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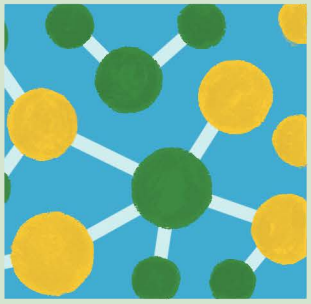
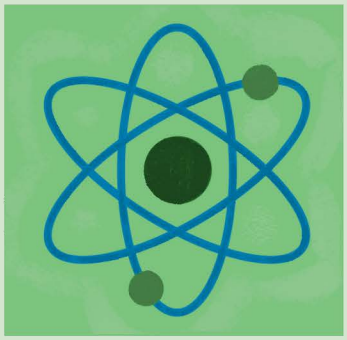
Annual Site Environmental Report Summary





ANNUAL SITE ENVIRONMENTAL REPORT SUMMARY FOR 2024

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Detailed findings and complete data are available in the *Los Alamos National Laboratory 2024 Annual Site Environmental Report*, found on OSTI.gov.

It is available to U.S. Department of Energy employees and contractors from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, (423) 576-8401.

It is available to the public from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Rd, Springfield, VA 22616.

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If you have questions or suggestions regarding improvements to this report, or if you want copies of the *Annual Site Environmental Report Summary*, please contact us at ASER@lanl.gov. You may also contact Environmental Communication & Public Involvement at envoutreach@lanl.gov or call (505) 667-3792.

Table of Contents

1 **Introduction:** The Laboratory's Governing Policy for the Environment

We are committed to act as stewards of our environment to achieve our mission in accordance with all applicable environmental requirements.

We set continual improvement objectives and targets, measure and document our progress, and share our results with our workforce, sponsors, and the public.

We reduce our environmental risk through legacy cleanup, pollution prevention, and long-term management programs.

2 Compliance at a Glance

Numerous federal laws, state laws, executive orders, and DOE orders drive environmental compliance at the Laboratory.

Los Alamos National Laboratory (the Lab or the Laboratory) is committed to protecting the health of its workers, surrounding communities, and the environment. These laws, regulations, and orders direct Laboratory staff on how to handle, transport, and dispose of waste; protect air and water quality; manage releases of radioactive materials; and protect cultural and biological resources.

Air Quality

CLEAN AIR ACT TITLE V OPERATING PERMIT
Sets limits for air emissions of regulated pollutants.

CLEAN AIR ACT TITLE IV
Regulates chemicals known to deplete the ozone layer in the atmosphere.

NEW MEXICO AIR QUALITY CONTROL ACT
Requires new or modified sources of air emissions to be evaluated.

Radiation Protection

DEPARTMENT OF ENERGY ORDER 458.1
Establishes limits for radiological releases from DOE facilities to humans, wildlife, and plants.

DEPARTMENT OF ENERGY ORDER 435.1
Regulates all generation, storage, and disposal of radioactive wastes.

Waste Management

RESOURCE CONSERVATION AND RECOVERY ACT
Regulates covered hazardous wastes from generation to disposal.

FEDERAL FACILITIES COMPLIANCE ACT
Regulates mixed wastes with both radioactive and hazardous components.

COMPLIANCE ORDER ON CONSENT FOR LEGACY WASTE CLEANUP
Contains a process for remediating solid waste management units.

TOXIC SUBSTANCES CONTROL ACT
Addresses the production, use, and disposal of specific chemicals, including PCBs.

2024 Updates

Air Quality

- In 2024, the estimated maximum dose of air emissions to a member of the public was 0.78 millirem, less than 5 percent of the limit allowed by the act.
- The Laboratory's emissions in 2024 were significantly lower than the permit limits; for example, nitrogen oxide emissions were approximately 17 percent of the permit limit, carbon monoxide emissions were 16 percent of the permit limit, and particulate matter emissions were 3 percent of the permit limit.

Radiation Protection

- During 2024, the estimated maximum radiological dose from all exposure pathways (inhalation, ingestion, and contact) to a member of the public from Laboratory operations was approximately 1 millirem, and radiation doses to wildlife and plants were below the annual DOE dose limits.

Waste Management

- The New Mexico Environment Department inspected the Laboratory's Hazardous Waste Facility Permit (Sept. 23–25, 2024) and closed out on Nov. 6 with no findings.
- Road Improvement Project: Realignment of the State Road 4/East Jemez Road intersection to support transuranic waste transport was completed in 2024.

Natural and Cultural Resources

NATIONAL ENVIRONMENTAL POLICY ACT
Requires federal agencies to evaluate the environmental impacts of their undertakings.

NATIONAL HISTORIC PRESERVATION ACT
Requires agencies to identify and document resources and access, minimize, or mitigate impacts on historic properties.

ENDANGERED SPECIES ACT
Mandates protection of endangered or threatened species and their habitats.

MIGRATORY BIRD TREATY ACT
Prohibits harm to migratory birds without a permit and ensures project compliance through monitoring.

FLOODPLAIN AND WETLAND EXECUTIVE ORDERS
Requires agencies to evaluate and avoid adverse impacts on floodplains and wetlands.

INVASIVE SPECIES MANAGEMENT (EXECUTIVE ORDER 13751)
The Lab tracks and removes invasive plant species as part of land management and construction efforts.

Water Quality

CLEAN WATER ACT
Regulates pollutant discharges into US waters and sets requirements for permits, storage tanks, and dredge/fill activities.

NEW MEXICO WATER QUALITY ACT (SURFACE WATER)
Sets goals, uses, and standards to protect the quality of state surface waters.

NEW MEXICO WATER QUALITY ACT (GROUNDWATER)
Establishes contaminant limits and discharge regulations to protect groundwater quality.

MULTI-SECTOR GENERAL PERMIT
Requires industrial sites to control stormwater pollution through best practices, maintenance, and monitoring.

SAFE DRINKING WATER ACT
Sets safe standards for contaminants in public drinking water systems.

2016 COMPLIANCE ORDER ON CONSENT
Outlines cleanup procedures for legacy waste and groundwater contamination at the Lab.

Other Environmental Protection

FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT
Regulates the distribution, sale, and use of pesticides.

DOE ORDER 231.1B, ENVIRONMENT, SAFETY, AND HEALTH REPORTING
Requires the timely collection and reporting of information on environmental issues that could adversely affect the health and safety of the public and the environment at DOE sites.

EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW ACT
Requires emergency plans for onsite hazardous substances.

DOE ODER 232.2, OCCURRENCE REPORTING AND PROCESSING OF OPERATIONS INFORMATION
Requires reporting of off-normal events or conditions that could affect human health or the environment.

2024 Updates

Natural and Cultural Resources

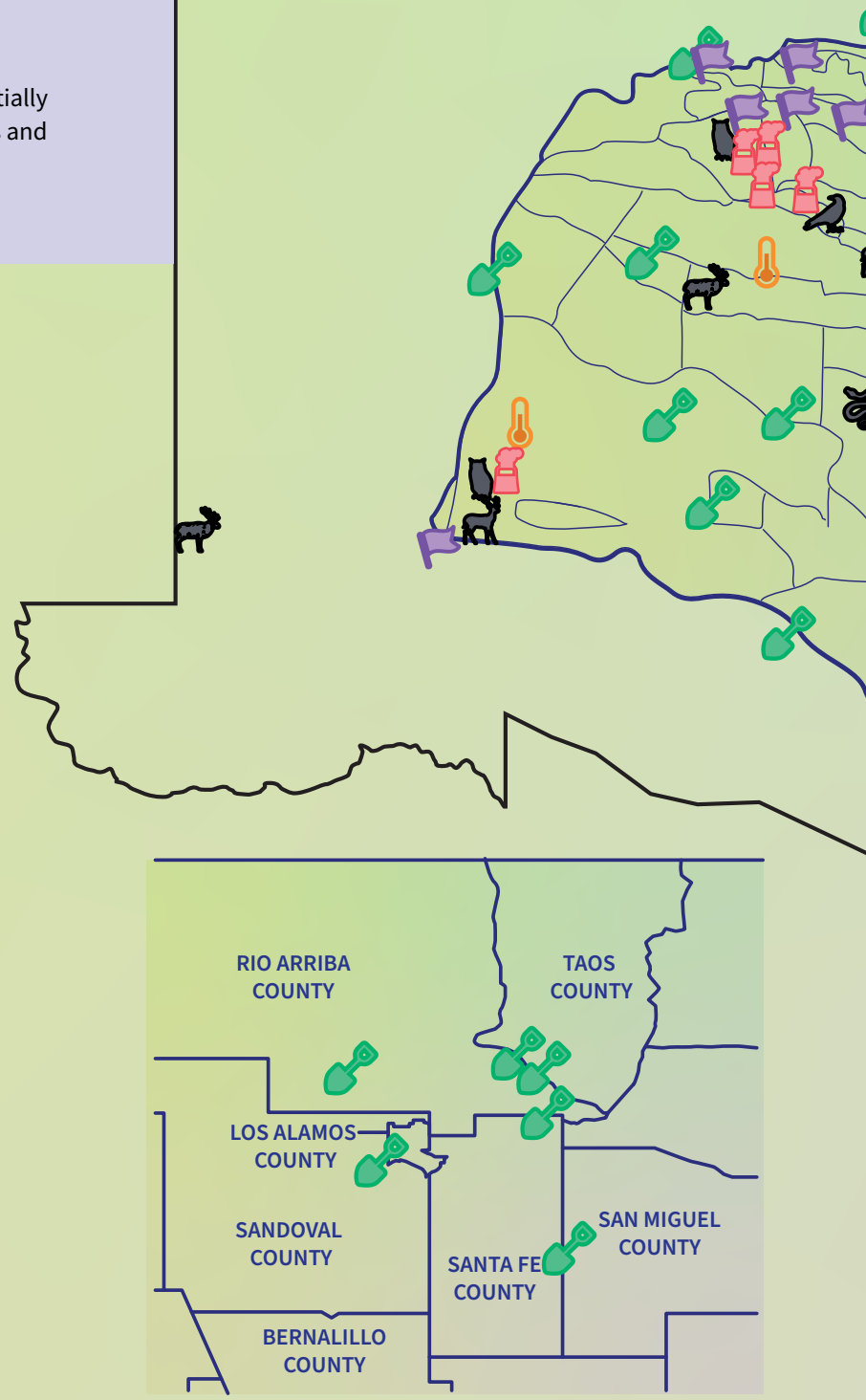
- In 2024, Laboratory archaeologists conducted cultural resources surveys or verified previous surveys for 34 projects, and successfully avoided 530 sites.
- In 2024, Triad historical facilities staff participated in surveillance and maintenance evaluations of historic properties, including the 17 buildings and structures that are either included in the Manhattan Project National Historic Park or that are eligible for the Park.
- The DOE/National Nuclear Security Administration continues to consult with the Accord Pueblos (Pueblo de San Ildefonso, Santa Clara Pueblo, Pueblo of Jemez, and Pueblo de Cochiti) and other Tribes and Pueblos with cultural ties to the Pajarito Plateau regarding the identification and preservation of traditional cultural properties, human remains, and sacred objects in compliance with the National Historic Preservation Act and the Native American Graves Protection and Repatriation Act.
- In 2024, biologists reviewed 770 excavation permits, 445 project profiles in the permits and requirements identification system, 73 minor siting proposals, and 11 stormwater pollution prevention plans to determine if they have the potential to affect federally listed species or their habitat. In 2024, there were no projects out of compliance with endangered species protection requirements.

Water Quality

- Of the 738 water samples in 2024 from outfall locations, only 3 of these (approximately 0.4 percent) exceeded a permit limit listed in the National Pollutant Discharge Elimination System. These were immediately addressed and corrected.
- In 2024, the drinking water quality for Los Alamos met all U.S. Environmental Protection Agency regulations.

Environmental Sampling Sites Across the Laboratory and Surrounding Communities

This map shows a few of the sites where environmental professionals sample water, air, plants, animals, soil, and weather to track the impacts the Laboratory could potentially have on the natural environment. Sampling explanations and results can be found in the following pages.



Key

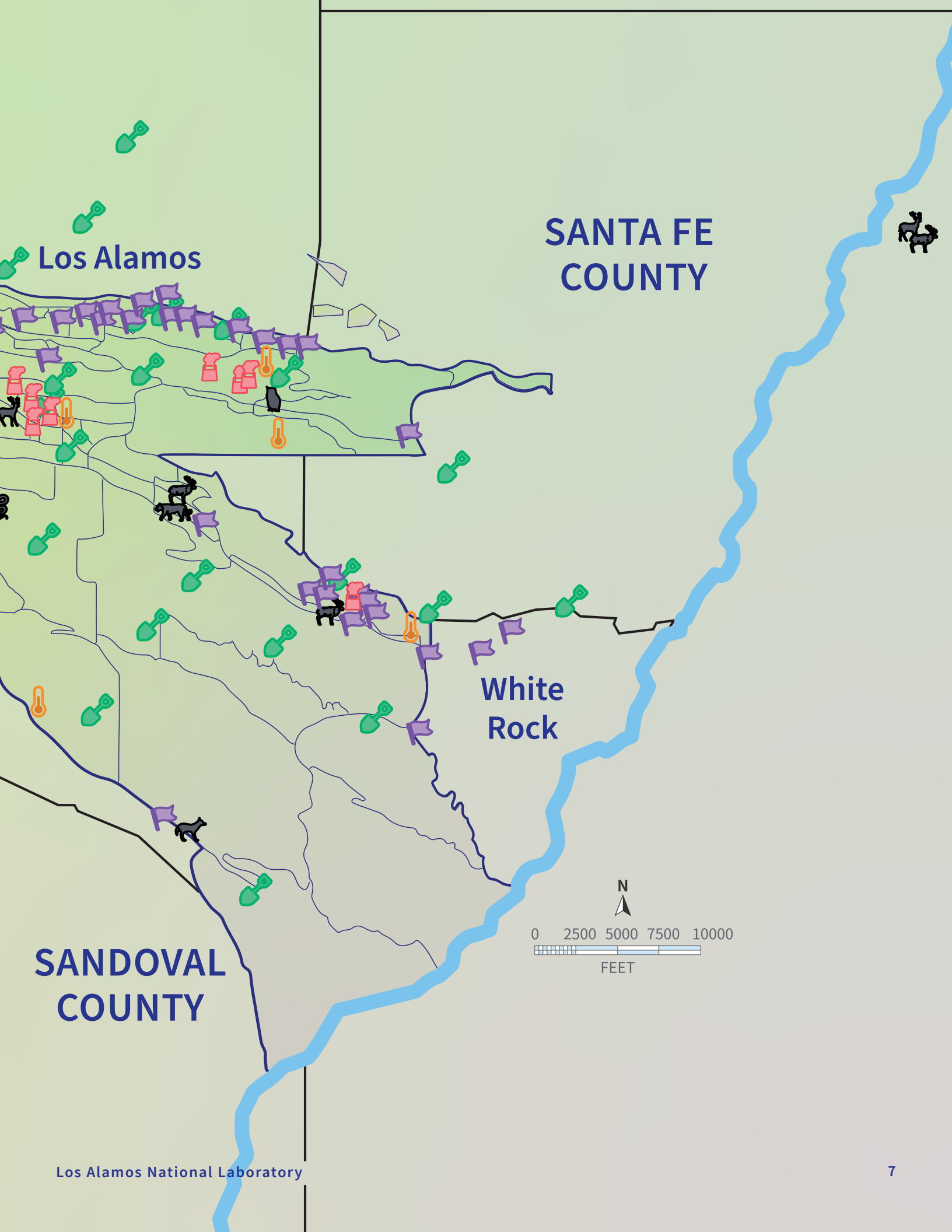
Air and Weather

- Tower
- Rain gauge
- Airnet stations
- Monitored stack

- Soil and Vegetation (onsite, perimeter, and background samples)

Opportunistic Large Game

- Common raven
- Coyote
- Deer
- Elk
- Gopher snake
- Great horned owl
- Mountain lion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FEET

Los Alamos National Laboratory recently debuted a new exhibit on the homesteaders of the Pajarito Plateau at its Bradbury Science Museum.

