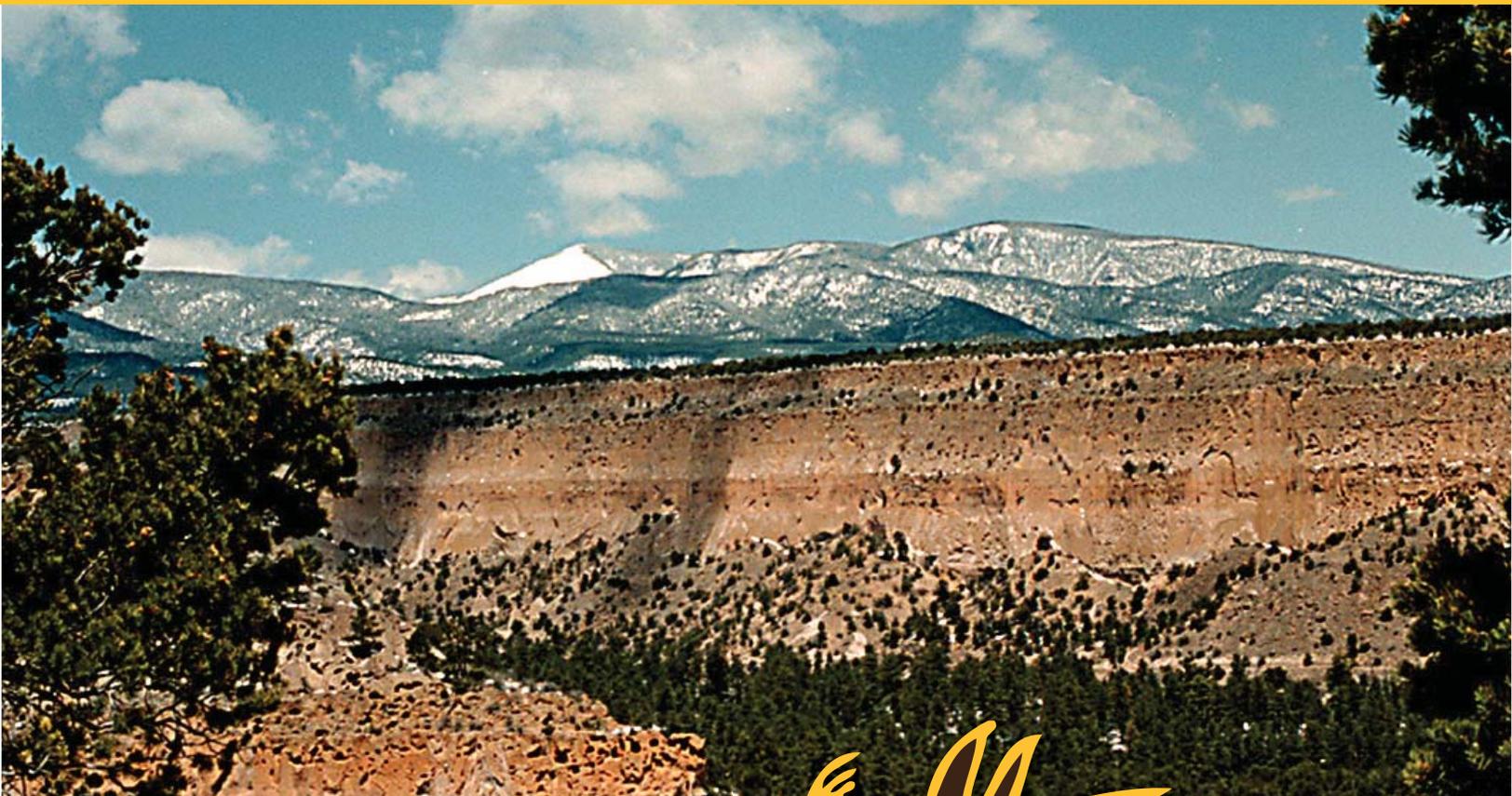


# Los Alamos National Laboratory Environmental Report 2012 *Summary*



LA-UR-13-26789

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## Los Alamos National Laboratory Commitment to 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.



Abert's squirrel (*Sciurus aberti*) in Los Alamos



Male mule deer (*Odocoileus hemionus*) in Los Alamos



Three Cooper's Hawk (*Accipiter cooperii*) chicks in White Rock

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# Contents

The Laboratory's commitment to environmental stewardship .....	2
Your neighbor on the Pajarito Plateau .....	2
The history of the Pajarito Plateau .....	3
What is the Laboratory's mission today? .....	3
Protecting human health and the environment.....	4
Monitoring weather and climate change.....	6
Woodland ecosystems suffer from rising temperatures .....	7
Fire occurrence in the Jemez Mountains .....	8
Aerial survey of radioactivity found no changes as a result of fires.....	9
Radiation is a part of life .....	10
Protecting the quality of air .....	13
Monitoring surface water for Laboratory impacts .....	16
Does the Laboratory impact the Rio Grande? .....	17
Defenses in depth: Watershed management for sediment capture .....	19
Protecting our aquifer .....	20
Checking food for safety.....	23
Does the Laboratory impact plants or animals? .....	24
Special monitoring for special populations .....	25
Why do we monitor soil? .....	26
What is dose?.....	28
Environmental remediation programs.....	31
What is the Laboratory's long-term strategy for the environment?.....	32
A message from the students.....	33

This report is a summary version of the Los Alamos National Laboratory Environmental Report 2012 and is compiled by students working at the Laboratory. The full report is available on the web at <http://permalink.lanl.gov/object/tr?what=info:lanl-repo/epr/ERID-250040>.



Mexican Spotted Owl (*Strix occidentalis lucida*)

## The Laboratory's commitment to environmental stewardship

Los Alamos National Laboratory (the Laboratory) is committed not only to excellence in science and technology but also to completing all work in an environmentally responsible manner. Every year, the Laboratory produces an environmental report in compliance with a U.S. Department of Energy (DOE) order. This report informs the public of the Laboratory's commitment to excellence in environmental stewardship by

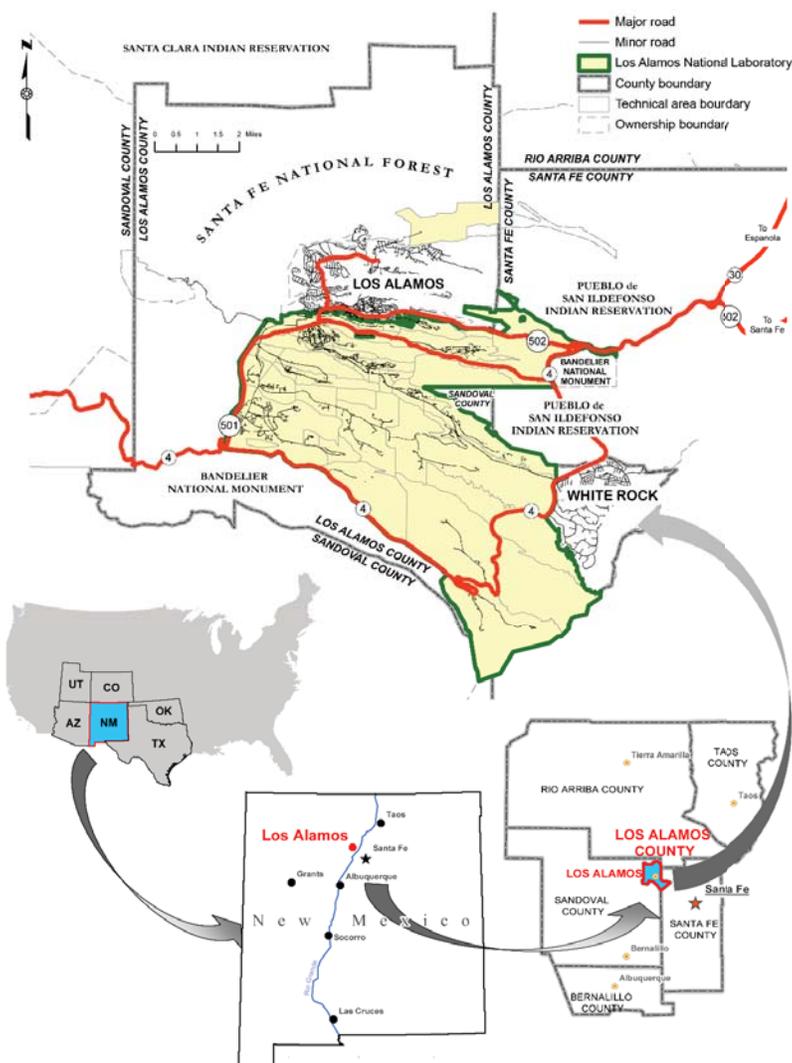
- characterizing site environmental management performance, including effluent releases, environmental monitoring, and estimated radiological doses to the public from releases of radioactive materials;
- summarizing environmental occurrences and responses reported during the calendar year;
- confirming compliance with environmental standards and requirements; and
- highlighting significant programs and efforts, including environmental performance indicators and measures.

## Your neighbor on the Pajarito Plateau

The Laboratory is located in Los Alamos County, in north-central New Mexico. The 36-square-mile Laboratory is situated on the Pajarito Plateau, which is approximately 25 miles northwest of Santa Fe. The plateau, surrounded by the Sangre de Cristo Mountains to the east and the Jemez Mountains to the west, consists of a series of finger-like mesas separated by deep east-to-west-oriented canyons cut by streams. The surrounding land is largely undeveloped with the exception of the communities of Los Alamos, White Rock, and the Pueblo de San Ildefonso.



Pueblo Canyon, looking west



Regional location of Los Alamos National Laboratory

# The history of the Pajarito Plateau

The Pajarito Plateau formed as the result of a pair of volcanic eruptions from the Valles Caldera that occurred 1.4 million and 1.1 million years ago. Paleoindians used the plateau as an occasional hunting ground approximately 10,000 years ago; much more recently, from the 1150s to 1600s, the plateau was home to ancestral puebloans who are believed to have abandoned the area because of drought. There is little mention of the plateau during the Spanish Colonial period, though it was likely used for seasonal grazing. In 1742, the viceroy of Spain granted a portion of the plateau to Pedro Sanchez, which would later come to be known as the Ramón Vigil Grant. Activity on the remaining portion of the plateau followed a little more than 100 years later, after the annexation of New Mexico in 1846.

In 1887, the “Chili Line” of the Denver and Rio Grande Western Railroad was built, and the homesteading era began. Hispanics already grazing cattle on the plateau laid claim to land by staking out farms and building one-room cabins.

In 1917, a businessman from Detroit named Ashley Pond started the Los Alamos Ranch School. The school aimed to help sickly boys regain their health by participating in outdoor activity away from the pollution of urban areas. The boys spent time building trails, hunting, hiking, horseback riding, and in the winter, skiing. The school was successful in educating more than 600 boys, but the days of the Ranch School came to a close abruptly in December of 1942 when students and faculty received a letter informing them that the U.S. Army would be taking over the school’s property. A special schedule was set up so that the boys could complete the school year by February.

By March of 1943, a small group of scientists had moved to Los Alamos for Project Y of the Manhattan Project. Their main objective was to develop the world’s first nuclear weapon. It was originally expected the task would require only 100 scientists, but by 1945 more than 6000 civilian and military personnel were living and working in Los Alamos. In 1947, Los Alamos Scientific Laboratory was established, which in turn became Los Alamos National Laboratory in 1981.

## What is the Laboratory’s mission today?

With changes in technologies, priorities, and the global community, the Laboratory’s original mission to design, develop, and test nuclear weapons has broadened. Today, the Laboratory’s mission is to develop and apply science and technology to

- ensure the safety and reliability of the United States’ nuclear deterrent,
- reduce global threats, and
- foster energy security by developing clean, sustainable energy sources.

Inseparable from the Laboratory’s commitment to excellence in science and technology is its commitment to environmental stewardship and full compliance with environmental protection laws.



Coalition pottery



Cavates with roof beam holes



Romero relatives at Romero Cabin



A homestead in Los Alamos



Ranch School students in front of the Big House



Manhattan-era facilities located near Ashley Pond

# Protecting human health and the environment

## Compliance comes first

Clean Air	Clean Water	Waste	Stewardship
<b>Compliance: Regulations, Permits, and Programs</b>			
<ul style="list-style-type: none"> <li>Title V Operating Permit</li> <li>Construction Permits</li> <li>Stratospheric Ozone Protection</li> <li>Asbestos Notifications</li> <li>Greenhouse Gas Reporting</li> <li>Emergency Planning and Community Right-to-Know Act Reporting</li> <li>New Mexico Administrative Code Operating Permit</li> <li>Rad-NESHAP</li> <li>Air-Monitoring Network</li> <li>Meteorology</li> </ul>	<ul style="list-style-type: none"> <li>Individual Permit for Storm Water</li> <li>National Pollutant Discharge Elimination System</li> <li>Pesticide Control</li> <li>Water Quality Control Commission</li> <li>Spill Prevention and Aboveground Storage Tanks</li> <li>Dredge and Fill Permits</li> <li>Groundwater Protection under Compliance Order on Consent</li> <li>Waste Water Treatment</li> <li>Cooling Tower Discharges</li> </ul>	<ul style="list-style-type: none"> <li>RCRA Compliance</li> <li>Treatment Storage and Disposal Facilities</li> <li>Chemical and Physical Treatment</li> <li>Open Burning and Open Detonation of Waste</li> <li>Hazardous Waste Facility Permit</li> <li>RCRA Corrective Actions and Closures</li> <li>Compliance Order on Consent</li> <li>Toxic Substances Control Act Compliance</li> </ul>	<ul style="list-style-type: none"> <li>NRDA</li> <li>Biological Resource Management</li> <li>Endangered Species Act</li> <li>Migratory Bird Treaty Act</li> <li>Antiquities Act</li> <li>National Historic Preservation Act</li> <li>Native American Graves Protection and Repatriation Act</li> <li>Environmental Health Reporting</li> <li>Radiation Protection</li> <li>Dose Assessment</li> <li>Land Transfer</li> <li>Environmental Management System</li> <li>NEPA Compliance</li> </ul>

Rad-NESHAP = Radionuclide National Emission Standards for Hazardous Air Pollutants;  
 RCRA = Resource Conservation and Recovery Act; NRDA = Natural Resource Damage Assessment;  
 NEPA = National Environmental Policy Act.



## Keeping environmental impacts as low as reasonably achievable (ALARA)

To prevent or lower risk of harm:

1. We remove or lower the amount of a contaminant or its concentration from the source by disposing of it off-site or by stopping production or use of the material.
2. We contain the source permanently or block the pathway by which a person, plant, or animal can be exposed.

