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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

2023

SANDIA NATIONAL LABORATORIES

ANNUAL SITE ENVIRONMENTAL REPORT

ALBUQUERQUE
NEW MEXICO

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

2023 Annual Site Environmental Report

for Sandia National Laboratories, Albuquerque, New Mexico

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

Abstract

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

The U.S. Department of Energy and its management and operating contractor are committed to safeguarding the environment, assessing sustainability practices, and ensuring the validity and accuracy of the monitoring data presented in this annual site environmental report. This report summarizes the environmental protection and monitoring programs in place at Sandia National Laboratories, New Mexico, during calendar year 2023. 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.

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Note to the Reader

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

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

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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	
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CGP	Construction General Permit
COVID-19	Coronavirus Disease 2019
CREST	Combined Radiation Environments for Survivability Testing
D	
DE	data excluded
DOE	U.S. Department of Energy
DOECAP	DOE Consolidated Audit Program
DP	discharge permit
E	
E. coli	*Escherichia coli*
EEEJ	energy equity and environmental justice
EISA	Energy Independence and Security Act
EO	Executive Order
EPA	U.S. 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
HSWA	Hazardous and Solid Waste Amendment
I	
ISO	International Organization for Standardization
K	
KAFB	Kirtland Air Force Base
M	
MAPS	Monitoring Avian Productivity and Survivorship
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
MSGP	Multi-Sector General Permit

Term	Definition
N	
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
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NTESS	National Technology & Engineering Solutions of Sandia, LLC
P	
PCB	polychlorinated biphenyl
PFAS	perfluoroalkyl and polyfluoroalkyl substances
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
R	
RCRA	Resource Conservation and Recovery Act
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
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
TSDF	Treatment, storage, and disposal facility
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/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µm	micrometer
m	meter
m^3	cubic meter
mb	millibar

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

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 National Nuclear Security Administration (DOE/NNSA) 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 2023.

Environmental Management System

Sandia management takes environmental stewardship seriously. A robust environmental management system was established in 2005 as part of this commitment. This environmental management system is Sandia's primary platform for implementing the environmental management programs that help achieve annual site sustainability goals. 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 annually by an external, third-party audit. For fiscal year 2023, the Environmental Aspects and Impacts Analysis found that the significant aspects for SNL/NM operations were: greenhouse gas air emissions, hazardous materials and waste, 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* and EO 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability*. Sandia's most recent plan, *Fiscal Year 2024 Site Sustainability Plan*, describes performance status for fiscal year 2023. Highlights for SNL/NM in 2023 include (1) decreasing the year-over-year greenhouse gas emissions relative to fiscal year 2022; (2) updating the implementation status of the vulnerability assessment and resilience plan resiliency solutions; (3) decreasing potable water intensity by 35.9 percent relative to a fiscal year 2021 baseline; and (4) meeting sustainable building standards, with 33.3 percent of the building count complying with the *Guiding Principles for Sustainable Federal Buildings*. In contrast, energy intensity increased by 19.1 percent relative to baseline fiscal year 2015.

Additionally, SNL/NM personnel diverted 75.2 percent of nonhazardous solid waste from treatment and disposal facilities and diverted 83.8 percent of construction and demolition waste from treatment and disposal facilities. Sustainable acquisition reporting requirements were added into the request for information and request for quote processes. Additionally, new rules were created in the Oracle software system to add the updated 350APR "green language" clause into applicable contract categories to promote sustainable acquisition.

Also, SNL/NM personnel managed electronics stewardship, with 93.7 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/NNSA assesses environmental performance through data measures and indicators and then reports on this as part of an annual performance evaluation. The performance evaluation is the DOE/NNSA report card that ascribes a rating for five key performance goals and an overall rating. During the most recent evaluation, Sandia earned a rating of very good for the Mission Enablement performance goal, which includes the objective of delivering effective, efficient, and responsive Environment, Safety, and Health quality. By exceeding almost all of the objectives and key outcomes under the performance goals, Sandia received an overall rating of excellent for fiscal year 2023.

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." For this

annual site environmental report, the Occurrence Reporting and Processing System database was queried for occurrences related to environmental programs/compliance. During 2023, four occurrences met the criteria for reporting in this annual site environmental report.

All environmental monitoring in 2023 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. In Bernalillo County, New Mexico, the City of Albuquerque Air Quality Program implements air quality regulations and standards established by the U.S. Environmental Protection Agency (EPA) and the Albuquerque Bernalillo County Air Quality Control Board. During 2023, emissions from permitted and registered stationary sources were 8.9 tons of combined hazardous air pollutants, 26.21 tons of volatile organic compounds, 11 tons of carbon monoxide, 1.79 tons of nitrogen oxides, 8.7 tons of particulate matter with a diameter ≤ 10 μm, and 0.09 tons of sulfur dioxide. These emissions were within permitted limits. During fiscal year 2023, SNL/NM operations directly emitted a total of 87,058 tons of carbon dioxide-equivalent emissions. Activities resulting in greenhouse gas emissions were below federal regulatory reporting thresholds.

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 (i.e., $PM_{2.5}$) was measured at two monitoring locations (CPMSTEOM and A3BAM). The 2023 annual average for one-hour $PM_{2.5}$ measurements was 3.19 $\mu g/m^3$ at A3BAM and 5.75 $\mu g/m^3$ at CPMSTEOM. The highest monthly average PM10 (particulate matter that has a diameter equal to or less than 10 μm) concentration in fiscal year 2023 was 63.49 $\mu g/m^3$, which occurred in the first quarter of fiscal year 2023. The PM_{10} samples are also analyzed for metals and radiological constituents, and the majority of the fiscal year 2023 averages were well below threshold limit values. The average result for gross alpha was measured but the data was excluded due to quality assurance procedures; the average result for gross beta was measured at 9.51E-03 pCi/m^3. Both of these radiological constituents have a threshold limit value of zero.

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 2023. Routine instrument calibrations and a preventive maintenance field program ensured data quality. In 2023, local conditions across SNL/NM were generally in line with the statewide pattern, observing warmer and drier conditions than average and ending the year in severe drought.

Radionuclide National Emission Standards for Hazardous Air Pollutants Program. Radionuclide air emissions from Sandia facilities are reported each year. In 2023, 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.

Chemical Information System and Chemical Exchange Program. The Chemical Information System is a comprehensive chemical information tool used to track workplace chemical and biological containers by location. The primary drivers for the Chemical Information System are state and federal regulations, including the Emergency Planning and Community Right-to-Know Act. The Chemical 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. In 2023, chemical containers at SNL/NM were tracked along with information about any related chemical hazards. Three hundred and two chemicals were submitted to the Chemical Exchange Program in 2023; 252 chemicals were accepted, and 56 chemicals were reapplied.

Cultural Resources Program. The Cultural Resources 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. The Cultural Resources Program is focused on two main cultural resource categories: archaeological resources and historic buildings. In 2023, 12 archaeological surveys were conducted; no cultural resources were affected by ongoing or proposed activities.

The historian completed historic building assessments in response to new proposed actions at 32 properties that required consultation in 2023. Consultation between DOE/NNSA and the State Historic Preservation Officer is complete on 28 of the actions. Consultation is ongoing for four projects at three buildings begun in 2023; they are expected to be completed in 2024. In accordance with the memorandum of agreement between DOE/NNSA and the New Mexico State Historic Preservation Officer, Building 862 was demolished in 2023. The consultation on demolishing Structure S6624 and Building 6625, begun in 2021, was completed in 2023, and a signed memorandum of agreement is in place between DOE/NNSA and the New Mexico State Historic Preservation Officer.

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; reptile and amphibian, bird, and wildlife surveillance; passive bat monitoring using bioacoustic recordings; and Eco Ticket responses.

In 2023, the Assessment, Inventory, and Monitoring vegetation monitoring strategy was used to quantitatively assess three new plots. Two plots were established in open canopy woodland, and one plot was established in closed canopy woodland. Data collected on each 0.7 acre plot include line point intercept of vegetation with height, a complete species inventory, gaps between vegetation canopies, gaps between vegetation bases, soil stability, tree height, tree diameter, and tree density.

Vegetation Surveillance. In 2023, the Ecology Program revegetation subject matter expert supported three ecological restoration projects, participated in 17 Facilities Conceptual Location Analysis planning processes, reviewed 50 National Environmental Policy Act (NEPA) checklists, and monitored ongoing restoration projects.

Reptile and Amphibian Surveillance. During 2023, herpetofaunal field monitoring at the Scale Compatibility Dome and west of Technical Area III site locations, 107 individuals representing 14 species were recorded using drift fence arrays with funnel traps: 7 snake species, 6 lizard species, and 1 amphibian species. Species diversity was slightly lower compared to average at both sites in 2023.

Bird Surveillance. In 2023, the winter bird survey was completed in February. Forty-one species and 364 individuals were detected. The breeding bird survey was conducted in June 2023. Fifty-one species and 519 individuals were detected across the transect. Monitoring Avian Productivity and Survivorship protocol banding sessions were run from May through July. Nineteen species were captured, and 90 individuals were newly banded. Six fall migration banding sessions were run from September to October 2023. Seventeen species and 56 individuals were newly banded.

Remote Camera Surveillance of Mammals and Other Wildlife. Ecology Program personnel maintain two wildlife water guzzlers: the Madera Canyon Guzzler and the Range Guzzler. Since June 2005, 71 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 2023, 20 different species were observed at the Madera Canyon Guzzler, including 7 mammal species and 13 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 2023, 24 different species were observed at the Range Guzzler, including 8 mammal species and 16 bird species.

Eco Ticket Request System. Sandia personnel use Eco Ticket, a web-based ticketing system, to report wildlife issues or concerns and request biological surveys. In 2023, 221 wildlife issues or requests were received through Eco Ticket. There were 50 snake removal tickets in 2023, an increase from 2022. Of the 50 tickets, 23 were for venomous snakes. Ecology Program personnel received 530 Eco Ticket requests for biological surveys in 2023. 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 135 requests were for projects that did not fall under routine maintenance activities. Outdoor testing and large-scale construction activities made up the majority of these requests.

Environmental Education Outreach. Environmental Education Outreach personnel connect with the local community and Sandia personnel through organized events. In addition to complying with requirements, it is recognized that communicating with the local community and Sandia personnel about reducing environmental impacts at work and at home is important. An integrated approach is employed to communicate environmental awareness to personnel via newsletters, annual campaigns, and outreach events. Events conducted in 2023 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 Team. Environmental Release, Response, and Reporting Team 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. In 2023, no releases met the criteria for reporting to the U.S. Environmental Protection Agency (EPA). The chemical inventory report was submitted to support compliance with the Emergency Planning and Community Right-to-Know Act.

In 2023, there was one release to the environment that required reporting to the New Mexico Environment Department. In August, approximately 10 gallons of vanadium electrolyte were released from a commercial flow battery system. The batteries were drained and removed, and the contaminated asphalt, concrete, and soil were also removed. Final soil samples confirmed that all contaminated material had been removed.

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 Resource Conservation and Recovery Act, as amended by the Hazardous and Solid Waste Amendments of 1984. In 2023, six sites remained in corrective action status, including three groundwater areas of concern and three active test facilities. In 2023, routine samples were collected for the three groundwater areas of concern: Technical Area V Groundwater, Tijeras Arroyo Groundwater, and Burn Site Groundwater. For the Technical Area V Groundwater area of concern, 17 monitoring wells were sampled in 2023. Several results exceeded the maximum contaminant levels for trichloroethene (six wells) and nitrate plus nitrite (two 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 two wells. For the Burn Site Groundwater area of concern, 13 wells were sampled in 2023. Nitrate plus nitrite exceeded the maximum contaminant levels in five wells.

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 permits. In 2023, 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. All Resource Conservation and Recovery Act Facility Operating Permit-required physical inspections were completed in 2023. The need for replacement of weathered signs was observed and resolved in 2023.

Groundwater Monitoring. At the Chemical Waste Landfill, semiannual groundwater monitoring was performed in January and July 2023 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. No analytes were detected at concentrations exceeding EPA maximum contaminant levels or post-closure care permit-defined hazardous concentration limits.

At the Mixed Waste Landfill, semiannual groundwater monitoring was performed in May/June and November in 2023. 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 April to analyze for perfluorohexane sulfonic acid, perfluorooctane sulfonic acid, and perfluorooctanoic acid in accordance with a New Mexico Environment Department request. There were no detections above laboratory method detection limits in any groundwater sample for those polyfluoroalkyl substances (PFAS).

In addition, Groundwater Monitoring Program personnel sampled 16 wells and one spring in 2023. 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 Coyote Springs and five 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.

Soil Vapor Monitoring. The 2023 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 2023 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 2023, 200 gallons of leachate were removed from the leachate collection system compared to 218 gallons in 2022. The evapotranspirative cover continues to meet revegetation criteria and is in excellent condition with even coverage of mature, native perennial grasses.

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 goal. Sandia has changed its Zero Waste by 2025 initiative to Zero Waste Every Day. The goal will be accomplished when operations meet the internationally accepted definition of "Zero Waste," which means reducing waste by 90 percent from the baseline year (2008). Since establishing the goal of

Zero Waste by 2025, the diversion rate (percentage of total waste diverted from a landfill or incinerator) at SNL/NM went from 47 percent in the baseline year of 2008 to 64 percent in 2022. The new Zero Waste initiative, Zero Waste Every Day, had a diversion rate of 75 percent reported at the end of 2023.

The Materials Sustainability Program successfully lead an interdepartmental working group that deployed the Sustainable Facilities Tool (SFTool+) in 2023 to track compliance with new DOE sustainability requirements. In addition, Program staff ensured that the 350APR "green language" clause continued to be populated in applicable contract categories valued over $250,000. The 350APR clause states that a subcontractor shall "provide its services in a manner that promotes the expanded use of green products, reduces greenhouse gas emissions and protects the health and wellbeing of building occupants, service providers and visitors in the facility." The addition of this clause in subcontractor contracts and the requirement to use SFTool+ for reporting generated data for over $38,000,000 spent in fiscal year 2023. This data captured purchases that were compliant and noncompliant with environmental specifications in seven federal programs outlining product parameters. Data collected on biobased product purchases increased by 114 percent from 2022, which provides evidence that the implementation of the SFTool+ has allowed Sandia to improve compliance with the governing Federal Acquisition Regulations.

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. 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 determine whether proposed projects and activities have been evaluated in existing NEPA documentation. In addition, other relevant environmental program subject matter experts review NEPA checklists to identify any applicable environmental permitting and/ or other requirements for the proposed work and then communicate this to project managers. In 2023, program personnel reviewed 323 proposed projects through the NEPA online tool, and an additional 326 routine maintenance activities were reviewed through the Routine Maintenance Criteria SharePoint site.

As part of ongoing coordination with the KAFB NEPA office, 23 Air Force 813 forms were submitted by NEPA Program personnel on behalf of the Sandia Field Office. In addition, Sandia NEPA Program personnel developed a corrective action plan in 2023 to create efficiencies and ensure that deliverables are comprehensive and actionable and meet statutory and regulatory requirements. The goal of the corrective action plan is to better facilitate DOE/NNSA decision making to effect efficient mission execution at SNL/NM. NEPA Program personnel continued to support DOE/NNSA in the preparation of a new site-wide environmental impact statement for SNL/NM. Program personnel also continued to provide ongoing support for NEPA and related environmental documentation requirements for two capital line-item proposed projects that are in the design phase, Power Sources Capability and Combined Radiation Environments for Survivability Testing (CREST).

Terrestrial Surveillance Program. Terrestrial Surveillance Program personnel collect various environmental sample media, including surface soil, arroyo sediment, and river sediment samples at on-site, off-site, and perimeter locations. Soil and sediment samples are analyzed for radiological and nonradiological (metals) constituents. Statistical analysis was performed on sample results from 2023. When the sample results at an on-site location are significantly different from and greater than the off-site and perimeter results and the sample results at the on-site location are trending upward, it is noted for further evaluation.

Analysis of 2023 results for selected radionuclides revealed no statistically significant population differences or any increasing trends in the on-site location sample results. Analysis results for metals identified 12 instances of statistical significance for the following metals: aluminum, arsenic, beryllium, chromium (total), copper, iron, nickel, selenium, and thallium. The results from this group of metals were compared to reference values and to results from previous years. No results met or exceeded New Mexico Environment Department soil screening levels for residential use.

Three on-site locations were analyzed for high explosive compounds; there were no detections above the method detection limit. 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 2023.

Waste Management Program. Wastes (including solid wastes, hazardous wastes, and radioactive wastes) are generated during ongoing operations. The wastes are collected and managed (i.e., stored, treated, and packaged) at SNL/NM before shipment to off-site permitted facilities. In 2023, the following types of waste were handled and shipped: low-level radioactive waste, mixed low-level radioactive waste, hazardous waste, polychlorinated biphenyl waste, other regulated waste (asbestos containing wastes, chemical, and infectious waste), and solid waste. Materials were recycled in the categories of commercial, construction, and demolition solid waste and regulated or chemical wastes. The quantities of each type of waste vary from year to year, and the 2023 quantities were similar to quantities generated and managed in previous years.

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 four times in 2023.

During 2023, DOE/NNSA 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, Sandia personnel managed 1.76 cubic meters of mixed transuranic waste and 0.10 cubic meters of mixed waste that was subject to the Federal Facility Compliance Order.

Representatives of the New Mexico Environment Department Hazardous Waste Bureau performed a no-notice hazardous waste compliance evaluation inspection of the entire

SNL/NM site from April 3 to 5, 2023. The New Mexico Environment Department issued a final notice of violation on December 1, 2023. The notice of violation included two findings related to container labels and one finding related to emergency equipment. All findings were corrected during the inspection, and no further action was required.

Water Quality Programs.

Sandia personnel monitor water quality through numerous programs—including the Oil Storage Program, Safe Drinking Water Protection Program, Stormwater Program, Surface Discharge Program, and Wastewater Discharge Program—to ensure compliance with federal, state, and local requirements.

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 2023, the inventory of oil storage containers operating under the *Sandia National Laboratories Spill Prevention, Control, and Countermeasure Plan* included 47 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. There were no reportable oil spills in 2023.

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 2023, 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 all required compliance activities were conducted in 2023. 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 five 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 2023, 19 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 on August 17, 2023 and Lagoon 2 on August 28, 2023. 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.

Wastewater Discharge Program. Wastewater is discharged from six permitted on-site outfalls. In 2023, 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 January and June 2023, 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/NNSA and Sandia with six Pretreatment Gold Awards in 2023. 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.

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

Sandia skies

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 (Sandia) is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC (NTESS), a wholly owned subsidiary of Honeywell International Inc., for the DOE National Nuclear Security Administration (DOE/NNSA). The DOE/NNSA Sandia Field Office administers the Prime 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 2023 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.

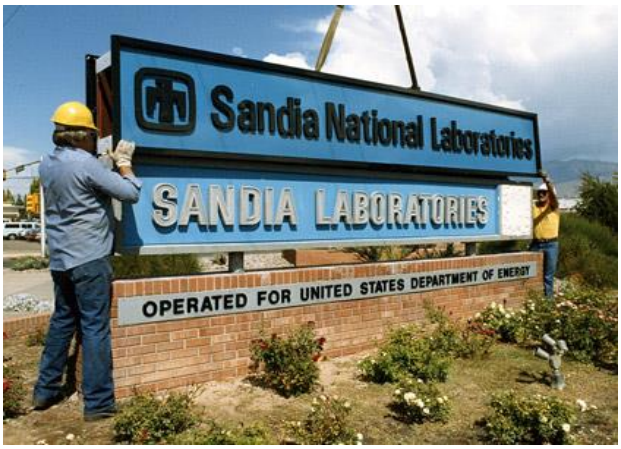
1.1 Purpose

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 16,736 employees and contractors in 2023, with 13,361 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.

Sandia conducts operations on DOE/NNSA-owned property, non-DOE/NNSA-owned property contracted from other federal and state agencies, and privately owned leased property. Sandia sites located on DOE/NNSA-owned property comprise 2,938 acres and include five technical areas (DOE 1999). At non-DOE/NNSA-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/NNSA 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 6.25 million gross square feet of existing facilities at SNL/NM (Sandia n.d.).

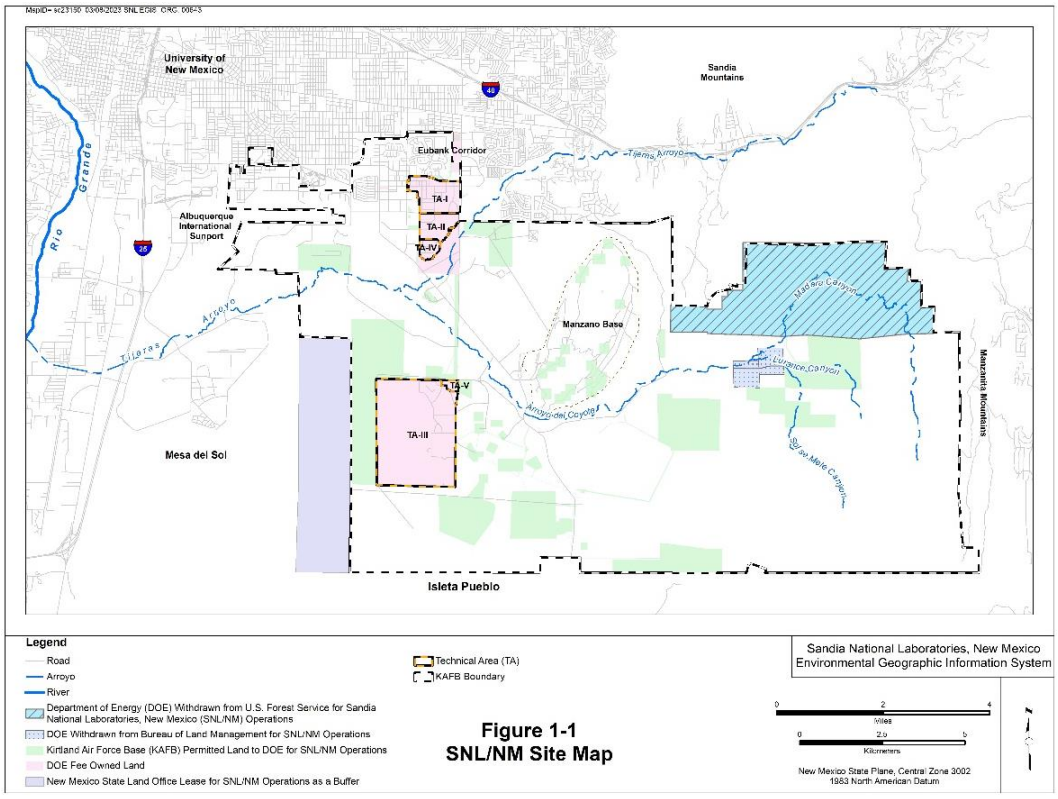


Figure 1-1. SNL/NM location, including technical areas and permitted areas

1.4 Demographics

New Mexico is the fifth-largest state in the United States, encompassing approximately 121,000 square miles. New Mexico's 2023 population was 2,114,371 (U.S. Census Bureau 2024). Albuquerque is the largest city in the state, with an estimated population of 560,274 in 2023 (U.S. Census Bureau 2024). The estimated metropolitan area population within a 50-mile radius of Albuquerque (Figure 1-2) was 1,078,252 in 2023 (StatsAmerica n.d.).

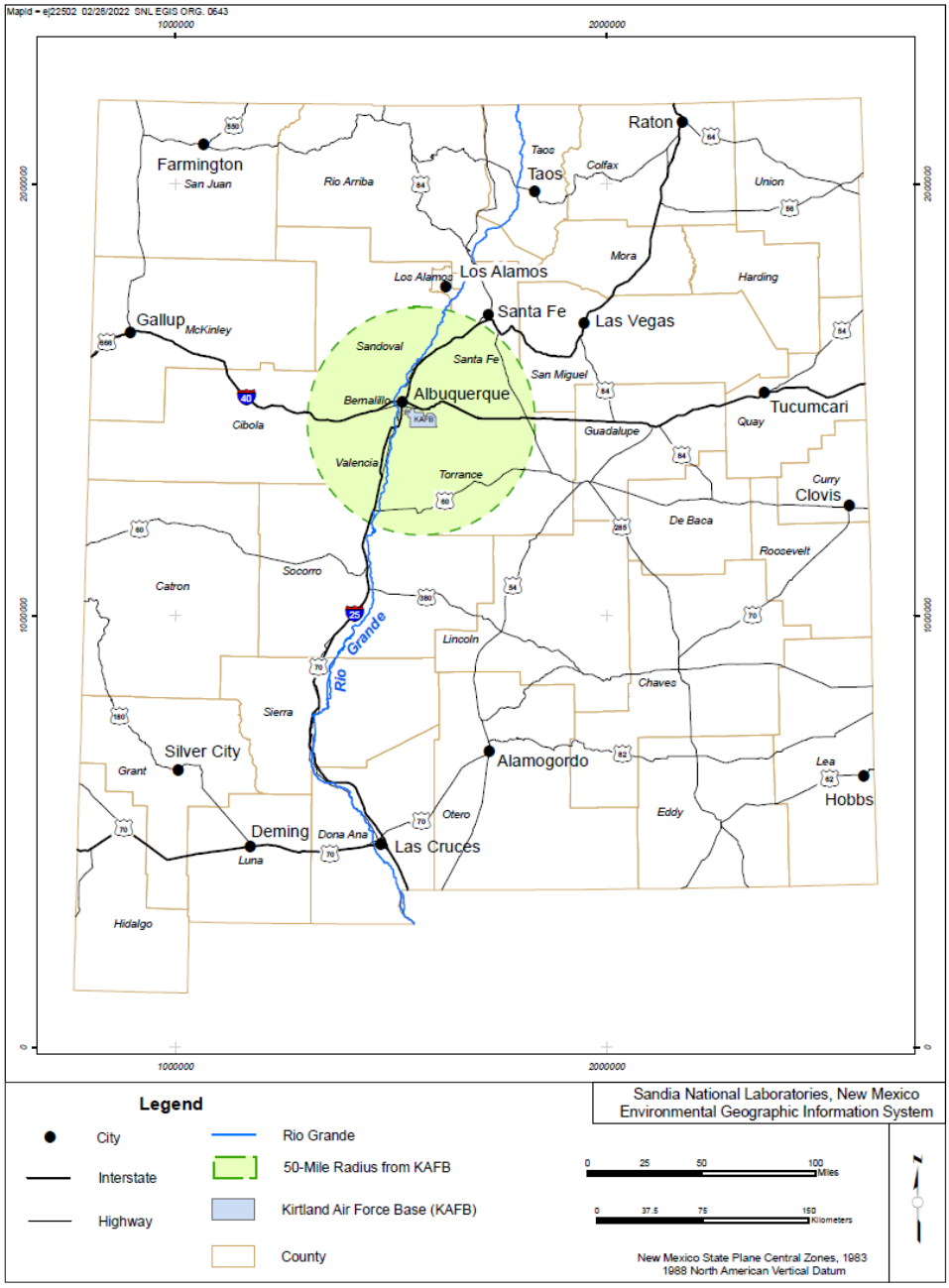


Figure 1-2. State of New Mexico, including counties

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

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/NNSA 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 dry except for brief periods 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 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.

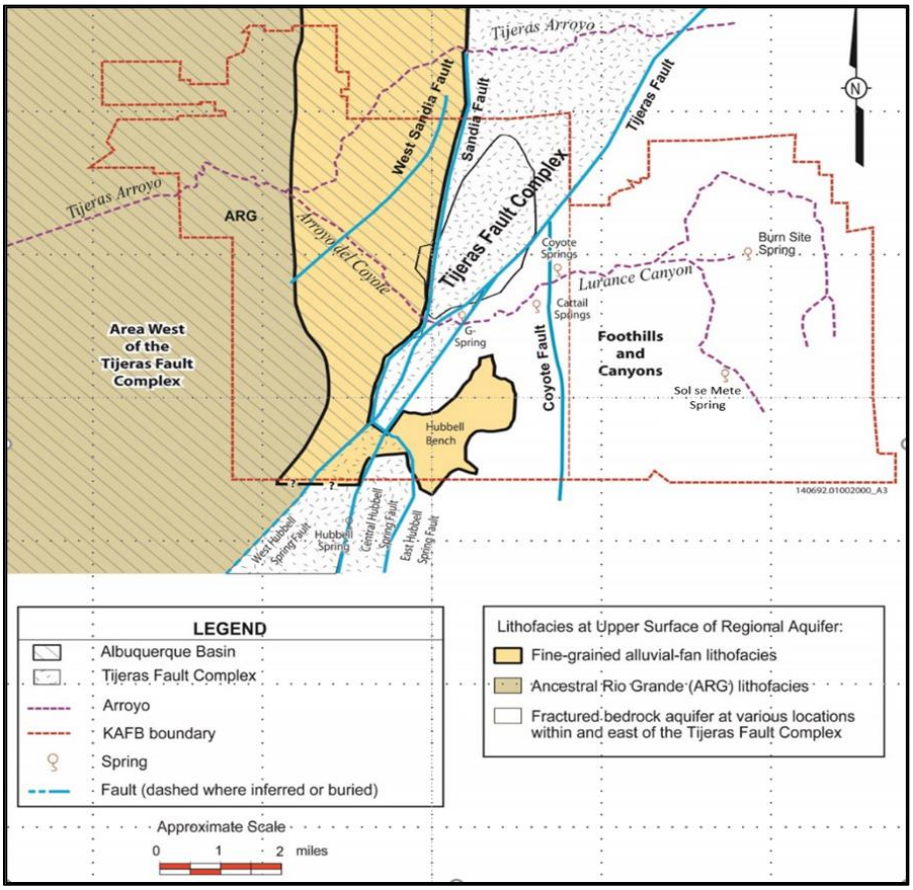


Figure 1-3. Faults and hydrogeologically distinct areas

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.

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

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 Sandia and Manzanita Mountains to the east of SNL/NM and flows through KAFB in a roughly northeast to southwest direction. The Tijeras Arroyo is a 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. Discharges from Tijeras Arroyo to the Rio Grande occur infrequently, in response to large storm events which occur most typically during the summer monsoon season (July-October).

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.

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 46 to 362 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.

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 at SNL/NM 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.

A diverse set of plant and animal communities have resulted from the large tracts within SNL/NM and KAFB that are undeveloped. Undeveloped land generally refers to natural areas that have not been altered for human use.

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 3 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*
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, Manzanita, 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 mountains toward the Rio Grande Valley. These topographically induced wind flows can be enhanced or negated by weather systems that move across the southwestern United States. The strongest winds occur in the spring when monthly wind speeds average 10 miles per hour and wind gusts commonly reach 50 miles per hour. Chapter 5 provides more information on meteorological conditions.

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 negative environmental impacts and environmental risk, as well as 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

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 1-4.

