1
			Tritium	63.7 ± 114	199	U	EPA 906.0 Modified
			Uranium-235	23.1 ± 21.9	23.1	U	EPA 901.1
			Uranium-238	−5.83 ± 101	128	U	EPA 901.1
		30-Nov-2022	Actinium-228	13 ± 28	22.2	U	EPA 901.1
			Alpha, gross	0.667 ± 2.05	3.63	U	EPA 900.0/SW-846 9310
			Americium-241	−1.16 ± 2.42	4.32	U	EPA 901.1
			Beryllium-7	−2.7 ± 19	30.2	U	EPA 901.1
			Beta, gross	12 ± 2.09	2.76		EPA 900.0/SW-846 9310
			Bismuth-212	32.9 ± 37.3	64.8	U	EPA 901.1
			Bismuth-214	−2.97 ± 9.09	10.9	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	30-Nov-2022	Cesium-137	0.29 ± 2.85	5.02	U	EPA 901.1
			Cobalt-60	−0.545 ± 2.78	4.93	U	EPA 901.1
			Lead-212	−5.57 ± 6.25	6.91	U	EPA 901.1
			Lead-214	2.23 ± 9.27	9.19	U	EPA 901.1
			Neptunium-237	1.48 ± 4.29	7.2	U	EPA 901.1
			Potassium-40	−6.09 ± 53.7	80.7	U	EPA 901.1
			Radium-223	−33.3 ± 41.2	59.6	U	EPA 901.1
			Radium-224	−65.1 ± 65.9	61.9	U	EPA 901.1
			Radium-226	10.6 ± 96.3	54.6	U	EPA 901.1
			Radium-228	13 ± 28	22.2	U	EPA 901.1
			Sodium-22	0.868 ± 2.59	4.91	U	EPA 901.1
			Thorium-227	−9.2 ± 15.9	24.9	U	EPA 901.1
			Thorium-231	−36.7 ± 29.4	28.8	U	EPA 901.1
			Thorium-234	−47 ± 51.8	70.2	U	EPA 901.1
			Tritium	70.5 ± 116	199	U	EPA 906.0 Modified
			Uranium-235	−3.47 ± 17.2	18.8	U	EPA 901.1
			Uranium-238	−47 ± 51.8	70.2	U	EPA 901.1
		01-Dec-2022	Actinium-228	−3.76 ± 11.5	14.4	U	EPA 901.1
			Alpha, gross	0.261 ± 1.72	3.06	U	EPA 900.0/SW-846 9310
			Americium-241	1.45 ± 3.91	6.99	U	EPA 901.1
			Beryllium-7	6.66 ± 12.7	23.2	U	EPA 901.1
			Beta, gross	12.7 ± 1.28	1.4		EPA 900.0/SW-846 9310
			Bismuth-212	3.15 ± 52	37	U	EPA 901.1
			Bismuth-214	−3.74 ± 7.89	8.68	U	EPA 901.1
			Cesium-137	−1.43 ± 1.82	2.91	U	EPA 901.1
			Cobalt-60	−1.79 ± 1.81	2.46	U	EPA 901.1
			Lead-212	3.66 ± 6.86	6.95	U	EPA 901.1
			Lead-214	1.94 ± 8.17	7.39	U	EPA 901.1
			Neptunium-237	4.71 ± 3.68	5.42	U	EPA 901.1
			Potassium-40	34.2 ± 57.9	29.1	X	EPA 901.1
			Radium-223	34.3 ± 46	50.9	U	EPA 901.1
			Radium-224	22.7 ± 32.6	50.1	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	01-Dec-2022	Radium-226	67.5 ± 73.6	53.5	X	EPA 901.1
			Radium-228	−3.76 ± 11.5	14.4	U	EPA 901.1
			Sodium-22	0.996 ± 1.68	3.09	U	EPA 901.1
			Thorium-227	−3.08 ± 11.8	19.6	U	EPA 901.1
			Thorium-231	4.35 ± 38.1	30.8	U	EPA 901.1
			Thorium-234	−75.5 ± 88	78.2	U	EPA 901.1
			Tritium	−6.28 ± 102	190	U	EPA 906.0 Modified
			Uranium-235	8.05 ± 19.8	16	U	EPA 901.1
			Uranium-238	−75.5 ± 88	78.2	U	EPA 901.1
		02-Dec-2022	Actinium-228	0.262 ± 16	16.7	U	EPA 901.1
			Alpha, gross	2.19 ± 1.96	3.22	U	EPA 900.0/SW-846 9310
			Americium-241	−1.77 ± 14.9	26.8	U	EPA 901.1
			Beryllium-7	0.265 ± 15.9	28.6	U	EPA 901.1
			Beta, gross	19.8 ± 2.07	2.54		EPA 900.0/SW-846 9310
			Bismuth-212	6.35 ± 51.4	43.5	U	EPA 901.1
			Bismuth-214	2.01 ± 9.18	7.13	U	EPA 901.1
			Cesium-137	2.1 ± 3.53	3.53	U	EPA 901.1
			Cobalt-60	−.811 ± 2.04	3.54	U	EPA 901.1
			Lead-212	−4.46 ± 7.72	7.72	U	EPA 901.1
			Lead-214	−5.57 ± 7.94	8.31	U	EPA 901.1
			Neptunium-237	−1.7 ± 4.1	6.69	U	EPA 901.1
			Potassium-40	40.3 ± 56.7	38.8	X	EPA 901.1
			Radium-223	3.14 ± 36.6	62.2	U	EPA 901.1
			Radium-224	−81.1 ± 56.6	67.6	U	EPA 901.1
			Radium-226	50.6 ± 113	64	U	EPA 901.1
			Radium-228	0.262 ± 16	16.7	U	EPA 901.1
			Sodium-22	−1.13 ± 2.14	3.61	U	EPA 901.1
			Thorium-227	−13.4 ± 16.6	25.3	U	EPA 901.1
			Thorium-231	4.17 ± 54.9	48.8	U	EPA 901.1
			Thorium-234	−179 ± 229	247	U	EPA 901.1
			Tritium	64.7 ± 109	188	U	EPA 906.0 Modified
			Uranium-235	6.89 ± 23.2	18.8	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW006	2069F	02-Dec-2022	Uranium-238	−179 ± 229	247	U	EPA 901.1
WW007	2069G	29-Nov-2022	Actinium-228	5.87 ± 16.2	14.1	U	EPA 901.1
			Alpha, gross	1.62 ± 1.02	1.55		EPA 900.0/SW-846 9310
			Americium-241	1.8 ± 6.19	11.2	U	EPA 901.1
			Beryllium-7	1.8 ± 12.7	22.8	U	EPA 901.1
			Beta, gross	1.39 ± .609	0.954		EPA 900.0/SW-846 9310
			Bismuth-212	43.8 ± 33.1	38.2	X	EPA 901.1
			Bismuth-214	0.0939 ± 6.46	7.43	U	EPA 901.1
			Cesium-137	1.17 ± 4.71	2.82	U	EPA 901.1
			Cobalt-60	5.02 ± 3.23	5.02	U	EPA 901.1
			Lead-212	1.9 ± 5.58	5.97	U	EPA 901.1
			Lead-214	5.25 ± 6.06	5.63	U	EPA 901.1
			Neptunium-237	−0.477 ± 2.68	4.83	U	EPA 901.1
			Potassium-40	−49.5 ± 41	44.8	U	EPA 901.1
			Radium-223	34.5 ± 25.9	52.2	U	EPA 901.1
			Radium-224	17.6 ± 38.1	44.4	U	EPA 901.1
			Radium-226	62.6 ± 71.7	50.7	X	EPA 901.1
			Radium-228	5.87 ± 16.2	14.1	U	EPA 901.1
			Sodium-22	−0.83 ± 1.86	3.16	U	EPA 901.1
			Thorium-227	0.592 ± 12.3	20.4	U	EPA 901.1
			Thorium-231	5.16 ± 31.1	34.4	U	EPA 901.1
			Thorium-234	−71.3 ± 103	130	U	EPA 901.1
			Tritium	76.8 ± 116	198	U	EPA 906.0 Modified
			Uranium-235	−14.9 ± 16.8	17.2	U	EPA 901.1
			Uranium-238	−71.3 ± 103	130	U	EPA 901.1
		30-Nov-2022	Actinium-228	−6.97 ± 15.8	16.9	U	EPA 901.1
			Alpha, gross	2.94 ± 1.51	2.2		EPA 900.0/SW-846 9310
			Americium-241	5.58 ± 14.9	26.7	U	EPA 901.1
			Beryllium-7	−19.2 ± 17.3	24.8	U	EPA 901.1
			Beta, gross	2.51 ± 1.04	1.63		EPA 900.0/SW-846 9310
			Bismuth-212	23.9 ± 45.4	47.4	U	EPA 901.1
			Bismuth-214	−5.09 ± 9.47	8.88	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	30-Nov-2022	Cesium-137	−1.03 ± 3.83	3.95	U	EPA 901.1
			Cobalt-60	−0.235 ± 2.3	3.61	U	EPA 901.1
			Lead-212	4.71 ± 8.62	7.56	U	EPA 901.1
			Lead-214	2.3 ± 9.76	8.64	U	EPA 901.1
			Neptunium-237	0.367 ± 3.79	6.45	U	EPA 901.1
			Potassium-40	60.4 ± 32.4	39.6		EPA 901.1
			Radium-223	−22 ± 40	63.7	U	EPA 901.1
			Radium-224	45.7 ± 44.4	63.4	U	EPA 901.1
			Radium-226	−25.6 ± 78	102	U	EPA 901.1
			Radium-228	−6.97 ± 15.8	16.9	U	EPA 901.1
			Sodium-22	1.15 ± 2.03	3.81	U	EPA 901.1
			Thorium-227	−1.41 ± 15.1	25.7	U	EPA 901.1
			Thorium-231	−63.6 ± 60.5	52.8	U	EPA 901.1
			Thorium-234	−20.4 ± 223	261	U	EPA 901.1