Although relocating the person, animal, or plant is an option, we do not use this method.



A Laboratory storm water expert explains storm water controls to the public

## Accomplishing sustainability through fulfilling national goals

1. We conserve energy through reducing greenhouse gas emissions.
2. We use high-performance sustainable buildings that
  - reduce energy intensity,
  - contain evaluated water and energy systems,
  - have metering installed,
  - are retrofitted for cool roofs, and
  - use renewable electrical sources.
3. We are greening transportation and fleet management by
  - increasing the use of alternative fuel and vehicles,
  - reducing the use of petroleum, and
  - reducing fleet size.
4. We are efficiently using and managing water and have the goal of diverting 50% of nonhazardous waste and construction and demolition debris by 2015.
5. We support green purchasing, which means buying products created from recycled materials or that cause the lowest possible environmental impact.
6. We monitor data centers and install efficient systems.
7. We encourage science to serve sustainability through innovation and community involvement.

Sustainability

Community Connection

### How to learn more and contact us

The Laboratory works to increase public knowledge of environmental stewardship status and practices, to inform the public of the progress in our work toward solving the Environmental Grand Challenges, and to apply stakeholder input to influence environmental stewardship decisions. We value and use your feedback, so please use the resources listed below and contact us.

- Visit the Laboratory's environmental website: [www.lanl.gov/environment](http://www.lanl.gov/environment) and sign up for e-mail notification
- Explore the Long-Term Strategy for Environmental Stewardship and Sustainability: [www.lanl.gov/projects/envplan](http://www.lanl.gov/projects/envplan)
- Visit the electronic Public Reading Room: <http://epr.lanl.gov>
- Visit the print Public Reading Room:  
94 Cities of Gold Road, Pojoaque, NM
- Call the Environmental Outreach Office: 505-667-0216
- E-mail the Environmental Outreach Office: [envoutreach@lanl.gov](mailto:envoutreach@lanl.gov)
- Write us: Environmental Outreach  
Los Alamos National Laboratory  
P.O. Box 1663, MS M996  
Los Alamos, NM 87545
- View all sampling data from the Laboratory: [www.intellusNMdata.com](http://www.intellusNMdata.com)



The public, Laboratory experts, and regional managers discuss the use of hiking trails on Laboratory property

# Monitoring weather and climate change



One of the Laboratory's meteorological monitoring towers

Meteorological data is essential to many Laboratory activities, such as emergency management and response and environmental surveillance programs. The Laboratory's meteorological monitoring program measures a wide variety of meteorological variables, including wind, temperature, pressure, relative humidity and dew point, precipitation, and solar and terrestrial radiation.

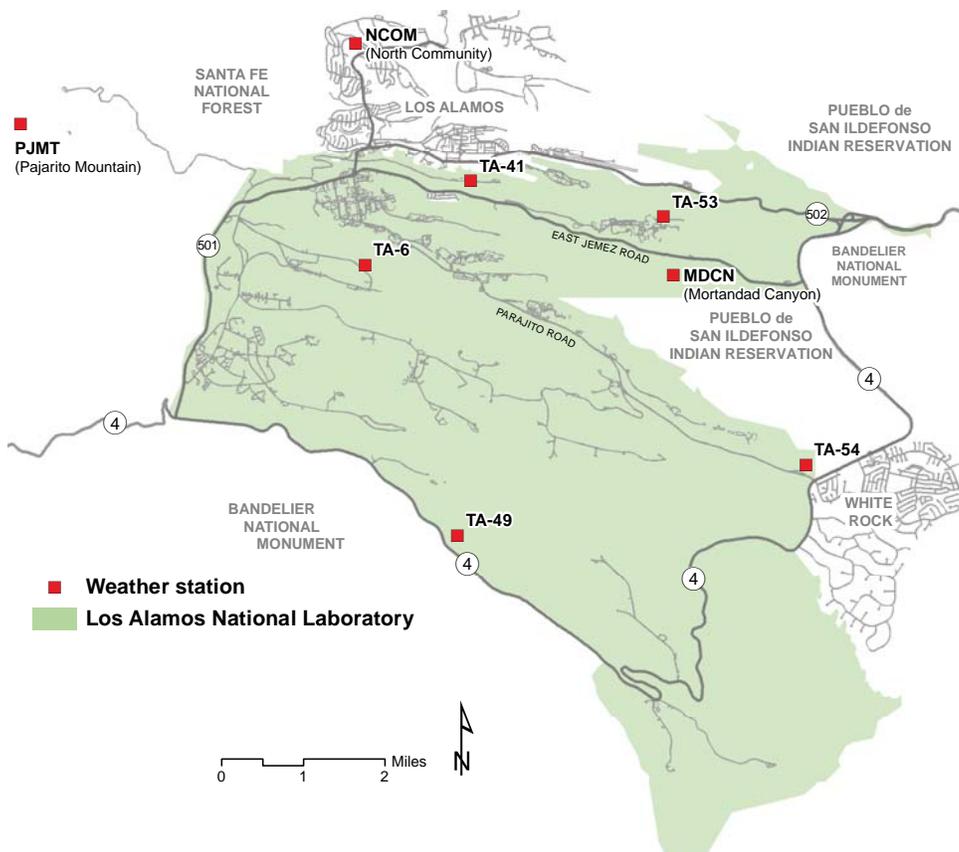
## The most dense meteorological monitoring network in New Mexico

The Laboratory uses a network of seven stations to gather meteorological data. Four of the stations are located on the tops of mesas, two are in canyons, and one is located on the top of Pajarito Mountain. The meteorological stations are located in areas with good exposure to the elements, usually in open fields.

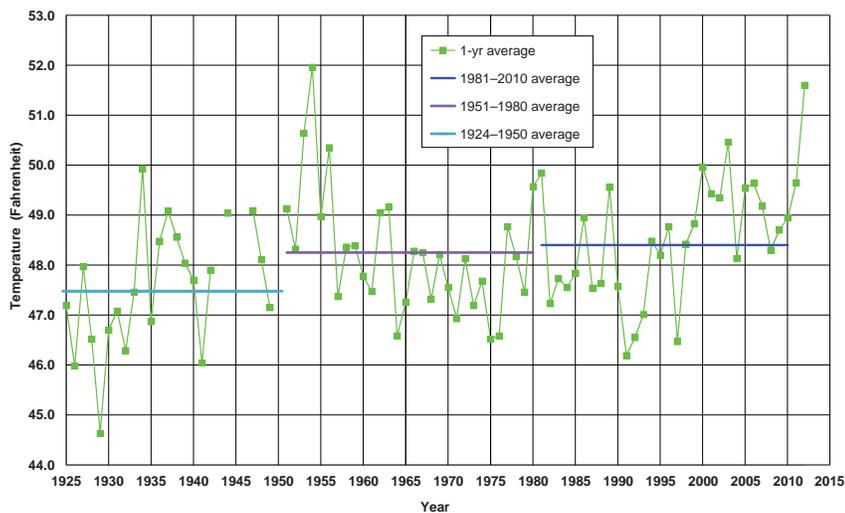
## 2012: Another hot, dry year

In Los Alamos County, 2012 was the second warmest and second driest year on record. The warmest year was 1954 and the driest year was 1956. Five-year averaging shows that the warm spell during the past decade is nearly as extreme as the early-to-mid 1950s and longer lived.

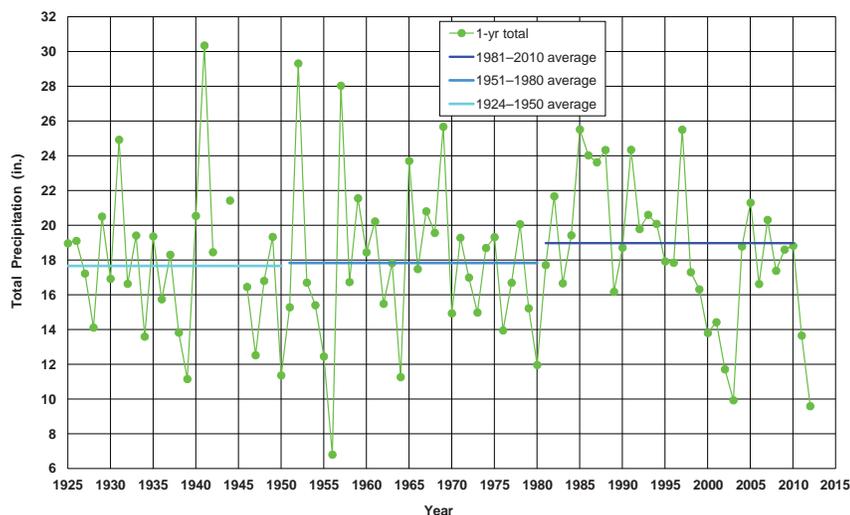
Below-average precipitation was recorded for every month in 2012. The summer monsoon, which typically produces 40% of annual Los Alamos precipitation, was located over Arizona and Nevada during much of the summer. Thus, the summertime rainfall was 48% of normal.



Locations of meteorological monitoring towers and rain gauges



Temperature history for Los Alamos



Total precipitation history for Los Alamos

## Woodland ecosystems suffer from rising temperatures

The current U.S. drought, along with high temperatures, has resulted in an accelerated rate of tree mortality that spans a variety of elevations, species, and sizes. Scientific and government agencies report that temperatures are expected to increase by 1.1°C to 6.4°C by the end of the century.

Changes in the climate are likely because of rising carbon dioxide (CO<sub>2</sub>) levels in the atmosphere, and although living trees take up CO<sub>2</sub> as part of photosynthesis, dying trees release CO<sub>2</sub> back into the atmosphere, further accelerating global warming.

The increased mortality rate of trees will also negatively impact, if not destroy, woodland ecosystems in many locations because the disappearance of trees will result in the loss of habitat for various animals.

The SUMO (SURvival MOrtality experiment) site at the Laboratory consists of 80 trees, primarily piñon and juniper, many of which are contained in enclosures that allow scientists to manipulate the temperatures of the trees' habitats. A large drought plot was also installed at the site, giving scientists the capability to remove nearly half of the natural precipitation. The site allows Laboratory scientists to study the impacts of heat and drought on trees, as well as simulate future conditions to better understand the effects rising temperatures and prolonged drought will have on the environment.

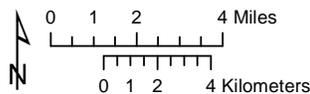
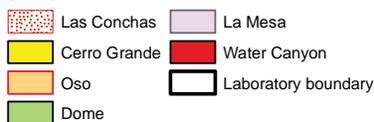
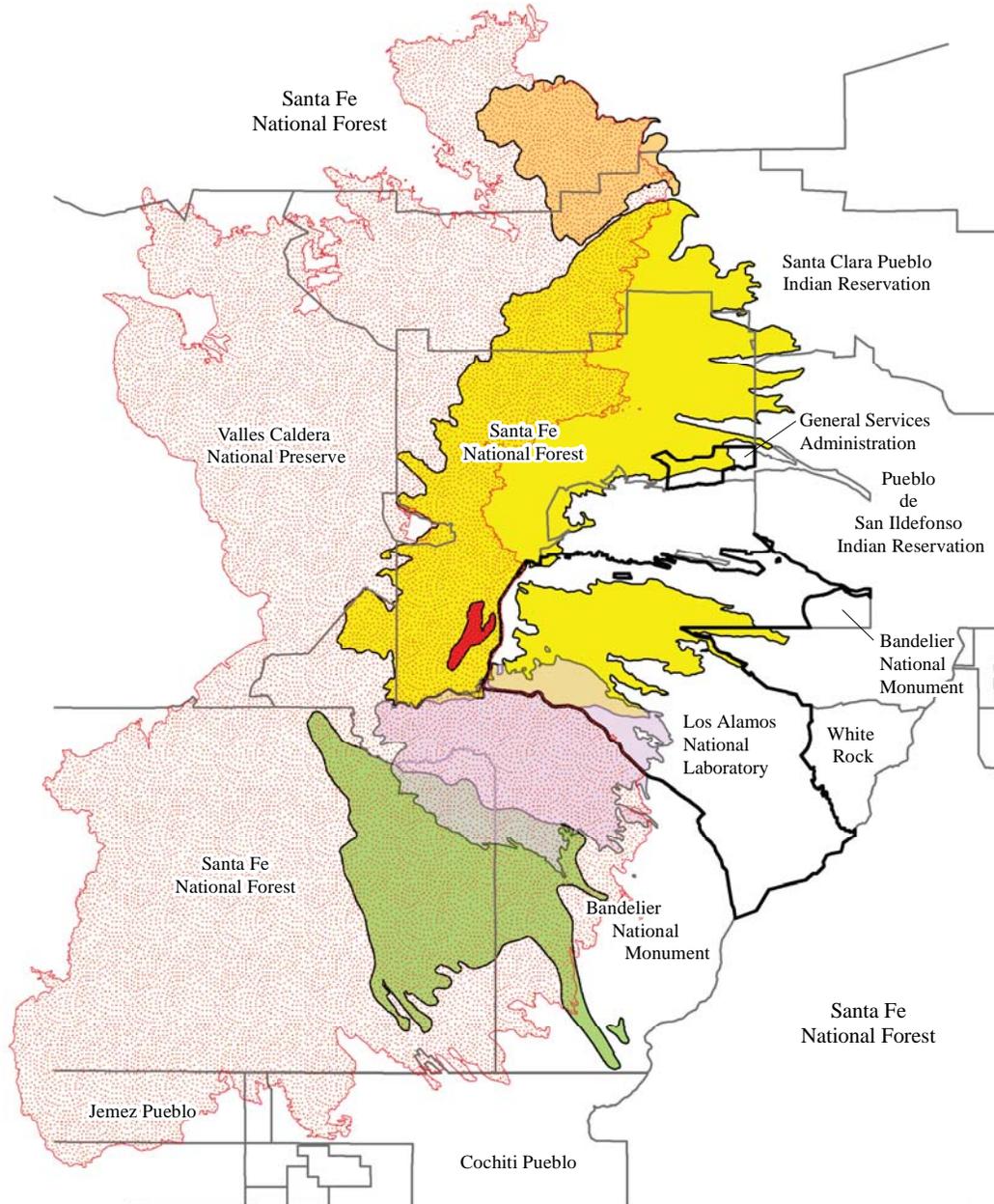
**2012 was the second warmest and second driest year on record in Los Alamos County**



Enclosed in an acrylic chamber, a piñon tree and a juniper tree at the Los Alamos SUMO field site are introduced to increased temperature and decreased water to simulate the effects of climate change and determine how trees die.