Figure 1-4. Environmental programs at SNL/NM

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

- Cultural Resources Program (Chapter 2)
- Ecology Program (Chapter 3)
- Terrestrial Surveillance Program (Chapter 4)
- Air Quality Compliance Program and related programs (Chapter 5)
  - Ambient Air Surveillance Program (Section 5.2)
  - Meteorology Program (Section 5.3)
  - Radionuclide National Emission Standards for Hazardous Air Pollutants Program (Section 5.4)
- Water Quality Programs (Chapter 6)
  - Oil Storage Program (Section 6.1)
  - Safe Drinking Water Protection Program (Section 6.2)
  - Stormwater Program (Section 6.3)
  - Surface Discharge Program (Section 6.4)
  - Wastewater Discharge Program (Section 6.5)
- Other Environmental Programs (Chapter 7)
  - National Environmental Policy Act Program (Section 7.1)
  - Environmental Education Outreach (Section 7.2)
  - Chemical Information System and Chemical Exchange Program (Section 7.3)
  - Materials Sustainability and Pollution Prevention programs (Section 7.4)
  - Waste Management Program (Section 7.5)
  - Environmental Restoration Operations (Section 7.6)

- Long-Term Stewardship Program (Section 7.7)
- Environmental Release, Response, and Reporting Team (Section 7.8)

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 Resources Program

Historic Building 6501, the Non-Hazardous Assembly Facility (photograph by Norman Johnson, October 25, 2011)

OVERVIEW ▪ Cultural Resources 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/NNSA is responsible for ensuring that impacts on cultural resources are assessed and appropriate actions are taken to mitigate those impacts.

The Cultural Resources Program personnel focus 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. There are two main cultural resource categories: archaeological resources and historic buildings.

Between 1977 and 2023, 89 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.

Historic building surveys and assessments completed since 1997 identified multiple properties and the TA-II Historic District and the Old Centrifuge Historic District as eligible for inclusion in the National Register of Historic Places. Seven additional historic districts have been identified and are recommended as eligible. Over time, properties have been demolished or undergone renovations that undercut their integrity, making them ineligible.

DOE/NNSA has determined additional properties to be eligible in consultation with the New Mexico State Historic Preservation Officer. Currently, there are 72 properties eligible for the National Register of Historic Places. 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/NNSA, and the Advisory Council on Historic Preservation. In succeeding years, the facilities were decontaminated and torn down. In 2011, the Old Centrifuge Historic District was similarly demolished after consultation and agreement between DOE/NNSA and the New Mexico State Historic Preservation Officer.

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.

Obsidian projectile point (arrowhead)

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.

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 Oxnard Field 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 the fuze was done at Johns Hopkins University and the University of Chicago. 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 and identified as Coyote Test Field.

In July 1945, Los Alamos 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 was 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/NNSA 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 Scientific 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 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/NNSA 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/NNSA.

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/NNSA, the New Mexico Historic Preservation Division, and tribal sovereign nations. See Chapter 7 for details on state and federal requirements related to cultural resources.

2.4 Archaeological Resources

The Sandia archaeological staff helps Sandia personnel and DOE/NNSA 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.

Program Activities and Results 2023: Archaeological Resources

In 2023, the archaeological staff completed 12 pedestrian surveys, reviewing more than 120 outdoor projects and surveying more than 52.96 acres. Proposed projects included utility work, building modifications, road grading, and ongoing operational activities. Multiple archaeological reviews were conducted for projects on DOE/NNSA land in the Cibola

National Forest in the U.S. Forest Service withdrawn area, as well as on and near DOE/NNSA-permitted property and environmental restoration sites. These reviews resulted in more than 11 written memos provided to both DOE/NNSA and project owners associated with the proposed work. The memos provided guidance regarding cultural resource concerns and mitigative measures. Archaeological staff also participated in 14 conceptual analyses to support site planning. The support included research that identified any potential effects that might result from the proposed site plans.

2.5 Historic Buildings

The Sandia historian surveys and assesses historic properties in support of the National Historic Preservation Act, Section 106, for all properties owned by DOE/NNSA and used by Sandia personnel at SNL/NM, whether the properties are located on land owned by DOE/NNSA 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, analyzes 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 the proposed work will have an adverse effect on any historic properties or districts, including the property where the work is occurring. Information regarding the property, photographs, 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 NNSA 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/NNSA identified eight historic districts and three individually eligible buildings. DOE/NNSA did not consult with the State Historic Preservation Office regarding the 2010 recommendation; however, the assessments have been used by DOE/NNSA 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/NNSA 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 eligible to the National Register of Historic Places 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/NNSA 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/NNSA and the State Historic Preservation Office establish a memorandum of agreement specifying the actions needed to ensure that the building or appearance, architecture, history, and significance will be preserved. In most instances, the historian prepares Historic American Building Survey/Historic American Engineering Record documentation, including high-resolution 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 determined to be eligible to the National Register of Historic Places 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]
185-Foot Drop Tower (S6515)	S6515	11/13/2023	Yes	Yes	No
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

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 801		12/21/2000	Yes	Yes	No
Building 802		12/21/2000	Yes	Yes	No
Building 803		11/13/2023	Yes	Yes	Yes
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 833		07/07/2022	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 858N		02/21/2023	Yes	Yes	No
Building 860		12/21/2000	Yes	Yes	No
Building 862		01/28/2022	No	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 953		03/15/2023	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 6505A		03/15/2023	Yes	Yes	No
Building 6523B		12/17/2003	Yes	Yes	No
Building 6560		12/17/2003	Yes	Yes	No
Building 6570		12/17/2003	Yes	Yes	No
Building 6580B		01/17/2023	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 6595		05/17/2022	Yes	Yes	No
Building 6597		02/01/2022	Yes	Yes	No
Building 6610		12/17/2003	Yes	Yes	No
Building 6620		11/7/2017	Yes	Yes	No
Building 6631		03/03/2022	Yes	Yes	No
Building 8895		07/29/2008	No	No	Yes
Building 9920		06/03/2017	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 9926		06/22/2023	Yes	Yes	No
Building 9938		12/13/2023	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 high resolution photographs, photographic descriptions, and a written historical and architectural summary of a property.

Program Activities and Results 2023: Historic Buildings

In 2023, the historian completed historic building assessments in response to new proposed actions at 32 properties that required consultation. Consultation between DOE/NNSA and the State Historic Preservation Officer is complete on 28 of the proposed actions. Consultation is ongoing for four projects at three buildings begun in 2023; they are expected to be completed in 2024.

Nineteen of the consultations involved re-roofs or roof repairs, while seven involved modifications, and two were for proposed demolition. In addition to the new 2023 assessments and consultations, DOE/NNSA and the New Mexico State Historic Preservation Officer completed consultation on nine re-roof projects that had not been completed in 2022. Consultation on the demolition of four obsolete observation towers in Tech Area III was also completed in 2023 and a memorandum of agreement was signed stipulating the actions Sandia must take prior to demolition.

Consultation on the demolition of Building 862 and Building 6592, begun in 2021, was completed in 2022. DOE/NNSA 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. After the initial stipulations were met—to obtain State Historic Preservation Office approval of photographs and drawings of the buildings prior to demolition—Building 862 was demolished in 2023. Building 6592 has not been demolished yet. The consultation on demolishing Structure S6624 and Building 6625, begun in 2021, was completed in 2023 and a signed memorandum

of agreement is in place between DOE/NNSA and the New Mexico State Historic Preservation Officer.

2.6 Quality Check and Validation of Process

Each fiscal year, Cultural Resources 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 adhering 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 2023 checklists indicated that no federal actions occurred prior to cultural review.

2.7 Additional Activities

In 2023, Sandia's Cultural Resources Program personnel held a Cultural Resources Town Hall within Sandia during National Historic Preservation Month (May). The goal was to inform the workforce of the program, its purpose, its goals, and its relevance to day-to-day work within Sandia. The meeting was successful, drawing an audience both online and in person. The team fielded a variety of questions and there was clear audience interest. The intent is to continue this as an annual event.

Cultural Resources Program 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.).

Chapter 3. Ecology Program

Greater roadrunner (*Geococcyx californianus*)

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/NNSA-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 3-1 lists sampling locations at SNL/NM. Data are collected on vegetation, reptile, amphibian, mammal, and bird species that currently inhabit DOE/NNSA-controlled land:
  - Vegetation monitoring (Section 3.1)
  - Reptile and amphibian monitoring (Section 3.2)
  - Mammal monitoring (Section 3.3 and Section 3.5)
  - Bird monitoring (Section 3.4)

- 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 4 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. *Vegetation* refers to plant life or the total plant cover of an area. *Habitat* refers to the place or environment where a plant or animal naturally or normally lives and grows.

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 3-1.

Table 3-1. Sampling locations with vegetation type or habitat description

Sampling Site Name	Vegetation Type or Habitat Description
Grasslands	
Coyote Springs	Wetland
Tijeras Arroyo 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
Open Canopy Plot-093	Open canopy woodland
Open Canopy Plot-086	Open canopy woodland
Closed Canopy Plot-134	Closed canopy woodland

SC Dome = Scale Compatibility Dome

3.1 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 3-1). 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.

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).

3.1.1 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 2023, three AIM plots were established and completed (Figure 3-1). Data collected at each of the AIM plots to date are important in providing baseline information; however, comparing plot assessments is not currently possible 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.

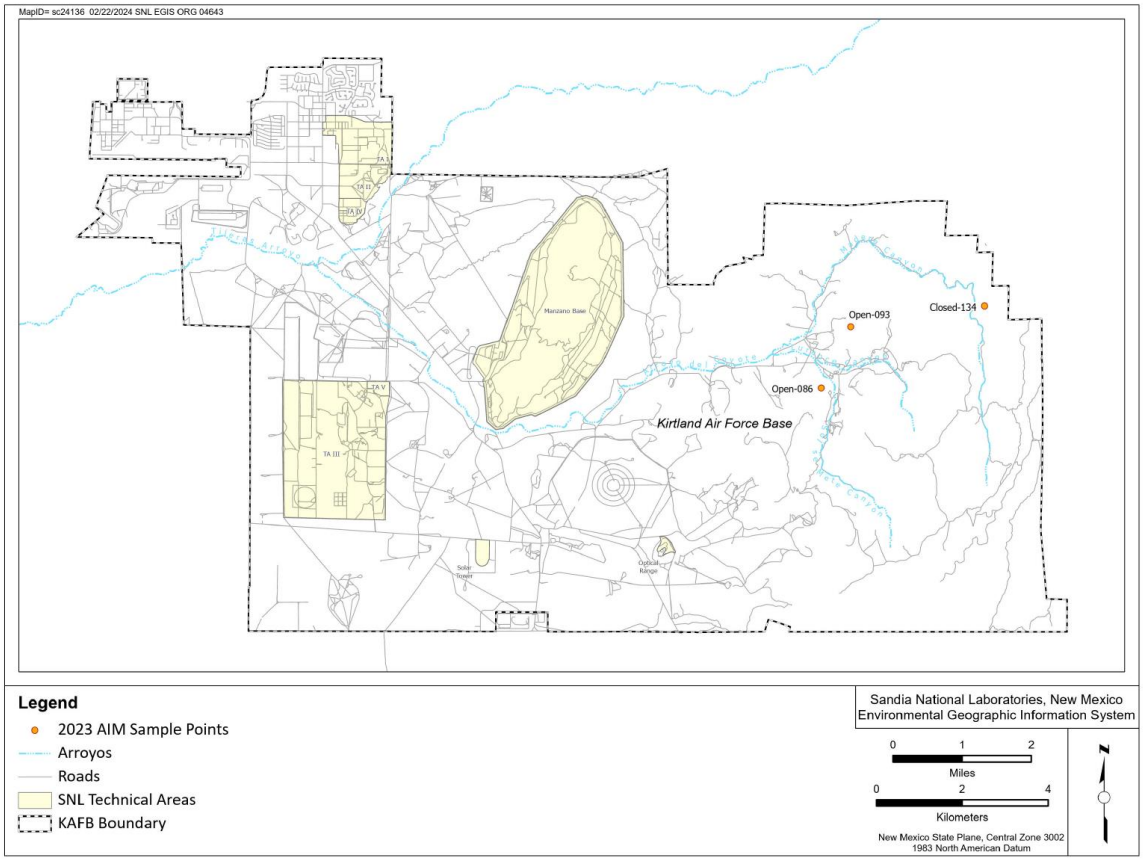


Figure 3-1. Three AIM monitoring plots established in 2023

3.1.2 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 plant species occurring along the path; 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), tree measurements (tree density, tree diameter, and tree height), 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 ground and few large gaps.

The three 2023 AIM plots were established in woodlands: Open Canopy Woodland Plot-093 (Open-093), Open Canopy Woodland Plot-086 (Open-086), and Closed Canopy Woodland (Closed-134).

Program Activities and Results 2023: Plot Open-093 Vegetation Monitoring

Plot Open-093 is located at an elevation of 6,330 feet in the foothills of the Manzanita mountains. The plot is on a gradual westerly aspect with gravelly soils and has a small ephemeral drainage along its northern edge. The plot has a light cover of native grasses, widely scattered junipers, occasional piñon pines, and interspersed shrubs within the larger overall landscape of open canopy woodland (Figure 3-2). This plot has experienced no obvious recent human impact.

Figure 3-2. Plot Open-093 has a gradual westerly aspect with gravelly soils and light native grass cover

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

The 32 plant species in Plot Open-093 are indicative of moderately high open woodland plant species richness (Table 3-2). Native trees and native grasses are the dominant plants on Plot Open-093, as shown in Table 3-2. One-seed juniper (*Juniperus monosperma*) is shown in Table 3-3 as the dominant plant species in the plot, with the highest foliar cover. Foliar cover is the leaf area of a plant or a plant grouping. Blue grama (*Bouteloua gracilis*) and black grama (*Bouteloua eriopoda*) are the next dominant species; both provide excellent forage for wildlife and provide protection against erosion in the interspaces between the tree canopies of one-seed juniper and piñon pine (*Pinus edulis*).

Table 3-2. Foliar cover at Plot Open-093

Plot Area	Percent
Average foliar cover	60.0
Foliar Cover by Vegetation Type	
Grasses	26.7
Forbs	0.0
Shrubs	2.0
Trees	31.3

Table 3-3. Foliar cover of dominant plant species at Plot Open-093

Common Name	Scientific Name	Percent
One-seed juniper	*Juniperus monosperma*	24
Blue grama	*Bouteloua gracilis*	14
Black grama	*Bouteloua eriopoda*	8.7
Piñon pine	*Pinus edulis*	7.3
Side-oats grama	*Bouteloua curtipendula*	4
Tulip pricklypear	*Opuntia phaeacantha*	2

Canopy gap and basal gap data for Plot Open-093 are shown in Table 3-4 and Table 3-5, respectively. More than 84 percent of the plot transects are covered by the protective canopy of plants. Native tree and grass canopies dominate the plot, providing excellent protection against the erosive effects of raindrops and wind erosion. Just over one-quarter of the transect lengths have basal gaps. This low percentage of basal gaps indicates the stems of many plants can increase friction during storm events to reduce the erosive effects of sheet flow.

Table 3-4. Canopy gaps between plants at Plot Open-093

Size of Gap	Percent of Line
0–20 cm	0.1
21–50 cm	2.1
51–100 cm	4.5
101–200 cm	5.3
> 200 cm	3.8
Plot total	**15.8**

Table 3-5. Basal gaps between plants at Plot Open-093

Size of Gap	Percent of Line
0–20 cm	0.0
21–50 cm	3.7
51–100 cm	4.7
101–200 cm	3.9
> 200 cm	15.3
Plot total	**27.6**

The surface soil stability of Plot Open-093 is shown in Table 3-6. 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 3.5. These scores combined with the very low percent of canopy gaps and low percent of basal gaps indicate that the plot soils have high stability.

Table 3-6. Soil stability of Plot Open-093

Soil Surface Stability	Score
Overall plot soil stability	3.5
Soil stability of protected soils	4.1
Soils not protected by plant cover	2.3

Plot Open-093 contained a combined 20 one-seed juniper and piñon pine trees, with three small diameter trees/saplings.

Any tree with either a diameter of its root collar or a diameter at breast height, located 4.5 feet above ground surface, that is between 1 and 5 inches is generally considered to be a sapling in forestry. However, in all three of the 2023 AIM plots, nearly all of the piñon pine trees with a diameter at breast height or diameter of its root collar of less than 5 inches do not appear to be young saplings but appear to be mature trees with stunted growth. Saplings

indicate stand replacement and the associated stand dynamics. Trees with such stunted growth that measure as saplings indicate very stressed growing conditions, which may be of varied factors. Also, without a regular interval of natural disturbance events that cause the death of some trees within the stand and active replacement by young saplings, tree stands become stagnant.

Natural disturbance events under non-drought, normal historical meteorological conditions allow for healthy tree stand mosaics with tree decomposition, associated nutrient cycling, openings created in the landscape, sapling growth, and other ecosystem processes to occur. Smaller diameter trees are not labeled only as saplings in this report because most of the smaller diameter trees do not represent the active ecosystem processes that saplings represent. The number of trees and small diameter trees/saplings and their density per hectare are shown in Table 3-7.

Table 3-7. Tree density of Plot Open-093

Tree Characteristic	Number
Number of trees	20 within the plot
Number of small diameter tree/saplings	3 within the plot
Tree density	74.7 trees per hectare
Small diameter tree/sapling density	11.2 small diameter tree/sapling per hectare

For multi-stemmed trees such as one-seed juniper, diameter of its root collar is used as the standard measurement. The diameter of its root collar of each stem is measured, then the tree diameters of their root collars are collectively calculated for an overall diameter at the root collar for the tree. Small diameter trees and saplings are not calculated into the average tree measurements and are not included in the tree height ranges on the 2023 AIM plots.

Table 3-8 shows the tree measurements of both one-seed juniper and piñon pine trees at Plot Open-093. Although the piñon pine average height is taller than the one-seed juniper, the average diameter at breast height or diameter of its root collar of the one-seed juniper is significantly larger. In this middle elevation juniper dominated habitat, the average biomass of a mature juniper tree is much greater than that of a piñon pine.

Table 3-8. Tree measurements of Plot Open-093

Tree Measurements	
Juniper Tree Characteristics	**Measurement**
Average diameter at the root collar or breast height of trees	10.6 inches
Average height	10.0 feet
Height range	5.8–16.4 feet
Piñon Pine Tree Characteristics	**Measurement**
Average diameter at the root collar or breast height of trees	6.0 inches
Average height	14.2 feet
Height range	10.5–14.8 feet

Program Activities and Results 2023: Plot Open-086 Vegetation Monitoring

Plot Open-086 is characterized by a rocky slope with an ephemeral drainage along the western edge of the plot at 6,328 feet elevation. The plot has a westerly aspect and is

dominated by native plant species, primarily one-seed junipers, piñon pines, and grasses. This plot does not show any sign of recent human impact (Figure 3-3).

Figure 3-3. Plot Open-086 is on a rocky slope and includes an ephemeral drainage on the western edge of the plot

The 32 plant species in Plot Open-086 indicate moderately high open woodland plant species richness. Average foliar cover for the plot was over 65 percent, composed primarily of trees, then grasses as shown in Table 3-9. The dominant plant species by foliar cover are shown in Table 3-10. All plants on the plot were native species.

Table 3-9. Foliar cover at Plot Open-086

Plot Area	Percent
Average foliar cover	66.7
Foliar Cover by Vegetation Type	
Grasses	24.7
Forbs	1.3
Shrubs	6.0
Trees	34.7

Table 3-10. Foliar cover of dominant plant species at Plot Open-086

Common Name	Scientific Name	Percent
One-seed juniper	*Juniperus monosperma*	23.3
Side-oats grama	*Bouteloua curtipendula*	11.3
Piñon pine	*Pinus edulis*	11.3
Blue grama	*Bouteloua gracilis*	7.3
Banana yucca	*Yucca baccata*	3.3
Black grama	*Bouteloua eriopoda*	2.7
Tree cholla	*Cylindropuntia imbricata*	2.7
New Mexico muhly	*Muhlenbergia pauciflora*	2.0

Canopy gap and basal gap data for Plot Open-086 are shown in Table 3-11 and Table 3-12, respectively. Overall, a small portion of the plot transects contain canopy gaps of any size. The plot contains a moderate percent of basal gaps between plants.

Table 3-11. Canopy gaps between plants at Plot Open-086

Size of Gap	Percent of Line
0–20 cm	0.0
21–50 cm	4.3
51–100 cm	10.6
101–200 cm	3.6
> 200 cm	1.4
Plot total	**19.9**

Table 3-12. Basal gaps between plants at Plot Open-086

Size of Gap	Percent of Line
0–20 cm	0.0
21–50 cm	3.6
51–100 cm	10.7
101–200 cm	10.4
> 200 cm	20.4
Plot total	**45.1**

Soil stability of the plot was moderate, with a consistent stability class of 3.5 on a scale of 1 to 6 (Table 3-13). The soils protected by plant cover were much more stable than bare soils. The overall soil stability score combined with the very low percent of canopy gaps and moderate percent of basal gaps indicate that the plot soils have moderately high resistance to erosion.

Table 3-13. Soil stability of Plot Open-086

Soil Surface Stability	Score
Overall plot soil stability	3.5
Soil stability of protected soils	4.2
Soils not protected by plant cover	2.4

Plot Open-086 contained 28 one-seed juniper trees. The number of trees and small diameter trees/saplings and their density per hectare are shown in Table 3-14. The diameter at breast height or diameter of its root collar of all seven piñon pines on the plot were less than 5 inches, excluding piñon pines from being counted as trees.

Table 3-14. Tree density of Plot Open-086

Tree Characteristic	Number
Number of trees	28 within the plot
Number of small diameter tree/saplings	8 within the plot
Tree density	104.5 trees per hectare
Small diameter tree/sapling density	29.9 small diameter tree/sapling per hectare

A discussion of tree and small diameter tree/sapling measurements was provided in the previous section for Plot Open-093. Juniper tree measurements for Plot Open-086 are shown in Table 3-15. The average diameter of one-seed junipers is almost identical between Plot Open-086 and Open-093, with the average height precisely the same at exactly 10 feet.

Table 3-15. Tree measurements of Plot Open-086

Tree Measurements	
Juniper Tree Characteristics	**Measurement**
Average diameter at the root collar or breast height of trees	10.34 inches
Average height	10.0 feet
Height range	4.9–14.8 feet

Program Activities and Results 2023: Plot Closed-134 Vegetation Monitoring

Plot Closed-134 is located at an elevation of 7,006 feet in the Manzanita mountains. The plot has a moderately steep northwest aspect, with the soil surface generally covered by slowly decomposing natural materials and rocks. The plot is crowded with small piñon pines and occasional one-seed junipers in a closed canopy woodland (Figure 3-4). This plot has experienced no obvious recent human impact.

Figure 3-4. Plot Closed-134 is crowded with small trees on a moderately steep northwest aspect

The 16 plant species in Plot Closed-134 are indicative of moderately low woodland species richness.

Native trees dominate the plot, at nearly 80 percent of the 90 percent total foliar cover, as shown in Table 3-16. Piñon pines have more than four times the foliar cover of one-seed junipers, followed by the functional shrubs gambel oak (*Quercus gambelii*) and banana yucca (*Yucca baccata*), as shown in Table 3-17**.** Grasses and forbs are scarce on the plot, likely due to very little sunlight reaching the forest floor.

Table 3-16. Foliar cover at Plot Closed-134

Plot Area	Percent
Average foliar cover	90.8
Foliar Cover by Vegetation Type	
Grasses	0.7
Forbs	0.7
Shrubs	10.8
Trees	78.6

Table 3-17. Foliar cover of dominant plant species at Plot Closed-134

Common Name	Scientific Name	Percent
Piñon pine	*Pinus edulis*	63.2
One-seed juniper	*Juniperus monosperma*	15.4
Gambel oak	*Quercus gambelii*	6.7
Banana yucca	*Yucca baccata*	3.4
New Mexico muhly	*Muhlenbergia pauciflora*	0.7
Tulip pricklypear	*Opuntia phaeacantha*	0.7
Perkysue	*Tetraneuris argentea*	0.7

Canopy gap and basal gap data for Plot Closed-134 are shown in Table 3-18 and Table 3-19, respectively. More than 87 percent of the plot transects are covered by the protective canopy of plants. The tree canopy cover provides excellent protection against the erosive effects of raindrops and wind erosion. However, the dense tree canopy prevents most sunlight from reaching the forest floor, preventing the growth of groundcover plants. The lack of middle and lower story plants results in very few plant bases, with basal gaps present across nearly 99 percent of the plot. This extremely high percentage of basal gaps indicates the plot is susceptible to the erosive effects of sheet flow during stormwater events.

Table 3-18. Canopy gaps between plants at Plot Closed-134

Size of Gap	Percent of Line
0–20 cm	0.0
21–50 cm	1.1
51–100 cm	1.7
101–200 cm	6.4
> 200 cm	3.5
Plot total	**12.7**

Table 3-19. Basal gaps between plants at Plot Closed-134

Size of Gap	Percent of Line
0–20 cm	0.0
21–50 cm	0.6
51–100 cm	2.7
101–200 cm	9.4
> 200 cm	86.1
Plot total	**98.8**

The surface soil stability of Plot Closed-134 is shown in Table 3-20. All soils collected by random sample collection protocol were protected by plant cover. The overall plot soil stability class is 4.1. These scores, combined with a very low percent of canopy gaps, indicate that the plot soils generally have very high stability under most conditions. When considered in combination with an extremely high percent of basal gaps, the soils could be more prone to erosion if extreme storm events occur.

Table 3-20. Soil stability of Plot Closed-134

Soil Surface Stability	Score
Overall plot soil stability	4.1
Soil stability of protected soils	4.1
Soils not protected by plant cover	None

Plot Closed-134 contained a total of 22 trees, with 70 small diameter trees/saplings, as shown in Table 3-21. The tree density of this closed canopy plot was approximately the same as, or lower than, the tree density of the two open canopy plots assessed in 2023. The tree density of Plot Closed-134 is 84.6 trees per hectare, and the small diameter tree/sapling density is extremely high at 263.7 per hectare. This is an unhealthy number of small diameter trees/saplings, most of which appear to not be young trees, but mature trees with stunted growth. The stunted tree growth is due to the crowded conditions and limited resources without occasional natural disturbances to initiate dynamic ecosystem processes. The plot generally appears to be stagnant.

Table 3-21. Tree density of Plot Closed-134

Tree Characteristic	Number
Number of trees	22 within the plot
Number of small diameter tree/saplings	70 within the plot
Tree density	84.6 trees per hectare
Small diameter tree/sapling density	263.7 small diameter tree/sapling per hectare

Beyond these small diameter trees/saplings, the crowded conditions harm the health of the trees through competition for soil moisture and nutrients. Without disturbance processes naturally removing smaller diameter trees, the larger trees are prevented from growing to their full above and below ground potential due to limited soil moisture and nutrients. Table 3-22 shows tree measurements for Plot Closed-134. Although the height and diameter at breast height or diameter of its root collar of the piñon trees is larger than what was measured in the open canopy woodland plots, on Plot Closed-134 the average height of 18.4 feet and the average tree size diameter of 7.87 inches is small for mature piñon trees. According to the United States Forest Service, the height range for mature piñon trees is 10 to 51 feet, and the diameter at breast height range is 6 to 30 inches (Ronco 1990). Under the conditions of the ongoing megadrought and continual competition for resources, the larger trees are commonly in a stressed state. Tree stands such as what occur in this plot have a concerning future as the climate warms across all seasons, adding additional stressors.

Table 3-22. Tree measurements of Plot Closed-134

Tree Measurements	
Juniper Tree Characteristics	**Measurement**
Average diameter at the root collar or breast height of trees	10.0 inches
Average height	12.3 feet
Height range	5.4–17.8 feet
Piñon Pine Tree Characteristics	**Measurement**
Average diameter at the root collar or breast height of trees	7.87 inches
Average height	18.4 feet
Height range	13.1–24.3 feet

3.1.3 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 Policy Working Group 2004).

Since 2009, Ecology Program personnel have provided ecological restoration guidance and support for a variety of projects. The successful recovery of degraded lands in central New Mexico is extremely challenging. SNL/NM resides in an arid climate that receives less than 9 inches of precipitation per year, experiences drying winds in the spring, and has hot summers and cold winters. Prior to Ecology Program personnel becoming involved with the restoration of degraded sites, reseeding efforts were generally unsuccessful. The Ecology Program 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 associated with EPA Construction General Permits (CGPs). 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 2023: Ecological Restoration and Revegetation

In 2023, Ecology Program personnel supported the following ecological restoration projects:

- **Liquified Natural Gas Cleanup.** The liquified natural gas cleanup project was seeded in June 2023.
- **6505A Thermal Spray Research Lab Drainage Improvements.** The planned project area was surveyed in March 2023, then a seeding specification was written and provided to the project manager.
- **9960 Drainage Improvement Project.** The planned project area was surveyed in May 2023, then a seeding specification was written and provided to the 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.

In 2023, the Ecology Program revegetation subject matter expert supported the Facilities Conceptual Location Analysis planning process by reviewing 17 proposed projects. The revegetation subject matter expert also reviewed 50 NEPA checklists in 2023. These planning reviews often occur many years prior to project initiation and they determine the need for revegetation on proposed projects.

3.2 Reptile and Amphibian 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. Lizards prey on insects, thus moderating ant, grasshopper, termite, beetle, and spider populations. Snakes are also important prey species, supporting medium- to large-sized mammal and bird 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.

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.

3.2.1 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 (Figure 3-5 and Figure 3-6).

Figure 3-5. Painted desert glossy snake (*Arizona elegans philipi*) inside a funnel trap at the West of Technical Area-III monitoring location in 2023

Figure 3-6. Mountain Patch-nosed Snake (*Salvadora grahamiae grahamiae*) inside a funnel trap at the SC Dome monitoring site

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 (Figure 3-7).

