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ASER

Annual Site Environmental Report Summary

Published in 2023

Based on 2022 data

Los Alamos
NATIONAL LABORATORY

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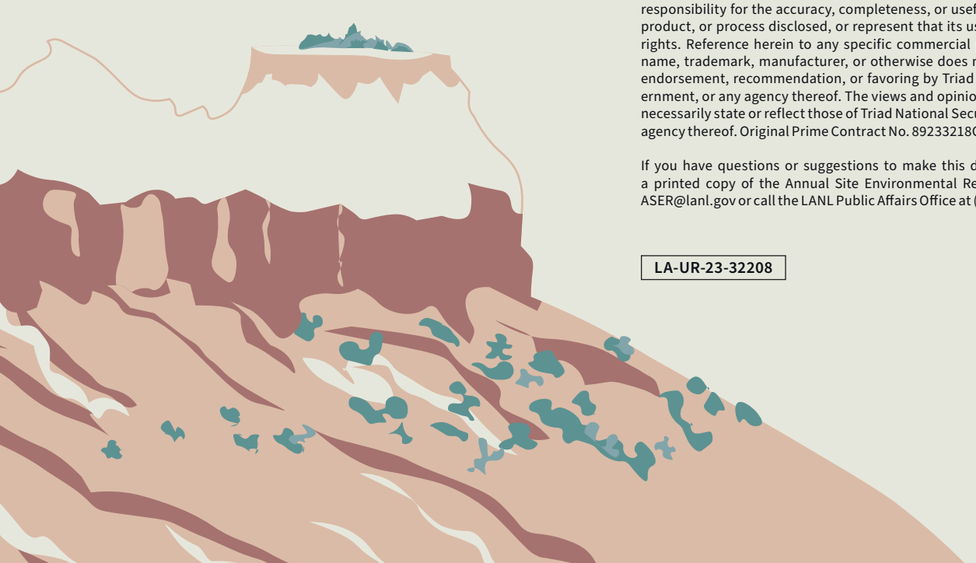

Los Alamos National Laboratory Governing Policy for the Environment

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 public.

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

Annual Site Environmental Report Summary for 2022

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LA-UR-23-32208

INTRODUCTION

Aerial footage of the NM-4 and East Jemez intersection

NM-4 and East Jemez Road Intersection Redesign Project

Improving safety and traffic flow for Los Alamos.

Madeline Tapia

The Department of Energy's (DOE) National Nuclear Security Administration (NNSA) broke ground in spring 2023 on the NM-4 and East Jemez Road intersection redesign. As a federal project being completed by the New Mexico Department of Transportation (NMDOT), the redesign will go through multiple phases, with minimal disruptions to traffic flow, and is scheduled to be completed in November 2023.

Following a 2014 incident at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, the DOE, NNSA, and NMDOT decided to implement this new intersection to ensure the essential route from Los Alamos National Laboratory (LANL) to WIPP is safe and functional. The intersection is being funded by the NNSA as part of a settlement agreement with the State of New Mexico, and a parking lot for Bandelier National Monument is being funded by the National Park Service.

This new intersection will be very beneficial to the community of Los Alamos, along with the many LANL workers commuting to and from work. This intersection's past ineffectiveness caused a high volume of traffic. To ease this congestion, the new intersection will add another turning lane going north towards Santa Fe from White Rock, as well as another lane for cars turning left from Los Alamos going east towards Santa Fe. The double lanes will then merge to become single lanes, as are NM-4 and East Jemez Road. This will allow traffic to move faster and more efficiently by doubling the capacity of the intersection, thereby increasing safety for drivers.

The turning lanes are not the only new redesign addition. The original three-way intersection will be converted into a four-way intersection with a parking lot for the Tsankawi section of Bandelier National Monument on the east side. Improvements to the storm drainage system, new curbs and gutters, new retaining walls, ramps compliant with the Americans with Disabilities Act, intersection warning flashers, a new traffic signal, new lighting, new roadway signing, and new striping are all being implemented as part of this intersection project.

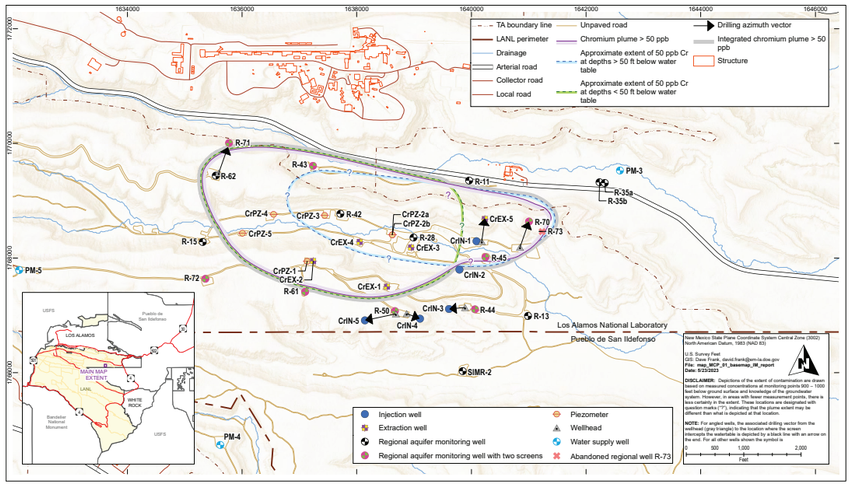
The NM-4 and East Jemez Road intersection redesign will decrease traffic time, improve the throughput of crossroads, and increase the safety of LANL employees, citizens of Los Alamos County, and the many tourists and visitors traveling through.

Stoppage of Chromium Treatment Wells

Interim chromium treatment wells cease operations pending discussion with regulators and stakeholders.

Mariah Gonzales

The historic release of potassium dichromate into Sandia Canyon, which occurred between 1956 and 1972, was first discovered during the installation of a new groundwater monitoring well in 2005. The contaminated water traveled through the canyon and penetrated two groundwater zones, now resting in parts of the regional aquifer as a hexavalent chromium plume. When discovered, the plume was measured at approximately a mile in length and half mile in width.



Map of current chromium wells

To prevent further migration of the plume, in 2018 the Laboratory began to install and operate extraction and injection wells. Forty-one wells were installed in what was intended as an interim measure to mitigate the chromium plume spread.

Initially, the wells succeeded in shrinking the plume boundary by approximately 500 feet from its original size. Subsequently, treatment results began to plateau. Because the plume is mainly concentrated under Mortandad Canyon, the terrain is difficult for machinery and cleanup crews to traverse. Sheer cliffs surround the treatment center and drills would have to penetrate 1,200 feet, or approximately the height of the Empire State Building, into the earth to access the contaminated aquifer.

In late 2022, N3B, the contractor for the Laboratory's legacy waste cleanup operations, was informed that the use of injection wells had to be halted before April 2023 after regulatory limits were exceeded at chromium treatment sites. The Ground Water Quality Bureau was concerned that chromium treatment wells were no longer an effective solution to the chromium plume mitigation effort, because of increased chromium levels in groundwater samples.

"We're no longer implementing any sort of hydraulic containment until the Ground Water Quality Bureau approves the resumption of the interim measure and we receive partial approval from the Hazardous Waste Bureau," said Clark Short, project manager for Chromium and RDX remediation.

The New Mexico Environment Department (NMED) decided to pause any further operations until a more effective remedy can be established. The extraction and injection wells will prevent chromium levels from rising, but do not reduce overall chromium levels. However, without injection well operations, the groundwater has an opportunity to relax, meaning that the hexavalent chromium plume could spread.

Resuming operations is a priority for NMED, N3B, the Environmental Management Los Alamos Field Office, and any Laboratory-affiliated contractors. N3B advocates that treatment wells be reinstated in critical areas to prevent the chromium plume from migrating into San Ildefonso Pueblo.

Any further treatment operations will have to be presented to and approved by the NMED before implementation. In the meantime, N3B is repairing machinery and maintaining equipment so it's ready to go at a moment's notice.

Aerial view of the Pajarito Corridor

Environmental Stewardship Essential to the Mission

During a time of growth in the Pajarito Corridor, the Laboratory remains dedicated to sustainability and protecting natural and cultural resources.

Kaia Bigej-Nunley

An unprecedented level of development is underway at Los Alamos National Laboratory to support its expanded plutonium mission. The ongoing Pajarito Corridor expansion is the largest construction and modernization effort in four decades, and its projects are governed by the Campus Master Plan, which aims to modernize Laboratory facilities and infrastructure over the next thirty years. The Master Plan includes objectives to enhance safeguarding of national security, pursue sustainable development and modernization, and continue environmental stewardship.

The Pajarito Corridor, which is the physical center of nuclear research and production for the Laboratory's plutonium mission, will see 150 infrastructure projects in the next decade, creating nearly 2,000 new jobs by 2030. Revitalized infrastructure initiatives will enhance overall efficiency and safety, upgrade roads and utilities, minimize the Laboratory's environmental impact, and optimize power and water distribution on site.

These development projects come with an extensive review process to ensure environmental compliance. In fact, minimizing environmental consequences is a primary principle of Pajarito Corridor modernization. The Laboratory follows a proactive strategy to protect, conserve, and practice sustainable use of the landscape. This includes biological assessments to gather valuable information about the habitat, conditions, species, and ecological resources of an area.

For example, the Mexican spotted owl is a federally listed endangered species present in the Pajarito Corridor. A biological assessment was conducted to evaluate potential impacts of proposed activities on owl populations. This assessment was submitted to the U.S. Fish and Wildlife Service to inform how development should proceed. Three main requirements were put into place: (1) lighting requirements for new buildings, (2) maintenance of identified noise restrictions for heavy machinery, and (3) preservation of the identified development boundaries. Laboratory biologists in the Environmental Protection and Compliance (EPC) division work closely with project planners and designers to ensure that requirements are followed.

Other environmental considerations include the movement of elk, deer, and other large animals in the Pajarito Corridor, and the Migratory Bird Treaty Act, which restricts vegetation removal during active nesting times for migratory bird species. Migration corridors and pinch points were cross-referenced with new building locations and possible human traffic areas to ensure local wildlife is protected.

Project planners closely collaborate with EPC archeologists to avoid impacts to cultural heritage. The Pajarito Corridor is home to archeological sites including archaic artifact scatters, Ancestral Pueblo fieldhouses and settlements, and some Homestead-era roads. The locations of development projects along the corridor were adjusted to keep archeological sites undisturbed. To ensure no unrecorded sites were inadvertently impacted, a cultural resource survey was performed prior to breaking ground. During any soil-disturbing activities, experts are present onsite as monitors.

In line with the Laboratory's Master Plan goal to reach net-zero carbon emissions and 100% renewable energy by 2050, Pajarito Corridor development also provides a great opportunity to construct renewable infrastructure. Modernized transportation plans are being developed to reduce greenhouse gas emissions, as well as improved power and water distribution plans. These ongoing infrastructure initiatives showcase the Laboratory's performance of environmental compliance and protection, dedication to environmental stewardship, and commitment to sustainability principles and regenerative energy sources.

Compliance at a Glance

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

Los Alamos National 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 minimize impacts to cultural and biological resources.