# Fire occurrence in the Jemez Mountains

	Date of Origin	Ignition Source	Total Acres	Laboratory Acres
Water Canyon Fire	June 5, 1954	Burning trash/debris	3000–6000	0
La Mesa Fire	June 16, 1977	Human-caused	15,444	2730
Dome Fire	April 26, 1996	Improperly extinguished campfire	16,516	0
Oso Fire	June 20, 1998	Arson	5185	0
Cerro Grande Fire	May 5, 2000	Controlled burn	43,000	7500
Las Conchas Fire	June 26, 2011	Power line	156,593	1 to 2
Thompson Ridge Fire	May 31, 2013	Power line	23,965	0



Note: The Thompson Ridge Fire is not shown because it occurred over an area too far west.

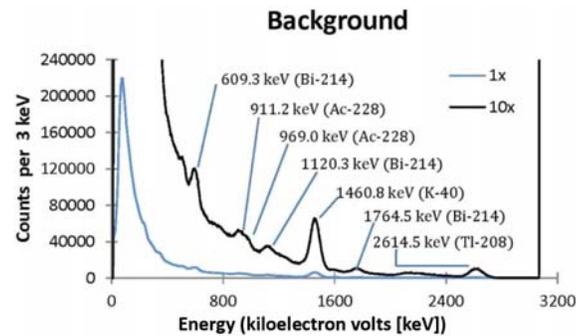
Approximately every 10 years, this ecosystem endures a major forest fire.

# Aerial survey of radioactivity found no changes as a result of fires

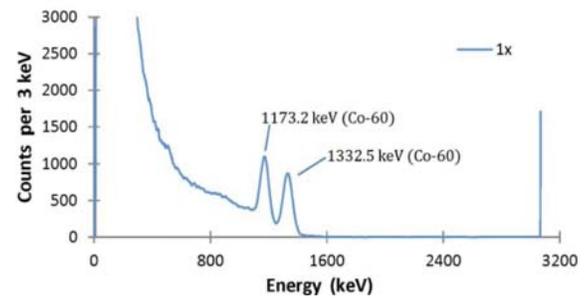
During August 2011 and June 2012, the DOE Los Alamos Field Office commissioned an aerial radiological survey of the Laboratory and the surrounding communities using a large array of helicopter-mounted gamma-ray detectors.

The objectives were to support the Laboratory's long-term environmental stewardship endeavor, to compare with a previous aerial survey taken in 1994, and to look for changes that might have resulted from the Cerro Grande and Las Conchas Fires. No changes from the Cerro Grande and Las Conchas Fires were found.

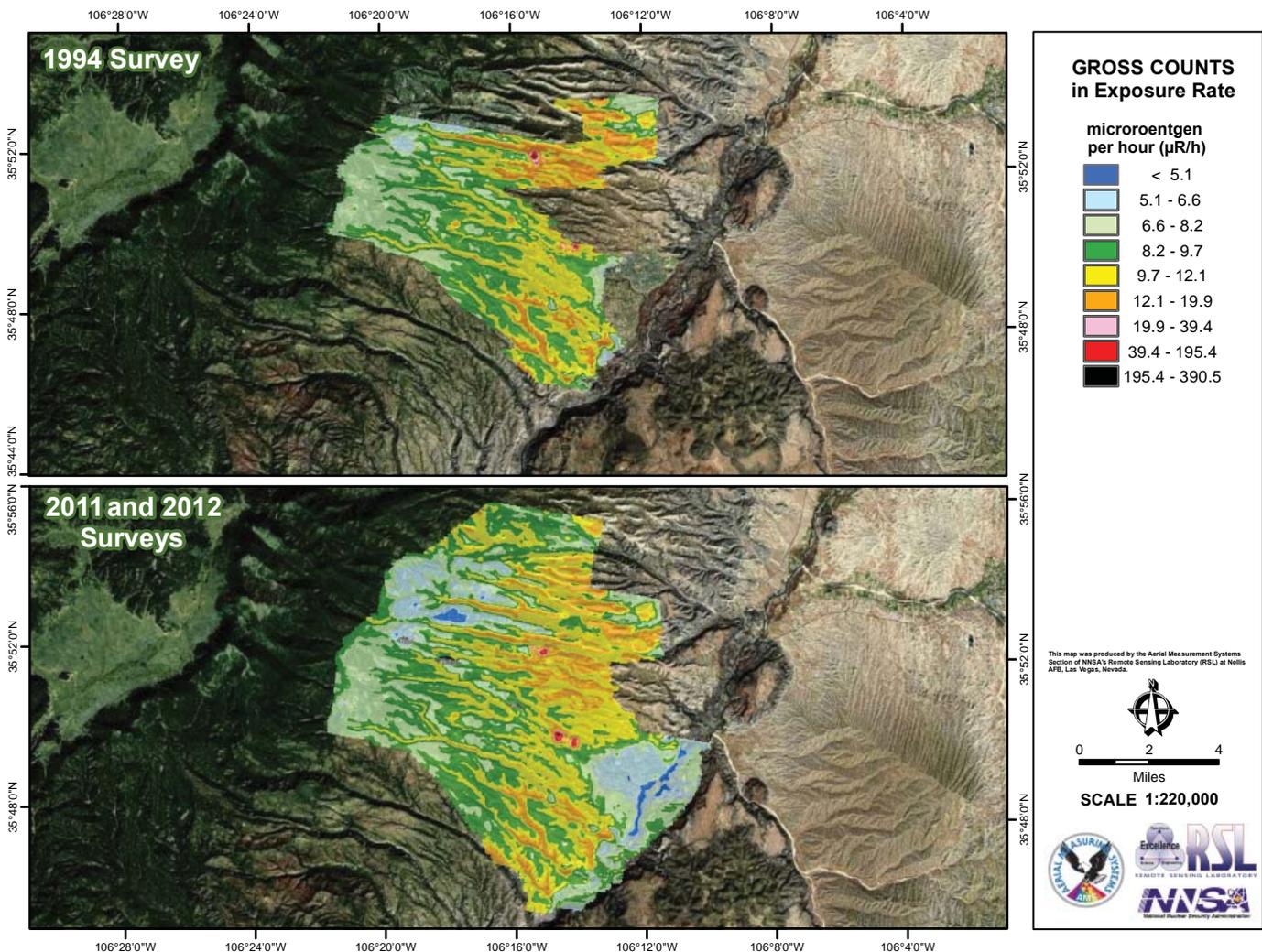
Over almost the entire Laboratory, the results showed only naturally occurring radioactivity. As expected, man-made radioactivity was detected in areas of the Laboratory where known radioactive sources are present, such as Area G and the Los Alamos Neutron Science Center (LANSCE).



Background spectrum showing naturally occurring radionuclides



Spectrum from LANSCE showing the typical peaks from cobalt-60



Comparison of the 1994 and 2011/2012 surveys

# Radiation is a part of life

## What is "radiation?"

Radiation is the transfer of energy through space. The radiation of interest is ionizing radiation and is in the form of alpha particles, beta particles, gamma photons, and neutrons. It is measured in units of millirem (mrem).

Radiation dose is also measured in mrem. Dose is a measure of the potential risk or harm. Risk or harm is caused by the energy transferred from a radioactive atom to a person, animal, or plant. "Direct-penetrating radiation" is direct because it is the energy of the radiation that directly causes dose, risk, or harm.

## Does all radiation penetrate?

Alpha particles will not penetrate the skin, so they can only do harm if the radioactive material is inside you. Plutonium is an example of a radioactive material that emits alpha particles.

Beta particles will not penetrate more than 7 meters of air, so they can only do harm if the source is close. Tritium is an example of a radioactive material that emits beta particles.

Gamma photons and neutrons, which are emitted from LANSCE and are examples of direct-penetrating radiation, can penetrate more than 100 meters of air. Cobalt-60 is an example of a radioactive material that emits gamma photons.

### Background Radiation

Radioactivity has been present all around us, as well as inside of us, since the formation of the Earth. Each day we receive a radiation dose from various sources, which include the following:

- Potassium—Natural radioactivity. Potassium is essential to every living cell and is found in all natural foods.
- Cosmic Rays—Radiation from space that has been present since the beginning of the universe. Cosmic rays offer insight into the science behind cosmological processes.
- Radon—A natural, radioactive gas that diffuses out of soil
- Global Fallout—Radioactive material dispersed into the atmosphere as the result of nuclear weapons testing from the 1940s to the 1960s
- Medical and Dental Radiation—Radiation dose from medical and dental x-rays, which is increasing because of advances in diagnostics

### Radiation and Radioactive Material

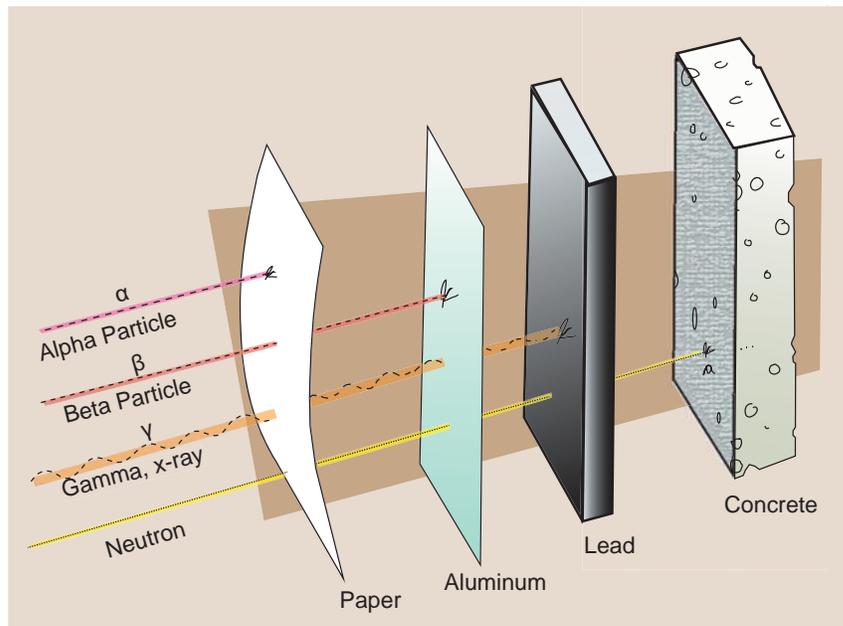


Sun = **radioactive material/source**

Sun rays = **radiation**

Person on the beach = **receptor**

Sunburn on skin = **dose**



Radiation has varying energies and travels different distances.

## Why do we monitor direct-penetrating radiation?

There are known sources of radiation near Los Alamos. In addition to radiation from natural background sources, there is radiation from current and past operations at locations such as Area G and LANSCE. To ensure the public is protected from these sources, the Laboratory monitors gamma photons and neutrons in the surrounding environment.

## How does the Laboratory monitor radiation?

To monitor gamma photons and neutrons, the Laboratory established the Direct-Penetrating Radiation Monitoring Network (DPRNET). DPRNET uses a series of detectors called thermoluminescent dosimeters (TLDs) to distinguish Laboratory radiation from natural radiation.

TLDs are placed at 98 locations around the Laboratory, near known sources of radiation, and are also worn by many employees. These are analyzed quarterly for dose measurements.

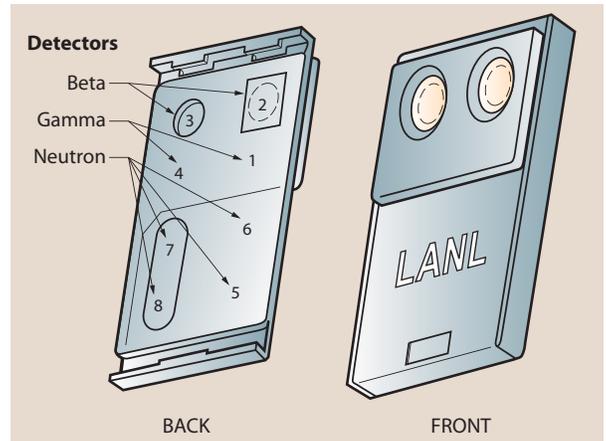
## Protecting our employees

Natural radiation is much higher than the radiation from the Laboratory and is quite variable. A TLD cannot distinguish between the small amount of Laboratory radiation and the large variations of natural radiation if the person is not close to the source of radiation. Depending on work locations and work activities, Laboratory employees may spend time near sources of high radiation that are inaccessible to the public. Such workers could expect to receive a dose from the Laboratory.

## Is this radiation from the Laboratory?

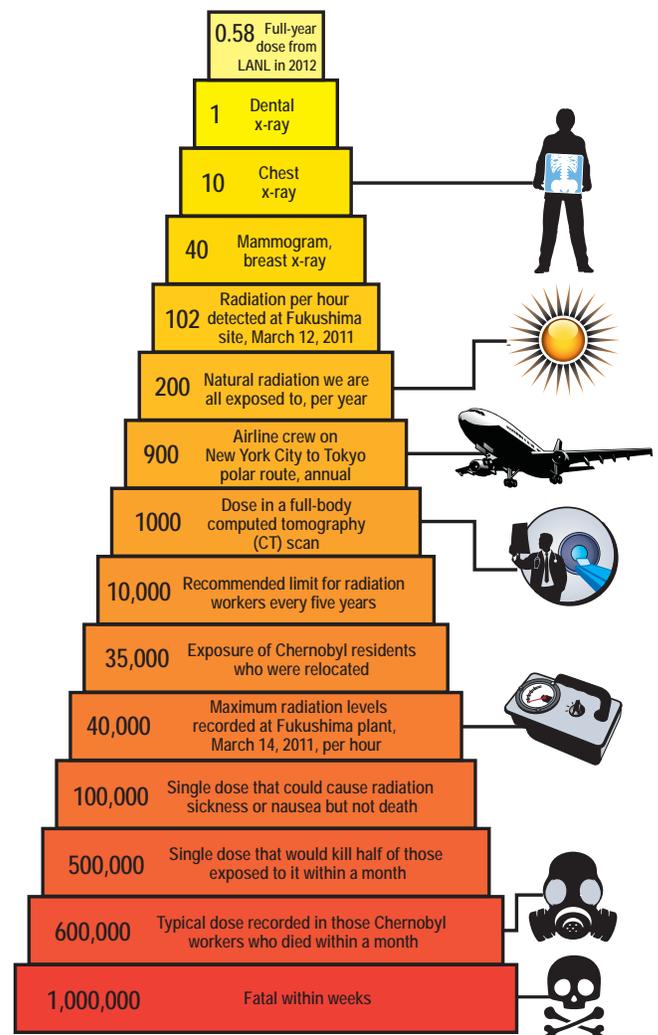
In the case of DPRNET, we measure the dose close to the source in addition to calculating the dose to the public. If the amount of radiation from the source is high, we can measure it at someone's location; if the amount is low, we can calculate the dose to a person.