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

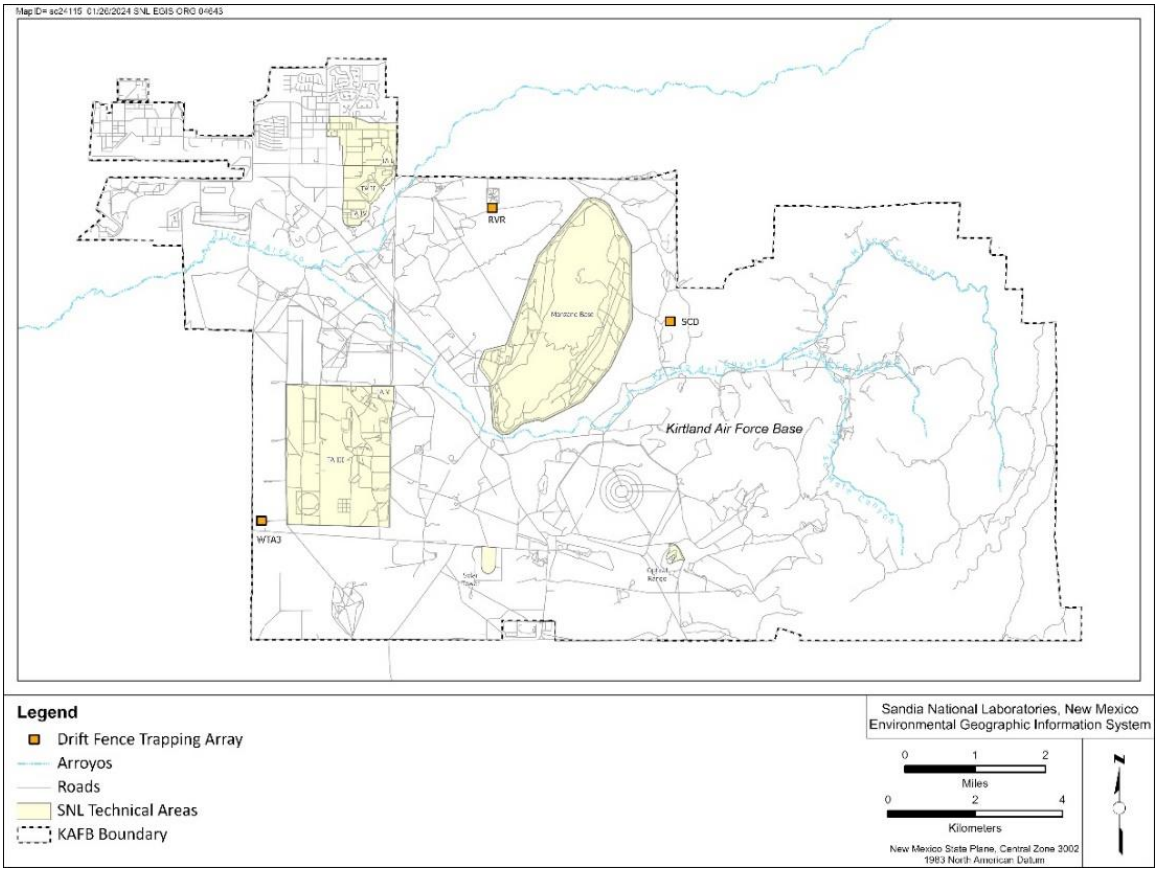


Figure 3-7. Herpetofaunal monitoring locations

Program Activities and Results 2023: Reptile and Amphibian Surveillance

Herpetofaunal communities were monitored at two sites in 2023: the Scale Compatibility Dome (SC Dome) and west of the TA-III site.

During 2023 herpetofaunal field monitoring, 107 individuals representing 14 species were recorded using drift fence arrays with funnel traps: 7 snake species, 6 lizard species, and 1 amphibian species (Table 3-23).

Table 3-23. Total reptile and amphibian captures by site and trapping period, 2023

Common Name	Scientific Name	SC Dome				West of Technical Area-III				Total
		Trapping Period				Trapping Period				
		1	2	3	Total	1	2	3	Total	
Chihuahuan Spotted Whiptail	*Aspidoscelis exsanguis*	30	17		**47**					**47**
Coachwhip	*Coluber flagellum testaceus*						2	3	5	**5**
Common Side-blotched Lizard	*Uta stansburiana*					7	12	10	29	**29**
Couch's Spadefoot Toad	*Scaphiopus couchii*							1	1	**1**
Desert Striped Whipsnake	*Coluber taeniatus taeniatus*	4		1	**5**					**5**
Great Plains Skink	*Plestiodon obsoletus*						1	1	2	**2**
Greater Short-horned Lizard	*Phrynosoma hernandesi*		1		**1**		1		1	**2**
Little striped Whiptail	*Aspidoscelis inornata*					1	1		2	**2**
Long-nosed Snake	*Rhinocheilus lecontei*	2			**2**					**2**
Mountain Patch-nosed Snake	*Salvadora grahamiae grahamiae*	1	1	1	**3**					**3**
New Mexico Whiptail	*Aspidoscelis neomexicana*	1			**1**	3			3	**4**
Painted Desert Glossy Snake	*Arizona elegans philipi*					2			2	**2**
Prairie Rattlesnake	*Crotalus viridis*					1			1	**1**
Sonoran Gopher Snake	*Pituophis catenifer affinis*	1			**1**			1	1	**2**
Total		**39**	**19**	**2**	**60**	**14**	**17**	**16**	**47**	**107**

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 methodology 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 3-24). 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 3-24. Reptile and amphibian biodiversity monitoring data by site, 2023

Site	Total Number of Captures	Species Richness	Species Diversity	Species Evenness
SC Dome	60	7	0.87 *Average = 0.97* *Range = 0.72-1.44*	0.45 *Average = 0.53* *Range = 0.40-0.74*
West of Technical Area-III	47	10	1.44 *Average = 1.79* *Range = 1.44-2.16*	0.63 *Average = 0.78* *Range = 0.63-0.94*

Notes:
Averages and ranges were calculated from available 2012–2023 data.
Monitoring performed from 2012 to 2014 consisted of a single three-consecutive-week trapping session compared with the current spread trapping schedule.
SC Dome = Scale Compatibility Dome

3.3 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 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). Specimen records indicate the tri-colored bat is expanding its range into New Mexico and has the potential to occur at SNL/NM. Given the serious threats to bats outlined above, it is imperative that populations be monitored at SNL/NM so potential threats can be mitigated. At SNL/NM, passive bioacoustic recordings were used to monitor bats from January 2023 through December 2023.

Program Activities and Results 2023: Bat Surveillance

Unfortunately, due to a computer-related data loss event, bat surveillance results are not available for 2023. Ultrasonic bat detectors will continue to be used at SNL/NM and data will be reported in the next iteration of the annual site environmental report.

3.4 Bird Surveillance

Long-term monitoring of breeding and wintering birds can reveal population trends and dynamics. Additionally, long-term bird surveillance data aids land use decision-making by documenting areas that are important for the survival of native bird species across SNL/NM. 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.

3.4.1 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 3-8). 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.

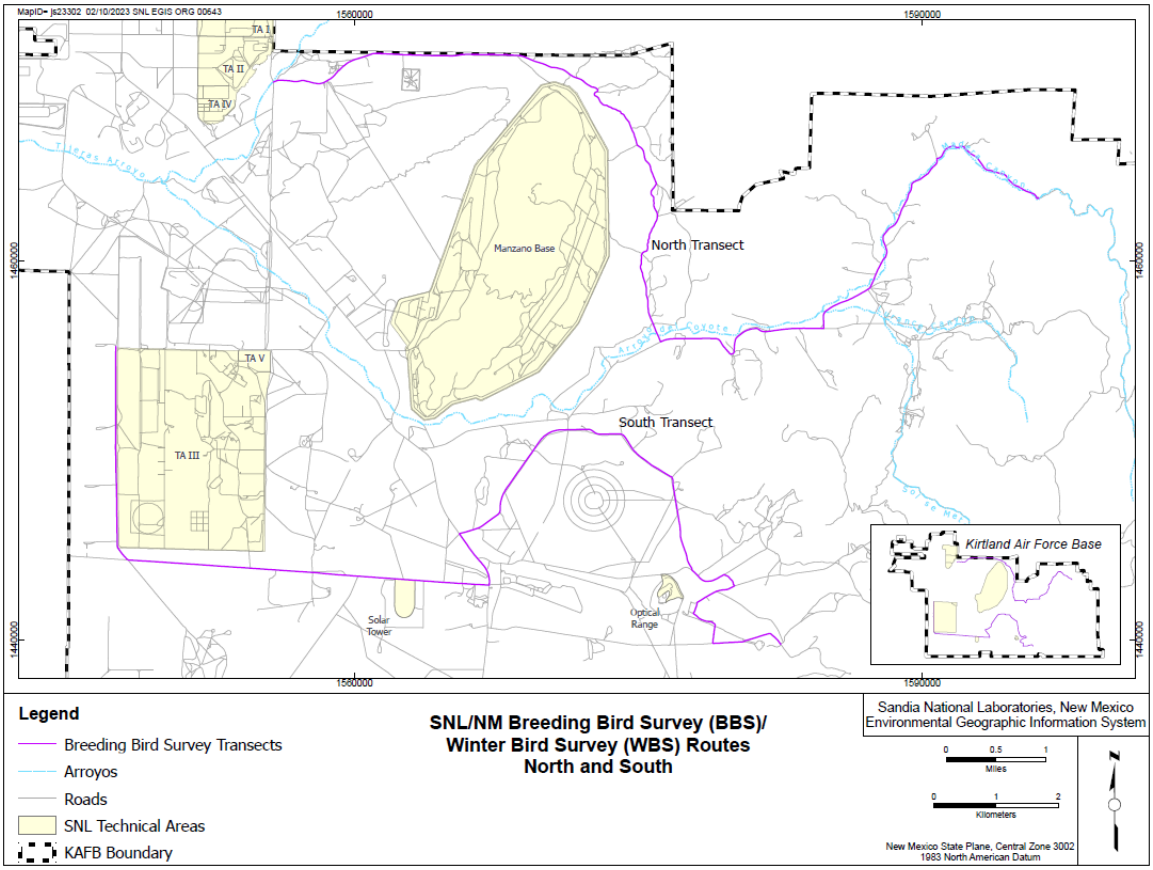


Figure 3-8. SNL/NM breeding and winter bird survey routes

A *bird survey* is the process of counting birds by sight and sound; *bird banding* involves capturing a bird, placing an aluminum band on one of the bird's legs, and releasing the bird. Trained SNL staff record information about each bird captured and evaluate the numbers of re-caught birds from previous years.

Program Activities and Results 2023: Bird Surveys

In 2023, the breeding bird survey was conducted in June. Fifty-one species and 519 individuals were detected across the transect (Table 3-25). The 2023 winter bird survey was completed in February. Forty-one species and 364 individuals were detected (Table 3-26).

Table 3-25. Species totals detected during the breeding bird survey, 2023

Common Name	Scientific Name	Number of Detections
Scaled quail	*Callipepla squamata*	4
White-winged dove	*Zenaida asiatica*	4
Mourning dove	*Zenaida macroura*	18
Black-chinned hummingbird	*Archilochus alexandri*	9
Broad-tailed hummingbird	*Selasphorus platycercus*	2
Cooper's hawk	*Accipiter cooperii*	1
Ladder-backed woodpecker	*Dryobates scalaris*	2
American kestrel	*Falco sparverius*	10
Ash-throated flycatcher	*Myiarchus cinerascens*	12
Cassin's kingbird	*Tyrannus vociferans*	3
Western kingbird	*Tyrannus verticalis*	20
Western wood-pewee	*Contopus sordidulus*	2
Gray flycatcher	*Empidonax wrightii*	2
Say's phoebe	*Sayornis saya*	11
Gray vireo	*Vireo vicinior*	20
Plumbeous vireo	*Vireo plumbeus*	1
Loggerhead shrike	*Lanius ludovicianus*	7
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*	4
Chihuahuan raven	*Corvus cryptoleucus*	1
Common raven	*Corvus corax*	7
Raven sp.	*Corvus sp.*	3
Juniper titmouse	*Baeolophus ridgwayi*	8
Horned lark	*Eremophila alpestris*	17
Barn swallow	*Hirundo rustica*	2
Bushtit	*Psaltriparus minimus*	12
Blue-gray gnatcatcher	*Polioptila caerulea*	2
Rock wren	*Salpinctes obsoletus*	4
Cactus wren	*Campylorhynchus brunneicapillus*	2
Bewick's wren	*Thryomanes bewickii*	7
Curve-billed thrasher	*Toxostoma curvirostre*	3
Northern mockingbird	*Mimus polyglottos*	91
House sparrow	*Passer domesticus*	13
House finch	*Haemorhous mexicanus*	63
Pine siskin	*Spinus pinus*	1
Lesser goldfinch	*Spinus psaltria*	3
Cassin's sparrow	*Peucaea cassinii*	9
Black-throated sparrow	*Amphispiza bilineata*	56
Lark sparrow	*Chondestes grammacus*	9
Black-chinned sparrow	*Spizella atrogularis*	3
Canyon towhee	*Melozone fusca*	2
Rufous-crowned sparrow	*Aimophila ruficeps*	2
Spotted towhee	*Pipilo maculatus*	10
Chihuahuan meadowlark	*Sturnella lilianae*	18

Common Name	Scientific Name	Number of Detections
Western meadowlark	*Sturnella neglecta*	15
Bullock's oriole	*Icterus bullockii*	4
Scott's oriole	*Icterus parisorum*	7
Brown-headed cowbird	*Molothrus ater*	1
Black-throated gray warbler	*Setophaga nigrescens*	1
Western tanager	*Piranga ludoviciana*	3
Black-headed grosbeak	*Pheucticus melanocephalus*	5
Blue grosbeak	*Passerina caerulea*	3
Total		**519**

sp. = unknown species, singular

Table 3-26. Species totals detected during the winter bird survey, 2023

Common Name	Scientific Name	Number of Detections
Rock pigeon (feral pigeon)	*Columba livia*	2
Eurasian collared-dove	*Streptopelia decaocto*	1
White-winged dove	*Zenaida asiatica*	10
Mourning dove	*Zenaida macroura*	18
Sandhill crane	*Antigone canadensis*	4
Red-tailed hawk	*Buteo jamaicensis*	1
Ladder-backed woodpecker	*Dryobates scalaris*	5
Hairy woodpecker	*Dryobates villosus*	1
Northern flicker (red-shafted)	*Colaptes auratus*	1
American kestrel	*Falco sparverius*	3
Merlin	*Falco columbarius*	1
Say's phoebe	*Sayornis saya*	1
Loggerhead shrike	*Lanius ludovicianus*	3
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*	5
Common raven	*Corvus corax*	1
Juniper titmouse	*Baeolophus ridgwayi*	11
Horned lark	*Eremophila alpestris*	16
Bushtit	*Psaltriparus minimus*	6
Cedar waxwing	*Bombycilla cedrorum*	1
Cactus wren	*Campylorhynchus brunneicapillus*	1
Bewick's wren	*Thryomanes bewickii*	6
Curve-billed thrasher	*Toxostoma curvirostre*	1
Crissal thrasher	*Toxostoma crissale*	1
European starling	*Sturnus vulgaris*	1
Western bluebird	*Sialia mexicana*	8
Mountain bluebird	*Sialia currucoides*	3
Townsend's solitaire	*Myadestes townsendi*	5
American robin	*Turdus migratorius*	72
House sparrow	*Passer domesticus*	10
House finch	*Haemorhous mexicanus*	63
Pine siskin	*Spinus pinus*	2

Common Name	Scientific Name	Number of Detections
Black-throated sparrow	*Amphispiza bilineata*	2
Dark-eyed junco	*Junco hyemalis*	46
White-crowned sparrow	*Zonotrichia leucophrys*	11
Sagebrush sparrow	*Artemisiospiza nevadensis*	6
Song sparrow	*Melospiza melodia*	1
Lincoln's sparrow	*Melospiza linolnii*	2
Canyon towhee	*Melozone fusca*	8
Spotted towhee	*Pipilo maculatus*	5
Chihuahuan meadowlark	*Sturnella lilianae*	5
Western meadowlark	*Sturnella neglecta*	14
Total		**364**

3.4.2 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. 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. 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 2023: Monitoring Avian Productivity and Survivorship Banding

SNL/NM has operated its MAPS station for 19 breeding seasons between 2003 and 2023, yielding a large long-term dataset. The data was organized and analyzed to draw trends and summarize results for the last 20 years. Since 2003, 55 species have been banded, amounting to over 1,500 birds. The MAPS station was not operated for two seasons, 2019 and 2020. Biologists awaited the issuance of bird banding permits in 2019 and COVID-19 work restrictions limited field work in 2020.

Total captures and diversities were calculated for the 2003-2023 dataset to understand mist netting efforts and community changes over time. To quantify the effort for bird banding

activities, captures can be related to the amount of time that mist nets are open. Season net hours were totaled and multiplied by 100 to standardize the birds captured per 100 net hours by the MAPS year. The average birds per 100 net hours from 2003-2023 is 21.46. The Shannon diversity index was used to measure diversity of the birds sampled (captured) over the years. For 2003-2023, the average Shannon diversity index for the SNL/NM MAPS station is 2.65 (Figure 3-9).

The most commonly captured species between 2003-2023 were black-throated sparrow, Northern mockingbird, bushtit, gray vireo, and juniper titmouse (Table 3-27). All species are likely or known breeders in the area of the MAPS station and thus their individual species trends over time can be particularly meaningful in terms of climatic or environmental changes.

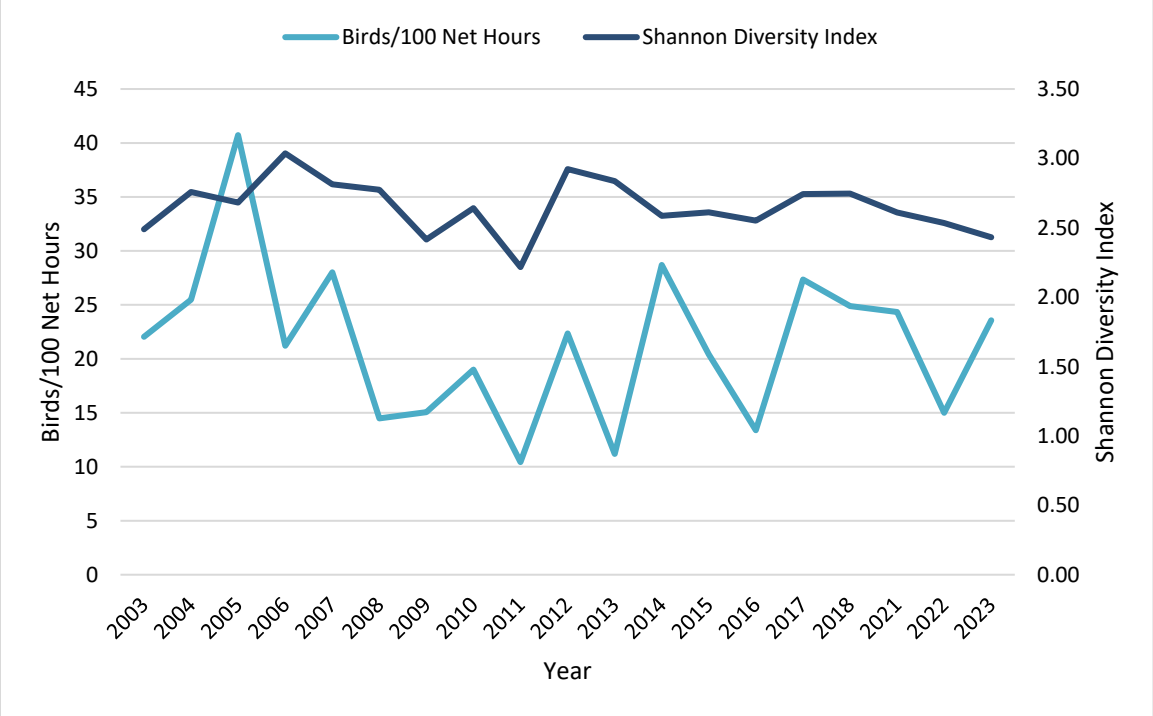


Figure 3-9. Birds per 100 net-hours and Shannon diversity index for all MAPS seasons, 2003–2023

Table 3-27. Top 10 most commonly captured species during MAPS, 2003-2023

Common name	Scientific Name	Number Captured
Black-throated sparrow	*Amphispiza bilineata*	270
Northern mockingbird	*Mimus polyglottos*	241
Bushtit	*Psaltriparus minimus*	196
Gray vireo	*Vireo vicinior*	109
Juniper titmouse	*Baeolophus ridgwayi*	102
Ash-throated flycatcher	*Myiarchus cinerascens*	78
Rufous-crowned sparrow	*Aimophila ruficeps*	74
Canyon towhee	*Melozone fusca*	73
Chipping sparrow	*Spizella passerina*	72
Bewick's wren	*Thryomanes bewickii*	64

Gray vireo is listed as a threatened species in New Mexico and threats to their populations include habitat loss or degradation, brood parasitism by brown-headed cowbirds, and drought (New Mexico Department of Game and Fish 2022) (Fischer et al. 2021). Though understudied, gray vireo captures may correlate with periods of drought in Bernalillo County (Figure 3-10). Drought can impact the health of piñon -juniper habitats that gray vireos rely on during the breeding season. The National Drought Mitigation Center categorizes droughts by their severity, "extreme" and "exceptional" being the most severe. Extreme droughts and exceptional droughts (asterisked) occurred in Bernalillo County in 2003, 2004, 2006, 2011*, 2013*, 2018, 2020*, 2021*, 2022*, and 2023 (National Drought Mitigation Center 2024). Given the state-threatened status of gray vireos, it is continually important to document gray vireo trends via MAPS and breeding bird surveys in this critical part of their breeding range.

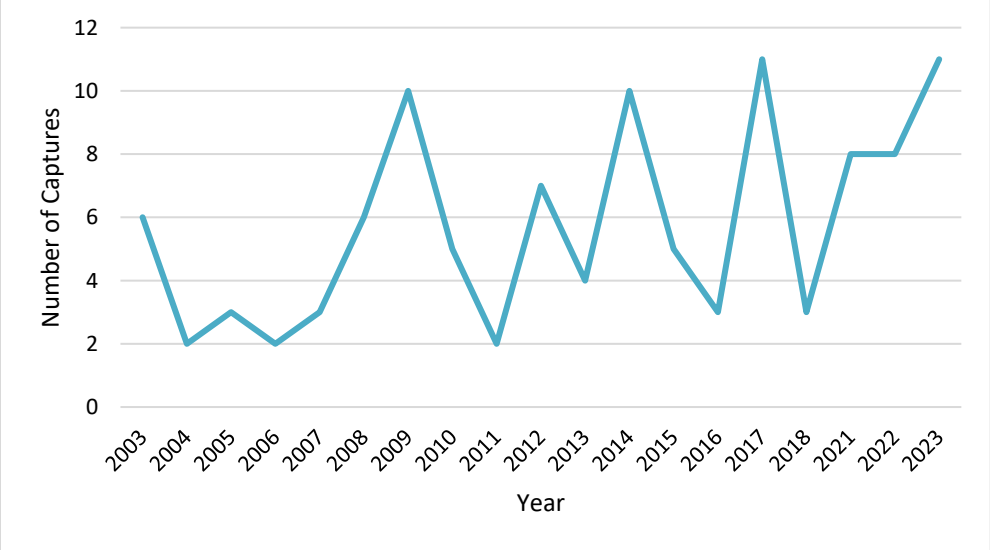


Figure 3-10. Gray vireo MAPS captures trend, 2003–2023

In 2023, MAPS banding sessions were run from May to July with seven sessions completed in that timeframe. Nineteen species were captured, 90 individuals were newly banded, and 8 individuals were recaptured (banded in a previous year) (Table 3-28).

Table 3-28. Species composition and total number of birds banded during the MAPS season, 2023

Common Name	Scientific Name	Number Captured
Ladder-backed woodpecker	*Dryobates scalaris*	2
Ash-throated flycatcher	*Myiarchus cinerascens*	2
Western wood-pewee	*Contopus sordidulus*	1
Willow flycatcher	*Empidonax traillii*	1
Dusky flycatcher	*Empidonax oberholseri*	1
Gray vireo	*Vireo vicinior*	11
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*	1
Juniper titmouse	*Baeolophus ridgwayi*	5
Bushtit	*Psaltriparus minimus*	13
Blue-gray gnatcatcher	*Polioptila caerulea*	4

Common Name	Scientific Name	Number Captured
Rock wren	*Salpinctes obsoletus*	2
Northern mockingbird	*Mimus polyglottos*	6
House finch	*Haemorhous mexicanus*	1
Black-throated sparrow	*Amphispiza bilineata*	28
Lark sparrow	*Chondestes grammacus*	3
Canyon towhee	*Melozone fusca*	2
Rufous-crowned sparrow	*Aimophila ruficeps*	6
Spotted towhee	*Pipilo maculatus*	3
Scott's oriole	*Icterus parisorum*	6
Total		**98**

Program Activities and Results 2023: Fall Migration Bird Banding

In 2023, Ecology Program personnel conducted six sessions of fall migration bird banding in September and October. Figure 3-11 shows a sage thrasher's age being determined during fall banding. Seventeen species and 56 individuals were captured in fall (Table 3-29).

Figure 3-11. Determining a sage thrasher's age during fall banding, 2023

Table 3-29. Species composition and total birds captured, fall 2023 season

Common Name	Scientific Name	Number Captured
Black phoebe	*Sayornis nigricans*	1
Juniper titmouse	*Baeolophus ridgwayi*	4
Ruby-crowned kinglet	*Corthylio calendula*	2
Red-breasted nuthatch	*Sitta canadensis*	1
Bewick's wren	*Thryomanes bewickii*	1
Curve-billed thrasher	*Toxostoma curvirostre*	1
Crissal thrasher	*Toxostoma crissale*	2
Sage thrasher	*Oreoscoptes montanus*	18
Western bluebird	*Sialia mexicana*	1
American robin	*Turdus migratorius*	2
House finch	*Haemorhous mexicanus*	6
Cassin's finch	*Haemorhous cassinii*	3

Common Name	Scientific Name	Number Captured
Dark-eyed junco	*Junco hyemalis*	4
Canyon towhee	*Melozone fusca*	3
Green-tailed towhee	*Pipilo chlorurus*	1
Spotted towhee	*Pipilo maculatus*	1
Audubon's warbler	*Setophaga coronata auduboni*	5
Total		**56**

3.5 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 presence 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/NNSA-permitted land withdrawn from the U.S. Forest Service, and the Range Guzzler, which is on land permitted to DOE/NNSA 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.

3.5.1 Madera Canyon Camera Station

Since June 2005, 71 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 15 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*), elk (*Cervus elaphus canadensis*), 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 2023: Madera Canyon Camera Station

In 2023, 20 different species were observed at the Madera Canyon Camera Station (Table 3-30), including 7 mammal species and 13 bird species. No reptiles, amphibians, or invertebrates were observed at the Madera Canyon Camera Station during 2023.

Table 3-30. Wildlife species observed at the Madera Canyon Camera Station, 2023

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*		•	•	•			•	•	•		•	•
Elk	*Cervus elaphus canadensis*			•	•			•					
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*			•	•			•					
Golden eagle	*Aquila chrysaetos*							•	•				
Great horned owl	*Bubo virginianus*				•			•	•			•	
House finch	*Haemorhous mexicanus*				•	•							
Lark sparrow	*Chondestes grammacus*							•	•				
Mourning dove	*Zenaida macroura*				•	•		•	•				
Northern mockingbird	*Mimus polyglottos*							•					
Pinyon jay	*Gymnorhinus cyanocephalus*							•					
Unidentified bird	*Unidentified*			•	•	•		•	•			•	
Western bluebird	*Sialia mexicana*											•	
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*							•	•				
Reptiles													
None													
Amphibians													
None													
Invertebrates													
None													

Elk were documented at the Madera Guzzler during the months of March, April, and July (Figure 3-12). This is the first time that this species has been documented at the Madera Guzzler since camera monitoring began. According to the New Mexico Department of Game and Fish (NMDGF), elk populations within Game Management Unit 14 (within which the Madera Guzzler falls) have been increasing in recent years. However, the density of elk within this area is not known as data is limited.

Figure 3-12. A bull elk visits the guzzler for a drink

3.5.2 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.

Gray fox and mule deer have been observed in images at the Range Guzzler every year of monitoring.

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. [unknown species, plural]).

Program Activities and Results 2023: Range Camera Station

In 2023, 24 different species were observed at the Range Camera Station (Table 3-31), including 8 mammal species and 16 bird species. No amphibian, reptile, or invertebrate species were observed.

Table 3-31. Wildlife species observed at the Range Camera Station, 2023

Common Name	Scientific Name	Month											
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Mammals													
American black bear	*Ursus americanus*								•				
Black-tailed jackrabbit	*Lepus californicus*			•									
Bobcat	*Lynx rufus*		•										
Coyote	*Canis latrans*	•	•	•	•			•	•			•	
Gray fox	*Urocyon cinereoargenteus*	•		•	•								
Mountain lion	*Puma concolor*							•			•		•
Mule deer	*Odocoileus hemionus*	•	•	•	•		•	•	•	•	•	•	•
Rock Squirrel	*Otospermophilus variegatus*				•			•					
Birds													
American robin	*Turdus migratorius*			•									
American kestrel	*Falco sparverius*							•		•			
Broad-tailed Hummingbird	*Selasphorus platycercus*							•					
Canyon towhee	*Melozone fusca*					•							
Common raven	*Corvus corax*						•						
Cooper's hawk	*Accipiter cooperii*					•		•	•				
Golden eagle	*Aquila chrysaetos*	•					•	•		•	•		
Great horned owl	*Bubo virginianus*								•		•		
Greater roadrunner	*Geococcyx californianus*							•	•				
House finch	*Haemorhous mexicanus*	•	•	•	•								
Mourning dove	*Zenaida macroura*			•	•	•	•	•	•	•			
Pinyon jay	*Gymnorhinus cyanocephalus*				•						•		
Say's phoebe	*Sayornis saya*			•				•					
Townsend's solitaire	*Myadestes townsendi*	•		•	•								
Unidentified bird	*Unidentified*	•			•	•			•		•		
Western bluebird	*Sialia mexicana*	•							•	•			
Woodhouse's scrub-jay	*Aphelocoma woodhouseii*	•			•				•				
Reptiles													
None													
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.

A golden eagle was documented visiting the Range Guzzler in July 2023 (Figure 3-13). Multiple visits were made to the Range Guzzler by golden eagles in 2023; these visits could have been made by the same individual or multiple individuals. Also in July 2023, a greater roadrunner (Figure 3-14) and a mule deer doe with her two fawns (Figure 3-15), were captured on camera visiting the Range Guzzler.

Figure 3-13. Golden eagle visiting the Range Guzzler in July 2023

Figure 3-14. Greater roadrunner visiting the Range Guzzler in the heat of July 2023

Figure 3-15. Mule deer doe, with her two fawns, visiting the Range Guzzler in July 2023

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

As stated in Chapter 7, the Endangered Species Act is intended to protect all animal and plant species that are federally listed as endangered or threatened. Currently, no known Endangered Species Act protected species breed in or reside within DOE/NNSA-permitted and fee-owned areas at SNL/NM. Several federally listed species are found in Bernalillo County, New Mexico (Table 3-32). Golden eagles, federally protected under the Bald and Golden Eagle Protection Act, are potentially present year-round within the boundaries of SNL/NM (Figure 3-13). Breeding has yet to be documented within DOE/NNSA-permitted and fee-owned areas at SNL/NM, but the Ecology Program performs site-wide monitoring year-round to detect the presence of the species. In the case that a golden eagle nest is found, protection buffers would be put in place to avoid disturbance to nesting eagles.