Air Quality and Protection

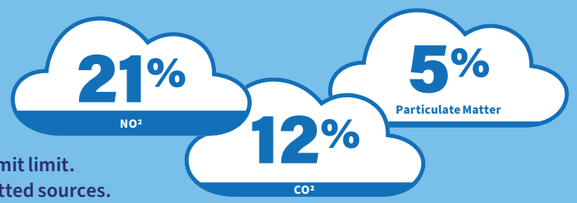
Clean Air Act Title V Operating Permit:
Sets limits for air emissions of regulated pollutants.

Clean Air Act Title IV:
Directs the Laboratory how to manage ozone-depleting substances.

New Mexico Air Quality Control Act:
Requires evaluation of new and modified sources of air emissions.

In 2022, no deviations with the conditions of the Title V Operating Permit were reported for the Laboratory.

The Laboratory's air emissions in 2022 were significantly lower than the permit limits; for example, nitrogen oxide emissions were approximately 21 percent of the permit limit, carbon monoxide emissions were 12 percent of the permit limit, and particulate matter emissions were 5 percent of the permit limit. No emissions above permit limits occurred from any of the permitted sources.



Natural and Cultural Resources

During 2022, Laboratory staff continued discussions with the New Mexico Environment Department Air Quality Bureau to address public comments and revise draft Title V permit language on an application submitted in 2021.

National Environmental Policy Act:
Requires federal agencies to consider the environmental impacts of proposed activities, operations, and projects.

National Historic Preservation Act:
Requires federal agencies to evaluate federally-controlled cultural properties (archaeological sites and historic buildings) and consult on potential adverse effects.

Endangered Species Act:
Requires federal agencies to protect federally listed threatened or endangered species and their habitats.

Migratory Bird Treaty Act:
Prohibits the unlawful hunting, capture, or killing of any migratory birds except as permitted by the U.S. Fish and Wildlife Service.

Floodplain and Wetland Executive Orders :
Requires federal agencies to assess impacts of projects in floodplains and to wetlands.

On August 19, 2022, the National Nuclear Security Administration published a Notice of Intent to prepare a new Site-Wide Environmental Impact Statement for Los Alamos National Laboratory. Public meetings for this new Site-Wide Environmental Impact Statement were held on September 13 and 14, 2022.

In 2022, Triad archaeologists supported 27 projects, seven of which are major construction projects, by conducting surveys and verifying site boundaries to ensure cultural resource compliance.

Historic buildings staff performed inspections and research on the historical use of the buildings for 21 Laboratory projects and prepared an eligibility and historical context report for the Health Research Laboratory building (Technical Area 43, Building 1).

Triad biologists prepared a biological assessment to analyze the impacts to listed species and did not find any projects out of compliance with endangered species protection requirements in 2022.

In 2022, Mexican spotted owls were found on Laboratory property in the same nesting locations as past years, seven willow flycatchers of unknown subspecies were recorded during bird banding, and one Yellow-billed cuckoo was heard during the survey period along the Rio Grande.

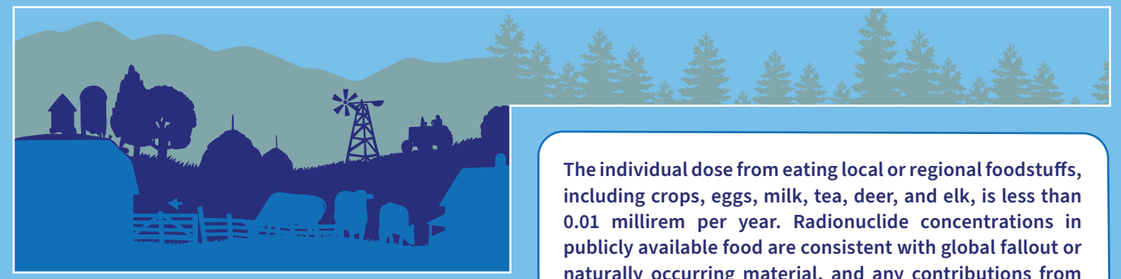
Radiation Protection

DOE Order 458.1, Radiation Protection of the Public and the Environment:
Establishes limits for radiological releases from DOE facilities.

DOE Order 435.1, Radioactive Waste Management:
Regulates storage and disposal of radioactive wastes.

Clean Air Act Radionuclide National Emission Standard for Hazardous Air Pollutants:
Sets dose limits for air emissions.

The estimated maximum dose of airborne radionuclides to a member of the public in 2022 was 0.45 millirem, less than 1 percent of the 10 millirem dose limit allowed by the Clean Air Act regulations- specifically the National Emission Standards for Hazardous Air Pollutants Other Than Radon From Department of Energy Facilities.



The individual dose from eating local or regional foodstuffs, including crops, eggs, milk, tea, deer, and elk, is less than 0.01 millirem per year. Radionuclide concentrations in publicly available food are consistent with global fallout or naturally occurring material, and any contributions from the Laboratory are too small to measure.

In 2022, the total onsite dose calculated for a maximally exposed individual was 0.7/40 ≈ 0.02 millirem, which is less than the offsite dose for a maximally exposed individual at 0.45 millirem. Both are well below the regulatory limit of 100 millirem.

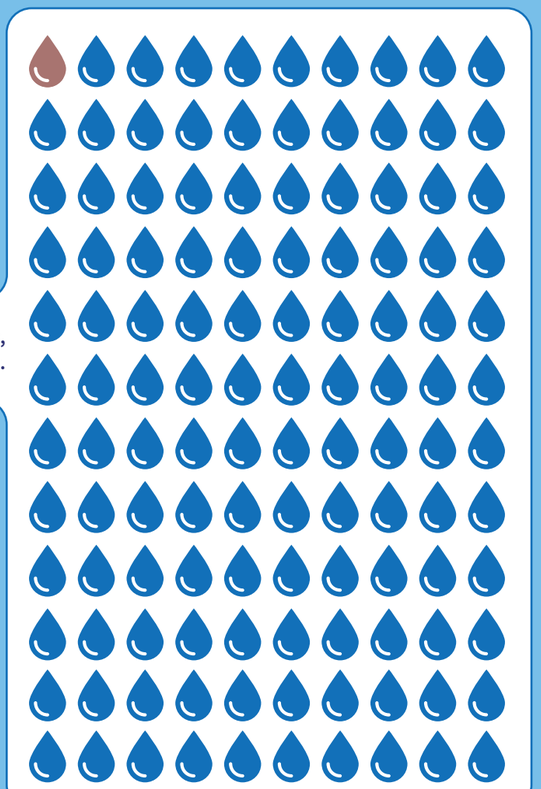
Water Quality and Protection

Clean Water Act:
Requires National Pollutant Discharge Elimination System permits for effluent and storm water discharges; the Act also has requirements for aboveground storage tanks and dredge and fill permits.

New Mexico Water Quality Act (Surface Water):
Establishes water quality goals for state surface waters by designating uses and setting standards;

New Mexico Water Quality Act (Groundwater):
Establishes maximum allowable concentrations of specified contaminants in groundwater and regulates liquid discharges onto or below the ground surface.

2016 Compliance Order on Consent:
Contains a process for remediating groundwater contaminant plumes.



Of the 785 collected samples in 2022 from outfall locations, only six of these (less than 1.0 percent) exceeded a permit limit.

In 2022, Triad was responsible for 32 storm water pollution prevention plans and performed 908 inspections, with 95.2 percent of inspections fully compliant.

The Laboratory also successfully completed site-wide implementation of the new 2022 Construction General Permit issued by the U.S. Environmental Protection Agency, which was effective February 17, 2022.

For the Storm Water Individual Permit, N3B staff completed **1,142** inspections of storm water controls at **250** site-monitoring areas, and conducted storm water monitoring at **136** site-monitoring areas.

Waste Management

Resource Conservation and Recovery Act:
Regulates hazardous wastes from generation to disposal; mandates a hazardous waste facility permit.

Federal Facilities Compliance Act:
Regulates wastes with both radioactive and hazardous components.

2016 Compliance Order on Consent:
Contains a process for remediating solid waste management units.

Toxic Substances Control Act:
Addresses the production, use, and disposal of specific chemicals, including PCBs.

The legacy waste cleanup project received one certificate of completion for a corrective action site.

The Laboratory's current Hazardous Waste Facility Permit, which expired in 2020, is administratively continued while the New Mexico Environment Department considers our application for a permit renewal.

Mixed wastes managed under the Laboratory's Site Treatment Plan decreased by approximately 72 cubic yards for mixed low-level waste and 146 cubic yards for mixed transuranic waste.

Other Environmental Protections

Federal Insecticide, Fungicide, and Rodenticide Act:
Protects workers using these substances.

Emergency Planning and Community Right-To-Know Act:
Requires emergency plans for onsite hazardous substances.

DOE Order 231.1, Occurrence Reporting and Processing of Operations Information:
Requires reporting of off-normal events or conditions.

DOE Order 436.1, Departmental Sustainability:
DOE sets sustainability goals including energy and water use and conservation of other natural resources.

Truck transporting waste containers to an off-site facility

What Happens to Waste?

The Laboratory disposes of its generated waste in a variety of ways.

Hunter Swavely

Waste management at Los Alamos National Laboratory is a crucial part of ensuring that the Laboratory complies with environmental laws. The Laboratory produces many different types of wastes, each of which has its own disposal pathway and management plan. Some wastes can be disposed of on site, while others must be transported off site for safe disposal.

Hazardous Wastes

Hazardous waste is solid waste identified by the U.S. Environmental Protection Agency as hazardous that also includes wastes characterized as ignitable, corrosive, reactive, or toxic; batteries, pesticides, lamp bulbs, aerosol cans; or waste that contains mercury. A total of 112 tons of hazardous waste (101,587 kilograms) was disposed of in 2022.

Radioactive Wastes

Department of Energy (DOE) Order 435.1, Radioactive Waste Management, ensures that all radioactive waste generation, storage, and disposal is managed in a way that prioritizes the safety of the public and workers while also ensuring compliance with environmental laws and standards. Furthermore, all radioactive waste generated at Los Alamos must meet Laboratory requirements for on-site storage as well as transportation and final disposal.

Four types of radioactive waste are generated during Laboratory operations that use nuclear materials. Low-level radioactive waste ("low-level waste") contains added radioactivity but does not contain high-level or hazardous waste. Mixed low-level radioactive waste is low-level waste that also contains a hazardous component. In total, 377 cubic yards (288 cubic meters) of mixed low-level waste was disposed of in 2022.

Another waste type is transuranic, which contains high levels of a radioactive element(s). Transuranic waste has an activity of alpha-emitting transuranic radionuclides with half-lives of 20 years or more that amounts to greater than 100 nanocuries per gram of waste (plutonium, cesium, etc.). Mixed transuranic waste is transuranic waste that also contains a hazardous component. In total, 470 cubic yards (360 cubic meters) of transuranic waste and mixed transuranic waste was disposed of in 2022.

Waste Disposal Pathways

The disposal method for waste at Los Alamos depends on the characterization and type of waste. Solid transuranic and solid mixed transuranic waste are transported to the Waste Isolation Pilot Plant (WIPP), located outside of Carlsbad, New Mexico. Transuranic waste is stored at the Laboratory until an acceptable disposal pathway is found and the waste meets criteria established by WIPP.

Solid low-level radioactive waste generated at Los Alamos is shipped off site to licensed treatment, storage, and disposal facilities. Some examples of these facilities include the DOE-operated Nevada Nuclear Security Site (NNSS), as well as commercial facilities in Utah, Washington, and Texas.