Some Laboratory radiation is from radioactive material in the air, water, and other media. If we measure the amount of these materials, in units of picocuries (pCi), we can then calculate the amount of radiation, in units of mrem, that comes in contact with people, animals, or plants.

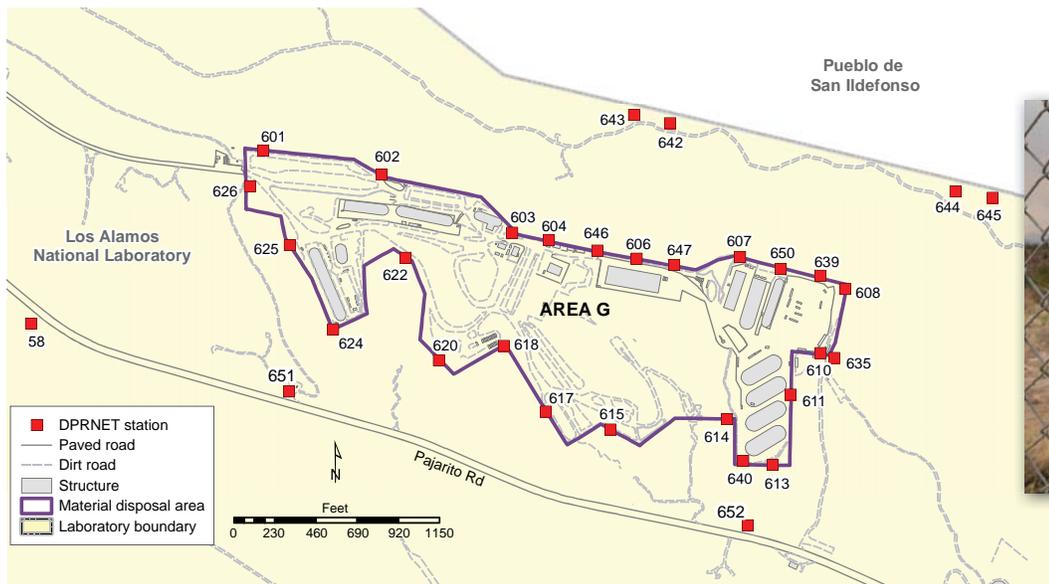


TLDs contain a total of eight detector chips.

- Two chips detect beta particles: one for high-energy beta particles and one for low-energy beta particles.
- Two chips detect gamma rays: one for high-energy gamma rays and one for low-energy gamma rays.
- Four chips detect neutrons: two for high-energy neutrons and two for low-energy neutrons.

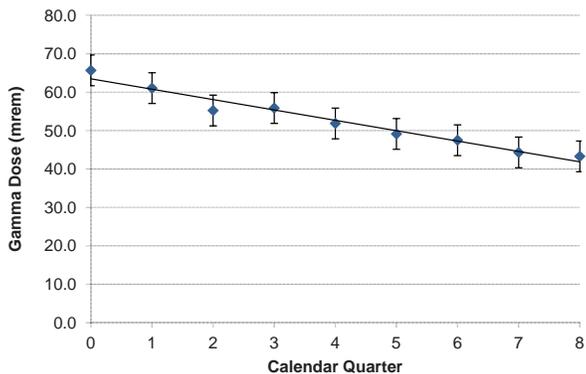


Breakdown of radiation doses (in mrem) and their effects

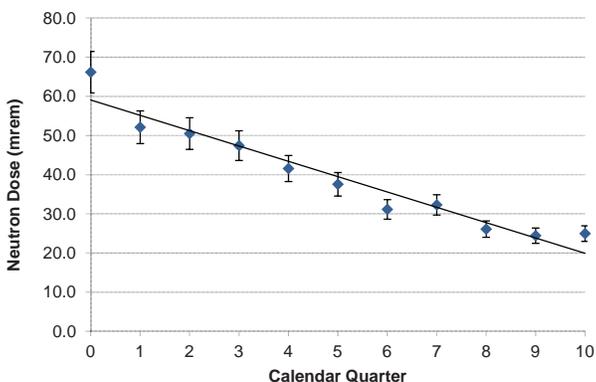


TLDs between Area G and Pueblo de San Ildefonso ensure no unacceptable dose reaches tribal lands.

TLD radiation monitoring stations surround Area G.



The figure shows the decreasing average quarterly gamma doses (mrem) around the perimeter of Area G for calendar quarters of 2011 (1–4) and 2012 (5–8). The first point is the average dose of the previous years.



The figure shows the decreasing average quarterly neutron doses (mrem) around the perimeter of Area G for the last two quarters of 2010 (1–2), the four quarters of 2011 (3–6), and the four quarters of 2012 (7–10). The first point is the average dose of the previous years.

## Reducing dose by shipping waste

Area G is the Laboratory's radioactive waste storage and shipping facility. Waste is categorized and then contained in pits or shafts or stored in drums. During 2012, the Laboratory shipped more than 920 cubic meters of transuranic (TRU) waste to the Waste Isolation Pilot Plant (WIPP) located east of Carlsbad, New Mexico, thus reducing the amount of radioactive material stored at Area G. As a result, the gamma and neutron dose rates around the perimeter of Area G decreased, as shown in the figures to the left.

## Dose reduced

For 2012, the maximum public dose from direct-penetrating radiation was 0.35 mrem/year, which is far below the DOE dose constraint of 25 mrem/year.



The Laboratory shipped over 920 cubic meters of TRU waste in 2012.

# Protecting the quality of air

Of the different monitoring that takes place at the Laboratory, air monitoring is the most significant. Air monitoring is of great importance because

- it is impossible to contain harmful material released in air,
- material released in air has the potential to move rapidly and to great distances, and
- once material is inhaled into the lungs, it is difficult to remove.

## How does the Laboratory monitor the air?

### Stack monitoring

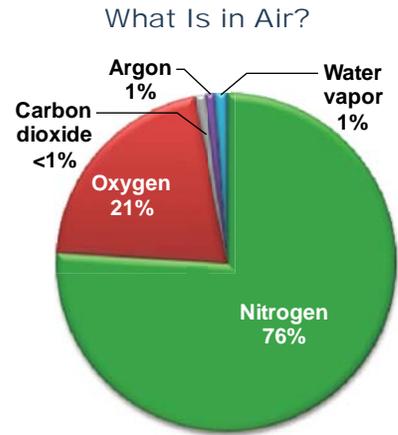
Stack monitoring measures the amount of radioactive material at the source of the emission (i.e., the stack) to calculate the dose at the location of the receptor).

The Laboratory monitors four different types of stack emissions:

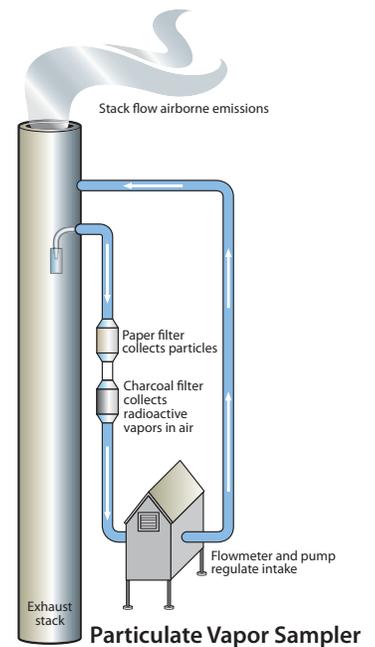
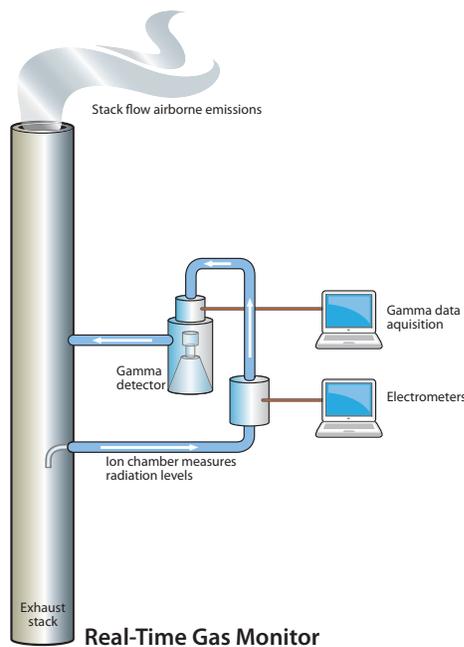
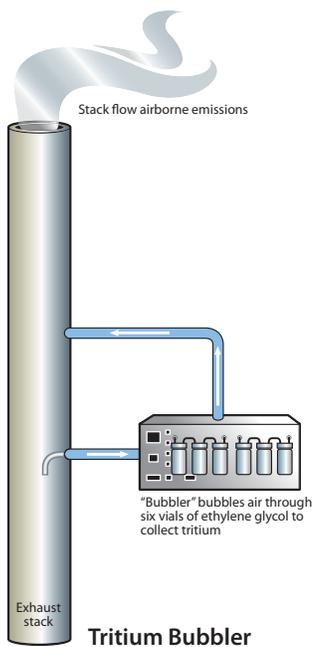
1. Particulate matter, such as plutonium and uranium particles
2. Radioactive vapors, such as iodine-131
3. Tritium, an isotope of hydrogen
4. Radioactive gases, such as oxygen-15, nitrogen-13, and carbon-11

Samples are taken from the air in the stack and analyzed, and a dose to the public is calculated.

Monitoring systems are selected based on the type of material in the stack.



Monitoring systems are maintained regularly for optimal functioning.

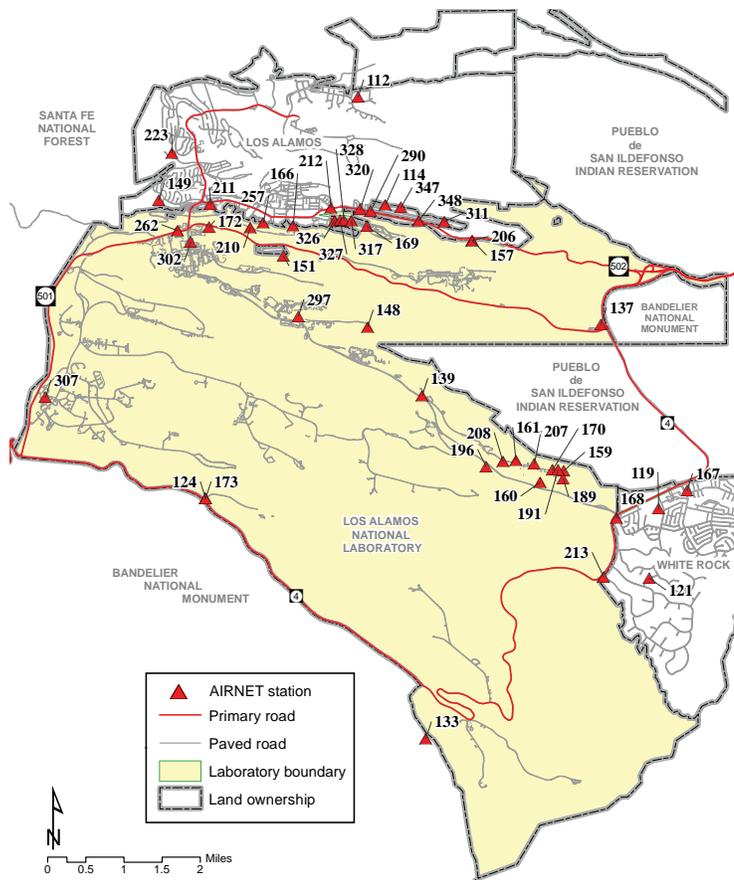


## Protecting those nearby and downwind

The Los Alamos townsite is downwind of the Laboratory, so many air-monitoring stations are located in and around the town. In 2012, the Laboratory operated 59 air-monitoring network (AIRNET) stations to sample for radionuclides. AIRNET stations monitor for 24 hours a day, 365 days a year.

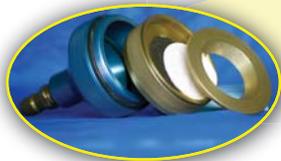
The monitoring stations take in air at 4 cubic feet per minute, which is approximately 10 times the rate at which humans breathe. Because the AIRNET stations are able to sample a large amount of air, the data the Laboratory produces are more accurate.

The Laboratory expects to produce certain materials based on those used at each facility. The materials used include tritium, americium, uranium, and plutonium. Tritium is collected in the form of water vapor, while americium, uranium, and plutonium are found in the air as particulate matter. The samples are collected and analyzed every two weeks for identification of analytes and assessment of the potential impact on the public.



The majority of air-monitoring stations are mounted on pickets between Laboratory operations and population centers.

## AIRNET stations monitor ambient air on-site and off-site



Polypropylene filters collect particulate matter; samples are collected every two weeks



Silica gel absorbs water vapor; samples are collected every two weeks and tested for tritium

How an AIRNET station works



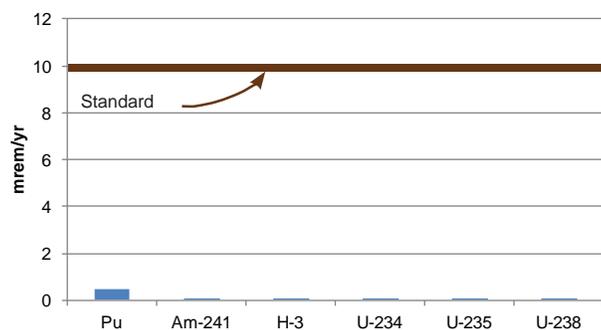
A worker checks the air flow of an AIRNET station.



AIRNET stations are a common sight around the Laboratory.

## Safe limits maintained

During 2012, the Laboratory detected no airborne radioactivity that exceeded the U.S. Environmental Protection Agency (EPA) standard of 10 mrem/year, with the largest dose to the public being 0.58 mrem. All tritium concentrations were far below EPA standards, with the highest activity occurring at a known source near Area G. Americium levels were similar to those in previous years and remained well below EPA standards. There was also no detection of enriched or depleted uranium in 2012. Plutonium levels (plutonium-239) were higher than usual because of work being done at the Material Disposal Area (MDA) B cleanup site, but remained below EPA standards.