BREAKING NEWS

Life Before the Lab: New Exhibit Exploring Homesteaders of the Pajarito Plateau

A new exhibit provides a window into the lives and legacies of homesteading families.

BY MADELINE TAPIA

At Los Alamos National Laboratory's Bradbury Science Museum, a new exhibit recently debuted on homesteaders from the late 1800s to early 1900s. The exhibit brings attention to and honors the legacy of the homesteading families who lived and worked on the Pajarito Plateau (the Plateau) before the start of Project Y. The exhibit focuses on knowledge gained through the investigation of the Vigil y Montoya homestead, which culminated in nearly 40 descendants across 4 generations visiting the homestead and sharing stories with archaeologists and each other.

Photo of Enrique Montoya, daughter Eloisa, wife Sara "Sarita," and daughter-in-law Eliria with grandchildren Susie and Siria. (Photo courtesy of Montoya family.)

This exhibit is part of ongoing updates to the Environmental Stewardship exhibit—a larger effort to strengthen communication with the public about the Lab's commitment to responsible management of cultural and natural resources.

Homesteading on the Pajarito Plateau

Until the late 1500s, the Pajarito Plateau was home to Ancestral Pueblo peoples. They never abandoned this ancestral landscape but moved closer to the Rio Grande. Pueblo peoples continued to visit and use the Plateau during the Spanish Colonial Period (approximately 1600–1887), and Hispanic peoples began to use this upland area to graze sheep, goats, and cattle.

"When you have a true collaboration with descendant families, you can get much more nuanced and fascinating stories about people than you can just looking at artifacts."

—Ali Livesay, Archaeologist, EPC-ES

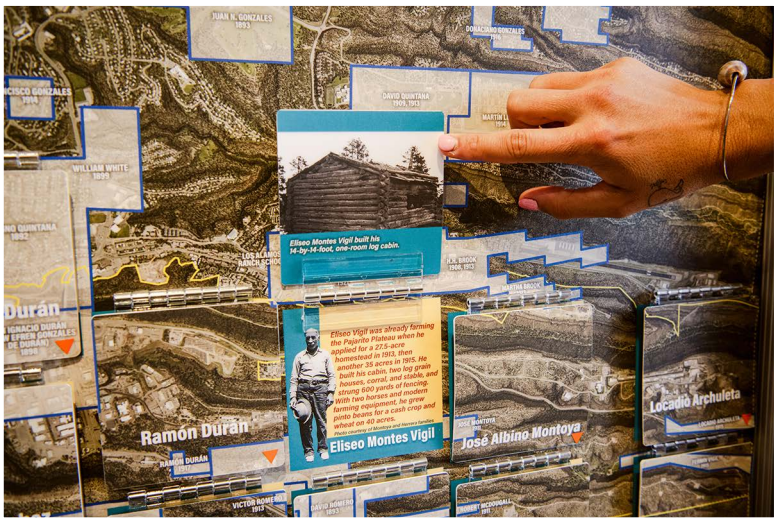
The Homestead Act of 1862 offered many families the opportunity to legally formalize their use of these lands. Because of their familiarity with the area, local Hispanic homesteaders were very successful in improving the land to receive patents for their claims and often selected the best parcels. Every spring and summer, many homesteaders moved up to the Plateau from their permanent homes in the Rio Grande Valley to seasonally farm surplus cash crops, such as beans, and raise their livestock. They worked hard to clear land, cut timber, and build cabins, corrals, outbuildings, and fences. Some took on additional work, either for the Los Alamos Ranch School (a private school for boys founded in 1917) or at the Anchor Ranch (a nearby large Anglo homestead). There were 36 homesteading families when the Plateau was taken over by the US government in the 1940s for the Manhattan Project—the World War II–era effort to build the first nuclear weapons. These families often worked for the Manhattan Project, and their descendants continue to be a critical part of the workforce today.

The Role of the Laboratory

Today, Los Alamos National Laboratory upholds its commitment to cultural stewardship in accordance with National Historic Preservation Act and Department of Energy mandates. Laboratory archaeologists review projects for potential impacts to archaeological sites and how to best avoid them, survey and record sites, determine site eligibility, perform internal and external outreach, and collaborate with descendants. As Laboratory archaeologist Ali Livesay says, "When you have a true collaboration with descendant families, you can get much more nuanced and fascinating stories about people than you can just looking at artifacts." For example, one story shared by descendants with archaeologists was about Grandma Sara "Sarita" Montoya. She could roll cigarettes with one hand and often wore a religious medal. A similar medal was found at the homestead and may very well have belonged to Sarita!

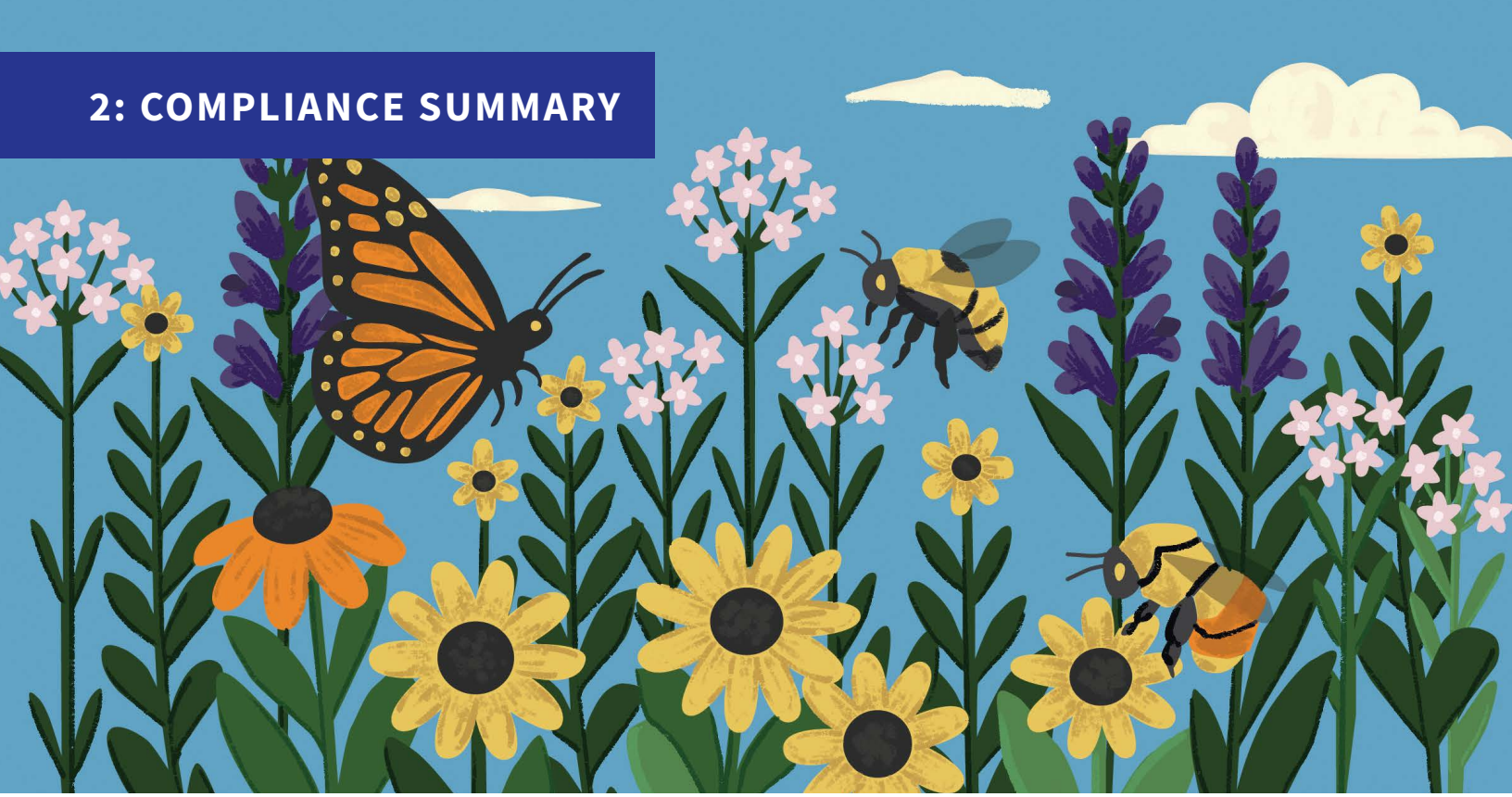
The Exhibit Today

The new homestead exhibit strives to share the significant stories of the homesteaders on the Pajarito Plateau before the Laboratory. Designed as a temporary installation, the exhibit is now transitioning into a mobile display that will travel around the Laboratory. Through personal stories, artifacts, maps, and a timeline, the exhibit offers a window into the lives of homestead families and ensures that their enduring legacies will be shared with future generations.



A glimpse into the new exhibit sharing the history and stories of homesteaders such as Sara "Sarita" Montoya (above) and Eliseo Montes Vigil (right).

In 2026, keep an eye out for the larger Environmental Stewardship exhibit that will highlight key moments of the homestead era on the Plateau along with other environmental topics and programs.



BREAKING NEWS

Implementing Pollinator Protections at the Lab

The Laboratory is proactively working towards protecting pollinators, which are important to ecological health and food production.

BY MIQUELLE ANGEL-SANCHEZ

Pollinators are a vital part of our ecosystem; they contribute to food production by moving pollen from the male part of the flower to the female part of another, allowing plants to reproduce to make fruit and seeds. Much of the world's flowering plants rely on pollinators and they are essential for fruits, vegetables, and nuts to grow.

Two native pollinators that have been proposed or petitioned for listing under the Endangered Species Act are the monarch butterfly and the Morrison bumblebee, respectively. Although these species have not yet been listed, the Lab is proactively documenting their occurrence onsite and implementing guidelines to protect these species that are consistent with the Lab's mission.

Showy milkweed planted in raised beds at TA-22 is a designated Monarch Waystation. Monarch Waystations are places that provide resources necessary for monarchs to produce successive generations and sustain their migration.

Taking Steps to Manage Special Status Species

The Laboratory has developed a site-specific Pollinator Protection Plan to protect pollinators and enhance their habitats.

The Morrison bumble bee is petitioned to be listed under the Endangered Species Act.

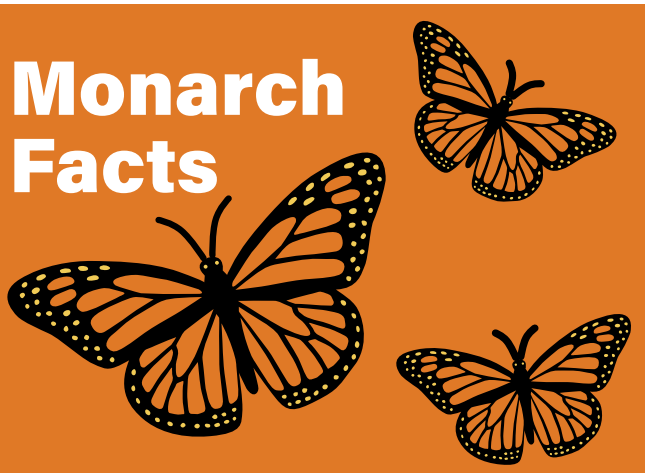
The plan outlines best management practices already being implemented and helps position the Lab to easily comply with federal management regulations for the monkey butterfly and the Morrison bumblebee if they become listed. One of these best management practices is the opportunistic planting of native species, which has led to the creation of pollinator gardens across the Lab, specifically at Los Alamos Neutron Science Center, Technical Area 03, and Technical Area 22, totaling 5 gardens. These gardens contain native perennials including penstemon, chocolate flower, prairie coneflower, and even include different species of milkweed, which is the only food source for monarch caterpillars. This effort benefits native pollinators by providing more habitat. It also increases aesthetic beauty for staff and visitors.

"Wildlife conservation isn't always easy. But with pollinators, you can plant milkweed and have monarch eggs on it that same summer, and that feels impactful."

—Jenna Stanek, Biologist, EPC-ES

Jenna Stanek is a wildlife biologist and has recently been awarded the Bandelier stewardship award. She currently helps organize and support protection plans in place for the Lab.

Monarch Facts



Monarchs migrate thousands of miles across the US to Mexico and the coast of California.

Their bright orange color help protect the butterfly, warning predators of their toxicity.

A monarch mom can lay up to 500 eggs in her lifetime, but only 1 to 5 percent of those eggs survive to become adults.