			Tritium	27.3 ± 112	203	U	EPA 906.0 Modified
			Uranium-235	5.23 ± 25.3	23.1	U	EPA 901.1
			Uranium-238	−20.4 ± 223	261	U	EPA 901.1
		01-Dec-2022	Actinium-228	−4.02 ± 11.4	12.1	U	EPA 901.1
			Alpha, gross	2.44 ± 1.37	2.12		EPA 900.0/SW-846 9310
			Americium-241	2.05 ± 4.28	6.88	U	EPA 901.1
			Beryllium-7	1.85 ± 11.6	20.9	U	EPA 901.1
			Beta, gross	1.73 ± .713	1.12		EPA 900.0/SW-846 9310
			Bismuth-212	1.41 ± 38.3	43.7	U	EPA 901.1
			Bismuth-214	3.83 ± 8.74	6.97	U	EPA 901.1
			Cesium-137	0.91 ± 1.64	2.92	U	EPA 901.1
			Cobalt-60	1.32 ± 1.56	2.96	U	EPA 901.1
			Lead-212	0.844 ± 5.59	4.27	U	EPA 901.1
			Lead-214	4.86 ± 8.68	6.64	U	EPA 901.1
			Neptunium-237	0.135 ± 2.74	4.95	U	EPA 901.1
			Potassium-40	25 ± 47	25.9	U	EPA 901.1
			Radium-223	−7.81 ± 27.1	47.8	U	EPA 901.1
			Radium-224	12.5 ± 44.1	43.3	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	01-Dec-2022	Radium-226	35.3 ± 66.7	44.3	U	EPA 901.1
			Radium-228	−4.02 ± 11.4	12.1	U	EPA 901.1
			Sodium-22	−0.536 ± 1.58	2.8	U	EPA 901.1
			Thorium-227	−0.457 ± 10.3	18.6	U	EPA 901.1
			Thorium-231	−21.4 ± 31.7	29.6	U	EPA 901.1
			Thorium-234	12.6 ± 86.7	80.1	U	EPA 901.1
			Tritium	−49.9 ± 96.1	190	U	EPA 906.0 Modified
			Uranium-235	4.53 ± 16.1	13.5	U	EPA 901.1
			Uranium-238	12.6 ± 86.7	80.1	U	EPA 901.1
		02-Dec-2022	Actinium-228	−4.06 ± 11.8	15.2	U	EPA 901.1
			Alpha, gross	2.89 ± 1.92	3.1	U	EPA 900.0/SW-846 9310
			Americium-241	−0.519 ± 4.21	6.96	U	EPA 901.1
			Beryllium-7	−1.62 ± 12.4	22.6	U	EPA 901.1
			Beta, gross	2.04 ± .718	1.08		EPA 900.0/SW-846 9310
			Bismuth-212	11.1 ± 56.2	36.4	U	EPA 901.1
			Bismuth-214	3.26 ± 8.51	5.73	U	EPA 901.1
			Cesium-137	0.436 ± 1.64	2.74	U	EPA 901.1
			Cobalt-60	0.749 ± 1.75	3.19	U	EPA 901.1
			Lead-212	3.9 ± 6.76	4.75	U	EPA 901.1
			Lead-214	3.55 ± 8.19	7.46	U	EPA 901.1
			Neptunium-237	2 ± 3.19	5.3	U	EPA 901.1
			Potassium-40	−18.8 ± 41.4	57.8	U	EPA 901.1
			Radium-223	1.16 ± 30.7	51.6	U	EPA 901.1
			Radium-224	13.9 ± 43.3	51	U	EPA 901.1
			Radium-226	12.1 ± 71.6	52.8	U	EPA 901.1
			Radium-228	−4.06 ± 11.8	15.2	U	EPA 901.1
			Sodium-22	0.83 ± 1.53	2.84	U	EPA 901.1
			Thorium-227	−1.02 ± 12.3	20.7	U	EPA 901.1
			Thorium-231	−25.5 ± 34.2	30.4	U	EPA 901.1
			Thorium-234	85.3 ± 78.9	64.8	X	EPA 901.1
			Tritium	18 ± 100	183	U	EPA 906.0 Modified
			Uranium-235	16.9 ± 23.5	16.1	X	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW007	2069G	02-Dec-2022	Uranium-238	85.3 ± 78.9	64.8	X	EPA 901.1
WW008	2069I	29-Nov-2022	Actinium-228	−12.4 ± 17.5	19.8	U	EPA 901.1
			Alpha, gross	12.5 ± 1.94	2.17		EPA 900.0/SW-846 9310
			Americium-241	7.13 ± 13.8	21.6	U	EPA 901.1
			Beryllium-7	−10.3 ± 17.3	27.7	U	EPA 901.1
			Beta, gross	17.8 ± 1.5	1.57		EPA 900.0/SW-846 9310
			Bismuth-212	16.7 ± 29.9	54.2	U	EPA 901.1
			Bismuth-214	−7.6 ± 9.48	10.2	U	EPA 901.1
			Cesium-137	−2.19 ± 3.71	4.32	U	EPA 901.1
			Cobalt-60	0.346 ± 2.23	4.04	U	EPA 901.1
			Lead-212	2.17 ± 8.91	7.33	U	EPA 901.1
			Lead-214	−9.2 ± 10.2	9.58	U	EPA 901.1
			Neptunium-237	1.4 ± 3.92	6.89	U	EPA 901.1
			Potassium-40	13.3 ± 71	39.7	U	EPA 901.1
			Radium-223	−13.3 ± 40.8	69.6	U	EPA 901.1
			Radium-224	19.7 ± 43.9	64.3	U	EPA 901.1
			Radium-226	−81.8 ± 91.4	112	U	EPA 901.1
			Radium-228	−12.4 ± 17.5	19.8	U	EPA 901.1
			Sodium-22	2.61 ± 3	4.07	U	EPA 901.1
			Thorium-227	−8.31 ± 15.5	25.9	U	EPA 901.1
			Thorium-231	−18.5 ± 61.3	60.8	U	EPA 901.1
			Thorium-234	161 ± 270	172	U	EPA 901.1
			Tritium	80.6 ± 122	209	U	EPA 906.0 Modified
			Uranium-235	14.3 ± 23.8	25	U	EPA 901.1
			Uranium-238	161 ± 270	172	U	EPA 901.1
		30-Nov-2022	Actinium-228	−20 ± 19	19.4	U	EPA 901.1
			Alpha, gross	1.7 ± 1.05	1.63		EPA 900.0/SW-846 9310
			Americium-241	3.99 ± 14.1	22.1	U	EPA 901.1
			Beryllium-7	−0.353 ± 17.4	29.9	U	EPA 901.1
			Beta, gross	14.2 ± 1.29	1.69		EPA 900.0/SW-846 9310
			Bismuth-212	15.3 ± 29.5	53.7	U	EPA 901.1
			Bismuth-214	−4.47 ± 9.11	10.6	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	30-Nov-2022	Cesium-137	−4.37 ± 4.06	3.98	U	EPA 901.1
			Cobalt-60	−0.538 ± 2.23	3.86	U	EPA 901.1
			Lead-212	−3.25 ± 7.81	7.04	U	EPA 901.1
			Lead-214	−7.8 ± 9.93	9.53	U	EPA 901.1
			Neptunium-237	1.59 ± 4.04	7.09	U	EPA 901.1
			Potassium-40	37 ± 70.9	37.4	U	EPA 901.1
			Radium-223	37 ± 57	66.5	U	EPA 901.1
			Radium-224	−87.3 ± 55.7	63.4	U	EPA 901.1
			Radium-226	14.5 ± 98.2	66.6	U	EPA 901.1
			Radium-228	−20 ± 19	19.4	U	EPA 901.1
			Sodium-22	1.83 ± 2.48	4.44	U	EPA 901.1
			Thorium-227	−12.5 ± 17.7	25.5	U	EPA 901.1
			Thorium-231	−20.6 ± 61.7	61.5	U	EPA 901.1
			Thorium-234	27.9 ± 263	253	U	EPA 901.1
			Tritium	92.1 ± 120	203	U	EPA 906.0 Modified
			Uranium-235	11.4 ± 26	21.2	U	EPA 901.1
			Uranium-238	27.9 ± 263	253	U	EPA 901.1
		01-Dec-2022	Actinium-228	13 ± 13.8	15.3	U	EPA 901.1
			Alpha, gross	0.686 ± 1.28	2.07	U	EPA 900.0/SW-846 9310
			Americium-241	−4.18 ± 20.1	24.5	U	EPA 901.1
			Beryllium-7	12.6 ± 16.6	27.6	U	EPA 901.1
			Beta, gross	13.3 ± 1.28	1.4		EPA 900.0/SW-846 9310
			Bismuth-212	122 ± 75.8	40.6	X	EPA 901.1
			Bismuth-214	5.6 ± 9.59	6.64	U	EPA 901.1
			Cesium-137	0.731 ± 2.03	3.7	U	EPA 901.1
			Cobalt-60	0.728 ± 2.04	3.77	U	EPA 901.1
			Lead-212	0.715 ± 7.44	5.25	U	EPA 901.1
			Lead-214	5.28 ± 7.99	7	U	EPA 901.1
			Neptunium-237	0.228 ± 3.5	5.97	U	EPA 901.1
			Potassium-40	82.2 ± 36.8	34.6		EPA 901.1
			Radium-223	−10.4 ± 37.4	62.2	U	EPA 901.1
			Radium-224	37.8 ± 39.3	56.9	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	01-Dec-2022	Radium-226	25.2 ± 83	59.6	U	EPA 901.1
			Radium-228	13 ± 13.8	15.3	U	EPA 901.1
			Sodium-22	−0.173 ± 2.08	3.73	U	EPA 901.1
			Thorium-227	−10.1 ± 14.7	22.9	U	EPA 901.1
			Thorium-231	7.76 ± 66.6	50.8	U	EPA 901.1
			Thorium-234	87.9 ± 299	259	U	EPA 901.1