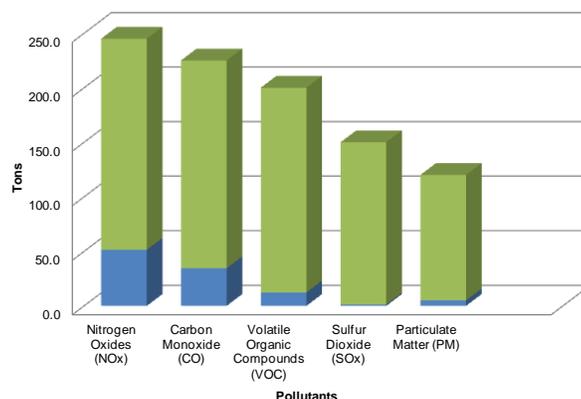


Largest public dose by analyte. For 2012, the total of 0.58 mrem was far below the 10-mrem/yr standard.

## Monitoring nonradiological materials

In compliance with the Clean Air Act, the Laboratory also monitors nonradiological pollutants, such as carbon monoxide (CO), sulfur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs), and particulate matter (PM).

- CO is the product of inefficient burning, such as from a motor vehicle.
- SO<sub>x</sub>, including sulfur dioxide, is the result of burning coal, which contains sulfur. When sulfur dioxide mixes with water, sulfurous acid is created. Sulfurous acid causes respiratory damage to humans and animals and damages the vegetation in the environment.
- NO<sub>x</sub>, including nitrogen dioxide, is the result of burning coal, oil, or gasoline at high temperatures. When nitrogen dioxide mixes with water, nitric acid is created. Nitric acid is harmful in similar ways to sulfurous acid.
- VOCs are chemical compounds that vaporize when they are exposed to the air. When VOCs evaporate, they are able to enter the lungs and cause damage. VOCs are produced by motor vehicles and many commonly used solvents.
- PM is a hazard to human health when the particle size becomes small enough to enter the lungs, for example, smoke.



2012 nonradionuclide air emissions (blue) compared with the permit limits (green)

## Far below health limits

Emissions of these pollutants from 2007 to 2012 are relatively constant and remain far below permit limits. Meeting the permit limits ensures that the Laboratory meets the EPA's National Ambient Air Quality Standards.

# Monitoring surface water for Laboratory impacts

## Types of Surface Water

**Base Flow**—Surface water flow other than from snow melt or a storm

**Snowmelt Runoff**—Surface water flow as the result of melting snow

**Storm Water Runoff**—Surface water flow as the result of rainfall, usually of concern because of the volume and timing of the precipitation event

The Laboratory monitors surface water, including storm water and canyon sediment, to

- evaluate the transport of legacy contamination,
- evaluate potential changes in dose as a result of the transport of contaminants,
- confirm that concentrations are not increasing because of ongoing operations, and
- evaluate the effectiveness of sediment transport mitigation in Los Alamos and Pueblo Canyons.

The flow of surface water on the Pajarito Plateau is limited, and no drinking water systems rely on surface water supplies, so it is not considered a drinking water source for humans. However, because wildlife may use surface waters within and around the Laboratory, standards are set for the protection of wildlife.

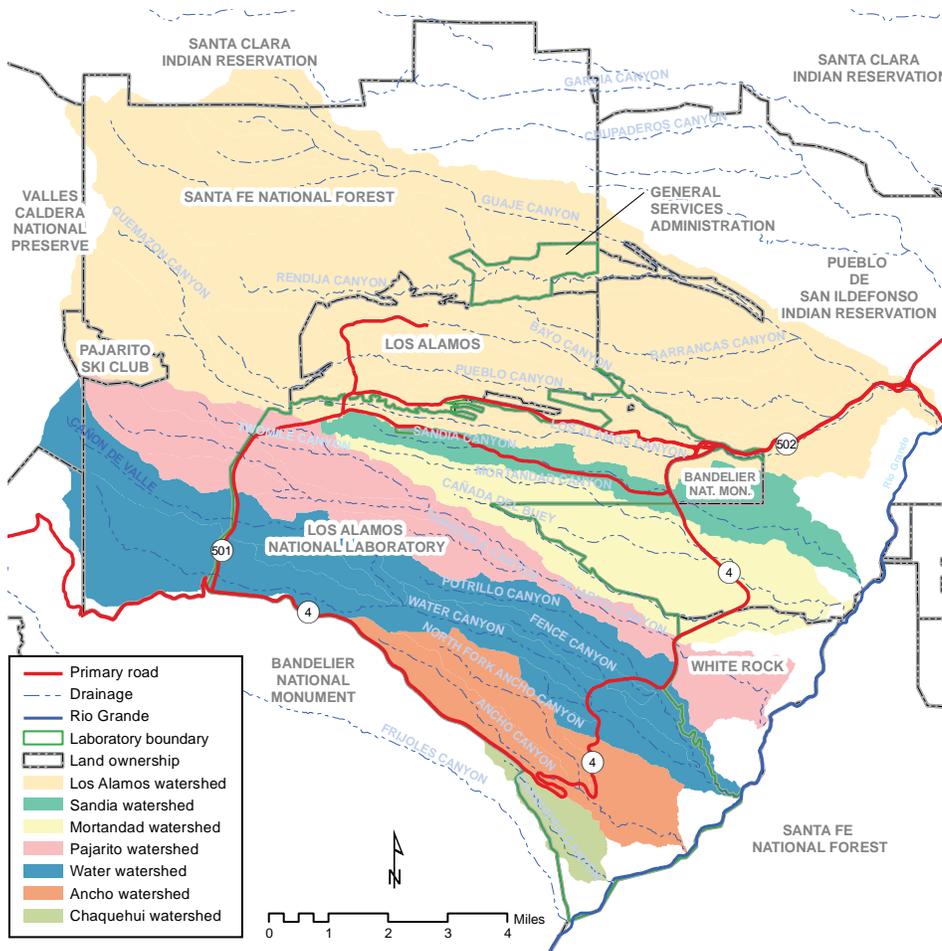


Water Canyon is one of the few places on Laboratory property with perennial water flow.

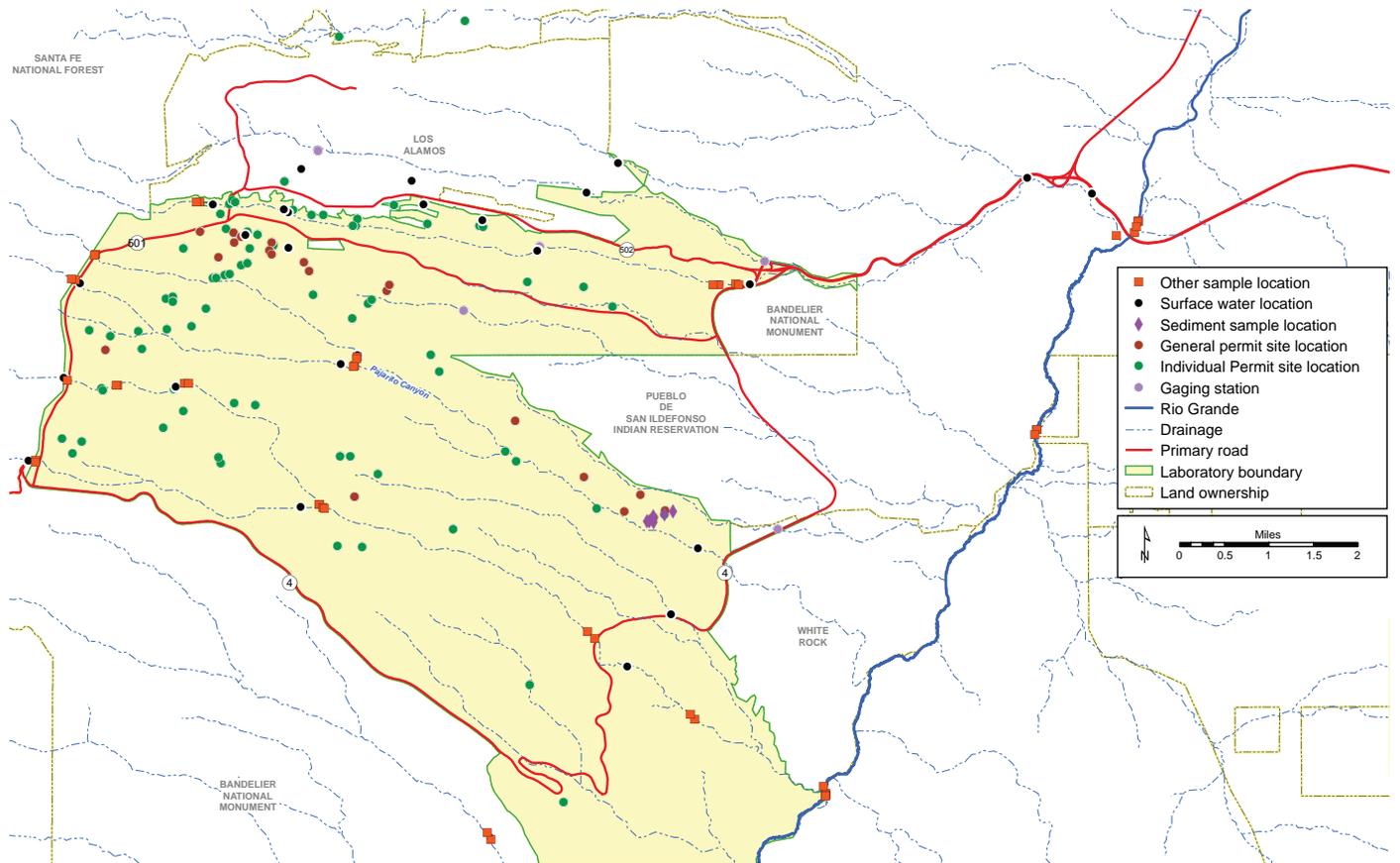
## How do we monitor surface water?

The Laboratory property encompasses seven primary watersheds, each of which drains directly into the Rio Grande. The watersheds are defined by seven major canyons: Los Alamos, Sandia, Mortandad, Pajarito, Water, Ancho, and Chaquehui.

Surface water and sediment samples are collected in the canyons, with extra monitoring taking place near and downstream of potential sources of Laboratory-produced substances. The samples are collected either manually (grab sampling) or by automated samplers that are activated during periods of high storm water runoff. All surface water and sediment samples are then analyzed for radionuclides and chemicals.



Watershed locations



Surface water sampling locations

## Fire caused increased ash and sediments in storm water

During 2012, the amount of ash and sediment transported by storm water increased. Samples contained correspondingly increased concentrations of radioactivity and chemicals, though the levels were lower than those in 2011. The increase was the direct result of the Las Conchas Fire, which burned areas uphill from the Laboratory in the Santa Fe National Forest. Following the Cerro Grande Fire in May 2000, the transport of ash and sediment returned to pre-fire levels in 3 to 5 years, as is expected for the Las Conchas Fire.



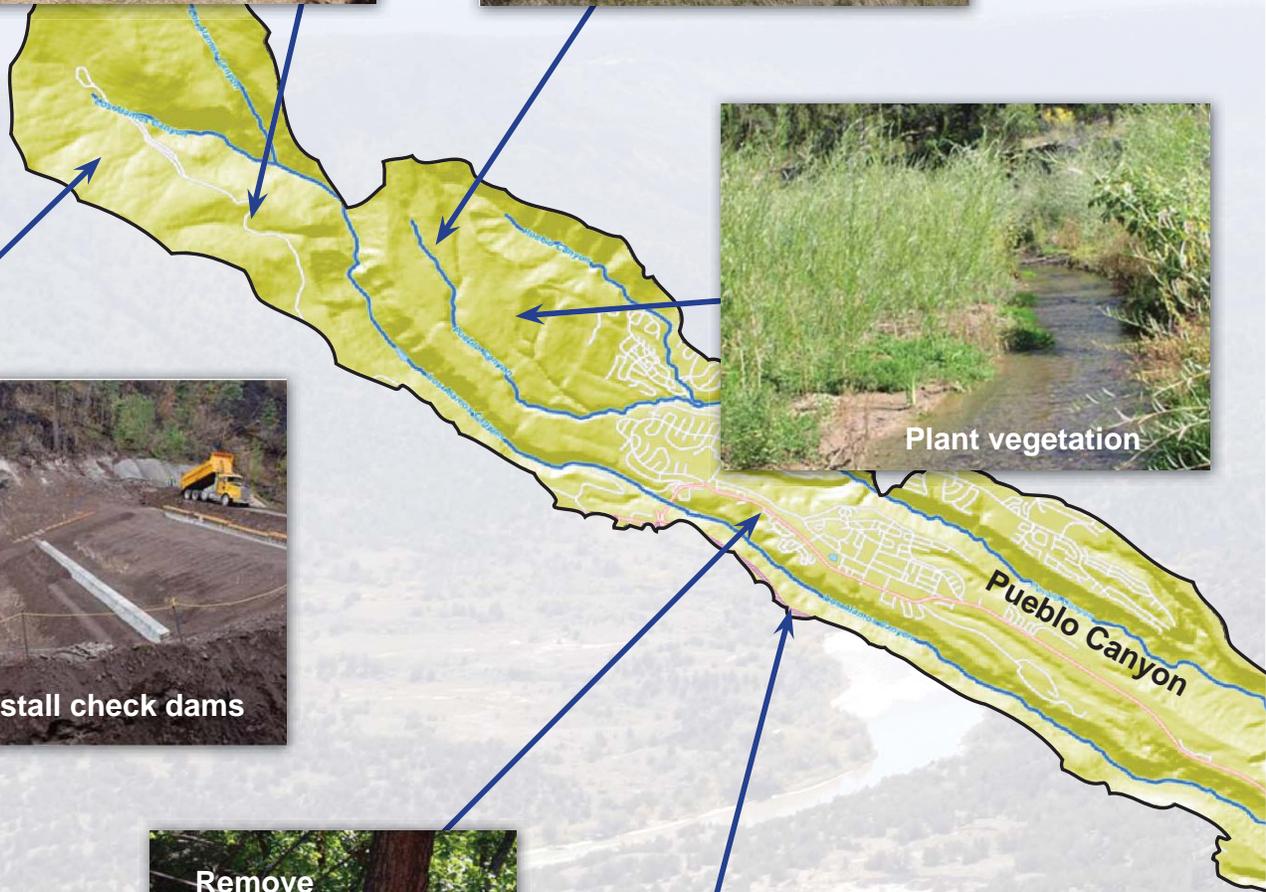
Sediment-control structures were built following the Las Conchas Fire to prevent the transport of ash and sediment.