A few mammal species protected by the State of New Mexico have been encountered (Table 3-32). One bird species, the gray vireo (*Vireo vicinior*), well known as a breeding bird on DOE/NNSA-permitted and fee-owned areas, is listed as threatened (New Mexico Department of Game and Fish 2022). The gray vireo's primary breeding habitat is open piñon-juniper woodlands within the foothills of the Manzano Mountains.

Table 3-32. 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	

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed within KAFB and SNL/NM
Common Name	**Scientific Name**			
Common hog-nosed skunk	*Conepatus leuconotus*	No designation	Sensitive	●
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	●
Pinyon Jay	*Gymnorhinus cyanocephalus*	Under Review	Species of greatest conservation need	●
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	
Reptiles				
Desert massasauga	*Sistrurus catenatus dewardsii*	Under review	Species of greatest conservation need	●
Southwestern fence lizard	*Sceloporus cowlesi*	No designation	Sensitive	●

Species		Federal Endangered Species Act Status	New Mexico Status	Previously Observed within KAFB and SNL/NM
Common Name	Scientific Name			
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.

3.7 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.

Program Activities and Results 2023: 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 had 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 3-16). The trend continued through 2022 and 2023, 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 3-17. Wildlife response tickets are described first followed by tickets for biological surveys required for facilities work orders and projects.

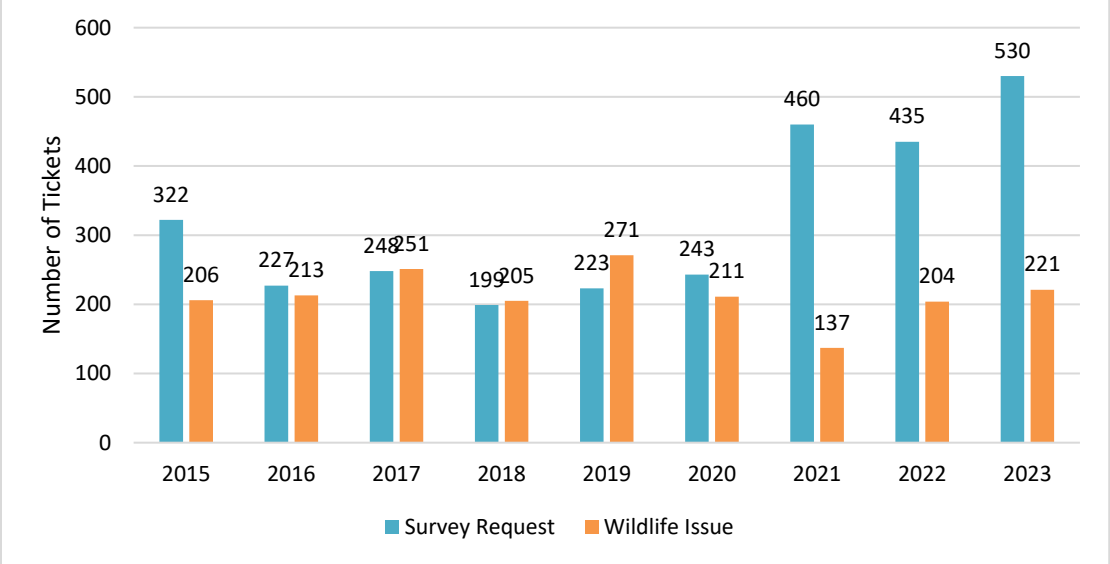


Figure 3-16. Two major categories of Eco Ticket requests, 2015–2023

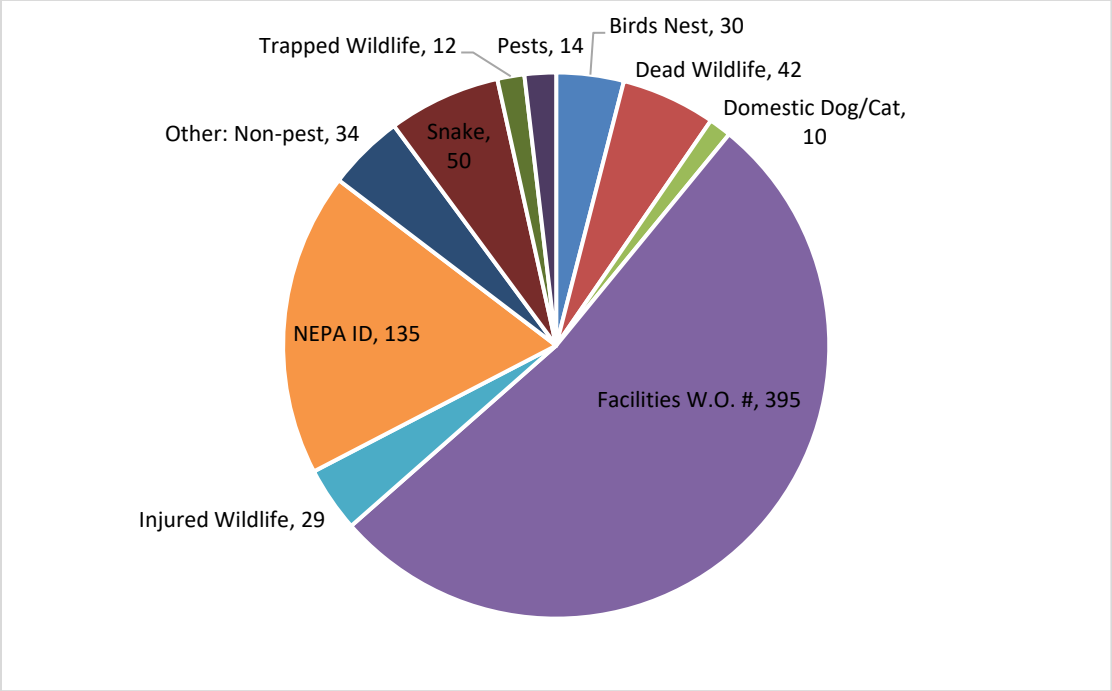


Figure 3-17. Eco Tickets by type, 2023

3.7.1 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.

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.

Injured animals that are discovered at SNL/NM and require intervention are taken to a permitted wildlife rehabilitator where they will be given the best opportunity to survive.

Program Activities and Results 2023: Eco Tickets for Wildlife Response

In 2023, 221 wildlife issues were received through Eco Ticket. Wildlife is most active during the spring and summer (April to August), when the weather is warmer, and most breeding occurs. Wildlife issues peaked in June, at a total of 39 tickets (Figure 4-17). Unsurprisingly, the number of tickets typically decreases in the late fall through winter (November to February) when many animals retreat from the cold weather. The smaller amount of wildlife concerns reported around the site may also be attributed to fewer members of the workforce working on-site around the holidays and simply the lack of wildlife observations to report.

Due to the number of pest-related requests received as "Other" in previous years, a new category, "Pests" was added to Eco Ticket. When selected, the requestor is directed to place a facilities service request through the Maximo system. Animals such as ants, spiders, wasps, and mice fall under the purview of Facilities' pest management. A total of 14 pest-related issues were redirected in 2023 (Figure 3-18).

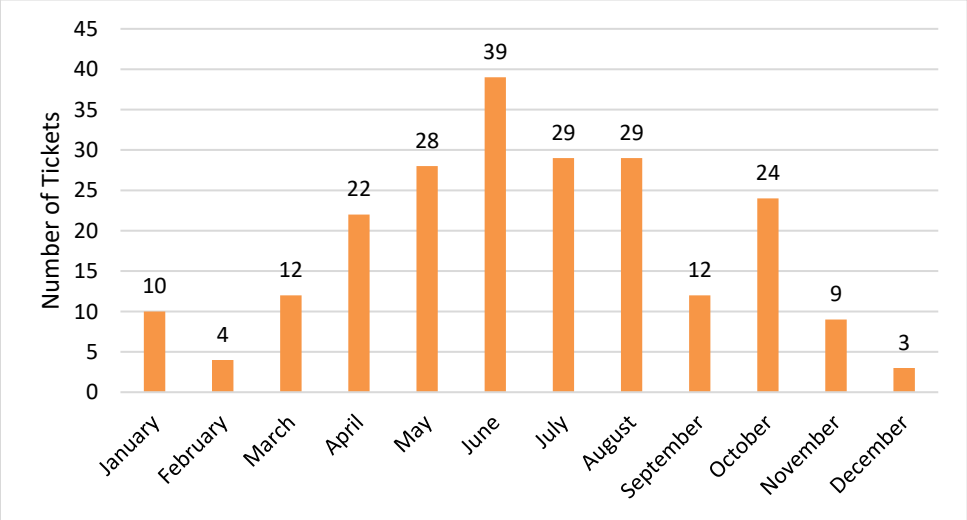


Figure 3-18. Total wildlife issues by month, 2023

Ecology Program personnel responded to an unusual wildlife incident in May 2023. A mallard hen and her ducklings became trapped in an equipment yard in TA-4. The hen, and all nine ducklings were safely captured from under equipment and pallets (Figure 3-19). They were carefully transported to the nearest pond at Tijeras Golf Course, where they were reunited and able to cool down in the water (Figure 3-19).

Figure 3-19. *Left*, mallard ducklings gathered into a bucket after being rescued from TA-4; *right*, hen and ducklings reunited and released by biologists at the Tijeras Golf Course pond

Snake removals were the most requested wildlife issue category in 2023, at 50 tickets (Table 3-33). This was an increase from 2022, which had 36 tickets. Of the 50 tickets, 23 were for venomous snakes. Prairie rattlesnakes (*Crotalus viridis,* Figure 3-20) continue to be the most common venomous snakes encountered with 21 removals, followed by gopher snakes (*Pituophis catenifer*) with 8 removals. Other snakes relocated include coachwhip (*Masticophis flagellum*), glossy snake (*Arizons elegans*, Figure 3-20), desert massasauga (*Sistrurus catenatus edwardsii*), and Western diamondback rattlesnake (*Crotalus atrox*). Occasionally, Ecology Program personnel are unable to locate and identify the snake when they arrive at the location to remove it. This was the case for 14 snake removal tickets in 2023.

Table 3-33. Snake removal tickets, 2023

Common Name	Scientific Name	Number of Tickets
Prairie rattlesnake	*Crotalus viridis viridis*	21
Unidentified (i.e., snake not located)		14
Gopher snake	*Pituophis catenifer*	8
Coachwhip	*Masticophis flagellum*	3
Glossy snake	*Arizons elegans*	2
Desert massasauga	*Sistrurus catenatus edwardsii*	1
Western diamondback rattlesnake	*Crotalus atrox*	1
Total		**50**

Figure 3-20. *Left*, a prairie rattlesnake trapped within silt fencing around a construction site in TA-3; *right*, a glossy snake upon relocation from TA-4

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. While 10 raccoon-related tickets were received in 2023, this is a significant decrease from 27 raccoon-related tickets received in 2022.

3.7.2 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 2023: Eco Tickets for Work Orders and Projects

In 2023, Ecology Program personnel received 530 Eco Ticket requests for biological surveys (Figure 3-16), an increase from 435 requests in 2021. Over 70 percent (395 of 530 tickets) of biological survey requests 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. Facilities Work Order-related survey requests were highest between June and July (Figure 3-21). Several emergency irrigation repairs occurred during this timeframe.

The remaining 135 requests were part of "NEPA ID" requests associated with an active NEPA checklist or projects that did not fall under routine maintenance activities. Outdoor testing and large-scale construction activities made up the majority of the "NEPA ID"

requests for biological surveys. NEPA-ID-related survey requests peaked in March (Figure 3-21). Many of those requests were for roof improvement activities.

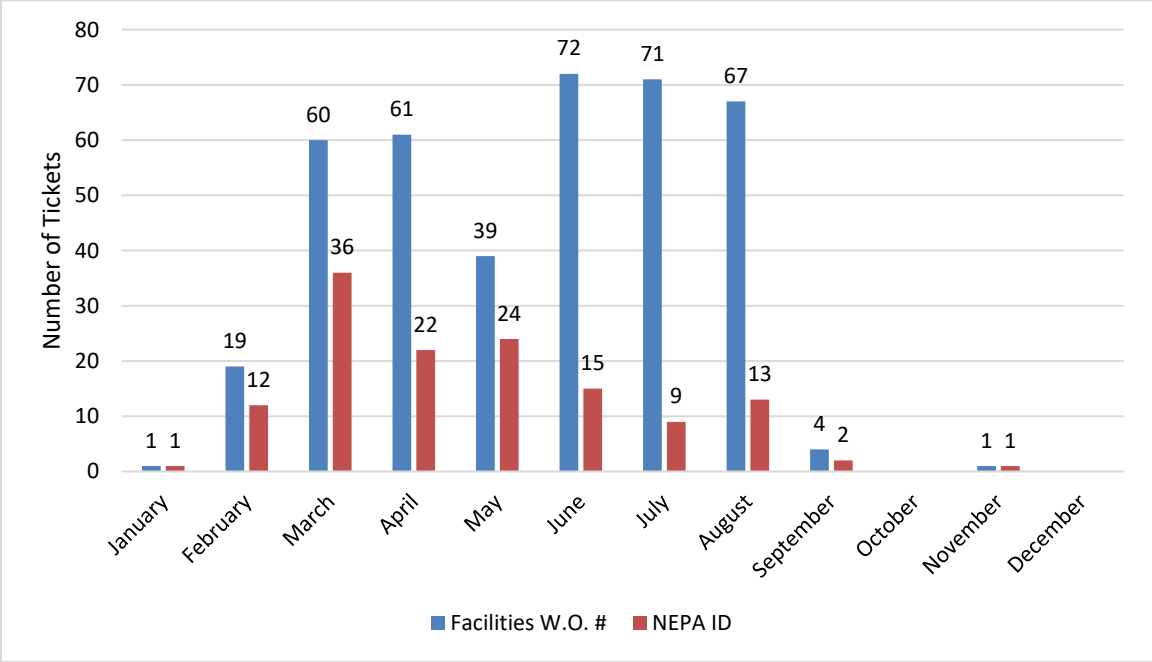


Figure 3-21. Total survey requests by type and month, 2023

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Chapter 4. Terrestrial Surveillance Program

Eastern collared lizard (*Crotaphytus collaris*)

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, 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.

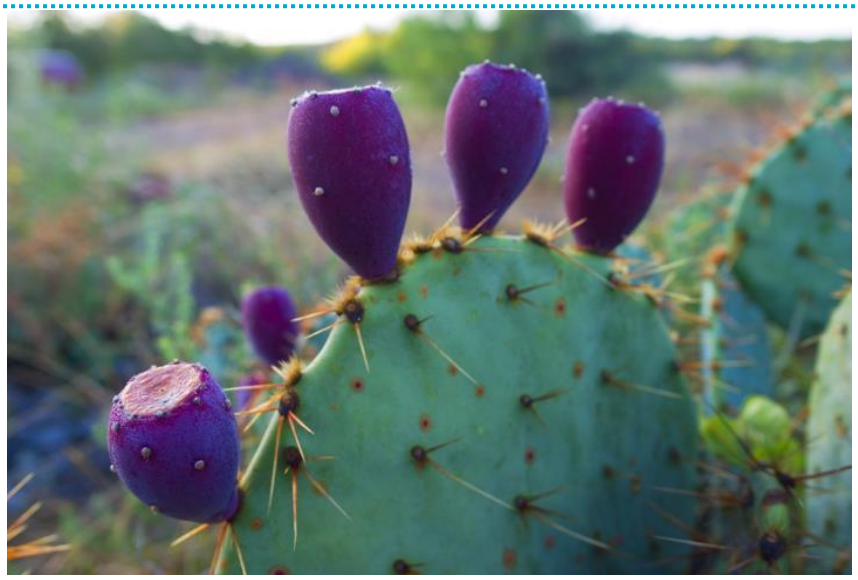
In addition to the environmental samples collected, ambient external gamma radiation levels are measured using environmental dosimeters. These surveillance activities are conducted at designated locations that are on-site, off-site, and around the perimeter of DOE/NNSA fee-owned areas, leased property, 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. Environmental media sampling is conducted annually, and the dosimeters are exchanged quarterly.

4.1 Regulatory Criteria

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

The Terrestrial Surveillance Program is also conducted to satisfy implementation of Sandia's Environmental Management System; the Environmental Management System is certified to ISO 14001:2015, *Environmental Management Systems –Requirements with Guidance for Use* (ISO 14001:2015 2015). Reporting is done in accordance with DOE O 231.1B, Admin Change 1, *Environment, Safety and Health Reporting* (DOE O 231.1B, Admin Change 1 2012).



Prickly pear cactus *(Opuntia species)* with fruit

4.2 Sample Locations and Media

Terrestrial Surveillance Program personnel use three sample location classifications: on-site, perimeter, and off-site. Sampling locations were selected based on locations of previous and ongoing activities. The environmental sample media that are collected include surface soil (less than 2 inches deep), arroyo and river sediment, and vegetation samples. 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 man-made sources.

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

New Mexico (Figure 4-2). Table 4-1, Table 4-2, and Table 4-3 list the sampling locations and the type of media collected at the on-site, perimeter, and off-site locations, respectively.

Terrestrial Surveillance Program sampling in 2023 was conducted with the following variances from past years. Soil and sediment sampling was discontinued at two perimeter (Table 4-2) and five off-site (Table 4-3) locations per request from the Sandia Field Office while Terrestrial Surveillance Program personnel reevaluate the program.

Ongoing drought conditions have reduced suitable biomass material for analysis, which, in turn, has impacted vegetation sampling.

Vegetation sampling has been impacted by ongoing drought conditions by reducing suitable biomass material for analysis (Sandia 2022). On-site, perimeter, and off-site vegetation sampling was discontinued in 2023 (Table 4-2, Table 4-3, Table 4-4).

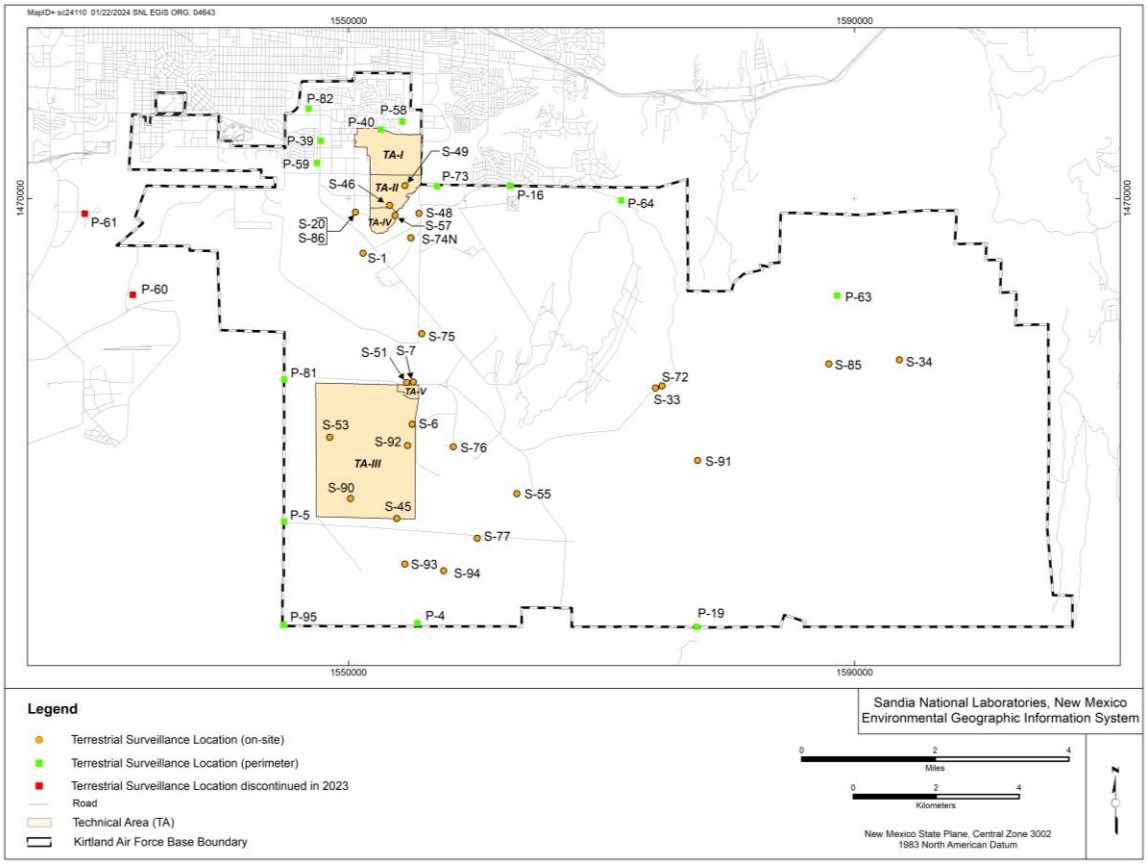


Figure 4-1. Terrestrial Surveillance Program on-site and perimeter sampling locations

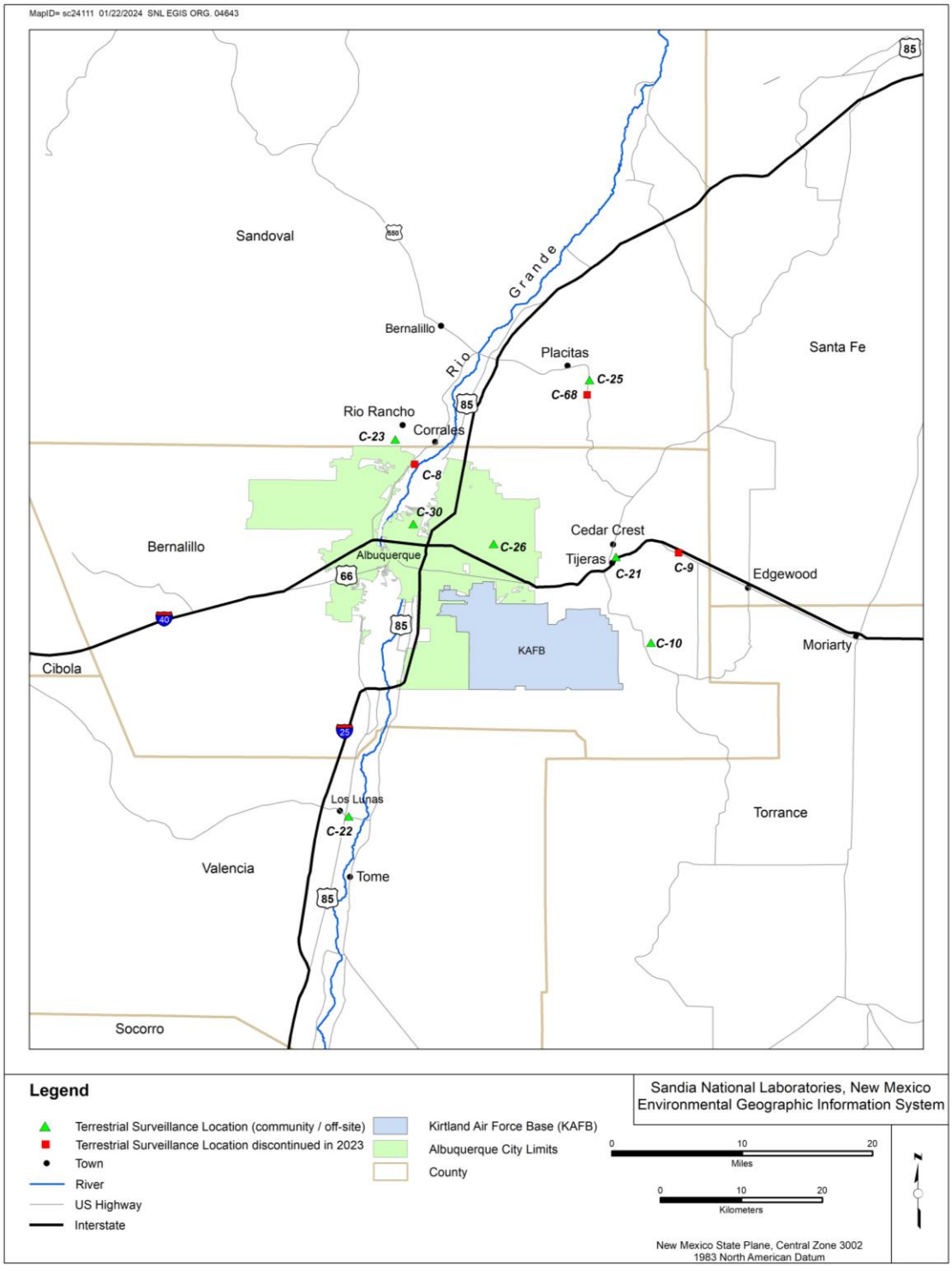


Figure 4-2. Terrestrial Surveillance Program off-site sampling locations

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

Location Number	Sampling Location	Soil	Sediment	Vegetation	Dosimeter
S-1	Pennsylvania Avenue	X			X
S-6	TA-III (east of the water tower)	X		Discontinued in 2023	X
S-7	Unnamed arroyo (north of TA-V)				X
S-20	TA-IV (southwest)				X
S-33	Coyote Springs	X		Discontinued in 2023	
S-34	Lurance Canyon Burn Site	X		Discontinued in 2023	
S-45	Radioactive and Mixed Waste Management Unit, TA-III (northwest corner)	X		Discontinued in 2023	X
S-46	TA-II (south corner)	X		Discontinued in 2023	X
S-48	Tijeras Arroyo (east of TA-II)				X
S-49	Near the Explosives Components Facility	X		Discontinued in 2023	
S-51	TA-V (north of a culvert)	X		Discontinued in 2023	
S-53	TA-III (south of the Long Sled Track)	X			
S-55	Large Melt Facility, Building 9939	X		Discontinued in 2023	
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			
S-77	Thunder Range (south)	X			
S-85	Arroyo del Coyote Cable Site		X		
S-86	Corner of Wyoming Boulevard and S Street	X		Discontinued in 2023	
S-90	TA-III Land Mine Test Site	X			
S-91	Background Arroyo near SWMU 87		X		
S-92	TA-III Classified Waste Landfill	X			
S-93	Thunder Range Explosives Test Area	X			
S-94	Thunder Range (southeast of Range 5)	X			

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

Location Number	Sampling Location	Soil	Sediment	Vegetation	Dosimeter
P-4	Isleta Reservation gate	X		Discontinued in 2023	X
P-5	McCormick gate	X		Discontinued in 2023	X
P-16	Four Hills	X		Discontinued in 2023	X
P-19	U.S. Geological Survey Seismic Center gate	X			X

Location Number	Sampling Location	Soil	Sediment	Vegetation	Dosimeter
P-39	Northwest DOE complex				X
P-40	TA-I (northeast)				X
P-58	North KAFB housing	X		Discontinued in 2023	
P-59	Zia Park (southeast)	X			
P-60	Tijeras Arroyo (downstream)		Discontinued in 2023		
P-61	Albuquerque International Sunport	Discontinued in 2023			
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		Discontinued in 2023	
P-95	Southwest corner of KAFB	X			

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

Location Number[a]	Sampling Location	Soil	Sediment	Vegetation	Dosimeter
C-8	Rio Grande, Corrales Bridge (upstream)		Discontinued in 2023		
C-9	Sedillo Hill, Interstate 40	Discontinued in 2023		Discontinued in 2023	
C-10	Oak Flats	Discontinued in 2023		Discontinued in 2023	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	Discontinued in 2023		Discontinued in 2023	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		Discontinued in 2023		

4.3 Field Methods, Analytical Parameters, and Quality Control Procedures

All samples were collected in accordance with applicable field operating procedures for soil, sediment, and vegetation sampling activities and with the *Quality Assurance Project Plan for Terrestrial Surveillance at Sandia National Laboratories, New Mexico* (Sandia 2022).

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.

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 2022). Samples were analyzed for the following parameters: specific metals, high explosive compounds, perchlorate, and select radionuclides. 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 2023, optically stimulated luminescence dosimeters were employed to measure ionizing radiation. The dosimeters are issued and analyzed by an accredited off-site laboratory. Optically stimulated luminescence 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 were prepared and analyzed in accordance with established methods specified in Chapter 9.

4.4 Data Analysis and Methodology

The 2023 analytical results were reviewed by Terrestrial Surveillance Program personnel. Summary statistics, population comparisons, and trend analysis were performed and were evaluated. Additional comparisons were made with selected reference values.

4.4.1 Statistical Analysis

The statistical analysis methodology was performed on 2023 soil and sediment sample results. Statistical analyses were used to compare sample results at on-site locations versus off-site 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 off-site 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 results are greater than the off-site and perimeter sample 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 off-site 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 4.4.3 and Section 4.4.5) 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.

4.4.2 Other Reference Comparisons

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

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

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

	NM Soil Concentrations[a]		NMED Soil Screening Levels[b]		Trace Elements in Soil[c]	
Analyte	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 or sediment.

Environmental dosimeter data are 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).

Program Activities and Results 2023: Terrestrial Surveillance

The following Terrestrial Surveillance Program activities occurred in 2023:

- Annual soil and sediment sampling occurred in May 2023 at designated locations.
- Environmental dosimeters were deployed and collected at designated locations and analyzed quarterly. The results are reported as an estimated annual dose rate.

The full analytical results for environmental media samples and environmental dosimeters are provided in z, "Terrestrial Surveillance Analytical Results in 2023."

4.4.3 Radiological Results

Radiological analyses were performed on soil and sediment samples. Statistical analyses of the 2023 results for the selected radionuclides revealed no statistically significant population differences nor any increasing trends in the on-site sample results. No further investigation is warranted; sampling will continue in the next calendar year.

4.4.4 Dosimeter Results

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

Table 4-5 shows the average dose rate summary statistics for 2023. 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 4-5. Dosimeter dose rate summary statistics by location classification, 2023

Location Classification	Number of Observations	Average (mrem/year)	Median (mrem/year)	Standard Deviation (mrem/year)	Minimum (mrem/year)	Maximum (mrem/year)
On-site	7	66	68	7.5	51	76
Perimeter	7	67	62	12.2	55	91
Off-site	7	65	71	13.5	44	80

4.4.5 Nonradiological Results

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

Metals

The results of the statistical analysis for metals in soil and sediment identified twelve instances of statistical significance (population difference and increasing trend) in the on-site sample results. All 2023 metal results from this group were also compared to values referenced in Section 4.4 and provided in Table 4-4 and to results from previous years. Table 4-6 presents the results and summary statistics for the statistically significant metals.