			Tritium	76.6 ± 110	187	U	EPA 906.0 Modified
			Uranium-235	−8.29 ± 19.3	21	U	EPA 901.1
			Uranium-238	87.9 ± 299	259	U	EPA 901.1
		02-Dec-2022	Actinium-228	4.27 ± 11.3	19.7	U	EPA 901.1
			Alpha, gross	1.41 ± 1.62	2.7	U	EPA 900.0/SW-846 9310
			Americium-241	−3.78 ± 8.68	11.7	U	EPA 901.1
			Beryllium-7	−3.22 ± 22.5	40.7	U	EPA 901.1
			Beta, gross	14.5 ± 1.46	1.75		EPA 900.0/SW-846 9310
			Bismuth-212	8.57 ± 50.5	88.8	U	EPA 901.1
			Bismuth-214	6.22 ± 11.3	9.63	U	EPA 901.1
			Cesium-137	2.98 ± 2.54	4.71	U	EPA 901.1
			Cobalt-60	−1.46 ± 2.44	4.16	U	EPA 901.1
			Lead-212	7.35 ± 11.6	11.2	U	EPA 901.1
			Lead-214	1.36 ± 6.68	10.5	U	EPA 901.1
			Neptunium-237	3.36 ± 4.84	9.04	U	EPA 901.1
			Potassium-40	38.6 ± 45	40.4	U	EPA 901.1
			Radium-223	35.5 ± 49.9	92.4	U	EPA 901.1
			Radium-224	33.3 ± 46.2	84.9	U	EPA 901.1
			Radium-226	47.1 ± 109	76.9	U	EPA 901.1
			Radium-228	4.27 ± 11.3	19.7	U	EPA 901.1
			Sodium-22	3.63 ± 3.48	6.88	U	EPA 901.1
			Thorium-227	−8.92 ± 19.3	33.9	U	EPA 901.1
			Thorium-231	−39.5 ± 41.8	49.1	U	EPA 901.1
			Thorium-234	62 ± 143	151	U	EPA 901.1
			Tritium	−36.7 ± 95.8	187	U	EPA 906.0 Modified
			Uranium-235	9.3 ± 21.1	24.6	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW008	2069I	02-Dec-2022	Uranium-238	62 ± 143	151	U	EPA 901.1
WW011	2069K	29-Nov-2022	Actinium-228	0.257 ± 17.6	14.4	U	EPA 901.1
			Alpha, gross	5.74 ± 2.48	3.73		EPA 900.0/SW-846 9310
			Americium-241	−0.705 ± 13.6	20.6	U	EPA 901.1
			Beryllium-7	1.01 ± 16	28	U	EPA 901.1
			Beta, gross	20.3 ± 1.64	1.77		EPA 900.0/SW-846 9310
			Bismuth-212	6.74 ± 27.9	49	U	EPA 901.1
			Bismuth-214	0.679 ± 7.57	9.4	U	EPA 901.1
			Cesium-137	1.2 ± 5.28	3.77	U	EPA 901.1
			Cobalt-60	1.31 ± 2.2	4.15	U	EPA 901.1
			Lead-212	1.96 ± 7.16	7.17	U	EPA 901.1
			Lead-214	8.72 ± 11.2	9.51	U	EPA 901.1
			Neptunium-237	0.188 ± 3.78	6.65	U	EPA 901.1
			Potassium-40	25 ± 65.8	41.1	U	EPA 901.1
			Radium-223	36.7 ± 39.9	66.6	U	EPA 901.1
			Radium-224	56 ± 48	58.8	U	EPA 901.1
			Radium-226	−137 ± 99.2	94.6	U	EPA 901.1
			Radium-228	0.257 ± 17.6	14.4	U	EPA 901.1
			Sodium-22	−2.35 ± 2.4	3.51	U	EPA 901.1
			Thorium-227	−4.6 ± 15.2	26.2	U	EPA 901.1
			Thorium-231	−22.6 ± 49.4	53.2	U	EPA 901.1
			Thorium-234	122 ± 228	226	U	EPA 901.1
			Tritium	52.5 ± 119	209	U	EPA 906.0 Modified
			Uranium-235	6.42 ± 26.4	24.2	U	EPA 901.1
			Uranium-238	122 ± 228	226	U	EPA 901.1
		30-Nov-2022	Actinium-228	9.86 ± 17.8	17.8	U	EPA 901.1
			Alpha, gross	1.89 ± 1.62	2.59	U	EPA 900.0/SW-846 9310
			Americium-241	−3.3 ± 12.9	21	U	EPA 901.1
			Beryllium-7	2.81 ± 16.9	29.7	U	EPA 901.1
			Beta, gross	29.1 ± 1.95	2.08		EPA 900.0/SW-846 9310
			Bismuth-212	58.1 ± 34.4	45.3		EPA 901.1
			Bismuth-214	−5.45 ± 8.16	9.26	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	30-Nov-2022	Cesium-137	0.973 ± 4.49	5.46	U	EPA 901.1
			Cobalt-60	1.51 ± 2.41	4.49	U	EPA 901.1
			Lead-212	1.48 ± 8.81	5.7	U	EPA 901.1
			Lead-214	3.41 ± 13.8	8.68	U	EPA 901.1
			Neptunium-237	0.872 ± 3.73	6.6	U	EPA 901.1
			Potassium-40	84.8 ± 64.6	35.3	X	EPA 901.1
			Radium-223	−15.4 ± 37	62.4	U	EPA 901.1
			Radium-224	1.06 ± 37.9	60.1	U	EPA 901.1
			Radium-226	−81.4 ± 86	97.9	U	EPA 901.1
			Radium-228	9.86 ± 17.8	17.8	U	EPA 901.1
			Sodium-22	0.736 ± 2.11	3.99	U	EPA 901.1
			Thorium-227	−4.45 ± 14.9	25.6	U	EPA 901.1
			Thorium-231	−9.28 ± 48.9	54.9	U	EPA 901.1
			Thorium-234	116 ± 199	228	U	EPA 901.1
			Tritium	33.6 ± 111	199	U	EPA 906.0 Modified
			Uranium-235	−6.34 ± 21.1	22.8	U	EPA 901.1
			Uranium-238	116 ± 199	228	U	EPA 901.1
		01-Dec-2022	Actinium-228	−6.01 ± 13.4	14.2	U	EPA 901.1
			Alpha, gross	3.79 ± 1.76	2.53		EPA 900.0/SW-846 9310
			Americium-241	0.76 ± 6.68	11.3	U	EPA 901.1
			Beryllium-7	4.76 ± 12.6	22.6	U	EPA 901.1
			Beta, gross	25.3 ± 1.72	1.81		EPA 900.0/SW-846 9310
			Bismuth-212	32.6 ± 27.1	38.2	U	EPA 901.1
			Bismuth-214	−2.78 ± 6.53	7.09	U	EPA 901.1
			Cesium-137	2.56 ± 4.78	3.1	U	EPA 901.1
			Cobalt-60	0.32 ± 1.72	3.19	U	EPA 901.1
			Lead-212	0.594 ± 6.28	4.38	U	EPA 901.1
			Lead-214	6.24 ± 7.55	6.82	U	EPA 901.1
			Neptunium-237	0.372 ± 2.83	5.16	U	EPA 901.1
			Potassium-40	−31.8 ± 38.9	51.2	U	EPA 901.1
			Radium-223	−16 ± 29.7	50.9	U	EPA 901.1
			Radium-224	8 ± 31.1	47.9	U	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	01-Dec-2022	Radium-226	84 ± 85.2	48.3	X	EPA 901.1
			Radium-228	−6.01 ± 13.4	14.2	U	EPA 901.1
			Sodium-22	−0.484 ± 2.25	3.45	U	EPA 901.1
			Thorium-227	−4.25 ± 13.1	21	U	EPA 901.1
			Thorium-231	12 ± 43.3	31.5	U	EPA 901.1
			Thorium-234	4.57 ± 110	133	U	EPA 901.1
			Tritium	24.4 ± 103	186	U	EPA 906.0 Modified
			Uranium-235	−18.1 ± 18.4	17.3	U	EPA 901.1
			Uranium-238	4.57 ± 110	133	U	EPA 901.1
		02-Dec-2022	Actinium-228	2.16 ± 14.1	12.5	U	EPA 901.1
			Alpha, gross	0.576 ± .642	1.03	U	EPA 900.0/SW-846 9310
			Americium-241	0.944 ± 5.75	10.1	U	EPA 901.1
			Beryllium-7	−5.81 ± 11.5	19.5	U	EPA 901.1
			Beta, gross	22.9 ± 1.65	1.49		EPA 900.0/SW-846 9310
			Bismuth-212	13.4 ± 21	37.2	U	EPA 901.1
			Bismuth-214	−4.9 ± 6.25	6.53	U	EPA 901.1
			Cesium-137	1.45 ± 1.66	2.4	U	EPA 901.1
			Cobalt-60	0.69 ± 1.72	3.15	U	EPA 901.1
			Lead-212	−1.11 ± 4.57	5.09	U	EPA 901.1
			Lead-214	−2.11 ± 6.9	6.23	U	EPA 901.1
			Neptunium-237	−1.94 ± 2.69	4.45	U	EPA 901.1
			Potassium-40	27.8 ± 41.3	26	X	EPA 901.1
			Radium-223	−13.2 ± 27	46.5	U	EPA 901.1
			Radium-224	−67.1 ± 42.8	43.6	U	EPA 901.1
			Radium-226	2.55 ± 68.8	43.2	U	EPA 901.1
			Radium-228	2.16 ± 14.1	12.5	U	EPA 901.1
			Sodium-22	0.468 ± 2.08	2.65	U	EPA 901.1
			Thorium-227	2.92 ± 10.7	17.7	U	EPA 901.1
			Thorium-231	4.86 ± 34.6	28.4	U	EPA 901.1
			Thorium-234	30.4 ± 100	88.8	U	EPA 901.1
			Tritium	−18.5 ± 99.1	188	U	EPA 906.0 Modified
			Uranium-235	16.6 ± 19.3	13.4	X	EPA 901.1