## Does the Laboratory impact the Rio Grande?

To assess the Laboratory's impact on the river, samples of water, sediment, and foodstuffs are collected both upstream and downstream from the Laboratory. Samples are analyzed for radionuclides and chemicals. The concentrations of radionuclides and chemicals are the same downstream and upstream from the Laboratory, indicating that radionuclides are natural or from fallout and that the Laboratory is not a major contributor to the chemical contamination of the Rio Grande.



The Rio Grande supplies much of northern New Mexico with water.



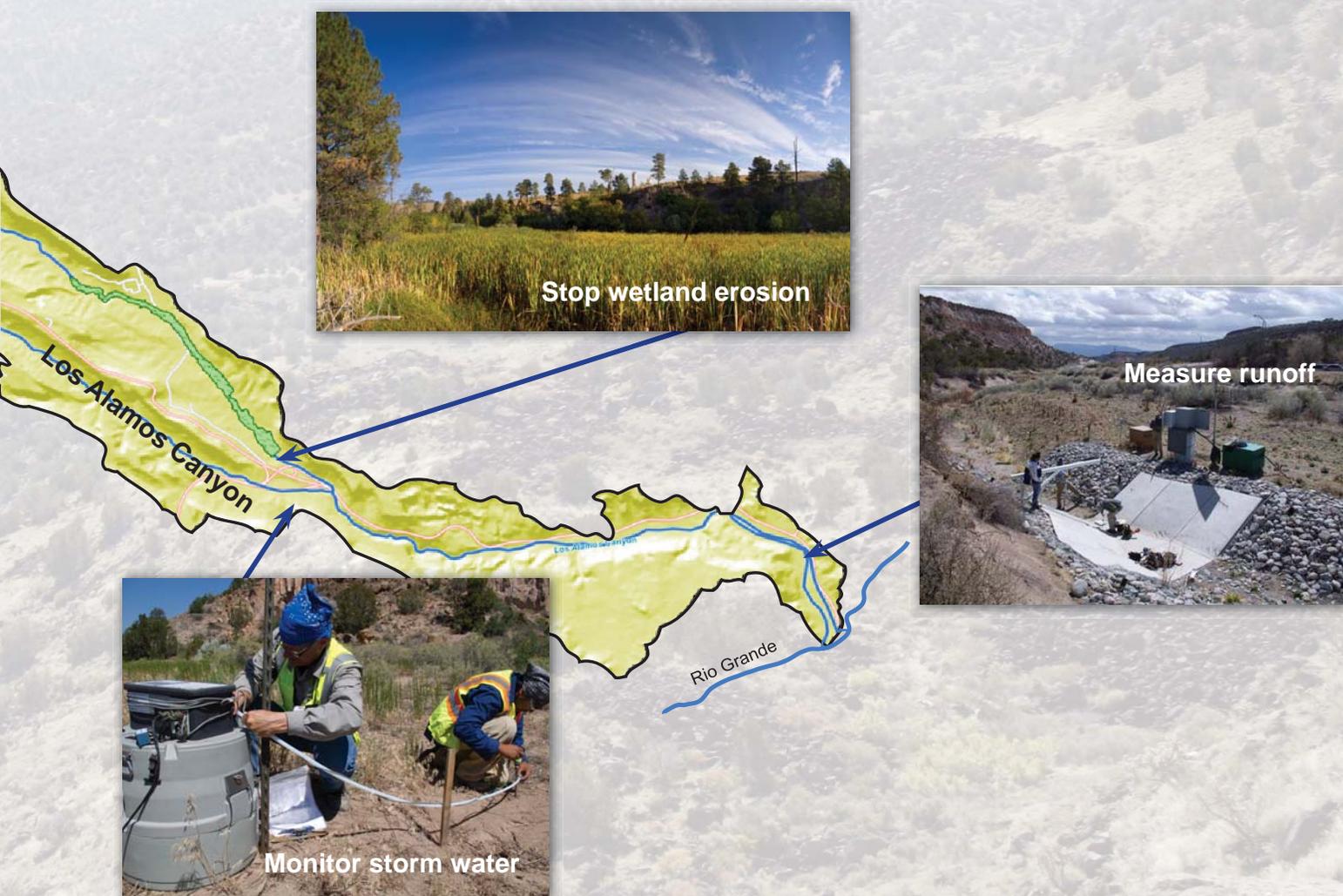
## Defenses in depth: Watershed management for sediment capture

As part of the EPA Clean Water Act, the Laboratory operates under the National Pollutant Discharge Elimination System permit program. The permit program serves to monitor and control surface water releases associated with industrial activities at the Laboratory to minimize the discharge of pollutants.

Surface water monitoring leads to actions with three main objectives:

- monitoring for known and unknown pollutants,
- controlling sediment transport by minimizing water flowing onto areas with known contamination and slowing the flow of water off Laboratory property, and
- removing known contaminants.

The Laboratory has installed multiple sediment-control structures at 405 sites to minimize erosion and reroute storm water away from areas of known contamination. The structures also enhance the deposition of sediment to prevent the movement of contaminants off Laboratory property.



# Protecting our aquifer

## Types of Groundwater

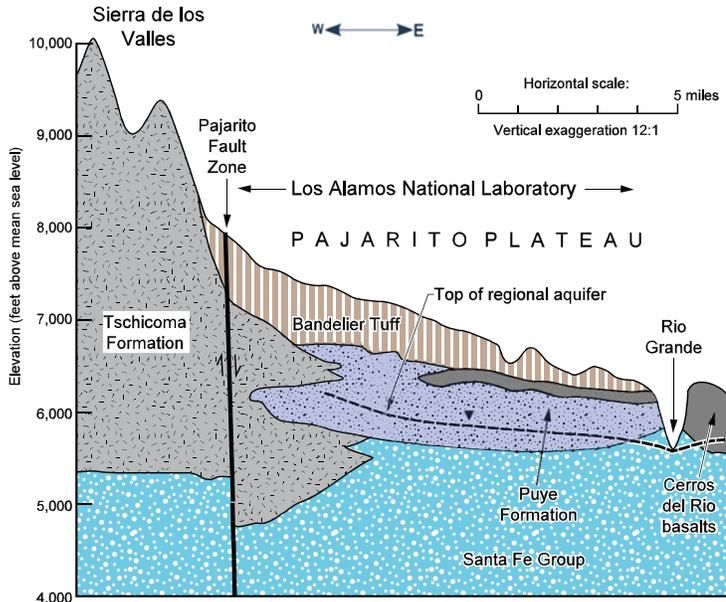
**Alluvial**—Water that occupies sediment in canyon bottoms

**Intermediate**—Water found at various depths, settled on rocks that it cannot easily travel through

**Regional Aquifer**—Water located 600 to 1200 feet below the surface, separated from alluvial and intermediate groundwater by several layers of rock and dry tuff, and a source of public drinking water

There are three different forms of groundwater that occur beneath the Pajarito Plateau: alluvial groundwater, intermediate groundwater, and the regional aquifer. Los Alamos County's drinking water supply consists of water pumped from the regional aquifer.

To determine the impact of past and present liquid waste discharges from Laboratory facilities on groundwater quality, the Laboratory collects and analyzes samples from the three different modes of groundwater.

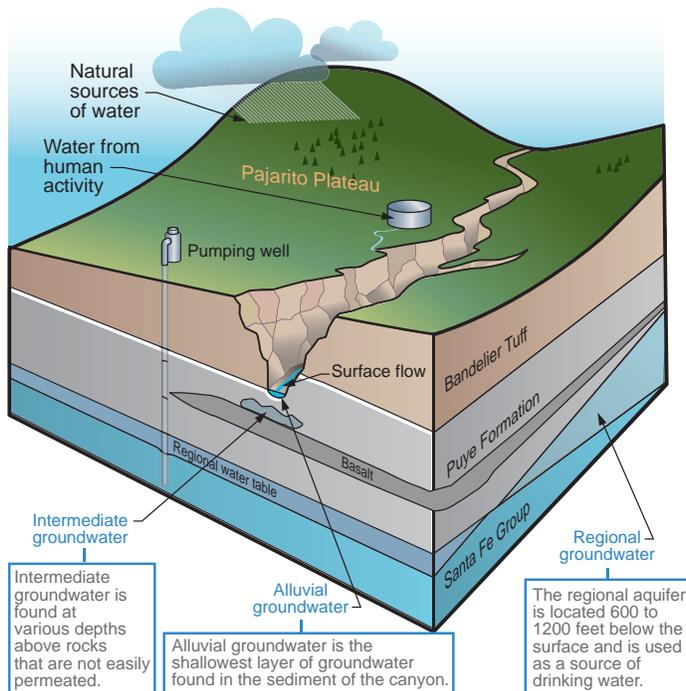


Geologic cross-section of the Pajarito Plateau

## Hydrogeological setting of the Pajarito Plateau

The Laboratory is located on the Pajarito Plateau, which is bordered to the west by the range of the Jemez Mountains known as Sierra de los Valles, and to the east by the Rio Grande. The plateau is capped by Bandelier Tuff, which formed as the result of a volcanic eruption that occurred in the Jemez Mountains 1.2 to 1.6 million years ago. Underlying the Bandelier Tuff is a combination of Tschicoma Formation, Puye Formation conglomerate, and Cerros del Rio basalt. Beneath these formations lie the sediments of the Santa Fe Group.

The three modes of groundwater are separated by layers of unsaturated rock. The alluvial groundwater situated in the bottoms of canyons is separated from the intermediate groundwater by a thick layer of Bandelier Tuff. Intermediate groundwater occurs within the lower part of Bandelier Tuff as well as in the Puye Formation and Cerros del Rio basalt. Approximately 350 to 600 feet of unsaturated tuff, basalt, and sediments separate the perched and intermediate groundwater from the regional aquifer. Because the rock has such low permeability, groundwater moves between the different modes only where cracks are present.



Geologic and hydrologic relationships of the three groundwater levels of the Pajarito Plateau

## How do we monitor groundwater?

In 2012, the Laboratory used a total of 186 wells and springs to collect groundwater samples. Deep wells, such as monitoring and supply wells, were used to collect water from the regional aquifer and intermediate groundwater, while alluvial groundwater samples were taken from shallow wells. Because groundwater is monitored at various depths, the Laboratory is able to track the movement of materials through each of the levels of groundwater. This monitoring system allows the Laboratory to prepare for and minimize any potential impact to public drinking water.

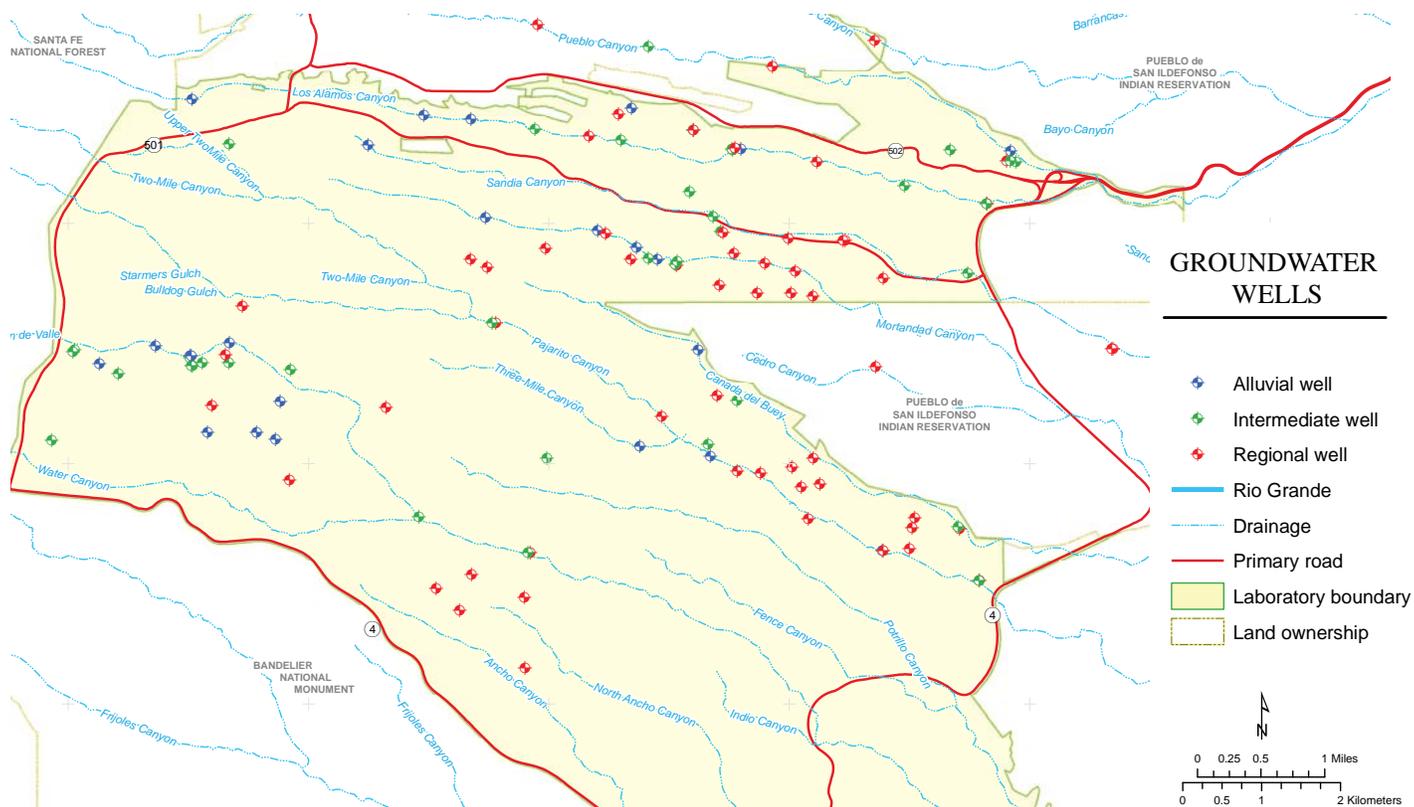
For example, the movement of chromium has been tracked from the alluvial groundwater in Sandia Canyon to the intermediate groundwater that extends from Sandia Canyon to Mortandad Canyon and from there to the regional aquifer beneath Mortandad Canyon. The concentrations are monitored closely, and treatment options are being evaluated to prepare for the possibility of chromium reaching the public drinking water supply.