Best Management Practices at Los Alamos

In addition to planting pollinator gardens and addressing species that may be listed under the Endangered Species Act in the future, employees in the Environmental Stewardship group have implemented other best management practices for pollinators to support a diverse foraging habitat, which include the following:

- Documenting and identifying native plant and animal species onsite
- Managing invasive species opportunistically
- Adjusting roadside mowing schedules to avoid monarch breeding seasons (June–October in Los Alamos County) and inspecting milkweed before mowing
- Partnering with stormwater teams to include more pollinator plant species in seed mixes that are spread on the ground after disturbances
- Encouraging use of native plants in landscaping
- Preserving and protecting existing milkweed patches

All these protective actions will continue to benefit pollinators. Since the Pollinator Protection Plan has been implemented, the Environmental Stewardship group has successfully established gardens and created good rapport with facilities that enabled biologists to check the milkweed prior to mowing, an effort that has saved a combination of 83 monarch eggs and caterpillars since 2018.

3 Environmental Programs

Pueblo de San Ildefonso members at an ancestral place.

Reconnecting Communities through Ancestral Places

Cultural Resources staff facilitate visits to ancestral places for descendant community members.

BY JORDAN FRANKLIN-GARZA

Enduring Connections

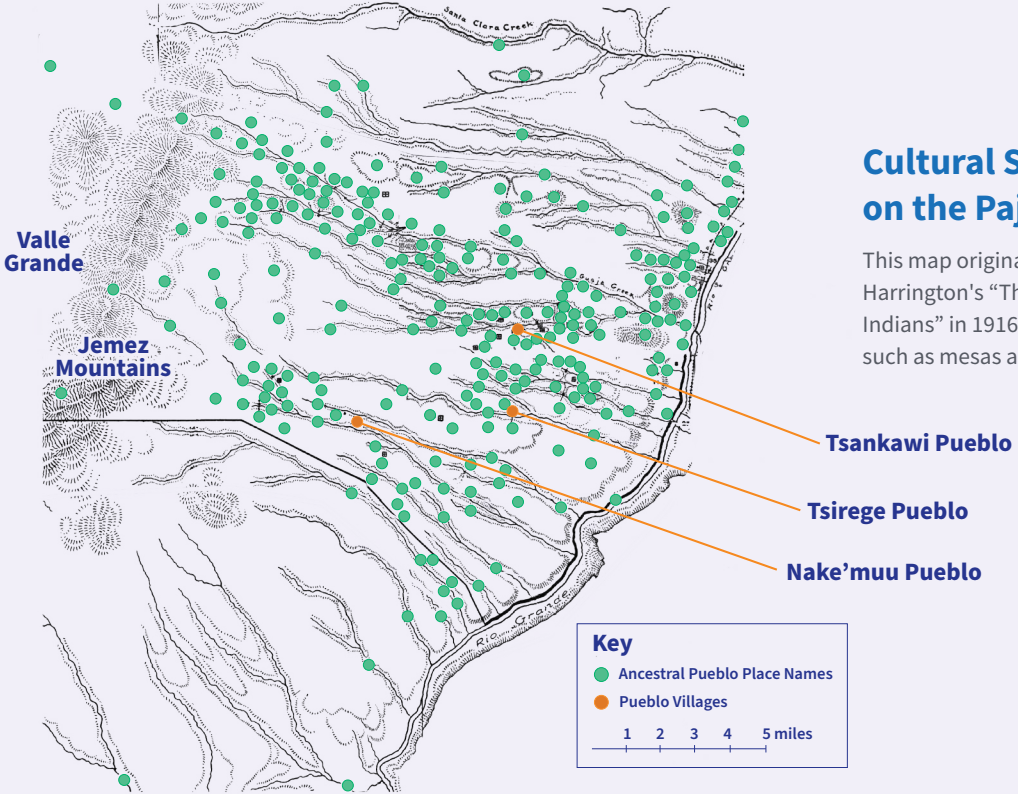
The land that the Los Alamos National Laboratory site resides on holds longstanding importance with the Pueblo de San Ildefonso and other local Pueblo communities. The landscape was continually inhabited before the Lab was constructed and contains around 2,000 cultural sites, the majority of which are ancestral to Pueblo peoples. These landscapes are viewed by the Pueblo de San Ildefonso and other Pueblo peoples as living places that their ancestors still inhabit. The Cultural Resources Program plays a large role in documenting and protecting these sites. While there are no public tours of the sites, the Cultural Resources Program does facilitate visits from descendant Tribal communities, such as Pueblo de San Ildefonso. Cultural Resources staff engage with Tribal neighbors out of recognition that the descendants of these places have maintained continuous cultural ties to this special landscape.

These visits are essential to the Lab's objective to create and build trust with surrounding communities through engagement. Through these connections, the Laboratory provides descendants room to connect with their ancestral places, which have been inaccessible since the Lab was established. As the only national laboratory that shares a physical border with Tribal neighbors, it is important that the Lab forges a strong community relationship with its Tribal neighbors, and these facilitated visits allow the Cultural Resources Program to work toward that goal.

> **"It's important to know who your neighbors are." —Alex King, Deployed Environmental Professional and Pueblo de San Ildefonso member**

Facilitating Visits

Any visit involving large groups coming onto Lab property can be logistically challenging, and outings to ancestral places often require unique considerations. Along with standard requirements like securing adequate transportation, complying with security regulations, and ensuring there are enough escorts, the Lab strives to be culturally sensitive by welcoming Tribal members to have the space they need to



Cultural Sites and Place Names on the Pajarito Plateau

This map originally comes from John Peabody Harrington's "The Ethnogeography of the Tewa Indians" in 1916. Place names can be for landforms such as mesas and canyons or for ancestral villages.

Pueblo members visit Nake'muu Pueblo.

explore their ancestral places. The Cultural Resources Program aspires to make the access process as smooth as possible, so Tribal members feel respected and a sense of autonomy when visiting these sites.

2024 Visits

In 2024, the Cultural Resources Program successfully enabled visits to four different ancestral places, including Tsirege (Tewa name meaning "Bird Place") and Nake'muu ("Village at the Edge/Point"). The Cultural Resources Program coordinated with the Pueblo de San Ildefonso Tribal Historic Preservation Officer and Tribal elders to advertise the visits and encourage interested people to sign up. Over four days, 65 adults and 17 youth attended the site visits and were able to walk in the same places that their ancestors once tread. They often spoke in Tewa and shared stories with each other that had been passed down for generations. Pueblo de San Ildefonso oral histories document Tsirege as one of the last pueblos to be occupied before their ancestors moved closer to the Rio Grande and explain Nake'muu was reoccupied in the 1690s by women, children, and elders to escape the Spanish following the Pueblo Revolt of 1680.

Looking to the Future

Restricted access to ancestral places because of site operations has been, and continues to be, a point of frustration for Tribal communities. The Cultural Resources Program hopes to continue to provide more opportunities for increased connection. More engagement and collaboration will help create a positive cycle that reinvigorates relationships. Through greater dialogue with descendant communities, Laboratory archaeologists can better understand the important role they play in protecting these living places by providing more and easier access for Pueblo visits to collect minerals and plants for use by the people as well as annual visits or pilgrimages to these ancestral places that are part of continuous ancient and ongoing San Ildefonso culture.

According to Alex King, the Lab is headed in the right direction when it comes to improving relationships with its Tribal neighbors. Increased outreach, engagement, and collaboration will ensure that these ancestral places are appropriately honored, cared for, and protected for future Pueblo generations to visit. "By keeping relationships between the Lab and local Tribal communities positive, the Cultural Resources Program can serve the best interests of both parties."

Left: The Forest Monitoring crew assessing a ponderosa tree.
Right: Aerial view of Rendija Canyon before thinning.

Forest Monitoring

The Forest Monitoring Program supports the Laboratory's mission by surveying the evolution of forest ecosystems following human-made forest management treatments.

BY KAYA KRANTZ

Los Alamos National Laboratory is positioned directly on the border between urban and natural environments. This unique interface means that Lab property is especially vulnerable to the threat of wildfires—an ever-present concern that is steadily growing. The threat of wildfires, coupled with high rates of tree mortality from drought, are some of the major reasons consistent forest management is necessary across the Laboratory. One of the goals of the Forest Monitoring Program is to collect pre- and post-forest treatment (tree thinning, vegetation mastication, etc.) data to ensure the health of the forests and monitor the impact of these treatments.

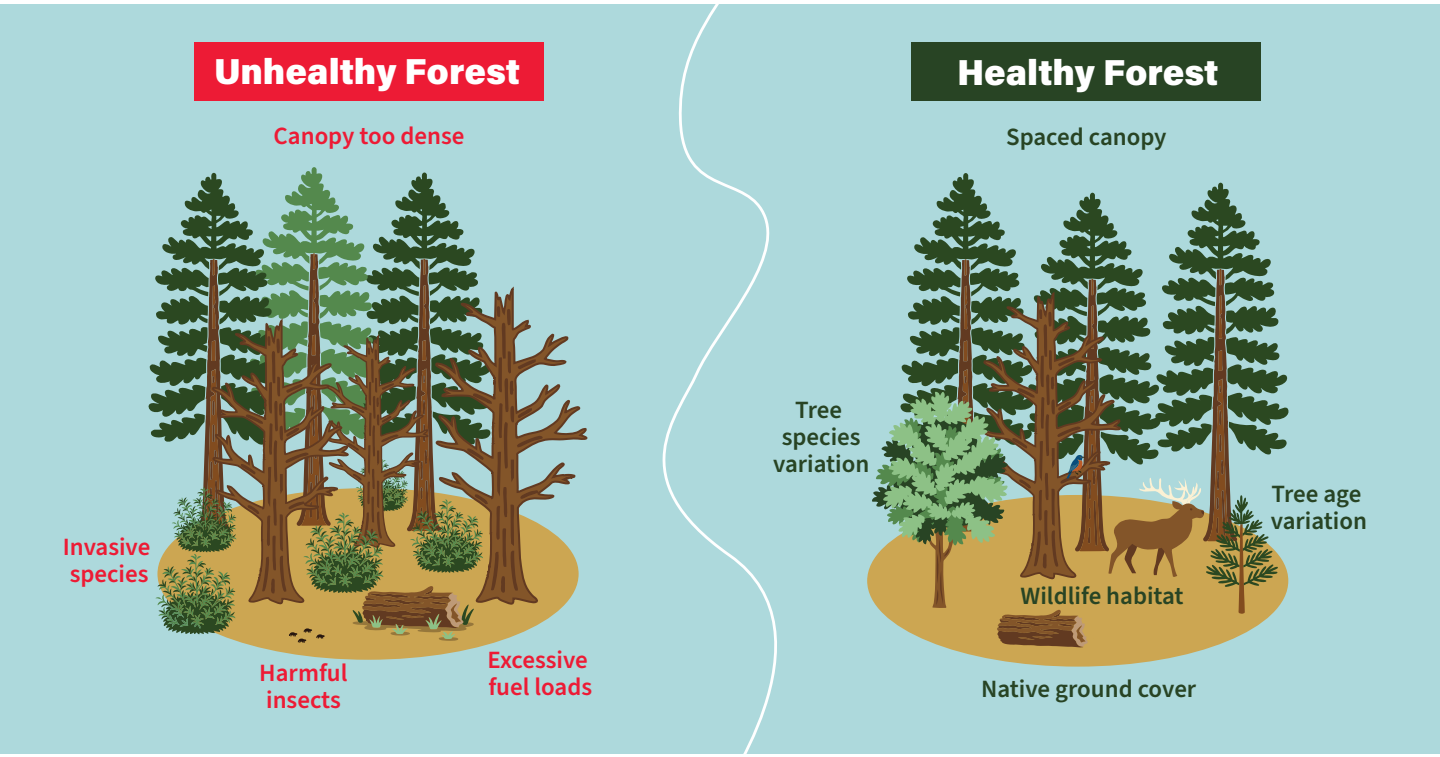
The Forest Monitoring Program oversees about 40 square miles of Lab property and inventories more than 250 acres each year. The monitoring protocols implemented by the team help quantify the effectiveness of current forest management techniques, which aim to limit soil erosion, increase resilience against invasive species, preserve old-growth trees, and minimize the spread of destructive insects like bark beetles. The Forest Monitoring Program tackles interdisciplinary projects that often involve collaborations with other programs such as Biological Resources; Cultural Resources; Soils, Foodstuffs, and Biota; Trails Management; and Wildland Fire.

Rendija Canyon Thinning Project

In 2023 and 2024, a forest thinning project was conducted in Rendija Canyon. This project involved cutting down trees and masticating (shredding or chipping into smaller pieces) them to lessen the fuel load. The ultimate goal of the project was to promote a more robust and drought-tolerant landscape and implement fuel breaks along the canyon boundaries to protect the surrounding residential areas of Los Alamos County from potential wildfires.

This project required the aid of a number of collaborators. To ensure the safety of the bird populations during their breeding season (May 15 to July 31), the Biological Resources Program conducted surveys of the designated treatment areas to monitor bird activity in trees and ground vegetation. These nest checks provided the Wildland Fire crew with a five-day window to cut any vegetation without the risk of harming bird populations. During the thinning process, the Trails Management Program coordinated an erosion mitigation project on the Barranca Crossing Trail in Rendija Canyon. Within the project area, the Wildland Fire crew also installed a set of rolling dips on an eroded section of trail to stabilize the soil and reduce erosion by diverting water runoff. Cultural Resources staff also flagged known archaeological sites for avoidance and performed surveys to ensure no undocumented sites would be affected by thinning activities.

The Forest Monitoring Program collected pre- and post-treatment data (in 2023 and 2024, respectively), which included assessments of vegetation types and cover, fuel loads, and overstory trees. The team monitored 37 plots across the 167 acre treatment area. A significant part of the data



Features of a healthy forest compared to an unhealthy forest.

they collected focused on mature tree density (the number of mature trees in a given area) and total basal area (the sum of the cross-sectional area of trees at 4.5 feet). These types of standardized data allow the program to run statistical analyses to determine key indicators of the overall health of a forest. It is critical that the Forest Monitoring Program uses consistent and repeatable data collection methods so they can compare data spanning multiple years and construct a comprehensive understanding of how the landscape is changing over time.