Table 4-6. Statistically significant metals summary, 2023

			Historical Dataset						New Mexico Soil Screen Level[a]		
Analyte	Location	Sample Matrix	Number of Samples	Mean (mg/kg)	Median(mg/kg)	Standard Deviation (mg/kg)	Minimum (mg/kg)	Maximum (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)	2023 Result (mg/kg)
Aluminum	S-34	Soil	14	14,579	14,000	2,353	12,000 J	18,900 J	78,000	1,292,000	17,500 J
Arsenic	S-91	Sediment	10	4.2	3.5	2.2	1.1	7.82	13.0	208	7.82
Beryllium	S-91	Sediment	10	0.384	0.371	0.095	0.181	0.548	156	2,580	0.442
Beryllium	S-34	Soil	14	0.649	0.647	0.06	0.564	0.761	156	2,580	0.755
Chromium (total)	S-34	Soil	14	13.5	13	1.9	10.5	16.6 J	45,200	314,000	14.5
Copper	S-72	Sediment	14	9.5	9	2.6	6.18 J	16.8 J	3,130	51,900	10.9
Copper	S-33	Soil	14	10	10.2	1.4	7.93 J	12.3	3,130	51,900	12.3
Iron	S-72	Sediment	14	11,638	10,500	4,383	6,570 J	24,900 J	54,800	908,000	13,200 J
Nickel	S-72	Sediment	14	10	9.2	2.6	7.1 J+	17.7 J	1,560	25,700	9.71
Nickel	S-34	Soil	14	12.3	12.2	1.1	10.4 J-	14.2 J	1,560	25,700	12.3
Selenium	S-91	Sediment	10	1.211	1.08	0.245	0.298 UJ	1.59	391	6,490	1.32
Thallium	S-34	Soil	14	0.143	0.135	0.012	0.121 U	0.166	0.78	13.0	0.146

Note: Historical dataset is from 2010 to 2023.
[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 positive bias.
J- = The associated numerical value is an estimated quantity with a suspected negative bias.
UJ = The analyte was analyzed for but was not detected. The associated value was an estimate and might be inaccurate or imprecise.

Aluminum

One on-site location (S-34 soil sample) was identified as statistically significant for aluminum with a result of 17,500 J mg/kg. The J-qualified data indicates the result is an estimated quantity. The result is below the NMED soil screening level for residential use, within the range of values for New Mexico surface soils (Table 4-4), and within the historical range for the dataset at this location.

Arsenic

One on-site location (S-91 sediment sample) was identified as statistically significant for arsenic with a result of 7.82 mg/kg. The result represents a maximum for the dataset at this location; however, it is below the NMED soil screening level for residential use, and within the range of values for New Mexico surface soils (Table 4-4).

Beryllium

Two on-site locations (S-34 soil sample and S-91 sediment sample) were identified as statistically significant for beryllium with a result of 0.755 mg/kg for S-34 and 0.442 mg/kg for S-91. The results are below the NMED soil screening level for residential use, are below the range of values for New Mexico surface soils (Table 4-4), and within the historical ranges for the dataset at these locations.

Chromium (Total)

One on-site location (S-34 soil sample) was identified as statistically significant for chromium (total) with a result of 14.5 mg/kg. 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 4-4), and within the historical range for the dataset at this location.

Copper

An on-site location (S-72 sediment sample) was identified as statistically significant for copper with a result of 10.9 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 4-4), and within the historical range for the dataset at this location.

Another on-site location (S-33 soil sample) was identified as statistically significant for copper with a result of 12.3 mg/kg. The result represents a maximum for the dataset at this location; however, it is below the NMED soil screening level for residential use, and within the range of values for New Mexico surface soils (Table 4-4).

Iron

One on-site location (S-72 sediment sample) was identified as statistically significant for iron with a result of 13,200 J mg/kg. The J-qualified data indicates the result is an estimated quantity. The result is below the NMED soil screening level for residential use, within the range of values for New Mexico surface soils (Table 4-4), and within the historical range for the dataset at these locations.

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 9.71 mg/kg for S-72 and 12.3 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 4-4), 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 1.32 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 4-4), and within the historical range 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 0.146 mg/kg. The result is below the NMED soil screening level for

residential use, below the range of values for trace elements in soil (Table 4-4), and within the historical range for the dataset at this location.

All other metals results for 2023 were not statistically significant in both tests (population and trend). No NMED soil screening levels for metals were met or exceeded; therefore, no further action is warranted. 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 4-1). There were no detections above the method detection limit for any high explosive compounds at these locations.

Perchlorate

One on-site location (S-53; soil sample) was analyzed for perchlorate (Figure 4-1). The result was 0.00737 J- mg/kg. The J- qualified data indicates the result is an estimated quantity with a suspected negative bias. The estimated result is below the NMED soil screening level of 54.8 mg/kg for residential use (NMED 2022).

Chapter 5. Air Quality Compliance and Related Programs

Redbud (*Cercis* spp.)

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 5.1)
- Ambient Air Surveillance Program (Section 5.2)
- Meteorology Program (Section 5.3)
- Radionuclide (NESHAP) Program (Section 5.4)

5.1 Air Quality Compliance Program

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

5.1.1 Stationary Sources

Stationary source registrations are required for sources that emit more than 2,000 pounds of any air contaminant per year or any amount of a hazardous air pollutant. Stationary source

permits may be required for sources that have the potential to emit 10 pounds per hour or more or 25 tons per year or more of any single regulated air contaminant, 2 tons per year of a single hazardous air pollutant, or 5 tons per year of any combination of hazardous air pollutants. Permits may also be required for any equipment or process that is subject to federal New Source Performance Standards, or NESHAPs. Permits include requirements for monitoring source emissions and maintaining records of operations to ensure compliance with regulations, emission limits, and other conditions of the permit. Regulated air contaminants include criteria pollutants and hazardous air pollutants. Criteria pollutants include carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, and sulfur dioxide. DOE/NNSA's air quality permits and registrations for SNL/NM stationary sources are presented in Table 10-1.

Program Activities and Results 2023: 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, *CY2023 Stationary Source Emissions Inventory Report for Sandia National Laboratories* (DOE/NNSA/SFO 2023), was submitted to the City of Albuquerque Air Quality Program. Emissions data for permitted and registered stationary sources in 2023 are provided in Table 5-1.

Table 5-1. Permitted and registered stationary source emission data, 2023

Carbon Monoxide	Hazardous Air Pollutant	Nitrogen Oxide	Particulate Matter with a Diameter ≤ 10 µm	Sulfur Dioxide	Volatile Organic Compound
11.00	8.90	1.79	8.70	0.09	26.21

Note: All units are in tons per year.

Program Activities and Results 2023: 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 2023, potential emissions were 8.9 tons of combined hazardous air pollutants and 26.21 tons of volatile organic compounds. These emissions were within permitted limits.

Program Activities and Results 2023: Title V Operating Permit

DOE/NNSA 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 2023: 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 2023, Sandia operations directly emitted a total of 87,058 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 2023.

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

5.1.2 Stratospheric Ozone Protection

Title VI of the Clean Air Act Amendments of 1990 required EPA to establish regulations to phase out the production and consumption of ozone-depleting substances. Ozone-depleting substances are defined as chlorofluorocarbons, hydrochlorofluorocarbons, and other halogenated chemicals that have been found to contribute to the depletion of the

stratospheric ozone layer. EPA has established regulations in 40 CFR 82, *Protection of Stratospheric Ozone* (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.

5.1.3 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.

5.1.4 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 2023: Air Quality Compliance, Open-Burn Permits

A list of open-burn permits obtained in 2023 can be found in Chapter 10.

5.1.5 Fugitive Dust

As required by 20.11.20 NMAC, *Fugitive Dust Control* (20.11.20 NMAC 2008), DOE/NNSA 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 2023: Air Quality Compliance, Fugitive Dust

A list of fugitive dust permits obtained in 2023 is included in Chapter 10.

5.2 Ambient Air Surveillance Program

Ambient air is surveilled through a network of air monitoring stations located on or near Sandia property (Figure 5-1). Program activities are reported on a fiscal-year basis unless otherwise noted. In fiscal year 2023, 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}).

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

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

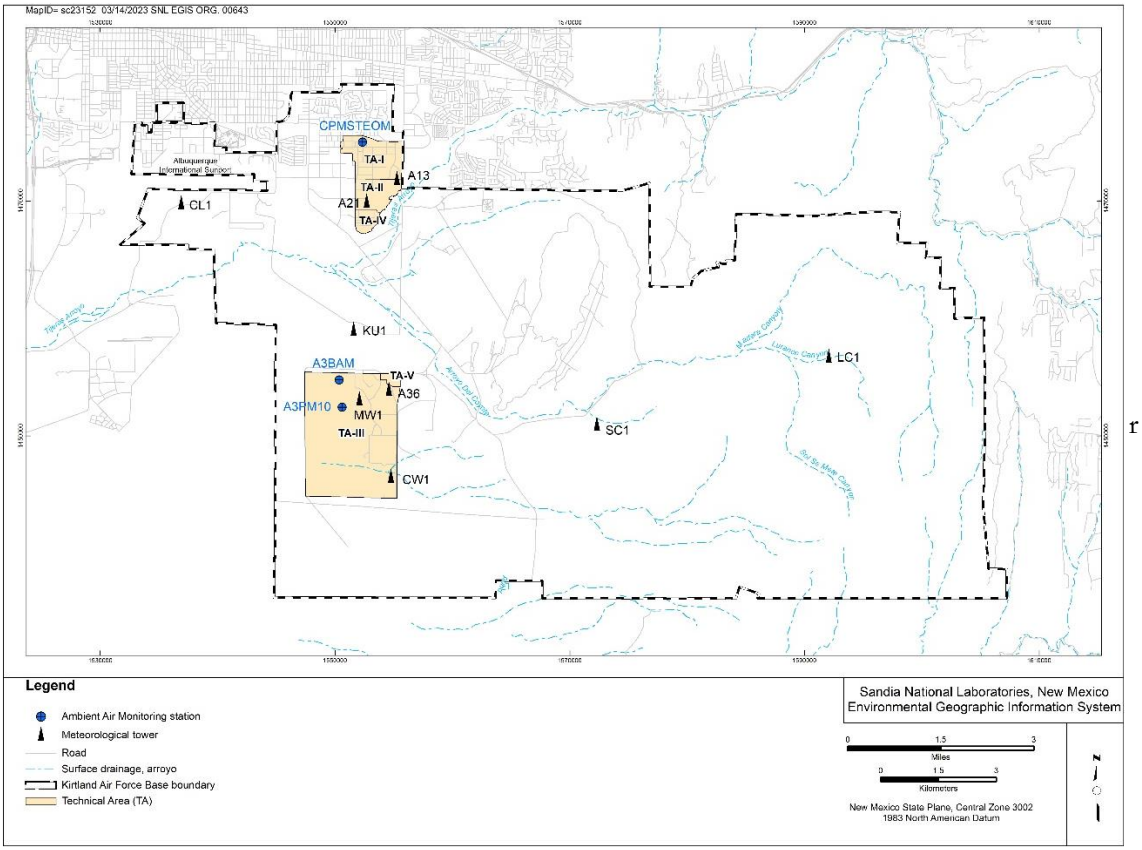


Figure 5-1. Clean air network of meteorological towers and ambient air monitoring stations

5.2.1 Monitoring Stations

Ambient air-monitoring stations used in fiscal year 2023 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.
- PM_{10} was measured at one monitoring location (A3PM10). The air was sampled for a 24-hour period every quarter, contingent on equipment functionality.

Program Activities and Results 2023: Ambient Air Surveillance

Ambient air-monitoring data are presented here for fiscal year 2023. Laboratory data are available in Appendix C, "Ambient Air Surveillance Results in Fiscal Year 2023," 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 2023 are listed in Table 5-2.

Table 5-2. Monthly and annual averages for one-hour $PM_{2.5}$ measurements, fiscal year 2023

Sample Location	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Year Average
A3BAM	2.51	2.48	2.84	2.28	2.76	2.35	3.46	3.51	3.93	4.80	4.01	3.32	3.19
CPMSTEOM	4.79	5.43	5.19	4.34	5.26	5.01	7.12	6.79	6.69	6.96	5.92	5.53	5.75

Note: All units are in µg/m³.

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

The highest quarterly average PM_{10} concentration in fiscal year 2023 was 63.49 µg/m³, which occurred in the first quarter of fiscal year 2023. The quarterly and annual averages for PM_{10} are provided in Table 5-3.

Table 5-3. Quarterly and annual averages for PM_{10}, fiscal year 2023

Sample Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year Average
A3PM10	63.49	NA	5.56	16.73	28.59

Note: All units are in µg/m³.

The PM_{10} samples are also analyzed for metals and radiological constituents, and the fiscal year 2023 averages are listed in Table 5-4. Most of the radionuclides are either naturally occurring or are short-lived decay daughter products detected during analysis and are not emitted from SNL/NM sources.

Table 5-4. Average results of PM_{10} analysis, fiscal year 2023

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Aluminum	µg/m³	3.85E-02	2,000
Antimony	µg/m³	6.00E-04	500
Arsenic	µg/m³	DE	10
Barium	µg/m³	1.19E-03	50
Beryllium	µg/m³	DE	0.05
Cadmium	µg/m³	DE	10
Calcium	µg/m³	1.10E-01	2,000
Chromium	µg/m³	7.72E-03	10
Cobalt	µg/m³	DE	20
Copper	µg/m³	1.71E-02	1,000
Iron	µg/m³	5.69E-02	5,000
Lead	µg/m³	1.10E-03	150
Magnesium	µg/m³	1.05E-02	10,000

Analyte	Units	Station A3PM10	Threshold Limit Value[a]
Manganese	µg/m^3	1.38E-03	200
Nickel	µg/m^3	2.63E-04	50
Potassium	µg/m^3	1.51E-01	2,000
Selenium	µg/m^3	1.64E-03	200
Silver	µg/m^3	DE	10
Sodium	µg/m^3	DE	5,000
Thallium	µg/m^3	DE	100
Uranium	µg/m^3	DE	200
Vanadium	µg/m^3	DE	50
Zinc	µg/m^3	9.44E-03	10
Actinium-228	pCi/m^3	DE	100
Alpha, gross	pCi/m^3	DE	0
Americium-241	pCi/m^3	DE	NE
Beryllium-7	pCi/m^3	1.52E-01	40,000
Beta, gross	pCi/m^3	9.51E-03	0
Bismuth-212	pCi/m^3	DE	700
Bismuth-214	pCi/m^3	DE	2,000
Cesium-137	pCi/m^3	DE	400
Cobalt-60	pCi/m^3	DE	80
Lead-212	pCi/m^3	7.17E-03	80
Lead-214	pCi/m^3	DE	2,000
Neptunium-237	pCi/m^3	DE	0
Potassium-40	pCi/m^3	DE	900
Radium-223	pCi/m^3	DE	NE
Radium-224	pCi/m^3	DE	4
Radium-226	pCi/m^3	DE	1
Radium-228	pCi/m^3	DE	3
Sodium-22	pCi/m^3	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

5.3 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."

5.3.1 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 5-5). Meteorological tower locations are shown in Figure 5-1. 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 5-5. Meteorological towers

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

Program Activities and Results 2023: Meteorological Monitoring

New Mexico's weather in 2023 was warmer and drier than climatological means. The statewide temperature average was 55.4°F, 2.6 degrees above the normal of 52.8°F. Calendar year 2023 was the 7th-warmest year on record for New Mexico (National Weather Service n.d.). The statewide average precipitation was 10.75 inches, which was 3.24 inches below the normal of 13.99 inches. This made 2023 the 18th driest 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 worsening as the year progressed and ending 2023 in a severe 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 2023, Tower A36 observations showed warmer and drier conditions than the site's 1995–2019 climatological averages. Rainfall at Tower A36 totaled 6.45 inches, well under the 8.86-inch average at that site. A late and inactive monsoon season continued the trend of dry conditions throughout the year. 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 58.8°F, 1.3°F above the 25-year average of 57.5°F. The months of May through December were all warmer than usual. February, March, and April were cooler than their climatological averages.

The 2023 annual summary for Tower A36 is shown in Table 5-6.

Table 5-6. Annual climatic summary from Tower A36, 2023

Measurement	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year Annual
Temperature (°C)													
Average daily low	-3.66	-3.72	0.49	3.77	11.00	14.50	21.00	18.30	14.80	7.60	1.68	-1.95	6.98
Average daily high	8.43	11.30	13.80	21.40	26.40	31.40	36.90	33.10	29.40	23.70	14.50	9.87	21.68
Monthly mean	3.23	4.35	7.66	13.50	19.20	24.00	29.10	25.70	22.60	16.40	8.71	4.46	14.91
Extremes (°C)													
Low	-9.98	-10.66	-5.29	-7.79	6.26	8.99	17.07	16.52	10.73	-3.93	-6.25	-7.08	-10.66
High	14.95	18.51	20.75	29.39	30.16	36.64	39.39	38.43	36.12	28.85	25.56	16.13	39.39
Relative Humidity													
Humidity (percent)	51.50	46.20	45.70	24.30	32.60	21.20	25.60	38.30	38.00	34.70	51.80	53.80	38.64
Precipitation (cm)													
24-hour maximum	0.38	0.33	0.61	0.05	1.70	0.05	0.23	0.53	1.12	0.00	0.89	1.30	1.70
Monthly total	0.76	0.58	2.51	0.05	2.39	0.10	0.43	1.70	2.67	0.00	2.59	2.59	16.38
Wind Speed (m/sec)													
Highest 24-hour average	12.78	9.22	8.72	9.33	10.09	6.73	6.65	8.72	6.47	8.10	9.58	10.21	12.78
Monthly mean	3.61	3.75	4.25	4.48	4.57	4.20	4.12	4.15	3.38	3.53	2.98	2.95	3.83
Maximum gust	25.89	32.81	23.38	27.89	28.93	21.82	23.98	22.74	17.73	25.07	16.85	17.86	32.81
Barometric (mb)													
Pressure	833	834	832	832	833	833	836	838	836	835	837	837	834.67

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 5-7 shows some of the variations and extremes from the meteorological measurements throughout the year.

Table 5-7. Variations and extremes in meteorological measurements across the tower network, 2023

Meteorological Measurement	Minimum	Maximum	Spread
Temperature	**°C**	**°C**	**°C**
Average daily temperature range	13.92 Tower A13	15.78 Tower CW1	1.86
Average daily minimum temperature	4.85 Tower LC1	7.89 Tower CL1	3.04

Meteorological Measurement	Minimum	Maximum	Spread
Average daily maximum temperature	19.51 Tower LC1	21.99 Tower CL1	2.48
Average annual temperature	12.51 Tower LC1	15.15 Tower KU1	2.64
Annual temperature extremes	-14.12 Tower LC1	40.59 Tower CL1	54.71
Precipitation	**cm**	**cm**	**cm**
Maximum daily precipitation	1.55 Tower SC1	2.72 Tower A21	1.17
Greatest monthly precipitation variation	2.59 Tower A36	4.57 Tower LC1	1.98 November
Annual precipitation extremes	16.38 Tower A36	23.44 Tower LC1	7.06
Wind Speed	**m/sec**	**m/sec**	**m/sec**
Average daily maximum wind speed	8.89 Tower LC1	14.36 Tower A13	5.47
Average annual wind speed	3.59 Tower LC1	3.97 Tower CW1	0.38
Maximum annual wind gust	27.17 Tower LC1	35.05 Tower A21	7.88

Note: Winter precipitation that falls as snow is underestimated.

Program Activities and Results 2023: 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 5-2. Typical diurnal variations and wind shifts cannot be seen in Figure 5-2.

Figure 5-3 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.

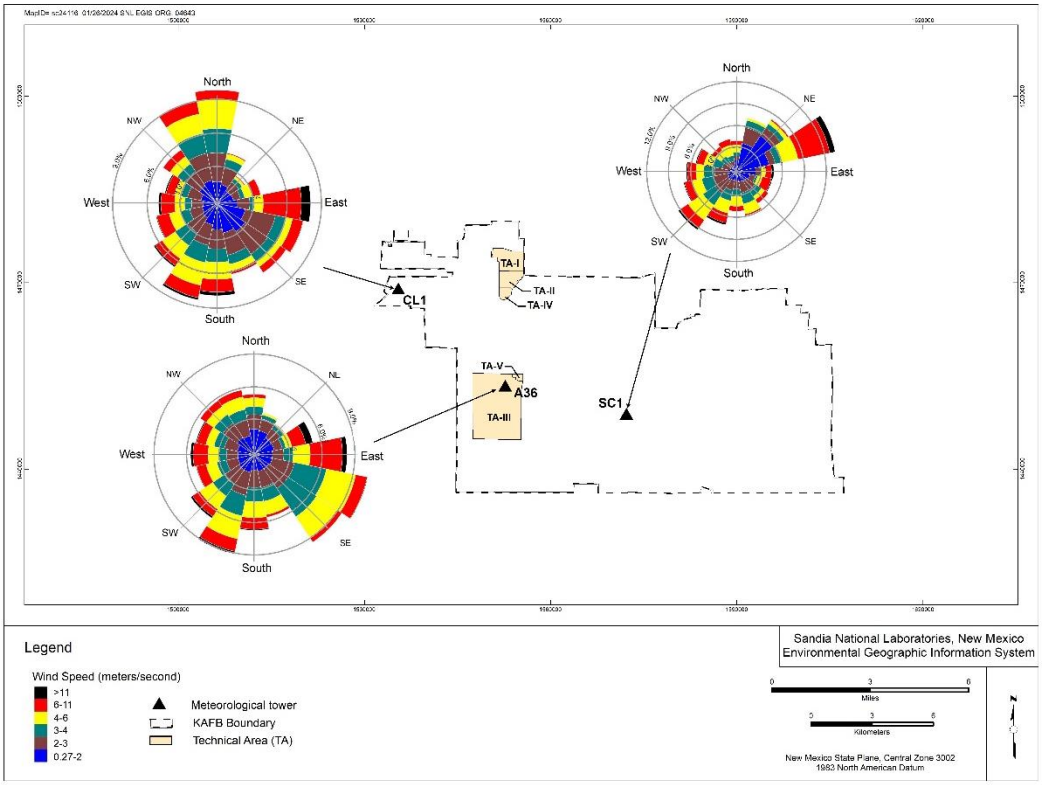


Figure 5-2. Annual wind roses at towers A36, CL1, and SC1

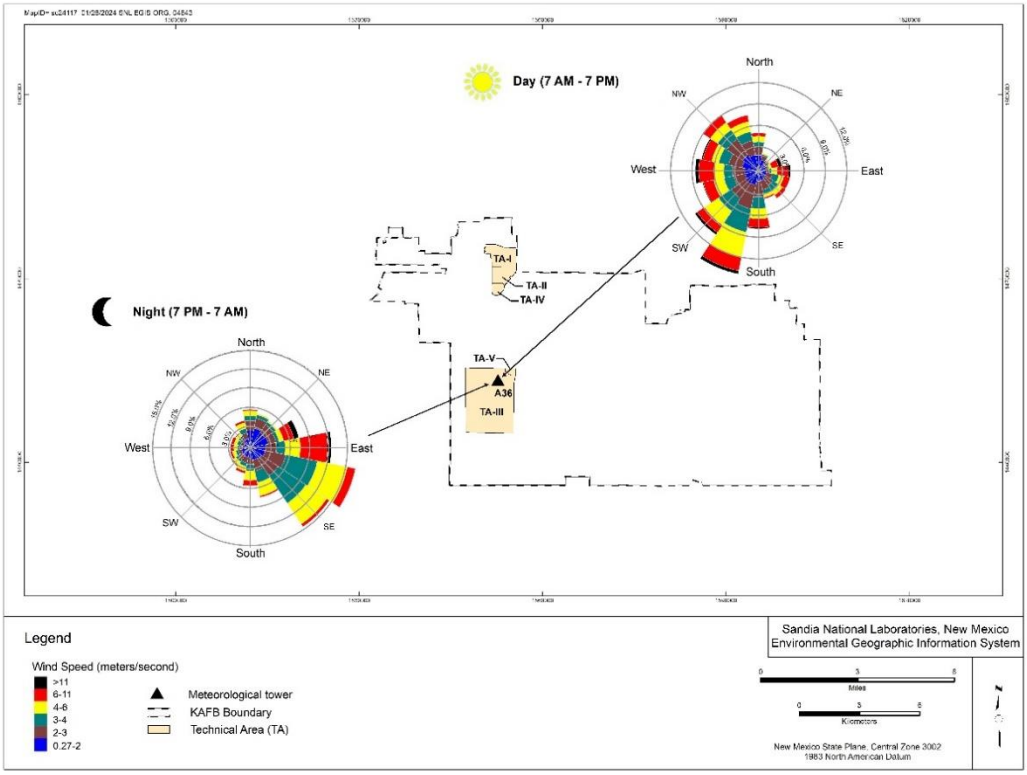


Figure 5-3. Annual wind roses for daytime and nighttime frequency at Tower A36

Table 5-8 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.

Table 5-8. Predominant wind directions for day and night periods by tower, 2023

Tower	Day	Night
A13	South-southwest	East-northeast
A21	South-southwest	Northeast
A36	South-southwest	East-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

5.4 Radionuclide National Emission Standards for Hazardous Air Pollutants Program

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

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

5.4.1 Compliance Reporting

An annual radionuclide NESHAP report summarizes radionuclide air emission releases from Sandia facilities and presents the results of the annual dose assessment. DOE/NNSA 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 2023, SNL/NM* (Sandia 2023).

5.4.2 Program Activities and Results 2023: 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 5-9 lists the radionuclides and the total reported emissions from each of Sandia's radionuclide NESHAP sources in 2023, and Figure 5-4 shows the locations of facilities with the potential to emit radionuclides.

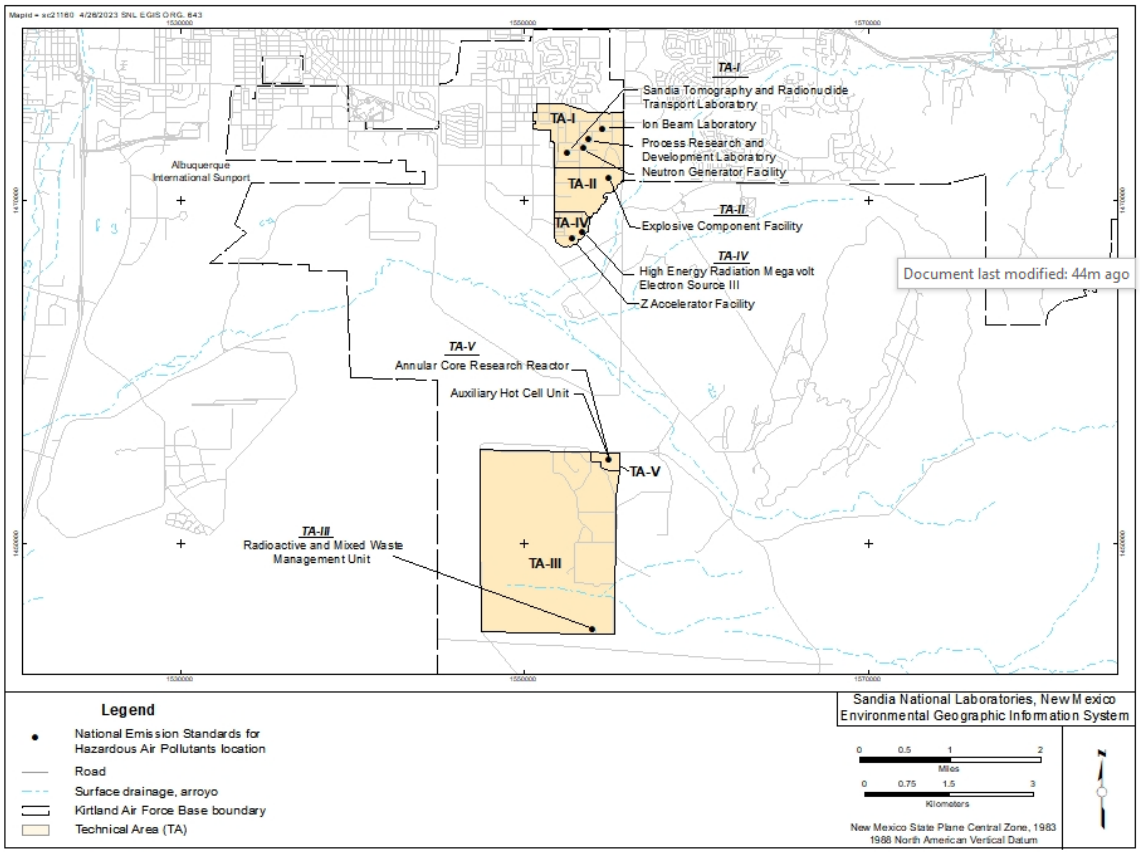


Figure 5-4. Locations of facilities with the potential to emit radionuclides

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 2023.

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 2023.

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 5-9. Radionuclide releases by NESHAP source, 2023

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	4.93

Source Name, Location	Description	Source Type	Monitoring Method	Radionuclide Emitted	Reported Release (Ci/year)
Auxiliary Hot Cell Unit, TA-V	Facility used to identify, sort, characterize, and repackage legacy nuclear materials for permanent removal; legacy material may include accountable nuclear material, spent nuclear fuel, and radiological material	Point	Periodic	Krypton-85 Strontium-90 Cesium-137 Tritium Samarium-151 Plutonium-241 Americium-241 Plutonium-238 Plutonium-239 Uranium-235m[a]	2.00E-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	2.24E-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	6.40E-04 6.40E-05
Ion Beam Laboratory, TA-I	Ion and electron accelerators used to study and modify materials systems	Point	Calculation	Tritium	14.0
Neutron Generator Facility, TA-I	Principal production facility used for neutron generators	Point	Continuous	Tritium	10.63
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)	1.70E-03 1.21E-03 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	2.40

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 2023, 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 5-5 shows the annual reported release of argon-41 and tritium for 2018 through 2023. The atmosphere contains 78.09 percent nitrogen, 20.95 percent oxygen, 0.93 percent argon, 0.03 percent carbon

dioxide, and minor concentrations of neon, methane, hydrogen, helium, and krypton. Some of these constituents are susceptible to isotope transformations during high-energy processes, which result in air-activation products such as argon-41. Emissions vary from year to year, based on the operations conducted at the various facilities.