The Laboratory treats most liquid radioactive waste on site at the Radioactive Liquid Waste Treatment Facility in Technical Area 50. Once treated, the water removed is clean enough to be discharged into the environment. Water is either evaporated or released at permitted outfall 051. Some liquid radioactive waste is dispositioned off site at disposal facilities.

Hazardous waste is sent off site for treatment and disposal at facilities such as Veolia North America in Colorado and Clean Harbors in Utah. Solid mixed low-level waste is also sent to off-site disposal facilities. This waste is treated to meet land disposal requirements and then disposed of at the NNSS.

The Laboratory also generates sanitary solid waste in the form of office and cafeteria trash. This waste is sent to the Los Alamos County Eco Station, where the waste is disposed of in municipal landfills.

On-site Waste Disposal

The Laboratory operates one waste disposal facility: Material Disposal Area G at Technical Area 54 (Area G). Past operations at Area G included the disposal of low-level radioactive waste, certain infectious waste that contains radioactive materials, asbestos-containing material, and PCBs (polychlorinated biphenyls). Transuranic waste is also temporarily stored here. The use of Area G for low-level waste disposal is very limited, and no waste was disposed of at Area G in 2022.

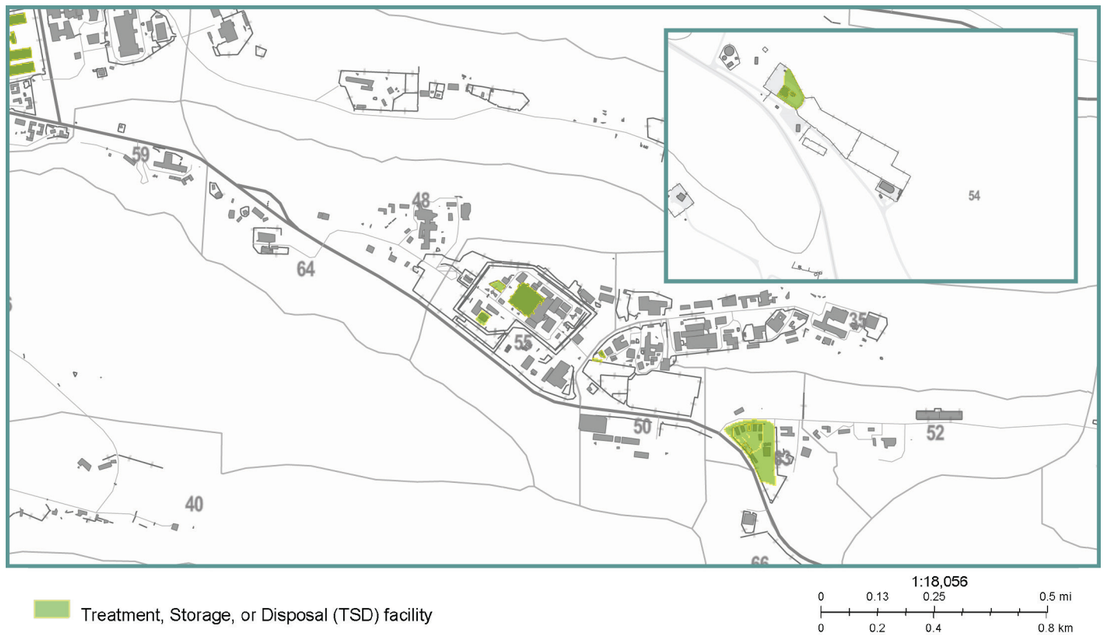
What do these waste terms mean?

Treatment:
Any process that changes the physical, chemical, or biological characteristics of a waste to minimize its threat to the environment.

Storage:
Temporary holding of waste before the waste is treated, disposed of, or stored somewhere else. A **storage unit** stores hazardous waste. Examples include tanks, containers, drip pads, and containment buildings.

Disposal:
Discharge, deposit, injection, or placing of any waste on or in the land or water. A disposal facility is any site where the waste is intentionally placed and where it will remain.

Remediated Waste:
Waste that has undergone treatment.



Map of Waste Treatment, Storage, or Disposal facilities at the Laboratory

Cultural Resources employee Elliot Schultz gives a tour to a WESH group

Cultural Resources Program Staff

Cultural Resources staff partner with UNM, NPS, and the Laboratory's workforce.

Keenan Greywolf

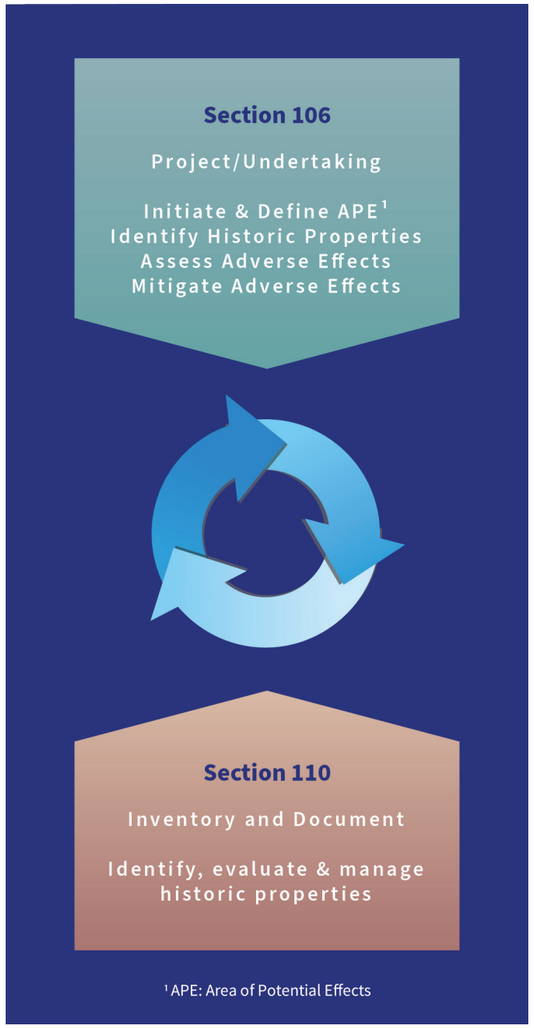
Los Alamos National Laboratory's Cultural Resources program partners with a range of groups to be good stewards and preserve historical and culturally significant sites across northern New Mexico. In 2022, collaborations with the University of New Mexico (UNM) helped train a new generation of archaeologists and update archaeological site records at the Laboratory. Working closely with the National Park Service (NPS), the Cultural Resources program also completed preservation activities at several Manhattan Project-era sites. Cultural Resources staff continued to educate and foster connections with Laboratory employees through the Weapons Engineering Study Hall initiative (WESH).

The Cultural Resources program complies with the National Historic Preservation Act (NHPA) to preserve the Laboratory's more than 1,800 archaeological sites. Section 110 of the NHPA requires that federal agencies identify and evaluate whether historic properties have the integrity and significance to be eligible for listing in the National Register of Historic Places. Section 106 of the NHPA directs much of the Cultural Resources program's daily work and requires federal agencies to review all projects and developments that have the potential to adversely affect cultural properties.

However, project review is not the only duty of the Cultural Resources program. Under Section 110 of the NHPA, the program is also tasked with performing surveys and recording archaeological sites. This is where opportunities for collaboration come in.

LANL-UNM Field School

In 2022, the Laboratory's Cultural Resources program worked with Dr. Hannah Mattson, an assistant professor of archaeology at UNM, to host an accredited four-week field school for thirteen students pursuing degrees in anthropology. These students gained valuable skills in the field of cultural resource management (CRM) while helping the Cultural Resources program Section 110 survey and update archaeological site records in Technical Areas (TA) 70 and 71. TA-70 and TA-71 are open to the public for hiking and



National Historic Preservation Act Section 110 versus Section 106

Various artifacts observed during the UNM field school survey

recreation and are not currently being developed. As such, there are no Section 106 drivers for the area.

The UNM field school provided an opportunity for students to help Cultural Resources staff with Section 110 compliance in an accessible area while receiving hands-on experience and training from Cultural Resources professionals. The field school performed pedestrian surveys of approximately 44 acres of terrain and recorded 17 sites—6 of which were newly identified. Staff taught students foundational skills in Cultural Resources Management, such as mapping, surveying, and artifact identification, which will help students pursue a CRM career. The success of the 2022 field school has fostered an excitement to partner with academic institutions in the future.

Manhattan Project Preservation with NPS

The Manhattan Project National Historical Park (MAPR) team, in collaboration with NPS, completed a Section 106 replacement project of degraded asbestos shingles at S-Site Magazine (TA-16-58), V-Site (TA-16-516 and TA-16-517), Q-Site (TA-14-06), and Quonset Hut (TA-22-01) in 2022. These buildings contained severely degraded cement asbestos shingles which created increased risk of asbestos fiber release. Asbestos fibers pose a serious risk to the environment as well as to human health. The MAPR team ensured that the cement asbestos shingles were replaced with fiber-cement replica shingles, mitigating the risk of worker exposure to asbestos fibers, and aiding in the preservation of buildings critical to the Laboratory's legacy.

WESH Initiative

The Cultural Resources program collaborates within the Environmental Protection and Compliance – Environmental Stewardship group on staff education initiatives, such as the Weapons Engineering Study Hall. Intended for early to mid-career Laboratory employees, this program consists of six week-long modules which educate staff through a series of tours, lectures, enrichment talks, and hands-on demonstrations.

UNM field school students surveying a ridge

New Site-Wide Environmental Impact Statement

The new SWEIS will analyze potential environmental impacts for continuing and proposed operations at the Laboratory over the next 15 years.

Kyla Fugate

The Site-Wide Environmental Impact Statement (SWEIS) forms the backbone of the National Environmental Policy Act (NEPA) documentation for continued facility operations at Los Alamos National Laboratory. Continued operation of the Laboratory is critical to the National Nuclear Security Administration's (NNSA) Stockpile Stewardship Program and to many other areas impacting national security, fundamental science and technological advances, and global stability.

Federally funded projects, projects requiring a federal permit, or projects occurring on federal lands are required to undergo NEPA analysis. This includes environmental impact analysis of proposed activities, operations, and projects from environmental resource areas, such as:

- Biological Resources
- Air Quality
- Human Health
- Cultural Resources
- Transportation
- Waste Management
- Water Resources

Signed in 1970, NEPA was the first major environmental law in the United States and is often called the "magna carta" of federal environmental laws.

No Action Alternative

Continue current operations, including projects where NEPA coverage already exists.

As part of the NEPA process, each current and proposed project at the Lab is categorized into one of three alternatives for NNSA consideration: no action, modernized operations, and expanded operations. NNSA then decides which alternative is preferable based on environmental impacts, technical feasibility, agency missions, national objectives, and cost. For a no action decision, the Laboratory continues current operations, including projects for which NEPA coverage already exists. A modernized operations decision allows for construction of replacement facilities, upgrades to existing facilities, and/or demolition projects, while an expanded operations decision greenlights expansion of capabilities and operations beyond those that currently exist.

Modernized Operations Alternative

Construction of replacement facilities, upgrades to existing facilities, and demolition projects. Also includes projects in the No Action.

Expanded Operations Alternative

Expands capabilities and operations beyond those that currently exist at the Lab. Also includes projects in the No Action and Modernized Operations.

The Environmental Stewardship group, part of the Laboratory's Environmental Protection and Compliance division, reviews development projects to assess potential environmental impact.