Station	Permit Number	Date Collected	Analyte	Activity (pCi/L)	MDA (pCi/L)	Laboratory Data Qualifiers[a]	Analytical Method
WW011	2069K	02-Dec-2022	Uranium-238	30.4 ± 100	88.8	U	EPA 901.1

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

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

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

Analytical Method
EPA 900.0/SW-846 9310 (EPA 1980) (EPA 1986)
EPA 901.1 (EPA 1980)
EPA 906.0 Modified (EPA 1980)

Appendix F. Climate Hazard Risks

Rattlesnake (*Crotalus atrox*)

Table F-7. Climate hazard risks by asset and infrastructure type

Asset and Infrastructure System Type	Number of Assets	Cold Wave	Ice Storm	Hail	Winter Weather	Strong Wind	Drought	Wildfire	Heat Wave	Precipitation	Riverine Flooding	Other, Flooding: Precip. = 6-hr 100-yr event	Other, Mean # of Days with Min. Temp. < 32°F	Other, Mean # of Days with Max. Temp. ≥ 95°F
Specialized or mission-critical equipment (e.g., lasers, high-performance computers, or particle accelerators)	66	7.3	5.4	7.1	6.7	7.1	8.6	8.2	9.4	7.0	7.0	8.1	None	7.1
Buildings, may be broken down by type (e.g., those with critical functions or office buildings)	37	6.3	2.7	5.7	5.7	6.2	7.7	6.4	8.5	None	6.0	7.2	None	6.2
Water and wastewater systems	6	6.5	4.0	4.9	7.3	5.3	7.8	5.0	7.7	None	6.0	7.0	5.5	8.5
On-site waste disposal facility	4	5.5	1.8	4.8	4.8	5.3	7.5	8.0	7.5	None	None	6.8	None	5.3
Other	4	6.0	1.8	4.8	4.8	5.3	6.8	6.0	7.7	None	None	6.0	None	5.3
Workforce (e.g., outdoor workers, researchers, or office staff)	1	6.5	4.5	6.5	6.5	7.0	7.5	9.3	7.5	6.0	8.0	7.5	6.5	7.0
Energy generation and distribution systems	1	7.3	2.5	None	5.5	6.0	None	7.0	6.5	6.0	6.0	5.5	None	6.0
IT and telecommunication Systems	1	None	None	None	None	6.0	None	7.0	7.0	None	6.0	7.0	None	None
Transportation and fleet infrastructure	1	4.5	4.0	None	7.0	None	None	8.3	5.5	7.8	8.8	8.3	None	6.0
Ecology and land preservation	1	8.3	None	None	None	6.0	10.0	9.3	9.3	None	8.8	8.3	8.3	9.8

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

Glossary

Great-horned owl (*Bubo virginianus*)

A

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

aboveground storage tank A fixed, stationary, or otherwise permanently installed storage tank that is wholly or partially above the ground surface and used to contain oil of any kind (petroleum, non-petroleum, synthetic, animal, or vegetable).

alluvial Relating to and/or sand deposited by flowing water.

ambient air That portion of the atmosphere, external to buildings, to which the general public has access.

analyte A substance or chemical constituent undergoing analysis.

anion A negatively charged ion.

anthropogenic Of, relating to, or resulting from the influence of human beings on nature.

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

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

arroyo A deep gully cut by an intermittent stream; a dry gulch.

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

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

audit (1) An examination of records or financial accounts to check their accuracy. (2) An adjustment or correction of accounts. (3) An examined and verified account.

B

background radiation Relatively constant low-level radiation from environmental sources such as building materials, cosmic rays, and ingested radionuclides in the body.

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

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

biota The animal and plant life of a given region.

biotic Relating to or resulting from living organisms.

bird banding The process of capturing a bird, adding a leg band, and then releasing the bird unharmed.

bird survey The process of counting birds visually and audibly.

C

cation A positively charged ion.

climate A description of an area's average weather conditions and the extent to which those conditions vary over long time intervals, generally decades or centuries.**containment** An enclosed space or facility designed to contain and prevent the escape of hazardous material.

containment cell An engineered structure designed to contain and prevent the migration of hazardous waste.

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

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

D

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

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

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

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

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

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

E

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

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

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

effective dose equivalent The weighted average of the estimated biological effect of a dose of ionizing radiation in certain human organs or tissues; can be used to estimate the health-effects risk for an exposed individual.

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

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

electroplating The act of coating or covering a substrate with a thin layer of metal.

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

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

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

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

environmental management system A continuing cycle of planning, evaluating, implementing, and improving processes and actions undertaken to achieve environmental goals.

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

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

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

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

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

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

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

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 considered as a group, especially of a particular region or period. (2) The plant life characterizing a specific geographic region or environment.

foliar cover The leaf area of a plant or a plant grouping.

fungicide An agent that destroys fungi or inhibits their growth.

G

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

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

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

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

H

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

hazardous substance (1) Any material that poses a threat to human health and/or the environment. Typical hazardous substances are toxic, corrosive, ignitable, explosive, or chemically reactive. (2) Any substance that EPA requires to be reported if a designated quantity of the substance is spilled in the waters of the United States or is otherwise released into the environment.

hazardous waste site Any facility or location at which hazardous waste operations take place.

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

herpetofauna The reptiles and amphibians of a particular region, habitat, or geological period.

herpetology The study of reptiles and amphibians.

high-level radioactive waste Materials produced as a byproduct of the reactions that occur inside nuclear reactors and determined to be waste.

I

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

industrial discharge Wastewater emitting from general laboratory research operations that may contain pollutants at levels that could affect the quality of receiving waters or interfere with publicly owned treatment works.

inertial confinement fusion A type of energy research that attempts to initiate nuclear fusion reactions.

inhalation hazard Risk from materials or chemicals that present a hazard if respired (inhaled) into the lungs.

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

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

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

L

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

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

legacy site A former Environmental Restoration site.

legacy waste Waste originally generated between 1990 and 1998.

low-level radioactive waste Items that have become contaminated with radioactive material or have become radioactive through exposure to neutron radiation and determined to be waste.

M

Materials Sustainability and Pollution Prevention Program A program to facilitate the use and reuse of materials in the most productive and sustainable manner across their entire life cycle.

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

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

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

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

N

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

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

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

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

nitrate A compound containing nitrogen that can exist in the atmosphere or as a dissolved gas in water and which can have harmful effects on humans and animals. Nitrates in water can cause severe illnesses in infants and domestic animals. A plant nutrient and inorganic fertilizer, nitrate is found in septic systems, animal feedlots, agricultural fertilizers, manure, industrial wastewaters, sanitary landfills, and garbage dumps.

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

nuclear particle acceleration A method for imparting large kinetic energy to electrically charged subatomic nuclear particles by applying electrical potential differences for the purpose of physics experiments.

O

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

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

outfall The place where effluent is discharged into receiving waters.

ozone (O_3) A colorless gas soluble in alkalis and cold water; a strong oxidizing agent; can be produced by electric discharge in oxygen or by the action of ultraviolet radiation on oxygen in the stratosphere (where it acts as a screen for ultraviolet radiation).

P

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

perennial spring A source of water issuing from the ground that flows continuously, as opposed to an intermittent spring or a periodic spring.

$PM_{2.5}$ Respirable particulate matter that has a diameter equal to or less than 2.5 microns.

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

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

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

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

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

pulsed power Technology used to generate and apply energetic beams and high-power energy pulses.

Q

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

quality control A system used to determine analytical accuracy, precision, and contamination when samples are collected and to assess the data's quality and usability.

R

radioactive waste Any waste that emits energy as rays, waves, streams, or energetic particles. Radioactive materials are often mixed with hazardous waste from nuclear reactors, research institutions, or hospitals.

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

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

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

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

S

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

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

sanitary discharge Liquid effluent that is exclusive of industrial wastewater and stormwater. It includes the liquid discharges from restrooms and showers, food preparation activities, and other domestic-type activities.

secondary containment Any structure or device that has been installed to prevent leaks, spills, or other discharges of stored chemicals, waste, oil, or fuel from storage, transfer, or end-use equipment from being released to the environment. Examples of secondary containment include pans, basins, sumps, dikes, berms, or curbs.