To mitigate wildfire danger, it is important that the treated forests mimic the structure of historical ponderosa pine forests, which consisted of well-spaced healthy trees that are fire tolerant and less susceptible to drought conditions.

Monitoring Results

The post-thinning monitoring results in 2024 indicated that the treated plots in Rendija Canyon had mature tree densities and total basal areas well within the desired range, corresponding to historical ponderosa pine densities and in accordance with the Lab's Wildland Fire Mitigation and Forest Health Plan. The majority of trees removed were smaller, less mature trees, which often retain their lower branches and therefore are less resilient to fire and can act as ladder fuels—material that allow fire to climb from the ground to the tree canopy.

The Forest Monitoring Program will continue to return to this locale in the following years to assess how the Rendija Canyon forest is responding to the treatment and to ensure that the health of the ecosystem endures.

A monitoring plot in Rendija Canyon before and after thinning.

Construction crews break ground on a parking garage at TA-55.

Neighborhood Planning in the Pajarito Corridor

At Los Alamos National Laboratory, programs in Environmental Protection and Compliance are taking a new neighborhood approach to streamline environmental compliance along the Pajarito Corridor.

BY KYLA FUGATE

The Pajarito Corridor is the area along Pajarito Road, which runs through Los Alamos National Laboratory and is the physical center of nuclear research and production at the Lab. In the next 5–10 years, about 150 infrastructure projects are planned for the Pajarito Corridor as part of the Campus Master Plan (CMP)—a Lab-wide vision over the next three decades to build modernized facilities and infrastructure. Some of the infrastructure projects in the corridor include upgraded power and water distribution in support of new facilities, while others are transportation projects to upgrade roads and intersections to reduce congestion and improve safety.

The Neighborhood Approach

All proposed projects at the Laboratory must undergo rigorous review of environmental permits

> **"The Pajarito Corridor improvements are necessary to support the Lab's mission but also will make the employees' work experience more efficient and comfortable."**
>
> **—Karen Borovina, Program Director, Pajarito Corridor Infrastructure Integration Office**

Technical Area (TA) 55 is one of the many TAs situated on the Pajarito Corridor.

and requirements through numerous Environmental Protection and Compliance (EPC) programs. To increase efficiency and certainty of environmental compliance, the Pajarito Corridor planning team and EPC programs have implemented a neighborhood approach to perform project review along the corridor. Formally adopted in 2024, the neighborhood approach is a collaborative effort to ensure that the Laboratory has the infrastructure it needs sooner, while complying with all environmental regulations.

"Implementing the neighborhood approach has led to more comprehensive environmental planning efforts, which has helped minimize environmental impacts from the ongoing projects as well as ensuring compliance with the many environmental programs at the Lab."

—Cole Hambleton, EPC

Through this approach, multiple projects are evaluated for infrastructure needs and environmental requirements at once, ensuring appropriate compliance through the National Environmental Policy Act (NEPA). Specifically, the goal is to ensure environmental compliance with existing NEPA analysis, such as environmental assessments and reviews. For example, Laboratory programs work collaboratively to identify and avoid impacts to cultural resources, evaluate impacts to endangered species, and combine stormwater permits to cover a whole neighborhood area. In doing so, project planners and environmental professionals are engaging collaboratively throughout the life cycle of projects, ensuring efficiency and certainty of environmental compliance.

Through the neighborhood approach, programs can better support the Lab's missions to meet national security challenges while prioritizing environmentally compliant continuous growth and environmental stewardship.

Fun Facts

An estimated 7,000 employees will be working in the Pajarito Corridor by 2028

150 infrastructure projects are planned for the next 5–10 years

60 projects that span 8 technical areas are the first priority

4 Air Quality and Meteorology

Left: A Met Tower on Laboratory property.
Right: Even on sunny days, important meteorological data is being collected by instruments located all over the Lab.

Meteorological Monitoring for Emergency Response

Weather data supports emergency response and helps Laboratory researchers conduct their work safely.

BY ALBERTO HERNANDEZ LUNA

For decades, Los Alamos National Laboratory has been recording and archiving data such as precipitation, daily maximum temperature, and daily minimum temperature. This data is used to demonstrate regulatory compliance and to support a comprehensive understanding of Los Alamos' climate. In 2024, according to the Laboratory's meteorological monitoring, the year started and ended at differing levels of drought, monthly temperatures were higher than average, and unusually heavy snowfall occurred in the months of March and November. These conditions affect fire danger ratings around the Laboratory, create a risk of heat exhaustion for workers, and cause adverse driving conditions, respectively.

Continuous Weather Observations for Emergency Preparedness

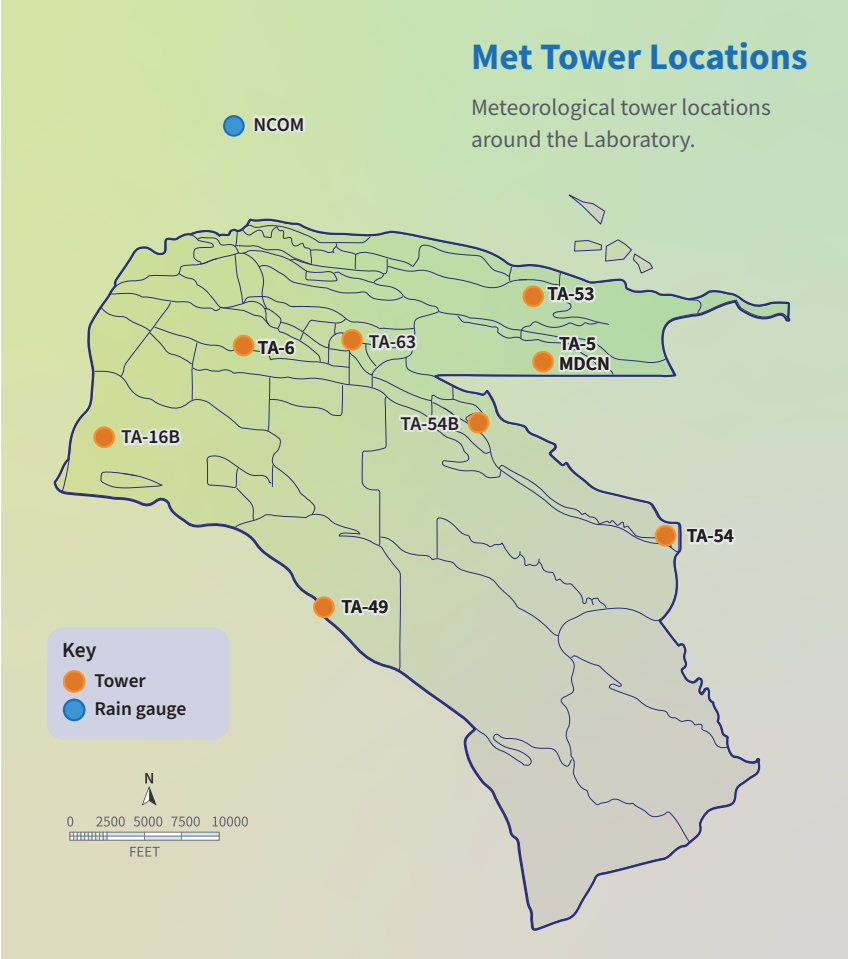
The Laboratory's weather network is comprised of eight meteorological towers outfitted with sensors that record data in 15-minute intervals. This data can be accessed through the Laboratory's Weather Machine (weather.lanl.gov) by employees and the public. Recorded data ranges from wind variables such as velocity, direction, and turbulence to fuel moisture and temperature variables. These factors affect the ignition potential of combustible plant material in the area, helping specialists determine local fire danger for the Laboratory and surrounding communities.

In the event of an emergency such as a chemical or radiological release, real-time meteorological data and dispersion modeling would be used to demonstrate regulatory compliance in areas such as air quality, water quality, and waste management. Meteorological data and dispersion modeling would also make it possible to assess the impact of the release and would help the Laboratory determine what actions to take. For example, meteorological data could help emergency responders determine if neighborhoods in the Los Alamos area should be evacuated.

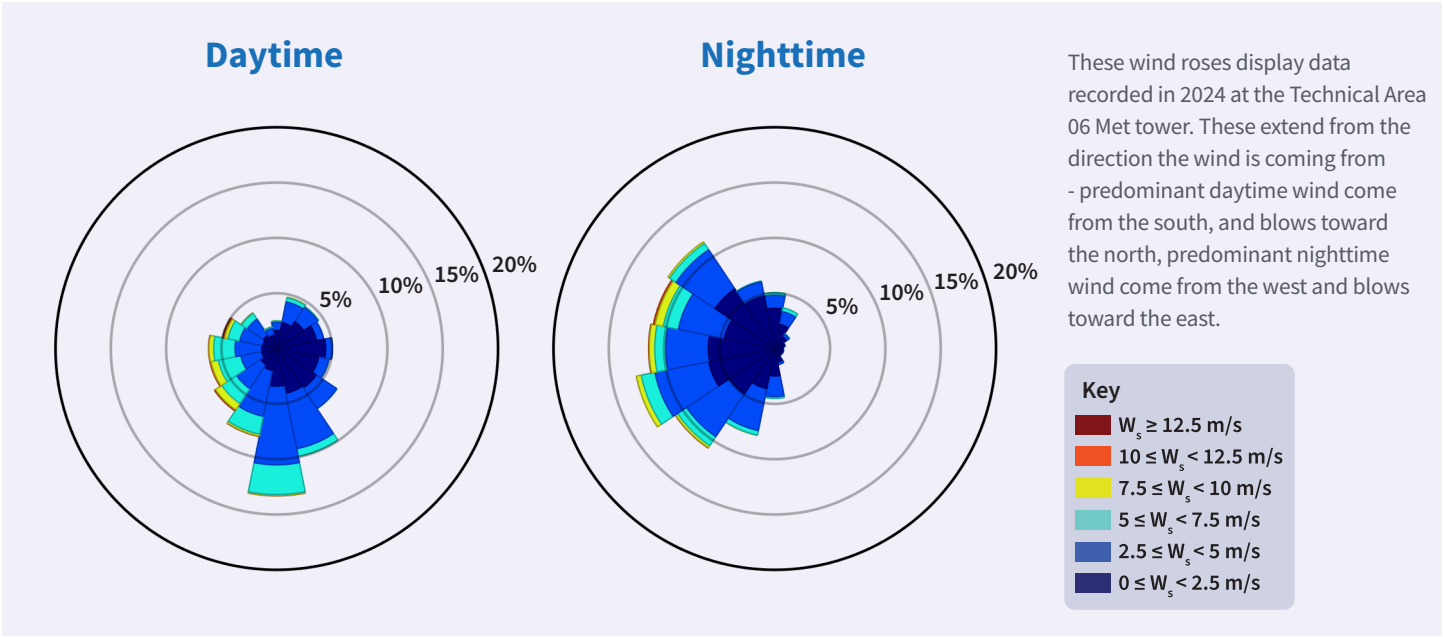
2024 Weather Summary and Recent Weather Trends

At the beginning of 2024, Los Alamos County was classified by the US Drought Monitor as an area experiencing severe drought. The county ended the year in a mild drought category ("abnormally dry"). The total precipitation for 2024 exceeded the 30-year average by a slight margin per the Laboratory's sensor network. The highest temperature recorded in 2024 was 92 degrees Fahrenheit (June 6), and the lowest temperature recorded was 3 degrees Fahrenheit (January 9). Monthly averages were higher than the 30-year average for 10 of the 12 months, and the highest officially recorded gust of wind happened on April 6 with a speed of 58 miles per hour.

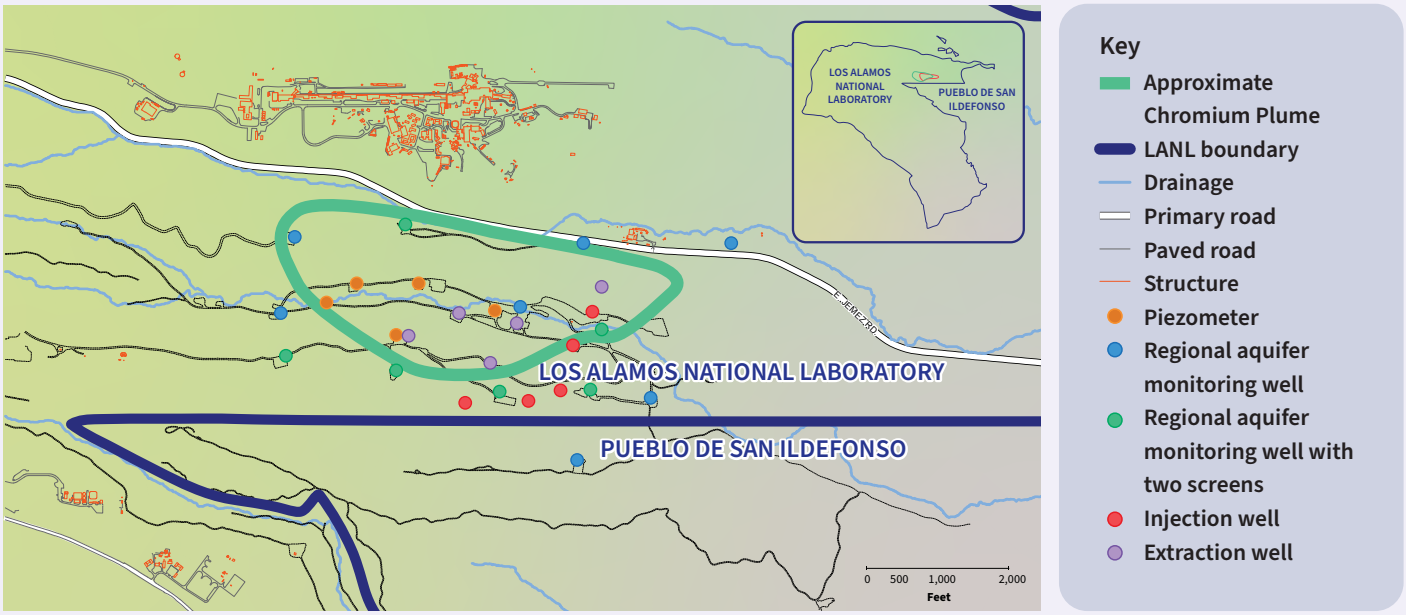
Los Alamos county has been experiencing a warm spell for the past 15 years that is more extreme than the last warm spell, which was documented in the early to mid-1950s. Five of the hottest summers on record have occurred since 2002, and the highest summertime (June, July, and August) average temperature on record was 71.1 degrees Fahrenheit, recorded during 2011. This increase in temperature has had little to no effect on the total annual precipitation, however, it seems to fluctuate independently of the average annual temperature.