In 2022, NNSA announced its intent to prepare a new SWEIS for the Laboratory. Previously, most Laboratory activities were covered under the 2008 SWEIS, in addition to subsequent periodic NEPA reviews to ensure SWEIS relevancy. However, the NNSA Los Alamos Field Office (NA-LA) and the Laboratory agreed that a new SWEIS would provide programmatic and operational benefits for ongoing and future operations and program projections. The Laboratory's SWEIS Program Office is assisting NNSA with the SWEIS update to provide additional scope and coverage.

NEW SITE-WIDE ENVIRONMENTAL IMPACT STATEMENT

The SWEIS Process

- Publish Notice of Intent to Prepare SWEIS
- Conduct Public Outreach/Scoping*
- Refine Scope (Alternatives and Issues)
- Prepare Draft SWEIS
- Publish Notices of Availability/ Completion of Draft SWEIS
- Hold Public Hearing Meetings and Comment Period*
- Respond to Comments and Prepare Final SWEIS
- Publish Notices of Availability/ Completion of Final SWEIS
- 30-Day Waiting Period
- Public Record of Decision

*Opportunities For Public Involvement

A worker checks one of the 60-plus air monitors that routinely check air quality

Radioactive Air Sampling Sets National Benchmark

Air quality stack sampling at the Laboratory demonstrates diligent air monitoring.

Mariah Gonzales

For the past two decades, Los Alamos National Laboratory's Air Quality Program has helped maintain a clean and safe environment by ensuring that radioactive emissions remain at or below environmental compliance standards. With over 40 ambient air monitoring stations and 27 monitored exhaust stacks, the Laboratory has one of the most sampled airsheds in the world. Radioactive Air Emissions Management Team Lead Dave Fuehne notes, "There are more sampled stacks and more ambient air samplers [at the Laboratory] than anywhere else in the country. It is the most rigorous air quality sampling done in the United States." With its host of sampling stations, the Laboratory has consistently measured its radioactive emission samples at less than 10% of the regulatory limit for more than 10 years.

"There are more sampled stacks and more ambient air samplers [at the Laboratory] than anywhere else in the country. It is the most rigorous air quality sampling done in the United States."

Two types of air samples are monitored at the Laboratory: ambient air and emission stack samples. Ambient air sampling involves measuring concentrations of pollutants in the open air. These sampling stations are placed at public locations from the Laboratory perimeter to nearby communities, and measure levels of radioactive material. Both Los Alamos processes and naturally occurring decay contribute to airborne radioactive pollutants. Naturally occurring radioactive materials include uranium (found in soil throughout the Southwest) and beryllium-7, which is generated by cosmic rays.

To directly measure pollutant emissions, stack sampling is performed at the source of pollution, with samplers measuring emissions directly from the exhaust stacks of Laboratory facilities. Radioactive materials are released in quantities below the regulatory limit through a highly regulated emission stack process that varies depending on the material emitted. Currently, four types of radioactive materials are sampled from Laboratory emission stacks: particulate matter, activated vapors and volatile compounds, tritium, and gaseous mixed activation products. Each category has its own sampling methods and, while all four types are sampled from emissions stacks, only tritium is analyzed on Laboratory property.

Particulate matter

Particulate matter, primarily uranium and plutonium, is sampled on a weekly basis. This sampling process entails a continuous sample of air passing through a glass-fiber filter that can capture small particles.

Activated Vapors and Volatile Compounds

Bromine and mercury are the most common activated vapor and volatile compound contaminants. These materials are sampled weekly using a charcoal cartridge which captures radioactive material as it is filtered through the sampler.

Tritium

Tritium emissions are measured weekly at the Laboratory by collection devices called bubblers. During this process, an air sample is continuously pulled from an exhaust stack and "bubbled" through three sequential vials containing ethylene glycol (which extracts tritium oxide from water molecules). The sample airstream is then processed through a catalytic conversion system, which chemically changes any remaining elemental tritium to its oxide form. The air is then directed through three more glycol-containing vials to collect the tritium oxide. Bubbler samples are changed weekly and analyzed by skilled Laboratory technicians.

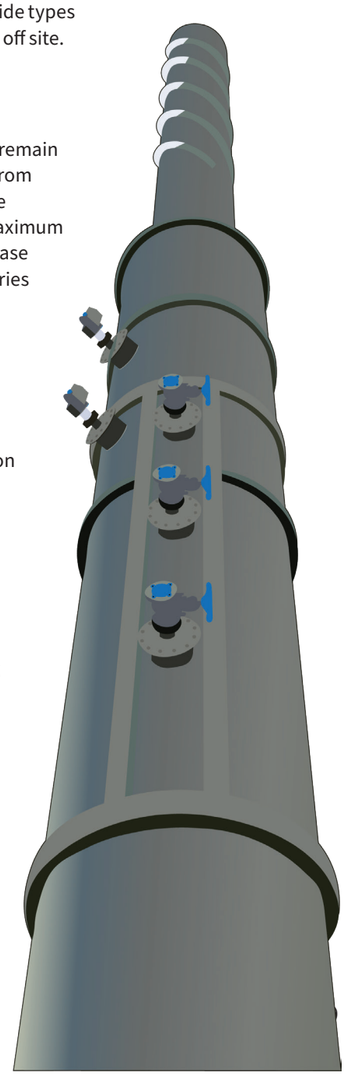
Picture of bubbler sampler

Gaseous Mixed Activation Products

Unlike the other materials sampled, gaseous mixed activation products are sampled in real time. Materials in this category include isotopes of carbon, nitrogen, and oxygen. The most common form is carbon dioxide. In real-time sampling, a sample of air is pulled from an exhaust stack through an ionization chamber where the sample's total radioactivity levels are measured. Gaseous samples are collected and analyzed in real time because paper and charcoal filters are unable to collect gaseous emissions and because the half-lives of these radionuclide types are too short to be analyzed off site.

Conclusion

Air quality sampling results remain consistent with the results from the last 20 years. In 2022, the Laboratory measured its maximum annual airborne tritium release at a waste site at 294 picocuries per cubic meter, well below the U.S. Environmental Protection Agency's limit of 1500 picocuries per cubic meter. Similarly, in 2022, the maximum airborne plutonium-239 concentration measured by a sampling station was 14 attocuries per cubic meter, well below the regulation limit of 2,000 attocuries per cubic meter. By continuously improving operations procedures and conducting frequent sampling, the Laboratory continues to progress its mission while achieving minimal environmental impact and maintaining air quality.



Groundwater Discharge Permit Recognition

Discharge permit team wins NNSA excellence award.

Rachel Greenwood

In October of 2022, the National Nuclear Security Administration (NNSA) Award of Excellence was awarded to the Laboratory's permitting team for Discharge Permit 1132 (DP-1132) covering the Radioactive Liquid Waste Treatment Facility (RLWTF). The team is comprised of members from the Laboratory's General Counsel, the Environmental Protection and Compliance division, and Technical Area 55 Facility Operations. This award recognized excellence in collaboration not only internally, but also with external regulators, to meet strict water quality standards for RLWTF discharges and to achieve success in facilitating updates for a thirty-year future regulatory plan for site closure.

The RLWTF processes and treats radioactive liquid waste generated at the Laboratory. These treatment processes use state-of-the-art technology to ensure that treated effluent discharges are protective of human health and comply with environmental protection requirements. As part of an extensive permitting process to treat this waste, the RLWTF contracts with and reports on treatment quality, operational updates, and closure of older parts of the facility to the New Mexico Environment Department (NMED).

Achieving Quality Standards through Collaboration

The permitting team's close attention to detail regarding treatment quality, operational updates, and the permitting process caught the attention of the Laboratory's NNSA Field Office. The team was nominated for the Excellence Award in September and received notification of the nomination later that month. In October, the NNSA announced that the permitting team had won the award. A recognition celebration was held later that month at the Buffalo Thunder Resort in Pojoaque, New Mexico, with a meet-and-greet dinner preceding the official award ceremony.

But the permitting team's efforts don't stop there. Soon, the RLWTF plans to put a solar evaporative tank system into place as another option for discharge processing.

Building 1 at TA-50: The ALDWP Radioactive Liquid Waste Treatment Facility

Groundwater and Watershed Protection

Monitoring PFAS in groundwater and surface water for a healthy community.

Allie Cunningham and Kaia Bigej-Nunley

Groundwater is water stored beneath Earth's surface inside porous rock or sediment layers known as aquifers. This valuable resource is formed by a process called infiltration, in which precipitation, snowmelt, and other types of water runoff seep into the ground and fill spaces between rock and soil particles. Over time, gravity helps this water accumulate in underground reservoirs.

A vital source of freshwater, groundwater is also used for irrigation, agriculture, industrial purposes, and drinking water. Moreover, groundwater is an integral component of the Earth's hydrological cycle: the movement of water on, above, and below Earth's surface. When precipitation falls, it either enters a body of water or seeps into the ground and becomes groundwater. Groundwater then helps fill surface-level bodies of water like lakes, streams, natural springs, and wetlands.

PFAS in Water Sources

Many contaminants have the potential to reach groundwater through the infiltration process, including per- and polyfluoroalkyl substances (PFAS). Called "forever chemicals" because they persist in the environment, PFAS are a family of manufactured compounds with many industrial, commercial, and consumer applications. These chemicals are widely manufactured for cleaning products, nonstick cookware, food packaging, firefighting foam, and nearly all water-, grease-, and stain-resistant products.

When PFAS contaminate water sources, most treatment methods fail to remove them because of the chemicals' strong bioaccumulation ability and resilient, non-degrading carbon-fluorine bonds. The enduring nature of PFAS poses a significant threat to human and environmental health. PFAS have been linked to various health issues in both humans and animals such as cancer, endocrine malfunction, reproductive complications, and a weakened immune system, and further research is in progress.

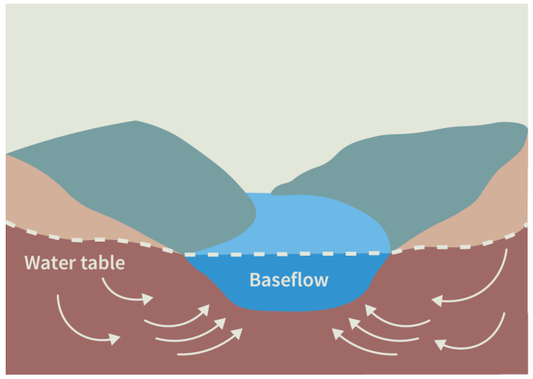
Monitoring PFAS at The Laboratory

The Pollution Prevention Team (P2) at the Laboratory works to reduce waste and pollution from Laboratory operations. Identifying and researching emerging and problematic contaminants is one of the main ways P2 manages current and prevents future pollution. PFAS have been identified around the world as emerging contaminants that can cause harm to environments and communities that are exposed to them.