Checking the water depth of well R-13, near the Pueblo de San Ildefonso boundary



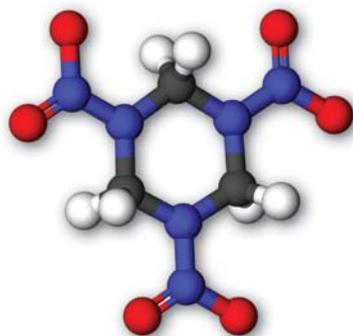
Taking samples at well R-37, above Cañada del Buey



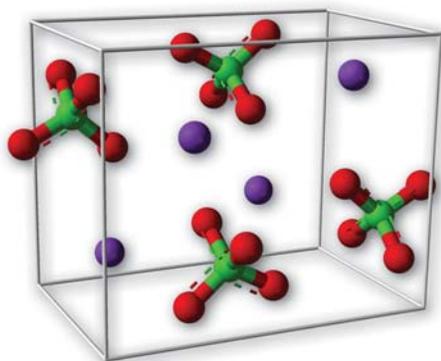
Groundwater monitoring well locations



The word chromium comes from the Greek word chroma, meaning color. Different oxidation states of chromium are different colors and have different solubilities.



An RDX molecule contains three carbon atoms (black), six nitrogen atoms (blue), six oxygen atoms (red), and six hydrogen atoms (white).



A perchlorate ion contains a chlorine molecule (green) surrounded by four oxygen atoms (red); the purple spheres represent atoms such as potassium.

### Groundwater Standards and Cleanup Levels

EPA maximum contaminant levels are the maximum allowed levels of a contaminant delivered to any user by a public water system. They are used as cleanup levels for groundwater in the event that corrective actions are implemented. For radionuclides, the levels are equivalent to a 4-mrem/year dose. Compliance with these levels may be evaluated after water treatment; therefore, measurements in a water supply well may be higher.

## What materials move easily in groundwater?

Materials that are soluble in water move readily with the groundwater, while insoluble materials usually bind to soil particles and only move if the sediment moves. The Laboratory expects to see certain materials, based on the work being done at each facility.

- Chromium**—Chromium is widely used as a corrosion inhibitor. Until 1972, the Laboratory used potassium dichromate in a cooling tower at Technical Area 03 (TA-03). The water was discharged into Sandia Canyon after use. The chromium at surface in soils and sediment is now in the form of relatively immobile trivalent chromium and remains in the wetlands of upper Sandia Canyon. However, much of the chromium has migrated downstream as soluble hexavalent chromium and infiltrated the intermediate and deep groundwater under Mortandad Canyon.
- Research Department Explosive (RDX)**—RDX was widely used during World War II. At the Laboratory, RDX has been used as part of explosives research and development. RDX is soluble in water, and so it moves easily in groundwater. From 1951 to 1996, the Laboratory discharged RDX into Cañon de Valle. As a result, low levels of RDX have been detected in the groundwater under Cañon de Valle at TA-16. The Laboratory is currently working on the removal of contaminated soil and sediment in this area to reduce the impact to groundwater.
- Perchlorate**—Perchlorates are salts that are derived from perchloric acid. They are produced through both natural and artificial processes. Perchlorate-based materials are often used in explosives, solid fuel for rockets, vehicle air bags, and batteries. Most perchlorates are soluble in water, and so they travel easily in groundwater. Perchlorate has been detected in the groundwater in Mortandad Canyon, but concentrations are decreasing as a result of reduced discharges from TA-50.

## Water supply wells meet all standards

In 2012, the water samples collected from the Los Alamos County water supply wells were in compliance with both federal and state standards.

# Checking food for safety

Foodstuffs are products edible to humans such as fruits, vegetables, and various animal tissues. To assess the potential impact of Laboratory operations on human health via the food chain, foodstuffs are collected within and around the Laboratory perimeter and analyzed for radionuclides and chemicals.

In 2010, the Laboratory collected more than 100 fruit and vegetable samples from locations on and surrounding Laboratory property, goat's milk and chicken eggs from noncommercial farms in White Rock and surrounding communities, and honey from hives located at TA-54 east of Area G, Los Alamos townsite, and Pojoaque, New Mexico. During 2011, samples of fish and crayfish were taken from the Rio Grande and analyzed for radionuclides, mercury, and polychlorinated biphenyls (PCBs).

## Special monitoring

### Wild edible foods—Navajo Tea (*Thelesperma* spp.)

Navajo Tea, also known as Hopi Tea, Greenthread, and Cota, is a common wild plant herb used to make a beverage tea. During 2012, samples of the native herb species were collected around the vicinity of the Laboratory. The herb samples were air-dried and used to brew tea, which was then analyzed for tritium, cesium-137, strontium-90, americium-241, and plutonium and uranium isotopes.

### No Laboratory effects on foodstuffs

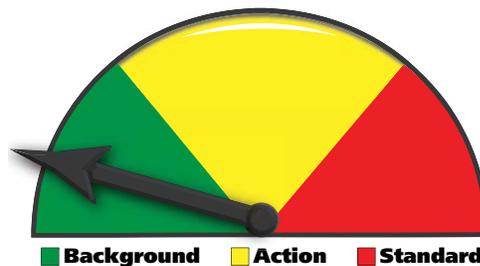
All foodstuffs samples collected in 2010 and 2011 contained concentrations of radionuclides and chemicals far below screening levels. Concentrations of radionuclides in Navajo Tea were either not detected or similar to background.



Local chickens (*Gallus gallus domesticus*)



Navajo Tea (*Thelesperma* spp.)



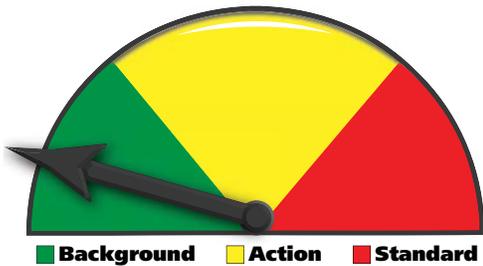
#### Foodstuffs Comparison Levels

Concentrations of radionuclides and chemicals in foodstuffs samples are compared with three reference levels to help identify and prevent any potential impact to human health.

**Background**—Regional background levels of radionuclides and chemical concentrations are calculated from foodstuffs collected at locations away from the influence of the Laboratory. Radionuclide and chemical concentrations in foodstuffs collected from background locations are the result of natural processes and global fallout.

**Action Limits**—Action limits for radionuclides in foodstuffs are set by the Laboratory at a 1-mrem/year single-pathway dose limit and serve as a “yellow flag,” so that potential human health concerns may be identified in advance. For other chemicals, such as mercury and PCBs, EPA action limits are used.

**Standards**—If radionuclide or chemical concentrations in foodstuffs exceed action limits, the concentration levels are compared with the appropriate standards. In the case of radionuclides, the potential dose to a person is calculated and compared with the DOE single-pathway dose constraint of 25 mrem/year. For mercury and PCBs, the concentrations are compared with the Food and Drug Administration action limits of 1 milligram per kilogram (mg/kg) in fish, and 3 mg/kg in red meat and poultry.



### Biota Comparison Levels

The data from biota samples are compared with three reference levels to help identify and prevent any potential impact to species population or diversity of biota species.

**Background**—Regional background levels of radionuclides and chemical concentrations representative of biota samples are collected at locations away from the influence of the Laboratory.

**Action Limits**—Action limits for radionuclides in biota correspond to a dose of 0.01 rad/day for animals and 0.1 rad/day for plants and serve as a “yellow flag,” so that potential concerns may be identified in advance. There are no action limits for chemicals in biota tissue. If the background level is exceeded for a chemical in a biota sample, chemical concentrations in the soil are compared with ecological screening levels (ESLs). ESLs reflect the highest soil concentration of a substance not expected to result in any negative impact to biota.

**Standards**—The dose to biota is calculated using the computer program RESRAD-BIOTA, as well as using radionuclide concentrations found in biota samples. The calculated dose is then compared with the DOE dose standard of 1 rad/day for terrestrial plants and aquatic biota and 0.1 rad/day for terrestrial animals.



Broad-tailed Hummingbird (*Selasphorus platycercus*)

## Does the Laboratory impact plants or animals?

The Laboratory monitors potential impact to the surrounding ecosystems by sampling and analyzing biota. Biota are organisms not normally eaten by humans and include native vegetation, small mammals, reptiles, birds, and bees. Samples are analyzed for radionuclides and chemicals. The Laboratory also looks for changes in population and diversity of biota species.

### Measurements show no impact

All biota samples collected in 2012 contained concentrations of radionuclides and chemicals consistent with background. The populations or diversity of biota species have not been impacted.



Staghorn cholla (*Cylindropuntia versicolor*)



Western fence lizard (*Sceloporus occidentalis*)

## Special monitoring for special populations

As part of the Laboratory's commitment to minimize risk to biological resources, the Laboratory has implemented the Biological Resources Management Plan (BRMP). The BRMP describes objectives, strategies, and actions that fulfill the following goals:

1. **Mission Support**—Ensure and facilitate compliance with biological resource laws and regulations
2. **Site Stewardship**—Identify and mitigate adverse impacts on biological resources
3. **Regional Commitment**—Meet responsibilities as a good neighbor and trustee of natural resources

Species management is an integral part of the BRMP. The Laboratory is committed to protecting special classes of species, including federally listed species, state-listed species, and migratory birds.

### Migratory birds

During the fall of 2012, biologists completed the third year of fall migration songbird monitoring at the Laboratory. The long-term monitoring of trends in migratory birds is useful in determining if bird populations are being impacted by Laboratory operations or environmental factors such as drought. A total of 443 songbirds, representing 49 species, were captured, measured, and banded during 2012 at a netting station located in a large wetland on the north side of Pajarito Road in Los Alamos County. The number of birds captured during this monitoring effort has been variable, but the number of captures in 2012 improved substantially compared with 2011. Variability in bird populations is likely because of changes in the regional climate and is not the result of Laboratory operations.

### Chytrid fungus testing of amphibians

As part of a cooperative study with the New Mexico Department of Game and Fish, various amphibian species at the Laboratory, including the canyon tree frog, chorus frog, Woodhouse's toad, and Jemez Mountains salamander, were tested for chytridiomycosis. Over just the past 30 years, chytridiomycosis has caused the catastrophic decline or extinction of at least 200 species of amphibians, and the infection has been documented throughout New Mexico. In 2007, an ongoing investigation was initiated to determine whether the fungus exists on Laboratory property. All amphibians collected on Laboratory property tested negative for the infection. Continued and expanded sampling of amphibians is expected as a result of the presence of the Jemez Mountains salamander on Laboratory property, and it is anticipated that this species will be listed under the Endangered Species Act within the next year.



Ash-throated Flycatcher (*Myiarchus cinerascens*)



Jemez Mountains salamander (*Plethodon neomexicanus*)

#### Chytrid Fungus

Chytridiomycosis is an infectious disease in amphibians caused by the chytrid fungus *Batrachochytrium dendrobatidis* (Bd). The infection from Bd causes the skin of amphibians to thicken. Because amphibians absorb water and electrolytes through their skin, and some even use their skin to breathe, the thickening of the skin often results in the death of the specimen. The exact origin of Bd is not known, but it is clear that the global trade of amphibians has caused the spread of the fungus to habitats in which it was not previously present.

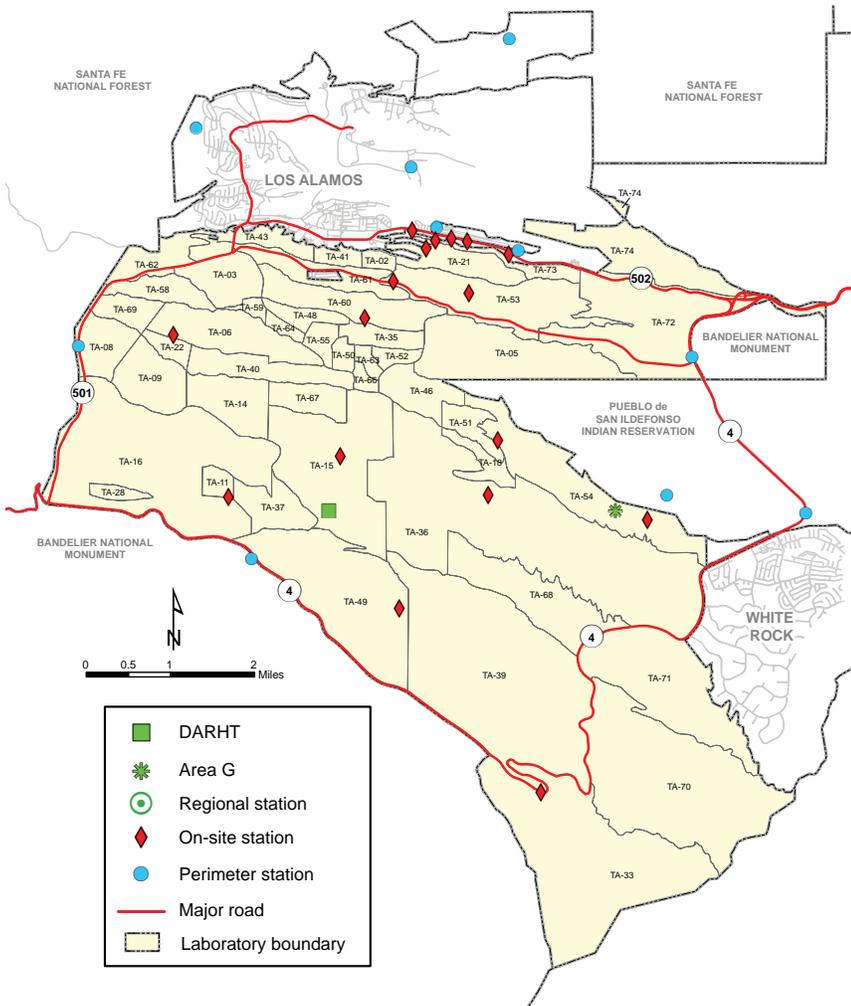
# Why do we monitor soil?

To evaluate the potential impacts of Laboratory operations on human health and the environment, the Laboratory collects and analyzes soil samples for radionuclides and chemicals.

Institutional sampling within and around the Laboratory is conducted once every 3 years, with the last large-scale soil sampling taking place in 2012. The Laboratory also conducts facility-specific sampling on an annual basis to monitor the soil around Area G and the Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility. In addition, the Pueblo de San Ildefonso requested that the Laboratory collect two soil samples on an annual basis to test for radionuclides and chemicals on pueblo lands downwind of Area G.