Laboratory meteorological monitoring is important not only for emergency response, but also for modeling trends and predicting the future weather of Los Alamos. Data shows that in 2024, the year started and ended with Los Alamos County in different levels of drought, and the area continued to experience a warm spell. Data will continue to be collected and used to further the Laboratory's understanding of the local climate and to ensure the safety of Los Alamos and surrounding areas.



5 Groundwater Protection Program



The approximate chromium plume footprint in the regional aquifer in Mortandad Canyon.

Limiting Groundwater Contamination through Protective Measures

Groundwater sampling and remediation efforts ensure the safety of local drinking water.

BY SHIV ANTAR KHALSA

Overview of Processes

The land encompassed by and surrounding the Los Alamos National Laboratory site is subject to groundwater standards set by the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the New Mexico Water Quality Control Commission. These agencies provide guidelines for the maximum levels of radionuclides and other pollutants in groundwater to protect private and public drinking water systems. To comply with the requirements, legacy waste cleanup contractor, Newport News Nuclear BWXT-Los Alamos, LLC (N3B), collects samples from monitoring wells, springs, and baseflows throughout the region.

Chromium Plume

The chromium plume is the result of historical effluent discharge from a power plant's cooling system from 1956 to 1972. Although the effluent was originally released in Sandia Canyon, contaminated water migrated below ground to the regional aquifer where it lies today. Sampling of groundwater monitoring wells within the existing plume in Sandia and Mortandad canyons have indicated concentrations of chromium that surpass the New Mexico groundwater standard of 50 micrograms per liter, but the contamination has not influenced production wells currently used for drinking water. Remediation efforts for the chromium plume began in 2017 and continue today with the goal of lowering chromium concentrations. These efforts include increased groundwater monitoring and the combined use of extraction and injection wells in what is known as the Chromium Plume Interim Measure.

In the interim measure system, contaminated water is removed from the plume at extraction wells before being transferred to an aboveground ion exchange treatment

Groundwater sampling at a regional aquifer monitoring well, R-70.

system. Treatment lowers the contamination of the water below the 50 micrograms per liter standard, after which the water is pumped back into the regional aquifer by an injection well, effectively lowering the chromium concentration of the groundwater. These efforts began in 2018 and persisted until March 2023, when the system was shut down for evaluation. The operation resumed in September 2024 and continues to contribute to chromium mitigation as staff work towards final remediation.

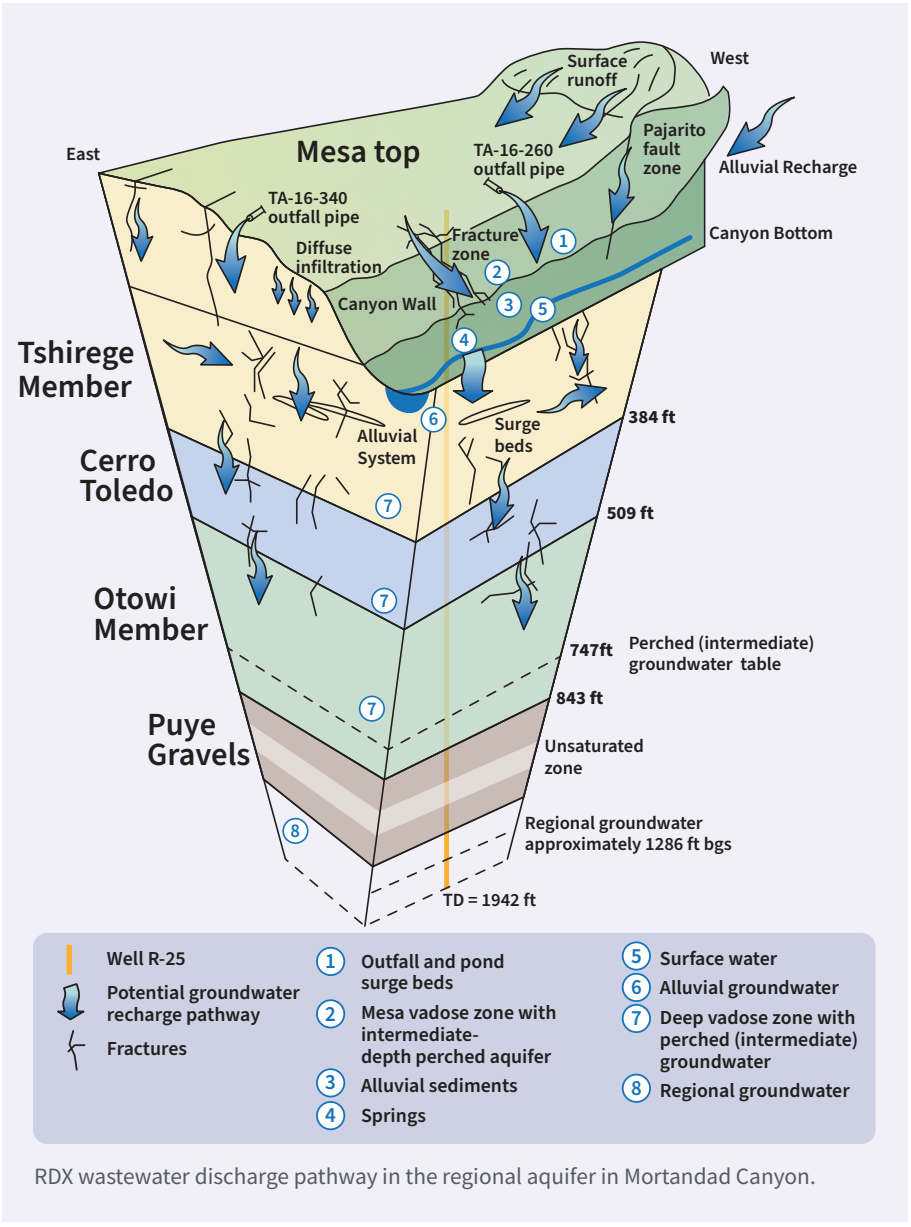
Technical Area 16-260: RDX

Similar to the origins of the chromium plume, past facility wastewater discharge has contributed to contamination of the regional aquifer with a synthetic explosive, Royal Demolition Explosive (RDX). Technical Area 16-260 operations discharged effluent water into Water Canyon and Cañon de Valle, which eventually percolated through the surface rock layers of Cañon de Valle and into subterranean water bodies. This wastewater contained multiple contaminants such as high-explosives and inorganic element contamination; however, RDX remains the only component that exceeds its designated screening level in the aquifer. As with chromium contamination, drinking wells remain safe from RDX contamination.

Consent Order and Public Involvement

Remediation efforts for issues such as the chromium plume and RDX contamination are largely influenced by the 2016 Compliance Order on Consent (Consent Order). This order represents an agreement between the New Mexico Environment Department and DOE that outlines responsibilities for corrective actions consistent with the Resource Conservation and Recovery Act and the New Mexico Hazardous Waste Act. It ensures accountability from both parties in legacy cleanup planning and action.

In recent years, the ability of the public to stay informed and influence the operations of the Consent Order has expanded. For example, Intellus, a publicly accessible online database, is maintained with up-to-date data regarding environmental sampling of groundwater. Furthermore, the public is free to submit comments to the DOE through email and may additionally opt to receive email notifications concerning groundwater analytical data. In addition to these virtual methods, public meetings and hearings are held by DOE to provide further opportunities for public input on affairs that impact the health and safety of the local environment.



RDX wastewater discharge pathway in the regional aquifer in Mortandad Canyon.

The current Radioactive Liquid Waste Treatment Facility has been operating since 1963.

The Laboratory's Radioactive Liquid Waste Treatment Facility

How the Lab treats its liquid waste and plans for more efficient management of waste.

BY YOLANA MARTIN

Waste generated at the Laboratory can take many forms, whether it be used office paper or radioactive byproducts of research. Before waste is discarded from the Laboratory, it is characterized and, if necessary, treated to remove harmful constituents. For example, to treat wastewater, the Lab uses a variety of methods including biological treatment, where bacteria are added to break down organic matter; adding soda ash to help regulate alkalinity and pH; and disinfecting water through chlorination, UV radiation, and ozonation. Waste treatment processes such as these ensure that the Lab safely manages all waste streams.

The Facility

At the Laboratory, certain research and production processes generate radioactive liquid waste. The facility responsible for receiving, storing, and treating this liquid waste is the Radioactive Liquid Waste Treatment Facility (the Facility). The Facility takes in two different influent streams: low-level liquid radioactive waste and transuranic liquid radioactive waste. Treatment of low-level liquid waste produces treated effluent and dewatered sludge; treated effluent is composed of liquids while dewatered sludge is mostly solids. The treated effluent can be discharged into Mortandad Canyon or the Mechanical Evaporator System. The dewatered sludge, however, must be sent to outside facilities, such as the Nevada National Security Sites, for final disposition. As for transuranic liquid waste, its treatment produces a liquid "supernatant" and "cemented sludge." The liquid supernatant can be sent back to the low-level liquid waste side of the Facility,

Before any waste is discharged to the outside environment, it is treated to remove harmful constituents.

while the cemented sludge is sent to the Department of Energy's Waste Isolation Pilot Plant in Carlsbad, New Mexico.

The Treatment Process

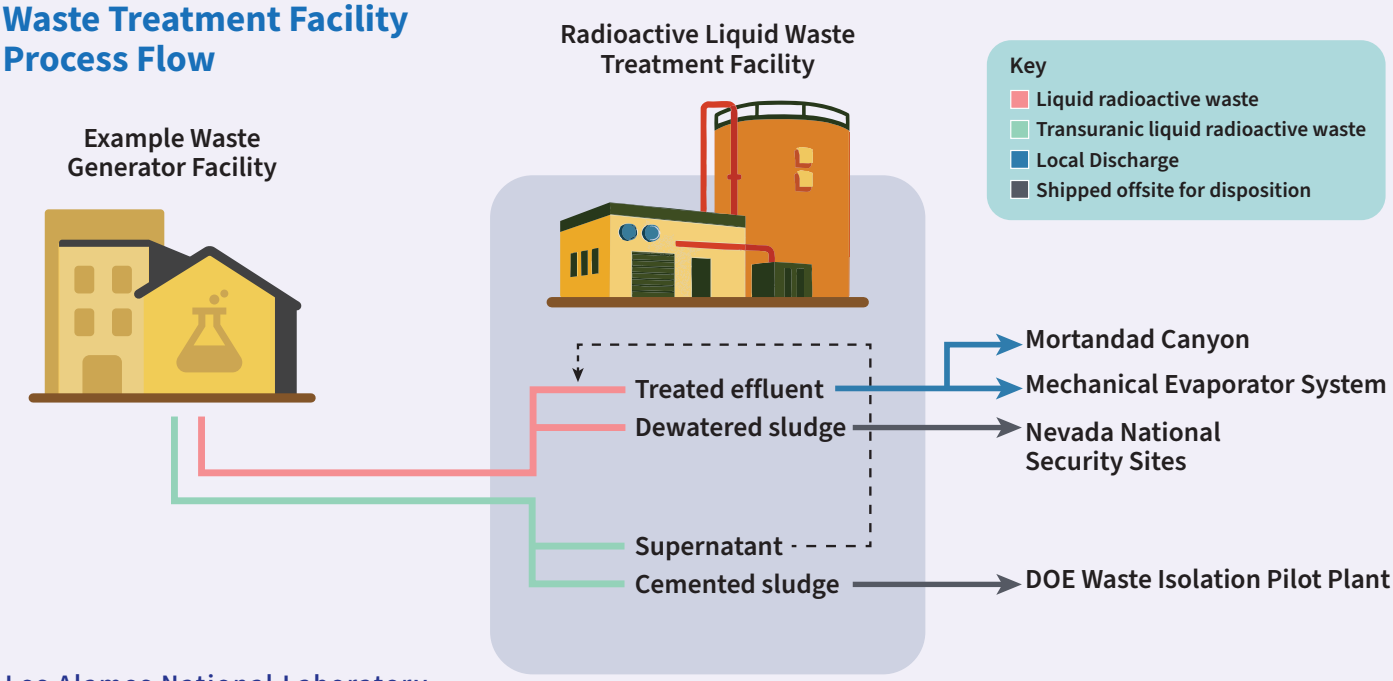
The treatment process of liquid radioactive waste begins with low-level liquid waste being sent from various Laboratory areas and transuranic liquid waste sent from Technical Area 55 to the Facility via separate underground double-walled collection pipes. Low-level liquid waste and transuranic liquid waste are kept isolated and treated in separate systems, and both streams undergo coagulation and pH adjustment. The low-level liquid waste stream undergoes further treatment via microfiltration, ion exchange, and reverse osmosis to remove harmful constituents. Then, the Facility process also entails preemptive sampling to ensure treatment was effective prior to discharge. Samples are tested for characteristics and constituents, such as radiological content, pH, nitrogen species, chemical oxygen demand, and heavy metals. Furthermore, regulatory sampling for offsite analysis, as required by the Groundwater Discharge Permit DP-1132 and the National Pollutant Discharge Elimination System outfall permit, ensures compliance with environmental regulations.

Construction at the new transuranic liquid waste facility. Specially fabricated 2,000-pound tanks were installed that will hold contaminated water during waste processing.

Modernization Plans

In order to continue operating effectively and reliably for decades to come, these facilities must be modernized. This need is being addressed by the construction of two new co-located facilities. The transuranic liquid waste treatment facility will also include a nitrate reduction system, which will further enhance the treatment capabilities. Other upgrades include the Solar Evaporative Tank, which gives an additional effluent discharge point, thus enhancing operational flexibility.

Radioactive Liquid Waste Treatment Facility Process Flow



6 Watershed Quality

Perennial stream in Sandia Canyon.