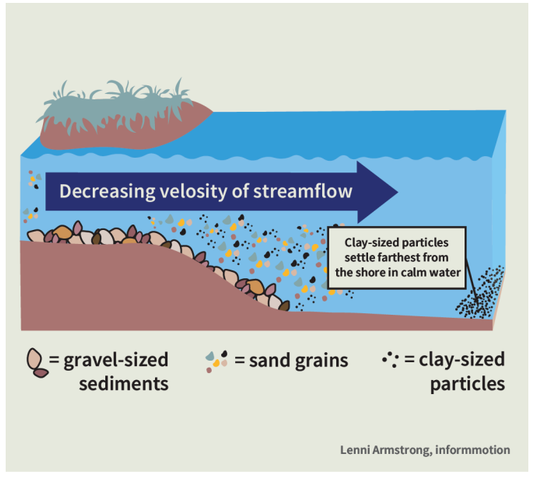
To understand the extent of PFAS contamination of groundwater at the Laboratory, the LANL team has partnered with N3B—the Los Alamos Legacy Cleanup Contractor—to create a monitoring program. By monitoring groundwater and other water sources, the team aims to identify sources of PFAS within watersheds. When a source is identified, P2 works with the Stormwater Team to reduce the amount of PFAS at the source.

P2 to monitor PFAS levels and movement, the Laboratory tests:

- surface water base flow,



- deposited sediments, and



- storm water runoff in all major canyons.

Results, Treatments, and Prevention

Until June 2022, 70 nanograms per liter of total PFAS in groundwater was a regulatory screening level for the Laboratory under the Consent Order. As knowledge of PFAS increase, standards and screening levels are being modified based on new information. All but one watershed tested under N3B's PFAS monitoring program had less than 70 nanograms per liter combined total concentration of PFAS. The Laboratory has recommended two actions that can be taken to amend contaminated areas.

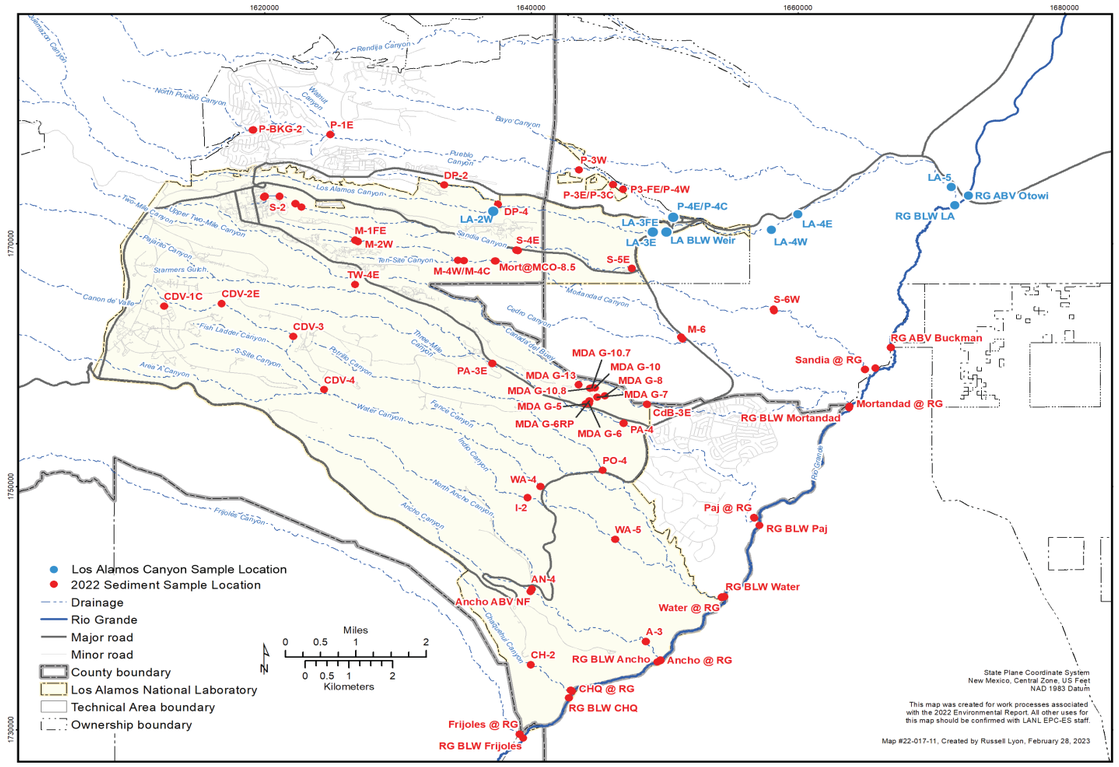
1. Injecting pre-treated water into aquifers so that it reaches groundwater and reduces concentration levels
2. Finding and developing technologies to treat water, soil, or other media containing PFAS

Maintaining a Healthy Community

While treatment of watersheds may be necessary in the future, prevention is the first line of defense to maintain a healthy ecosystem. At the Laboratory, prevention takes two main forms:

1. Implementation of low-impact projects in Technical Areas 3 and 53 to reduce stormwater runoff from developed areas to improve the quality of stormwater flow
2. A notification system for stormwater flow

With a combination of pollutant prevention, monitoring, and treatment, the Laboratory maintains the health of its groundwater, community, and ecosystem.



This map depicts all sediment sampling locations in 2022, with Los Alamos Canyon sample locations identified in blue. The blue line represents the Rio Grande, where a few of the sediment samples are taken. LA-2W is one of the nearest sediment samples to the Laboratory. Note: MDA = Material disposal area; RG = Rio Grande; BLW = below; @ = at; LA = Los Alamos Canyon; P = Pueblo Canyon; A or AN = Ancho Canyon; AC = Acid Canyon; S = Sandia Canyon; WA = Water Canyon; ABV = above; CdB = Cañada del Buey; PA = Pajarito Canyon; M or Mort = Mortandad Canyon; BKG = background; I = Indio Canyon.

New Trends in Los Alamos Canyon Sediment Radionuclide Concentrations

Radionuclide concentration has decreased from previous years.

Ashlyn Lovato & Sonya Quintana

To monitor legacy contamination from early and ongoing Laboratory activities, sediment samples across the site are collected, analyzed, and reported. In 2022, sediment samples were collected at 12 locations to record radionuclide concentrations within Los Alamos Canyon. This canyon feeds water to the Rio Grande River, which is the main water supply for many nearby communities.

The sediment sample collection locations are indicated in blue on the map shown. According to the results, radionuclides such as americium-241, cesium-137, plutonium-239/240, and strontium-90 have decreased in concentration relative to previous years. In 2022, no stormwater or sediment samples exceeded allowable radionuclide concentrations.

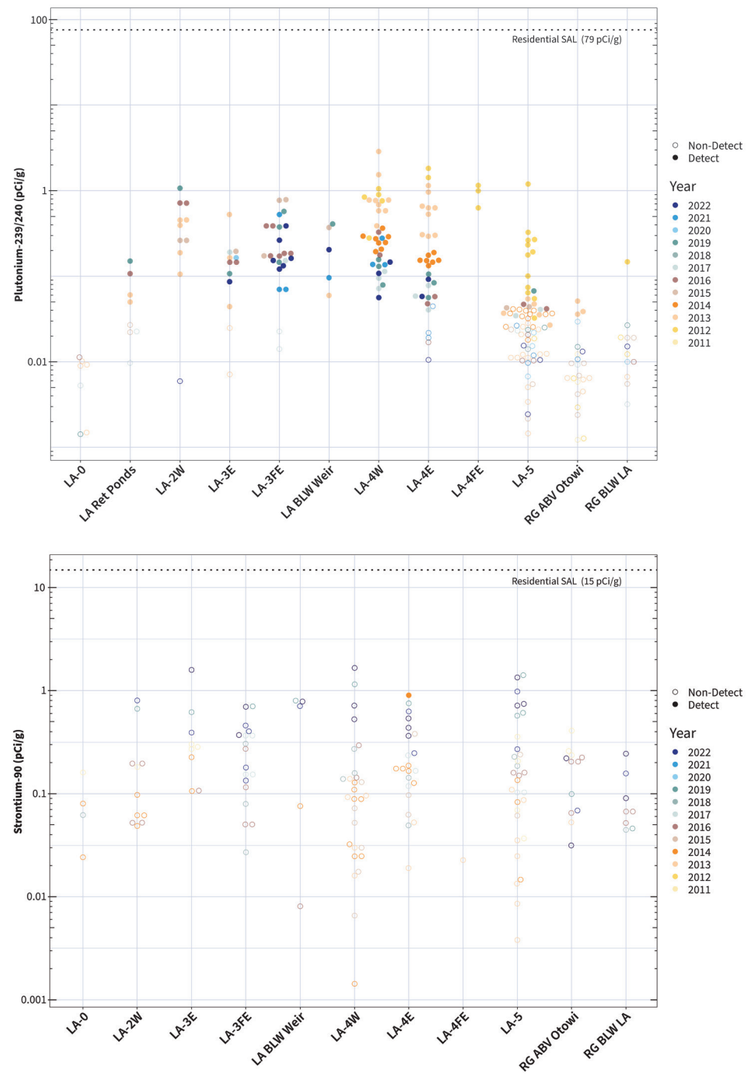
Sample collection method

Not all contributions to radionuclide concentrations are from Laboratory operations, as some concentrations occur naturally. Soil samples are collected by N3B, the company contracted to perform cleanup of legacy contamination using the “spade and scoop” method. With a stainless-steel trowel and mixing bowl, N3B staff collect each sample without cross-contamination by cleaning the bowl between each collection. Sediment samples are monitored annually and collected each fall to observe radionuclide concentration levels after the summer.

Nuclide:
An atom species with a specific number of protons and neutrons in its nucleus.

Radionuclide:
A nuclide that has extra nuclear energy, which makes it unstable.

This extra energy is called radioactive decay, and results in one of three outcomes from the radionuclide: emission of gamma radiation, release of a conversion electron, or the creation and release of an alpha or beta particle.



Concentrations in sediment samples in Los Alamos Canyon and the Rio Grande from 2011 to 2022. Top: Plutonium-239/240; SAL 79 pCi/g. As the sampling locations move closer to the Rio Grande, plutonium concentrations decrease. Bottom: Strontium-90; SAL 15 pCi/g. Except in 2016, no strontium has been detected at any sampling sites.

Sample results from multiple locations show a downward trend that is below the screening action level, especially at sample collection sites to the east and approaching the Rio Grande.

Why collect samples?

The primary reason for radionuclide sample collection is to ensure the safety of public water supplies. The 2016 Compliance Order on Consent (Consent Order) between the New Mexico Environment Department (NMED) and the Department of Energy (DOE) established the structure to accomplish monitoring and legacy cleanup work at the Laboratory. It established legally enforceable cleanup using campaigns with annual achievable milestones and targets. Campaigns are reviewed and updated every year as cleanup progresses. The Consent Order also serves to ensure cooperation between NMED and DOE, minimize duplicate work, and provide for effective public engagement. This requires the monitoring of Los Alamos Canyon as water flows from the canyon closer to the Rio Grande and neighboring communities down river.

A pinyon jay eats its favorite meal: a seed from a pinyon pine tree

Monitoring At-Risk Pinyon Jay Presence

As pinyon jays near potential listing as a federally threatened or endangered species, the Laboratory takes steps to understand their habitat.

Jacob Martinez

The pinyon jay (*Gymnorhinus cyanocephalus*) is a pale blue, long-billed songbird that relies heavily on pinyon-juniper woodlands—a significant habitat type on Laboratory property. Pinyon jays are crucial to the ecosystem in many ways, and in recent decades they have experienced drastic population decline due in part to habitat loss from human activity.