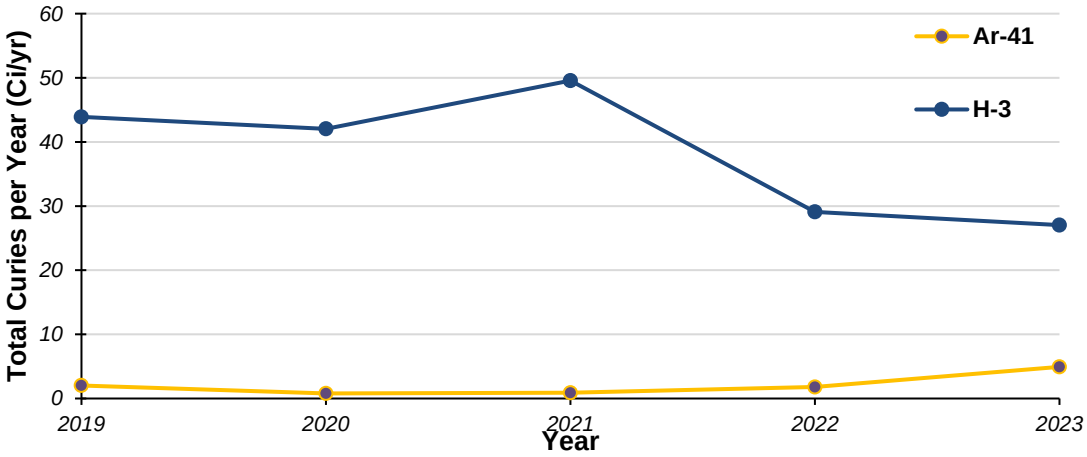


Figure 5-5. Atmospheric releases of argon-41 and tritium, 2018–2023

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/NNSA 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 2023. 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.

Program Activities and Results 2023: Summary of Radionuclide Releases by Category

A summary of radionuclide releases by NESHAP source from SNL/NM operations in 2023 is provided in Table 5-9. Table 5-10 is a summary of activity releases in 2023 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 5-9. 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 5-10. Radiological releases by category, 2023

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
2.70E+01	4.93E+00	7.04E-04	5.03E-06	5.04E-06	1.60E-06	2.06E-06	2.00E-08

Program Activities and Results 2023: 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 that are subject to 40 CFR 61, Subpart H submit annual emission data. Emissions are modeled using version 4.1.1 of the EPA Clean Air Act Assessment Package-1988 (EPA 2023) to estimate the annual dose to each of the identified public receptors.

The radiologic dose information is provided in Table 5-11 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 2024). For 2023 reporting, the population file continued to use 2020 census data. 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)).

Program Activities and Results 2023: 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 2023). 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 5-11.

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.

Table 5-11. Calculated dose assessment results for on-site and off-site receptors and for collective populations, 2023

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	Kirtland Storage Facility	7.23 E-04mrem/year	10 mrem/year
Off-site receptor effective dose to the maximally exposed individual	Eubank Gate area	6.98E-03 mrem/year	10 mrem/year
Collective Dose			
Collective regional population	Fifty-mile radius of KAFB	7.90E-04 person-rem/year	No standard available
Collective KAFB population	KAFB housing	4.58E-04 person-rem/year	No standard available

In 2023, as with previous years, the primary radionuclides released from SNL/NM facilities were tritium and argon-41. In 2023, the on-site maximally exposed individual was located on KAFB at the Kirtland Storage Facility. The on-site maximally exposed individual dose of 7.23E-04 mrem/year resulted primarily from argon-41 releases at the Annular Core Research Reactor and from tritium releases at the Ion Beam Laboratory and the Neutron Generator Facility. The off-site maximally exposed individual dose of 6.98E-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 5-11). 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 2023 was 7.90E-04 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 2023 calculation resulted in an estimated population dose of 4.58E-04 person-rem/year.

Unplanned Radionuclide Releases

SNL/NM facilities did not have any unplanned radionuclide releases in 2023.

Chapter 6. Water Quality Programs

Sandia Mountains

OVERVIEW ▪ Water quality programs—which include the 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 7. Additional water quality programs discussed in this chapter include the following:

- Oil Storage Program (Section 6.1)
- Safe Drinking Water Protection Program (Section 6.2)
- Stormwater Program (Section 6.3)
- Surface Discharge Program (Section 6.4)
- Wastewater Discharge Program (Section 6.5)

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.

6.1 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 *Spill Prevention, Control, and Countermeasure Plan for Sandia National Laboratories New Mexico* (Sandia 2024), which describes the oil storage facilities at SNL/NM and the mitigation controls in place to minimize the potential for an inadvertent discharge of oil from reaching navigable waters of the United States.

The oil storage capacity at SNL/NM is approximately 2.2 million gallons. The inventory of oil storage containers operating under the *Spill Prevention, Control, and Countermeasure Plan for Sandia National Laboratories New Mexico* includes 47 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.

Twelve of the 47 stationary aboveground storage tanks that were operational in 2023 are subject to NMED Petroleum Storage Tank Bureau regulation and registration. Registration numbers for the twelve aboveground storage tanks regulated by the NMED Petroleum Storage Tank Bureau are provided in 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 2023.

The NMED Petroleum Storage Tank Bureau owner identification number for SNL/NM-registered tanks is 14109, and the operator identification number is 13476.

Program Activities and Results 2023: Oil Storage

In 2023, 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, four of 11 field-fabricated tanks were inspected in 2023 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.

Installation of two new 20,000-gallon aboveground storage tanks was completed in 2023. The tanks have double-wall construction and are equipped with leak-detection monitoring. These tanks replaced two 20,000-gallon underground storage tanks that had been removed in 2022. No other underground oil storage tanks are operational at SNL/NM. The new tanks have been registered with the NMED Petroleum Storage Tank Bureau (Table 10-1). One new backup power generator installation project was completed in 2023. The generator is equipped with a 4,500-gallon diesel fuel storage tank (i.e., base tank) that has double-wall

construction and is equipped with leak detection monitoring. The generator base tank has been registered with the NMED Petroleum Storage Tank Bureau (see Table 10-1).

6.2 Safe Drinking Water Protection Program

Safe Drinking Water Protection Program activities ensure the availability of safe drinking water 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/NNSA-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/NNSA 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/NNSA 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.).

6.3 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.

6.3.1 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.

6.3.2 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 6-1). 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/NNSA 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.

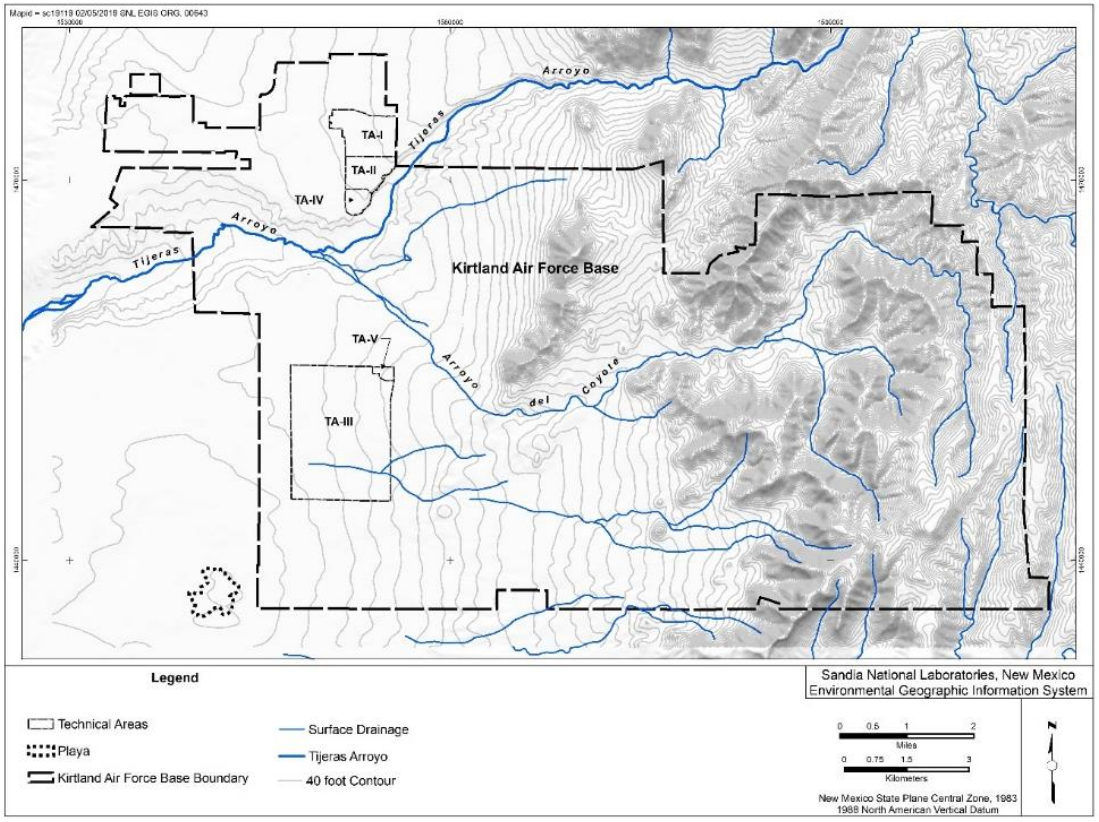


Figure 6-1. Location of primary surface water drainages and Waters of the United States that receive stormwater discharges from SNL/NM

6.3.3 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 2023: 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 transferred to the new permit without interruption. Requirements under the new permit remain essentially unchanged for SNL/NM.

During 2023, SNL/NM held active permit coverage for 16 construction sites (see Chapter 10); DOE/NNSA and NTESS held joint CGP coverage for one of these sites.

6.3.4 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 6-2. 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.

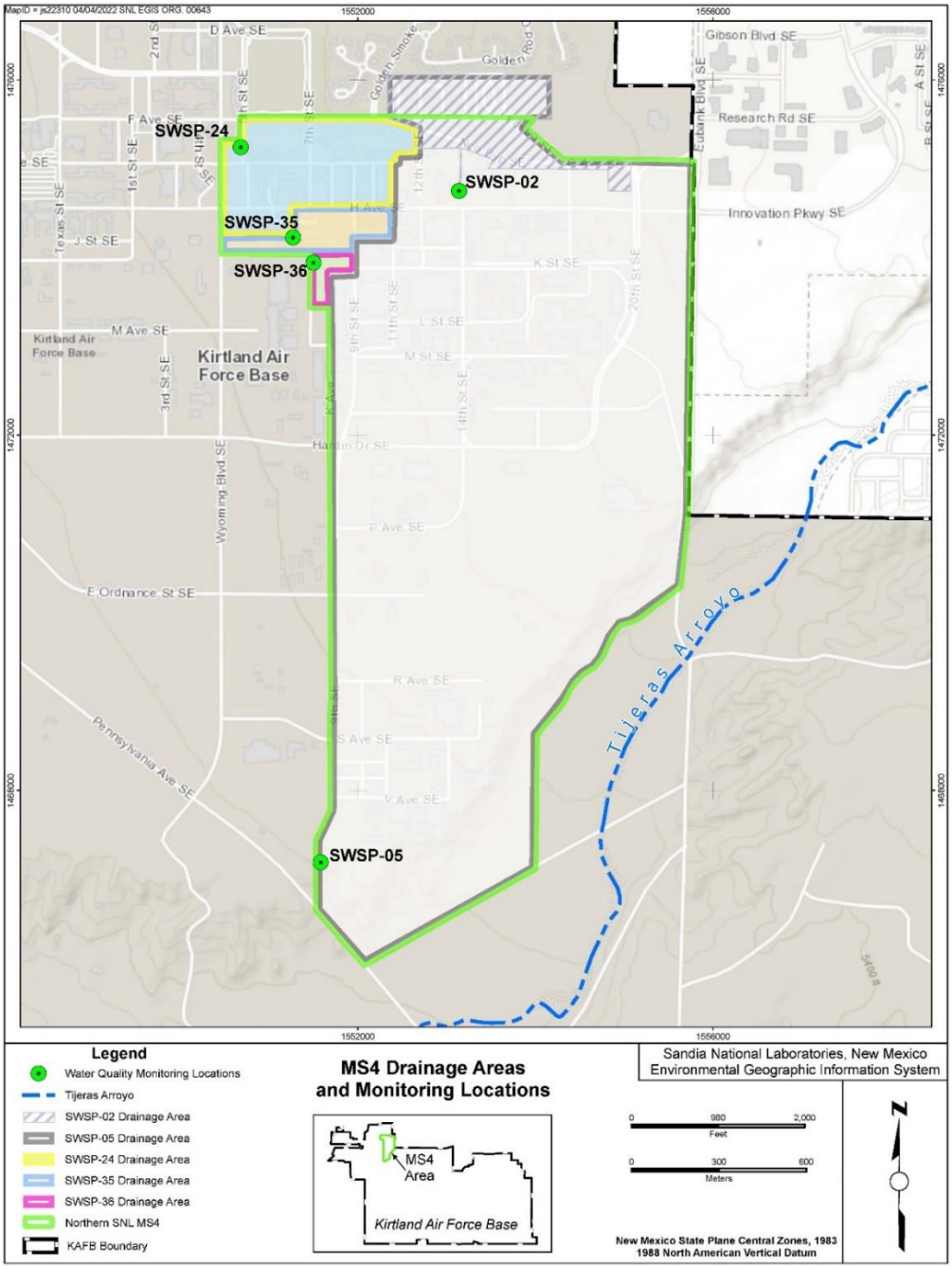


Figure 6-2. MS4 drainage areas and monitoring locations

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 5 years (starting in December 2014), but EPA has extended it indefinitely because they have not issued a new permit. The requirement for eight samples was met or exceeded within the 5-year permit term 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.

Polychlorinated biphenyls (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 and subsequent year MS4 *Stormwater Management Plans* 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 (University of New Mexico n.d.). Table 6-1 displays MS4 permit water quality standard exceedances in 2023.

Table 6-1. Middle Rio Grande Municipal Separate Storm Sewer System Permit water quality standard exceedances, 2023

Outfall	Parameter	Number of Samples Taken	Number of Exceedances	Date Exceeded	Description and Solution
SWSP-02	*E. coli*	1	1	9/12/2023	The source is local wildlife; SNL/NM is continuously implementing wildlife preclusion measures.
SWSP-05	*E. coli*	1	1	9/12/2023	
SWSP-35	*E. coli*	1	1	9/12/2023	
SWSP-36	*E. coli*	1	1	9/12/2023	
SWSP-02	PCBs	1	1	9/12/2023	The source is likely direct precipitation and diffuse deposition in soil and sediment from historic on-site and off-site activities. Methods to decrease PCBs in stormwater at SNL/NM include reducing sediment in stormwater, and reducing flow through green stormwater infrastructure.
SWSP-05	PCBs	1	1	9/12/2023	
SWSP-35	PCBs	1	1	9/12/2023	
SWSP-36	PCBs	1	1	9/12/2023	

Note: None of these exceedances resulted in a fine, notice of violation, or any regulatory action.
E. coli = *Escherichia coli*
PCBs = polychlorinated biphenyls

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 no significant 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 2023: Stormwater Quality Monitoring per the Middle Rio Grande Municipal Separate Storm Sewer System Permit

Four samples were collected during 2023 during a single sampling event on September 13, 2023. Samples were collected from SWSP-02, SWSP-05, SWSP-35, and SWSP-36. There were no water quality exceedances, except for *E. coli* and PCBs, both of which exceeded the water quality standard in all 4 samples. See Table 6-1 for more details.

6.3.5 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 2023, 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 6-2 and shown in Figure 6-3.

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 6-2).

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 6-2. 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

Sector Title	Sector	Permitted Sites	Stormwater Sampling Point
		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
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

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 20232, 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 2023." 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.

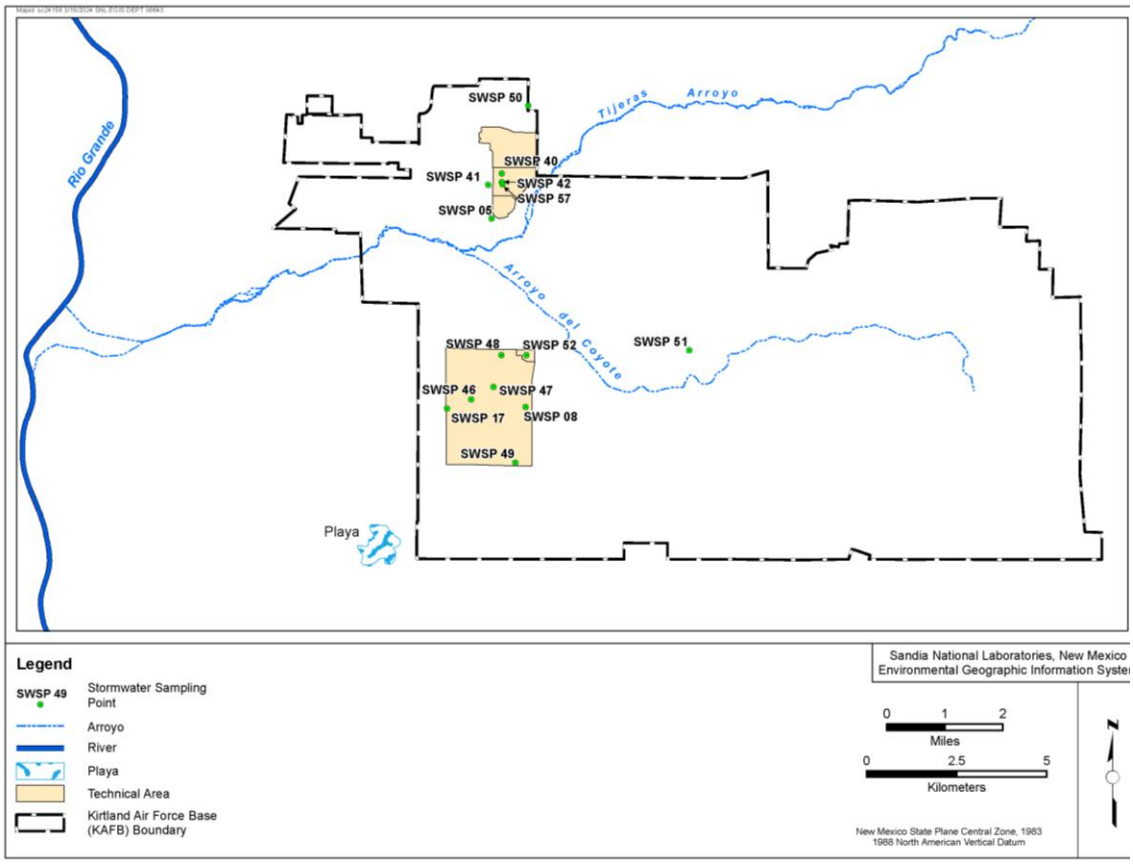


Figure 6-3. MSGP stormwater sampling point locations

Program Activities and Results 2023: Stormwater Quality Monitoring per the Multi-Sector General Permit

The analytical results for 2023, as submitted to EPA, are provided in Appendix D. Seventy-two individual MSGP compliance parameters were analyzed, of which ten exceeded water quality standards. Details of these exceedances are provided in Table 6-3.

Table 6-3. Multi-Sector General Permit water quality standard exceedances in 2023

Outfall	Parameter	Number of Samples Taken	Number of Exceedances	Date Exceeded	Description and Solution
SWSP-8	Total suspended solids	1	1	9/12/2023	The source is sediment coming from the site; a silt fence was added at the outfall.
SWSP-46	Lead	1	1	9/12/2023	The source is low level existing pollution in the soil from historic activities; SNL/NM is developing a drainage plan to prevent discharge.
SWSP-46	Ammonia	1	1	9/12/2023	The source is low level existing pollution in the soil from historic activities; SNL/NM is developing a drainage plan to prevent discharge.
SWSP-47	Lead	1	1	9/12/2023	The source is low level existing pollution in the soil from historic activities; SNL/NM is developing a drainage plan to prevent discharge.

Outfall	Parameter	Number of Samples Taken	Number of Exceedances	Date Exceeded	Description and Solution
SWSP-47	Ammonia	1	1	9/12/2023	The source is low level existing pollution in the soil from historic activities; SNL/NM is developing a drainage plan to prevent discharge.
SWSP-47	Chemical oxygen demand	1	1	9/12/2023	The source is low level existing pollution in the soil from historic activities; SNL/NM is developing a drainage plan to prevent discharge.
SWSP-47	Mercury	1	1	9/12/2023	The source is low level existing pollution in the soil from historic activities; SNL/NM is developing a drainage plan to prevent discharge.
SWSP-52	Cyanide	2	1	8/9/2023	The source is low level existing pollution in the soil from historic activities; preliminary RCRA closure activities have begun at the site.
SWSP-52	Ammonia	2	1	8/9/2023	The source is low level existing pollution in the soil from historic activities; preliminary RCRA closure activities have begun at the site.
SWSP-52	Arsenic	2	1	8/9/2023	The source is low level existing pollution in the soil from historic activities; preliminary RCRA closure activities have begun at the site.

Note: None of these exceedances resulted in a fine, notice of violation, or any regulatory action.

Additional Implementation Measures were triggered for three sites: the Short Sled Track (lead, selenium), the TA-V Sandlot (selenium), and the Classified Waste Landfill (total suspended solids). 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, five PFAS screening samples were collected at four of the ten Sector K sites listed in Table 6-2 to comply with NMED state-specific requirements listed in the MSGP. PFASs above the screening level of 0.070 µg/L was detected at three of the four sites where samples were collected (see 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."

6.3.6 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.

6.4 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.

6.4.1 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 2023: Surface Discharge Approvals

In 2023, 19 individual surface discharge requests were approved. Approved releases complied with applicable NMED requirements.

6.4.2 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/NNSA 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 6-4.

Table 6-4. DP-530 monitoring and reporting requirements

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

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 2023: Evaporation Lagoon Sampling

Samples were collected from Lagoon 1 on August 17, 2023 and Lagoon 2 on August 28, 2023. 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 2023, 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 deliverable to NMED. In addition, both lagoons are inspected monthly to verify water levels and to ensure that no damage to the lagoons' liners exist.

6.5 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.

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).

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.

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

6.5.1 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 6 months.

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

6.5.2 Requirements for Technical Area V Wastewater Discharges

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

TA-V wastewater samples are analyzed voluntarily for tritium, gross alpha, gross beta, and gamma spectroscopy to ensure that radionuclide levels meet regulatory standards established

in the ABCWUA Sewer Use and Wastewater Control Ordinance. These analytical results are also provided to ABCWUA semiannually as part of the report for Permit 2069K (Table 6-5). 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 6-5. Wastewater discharge permits and monitoring station characteristics

Permit	Station	Waste Stream Process
General Outfall		
2069A	WW001	All waste streams (includes effluent from Permit 2069G)
2069F	WW006	All waste streams (includes effluent from Permit 2238A)
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 2023: 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 2023.

6.5.3 Albuquerque Bernalillo County Water Utility Authority Permitting and Reporting

The ABCWUA operates a publicly owned treatment works that discharges to the Rio Grande. The Sandia sewer system connects to the ABCWUA sanitary sewer system and eventually to the publicly owned treatment works through six permitted outfalls (Figure 6-4). Wastewater effluent discharged from any of the six outfalls must meet the permit-specific ABCWUA Sewer Use and Wastewater Control Ordinance requirements (Table 6-5).

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

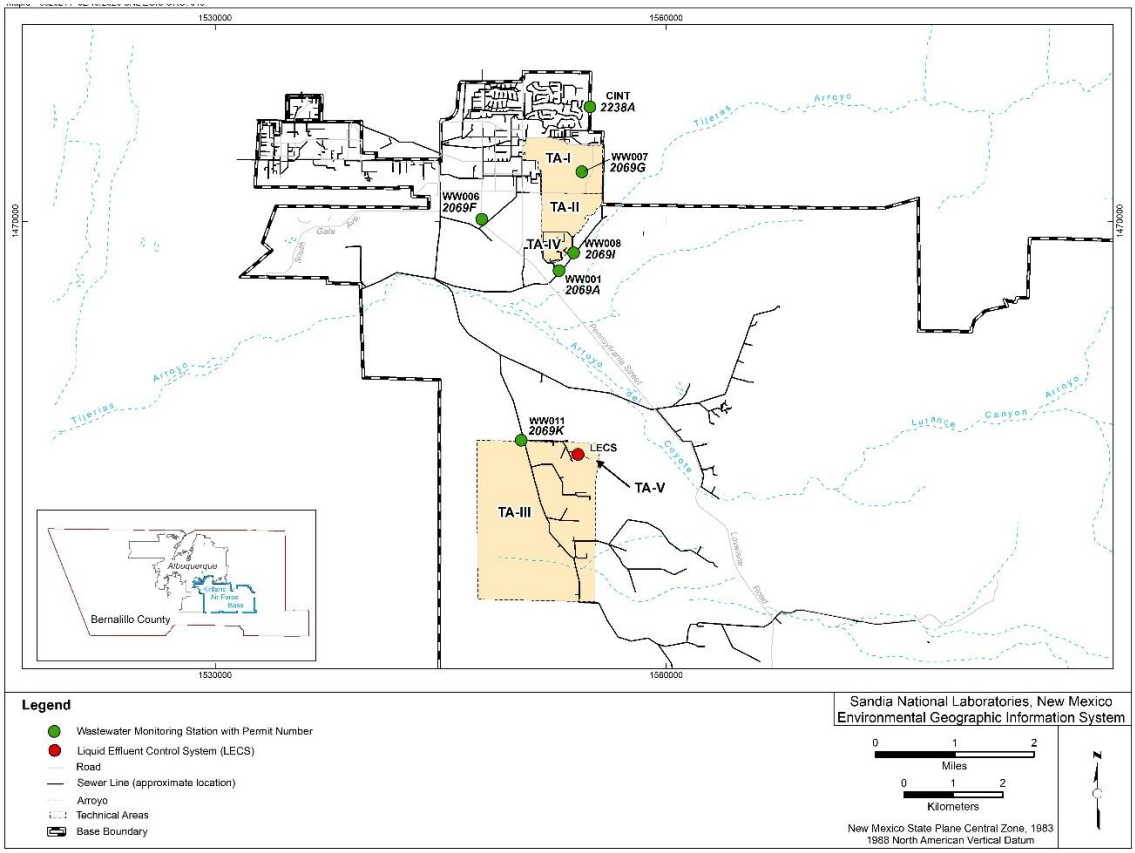


Figure 6-4. Wastewater monitoring station locations

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

Program Activities and Results 2023: Wastewater Discharge Requests

In 2023, the SNL/NM wastewater compliance program approved 396 wastewater discharge requests. Wastewater discharge approvals are not required for buildings that only produce domestic sewage from restrooms, showers, sinks, and drinking fountains.

6.5.4 Wastewater Monitoring Stations and Sampling Parameters

There are six on-site wastewater monitoring stations permitted by the ABCWUA at SNL/NM (Figure 6-4). Wastewater monitoring station characteristics are listed in Table 6-5. Wastewater from the four permitted general outfall monitoring stations (WW001, WW006, WW008, and WW011) contains a mixture of sanitary and industrial wastewater, which discharges into the ABCWUA sanitary sewer system through the Tijeras Arroyo Intercept.

EPA has established categorical pretreatment standards for specified classes of industrial discharges. Categorical monitoring station WW007 monitors the wastewater discharged from the acid waste neutralization system 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 SNL/NM personnel before the pH regulatory limit is reached. SNL/NM personnel notify DOE/NNSA when a pH limit is exceeded, and SNL/NM or DOE/NNSA 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/NNSA.

Wastewater was collected in 2023 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 dissolved solids)

Program Activities and Results 2023: Wastewater Monitoring Results and Inspections

During 2023, two ABCWUA sampling events were conducted. At the request of the ABCWUA, two additional routine sampling events that had been planned for 2023 were not scheduled by ABCWUA and did not occur. Sandia personnel collected wastewater split samples in April and October 2023 with ABCWUA and the NMED DOE Oversight Bureau. Laboratory analytical results for these split samples confirmed that Sandia operations were in compliance with ABCWUA requirements for permits 2069A, 2069F, 2069G, 2069I, 2069K, and 2238A (Table 6-5). All water discharged from the Liquid Effluent Control System in 2023 met requirements for radiological levels in wastewater. All analytical results from sampling conducted in 2023 met ABCWUA Sewer Use and Wastewater Control Ordinance discharge requirements. Analytical results are provided in Appendix E, "Sanitary Outfalls Monitoring Results in 2023."

In January 2023, the ABCWUA performed a permit renewal inspection of facilities that discharge within permitted flow basins 2069A. In June 2023, the ABCWUA performed annual inspections of facilities that discharge within permitted flow basins 2069F, 2069G, 2069I, 2069K, and 2238A. No issues or findings were identified during any of these inspections.

Program Activities and Results 2023: Sanitary Sewer System Releases

In 2023, no events were reported to either the ABCWUA or DOE/NNSA and accordingly, no notice of violations were received during 2023.

Program Activities and Results 2023: Pretreatment Gold Awards

The ABCWUA presented DOE/NNSA and NTESS with six Pretreatment Gold Awards in 2023. 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 7. Other Environmental Programs

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

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.

This chapter focuses on the environmental programs not covered in the previous chapters. The programs discussed in this chapter include:

- National Environmental Policy Act Program (Section 7.1)
- Environmental Education Outreach (Section 7.2)
- Chemical Information System and Chemical Exchange Program (Section 7.3)
- Materials Sustainability and Pollution Prevention programs (Section 7.4)
- Waste Management Program (Section 7.5)
- Environmental Restoration Operations (Section 7.6)
- Long-Term Stewardship Program (Section 7.7)
- Environmental, Release, Response, and Reporting Program (Section 7.8)

7.1 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 Kauaʻi Test Facility in Hawaiʻi; the Tonopah Test Range in Nevada; and other remote locations. For all proposed projects and activities, project owners must complete an online NEPA checklist using the internal 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.

As part of a NEPA checklist review, NEPA Program personnel 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/NNSA 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/NNSA or permitted to Sandia.

DOE/NNSA will review the NEPA checklist and make a NEPA determination. 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), would 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/NNSA in the development of a new site-wide environmental impact statement as described in Section 7.1.1.

7.1.1 NEPA Compliance Summary

In calendar year 2023, NEPA Program personnel continued to participate in process improvement activities with the DOE/NNSA Sandia Field Office, resulting in alignment between the field office and Sandia NEPA Program personnel on terminology, roles, and responsibilities, and both short- and long-term process improvements.

In calendar year 2023, NEPA Program personnel reviewed 409 NEPA checklists covering activities across all four primary sites and activities at other off-site locations. In addition to

reviewing checklists, Sandia NEPA program personnel developed a Corrective Action Plan in 2023 to create efficiencies and ensure deliverables are comprehensive, actionable, and meet statutory and regulatory requirements. The goal of the Corrective Action Plan is to better facilitate DOE/NNSA decision making to effect efficient mission execution at Sandia. NEPA Program personnel continue to support the DOE/NNSA in the preparation of a new Site-Wide Environmental Impact Statement for SNL/NM. Once completed, the new Site-Wide Environmental Impact Statement would replace the existing document published in 1999. NEPA Program personnel continued to provide ongoing support for NEPA and related environmental documentation requirements for two capital line-item proposed projects that are in the design phase, Power Sources Capability and Combined Radiation Environments for Survivability Testing (CREST). An environmental compliance strategy was completed for CREST Critical Design Phase 1. A formal NEPA review for CREST will be included in the new Site-Wide Environmental Impact Statement.