Updating the 100-Year Floodplain Boundaries

Understanding floodplains, their protection, and the compliance that goes along with them.

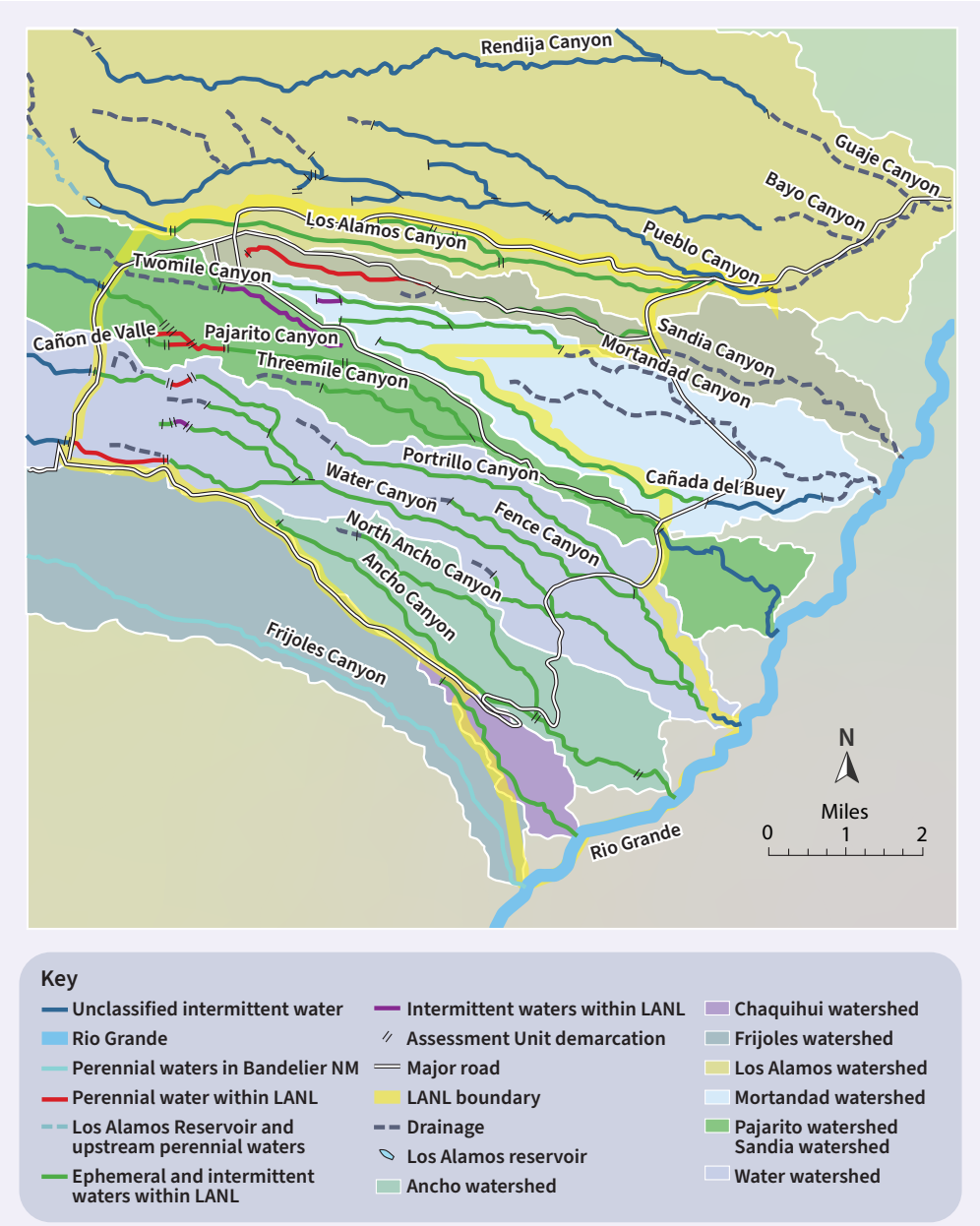
BY MADELYN OWEN

Floodplains are areas that naturally flood when water levels rise. They can be found near rivers or streams and play an important role in both ecological and human systems. Understanding floodplains and their boundaries is essential because flooding can directly impact site operations. In addition, to ensure compliance and environmental safety, Newport News Nuclear BWXT- Los Alamos, LLC (N3B), the site's legacy waste cleanup contractor, samples and monitors chemical and radionuclide levels in surface water and sediment found at floodplains and streams. These efforts help assess water quality within and downstream of the Laboratory, and they are used to evaluate potential risks to human and ecosystem health.

Importance of Floodplains

Assessing floodplains is important for several reasons, such as understanding their ability to be affected by human activity. The locations of floodplains can impact construction planning and infrastructure development, as projects could cause unforeseen changes to the local hydrology, which can destabilize the soil under existing developments. To plan for new construction projects, the Laboratory periodically updates waterflow pattern predictions to better understand how these areas might be impacted by human activities.

For example, the landscape in and around the Lab has experienced deforestation from pests and fire, ongoing drought, and an increased number of infrastructure projects in recent decades. These conditions make the soil less permeable, which could lead to faster waterflow into nearby



Stream reaches and watersheds within and around the Laboratory.

streams, making affected areas more susceptible to flooding. The Lab periodically reassesses floodplains to account for these types of changes.

The landscape of the Laboratory site consists of several finger like mesas with deep canyons in between. Because of this topography, some of the floodplains found locally include urban areas and canyon bottoms. At the Lab, the majority of streams are ephemeral—meaning they only flow periodically rather than constantly—and are fed by runoff from the mesas. Updating floodplain maps to reflect current conditions is crucial. The update of floodplains helps identify potential risks; a shifted stream path could put people and infrastructure at risk of flooding.

Planning and Compliance

Floodplain data is an essential planning resource at the Laboratory, particularly the 100 year floodplain. The 100 year floodplain is a floodplain with a 1.0 percent chance of flooding in any given year. The Lab follows Executive Order 11988, Floodplain Management, Section 2, which outlines the procedures for managing floodplain areas. Complying with this order means creating a floodplain assessment document prior to taking any action such as building a structure in a floodplain. This order is in place to try and avoid direct or indirect impacts of floodplain development whenever attainable alternatives exist by evaluating the potential long- and short-term risks associated with these areas. By complying with this order, the Lab can limit flood losses and preserve the natural and beneficial values of floodplains.

Floodplain Samples

At the Laboratory, most sediment samples are collected from dry stream channels or adjacent floodplains rather than from aquatic habitats. Some stormwater runoff samples are automatically collected after peak flow during a runoff event such as an intense rainfall; other surface water samples are collected yearly. When taking these samples, experts look for things that could be potentially harmful to the environment or people. A few examples of the chemical or radioactive constituents that the Lab tests for are aluminum, dissolved copper, total iron, and dissolved zinc, among others. Regulatory limits govern the allowable concentrations of these contaminants in certain settings. Because surface water sinks into the groundwater, which feeds local drinking wells and aquifers, any chemicals or contaminants in surface water can ultimately lead to an increased exposure risk to people. Thus, these regulatory limits help the Lab monitor potential human and ecosystem health risks associated with exposure to these waters. In 2024, all radionuclide levels in sediment samples were below screening action levels and DOE biota concentration guides.

7 Ecosystem Health

SFB crew members filling up sample bottles with soil.

Soil and Understory Vegetation Monitoring

Triennial soil and understory vegetation sampling allows environmental scientists to monitor potential impacts of constituents.

BY HANNA MORA

Soil and vegetation are vital components of an ecosystem, responsible for sustaining life and numerous ecological processes. Thus, monitoring for constituents in soil and vegetation is important for maintaining a healthy ecosystem. As such, the Laboratory strives to ensure historic and current operations do not adversely impact the environment, humans, or wildlife by conducting tests for potential contaminants in soil and vegetation.

Every three years, samples of soil and vegetation are collected onsite and in surrounding areas for testing. In 2024, the Laboratory's Soil, Foodstuffs, and Biota (SFB) program collected soil and understory vegetation samples to test for radionuclides, inorganic elements (mostly metals), high-explosive compounds, dioxins, furans, volatile and semi-volatile organic compounds, polychlorinated biphenyls (known as PCBs), and per- and polyfluoroalkyl substances (referred to as PFAS). Understory vegetation samples consist of a mix of native understory plants such as grasses and forbs from the same general location as the soil sample.

Ecologists collect samples from onsite locations on undisturbed mesa tops close to, and if possible, downwind of, major Laboratory facilities and operations. Samples are also collected from perimeter and background locations to monitor potential contamination and make comparisons to onsite samples. Perimeter locations are areas that are less than 15 kilometers from Laboratory property. Background locations are defined as areas more than 15 kilometers away from Laboratory property, and samples from these locations provide a baseline to compare onsite and perimeter samples

SFB team lead Shannon Gaukler, handing off a sample bottle to another crew member.

against. In 2024, ecologists collected samples from 18 onsite locations, 12 perimeter locations, and 6 background locations.

At each sampling location, a grab sample and composite sample of soil were collected, along with an understory vegetation sample. A grab sample is a specimen collected near the center of each location from a depth of 0 to 15 centimeters using a stainless-steel scoop. A composite sample is collected by taking five surface soil subsamples approximately 10 meters apart, one in the center of the sampling location and one in each corner. The subsamples are then combined and mixed in a large PFAS-free plastic bag to form a composite sample. The different sample types are used to test for different types of constituents that could potentially be present in the soil. All samples are analyzed at an offsite third-party laboratory.

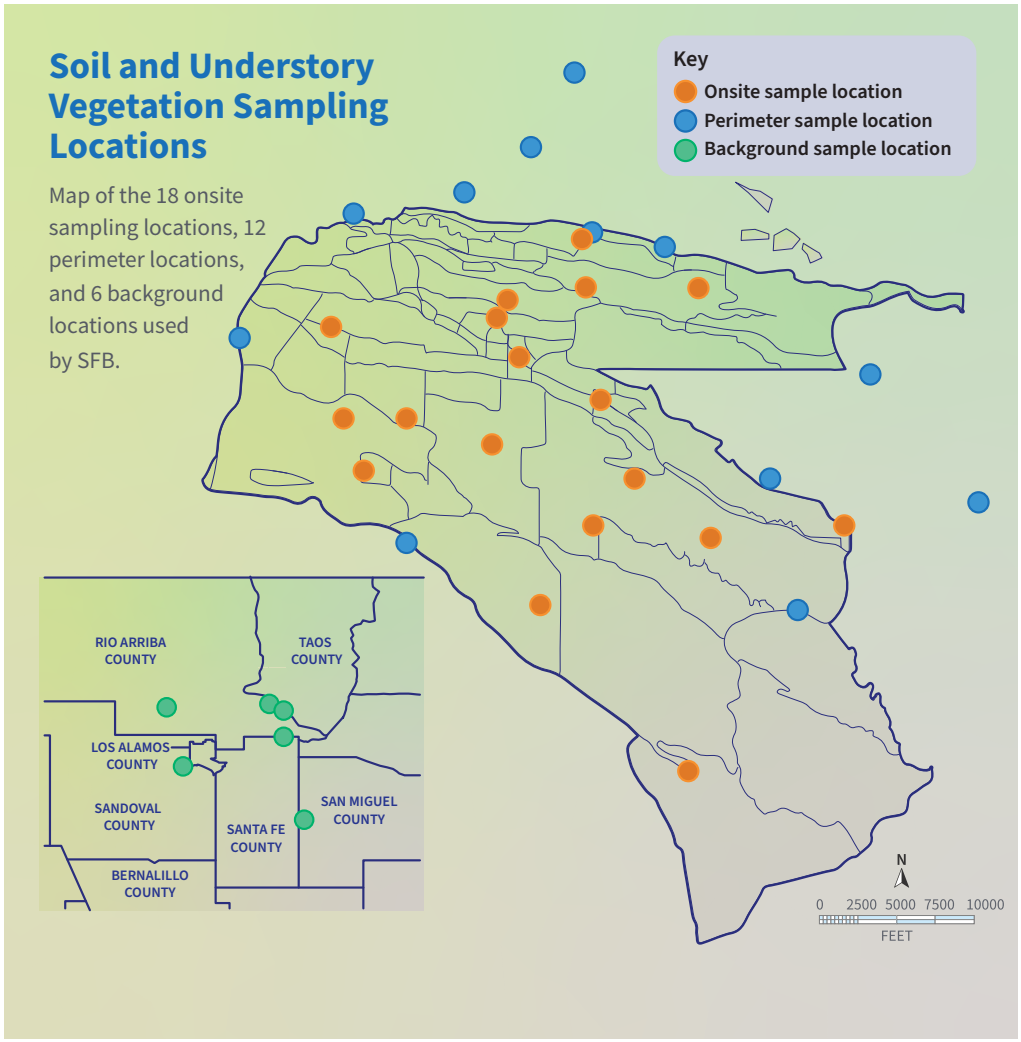
In the analysis of soil samples, most high-explosive compounds, dioxins, furans, volatile and semi-volatile organic compounds, PCBs, and PFAS were not detected or were detected below the background and screening levels that are protective of plants, animals, and humans. Most radionuclides were below background and all were below screening levels in soil samples. Most metals were detected in soil samples but at concentrations below background and screening levels. Additionally, the detected concentrations for most constituents were not found to have changed over time.

In the understory vegetation samples, PFAS were not detected, most inorganic elements that were detected were below background levels, and most radionuclides were not detected or were below background levels and far below screening levels.

Overall, results of the soil and vegetation sampling showed all radionuclides and most chemicals analyzed in soil and vegetation were below levels associated with adverse effects in plants, wildlife, or humans. As with past sampling events, the 2024 sampling determined that there are no negative impacts to humans, no ecological concerns, and no detrimental impacts on plant or animal life from the existing levels of these constituents in the soil from Laboratory operations. The results are an ongoing testament to the Lab's efforts to be a responsible and trusted steward of the land and environment, as well as its efforts to inform and protect surrounding communities.

Soil and Understory Vegetation Sampling Locations

Map of the 18 onsite sampling locations, 12 perimeter locations, and 6 background locations used by SFB.



A herd of elk observed grazing in Valles Caldera National Preserve.

Monitoring Chemical Concentrations in the Environment through Large Animal Sampling

The opportunistic collection of animal samples helps environmental scientists monitor the environment.