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

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

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

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

statement of work A comprehensive description of the goods, services, or combination of goods and services for which Sandia contracts.

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

surface discharge A release of water and water-based compounds to roads, open areas, or confined areas such as reservoirs.

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

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

T

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

time-weighted composite A sample consisting of several portions of the discharge collected during a 24-hour period in which each portion of the sample is collected within a specific time frame that is irrespective of flow.

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

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

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

transuranic waste Radioactive waste containing alpha-emitting radionuclides having an atomic number greater than 92 and a half-life greater than 20 years in concentrations greater than 100 nanocuries per gram.

tritium A radioactive hydrogen isotope with an atomic mass of 3 and a half-life of 12.5 years, prepared artificially for use as a tracer and as a constituent of hydrogen bombs.

U

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

upstream (1) In the direction opposite the flow of a stream. (2) In or to a position within the production stream closer to manufacturing processes.

U.S. Forest Service withdrawal area A portion of KAFB consisting of land within the Cibola National Forest that has been withdrawn from public access for use by the U.S. Air Force and DOE.

V

vadose zone The part of the Earth between land surface and the water table.

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

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

W

waste 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.

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

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

water table The level of groundwater.

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

wind direction The direction from which the wind originates.

wind rose A graphical presentation of wind speed and wind direction frequency distribution.

References

Painted lady butterflies (*Vanessa cardui*) on a chamisa (*Ericameria Nauseosa*)

10 CFR 1021. 2011. *National Environmental Policy Act Implementing Procedures.* Washington, D.C.: Office of the Federal Register.

10 CFR 830. 2016. *Nuclear Safety Management.* Washington, D.C.: Office of the Federal Register.

10 CFR 835. 2021. *Occupational Radiation Protection.* Washington, D.C.: Office of the Federal Register.

15 U.S.C. § 2601 et seq. 1976. "Toxic Substances Control Act."

16 U.S.C. § 1531 et seq. 1973. "Endangered Species Act."

16 U.S.C. § 49. 1980. "Fish and Wildlife Conservation Act."

16 U.S.C. § 703 et seq. 1918. "Migratory Bird Treaty Act of 1918."

16 U.S.C. 3371-3378. 1981. "Lacey Act Amendments of 1981."

16 U.S.C. 2016. "Conservation."

16 USC § 668-668d. 1940. "Bald and Golden Eagle Protection Act."

20.11.100 NMAC. 1995. "Motor Vehicle Inspection—Decentralized."

20.11.20 NMAC. 2008. "Fugitive Dust Control."

20.11.21 NMAC. 1995. "Open Burning."

20.4.1 NMAC. 2018. "Hazardous Waste."

20.5 NMAC. 2018. "Petroleum Storage Tanks."

20.5.115 NMAC. 2018. "Out-of-Service Storage Tank Systems and Closure."

20.6.2 NMAC. 1995. "Ground and Surface Water Protection."

20.6.2.3106 NMAC. 2018. "Application for Discharge Permits, Renewals, and Modifications."

20.6.2.3109 NMAC. 2018. "Secretary Approval, Disapproval, Modification or Termination of Discharge Permits, and Requirement for Abatement Plans."

20.6.4 NMAC. 2000. "Standards for Interstate and Intrastate Surface Waters."

20.9 NMAC. 2007. "Solid Waste."

33 U.S.C. § 1251. 1972. "Clean Water Act."

33 U.S.C. § 2201. 2018. "America's Water Infrastructure Act of 2018."

33 U.S.C. § 40. 1990. "Oil Pollution Act."

36 CFR 60. 2012. *National Register of Historic Places.* Washington, D.C.: Office of the Federal Register.

4.10.15 NMAC. 2006. "Standards for Survey and Inventory."

4.10.8 NMAC. 2019. "Permits to Conduct Archaeological Investigations on State Land."
40 CFR 112. 2011. *Oil Pollution Prevention*. Washington, D.C.: Office of the Federal Register.
40 CFR 141. 1998. *National Primary Drinking Water Regulations*. Washington, D.C.: Office of the Federal Register.
40 CFR 1500–1508. 2005. *CEQ Regulations for Implementing the Procedural Provisions of NEPA (CEQ, 1978) (archived)*. Washington, D.C.: Office of the Federal Register.
40 CFR 268.50. 2021. *Prohibitions on Storage of Restricted Wastes*. Washington, D.C.: Office of the Federal Register.
40 CFR 280. 2021. *Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks*. Washington, D.C.: Office of the Federal Register.
40 CFR 51. 2013. *Requirements for Preparation, Adoption, and Submittal of Implementation Plans*. Washington, D.C.: Office of the Federal Register.
40 CFR 52. 2021. *Approval and Promulgation of Implementation Plans*. Washington, D.C.: Office of the Federal Register.
40 CFR 60. 2021. *Standards of Performance for New Stationary Sources*. Washington, D.C.: Office of the Federal Register.
40 CFR 61. 2021. *National Emission Standards for Hazardous Air Pollutants*. Washington, D.C.: Office of the Federal Register.
40 CFR 63. 2012. *National Emissions Standards for Hazardous Air Pollutants for Source Categories*. Washington, D.C.: Office of the Federal Register.
40 CFR 82. 2021. *Protection of Stratospheric Ozone*. Washington, D.C.: Office of the Federal Register.
40 CFR 98. 2012. *Mandatory Greenhouse Gas Reporting*. Washington, D.C.: Office of the Federal Register.
42 U.S.C. § 11001 et seq. 1986. "Emergency Planning and Community Right-to-Know Act."
42 U.S.C. § 133. 1990. "Pollution Prevention Act of 1990."
42 U.S.C. § 17001. 2007. "Energy Independence and Security Act of 2007."
42 U.S.C. § 2011. 1954. "Atomic Energy Act of 1954."
42 U.S.C. § 300f. 1974. "Safe Drinking Water Act of 1974."
42 U.S.C. § 6901 et seq. 1976. "Resource Conservation and Recovery Act of 1976."
42 U.S.C. § 6961. 1992. "Federal Facility Compliance Act of 1992."
42 U.S.C. § 7401. 1970. "Clean Air Act, as amended."
42 U.S.C. § 9601. 1980. "Comprehensive Environmental Response, Compensation, and Liability Act of 1980."
42 U.S.C. § 9601. 1986. "Superfund Amendments and Reauthorization Act (SARA) Tille III of 1986."
42 USC § 4321. 1969. "National Environmental Policy Act."
7 U.S.C. § 136. 1910. "Federal Insecticide, Fungicide, and Rodenticide Act."
ABCWUA. n.d. *ABCWUA Industrial Pretreatment Overview*. Accessed 2022. https://www.abcwua.org/sewer-system-industrial-pretreatment-overview/.
American Conference of Governmental Industrial Hygienists. 2011. *2011 Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs)*. Cincinnati: American Conference of Governmental Industrial Hygienists.
American Petroleum Institute. 2014. *API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction*. Ann Arbor: American Petroleum Institute.
Balch, J. K., B. A. Bradley, C. M. D'Antonio, and J. Gomez-Dans. 2013. "Introduced Annual Grass Increases Regional Fire Activity across the Arid Western USA (1980–2009)." *Global Change Biology*, 1:173–183.
Bureau of Land Management. n.d. *Assessment, Inventory, and Monitoring: Support for BLM AIM Projects and Programs*. Accessed February 9, 2018. http://aim.landscapetoolbox.org.
Canadian National Vegetation Classification. 2013. *Canadian National Vegetation Classification*. Accessed June 3, 2017. http://cnvc-cnvc.ca/index.cfm.
City of Albuquerque. n.d. *Air Quality Monitoring*. Accessed 2022. https://www.cabq.gov/airquality/air-quality-monitoring.
Cordell, L. S. 1997. *Archaeology of the Southwest, 2nd ed.* New York: Academic Press.
Council on Environmental Quality. 2020. *Guiding Principles for Sustainable Federal Buildings and Associated*

Instructions. Accessed 2022. https://www.sustainability.gov/pdfs/guiding_principles_for_sustainable_federal_buildings.pdf.

Cryan, P. M. 2003. "Seasonal Distribution of Migratory Tree Bats (Lasiurus and Lasionycteris) in North America." *Journal of Mammology*, 84.2:579-593.

Cusack, J. J., A. J. Dickman, J. M. Rowcliffe, C. Carbone, D. W. Macdonald, and T. Coulson. 2015. "Random versus Game Trail-Based Camera Trap Placement Strategy for Monitoring Terrestrial Mammal Communities." *PLoS One*, May 7: 10(5):e0126373. Accessed 2018. https://doi.org/10.1371/journal.pone.

DeSante, D. F., K. M. Burton, P. Velez, D. Froehlich, and K. Kaschube. 2010. *MAPS Manual 2010 Protocol. Instructions for the Establishment and Operation of Constant-Effort Bird-Banding Stations as Part of the Monitoring Avian Productivity and Survivorship (MAPS) Program.* Point Reyes Station, CA: The Institute for Bird Populations.

Dick-Peddie, W. A., W. H. Moir, and R. Spellenberg. 1996. *New Mexico Vegetation: Past, Present, and Future.* Albuquerque: University of New Mexico Press.

DoD/DOE. 2021. *DoD/DOE Consolidated Quality Systems Manual (QSM) for Environmental Laboratories.* Washington, D.C.: U.S. Department of Defense and U.S. Department of Energy.