Program Activities and Results 2023: National Environmental Policy Act

In 2023, NEPA Program personnel reviewed 323 NEPA checklists for proposed activities at SNL/NM. Of the checklists reviewed in 2023 for SNL/NM activities, 249 checklists described activities and operations that were analyzed in previously published NEPA documents (Table 7-1). The remaining 74 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 7-2.

The following categorical exclusions were cited most often in DOE/NNSA NEPA checklist determinations in 2023, highlighting ongoing routine maintenance needs and growth and development at SNL/NM:

- B1.3 Routine maintenance/custodial services for buildings, structures, infrastructures, equipment
- B1.30 Transfer actions
- B1.24 Transfer of structures/residential, commercial, industrial use

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/NNSA-approved Routine Maintenance NEPA checklist. These activities do not require separate NEPA checklists, but are documented in the Routine Maintenance Criteria SharePoint tool. In 2023, Sandia personnel documented 326 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 form (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 23 AF Form 813 forms on behalf of the Sandia Field Office for work conducted on KAFB land in 2023.

Table 7-1. NEPA checklists reviewed in 2023 for projects and activities described in existing NEPA documentation

NEPA Document Title	Documents Cited in Sandia Determinations	Number of Checklists Citing Document
Final Site-Wide Environmental Impact Statement for Sandia New Mexico (1999)	DOE/EIS-0281	158
Final Environmental Assessment for the Microsystems and Engineering Sciences Applications Complex (2000)	DOE/EA-1335	18
Site-Wide Environmental Impact Statement for Continued Operation of the Department of Energy / National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (2013)	SWEIS DOE/EIS-0426	3
Continued Operations of the Kaua'i Test Facility, Sandia National Laboratories, Hawaii (2019)	EA DOE/EA-2089	4
Final Site-Wide Environmental Assessment for Sandia California (2003)	DOE/SWEA-1422	2
Final Environmental Assessment for the Center for Integrated Nanotechnologies at Sandia National Laboratories/New Mexico (2003)	DOE/EA-1457	1
Environmental Assessment for the Processing and Environmental Technology Laboratory (PETL) (1995)	DOE/EA-0945	1
Quality Assurance Review of Previously Determined Activities	Various	94

Note: Some determinations cited multiple NEPA documents.

Table 7-2. Categorical exclusions cited by DOE/NNSA NEPA Compliance Officer in DOE/NNSA determinations for SNL/NM-managed NEPA Checklists in 2023

Categorical Exclusions	Number of Citations
B1.2 Training exercises and simulation	2
B1.3 Routine maintenance/custodial services for buildings, structures, infrastructures, equipment	33
B1.4 Installation/modification of air conditioning systems for existing equipment	2
B1.7 Acquisition/installation/operation/removal of communication systems, data processing equipment	2
B1.11 Fencing, no adverse effect on wildlife movement/surface water flow	1
B1.12 Detonation/burning of failed/damaged high explosives propellants	2
B1.13 Construction/acquisition/relocation of onsite pathways, onsite access roads/railroads	4
B1.15 Siting/construction/operation of support buildings/support structures	7
B1.16 Removal of asbestos from buildings	2
B1.23 Demolition/disposal of buildings	1
B1.24 Transfer of structures/residential, commercial, industrial use	10
B1.30 Transfer actions	5
B1.31 Relocation/operation of machinery and equipment	4
B1.32 Traffic flow adjustments, existing roads	3
B1.33 Stormwater runoff control	4

Categorical Exclusions	Number of Citations
B1.34 Lead-based paint containment, removal, and disposal	1
B2.1 Modifications to enhance workplace habitability	10
B2.2 Installation of/improvements to building/equipment instrumentation (remote controls, emergency warning systems, monitors)	1
B2.5 Safety and environmental improvements of a facility, replacement/upgrade of facility components	3
B3.1 Site characterization/environmental monitoring	4
B3.2 Aviation activities for survey/monitoring/security	3
B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects	7
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	2
B3.16 Research activities in aquatic environments	3
B4.7 Adding/burying fiber optic cable	2
B4.11 Construction or modification of electric power substations.	1
B4.12 Construction of electric powerlines approximately 10 miles in length or less, not integrating major new sources.	1
B5.1 Actions to conserve energy	3
B5.16 Solar photovoltaic systems	1
B5.25 Small-scale renewable energy research and development and pilot projects in aquatic environments	2
B6.1 Small-scale, short-term cleanup actions under RCRA, Atomic Energy Act, or other authorities	2

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

7.2 Environmental Education Outreach

Environmental Education Outreach personnel connected with the local community and Sandia personnel through organized events in 2023. 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.

Program Activities and Results 2023: 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 2023 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 298 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 2023, 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.

7.3 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 129,000 safety data sheets in its library to use at all Sandia sites. 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 quantity 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.

Program Activities and Results 2023: Chemical Information System and Chemical Exchange Program

In 2023, 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 2023. In 2023, 302 chemicals were submitted to the Chemical Exchange Program, 252 chemicals were accepted, and 56 chemicals were reapplied.

7.4 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.

Over the past 5 years, the Materials Sustainability work scope has grown considerably. Therefore, in 2023, the Pollution Prevention and Materials Sustainability programs were separated into two distinct programs.

7.4.1 Waste Minimization

Waste is minimized by reducing or eliminating the generation of wastes and other pollutants at the source, including segregation, substitution, recycling and reuse of materials that could otherwise create future environmental legacies. SNL/NM has changed its Zero Waste by 2025 initiative to Zero Waste every day. 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 of 2008.

7.4.2 Sustainable Acquisition

Sustainable Acquisition 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. The goal of sustainable acquisitions is to reduce environmental impacts by integrating products with reduced 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 2022 pilot utilizing the modified Sustainable Facilities Tool (SFTool+) was successful and the tool was used for contracts in 2023. The SFTool+ allows Sandia to more efficiently collect and aggregate data from our subcontractors to submit applicable federal reports on sustainable acquisition. The SFTool+ has the capability to address new requirements listed

in DOE Order 436.1A, *Departmental Sustainability* (DOE O 436.1A 2023), and can identify products that have been evaluated for containing PFAS.

7.4.3 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. SNL/NM has been awarded 4 years in a row for its compliance with the governing Federal Acquisition Regulations.

7.4.4 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 Table 7-4.

7.4.5 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 website. Sandia continues to sponsor the New Mexico Recycling Coalition and, in 2023, the Materials Sustainability and Pollution Prevention programs set up booths for Kid's Day, Intern Welcome Day, and new employee onboarding events.

Program Activities and Results 2023: Materials Sustainability and Pollution Prevention

Since establishing the goal of Zero Waste by 2025, the diversion rate at SNL/NM went from 47 percent in the baseline year of 2008 to 64 percent in 2022. The new Zero Waste initiative, Zero Waste Every Day, had a diversion rate of 75 percent reported at the end of 2023.

In 2023, the efforts of the interdepartmental working group were successful in communicating and deploying the SFTool+ to members of the workforce and subcontractors. Subcontractors are able to reach out to Materials Sustainability personnel through a dedicated email entity account. Materials Sustainability personnel answer questions, clarify requirements, and provide additional training on the SFTool+. They 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 SFTool+. Personnel can then compare these reports with a list of contracts from the Oracle software system 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.

The 350APR "green language" clause continues being populated in applicable contract categories valued over $250,000. The 350APR clause states that a subcontractor shall "provide its services in a manner that promotes the expanded use of green products, reduces greenhouse gas emissions and protects the health and wellbeing of building occupants, service providers and visitors in the facility." The clause incorporates environmental specifications outlined by various federal programs: the EPA's Comprehenvise Procurement Guide for recycled content, the USDA on BioPreferred products for biobased content, the Federal Energy Management Program (FEMP) guidance for energy efficiency, Watersense for water efficiency, and Electronic Product Environmental Assessment Tool (EPEAT) standards for standard office electronic equipment. The addition of this clause in subcontractor contracts and the requirement to use the SFTool+ for reporting generated data for over $38 million dollars of spending in fiscal year 2023. This data captured purchases that were compliant and noncompliant with environmental specifications and product parameters for the federal programs listed above. In comparison, $35 million dollars of data in only two federal programs was captured in fiscal year 2022. Data collected on biobased product purchases increased by 114 percent from 2022, which provides evidence that the implementation of the SFTool+ has allowed Sandia to improve compliance with the governing Federal Acquisition Regulations.

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

7.5 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 7.

Wastes are generated during daily activities, such as 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 on-site 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.

Program Activities and Results 2023: Types and Amounts of Waste Handled and Shipped

Types of waste handled and shipped in 2023 at SNL/NM are summarized in Table 7-3. Wastes recycled in 2023 at SNL/NM are summarized in Table 7-4. The contracted off-site commercial waste vendor facilities that were used in 2023 by SNL/NM are listed in Section 6.3, along with any associated audit information for those facilities.

Table 7-3. Waste shipped by waste category, 2023

Waste Category	Waste Shipped (pounds)
Radioactive Waste	
Low-level radioactive waste	77,213
Transuranic waste	0
Subtotal	**77,213**
Mixed Radioactive and Hazardous Waste	
Mixed low-level radioactive waste	51,160
Mixed transuranic waste	0
Subtotal	**51,160**
RCRA Waste	
Hazardous waste	139,330
Subtotal	**139,330**
Toxic Substances Control Act	
PCBs	597
PCBs and hazardous waste mixture	0
Subtotal	**597**
Other Regulated Wastes	
Infectious waste	2,782
Asbestos waste	104,447
Chemical waste (includes special waste and industrial solid waste)	644,264
Used oil (not recycled)	0
Subtotal	**751,493**
Solid Waste	
Solid waste collection and recycling center dry waste	534,401
Off-site office waste (Sandia Science and Technology Park)	4,000
Construction and demolition waste	3,814,879
Other solid waste	42,160
Subtotal	**4,395,440**

Waste Category	Waste Shipped (pounds)
Total Waste Shipped	**5,415,233**

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

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.

Table 7-4. Waste recycled, 2023

Recycle Category	Waste Recycled (pounds)
Regulated or Chemical Waste Recycled	
Batteries	73,178
Capacitors	1,687
Computer electronics	217,467
Lead	57,861
Light bulbs	10,518
Toner and ink cartridges	131,603
Used oil	103,523
Subtotal	**595,837**
Commercial, Construction, and Demolition Solid Waste Recycled	
Asphalt/concrete	0
Batteries	0
Cardboard	301,660
Carpet	0
Chairs	69,560
Compost (food, green waste, paper, and plywood)	38,544
Food grease	750,125
Metals	1,219,011
Nitrile gloves	0
Paper (mixed and white)	21,040
Plastics	14,540
Three-dimensional printer cartridges	14,400
Tires	23,180
Wood	400,430
Subtotal	**2,852,490**
Total Waste Recycled	**3,448,327**

7.5.1 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 2023 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 7.5.2); hazardous and mixed waste management activities were 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 a nearby building were treated on-site.

7.5.2 Hazardous and Mixed Waste Permits in 2023

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 2023: RCRA Facility Operating Permit

The RCRA Facility Operating Permit was modified four times during 2023 as follows:

- On July 27, 2023, NMED (NMED 2023) approved a March 27, 2023 (DOE/NNSA/SFO and Sandia National Laboratories 2023) request to plug and abandon a groundwater monitoring well at the Mixed Waste Landfill (Solid Waste Management Unit 76). The well, which was installed 30 years ago, is not needed for compliance monitoring. DOE/NNSA/SFO, and Sandia National Laboratories presented information, solicited public comments, and answered questions at a meeting on April 18, 2023.
- The contingency plan for emergency response at each hazardous and mixed waste management unit was modified twice to update the names and contact information in the rosters of personnel who can serve as emergency coordinators. The first change was effective March 6, 2023 (DOE/NNSA/SFO and Sandia National Laboratories 2023); the second change took effect October 19, 2023 (DOE/NNSA/SFO and Sandia National Laboratories 2023).
- On September 14, 2023, NMED (NMED 2023) approved a June 15, 2023 request to replace two modular storage buildings at the Radioactive and Mixed Waste Management Unit with new smaller modular buildings of the same type (DOE/NNSA/SFO and Sandia National Laboratories 2023).
- On December 4, 2023, DOE/NNSA/SFO and NTESS requested a modification to re-authorize treatment of explosive wastes at the Radioactive and Mixed Waste Management Unit (DOE/NNSA/SFO and Sandia National Laboratories 2023).

The amount of RCRA hazardous waste handled and shipped in 2023 is reported in Table 7-3.

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 7.7.1.

7.5.3 Hazardous Waste

Hazardous waste generated at SNL/NM includes a wide variety of wastes from research and testing, together with larger quantities of wastes from decontamination and demolition, production, maintenance, and support operations, including waste management activities. Hazardous wastes that cannot be recycled or treated on-site are sent to permitted 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 2023 are reported in Table 7-3.

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/NNSA 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 7.4). Hazardous and mixed waste minimization activities are described in an annual report to NMED (Sandia 2023), 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.).

7.5.4 Radioactive Waste and Mixed Waste

DOE/NNSA 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/NNSA 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 2023, legacy wastes (wastes originally generated between 1990 and 1998) were also managed at SNL/NM.

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

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

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

All radioactive waste and mixed waste generators are 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 (NMED 2021) and (2) instructions for providing an annual update of activities and a current inventory of stored waste still on-site.

Program Activities and Results 2023: Radioactive Waste and Mixed Waste

During 2023, DOE/NNSA 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 2023).

During 2023, Sandia personnel managed 1.76 cubic meters of mixed transuranic waste and 0.10 cubic meters of mixed 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 2023. 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 2023 are reported in Table 7-3.

7.5.5 Other Regulated Waste

Other regulated waste types at SNL/NM are managed in accordance with applicable regulatory requirements. The amounts and types of other regulated waste handled and shipped in 2023 are reported in Section 7.5.

Industrial Solid and Special Wastes

Industrial solid waste and special waste include a wide variety of wastes generated from research and testing, production, maintenance and support, decontamination and demolition, and waste management activities. Wastes that cannot be recycled or treated on-site are sent to off-site facilities for treatment as needed before disposal at permitted off-site facilities. Many categories of nonhazardous waste are recycled, including alkaline batteries, fluorescent lamps, oils, and ballasts not containing PCBs. Waste minimization efforts are also applicable to nonhazardous waste, as discussed in Section 7.4.

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 7-3 summarizes the PCB waste shipped in 2023.

Asbestos Wastes

Asbestos-containing materials are present in older buildings, and abatement is ongoing. Asbestos-containing materials are only removed when they present 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 7-3 summarizes the quantities of asbestos waste shipped in 2023.

Program Activities and Results 2023: Hazardous Waste Compliance Evaluation Inspections

Representatives of the NMED Hazardous Waste Bureau performed a no-notice hazardous waste compliance evaluation inspection of the entire SNL/NM site from April 3-5, 2023. The NMED issued a final notice of violation on December 1, 2023, which is a DOE reportable occurrence (Chapter 8). The notice of violation included two findings related to container labels and one finding related to emergency equipment. All findings were corrected during the inspection, and no further action was required.

7.6 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 Amendment 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.

7.6.1 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 NM5890110518-1 (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 (DOE/AL 1987), potential sites, or individual historical activities have been identified for investigation. These sites were added to the list in Permit NM5890110518-1.

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 Kauaʻi Test Facility in Hawaiʻi; the Tonopah Test Range in Nevada; and a few miscellaneous sites located in other areas nationally and internationally.

DOE/NNSA 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 listed in the RCRA Facility Operating Permit, DOE/NNSA 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 remain in corrective action status 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).

Program Activities and Results 2023: Environmental Restoration Operations

In 2023, 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 2023." Details of all the groundwater monitoring conducted at SNL/NM can be found in the *Annual Groundwater Monitoring Report, Calendar Year 2023* (Sandia 2024), which documents the results of all groundwater monitoring activities for 2023. 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, perchlorate (at a select well), 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, 17 monitoring wells were sampled in 2023. 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 13.3 µg/L.
- Nitrate plus nitrite exceeded the maximum contaminant level of 10 mg/L in two wells with a maximum concentration of 13.0 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 2023:

- 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 21.9 mg/L. None of the wells screened in the regional aquifer exceeded the maximum contaminant level; the maximum nitrate plus nitrite concentration was 4.05 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 31.3 mg/L.
- Tetrachloroethene exceeded the maximum contaminant level (5 µg/L) at one well in the perched groundwater system with a maximum concentration of 11.9 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 22.4 µg/L. The maximum trichloroethene concentration in the regional aquifer exclusive of the merging zone well was 0.600 µg/L. In the merging zone above the regional aquifer, trichloroethene was not detected (< 0.333 µg/L).

For the BSG area of concern, 13 wells were sampled in 2023. Nitrate plus nitrite exceeded the maximum contaminant levels in five wells, with a maximum concentration of 33.8 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.

7.7 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 2023* (Sandia 2024).

7.7.1 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 2023: Chemical Waste Landfill

In 2023, semiannual groundwater monitoring was performed in January and July in accordance with post-closure care permit requirements. Groundwater samples were analyzed for volatile organic compounds (including trichloroethene), nickel, and chromium. January and July results were consistent with previous years; trichloroethene was the only volatile organic compound detected. No analytes were detected at concentrations exceeding EPA maximum contaminant levels or post-closure care permit-defined hazardous concentration limits.

In addition to semiannual groundwater monitoring, the post-closure care permit requires other monitoring, inspection, maintenance, and repair activities. Inspections conducted in 2023 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 2023 are documented in the *Chemical Waste Landfill Annual Post-Closure Care Report, Calendar Year 2023* (Sandia 2024).

7.7.2 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.

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

The 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.

Program Activities and Results 2023: Corrective Action Management Unit

The 2023 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 2023 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 five of the six Chemical Waste Landfill sanitary sewer monitoring subsystem locations are most likely related to a sanitary sewer line leak. Sewer line inspections camera surveys in 2020 and 2022 were inconclusive. Because the increases did not exceed the trigger levels, monitoring will continue, with no additional action required.

In 2023, 200 gallons of leachate (a listed hazardous waste) were removed from the leachate collection system compared to 218 gallons of leachate removed in 2022. 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 2023* (Sandia 2024).

7.7.3 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 2023: Mixed Waste Landfill

In 2023, semiannual groundwater monitoring was performed at the Mixed Waste Landfill in May/June and November in accordance with the Mixed Waste Landfill Long-Term Monitoring and Maintenance Plan. All groundwater samples were analyzed for volatile organic compounds; metals including cadmium, chromium, nickel, and uranium; specific radionuclides by gamma spectroscopy; gross alpha and gross beta; tritium; and radon-222. Results were consistent with previous years, and no analytes were detected at concentrations exceeding EPA maximum contaminant levels or Long-Term Monitoring and Maintenance Plan-defined trigger levels. Additional groundwater samples were collected in May/June 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 for those PFAS constituents.

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 2023, 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 2023 are documented in the *Mixed Waste Landfill Annual Long-Term Monitoring and Maintenance Report, April 2023 through March 2024* (Sandia 2024).

Submitted ahead of schedule in December 2023, the *Mixed Waste Landfill Second Five-Year Report* (Sandia 2024) determined that MWL site conditions have improved and are protective of human health and the environment, based upon nine years of monitoring, inspection, and maintenance. The report also confirms the regional aquifer beneath the Mixed Waste Landfill has not been impacted, nor will the landfill limit the development of land surrounding Kirtland Air Force Base, including Mesa del Sol and the Pueblo of Isleta. The *Mixed Waste Landfill Second Five-Year Report* (January 2024) concludes that the evapotranspirative cover with controls continues to be the preferred remedy over complete excavation, because it protects human health and the environment without increasing risk to site workers and the public (Sandia 2024). No changes to the remedy or controls are needed.

7.7.4 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 2023: Solid Waste Management Units

All RCRA Facility Operating Permit-required physical inspections were completed in 2023. Maintenance in 2023 included replacement of four faded signs and replacement of solid waste management unit numbers on three signs. The administrative and physical institutional controls in place for 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 2023* (Sandia 2024) was submitted to NMED.

7.7.5 Groundwater Monitoring Program

Groundwater Monitoring Program personnel sampled 16 wells and one spring in 2023. 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 was sampled for high explosive compounds, dissolved uranium (as mass), and isotopic uranium.

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

Program Activities and Results 2023: Groundwater Monitoring

Fluoride was detected above the maximum allowable concentration in Coyote Springs and five 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. All other analytical results for groundwater samples were below established maximum contaminant levels. The 2023 water quality results for this sampling were consistent with results from past years. Additional results and discussions are found in Chapter 2 of the *Annual Groundwater Monitoring Report, Calendar Year 2023* (Sandia 2024).

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

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.

7.8 Environmental Release, Response, and Reporting Team

Environmental Release, Response, and Reporting Team 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 Team 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.

Program Activities and Results 2023: Environmental Release, Response, and Reporting

Events Reported to the New Mexico Environment Department

In 2023, there was one release to the environment that required reporting to NMED. On August 1, 2023, an SNL/NM staff member noted a leak from a 20-foot shipping container holding a commercial flow battery system located east of Building MO240. The battery was one of two systems; each contained two separate 3,000-gallon tanks of mixed acid vanadium electrolyte solution within a 20-foot shipping container. Approximately 10 gallons of liquid had been released and flowed over concrete and asphalt near the container. SNL/NM and the Sandia Field Office notified NMED of the release on August 14, 2023 (DOE/NNSA/SFO and Sandia National Laboratories 2023). The spill area was stabilized and electrical power to both batteries and a third nearby battery was shut off. Soil samples collected on August 30, 2023 confirmed the release of electrolyte to the soil immediately under the asphalt near the battery. The three batteries and shipping containers were drained, decontaminated, and removed. The concrete, asphalt, and contaminated soil was also removed. Final soil samples were collected on October 3, 2023, and the results confirmed that all contaminated material had been removed. The vanadium electrolyte solution was sent to an off-site facility for recycling. The Sandia Field Office and SNL/NM submitted a final report to NMED on December 12, 2023 (DOE/NNSA/SFO and Sandia National Laboratories 2023).

Events Categorized as a DOE Reportable Occurrence

In 2023, one release to the environment that was 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). This release is described in the previous paragraph.

Chemical Inventory and Toxic Release Inventory Reporting

The chemical inventory report for 2023 was submitted to EPA to support compliance with EPCRA. The chemical inventory report documents toxic chemicals in use and all chemical purchases. Chemical use at SNL/NM did not meet the reporting threshold for submitting a toxic release inventory report any chemicals in 2023.

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Chapter 8. Compliance Summary

Gunnison's prairie dog (*Cynomys gunnisoni*)

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 2023 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.

The integrated safety management system incorporates the Environmental Management System, which is described below in Section 5.1.1 under the associated federal requirement of DOE O 436.1A, *Departmental Sustainability* (DOE O 436.1A 2023). Additionally, the Environmental Management System is described in detail in Section 5.3.

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/NNSA 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 law 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 assess them for potential environmental consequences and impacts. When projects or activities appear to be outside the

Compliance activities:

- Ensure that potential environmental impacts have been assessed adequately
- Coordinate NEPA assessments with DOE/NNSA personnel
- Inform project owners of environmental requirements

scope of existing NEPA documentation, a NEPA checklist is prepared and forwarded to DOE for review and determination.

Section 7.1 provides information on NEPA activities in 2023.

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

DOE O 436.1A, Departmental Sustainability

DOE O 436.1A, *Departmental Sustainability* (DOE O 436.1 was superseded by 436.1A in 2023), 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.

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 Inactive Remediation Sites

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) Title III of 1986 (42 U.S.C. § 9601 1986) establishes additional reporting requirements that are addressed under "Chemical Management."

Compliance activities:

- See "Chemical Management" for compliance activities

Federal Facility 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 7.5 provides information on Sandia's Waste Management Program.

Compliance activities:

- Maintain a site treatment plan (Sandia 2023), 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 7.5.

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 7.6 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 5).
- Monitor radioactive releases to the sanitary sewer (Chapter 6).
- Manage permitted radioactive waste units (Chapter 7).
- Adhere to regulations during operation and maintenance of the drinking water system (Chapter 6).
- Monitor groundwater (Chapter 7).

	• Monitor biota (Chapter 4 and Chapter 3). • Perform property clearances (during 2023, 232 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 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 enacted in 1976, as amended."

Chapter 6 provides information on compliance with surface water quality regulations.

Chapter 1 and Chapter 7 provide information on groundwater.

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
- 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 6.3 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 (33 U.S.C. § 40 1990)

Originally published in 1973 under the authority of §311 of the Clean Water Act, the Oil Pollution Prevention regulation sets forth requirements for prevention of, preparedness for, and response to oil discharges at specific facilities. In 1990, the Oil Pollution Act (OPA) amended the Clean Water Act to require some oil storage facilities to implement additional measures. The Oil Pollution Prevention regulations are set forth 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 6.1 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).

Compliance activities:

- In 2022, SNL/NM permanently closed and removed two underground storage tanks, so this regulation no longer applies to SNL/NM

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 6.2 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 6.2 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 7 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, harassment, or possession of and commerce in bald and golden eagles, with limited exceptions.

Chapter 3 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 3 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 3 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 3 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 3 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 3 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 3 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 3 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 3 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 3 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 Hawai'ians.

Chapter 2 provides more information on the Cultural Resources 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 Resources 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 Resources 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 Resources 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 Resources 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 Historic Preservation Act of 1966. It is the federal government's official list of districts, sites, buildings, structures, and objects deemed worthy of preservation for their historical significance at the national level.

Chapter 2 provides more information on the Cultural Resources 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, decisions, and consultation
- 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 Resources 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 414.1D, *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 permitting and registering**. The City of Albuquerque implements New Source Review requirements under 20.11.41 NMAC, Construction Permits (20.11.41 NMAC 2014) and 20.11.40 NMAC, Source Registration (20.11.40 NMAC 2002) to provide assurance to the public that any new or modified stationary 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 and aboveground 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 6 for more information.

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

Under RCRA, EPA delegates authority to state programs for nonhazardous solid waste and hazardous solid waste, also 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 7 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 7 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 6 for more information.

Water quality standards that apply to discharges of stormwater are defined under the State of New Mexico Water Quality Control Commission's *Standards for Interstate and Intrastate Surface Waters*, established under 20.6.4 NMAC (20.6.4 NMAC 2000).

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. Three executive orders address environmental justice and energy equity: 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).

Sandia hosts a variety of community-based technical assistance and energy equity programs. These programs utilize planning methodologies and tools and provide education and workforce development via its Energy Equity and Environmental Justice (EEEJ) initiative. EEEJ efforts focus on (1) improving the health, safety, and resilience of communities and (2) addressing the threat of climate change.

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 were gathered during 2023 as a part of this strategic initiative and resulted in the creation of an EEEJ subject-matter expert database, a repository of environmental justice white papers, as well as a summary of EEEJ efforts at Sandia. The EEEJ team hosted two internal EEEJ-focused workshops in 2022: *Energy Equity and Environmental Justice Workshop* and *Implementing Energy Equity and Environmental Justice into Research and Development Workshop*. The team continued to host a regular EEEJ Reading Club in 2023 to read and discuss relevant background material and emerging topics to help Sandians gain a better understanding of EEEJ, become more knowledgeable about incorporating EEEJ into work and research, and encourage discussion around EEEJ. More information can be found at Sandia Energy (Sandia n.d.).

Additionally, Sandia's Environmental Management System contains processes and procedures to identify and evaluate environmental justice risks and opportunities. All of Sandia's activities, products, and services with the potential to impact the environment, including surrounding communities, are reviewed on a regular basis. Improvements to Sandia's Environmental Management System, as directed by DOE O 436.1A, *Departmental Sustainability* (DOE O 436.1A 2023), include identification and documentation of disadvantaged and historically marginalized communities potentially impacted by operations, as well as supporting the implementation of environmental justice programs and activities at Sandia. In 2023, Sandia established a labs-wide Environmental Justice Working Group that meets regularly to discuss, learn, and support development of environmental justice goals and initiatives.

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.

DOE O 436.1A, *Departmental Sustainability*, presents requirements for managing sustainability practices (DOE O 436.1A 2023). Sandia personnel implement this order through an ISO 14001-certified environmental management system. Sandia National Laboratories received

initial ISO 14001:2004 certification in June 2009. In 2015, the Sandia site-specific certifications for primary operating locations in New Mexico and California were integrated into a multi-site ISO 14001:2004 certification. In 2018, the environmental management system was recertified under the new ISO 14001:2015 (ISO 14001:2015 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.).

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.

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

The fiscal year 2023 Environmental Aspects and Impacts Analysis found that the significant aspects for SNL/NM operations were: greenhouse gas air emissions hazardous materials and waste; 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 wherever feasible.

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), and EO 14057, *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability* (EO 14057 2021). The most recent plan, *Fiscal Year 2024 Site Sustainability Plan* (Sandia 2023), describes the performance status for fiscal year 2023.

Table 8-1 presents performance status for several selected key areas at SNL/NM (Sandia 2023).

Table 8-1. Site Sustainability Plan performance status for key areas for SNL/NM in 2023

DOE Goal/Sandia Objective	Sandia Performance Status in Fiscal Year 2023
Electronic Stewardship	
Manage electronics stewardship from acquisition, operations, to end of life.	Managed electronics stewardship, with 93.7 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 (EPA n.d.) (EPA n.d.). * Direct greenhouse gas emissions that occur from sources that are controlled or owned by an organization. ** Indirect greenhouse gas emissions associated with the purchase of electricity, steam, heat, or cooling. *** Indirect greenhouse gas emissions from assets not owned or controlled by the reporting organization, but that the organization indirectly affects in its value chain.	• Reduced Scope 1 and Scope 2 greenhouse gas emissions by 79.3 percent from the fiscal year 2008 baseline, and decreased year-over-year emissions by 29.7 percent relative to fiscal year 2022. • Reduced Scope 3 greenhouse gas emissions by 30.6 percent from the fiscal year 2008 baseline, and decreased year-over-year by 6.9 percent relative to fiscal year 2022.
Organizational Resilience	
Implement climate adaptation and resilience measures.	Updated the implementation status of the vulnerability assessment and resilience plan resiliency solutions.
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 75.2 percent of nonhazardous solid waste from treatment and disposal facilities. Diverted 83.8 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.	Added sustainable acquisition reporting requirements into the request for information and request for quote processes. Created rules in Oracle to add the updated 350APR clause into applicable contract categories.
Sustainable Buildings	
Increase the number of owned buildings that are compliant with the *Guiding Principles for Sustainable Federal Buildings* (Council on Environmental Quality 2020).	Met sustainable building standards, with 33.3 percent of the building count complying with the Guiding Principles for sustainable buildings.
Energy Management	
Reduce energy use intensity (Btu per gross square foot) in goal-subject buildings.	In fiscal year 2023, increased energy intensity by 19.1 percent from the fiscal year 2015 baseline, and increased year-over-year by 9.1 percent relative to fiscal year 2022.
Water Management	
Reduce potable water use intensity (gallons per gross square foot).	In fiscal year 2023, reduced potable water intensity by 35.9 percent from the fiscal year 2021 baseline, and decreased year-over-year by 4.6 percent relative to fiscal year 2022.