BY ZACH JONES

The primary goal of Los Alamos National Laboratory's Soil, Foodstuffs, and Biota (SFB) program is to determine whether Laboratory operations are affecting chemical concentrations in soil, foodstuffs, plants, and animals. To accomplish this goal, SFB ecologists collect samples from recently hit road-killed deer and elk as well as from a range of other deceased animal species from locations on and off Laboratory property. The analytical results from roadkill samples help to evaluate whether concentrations of certain chemicals are affecting human health through the food chain and/or the environment. Most observed chemical concentration levels were within the range found at background locations (outside of the potential impacts of the Laboratory).

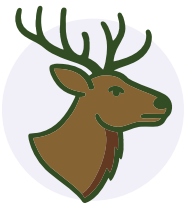
In 2024, Laboratory ecologists collected a total of fifteen animals from Laboratory property and surrounding areas. These include five elk, three mule deer, three great horned owls, one common raven, one coyote, one gopher snake, and one mountain lion. Depending on the animal sample, ecologists collected either muscle, liver, bone, full bodies, blood, or a combination. Each sample is tested for numerous constituents, such as radionuclides, inorganic elements (mostly metals), polychlorinated biphenyls (PCBs), and/or per- and polyfluoroalkyl substances (PFAS).

Monitoring Results

In large animal samples from 2024, most radionuclide and inorganic element results fell into one or more of the following categories: not detected, below background levels, or below regulatory limits. All observed levels in animal samples were far below biota dose screening levels, which are protective of biota.

PCBs were detected in most samples; however, all levels measured in the animals were below background levels. For comparison, the background level is 0.0000095 milligrams per kilogram for deer and 0.0000246 milligrams per kilogram for elk. Deer and elk PCB levels were also far below the U.S. Food and Drug Administration red meat consumption guidelines of 3 milligrams per kilogram. No samples had PCB levels at or above this amount.

Sampled Animals

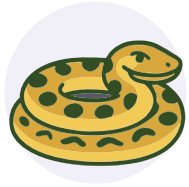

Elk


Deer


Great Horned Owl


Common Raven


Coyote


Gopher Snake

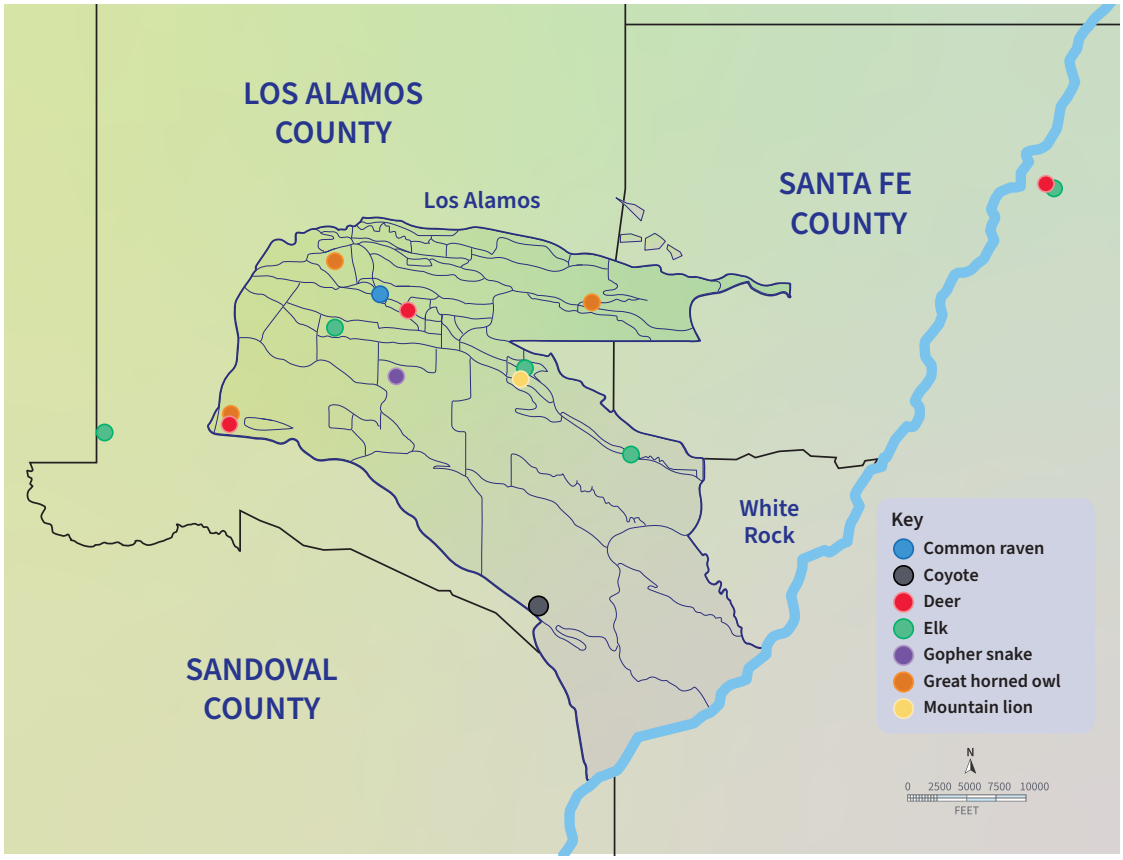

Mountain Lion

Motion-activated cameras captured a coyote and a mule deer with its fawn during wildlife monitoring activities.

The SFB program collected 23 muscle samples and 9 liver samples, which were analyzed for 39 different PFAS compounds. PFAS are not easily metabolized or excreted. Generally, liver samples had more detectable PFAS compounds than muscle samples because PFAS bioaccumulate in liver tissue. The liver is one of the organs to which the body transfers toxins. For example, PFAS compounds were detected in the liver samples of two elk, while the corresponding muscle samples from those same individuals showed no detectable levels. Still, the majority of PFAS compounds were not detected. Most levels that were detected are within the range of concentrations reported in published literature for animal tissues collected from non-polluted sites.

In 2024, two blood samples were collected from a live mountain lion for PFAS analysis. In these samples, concentrations of all individual PFAS compounds (except one) were less than 2.0 nanograms per milliliter. For reference, according to the National Academies' 2022 guidance on PFAS exposure, levels below this threshold are not associated with adverse health effects in humans. In one of the blood samples, perfluorooctanesulfonic acid (PFOS), a prevalent PFAS compound, was observed at a slightly higher amount than the other PFAS compounds at 2.2 nanograms per milliliter. Currently, there are no mountain lion blood samples from background areas for PFAS comparisons. (To learn more about the mountain lion project, please refer to Jack McGrath's ASER summary article, "Mountain Lion Monitoring Collaboration," on p. 30–31.)

Overall, most results show that Laboratory operations are not causing harm to large animals in the local ecosystems. Ecologists continue to monitor environmental samples closely and the Laboratory remains committed to strengthening its environmental monitoring efforts.



Locations of animals collected opportunistically from within and around the Laboratory in 2024.

Mountain Lion Monitoring Collaboration

The Laboratory collaborates with NMSU and surrounding agencies to monitor mountain lion activity.

BY JACK McGRATH

Collaboration with External Partners

Since 2022, the Laboratory's Biological Resources Program has collaborated with Bandelier National Monument, Valles Caldera National Preserve, the New Mexico Department of Game and Fish, and New Mexico State University (NMSU) on the Large Mammal Monitoring Project (LMMP). In 2024, Laboratory biologists had the unique opportunity to assist with mountain lion collaring and data collection on Lab property.

A mountain lion cub feeds at a kill site where an elk is cached.

The Large Mammal Monitoring Project

The LMMP has been monitoring Rocky Mountain elk, mule deer, black bears, and mountain lions since 2013. The goal is to investigate how these animals respond to wildfires, forest restoration following wildfires, and future wildfire mitigation and prevention efforts. Although LMMP is largely focused on public lands, monitored wildlife frequently use the Lab site, and the information that the Lab provides is crucial for scientists to understand the full extent of wildlife activity at a regional scale. Another important contribution to LMMP involves wildfire management, which is especially important in the Southwest, where uncontrolled fires often cause

A collared mountain lion detected by a Laboratory motion-sensing wildlife camera.

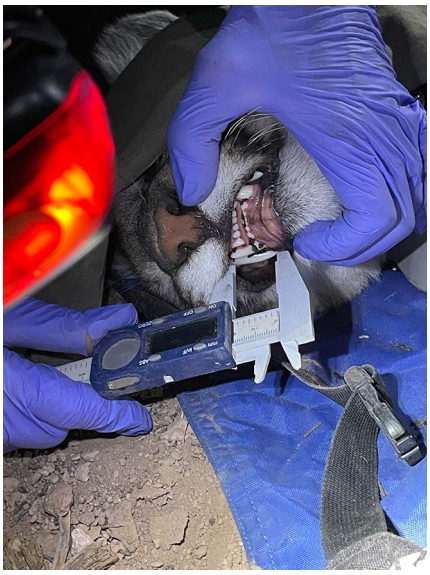
Young mountain lions are tranquilized and fitted with GPS tracking collars.

widespread damage to animal habitat and human property. Project staff seek to understand how wildfires impact animals' movement and habitat selection. In addition, LMMP is studying how prescribed burns and forest thinning—common wildfire mitigation techniques—affect these large mammals.

At the start of the collaboration in 2022 and at the request of biologists from Bandelier National Monument, Lab biologists deployed game cameras to monitor mountain lion activity at known kill sites. When mountain lions successfully hunt, they often hide their prey to limit other animals' access to an easy meal, and these hiding spots are called "kill sites." Kill sites are located using consecutive location pings from GPS collars on mountain lions. Monitoring kill sites can provide valuable information about where mountain lions are spending their time, whether they have kittens, what they are hunting, and if other animals are competing for the mountain lions' food sources.

In 2024, scientists from Bandelier and NMSU needed to deploy GPS collars on one-year-old mountain lions that were occupying Lab property before they dispersed away from their mother. Lab biologists assisted with data collection. The Laboratory's Soil, Foodstuffs, and Biota (SFB) program received a blood sample taken from the mountain lions during the collaring event to use for environmental monitoring. Receiving a blood sample from a live mountain lion was unique because normally SFB ecologists sample soil, fruit, honey, eggs, and roadkill (including roadkilled mountain lion provided by the LMMP). Staff use these samples to examine concentrations of constituents such as radionuclides, metals, polychlorinated biphenyls (PCBs) and per- and polyfluoroalkyl substances for environmental monitoring purposes. The opportunity to sample from live mountain lions provided SFB with a new source of data on these chemical concentrations and how they are dispersing throughout the environment or along the food chain (For more information on how the Lab uses these roadkill samples, see Zach Jones' article "Monitoring Radionuclide and Chemical Levels in the Environment Through Large Animal Sampling" on pages 28–29.)

By working with adjacent wildlife management agencies, Los Alamos National Laboratory contributes to a larger pool of scientific data that is integral to understanding how human activity such as fire mitigation impact the behavior of wildlife. This collaboration has also improved the Lab's ability to help inform wildlife and fire management practices in the future.



Biologists collect a variety of measurements from mountain lion cubs, including teeth size.

8 Radiological Dose and Nonradiological Risk to the Public

The Lab has a robust air-monitoring network.

Radiological Exposure Monitoring for the Public

Radiological monitoring and sampling protects Los Alamos and surrounding communities.

BY ELISE B. OLIVAS

Some operations at the Los Alamos National Laboratory site involve radioactive materials. To ensure the safety of communities surrounding the Laboratory, environmental professionals assess risks from radiological releases to the environment. Public dose, the amount of radiation individual members of the public absorb from exposure to radioactive materials, must comply with federal regulations provided by the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). With these measurements, Laboratory staff calculate the potential dose to humans and compare the results to the limits established by these federal agencies.

Radiological Dose

The DOE limits the annual dose for members of the public to 100 millirem from site operations. Additionally, a lower limit on air emissions is established by the EPA, limiting airborne releases to 10 millirem per year. The exposure to the public from site operations has averaged around 1 millirem per year over the past decade. Exposure can occur through a variety of pathways, and the Lab closely monitors exposure to the public and works to ensure these doses are as low as reasonably achievable. It is important to mitigate the risks these substances present and to reduce radiation exposure to Laboratory workforce, community members, and the environment.

Exposure Pathways

An exposure pathway is a route that radiation or radioactive material takes to enter the body. Radioactive substances can be found in various forms and include both naturally occurring and artificial sources. For example, soil or water sometimes contain radioactive substances, like radon gas, which can lead to plants and wildlife absorbing them into their system.

Direct-Penetrating Radiation

Direct-penetrating radiation is an exposure pathway including radiation that interacts directly with materials or tissue. Some

common examples of direct-penetrating radiation are medical and dental procedures like x-rays or CT scans. These can cause a resident of Northern New Mexico to receive a dose of 300–400 millirem per year. Moreover, people are exposed to small amounts of cosmic radiation every day. Site operations also produce direct-penetrating radiation at a few facilities. Direct-penetrating radiation is monitored at 73 locations around the Laboratory and surrounding communities. The maximum public dose from direct penetrating radiation produced by site operations is less than 0.2 millirem per year.

Air Pathway (Inhalation)

Airborne radioactive material can be released at very low levels from site operations. Ambient air sampling and exhaust stack sampling are two ways the Laboratory monitors airborne radioactivity. Stack sampling measures radionuclides at individual points of release and uses computer modeling to predict any public exposures, while ambient air sampling looks for any airborne radioactive material at public locations around the Lab perimeter and can directly measure any such exposures.

Environmental professionals use these data and computer models to estimate both the external dose from gamma-ray emitting radionuclides and the dose potentially inhaled from other radioactive material, such as plutonium. The maximum potential dose to the public in 2024 from airborne radioactivity resulting from site operations was 0.78 millirem.

Ingestion

Radioactive materials can be found in various places around the site including in groundwater, surface water, and in plants wildlife could eat. Many are naturally occurring. These materials can then be consumed by the public through drinking local water and eating locally grown produce, wildlife, or domesticated animals. The Laboratory's Soil, Foodstuffs, and Biota program closely monitors a variety of local provisions including crops, eggs, milk, deer, and elk to name a few. These foodstuff samples are routinely monitored, and the resulting dose amounted to less than 0.01 millirem per year.