Pinyon jays live in groups of between 50 and 300 individuals, forming smaller colonies of life-long nesting pairs during the breeding season. During the fall and winter, a single pinyon jay can collect and cache up to 2,600 pinyon pine seeds from their estimated 15 to 25-square-mile home range. With impeccable memory, pinyon jays can return to their hidden seed caches year after year. Not only do these seed caches serve as emergency food sources, but they also provide a seed dispersal route for pinyon pine trees and support other seed-eating animals that find them.

Pinyon jays, along with the bird's vital ecological role, face serious threats due to their sensitivity to human disturbances. "The main threats to pinyon jays at the Laboratory are habitat alteration and development along with the regional threats of climate change and wildfires," says Milu Velardi, a Laboratory wildlife biologist. "This has all resulted in loss of pinyon pine trees."

Over the last 50 years, it is estimated that pinyon jay populations have declined approximately 85%, largely due to approximately 150 years of reduction in pinyon-juniper woodlands.

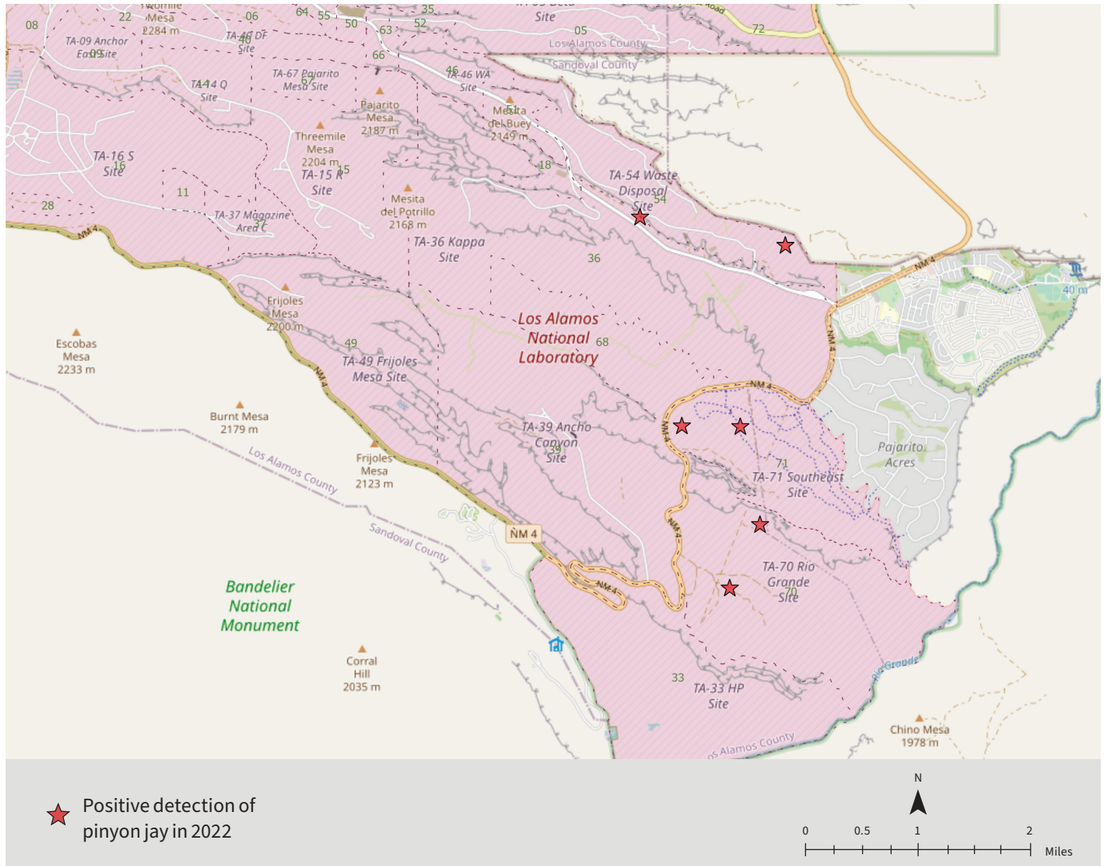
Pinyon jays are listed as a Species of Greatest Conservation Need by the state of New Mexico. As of April 2022, they were petitioned to be listed as endangered or threatened under the Endangered Species Act (ESA), a federal protection program. The Laboratory has taken proactive steps to understand this species' use of the site and how operations may pose potential threats to local pinyon jay populations.

In November and December of 2022, Laboratory biologists began a site-wide pilot study of pinyon jay presence. The goal is to understand what areas are being used by pinyon jays during breeding and non-breeding seasons, as well as note potential threats that the Laboratory may pose in these locations. By deploying autonomous recording units (ARUs), biologists can detect the presence of the bird through vocalization recordings. ARUs placed on the south-east portion of Laboratory property where habitat is suitable and human disturbance is low detected the presence of pinyon jays in both months, which suggests that the jays use Laboratory property during the non-breeding season.

As a non-migratory species, pinyon jay flocks will occupy an area for as long as it provides enough food and resources. Detecting the presence of pinyon jays during the non-breeding season when seed caching occurs means that Laboratory property serves as an important habitat for this imperiled species. Future monitoring in the spring and early summer will confirm breeding season use of Laboratory property if pinyon jays are detected.

With plans for more monitoring, Velardi adds, "We intend to continue our efforts with more acoustic deployment, walking surveys, and potential road surveys in the years to come."

Pinyon jays have approximately 11,000 acres of suitable habitat on Laboratory property. Future monitoring will allow Laboratory biologists to understand where the birds forage and breed, a crucial step for managing a potential threatened or endangered species and imposing requirements for projects and operations. This knowledge will both protect pinyon jays from operational impacts and prevent ESA-related risks to operations, such as significant timing delays to projects, budget exceedances and unexpected costs, and geographic access limitations.



Locations of ARUs placed throughout the southeast portion of the Laboratory where pinyon-juniper woodlands dominate the landscape. Pinyon jays were detected in both November and December 2022.

Mule deer crossing NM-4

Monitoring PFAS through Roadkill and Small Mammals

Animal sampling allows scientists to monitor the environmental effects of PFAS.

Zach Jones

Per- and polyfluoroalkyl substances, also known as PFAS, are a new area of research for environmental monitoring programs. PFAS are artificial chemicals first produced in the early 1940s. They are commonly used in many industrial and consumer products because of their unique ability to resist grease, oil, water, and heat.

Through the Soil, Foodstuffs, and Biota (SFB) program within the Environmental Stewardship group, PFAS testing has become a significant area of study at the Laboratory. In recent years, the Laboratory has relied on animal, vegetation, soil, and locally grown produce samples to monitor PFAS in the surrounding area. The SFB program has also gathered roadkill and small mammal samples from various locations in and around the Laboratory. Both sample sources provide the program with an accurate representation of the level of PFAS present in the surrounding ecosystem.

The SFB program began studying PFAS back in 2018. Now, the program is recognized as one of the most extensive PFAS sampling groups across the Department of Energy complex. This expertise led the U.S. Fish and Wildlife Service (USFWS) to reach out to SFB and ask to collaborate as USFWS begins its own PFAS monitoring operations.

MONITORING PFAS THROUGH ROADKILL AND SMALL MAMMALS

Specifically, USFWS was looking for guidance on how to start its own PFAS monitoring program at the Rocky Flats National Wildlife Refuge in Colorado. In December of 2022, SFB staff put together a presentation to provide guidance on the new program. Shortly after, USFWS began sampling for PFAS at its own respective sites. With the help and technical support of SFB staff, the number of PFAS monitoring programs has increased, aiding efforts to monitor and maintain healthy ecosystems.

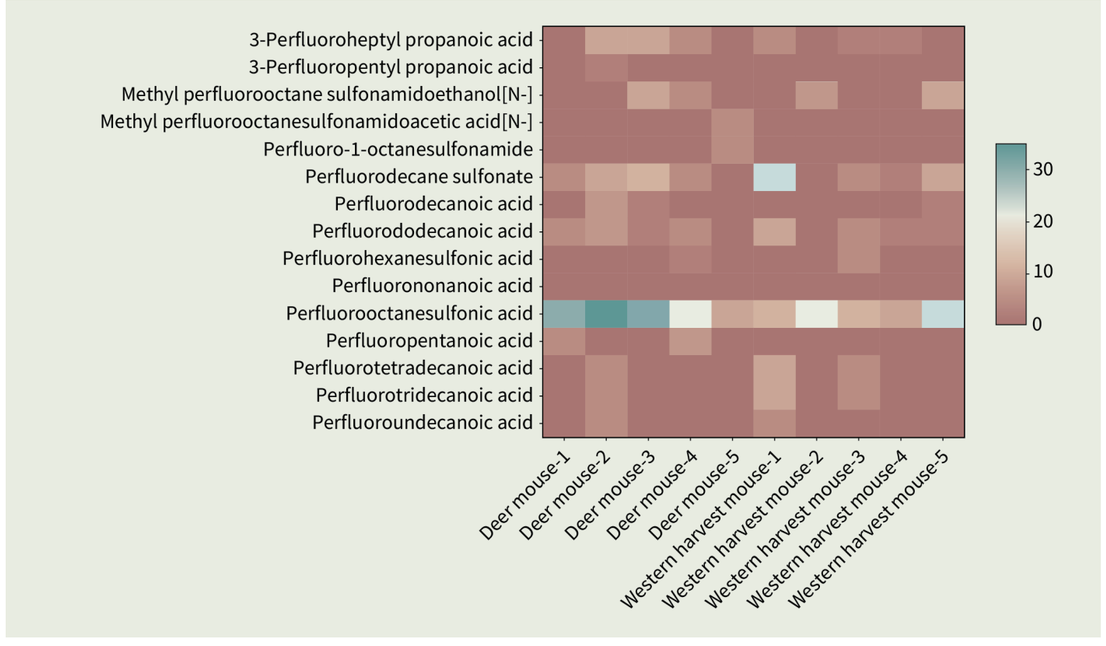
Many of the samples the SFB program examines for PFAS come from roadkill. Typically, the animals that are sampled are large mammalian species, including deer and elk. In 2022, however, the SFB program also received great horned owl, raven, and coyote samples. The program uses an animal's muscle and liver tissue to determine if PFAS levels are present.

SFB sampled a total of 11 individual animals for PFAS analysis in 2022. These animals were tested for 37 different PFAS compounds, and 16 were detected. Results revealed that the two most common PFAS compounds found were long-chain PFAS, which stay in an animal's system longer as they are harder to metabolize. **"Most observed PFAS levels were within the range found at background locations (outside of the potential impacts of the Laboratory)."**

The 2022 small mammal samples included six different species of mice. Like the results found in roadkill, mice samples had concentration levels close to and within range of background PFAS levels, when background levels were available. The SFB program sampled at three sites on Laboratory property in 2022. At each of the sites, Sherman® live traps were used to catch the mice. All animal handling procedures were and continue to be approved by the Laboratory's Institutional Animal Care and Use Committee. For accurate PFAS sampling, a minimum of three animals is required for each site.

Like the roadkill samples, small mammal samples were also tested for 37 PFAS compounds. Results showed that only a few PFAS compounds detected in mice from two terrestrial sites were above background levels. Researchers also observed that samples from the effluent-fed wetland site had higher detections and concentrations of PFAS compounds compared to terrestrial sites.