Guiding Principles = *Guiding Principles for Sustainable Federal Buildings* (Council on Environmental Quality 2020)

Sustainability Awards in 2023

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 2023, SNL/NM personnel submitted seven nominations for the internal Environmental Excellence Awards. From these internal award nominations, six were submitted for DOE Sustainability Award consideration, but were not selected as winners for 2023.

8.3.2 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 at SNL/NM: 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. The next revision to the climate vulnerability assessment and resilience plan is due in September 2026.

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 3-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 3-day period where the average high is greater than or equal to 100°F	Anticipated	Increase	Likely
Precipitation	For semiarid locations, a 1-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 6-hour, 100-year precipitation event	Anticipated	Increase	Likely
Other	Mean number of days with minimum temperature less than 32°F	Almost certain	Decrease	Likely

Regional Hazards Impacting the Site	Hazard Description	Current Hazard Likelihood	Projected Climate Change Effect	Projected Hazard Likelihood with Climate Change
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)	Implementation Status[a]
Install microgrid[b]	Heat wave, cold wave, wildfires causing power outages	Medium	Identified
Install photovoltaic-covered parking	Heat, drought, and wildfires causing power outages	Low	Identified
Install open land photovoltaic systems	Heat, drought, and wildfires causing power outages	High	Identified
Install concentrated solar power system	Heat, drought, and wildfires causing power outages	Medium	Identified
Improve Building 6570 east side and south drainage	Floods	Medium	Funded
Improve Buildings 6505, 6505A, and 6509 flood control	Floods	Medium	Identified
Improve Building 6742 areas sled track drainage	Floods	High	Identified
Improve Building 6640 drainage	Floods	Medium	Identified
Improve Building 6620 drainage	Floods	High	Operational
Upgrade Building 857 East drainage overflow	Floods	High	Identified
Upgrade Radioactive Mixed Waste Management Facility stormwater pond	Floods	High	Identified
Improve Building 6922 drainage	Floods	Medium	Identified

Solution	Hazard(s) Addressed	Priority Rank (High, Medium, or Low)	Implementation Status[a]
Replace Building 855 south side storm drain	Floods	Medium	Identified
Upgrade 6000 Igloos southwest diversion channel	Floods	High	Identified

[a] Implementation status is defined per the DOE Sustainability Dashboard as follows: identified = needs reliable estimates; funded = funds authorized; operational = in place and fully functional (DOE n.d.).
[b] 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's overall performance evaluation in 2023 were set forth in the *Fiscal Year 2023 DOE/NNSA Strategic Performance Evaluation Measurement Plan (PEMP)* (DOE/NNSA/SFO 2023). Subsequently, the DOE/NNSA Sandia Field Office prepared the *FY2023 Performance Evaluation Summary* (DOE/NNSA/SFO 2023), assessing the management and operating contractor performance—including environment, health, and safety—for October 1, 2022, through September 30, 2023. The performance evaluation is the annual DOE/NNSA report card that ascribes a rating for five key performance goals and an overall rating. Sandia received a rating of excellent in the following three goals: Mission Delivery: Global Nuclear Security; Mission Innovation: Advancing Science and Technology; and Mission Leadership. A rating of very good was received for all Sandia locations in two remaining categories: Mission Delivery: Nuclear Weapons, and Mission Enablement. ES&H compliance is evaluated under the Mission Enablement goal; this goal includes the objective of delivering effective, efficient, and responsive ES&H quality.

By exceeding almost all of the objectives and key outcomes under the Performance Evaluation Measurement Plan goals, Sandia received an overall rating of excellent for fiscal year 2023. This was achieved by meeting overall cost, schedule, and technical performance requirements with accomplishments that significantly outweighed issues.

8.4.1 Audits, Assessments, and Inspections in 2023

Environmental programs are routinely subjected to audits, assessments, inspections, and/or verifications by external agencies and authorities. Table 8-4 summarizes the 2023 external 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 2023, this included water 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, 2023

Appraising Agency/Authority	Title/Description	Date	Summary
City of Albuquerque Air Quality Program	Open Burn Permit compliance inspection - SNL/Rocket Sled Track Test	2/9/2023	No violations
Albuquerque Bernalillo County Water Utility Authority	2069A Permit Renewal	2/18/2023	No violations; permit approved
City of Albuquerque Air Quality Program	1) Pre-disturbance Fugitive Dust Control Construction Permit (FDCCP) inspection for Light Initiated High Explosive (LIHE) Facility (Building 6715) project; 2) Document Disintegrator replacement compliance assistance	1) 3/20/2023; 2) 3/21/2023	No violations; 1) Best management practice guidance and permit issuance; 2) permitting guidance
City of Albuquerque Air Quality Program	Pre-disturbance FDCCP inspection for Building 740 Geosciences construction project	4/11/2023	Facilities provided incorrect acreage for project on application form; Air Quality Control program coordinated a replacement check request for adjusted fees and provided a corrected application to Sandia Field Office and regulator.
New Mexico Environment Department	FY23 annual no-notice hazardous waste Compliance Evaluation Inspection	4/3/23–4/5/23	Three findings
Environmental Protection Agency and New Mexico Environmental Department	MS4 Permit Site Visit	5/25/2023	Four observations
City of Albuquerque Air Quality Program	SNL Thermal Treatment Unit burn inspection - OBP 23-0012	5/10/2023	No violations
City of Albuquerque Air Quality Program	Pre-disturbance site visit for Building 862 demolition and 1020 construction FDCCPs	5/9/2023	Issuance of FDCCPs
City of Albuquerque Air Quality Program	FDCCP Application Pre-Site Visit for TA-3 East Vehicle Gate	6/5/2023	Issuance of FDCCPs

Appraising Agency/Authority	Title/Description	Date	Summary
City of Albuquerque Air Quality Program	FDCCP modification site visit for Building 862 demolition	7/10/2023	Modification approved, permit issued
City of Albuquerque Air Quality Program	FDCCP site visit to Building 740 Construction site	7/10/2023 and 7/17/2023	Project started but fabric fencing was incomplete (7/10), inspector re-checked the following week (7/17) and the concern was resolved.
City of Albuquerque Air Quality Program	FDCCP site visit to Energetic Manufacturing Science Technology Facility Construction site	7/10/2023	No violations
City of Albuquerque Air Quality Program	Asbestos NESHAP inspection for Building 862 demolition	7/17/2023	No violations
City of Albuquerque Air Quality Program	OBP 23-0004 inspection of test at Rocket Sled Track Blast Tube	7/26/2023	No violations
City of Albuquerque Air Quality Program	FDCCP pre-disturbance site visit for Atmospheric Research Instrumentation and Systems (ARIAS) construction project	8/15/2023	Permit issued
Albuquerque/Bernalillo County Water Utility Authority	2069K-LECS sampling	8/15/2023	No violations
City of Albuquerque Air Quality Program	FDCCP pre-disturbance site visit for Building 872 modification	9/8/2023	Permit delayed pending corrections to area of disturbance on application.
DOE/NNSA Sandia Field Office	Contracting Officer Letter, Corrective Action Plan Request	9/13/2023	Corrective Action Plan requested for NEPA program
City of Albuquerque Air Quality Program	FDCCP pre-disturbance site visit for Building 6570 Drainage Improvements	10/20/2023	Permit issued
Albuquerque/Bernalillo County Water Utility Authority	Quarter 4 split sampling	10/12/2023–10/16/2023	No violations
City of Albuquerque Air Quality Program	SNL Thermal Treatment Unit burn inspection - OBP 23-0012	11/21/2023	No violations
City of Albuquerque Air Quality Program	SNL Rocket Sled Track Complex (blast tube) burn inspection - OBP 23-0009	11/29/2023	No violations
Albuquerque/Bernalillo County Water Utility Authority	2069K-LECS sampling	12/21/2023	No violations
DNV USA Business Assurance Inc.	FY 2023 Environmental Management System ISO 14001:2015 Surveillance Audit	3/7/2023–3/10/2023	Eleven observations, four findings, three noteworthy practices

FDCCP = Fugitive Dust Control Construction Permit
LECS = Liquid Effluent Control System
NEPA = National Environmental Policy Act
NESHAP = National Emission Standards for Hazardous Air Pollutants
OBP = Open Burn Permit

8.4.2 Occurrence Reporting in 2023

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.

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.

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

During 2023, the four occurrences shown in Table 8-5 met the criteria for reporting in this annual site environmental report. The occurrence titled *Chemical Off-Gassing in Building 890 Resulted in Hazardous Materials Evacuation* was filed under both the Group 5 and Group 10 criteria groups.

Table 8-5. Occurrence reports per DOE O 232.2A, 2023

Reporting Criteria	Date	Report Level	Report Number and Title
Group 5 – Environmental B(1) - Any occurrence including releases causing significant impact to ecological or cultural resource for which DOE has responsibility under applicable laws, regulations, and Executive Orders. For example, extensive damage to, or destruction of: (a) Ecologically preserved areas, or pristine or protected wetlands; (b) Threatened or protected flora or fauna or critical habitats; (c) Potable drinking water intake or well usage; or (d) Historical/archeological sites.	Discovery date of April 3, 2023	High	**NA--SS-SNL-NMSITE-2023-0001**, *Road Grading Results in Environmental Impacts*

Reporting Criteria	Date	Report Level	Report Number and Title
Group 10 – Management Concerns and Issues (1) - An event, condition, or series of events that does not meet any of the other reporting criteria, but is determined by the Facility Manager or line management to be of safety significance or of concern for that facility or other facilities or activities in the DOE complex.	May 9, 2023	Informational	**NA--SS-SNL-5000-2023-0002**, *Chemical Off-Gassing in Building 890 Resulted in Hazardous Materials Evacuation*
Group 5 – Environmental A(4) - Any discrete release of sulfur hexafluoride (SF6) due to an event or DOE operation equal to or exceeding 115 pounds (1,247 metric tons of CO2e according to 40 CFR Part 98, Subpart A, Table A-1, Global Warming Potentials) or 115 pounds more than the normal release quantity if the SF6 release is a common byproduct of the operation.	May 9, 2023	Informational	**NA--SS-SNL-5000-2023-0002**, *Chemical Off-Gassing in Building 890 Resulted in Hazardous Materials Evacuation*
Group 5 – Environmental A(4) - Any discrete release of sulfur hexafluoride (SF6) due to an event or DOE operation equal to or exceeding 115 pounds (1,247 metric tons of CO2e according to 40 CFR Part 98, Subpart A, Table A-1, Global Warming Potentials) or 115 pounds more than the normal release quantity if the SF6 release is a common byproduct of the operation.	July 30, 2023	Informational	**NA--SS-SNL-1000-2023-0007**, *SF6 Release at Building 983*
Group 5 – Environmental A(2) - Any release (onsite or offsite) of a pollutant from a DOE facility that is above levels or limits specified by outside agencies in a permit, license, or equivalent authorization, when reporting is required in a format other than routine periodic reports.	August 1, 2023	Informational	**NA--SS-SNL-8000-2023-0007**, *UniEnergy Technologies (UET) Vanadium Redox Flow Battery HazMat Leak*

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 2023?
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 Radionuclide NESHAP Dose Assessment Report	EPA requires reporting on a dose assessment of the calculated effective dose equivalent to the maximally exposed individual based on the assumption that an exposed individual resides 24 hours per day at an area of highest incident radiation.	EPA 40 CFR 61, Subpart H	Yes
Annual Emissions Inventory	The City of Albuquerque Air Quality Program requires annual reporting of emissions for all permitted and registered sources of air pollutants.	The City of Albuquerque Air Quality Program 20.11.47 NMAC	Yes
Excess air emissions reporting	The City of Albuquerque Air Quality Program requires reporting of excess emissions at permitted sources of air pollutants: • INITIAL REPORT: The Permittee shall file an initial report, no later than the end of the next regular business day after the time of discovery of an excess emission • FINAL REPORT: The Permittee shall file a final report, no later than ten (10) days after the end of the excess emission. If the period of an excess emission extends beyond ten (10) days, the Permittee shall submit the final report to the Program within seventy-two (72) hours of the date and time the excess emission ceased.	The City of Albuquerque Air Quality Program 20.11.49 NMAC	No
Annual Vehicle Inventory and Inspection Schedule	The City of Albuquerque Air Quality Program requires that persons who are responsible for government fleet vehicles or motor pools shall periodically, but not less than annually, update the vehicle inventory and forward the resulting inspection plan with inventory to the Program Manager.	The City of Albuquerque Air Quality Program 20.11.100 NMAC	Yes
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 7.		Yes

Report	Description	Agency and Regulation	Required Reporting in 2023?
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.		No
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	Yes
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

ABCWUA = Albuquerque Bernalillo County Water Utility Authority
EPA = U.S. Environmental Protection Agency
EPCRA = Emergency Planning and Community Right-to-Know Act
NESHAP = National Emission Standards for Hazardous Air Pollutants
NMED = New Mexico Environment Department

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Chapter 9. Quality Assurance

Prickly pear cactus (*Opuntia*)

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); 10 CFR 830, *Nuclear Safety Management*, Subpart A, "Quality Assurance Requirements" (10 CFR 830 2016) and QA001, *Quality Assurance Policy* (Sandia 2023)—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. The Sample Management Office-specific quality assurance project plan addresses each of the ten DOE O 414.1D criteria and documents those activities vital to assuring the quality of work performed.

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 *Sandia National Laboratories/New Mexico Sample Management Office Statement of Work for Analytical Laboratories* (Sandia 2023). All calibrations and detection limits must be verified before analyzing samples and reporting data. Once a laboratory has passed an initial appraisal and has been awarded a contract, Sample Management Office personnel are responsible for continuously monitoring laboratory performance to ensure that the laboratory meets its contractual requirements during annual audits.

Contract laboratories perform work in compliance with the *Sandia National Laboratories/New Mexico Sample Management Office Statement of Work for Analytical Laboratories* (Sandia 2023). 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 *Sandia National Laboratories/New Mexico Sample Management Office Statement of Work for Analytical Laboratories* (Sandia 2023). 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 2023 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 2023, Sample Management Office personnel processed 3,831 samples in support of programs and projects at SNL/NM.

9.2.1 Sample Handling and Analyses

In 2023, Sample Management Office personnel processed 3,831 samples in support of programs and projects at SNL/NM. Of the 3,831 samples, 934 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 2023:

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

During 2023, the following contract laboratories were employed to analyze samples:

- Cape Fear Analytical, LLC, in Wilmington, North Carolina
- Eurofins in West Sacramento, California, Knoxville, Tennessee, St. Louis, Missouri, and Albuquerque, New Mexico
- General Engineering Laboratories in Charleston, South Carolina
- Landauer, Inc., in Glenwood, Illinois
- Radonova, Inc., in Lombard, 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 2023, DOECAP and/or the accrediting bodies conducted assessments at five 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 2023 in DOECAP assessment reports or other applicable DOE programs.

9.3 Off-Site Waste Management Activities

Sandia personnel send waste, including radiological and hazardous waste, offs-ite for treatment and/or disposal to contracted off-site commercial waste vendor facilities. Wastes received at these facilities to be managed in a regulatory compliant manner and in conformance with DOE procurement contract stipulations and requirements.

The following list identifies recycling facilities and treatment, storage, and disposal facilities (TSDFs) used by SNL/NM in 2023.

- AAA Pumping Services
  2855 2nd Street SW
  Albuquerque, NM 87102
- Alpha Omega Recycling
  315 Whatley Road
  Longview, TX 75604
- Cirba Solutions
  618 Auto Center Drive
  Mesa, AZ 85204
- Perma-Fix of Florida, Inc.
  1940 NW 67th Place
  Gainesville, FL 32653
- Rio Rancho Sanitary Landfill
  33rd and Northern Boulevard
  Rio Rancho, NM 87144
- Safety-Kleen Systems
  2720 Girard NE
  Albuquerque, NM 87107

- Clean Harbors Colfax, LLC
  3763 Highway 471
  Colfax, LA 71417
- Clean Harbors Grassy Mountain, LLC
  Interstate 80, Exit 41, 3mi. E, 7mi. N of Knolls
  Grantsville, UT 84029
- Diversified Scientific Services, Inc.
  657 Gallaher Road
  Kingston, TN 37763
- DOE/NNSA/NFO
  Nevada National Security Site
  US Highway 95
  Mercury, NV 89023
- Hybrid Recovery Services
  16322 Avenue C
  Channelview, TX 77530
- Keers Environmental Inc.
  14 Miles South of Mountainair
  Mountainair, NM 87036
- Mayco Industries
  18 W. Oxmoor Road
  Birmingham, AL 35209
- Natural Evolutions
  5701 East 13th Street
  Tulsa, OK 74112
- Stericycle
  1920 1st Street NW
  Albuquerque, NM 87102
- Thermo Fluids Inc.
  9010 Bates Road
  Albuquerque, NM 87105
- US Ecology (Beatty NV)
  Highway 95, 11 Mi. South of Beatty
  Beatty, NV 89003
- Veolia ES Technical Solutions, LLC
  5736 West Jefferson
  Phoenix, AZ 85043
- Veolia ES Technical Solutions, LLC
  9131 East 96th Avenue
  Henderson, CO 80640
- Veolia ES Technical Solutions, LLC
  #7 Mobile Avenue
  Sauget, IL 62201
- Veolia ES Technical Solutions, LLC
  1 Eden Lane
  Flanders, NJ 07836

The DOE Consolidated Audit Program (DOECAP) reviews commercial TSDFs for each facility's ability to meet the applicable requirements for storing, handling, transporting, processing, and final disposition of DOE waste and material as outlined in DOE O 435.1 Chg 2 (AdminChg), *Radioactive Waste Management* (DOE O 435.1, Change 1 2001), and DOE O 414.1D Chg 2 (LtdChg), *Quality Assurance* (DOE O 414.1D, Change 2 (LtdChg) 2020). The audit teams are comprised of DOE federal and contractor subject matter experts.

In addition, established TSDFs used for radioactive and mixed waste management undergo periodic assessments that consider the following: quality assurance management systems, sampling and analytical data quality, waste operations, environmental compliance and permitting, radiological control, industrial and chemical safety, and transportation management.

Assessment reports identify Priority I findings (factual statements that document a requirement deficiency that represents a substantial risk and liability to DOE) and Priority II findings (factual statements that document a requirement deviation that could lead to a Priority I finding if not addressed and corrected). Observations document deviations from best management practices or opportunities for improvement. Table 9-1. presents findings

and observations from assessments performed in 2022 and 2023 for the waste management facilities used by Sandia personnel.

Table 9-1. Treatment, storage, and disposal facility findings and observation from assessments, 2022 and 2023

Facility	Assessment Type and Dates	Assessment Scope	Results
Diversified Scientific Services Inc.	DOE Consolidated Audit Program Continuing Audit 09/20/2022–09/29/2022	• Continuing assessments scope: quality assurance management systems, sampling and analytical data quality, waste operations, environmental compliance and permitting, radiological control, industrial and chemical safety, and transportation management	• 0 Priority I findings • 5 Priority II findings • 7 observations • 2 closed[a] • 0 open[a]
Diversified Scientific Services Inc.	DOE Consolidated Audit Program Continuing Audit 06/06/2023–06/14/2023	• Continuing assessments scope: quality assurance management systems, sampling and analytical data quality, waste operations, environmental compliance and permitting, radiological control, industrial and chemical safety, and transportation management	• 0 Priority I findings • 16 Priority II findings • 3 observations • 4 closed[a] • 1 open[a]
Diversified Scientific Services Inc.	DOE Consolidated Audit Program Surveillance Audit 10/23/2023–10/24/2023	• Evaluated corrective measures for 17 open findings	• 0 Priority I findings • 0 Priority II findings • 0 observations • 13 closed[a] • 4 open[a]
Perma-Fix of Florida, Inc.	DOE Consolidated Audit Program Continuing Audit 08/08/2022–08/12/2022	• Continuing assessments scope: quality assurance management systems, sampling and analytical data quality, waste operations, environmental compliance and permitting, radiological control, industrial and chemical safety, and transportation management	• 0 Priority I findings • 2 Priority II findings • 13 observations • 3 closed[a] • 0 open[a]
Perma-Fix of Florida, Inc.	DOE Consolidated Audit Program Continuing Audit 08/08 /2023–08/16/2023	• Continuing assessments scope: quality assurance management systems, sampling and analytical data quality, waste operations, environmental compliance and permitting, radiological control, industrial and chemical safety, and transportation management	• 0 Priority I findings • 14 Priority II findings • 11 observations • 5 closed[a] • 0 open[a]

[a] Finding from a previous assessment

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Chapter 10. Environmental Permits and Mixed Waste History

Black swallowtail (*Papilio polyxenes*)

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 2023.

Table 10-1. Summary of environmental permits and registrations in effect, 2023

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

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
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
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	1664	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (2,119 gallons)	TA-I	1665	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (2,000 gallons)	TA-I	1666	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (5,000 gallons)	TA-III	1667	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (5,500 gallons)	Coyote Test Field	1668	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (4,500 gallons)	TA-IV	1669	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (1,500 gallons)	TA-I	1670	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (10,700 gallons)	TA-I	1672	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (13,760 gallons)	TA-I	1671	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (2-20,000 gallons)	TA-I	TBD by NMED	7/1/2023	6/30/2024	NMED
Aboveground Storage Tank (4,500 gallons)	TA-1	TBD by NMED	7/1/2023	6/30/2024	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/NNSA: 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

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
NPDES Multi-Sector General Permit					
NPDES Multi-Sector General Permit	SNL/NM industrial discharge locations	NTESS: NMR04A012 DOE/NNSA: NMR04A011	5/31/2021	5/31/2026	EPA
NPDES Construction General Permit					
Building 6035 Igloos	KAFB	NTESS: NMR100565	11/2/2022	CGP expires 2/16/2027	EPA
Building 7517 LIHE	TA-III	NTESS: NMR1005FS	3/10/2023	CGP expires 2/16/2027	EPA
TA-IV DCWS	TA-IV	NTESS: NMR100550	10/18/2022	CGP expires 2/16/2027	EPA
Building 1020 EMSAT	TA-II	NTESS: NMR1005LB	5/8/2023	CGP expires 2/16/2027	EPA
Building 740	TA-I	NTESS: NMR10053U	10/3/2022	CGP expires 2/16/2027	EPA
TA-III East Gate	TA-III	NMR1005MZ	5/5/2023	CGP expires 2/16/2027	EPA
ARIAS SP-08	TA-II	NMR1005LA	5/9/2023	CGP expires 2/16/2027	EPA
6570 Drainage	TA-III	NMR1005N1	5/2/2023	CGP expires 2/16/2027	EPA
H-Avenue Water Line	TA-I	NMR100567	11/2/2022	CGP expires 2/16/2027	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
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
Building 814	TA-I	NTESS: NMR10042Y	7/30/2021	CGP expires 2/16/2027	EPA
Liquified Natural Gas Dome Decontamination 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
Ecological					
New Mexico Department of Game and Fish Nuisance Permit	Site-wide ecological monitoring activity	119	1/3/2023	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	1/11/2023	9/30/2025	New Mexico Department of Game and Fish

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
New Mexico Department of Game and Fish for Scientific/Educational Purposes Authorization for Taking of Protected Wildlife	Site-wide ecological monitoring activity	3757	3/9/2025	12/31/2025	New Mexico Department of Game and Fish
U.S. Department of the Interior Federal Bird Banding Permit	Site-wide ecological monitoring activity	24206	7/2/2019	9/30/2025	U.S. Department of the Interior
U.S. Fish and Wildlife Service Special Purpose-Salvage	Site-wide ecological monitoring activity	MB40881D	4/1/2022	3/31/2025	U.S. Fish and Wildlife Service
U.S. Fish and Wildlife Service Special Purpose-Miscellaneous	Site-wide ecological monitoring activity	MB47978D	4/1/2023	3/31/2026	U.S. Fish and Wildlife Service
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					
Training	DETS Complex	23-0007	1/1/2023	12/31/2023	City of Albuquerque
Thermite Applications	Terminal Ballistics Facility	23-0015	1/1/2023	12/31/2023	City of Albuquerque
Explosives & Fuel Applications	Terminal Ballistics Facility	23-0016	1/1/2023	12/31/2023	City of Albuquerque
Propellant Applications	Terminal Ballistics Facility	23-0017	1/1/2023	12/31/2023	City of Albuquerque
Explosive Applications	Terminal Ballistics Facility	23-0011	1/1/2023	12/31/2023	City of Albuquerque
Explosives Testing	Thunder Range Test Site	23-0013	1/1/2023	12/31/2023	City of Albuquerque
Explosives Testing	9939 Test Site	23-0003	1/1/2023	12/31/2023	City of Albuquerque
Disposal by Thermal Treatment	Thermal Treatment Unit	23-0012	1/1/2023	12/31/2023	City of Albuquerque
Explosives Testing	Rocket Sled Track Complex	23-0009	1/1/2023	12/31/2023	City of Albuquerque
Hot Torch Burning of Weeds	Rocket Sled Track Complex	23-0008	1/1/2023	12/31/2023	City of Albuquerque
Explosives Testing	Water Impact Complex	23-0014	1/1/2023	12/31/2023	City of Albuquerque

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
High Heat Flux Tests	National Solar Thermal Test Facility	23-0010	1/1/2023	12/31/2023	City of Albuquerque
Explosives Testing & Training	9930 Test Site	23-0002	1/1/2023	12/31/2023	City of Albuquerque
Explosives Testing	9920 Test Site	23-0001	1/1/2023	12/31/2023	City of Albuquerque
Explosives Testing	Aerial Cable Facility	23-0004	1/1/2023	12/31/2023	City of Albuquerque
Pool Fire Tests	Burn Site	23-0005	1/1/2023	12/31/2023	City of Albuquerque
Pool Fire Tests	Rocket Sled Track Complex	23-0006	1/1/2023	12/31/2023	City of Albuquerque
Stationary Source (Air)					
Building 725 Emergency Generator	TA-I	3456	1/12/2023	N/A	City of Albuquerque
Building 6920 Emergency Generator	TA-III	415-M3	1/27/2023	N/A	City of Albuquerque
Building 814 Emergency Generator	TA-I	3466	1/3/2023	N/A	City of Albuquerque
Thunder Range generator	Coyote Test Facility	3487-1AR	11/20/2023	N/A	City of Albuquerque
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-M1-1AR	2/15/2023	N/A	City of Albuquerque
Microsystems and Engineering Sciences Applications Facility Boilers and Generators	TA-I	Permit 1820-M2-1AR	3/1/2023	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-M1	1/11/2023	N/A	City of Albuquerque
Site-Wide Chemical Use	Site-wide	Permit 1901-M1	10/10/2016	N/A	City of Albuquerque

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
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
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

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
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 12/31/2023					
6715 LIHE Test Facility Upgrades	TA-III	2157-C	3/31/2023	8/13/2024	City of Albuquerque
740 STAR Geosciences Lab	TA-I	2205-C	4/18/2023	9/1/2024	City of Albuquerque
Decontamination and Demolition of Building 862	TA-I	2270-C	5/12/2023	3/1/2024	City of Albuquerque
Building 1020 EMSAT	TA-III	2271-C	5/12/2023	9/25/2024	City of Albuquerque
Install New TA-3 East Vehicle Gate	TA-III	2295-C	6/5/2023	9/15/2024	City of Albuquerque
ARIAS SP-08 Site Improvements	TA-II	2425-C	8/17/2023	11/30/2024	City of Albuquerque
872 Facility Modifications	TA-I	2481-C	9/15/2023	10/30/2025	City of Albuquerque
6570 Storm Drain Design for Flooding	TA-III	2556-C	10/27/2023	1/25/2025	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
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

Permit Type and/or Facility Name	Location	Permit or Registration Number	Issue Date	Expiration Date	Regulatory Agency
Building 6035 Transshipment Facility	SNL/Igloo	2016-C	12/9/2022	12/9/2027	City of Albuquerque
Fugitive Dust Control Programmatic Permit	Site-wide	1702-P	6/7/2022	6/7/2027	City of Albuquerque

[a] Renewal for Surface Discharge Permit DP-530 was submitted to DOE/NNSA 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.
ABCWUA = Albuquerque Bernalillo County Water Utility Authority
EPA = U.S. Environmental Protection Agency
N/A = not applicable
NMED = New Mexico Environment Department
TBD = To Be Determined

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 1-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.
November 2012	N/A	DOE and Sandia personnel submitted comments on the draft permit to NMED and requested resolution of comments.

Date	Milestone	Comment
2012–2014	N/A	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements • Updated the site treatment plan annually to reflect waste management activities and waste volumes • Requested approval of Revision 14 to the site treatment plan to revise waste volumes, establish new deadlines, and provide continuity
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.
2021–2023	Site treatment plan milestones met	• Treated wastes on-site and shipped mixed wastes to off-site treatment and disposal facilities in compliance with regulatory requirements, meeting all treatment and disposal milestones • Updated the site treatment plan to reflect waste management activities and waste volumes

FFCA = Federal Facility Compliance Act
FFCO = Federal Facility Compliance Order
HDRV = Historical Disposal Requests Validation
HSWA = Hazardous and Solid Waste Amendment
NMED = New Mexico Environment Department
N/A = not applicable
RCRA = Resource Conservation and Recovery Act

Table 10-3. Quantity of mixed waste subject to the Federal Facility Compliance Order, end of fiscal year 2023

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

Glossary

Western meadowlark *(Sturnella neglecta)*

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.

built environment The human-made space (including structures, features, and facilities) in which people live, work and recreate.

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.

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 In relation to water quality, an exceedance is a compliance monitoring result that does not meet (exceeds) an applicable water quality standard.

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.

finding In reference to an audit or inspection, a finding is a factual statement documenting deviation from a regulatory or procedural requirement.

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 by virtue of possessing one or more hazardous characteristics as defined by RCRA, its amendments, and related regulations. 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 A waste with chemical or physical properties that meets the definitions in federal and state regulations and may cause harm to human health or the environment if not managed properly.

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.

human environment Human environment means comprehensively the natural and physical environment and the relationship of present and future generations of Americans with that environment.

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.

isolated occurrences These are areas where cultural materials are sparse (fewer than 10 items) and are at least 50 years old.

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.

observation In reference to an audit or inspection, observations document deviations from best management practices or opportunities for improvement. As it relates to ecology and wildlife, an observation notes the occurrence of a species at a specific location.

optically stimulated luminescence 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.

treatment, storage, and disposal facility A facility at which waste management operations include treatment, storage, or disposal of hazardous wastes as defined by federal and state laws and regulations.

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/NNSA.

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.

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Appendices

See "2023 Annual Site Environmental Report for Sandia National Laboratories, New Mexico: Appendices" for appendix content.


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