Additionally, soil and vegetation samples are also collected. The resulting doses are less than 0.1 millirem per year.

Conclusion

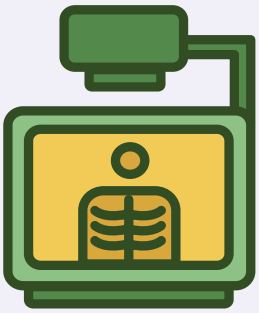
Data provided by environmental professionals demonstrate that all measured and calculated radiological doses comply with DOE regulations and are well below regulatory standards set by the EPA and DOE.

Data shows that radiological exposure to the public from Lab operations is approximately 1 millirem per year.

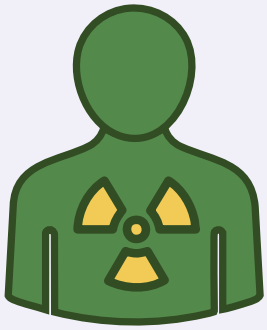
Radiological Exposure (in millirems per year)

~1
Public exposure from Lab operations

300
Natural exposure from the Earth



300
X-ray and CT scans



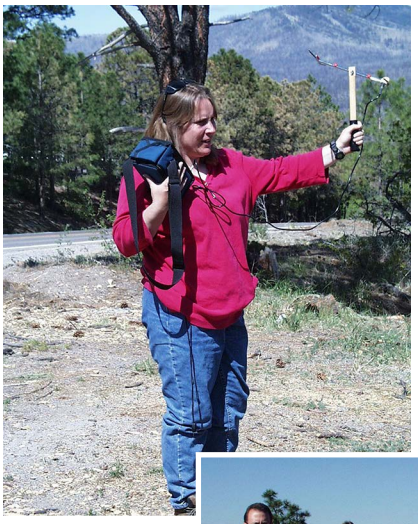
2,000
Recommended limit for radiation workers

600,000
Fatal within weeks

Honoring a Legacy: Celebrating Leslie Hansen's Lifelong Commitment to Environmental Stewardship

This year's Annual Site Environmental Report Summary is dedicated to Leslie Hansen, whose vision, passion, and unwavering commitment to environmental compliance have left an unforgettable mark on every page. Thank you for your years of service, the people you have uplifted, and the legacy you have built.

–ASER contributors and the EPC division and management



Leslie holding H-antenna and VHF receiver to track animal with radiocollar.

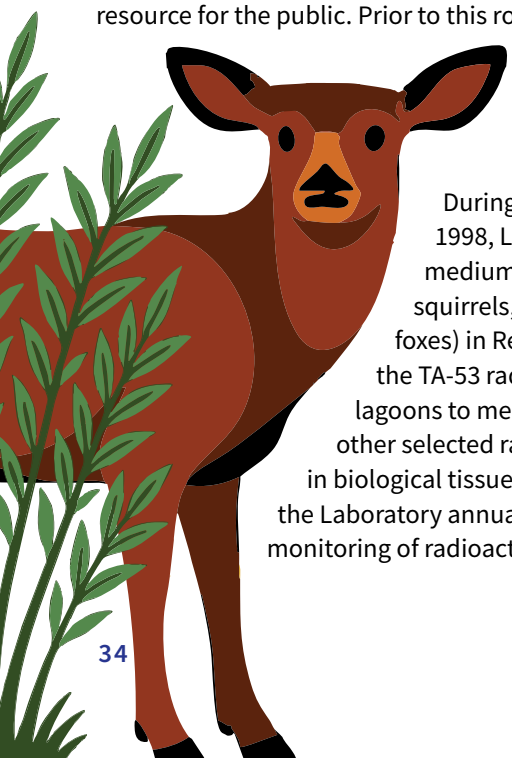
A Biological Resources team picture from the former ESH-20 group.

Several Laboratory biologists help to restrain a trapped elk while a blood sample is taken and a radiocollar attached.

About Leslie

Leslie began working at Los Alamos National Laboratory in 1996 as a staff research assistant. In 1997, she received her doctorate degree in wildlife management from Texas Tech University. Throughout her career, she served as technical staff, team leader for Biological and Cultural Resources, Natural Resources Damage Assessment project manager, chair for the Institutional Animal Care and Use Committee, and coordinator for the ASER.

During her extensive career, which spans more than 29 years, Leslie has contributed to more than 200 publications, including more than 10 ASERs and ASER Summaries. Under Leslie's leadership, her plain language edits evolved this publication from a highly technical document to a more approachable resource for the public. Prior to this role, Leslie was a wildlife biologist who spent her career working to protect wildlife on Laboratory property.



During the years of 1997 and 1998, Leslie led a study on medium-sized-mammals (like squirrels, bobcats, skunks, and foxes) in Rendija Canyon and at the TA-53 radioactive liquid waste lagoons to measure levels of tritium, other selected radionuclides, and metals in biological tissues of animals. While the Laboratory annually conducts extensive monitoring of radioactive and nonradioactive

Leslie and her two dogs, Freya and Sammy.

ESH-20 Ecology Group at TA-21 (2005)

contaminant levels in groundwater, surface water, soils, sediments, the atmosphere, and foodstuffs, little information was available on the occurrence of contaminants in natural vegetation and those higher in the food chain.

In December of 2001, Leslie also led a deer collaring effort to track movement of deer throughout Laboratory property. At the time, animal-vehicle collisions were at an all time high. The purpose of this study was to document how often mule deer crossed roads in and around the Laboratory in conjunction with a larger research project that focused on the western United States. Adult mule deer were captured using drop nets, collared with GPS-enabled collars, and tracked. These deer were found to cross roads multiple times a day. This research led to the placement of traffic signage in areas where ungulates crossed most often in and around the Laboratory.

The work Leslie led at the Laboratory marked a major time for wildlife protection and environmental compliance here. Today, monitoring efforts continue to ensure we protect both natural and cultural resources at the Laboratory.

As Leslie closes this chapter, we wish her all the best in the next chapter—embracing the adventures of retirement.

"One of the things I am proudest of in my Laboratory career is helping to write the first LANL Threatened and Endangered Species Management Plan. That plan has become a cornerstone of LANL's strategy for protecting biological resources."

—Leslie Hanson

Those who have worked with Leslie describe her as supportive, intuitive, knowledgeable, and having an infectious laugh. Here are a few words from those who have had the pleasure of working alongside Leslie:

"Leslie was an instrumental help with Sandia Wetlands. During the past several decades, Leslie ensured that additional willows were planted there and elsewhere, schlepping willows and helping to plant them. That's a huge contribution!"
–Jen Payne

"As a communications specialist for document editing and layout, I worked with Leslie on at least five ASERs. I've enjoyed being part of the ASER team and have always appreciated Leslie's kindness, solid guidance, excellent writing skills, and humbleness. We never missed the deadline!"
–Tamara Hawman

"Leslie has been the continuity of quality for the Los Alamos ASER for over a decade. The ASER requires dedication year after year to bring the highest quality data and reporting together. Leslie helped sustain the best report that could be compiled."
–Jeanne Fair

"When I first started at the Lab, Leslie was part of the Natural Resources Management team. Some of my fondest fieldwork memories come from assisting her with spotlight surveys, tracking collared deer around Los Alamos, and ground-truthing vegetation for the Land Cover Map. It has truly been an honor to know and work alongside Leslie all these years."
–Marjorie Wright

"For someone who has seen and managed it all through her diverse career at the Lab, Leslie maintains a humility and willingness to jump in that I truly appreciate. She can be an assertive expert, a supportive mentor, a steady editor, and is always a real joy to accompany in the field. I am grateful for all she has given to this institution—both to the work and to the people—and will miss her quick, observant wit."
–Katie Higgins

Contributors

Miquelle Angel-Sanchez

Hometown: Pojoaque, New Mexico

Major and School: Biology, Northern New Mexico College

Karaoke Song: Bohemian Rhapsody by Queen

Working at the Laboratory in EPC-ES has given me valuable knowledge and field experience that aligns with my studies and values. This opportunity has confirmed my passion for this work. Some highlights for me were participating in the safe handling and sampling of biological material, identifying bird and agricultural animal species, and problem solving while following detailed procedures and protocols. I have also learned the importance of regulatory compliance to support the safety and security at LANL.

Kyla Fugate

Hometown: Alamogordo, New Mexico

Major and School: Environmental Studies, University of Montana

Karaoke Song: Sweet Caroline by Neil Diamond

In addition to my master's, I received a graduate certificate in Natural Resources Conflict Resolution. The certificate program is designed to foster skills in collaboration and conflict resolution as they apply to natural resources and the environment. Since returning to the Lab post-grad, I am excited to bring my knowledge from the certificate to the NEPA program and across the EPC-ES team in navigating complex environmental challenges.

Jordan Franklin-Garza

Hometown: Rockwall, Texas

Major and School: Anthropology, Texas A&M University

Karaoke Song: My Way by Frank Sinatra

I've personally learned just how large of an impact the Lab has upon the surrounding Tribal communities. With the diversity of projects requiring archaeological survey or site updates, I had the opportunity to work with and see much of the ancestral Pueblo landscape that occupies the Pajarito Plateau. It has been incredible getting to learn about the rich cultural history that surrounds us.

Alberto Hernandez Luna

Hometown: Dallas, Texas

Major and School: Nuclear Engineering, Texas A&M University

Karaoke Song: Holding Out for a Hero by Bonnie Tyler

I want to help the New Mexico community by being as transparent as possible to the surrounding communities as well as the rest of New Mexico. Creating a healthy and open communication channel between the Lab and the communities of New Mexico should be priority.

Zach Jones

Hometown: Los Alamos, New Mexico

Major and School: Geography (Environmental Studies), New Mexico State University

Karaoke Song: Ain't No Mountain High Enough by Marvin Gaye & Tammi Terrell

The Laboratory's SFB program has provided me with the opportunity to help monitor the ecosystems surrounding the Laboratory. Through direct research and hands-on experience, I've gained valuable insight into how human activity impacts the soil, vegetation, and wildlife in our area. At MSU and NMSU, I've studied various biomes and how they function, and at LANL, I've been able to connect that academic knowledge to the environment through practical fieldwork. My experience has also helped me explore the range of careers available within my area of interest.

Shiv Antar Khalsa

Hometown: Española, New Mexico

Major and School: Biology and Psychology, Carleton College

Karaoke Song: Risk by Gracie Abrams

Research and mentorship in Pollution Prevention has developed my understanding of the many challenges imposed on the environment and its conservation efforts.

Kaya Krantz

Hometown: Los Alamos, New Mexico

Major and School: Environmental Science, Fort Lewis College

Karaoke Song: You're So Vain by Carly Simon

A unique aspect of the Lab is the amount of interdisciplinary work that occurs within the organization. During my time here, I've participated in an array of projects including pre- and post-treatment forest monitoring, planting and maintaining pollinator gardens, and insect monitoring. Beyond sharpening my skills in the field, my involvement in such a wide variety of projects has highlighted the importance of collaboration and strengthened my ability to effectively communicate with my peers.

Yolana (Yoli) Martin

Hometown: Madison, Wisconsin

Major and School: Public Health, University of Wisconsin - Madison

Karaoke Song: Love Story by Taylor Swift

Through my work at the Lab, I have had the opportunity to work with the New Mexico Office of Housing and learn more about homelessness in New Mexico. In July of this year, I was part of the LANL Data Sprint, where employees worked with community partners to answer data-related research questions. I truly enjoyed the experience, and I appreciated that I could use my experience to make an impact. I look forward to finding other ways through LANL to get involved with the New Mexico community.

Jack McGrath

Hometown: Leicester, North Carolina

Major and School: Biology, Colgate University

Karaoke Song: I Want It That Way by the Backstreet Boys

Working at the Lab has been a great opportunity for me to expand on what I learned in my undergraduate studies. What I do at the Lab is a career-oriented application of the things I learned academically. It has also given me experience and shown me what a career in wildlife biology entails and has helped me solidify a plan for how I want my future studies to progress.

Hanna Mora

Hometown: Las Vegas, New Mexico

Major and School: Wildlife Biology and Conservation, New Mexico Highlands University

Karaoke Song: Break Stuff by Limp Bizkit

I am incredibly grateful to be an intern at the Lab, especially with both the Biological Resources and SFB programs, as my internship really goes hand in hand with my academic studies in a way that gives me an added level of support and skill strengthening. Working at the Lab with both programs has allowed me to get a broad range of hands-on experience doing ecological fieldwork, such as bird banding, morphometric measurements, and foodstuffs sampling.

Elise B. Olivas

Hometown: Embudo, New Mexico

Major and School: Public Health, Environmental Health, Texas A&M University

Karaoke Song: Wagon Wheel by Darius Rucker

I learned about the importance of helping an organization maintain compliance with environmental regulations. I gained insight into how regulatory standards not only protect the Lab but also play a key role in safeguarding the surrounding environment and communities. Through environmental monitoring and inspections, I saw how critical it is to ensure that potential contaminants are properly managed. This work helps protect natural resources and public health, now and for future generations. Understanding the long-term impact of these efforts showed me how vital environmental stewardship and compliance is in supporting a safer world.

Madelyn Owen

Hometown: Los Alamos, New Mexico

Major and School: Environmental Science, University of Denver

Karaoke Song: Since U Been Gone by Kelly Clarkson

My work at the Lab directly complements and enhances my academic studies in environmental science. Serving on the rad air team allowed me to apply classroom concepts to real-world scenarios. During my time at school, I took a hydrology class which was helpful when writing about floodplains. These environmental classes have helped me to better appreciate the work that we do here at the Lab. It has been rewarding to see my studies align with my responsibilities.

Madeline Tapia

Hometown: Los Alamos, New Mexico

Major and School: Environmental and Sustainability Studies (BS), Northern Arizona University

Karaoke Song: Our Song by Taylor Swift

During my time at the Laboratory, I was able to integrate my major of Environmental and Sustainability Studies and minors of Environmental Communication and Parks and Recreation Management into my professional work. My role has involved engaging in Laboratory environmental communication efforts internally and externally. One of my key responsibilities has been contributing to fulfilling communication commitments externally through the Bradbury Science Museum's Environmental Protection and Compliance exhibit, and internally through the communication plan for the Pollution Prevention Program.

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