Although the SFB program has made significant progress in monitoring research of PFAS around the Laboratory, PFAS monitoring is still an emerging issue. Little is known about the long-term effects of PFAS on wildlife. Truly understanding how these chemicals affect the environment and food chain will require extensive research and experimentation. Much more data needs to be gathered not only at the Laboratory, but also at other locations, to characterize the impact of PFAS on the ecosystem. In the meantime, the Laboratory continues to improve its PFAS monitoring program with aims to include additional sampling locations in the future.



Detection frequencies of PFAS compounds (15 compounds total) that were detected in at least one individual small mammal collected from Sandia Canyon wetland in 2022.

A mountain lion cub investigates a game camera up close while its mother feeds on an elk in the background

Large Mammal Monitoring Collaboration

Laboratory supports surrounding agencies in monitoring large mammals' responses to wildfire mitigation.

Noelle Mason

While people recognize the boundaries of Los Alamos National Laboratory (LANL), mountain lions and other large mammals do not. Aware that the Laboratory impacts local wildlife, biologists in LANL's Environmental Protection and Compliance group collaborate with several agencies to support a comprehensive study on large mammals. The Laboratory contributes by bridging the data gap that exists when animals go "behind the fence" onto LANL property.

This long-term study, called the Large Mammal Monitoring Project (LMMP), investigates the responses of large mammals to wildfire in the southwest Jemez Mountains, as well as subsequent forest restoration and future fire mitigation efforts. The New Mexico Department of Game and Fish, Bandelier National Monument, Valles Caldera National Preserve, Santa Fe National Forest and the Laboratory all collaborate to support the study run by New Mexico State University PhD candidate Mark Peyton. While the rest of the study takes place on public land, data from LANL is needed to complete the full picture.

Land managing agencies throughout the Southwest region of the United States are implementing wildfire mitigation strategies, such as forest thinning, across the landscape to reduce and prevent the occurrence of catastrophic wildfires. The LMMP aims to understand the timing of when large mammals return to and use treated areas seasonally. Laboratory biologists help support this research study by providing data on large mammal behavior within Laboratory boundaries.

Large mammals, such as black bears and mountain lions, can be fitted with radio collars that transmit GPS coordinates several times a day, allowing collaborating researchers to

gain more insight into their foraging behavior, resource selection, and movement in areas treated for wildfire mitigation. Currently, three mountain lions spend time within the boundaries of the Laboratory. LANL biologists work with biologists at neighboring Bandelier National Monument to track the lions' movements. Together, the team has set up game cameras in LANL locations where the lions often cache, or hide, a hard-earned prey item. These cameras not only reveal mountain lion behavior, but also the presence of cubs and whether other wildlife species snack on the kill. LANL game cameras have recorded black bears, coyotes, and even mice visiting or feeding at mountain lion kill sites.

"We are lucky to collaborate with LANL folks since lions have such large home ranges and use both Bandelier and LANL frequently," says Sarah Milligan, a biologist at Bandelier National Monument. "We also collar elk, deer, and bears… being able to follow all four species to see how they are using the habitat and landscape across Bandelier, LANL, the Valles Caldera, and the Santa Fe National Forest is important to seeing how our forest treatments, such as thinning and burning, are affecting the wildlife."

The LMMP will give biologists and forest managers valuable information on large mammal behavior as efforts to mitigate and prevent catastrophic wildfire in the southwest Jemez Mountains continue. These data will be used to implement fire management practices which disturb less of the habitat used by large mammals.

"For wildlife that have these very large territories," says Jenna Stanek, a biologist at LANL, "it is so important for agencies to collaborate on data collection across jurisdictional boundaries to ultimately improve recommendations on habitat and wildlife management for the area."

Collaboration between agencies and the data collected during this project can be incorporated into both forest and wildlife management plans for the benefit of all living things that call the Los Alamos area home.

A mountain lion looks over its shoulder at a game camera on a snowy day

Food Source Monitoring Shows No Danger to Humans

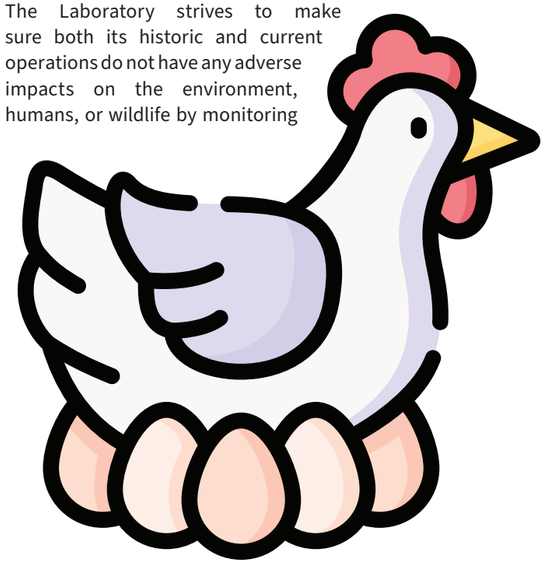
The Laboratory's Soil, Foodstuffs and Biota program monitors food sources from various locations to determine potential impacts on humans and the environment.

Hanna Mora

Farming and ranching communities have played an important role in Northern New Mexico's history and culture. Today, farmers and ranchers fill the growing demand for locally sourced fresh produce and goods within their communities and surrounding areas.

Los Alamos National Laboratory recognizes not only the importance of these local farmers' and ranchers' work, but also the care and concern they put into the goods they produce. In that light, the Laboratory understands that farmers, ranchers, consumers, and communities have concerns about how operations in Los Alamos may influence food grown nearby.

The Laboratory strives to make sure both its historic and current operations do not have any adverse impacts on the environment, humans, or wildlife by monitoring



Apricots on a tree

soil, foods, plants, and wildlife in the surrounding environment both on and offsite. In 2022, the Laboratory's Soil, Foodstuffs, and Biota program continued its efforts to monitor the Laboratory's effects on the environment through the collection and analyzation of food sources for radionuclides, metals, organic chemicals such as polychlorinated biphenyls (PCBs), as well as for chemicals called per- and polyfluoroalkyl substances (PFAS).

PCBs are artificial chemicals that are often used in electrical equipment. PCBs are no longer manufactured in the United States, and PCB levels have decreased since the 1970s due to stricter state and federal regulations. However, PCBs persist in the environment because these chemicals do not easily break down.

PFAS are artificial chemicals first developed about 80 years ago and found in many manufactured items such as cookware, sunscreens, and firefighting foams. PFAS chemicals are known for their ability to repel oil, stains, grease, and water. But in recent years, studies have suggested that PFAS may also cause negative health effects, such as cancer and a lowered immune response, in people who are exposed to sufficiently high levels. Background location samples provide a baseline for testing

Cherries on a tree

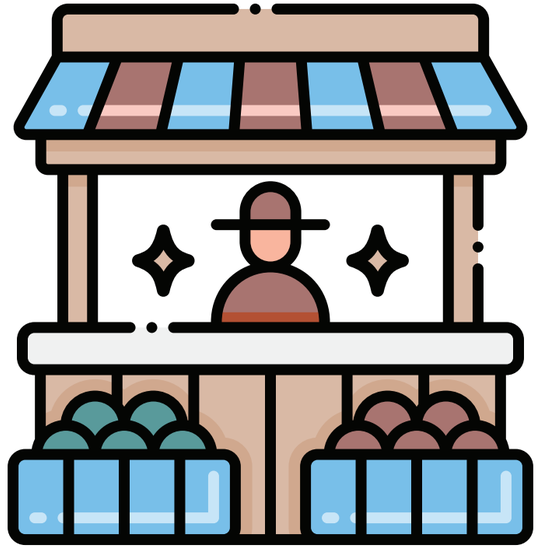
for the presence of these chemicals and other pollutants. The Laboratory defines a background location as an area that is more than 15 kilometers (about 10 miles) away from Laboratory property, far enough that a sample is not influenced by Laboratory operations. Other areas downstream of the Laboratory that are irrigated by the Rio Grande are also important for sample collections. Samples collected from these areas provide insight into the potential impact on human health from chemicals or radionuclides that may have been carried downstream from the Laboratory.

Every three years, samples of food grown in areas surrounding the Laboratory are collected for testing. In 2022, researchers collected a variety of locally grown fruits, vegetables, and wild produce—from apples to zucchini— from farms and gardens in Los Alamos, White Rock, Pajarito Acres, Pueblo de San Ildefonso (a perimeter location), Pueblo de Cochiti (downstream of the Laboratory), and other background locations. Goods such as milk, honey, and tea were also collected from select locations. Chicken eggs were collected from Pueblo de San Ildefonso, Pueblo de Cochiti, Los Alamos, White Rock, and other background locations. As always, samples of deer, elk, and other wildlife were also collected when available through roadkill or hunter donations from areas surrounding the Laboratory and at background locations. The samples were analyzed by an off-site laboratory.

When compared with background locations, the results from the 2022 foodstuffs sampling found that the majority of radionuclides in both crops and goods, such as eggs, milk, tea, and honey, were not detected or detected below background levels. Tests for inorganic elements (mostly metals) also showed that crops had concentrations below background levels.

PCB test results from animal-produced goods, such as chicken eggs and goat milk, found that most samples were below regional reference levels. Goat milk samples were also below the Food and Drug Administration's PCB tolerance value in milk. PFAS sampling revealed that the majority of these chemicals were not detected in the sampled crops, eggs or milk.

As in past years, the test results showed that there are no negative impacts to humans through the consumption of locally sourced food produced near the Laboratory. The results are a testament to the Laboratory's efforts to protect the environment and surrounding communities.



Assessing and Visualizing Dose from the LANSCE Isotope Production Facility

Visualization helps communicate public dose from Laboratory facilities.

Alberto Hernandez Luna

Dose is the measure of biological damage caused to a body by ionizing radiation. The Laboratory takes dose received by the public very seriously, using a concept called the maximally exposed individual (MEI) to determine the greatest dose any individual could receive outside of Laboratory property.

The MEI is theorized to absorb radiation via three major pathways: exposure, consumption, and inhalation. The MEI calculation also assumes that this hypothetical individual is growing crops, tending to livestock, and living right next to the nearest public point of interest to the Laboratory. The MEI can be any member of the public at any off-site location where there is a residence, school, business, or office. Typical points of interest are hospitals, churches, residential areas, and surrounding Pueblos.

The MEI dose is calculated with the assistance of the Clean Air Act Assessment Package–1988 (CAP-88), a federally developed program that is currently the standard for the Environmental Protection Agency (EPA). Dose is measured in the units of millirem (mrem). For context, a coast-to-coast flight from New York to Los Angeles would yield a dose of about 1.5 mrem, which is the same dose that one would experience when receiving dental X-rays. The mrem dose limits for Laboratory radiation set by the Department of Energy (DOE) are less than or equal to that of the background radiation that arises from natural radioisotopes. For example, the average yearly background radiation dose in New Mexico is approximately 430 mrem per year, while the DOE limit for the general public is 100 mrem per year. This is due to several factors including a higher average content of thorium and uranium in the soil, higher exposure to cosmic rays due to the high elevation of the state, and higher indoor radon levels that affect approximately 30% of all homes. In addition, the EPA has a more stringent annual air dose limit to the MEI of 10 mrem.