DOE and KAFB. 2018. *2018. Memorandum of Understanding for Operation of the Public Water System Utility Between the United States Department of Energy, National Nuclear Security Administration, Sandia Field Office and Department of the Air Force, Kirtland Air Force Base.* Albuquerque: U.S. Department of Energy and Kirtland Air Force Base 377th Air Base Wing.

DOE. 1995. *Doe/EA-0945 Envrionmental Assessment for the Processing and Envrionmental Technology Laboratory (PETL).* Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, Record of Decision.

DOE. 2000. *DOE/EA-1335 Final Envrionmental Assessment for the Microsystems and Engineering Sciences Applications Complex.* Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, Record of Decision.

DOE. 2003. *DOE/EA-1457 Final Envrionmental Assessment for the Center for Integrated Nanotechnologies at Sandia National Laboratories/New Mexico.* Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, Record of Decision.

DOE. 1999. *DOE/EIS-0281, Final Site-Wide Environmental Impact Statement for Sandia National Laboratories/New Mexico.* Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, Record of Decision.

DOE. 2006. *DOE/EIS-0281-SA-04 Final Supplement Analysis for the Final Site-Wide Environmental Impact Statement for Sandia National Laboratories/New Mexico.* Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, Record of Decision.

DOE. 2003. *DOE/SWEA-1422 Final Site-Wide Environmental Assessment for Sandia California.* Albuquerque: U.S. Department of Energy, Albuquerque Operations Office, Record of Decision.

DOE. 1997. *HASL-300, The Procedures Manual of the Environmental Measurements Laboratory, 28th ed., vol. 1.* New York: U.S. Department of Energy Environmental Measurements Laboratory.

DOE O 144.1. 2009. *Department of Energy American Indian Tribal Government Interactions and Policy.* Washington, D.C.: U.S. Department of Energy.

DOE O 231.1B, Admin Change 1. 2012. *Environment, Safety and Health Reporting.* Washington, D.C.: U.S. Department of Energy.

DOE O 232.2A, Chg 1 (MinChg). 2017. *Occurrence Reporting and Processing of Operations Information.* Washington, D.C.: Office of the Federal Register.

DOE O 414.1D, Change 2 (LtdChg). 2020. *Quality Assurance.* Washington, D.C.: Office of the Federal Register.

DOE O 430.1C. 2019. *Real Property Asset Management.* Washington, D.C.: U.S. Department of Energy.

DOE O 435.1, Change 1. 2001. *Radiation Waste Management.* Washington, D.C.: Office of the Federal Register.

DOE O 436.1. 2011. *Departmental Sustainability.* Washington, D.C.: U.S. Department of Energy.

DOE O 436.1A. 2023. *Department Sustainability.* Washington, D.C.: U.S. Department of Energy.

DOE O 458.1, Change 4 (LtdChg). 2020. *Radiation Protection of the Public and the Environment.* Washington, D.C.:

U.S. Department of Energy.
DOE P 141.1. 2011. *Management of Cultural Resources.* Washington, D.C.: U.S. Department of Energy.
DOE/AL. 1987. *Comprehensive Environmental Assessment and Response Program (CEARP) Phase 1: Installation Assessment (Draft).* Albuquerque: U.S. Department of Energy, Albuquerque Operations Office.
DOE/NNSA/SFO and Sandia National Laboratories. 2022. "Notification of Class 1 Modification No. 22-022 to Resource Conservation and Recovery Act Facility Operating Permit Sandia National Laboratories, EPA ID # NM5890110518, May 10, 2022." *Letter to R. Shean (New Mexico Environment Department) from D. Hauck (U.S. Department of Energy NNSA/Sandia Field Office).* Albuquerque: U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office.
DOE/NNSA/SFO. 2021. *CY2021 Stationary Source Emissions Inventory Report for Sandia National Laboratories, New Mexico.* Albuquerque: U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office.
DOE/NNSA/SFO. 2022. *Fiscal Year 2021 DOE/NNSA Strategic Performance Evaluation Measurement Plan (PEMP).* Albuquerque: U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office.
DOE/NNSA/SFO. 2022. *FY2021 Performance Evaluation Summary.* Albuquerque: U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office.
DOE/NNSA/SFO. 2007. *Memorandum of Understanding Tijeras Arroyo Wildlife Corridor.* Albuquerque: DOE/NNAA/SFO.
DOE/NNSA/SFO. 2002. *Title V Operating Permit Application No. 515, 2002 Update, Volume 1.* Albuquerque: U.S. Department of Energy, National Nuclear Security Administration, Sandia Field Office.
Dragun, J., and K. Chekiri. 2005. *Elements in North American Soils.* Amherst: The Association for Environmental Health And Sciences.
Elston, W. E. 1967. *Bulletin 81, Summary of the Mineral Resources of Bernalillo, Sandoval, and Santa Fe Counties, New Mexico.* Socorro, NM: New Mexico Institute of Mining and Technology, New Mexico Bureau of Mines and Mineral Resources.
Environmental Measurement Laboratory, U.S. Department of Energy. 1997. *HASL-300, EML Procedures Manual, 28th edition.* EML, DOE (EML is currently part of the Department of Homeland Security).
EO 11988. 1977. "Executive Order 11988 of May 24, 1977, Floodplain Management." U.S. President.
EO 11990. 1977. "Executive Order 11990 of May 24, 1977, Protection of Wetlands." U.S. President.
EO 12898. 1994. "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." U.S. President.
EO 13112. 1999. "Executive Order 13112 of February 3, 1999, Invasive Species." U.S. President.
EO 13751. 2016. "Executive Order 13751 of December 5, 2016, Safeguarding the Nation from the Impacts of Invasive Species." U.S. President.
EO 14008. 2021. "Executive Order 14008 of January 27, 2021, Tackling the Climate Crisis at Home and Abroad." U.S. President.
EO 14057. 2021. *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability.* U.S. President.
EO 17008. 2021. "Executive Order 14008 of January 27, 2021, Tackling the Climate Crisis at Home and Abroad." U.S. President.
EPA. 1985. *50 Federal Register 28702. Hazardous Waste Management System: Final Codification Rule.* Washington, D.C.: U.S. Environmental Protection Agency.
EPA. 2022. *Clean Air Act Assessment Package-1988 CAP-88 PC), Version 4.1.1.* Washington, D.C.: U.S. Environmental Protection Agency.
EPA. 1994. *EPA 200.8, Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry.* Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1994. *EPA 245.1, Determination of Mercury in Water by Cold Vapor Atomic Absorption Spectrometry (CVAA).* Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1974. *EPA 245.2, Mercury (Automated Cold Vapor Technique) by Atomic Absorption.* Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of

Research and Development.
EPA. 1993. *EPA 300.0, Determination of Inorganic Anions by Ion Chromatography*. Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1993. *EPA 335.4, Determination of Total Cyanide by Semi-Automated Colorimetry*. Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1993. *EPA 350.1, Determination of Ammonia Nitrogen by Semi-Automated Colorimetry*. Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1974. *EPA 365.4, Phosphorous, Total (Colorimetric, Automated, Block Digester AA II)*. Cincinnatti: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1993. *EPA 410.4, EPA 410.4, Revision 2.0: The Determination of Chemical Oxygen Demand by Semi-Automated ColorimetryPhosphorous, Total (Colorimetric, Automated, Block Digester AA II)*. Cincinnatti: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1980. *EPA 900.0, Gross Alpha and Gross Beta Radioactivity in Drinking Water*. Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1980. *EPA 901.1, Gamma Emitting radionuclides in Drinking Water*. Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
EPA. 1980. *EPA 906.0 Modified, Tritium in Drinking Water*. Cincinnati: U.S. Environmental Protection Agency Environmental Monitoring Systems Laboratory Office of Research and Development.
—. n.d. *Final Rule - Phasedown of Hydrofluorocarbons*. Accessed 2022. https://www.epa.gov/climate-hfcs-reduction/final-rule-phasedown-hydrofluorocarbons-establishing-allowance-allocation.
EPA. 1993. *RCRA Facility Investigation Work Plan for the Liquid Waste Disposal System (LWDS), ER Program Sites 4, 5 and 52*. Washington, D.C.: U.S. Environmental Protection Agency.
EPA. 1986. *SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd ed.* Washington, D.C.: U.S. Environmental Protection Agency.
Findley, J. S., A. H. Harris, D. E. Wilson, and C. Jones. 1975. *Mammals of New Mexico*. Albuquerque: University of New Mexico Press.
Frick, W. F., E. F. Baerwald, J. F. Pollock, R. M. R. Barclay, J. A. Szymanski, T. J. Weller, A. L. Russell, S. C. Loeb, R. A. Medellin, and L. P. McGuire. 2017. "Fatalities at Wind Turbines May Threaten Population Viability of a Migratory Bat." *Biological Conservation*, May: 209:172-177.
Fulp, M. S., W. J. Cavin, J. R. Connolly, and L. A. Woodward. 1982. "Mineralization in Precambrian Rocks in the Manzanita-North Manzano Mountains, Central New Mexico." In *New Mexico Geological Society 33rd Annual Fall Field Conference Guidebook*, by S. G. Wells, J. A. Grambling and J. F. Callender. Socorro, NM: New Mexico Geological Society.
Furman, N. S. 1990. *Sandia National Laboratories: The Postwar Decade*. Albuquerque: University of New Mexico Press.
Geluso, K. N., and K. Geluso. 2012. "Effects of Environmental Factors on Capture Rates of Insectivorous Bats, 1971–2005." *Journal of Mammology*, 93(1):161–169.
GL-RAD-A-002. 2010. *Standard Operating Procedure GL-RAD-A-002*. Charleston: GEL Laboratories, LLC.
Grant, P. R., Jr. 1982. "Geothermal Potential in the Albuquerque Area, New Mexico." In *New Mexico Geological Society Guidebook, 33rd Field Conference*, by J.A. Grambling and S. G. Wells, 325–331. Albuquerque: New Mexico Geological Society.
Grover, H. 2021. *Fungus That Causes White-Nose Syndrome Is Found on Bats in New Mexico Caves*. May 5. Accessed 2021. https://nmpoliticalreport.com/2021/05/05/fungus-that-causes-white-nose-syndrome-is-found-on-bats-in-new-mexico-caves/.
Heilbrun, R. D., N. J. Silvy, M. E. Tewes, and M. J. Peterson. 2003. "Using Automatically Triggered Cameras

to Individually Identify Bobcats." *Wildlife Society Bulletin (1973-2006)*, 31.3:748-755. http://www.jstor.org/stable/3784595.

Herrick, J. E., J. W. Van Zee, S. E. McCord, E. M. Courtright, J. W. Karl, and L. M. Burkett. 2017. "Volume I, Core Methods." In *Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, 2nd ed*. Las Cruces: USDA-ARS Jornada Experimental Range.

ISO 14001:2015. 2015. *Environmental Management Systems: Requirements.* Geneva: International Organization for Standardization.

ISO 9001:2015. 2015. *Quality Management Systems—Requirements.* Geneva: International Organization for Standardization.

Kabata-Pendias, A. 2000. *Trace Elements in Soils and Plants, 3rd ed.* Boca Raton: CRC Press, Inc.

Kirtland Air Force Base. n.d. *Kirtland Air Force Base Environmental Assessments.* Accessed 2022. https://www.kirtland.af.mil/Home/Environment.

Kucera, T. E., and R. H. Barrett. 2011. "A History of Camera Trapping." In *Camera Traps in Animal Ecology*, by A. F. O'Connell, J. D. Nichols and K. U. Karanth. New York City: Spring.

Leopardi, S. D., D. Blake, and S. J. Puechmaille. 2015. "White-Nose Syndrome Fungus Introduced from Europe to North America." *Current Biology*, 25.6:R217-219.

Lintz, C., A. Earls, N. Trierweiler, and J. Biella. 1988. *An Assessment of Cultural Resource Studies Conducted at Kirtland Air Force Base, Bernalillo County, New Mexico.* Albuquerque: Mariah Associates, Inc.

Lozinsky, R., and R. H. Tedford. 1991. *Geology and Paleontology of the Santa Fe Group, Southwestern Albuquerque Basin, Valencia County, New Mexico.* Socorro: New Mexico Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology.

Mauro, J., and N. M. Briggs. 2005. "Assessment of Variations in Radiation Exposure in the United States, Contract Number EP-D-05-002, Work Assignment Number 1-03." *Prepared for the EPA Office of Radiation and Indoor Air.* McLean, VA.

McClaran, M. P., and T. R. Van Devender (eds). 1997. *The Desert Grassland.* Tucson: University of Arizona Press.

National Climate Data Center. n.d. *Data Tools 1981–2010 Normals.* Accessed 2020. https://www.ncdc.noaa.gov/cdo-web/datatools/normals.

National Weather Service. n.d. *The 2021 Annual Weather Highlights.* Accessed 2022. https://www.weather.gov/abq/climonhigh2021annual-mainpage.

NCRP. 2009. *NCRP Report 160, Ionizing Radiation Exposure of the Population of the United States.* Bethesda: National Council on Radiation Protection and Measurements.

NELAC Institute, The. 2009. "Volume 1, Management and Technical Requirements for Laboratories Performing Environmental Analysis." *TNI Standards.* Weatherford, TX: National Environmental Laboratory Accreditation Conference.

New Mexico Deparmtent of Game and Fish. 2018. *Threatened and Endangered Species of New Mexico: 2018 Biennial Review.* Santa Fe: New Mexico Deparmtent of Game and Fish.

New Mexico Department of Game and Fish. n.d. *Biota Information system of New Mexico.* Accessed February 2020. https://www.bison-m.org/Index.aspx.

NMED. 2014. "Approval Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan, March 2012, Sandia National Laboratories, EPA ID# NM5890110518, HWB-SNL-12-007." *Transmittal from T. Blaine on January 8, 2014.* Santa Fe: New Mexico Environment Department.

—. 2022. "Approval, Class 1 Permit Modification (With Prior NMED Approval), Sandia National Laboratories, EPA ID # NM5890110518, HWB-SNL-21-016, February 16, 2022." *Letter to D. Hauck (U.S. Department of Energy NNSA/Sandia Field Office) and J. Huff (Sandia National Laboratories, New Mexico).* Santa Fe: New Mexico Environment Department.

—. 2022. "Approval, Class 1 Permit Modification (Without Prior NMED Approval), Sandia National Laboratories, EPA ID # NM5890110518, HWB-SNL-22-013, December 12, 2022." *Letter to D. Hauck (U.S. Department of Energy NNSA/Sandia Field Office) and D. Stuhan (Sandia National Laboratories, New Mexico).* Santa Fe: New Mexico Environment Department.

—. 2021. "Approval, Mixed Waste Landfill Five-Year Report, January 2019, Sandia National Laboratories, EPA ID# NM5890110518, HWB-SNL-19-001, July 9, 2021." *Letter to J. P. Harrell (U.S. Department of*

Energy NNSA/Sandia Field Office) and P. Shoemaker (Sandia National Laboratories, New Mexico). Santa Fe: New Mexico Environment Department.

NMED. 2004. *Compliance Order on Consent, Pursuant to the New Mexico Hazardous Waste Act § 74 4 10.* Santa Fe: New Mexico Environment Department Hazardous Waste Bureau.

NMED. 2005. *EPA ID# 5890110518. Final Order, State of New Mexico Before the Secretary of the Environment in the Matter of Request for a Class 3 Permit Modification for Corrective Measures for the Mixed Waste Landfill, Sandia National Laboratories, Bernalillo County, .* Santa Fe: New Mexico Environment Department.

NMED. 1995. *Federal Facility Compliance Order, amended on December 22, 2010, by the NMED (Amendment No. 5).* Sante Fe: New Mexico Environment Department Hazardous Waste Bureau.

NMED. 2016. *Final Order No. HWB 15-18 (P), State of New Mexico Before the Secretary of the Environment in the Matter of Proposed Permit Modification for Sandia National Laboratories, EPA ID #5890110518, To Determine Corrective Action Complete with Controls at the Mix.* 2016: New Mexico Environment Department.

—. n.d. *NMED Department of Energy Oversight Bureau.* Accessed 2022. https://www.env.nm.gov/doeob/.

NMED. 2015. *Resource Conservation and Recovery Act Facility Operating Permit, EPA ID No. NM5890110518, to the U.S. Department of Energy/Sandia Corporation, for the Sandia National Laboratories Hazardous and Mixed Waste Treatment and Storage Units and Post-Closure Car.* Santa Fe: New Mexico Environment Department Hazardous Waste Bureau.

NMED. 2009. *Resource Conservation and Recovery Act, Post-Closure Care Permit (as amended), EPA ID No. NM5890110518, to the U.S. Department of Energy/Sandia Corporation, for the Sandia National Laboratories Chemical Waste Landfill.* Santa Fe: New Mexico Environment Department Hazardous Waste Bureau.

NMED. 2022. "Table A-1." In *Risk Assessment Guidance for Site Investigations and Remediation, Volume 1—Soil Screening Guidance for Human Health Risk Assessments.* Santa Fe: New Mexico Environment Department.

—. 2011. "Transmittal from J. E. Kieling on June 3, 2011." *Notice of Approval, Closure of Chemical Waste Landfill and Post-Closure Care Permit in Effect, Sandia National Laboratories, EPA ID No. NM5890110518, HWB-SNL-10-013.* Santa Fe: New Mexico Enviornment Department.

NMSA 1978 § 17-2-13 through 17-2-15. 1978. "Hunting and Fishing Regulations."

NMSA 1978 § 17-2-37 through 17-2-46. 1978. "Wildlife Conservation Act."

NMSA 1978 § 17-6-1 through 17-6-11. 1978. "Habitat Protection Act."

NMSA 1978 § 74 6B 1. 1978. "New Mexico Groundwater Protection Act."

NMSA 1978 § 74-2-1 to 74-2-17. 1978. "Air Pollution."

NMSA 1978 § 74-4-1 through 74-4-14. 1978. "New Mexico Hazardous Waste Act."

NMSA 1978 § 74-6-1 through 74-6-17. 1978. "New Mexico Water Quality Act."

NMSA 1978 § 74-9-1 through 74-9-43. 1978. "New Mexico Solid Waste Act."

NMSA 1978 § 75-6-1. 1978. "Endangered Plants."

NMSA 1978 § 76-8-1 through 76-8-4. 1978. "Protection of Native New Mexico Plants."

Northrop, S. A. 1975. *Turquoise and Spanish Mines in New Mexico.* Albuquerque: University of New Mexico Press.

PL 101-601. 1990. "Native American Graves Protection and Repatriation Act."

PL 103-344. 1994. "American Indian Religious Freedom Act Amendments of 1994."

PL 105-85. 1997. "Sikes Act Improvement Act (Title XXIX)."

PL 89-665. 1966. "National Historic Preservation Act."

PL 96-95. 1979. "Archaeological Resources Protection Act of 1979."