At the Laboratory, dose calculations to the surrounding area are conducted in accordance with CAP-88, a modeling software required by the EPA. CAP-88 takes the wind speed for 16 cardinal directions and calculates the amount of radioactive material that would be present at a given distance for each direction. These distances are chosen based on nearby population centers such as towns and Pueblos, points of interest around the Laboratory, and surrounding businesses such as hospitals, as well as monitoring stations that are placed to monitor the ambient air emissions at these locations. Simulations are conducted with a variety of wind profiles to ensure that many scenarios can be estimated to ensure that each scenario would fall within the permit limits required for a gaseous or particulate release of radionuclides.

Stock sampling system for Isotope Production Facility at TA-53

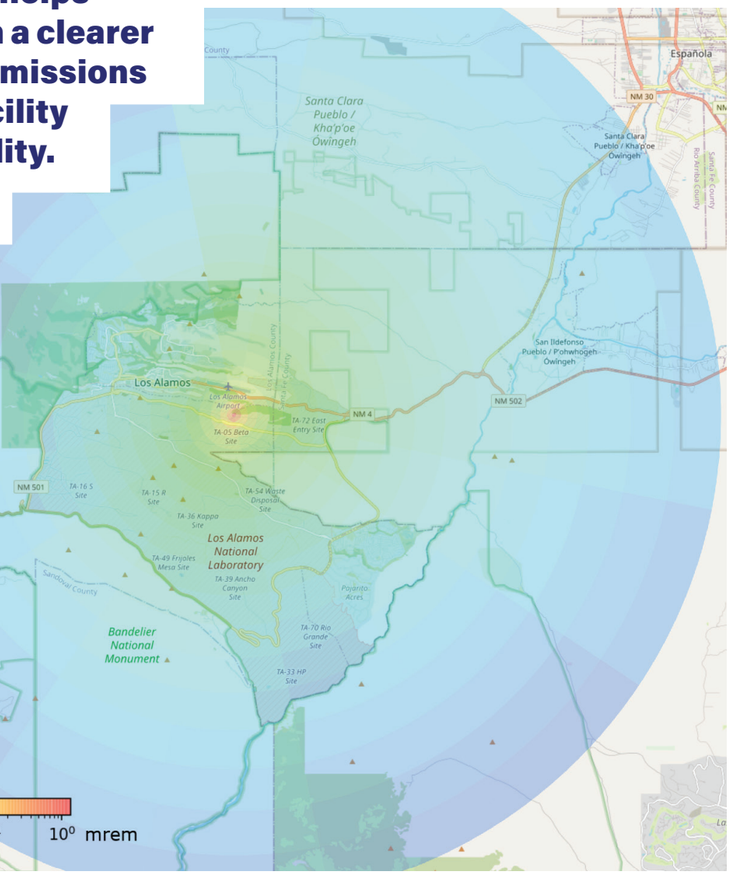
The Los Alamos Neutron Science Center (LANSCE) Isotope Production Facility (IPF) is a proton bombardment facility that specializes in the production of isotopes for use in industrial and medical applications. Some isotopes of note are shown in the table. During the bombardment process, small amounts of vaporized particles are vented out of the facility and into the atmosphere. Before leaving the facility, however, the gas will pass through gamma detectors to ensure that particles are identified, as well as verifying that the facility remains within DOE and EPA limits.

CAP-88 displays the results of the dose calculation in a table in scientific notation, which clearly communicates the risks associated with an air emission of particulate or gaseous radionuclides. In the figure below, is a visual example of the total emissions measured in 2022 for the LANSCE facility. The graph is created using the data values from the CAP-88 table, which is then placed on a satellite image of the affected area. According to the modelling, no area outside of LANL property received a dose greater than 0.027 mrem throughout the year.

Isotope	Chemical Notation	Use
Actinium-225	225Ac	Targeted alpha therapy for cancer treatment
Americium-241	241Am	Smoke detector and underground drilling
Sodium-22	22Na	Source for positron emission tomography (PET) scans typically used for identifying tumors
Arsenic-73	73As	Environmental research such as ensuring that drinking water is not contaminated with arsenic

This new visualization helps provide the public with a clearer understanding of the emissions from this particular facility and how low it is in reality.

– Kris Hyatt of the Rad-NESHAP program



CAP-88 visualization for the LANSCE Facility. The minimum shown in the color key (blue) is 0.0001 mrem and the maximum (red) is 1 mrem.

Allison Cunningham

Hometown: Los Alamos, NM
School: Colorado State University
Major: BS in Ecosystem Science and Sustainability
Favorite animal: Otters!

I have gained a ridiculous amount of knowledge in forestry in my position at the Lab. There are numerous different datasets that must be collected to ensure the forests are healthy and that we're doing a good job to restore them to a healthy state! My degree was in ecosystem science, so I learned a bit about various different ecosystems. Forestry was always my favorite, so it's nice to have a position where I can delve into it more. I believe I'm already helping the New Mexico community by gaining knowledge on healthy forests and working to prevent large and intense fires from burning through towns.

Alberto Hernandez Luna

Hometown: Dallas, TX
School: Texas A&M University
Major: Nuclear Engineering
Favorite animal: Bear

One thing I have learned at the Lab is that you should always ask questions and be prepared to learn at all times. It is always better to be prepared and to not need the information than to need the information and not be prepared.

Ashlyn T Lovato

Hometown: Santa Clara Pueblo, NM
School: Brown University
Major: BA: Linguistic Anthropology, MA: American Studies
Favorite animals: Sharks, Sloths, and Sphynx cats

I wish to help the New Mexico community by being transparent about the environmental and cultural impacts that have occurred in the past and have had effects on my people and other Pueblo, Hispanic, and Mexican communities for generations. In order to be good environmental stewards, relationships with local minority communities are crucial to the health and wellbeing of New Mexicans to thrive.

Hanna Mora

Hometown: Las Vegas, NM
School: New Mexico Highlands University
Major: Wildlife Biology and Conservation
Favorite animal: Cows

My internship at the Lab connects with my academic studies as it has provided me with a better understanding of what working in biological resources and soil foodstuffs and biota entails. It has also given me the opportunity to get hands-on field experience that is unique to the Lab. I hope to take the experience I have gained and use it as motivation to continue to seek out knowledge about the environment and wildlife as I pursue a degree in Wildlife Biology.

Hunter Swavely

Hometown: Los Alamos, NM
School: Texas A&M University
Major: Public Health with a Biology minor
Favorite animal: Orca

One thing I've learned at the Lab during my time here is the importance of solid communication, especially in a team environment. Communication is a skill applicable to many different facets of my life, including my personal relationships, studies at Texas A&M, and my professional career. I've learned that communicating effectively with the team I have here at the Lab leads to success and an increased understanding of what productive teamwork looks like. Building my communication skills has led to personal growth here at Los Alamos that will translate into all of my future relationships with those around me.

Jacob Martinez

Hometown: Española, NM
School: New Mexico State University
Major: Wildlife Science
Favorite animal: Hoary bat

Growing up in New Mexico, it is easy to grow a deep appreciation of nature from the beautiful landscapes that this state has to offer. It is more difficult, however, to recognize the numerous threats that our environment faces. While working at the Laboratory, I have witnessed the many ways that this organization is tackling environmental issues. This has opened my eyes to how fragile our ecosystems are and how important it is to prevent catastrophic and irreversible change to our environment. This has also motivated me to inspire local communities to fight for sustainable environmental policies through outreach and education.

Kaia Bigej-Nunley

Hometown: Albuquerque, NM
School: University of Denver
Major: Ecology and Biodiversity and Spanish
Favorite animal: Polar bear

At the Lab, Kaia is looking forward to learning more about land management, especially how it interacts with the crucial ecological component of wildfire in a world of critical climate change. She hopes to take this knowledge gained at the Lab in order to apply it to her passion for preserving the human natural environment, safeguarding biodiversity, promoting sustainability, and the maintenance of ecosystem health and resilience.

Keenan Greywolf

Hometown: Taos, New Mexico
School: University of New Mexico
Major: English Studies
Favorite animal: Raccoons

The Lab has provided me with valuable experience and skills, not only in my field, but for the workplace at large. Working at the Lab has prepared me for my future in the workforce in a way that few other places have been able to. Here at LANL, I have gained invaluable insights into exactly what to expect in my future career. Working alongside professionals in my field daily is an extremely rewarding and unique experience that has not been lost on me.

Kyla Fugate

Hometown: Alamogordo, NM
School: University of Montana
Major: MS Environmental Studies
Favorite animal: Tiger

As a student on the NEPA team, I help to analyze and evaluate potential environmental impacts for projects and operations at the Lab. I have also been fortunate to work with other programs at the Lab that have allowed me to explore my passions in environmental stewardship. As I begin my studies at the University of Montana this fall, I plan to utilize my experience at the Lab to further explore my passions in environmental justice and policy.

Madeline Tapia

Hometown: Los Alamos, NM
School: Northern Arizona University
Major: BS in Environmental and Sustainability

My time at The Lab over the past year has opened my eyes to the many different operations of the EPC division, especially with the Environmental Stewardship group. I am very fortunate to have learned a great amount of information about cultural resources and archaeology, forest health, pollinators, wildlife, and sustainability efforts at LANL. I am excited to share this information with Bradbury Science Museum so others can learn about the amazing and important environmental initiatives at LANL.

Mariah Gonzales

Hometown: Abiquiu, NM
School: Northern Arizona University
Major: English and Political Science
Favorite animal: Black-billed magpie

Through my experience at the Lab I have learned about the ancestral history of the Los Alamos area. It has been incredibly interesting to be a part of the team working to preserve and protect these cultural resources.

Noelle Mason

Hometown: Castle Rock, CO
School: Colorado State University
Major: Fish, Wildlife & Conservation Biology
Favorite animal: Black-footed ferret

I am so excited to put all of the skills and knowledge I learned at Colorado State University into practice. My studies in wildlife and conservation have equipped me to help LANL to understand and minimize its impact on the plants and wildlife that we share the landscape with. I am learning so much as a post-bac student and enjoy the variety of wildlife experiences I have at the Lab!

Rachel Greenwood

Hometown: Los Alamos, NM
School: Northwest Nazarene University (undergraduate), Colorado State University (masters)
Major: Ecology/Biodiversity, Masters in Natural Resource Stewardship
Favorite animal: Cats

As part of my work with the NEPA team, I help ensure that the Lab's natural and cultural resources are protected while also ensuring the Lab can expand its mission as needed. This particular form of stewardship is at the heart of the master's program I'll be starting this fall. My work at the Lab, especially as it relates to resource stewardship, has given me a solid knowledge base in anticipation of my studies, and has helped me narrow down the direction I would like to take my career.

Sonya Quintana

Hometown: Pojoaque, NM
School: University of New Mexico
Major: Biology
Favorite animal: Grizzly bear

There are so many things that I have learned throughout my time here at the Lab, but the one thing that I've learned the most is how important everybody's job is. When I first started working here, I was shocked by how many departments and groups there were, and everybody plays a key role in keeping the Laboratory up and running. I feel so honored to be able to be a part of a great organization. I will take all the lessons that I have learned here use them in the coming years!

Zach Jones

Hometown: Los Alamos, NM
School: New Mexico State University
Major: Geography
Favorite animal: Moose

The Laboratory's SFB program has given me the opportunity to help monitor the ecosystems around the Lab this summer. Through wildlife research, I have been able to learn about how human activity has affected the soil, plants, and animals in our area. At NMSU, I have studied different biomes and how they thrive. This summer I was able to connect those studies with the environment through hands-on field work. The Lab has been a great way for me to gain an understanding of the different careers in my area of interest.

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