Rovero, F., M. Tobler, and J. Sanderson. 2010. "Camera Trapping for Inventorying Terrestrial Vertebrates." In *Manual on Field Recording Techniques and Protocols for All Taxa Biodiversity and Inventories and Monitoring.* Brussels: The Belgian National Focal Point for the Global Taxonomy Initiative.

Sandia. 2022. *2021 Annual Site Environmental Report for Sandia National Laboratories, New Mexico.* Albuquerque: Sandia National Laboratories.

Sandia. 2023. *Annual Groundwater Monitoring Report, Calendar Year 2022.* Albuquerque: Sandia National Laboratories.

Sandia. 2020. *AOP 00-03, Data Validation Procedure for Chemical and Radiochemical Data, Rivision 6.* Albuquerque: Sandia National Laboratories.

Sandia. 2023. *Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2021.* Albuquerque: Sandia

National Laboratories.
Sandia. 2004. *Chemical Waste Landfill Corrective Measures Study Report.* Albuquerque: Sandia National Laboratories.
Sandia. 2023. *Corrective Action Management Unit Report of Post-Closure Care Activities Calendar Year 2021.* Albuquerque: Sandia National Laboratories.
Sandia. 1973. *Environmental Monitoring Report for Sandia Laboratories from 1964 through 1972.* Albuquerque: Sandia National Laboratories.
—. n.d. *Facts and Figures.* https://www.sandia.gov/about/facts-figures/.
Sandia. 2022. *Fiscal Year 2023 Site Sustainability Plan.* Albuquerque: Sandia National Laboratories.
Sandia. 2022. *Hazardous and Mixed Waste Minimization Annual Report, Fiscal Year 2022.* Albuquerque: Sandia National Laboratories.
—. 1996. "List of Non-ER Septic/Drain Systems for the Sites Identified through the Septic System Inventory Program." *Memorandum by D. Bleakly on July 8, 1996.* Albuquerque: Sandia National Laboratories.
Sandia. 2006. *Long-Range Development Plan.* Albuquerque: Sandia National Laboratories.
Sandia. 2022. *MAN-004, Sandia National Laboratories/New Mexico Design Standards Manual.* Albuquerque: Sandia National Laboratories.
Sandia. 2023. *Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report, April 2021 through March 2022.* Albuquerque: Sandia National Laboratories.
Sandia. 2012. *Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan, Environmental Restoration Project, Sandia National Laboratories.* Albuquerque: Sandia National Laboratories.
Sandia. 2016. *PLA 90-11, Sandia National Laboratories Spill Prevention, Control, and Countermeasure (SPCC) Plan, Revision 09.* Albuquerque: Sandia National Laboratories.
Sandia. 2022. *QUA 94-04, Quality Assurance Project Plan for Terrestrial Surveillance at Sandia National Laboratories, Revision 10.* Albuquerque: Sandia National Laboratories.
Sandia. 2022. *Quality Assurance Project Plan for the Sample Management Office, SMO QAPP, Revision 6.* Albuquerque: Sandia National Labortories.
Sandia. 2022. *Radionuclide NESHAP Annual Report for CY 2021, SNL/NM.* Albuquerque: Sandia National Laboratories.
Sandia. 2010. *SAND2010-4971-P, Sandia in the Cold War and Post-Cold War Periods: A Statement of Historic Context for Sandia National Laboratories/New Mexico.* Albuquerque: Sandia National Laboratories.
—. n.d. *Sandia Energy.* Accessed 2022. https://energy.sandia.gov/programs/climate-security/energy-equity-environmental-justice/.
—. n.d. *Sandia Environmental Management.* Accessed 2022. http://www.sandia.gov/about/environment/environmental_management_system/index.html.
—. n.d. *Sandia Environmental Reports.* Accessed 2022. http://www.sandia.gov/news/publications/environmental_reports/.
—. n.d. *Sandia Meteorological Program.* Accessed 2022. https://snlweather.sandia.gov/.
Sandia. 2020. *Sandia National Laboratories/New Mexico Statement of Work for Analytical Laboratories, Revision 8.* Albuquerque: Sandia National Laboratories.
—. n.d. *Sandia News.* Accessed 2022. https://www.sandia.gov/news/.
—. n.d. *Sandia Pollution Prevention.* Accessed 2022. https://www.sandia.gov/about/environment/pollution_prevention/index.html.
—. n.d. *Sandia RCRA Facility Operating Permit Information Repository Index.* Accessed 2022. Approval, Class 1 Permit Modification (Without Prior NMED Approval), Sandia National Laboratories, EPA ID # NM5890110518, HWB-SNL-22-013, December 12, 2022.
—. n.d. *Sandia's Cultural Resources in New Mexico.* Accessed 2022. https://www.sandia.gov/about/sandias-cultural-resources-in-new-mexico/.
Sandia. 2022. *Site Treatment Plan for Mixed Waste Fiscal Year 2020 Annual Update, 2022.* Albuquerque: Sandia National Laboratories.
Sandia. 1995. *Site-Wide Hydrogeologic Characterization Project, Calendar Year 1995 Annual Report.* Albuquerque: Sandia National Laboratories.
Sandia. 2023. *Solid Waste Management Unit and Areas of Concern Annual Long-Term Monitoring and Maintenance.*

Report for Calendar Year 2021. Albuquerque: Sandia National Laboratories.
Sandia. 2020. *The White Paper: Occurrence of E. coli in Stormwater at SNL/NM*. Albuquerque: Sandia National Laboratories.
Sandia. 2020. *The White Paper: Occurrence of Polychlorinated Biphenyls in Stormwater at SNL/NM*. Albuquerque: Sandia National Laboratories.
SER International Science and Polcy Working Group. 2004. *The SER International Primer on Ecological Restoration*. Tucson: Society for Ecological Restoration International.
Shephard, Z. M., K. E. Con, K. R. Beisner, A. D. Jornigan, and C. F. Bryant. 2019. *USGS Open-File Report 2019-1106, Characterization and Load Estimation of Polychlorinated Biphenyls (PCBs) From Selected Rio Grande Tributary Stormwater Channels in the Albuquerque Urbanized Area, New Mexico, 2017–18*. Reston: U.S. Geological Survey.
Standard Methods Committee of the American Public Health Association, American Water Works Association, and Water Environment Federation. 2018. "2540 Solids." In *Standard Methods for the Examination of Water and Wastewater*, by W.C. Lipps, T.E. Baxter and E. Braun-Howland. Washington, D.C.: APHA Press.
StatsAmerica. n.d. *Big Radius Tool*. Accessed June 2023. http://www.statsamerica.org/radius/big.aspx.
STI/SPFA. 2001. *SP001, Standard for the Inspection of Aboveground Storage Tanks, 5th ed*. Lake Zurich. IL: Steel Tank Institute/Stell Plate Fabricators Association.
Storms, E. F., G. P. Oelsner, E. A. Locke, M. R. Stevens, and O. C. Romero. 2015. *USGS Scientific Investigations Report 2015-5006, Summary of Urban Stormwater Quality in Albuquerque, NM 2003–2012*. Reston: U.S. Geological Survey.
Thorn, C. R., D. P. McAda, and J. M. Kernodle. 1993. *Water Resources Investigation Report 93-4149, Geohydrologic Framework and Hydrologic Conditions in the Albuquerque Basin, Central New Mexico*. Albuquerque: U.S. Geological Survey.
TLI Solutions. 2006. *South Kirtland Air Force Base Operations Area Operational History*. Golden, CO: TLI Solutions, Inc.
U.S. Air Force. 2012. "Integrated Natural Resources Management Plan, Kirtland, Air Force Base, New Mexico." *Prepared October 2012 by the 377th CES/CEANQ for the 377th Air Base Wing, Kirtland Air Force Base, Signed November 2012*. Abuquerque, NM: U.S. Air Force.
U.S. Census Bureau. 2022. *Quick Facts Albuquerque City, New Mexico*. Accessed 2023. https://www.census.gov/quickfacts/fact/table/albuquerquenewmexico,NM#.
U.S. Department of Agriculture National Agricultural Statistics Service. 2017. *2017 Census by State–New Mexico*. Accessed 2021. https://www.nass.usda.gov/Publications/AgCensus/2017/.
U.S. Fish and Wildlife Service, Department of the Interior. 2022. *Endangered and Threatened Wildlife and Plants; Endangered Species Status for Tricolored Bat*. September 14. Accessed 2022. https://www.federalregister.gov/documents/2022/09/14/2022-18852/endangered-and-threatened-wildlife-and-plants-endangered-species-status-for-tricolored-bat.
University of New Mexico. n.d. *University of New Mexico Digital Repository, 2015 Multi-Sector General Permit*. Accessed 2022. https://digitalrepository.unm.edu/snl_msgp/.
—. n.d. *University of New Mexico Digital Repository, Municipal Separate Storm Sewer System (MS4) Permit*. Accessed 2022. https://digitalrepository.unm.edu/snl_ms4/.
USDA and NMDOA. 2019. *New Mexico Agricultural Statistics 2019 Annual Bulletin*. Las Cruces: U.S. Department of Agriculture and National Agricultural Statistics Services New Mexico Field Office.
Woodward, L. A. 1982. "Tectonic Framework of Albuquerque Country." In *Geology and Paleontology of the Santa Fe Group, Southwestern Albuquerque Basin, Valencia County, New Mexico*, by S. G. Wells, J. A. Grambling and J. F. Callendar. Albuquerque: New Mexico Geological Society.

Sandia
National
Laboratories