Soil samples taken for the 32nd year of sampling



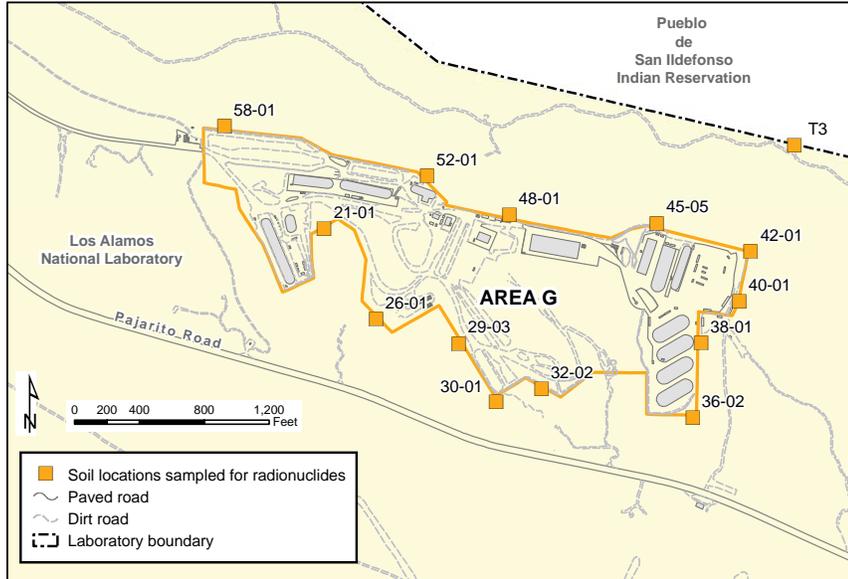
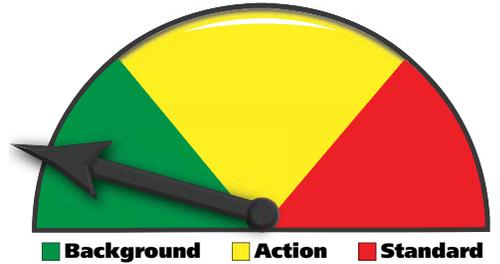
On-site, perimeter, and regional soil-sampling locations

<b>Agriculture</b> (crops, milk, eggs, and honey)	<b>Rio Grande</b> (fish and invertebrates)	<b>Soil</b>	<b>Biota</b> (plants and animals)
 <ul style="list-style-type: none"> <li>• 2010</li> <li>• 2013</li> <li>• 2016</li> </ul>	 <ul style="list-style-type: none"> <li>• 2011</li> <li>• 2014</li> <li>• 2017</li> </ul>	 <ul style="list-style-type: none"> <li>• 2012</li> <li>• 2015</li> <li>• 2018</li> </ul>	 <ul style="list-style-type: none"> <li>• Every year</li> </ul>

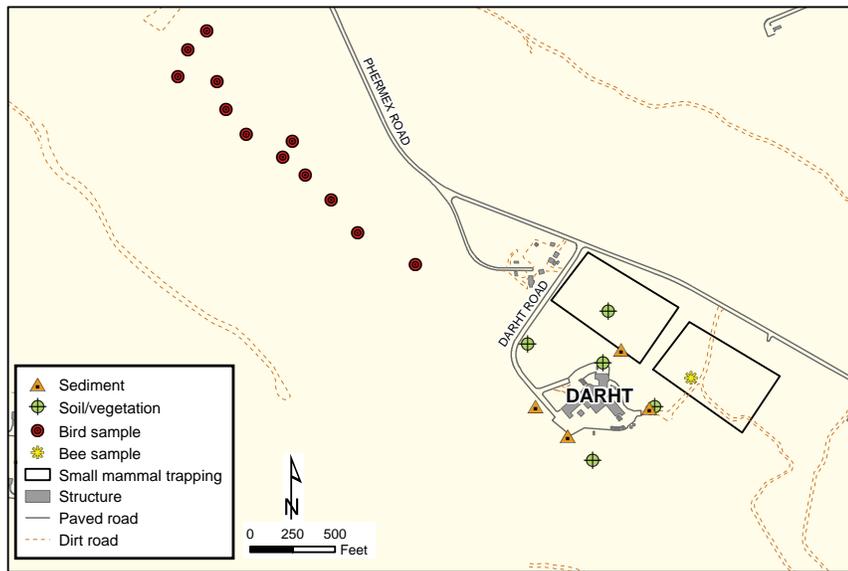
Sampling is conducted triennially, except for biota (plants and animals). In 2003, after 30 years of annual sampling, there was little change in results from year to year. By focusing on one category annually, a broader array of items is sampled, and samples are tested for more contaminants.

# Below action limits

All soil samples taken within and around the perimeter of the Laboratory contained concentrations of radionuclides and chemicals below action limits.



Locations of soil samples collected around Area G in 2012



Soil, sediment, and biota sample locations at DARHT in 2012

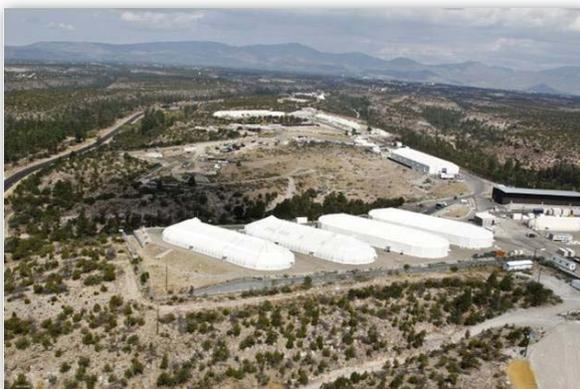
**Soil Data Comparison Levels**

The data from soil samples are compared with three reference levels to help identify and prevent any potential impact to human health.

**Background**—Regional background levels of radionuclides and chemical concentrations representative of surface soil are collected at locations away from the influence of the Laboratory.

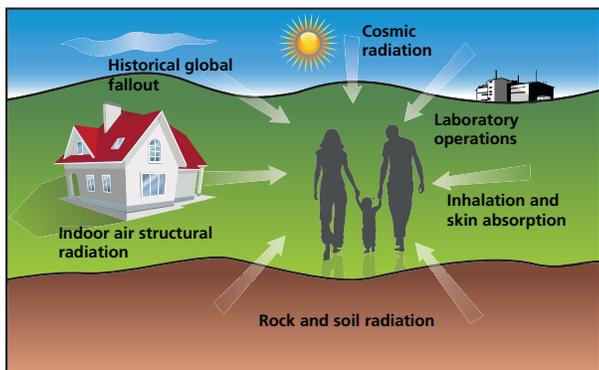
**Action Limits**—Action limits for radionuclides in soil are set by the Laboratory at a 15-mrem/year single-pathway dose limit and serve as a “yellow flag,” so that potential human health concerns may be identified in advance. For other chemicals, concentrations are compared with New Mexico Environment Department (NMED) screening levels.

**Standards**—When an action limit is exceeded, the potential dose to a person is calculated using the computer program RESRAD, as well as all available soil data for the year. The calculated dose is then compared with the DOE single-pathway dose constraint of 25 mrem/year.

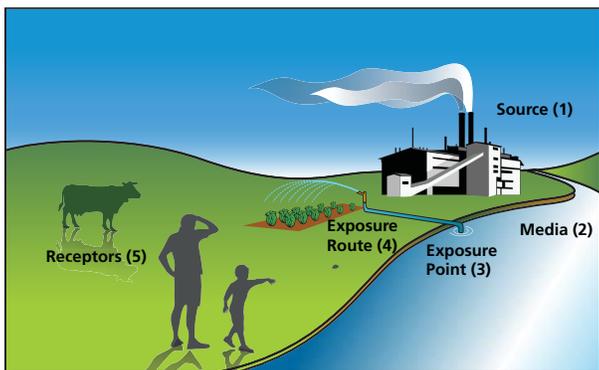
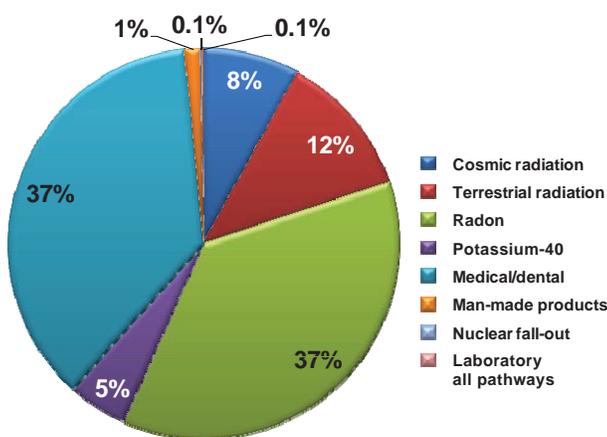


Because of radiological work, annual soil samples are taken at both Area G and DARHT.

Background radiation ~750 mrem/year  
 Additional from the Laboratory <1 mrem/year



You can calculate the dose you receive in your daily life at <http://newnet.lanl.gov/info/dosecalc.asp>.



- (1) **Source**—The point of origin of the contamination
- (2) **Media or Medium**—The means of transportation for contamination
- (3) **Exposure Point**—The location of potential contact between a person/animal and contamination
- (4) **Exposure Route or Pathway**—The means by which the contamination enters the body
- (5) **Receptor**—The exposed individual, plant, or animal

## What is dose?

Dose is a measure of harm or risk. A large dose of any sort has the potential to be harmful. The doses presented in this report are so small that the harm or risk is essentially zero. Radiation dose, measured in mrem, is the amount of energy per gram of living tissue a person receives from a radioactive source. The primary risk of radiation dose is cancer. For low doses of radiation, the risk of cancer is 0.0000008 per mrem received or 8/10,000,000.

For chemicals, dose is a measure of the amount of a chemical per gram of living tissue.

## How do we determine the dose to the public and the environment?

The Laboratory uses DPRNET to make direct measurements of radiation dose near radioactive sources, such as Area G.

For air, water, and food, the dose is not measured directly but instead calculated based on the amount that gets into the body and the given pathway.

## How could materials enter the body?

A “pathway” is a way that a material can get into the body, for example, breathing air, drinking water, or eating food. A pathway may involve several steps.

For the direct exposure pathway, radiation directly penetrates the body.

For the airborne pathway, a material is inhaled directly into the lungs and then moves into the bloodstream.

For the ingestion pathway, there are several different possibilities:

- An animal drinks surface water, and a human then eats the animal.
- Crops are irrigated with surface water, and a human then eats the crops.
- A contaminant gets into the aquifer, the aquifer supplies the public drinking water system, and the water is consumed.
- A contaminant gets into the aquifer, the aquifer supplies a natural spring, and the spring water is consumed.

A pathway may be interrupted or incomplete. For example, water from the aquifer is treated before it reaches the public drinking water system, and so contaminants are not ingested by the public.

## What is the MEI?

The Laboratory monitors the potential radiation dose to the public by calculating the dose to the maximally exposed individual (MEI). The MEI is a hypothetical person who receives the greatest radiation dose from Laboratory operations. The dose to the MEI is calculated assuming that the hypothetical person spends 24 hours of every day of the year at the location.

The MEI dose calculation takes into consideration every possible way radiation from Laboratory operations might affect a human. To determine the dose to the MEI, the potential dose to each pathway is calculated. The doses are then added together for a total all-pathways dose.

1. The direct exposure dose is measured and calculated using DPRNET.
2. The airborne pathway dose is calculated using AIRNET data, stack sampling, and computer models.
3. The ingestion pathway dose is calculated using data from food/water samples and computer models.

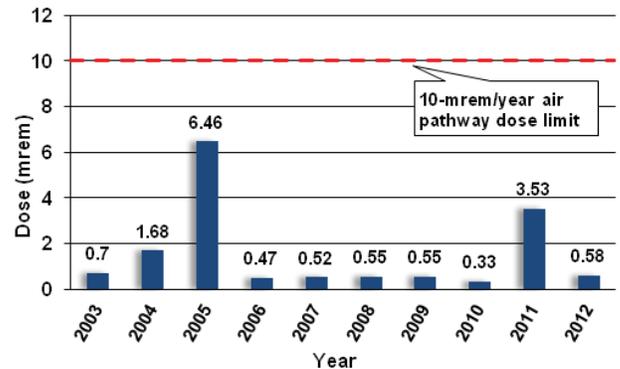
## Results: Far below dose limit

### MEI located on Laboratory property

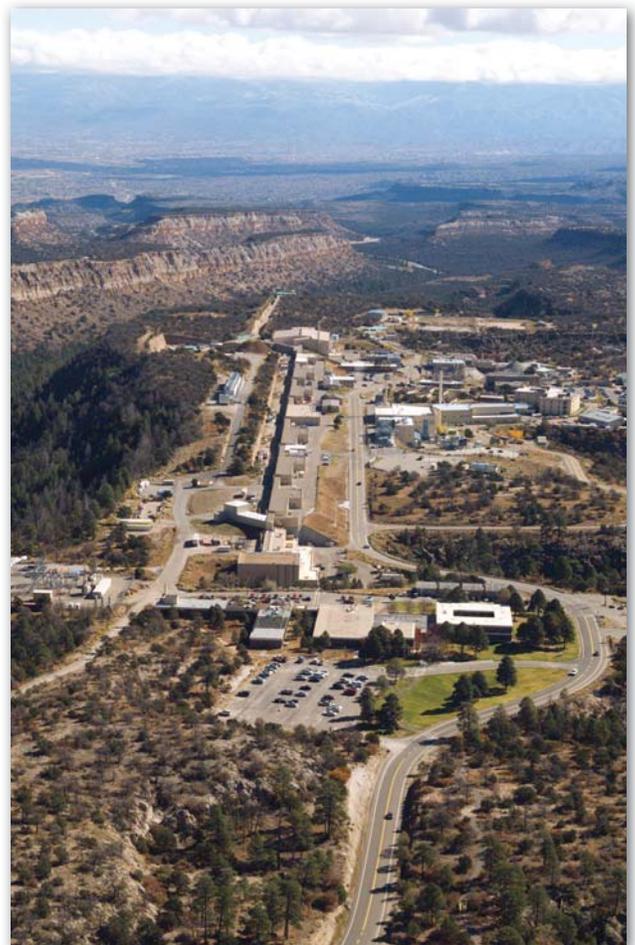
The only on-site location with a measurable dose to the public is East Jemez Road near LANSCE. Two doses were reported for the 2012 on-site MEI: a neutron dose of 0.34 mrem and a gamma dose of 0.20 mrem. Members of the public typically spend less than 15 minutes per day at this location, so the on-site MEI dose is much less than 0.1 mrem. The on-site MEI dose is also much less than the off-site MEI dose.



East Jemez Road, the location of the 2012 on-site MEI



Annual airborne pathway (Rad-NESHAP) dose (mrem) to the MEI over the past 10 years



Aerial view of LANSCE



The AIRNET station nearest the location of the 2012 off-site MEI

## Results: Far below dose limit

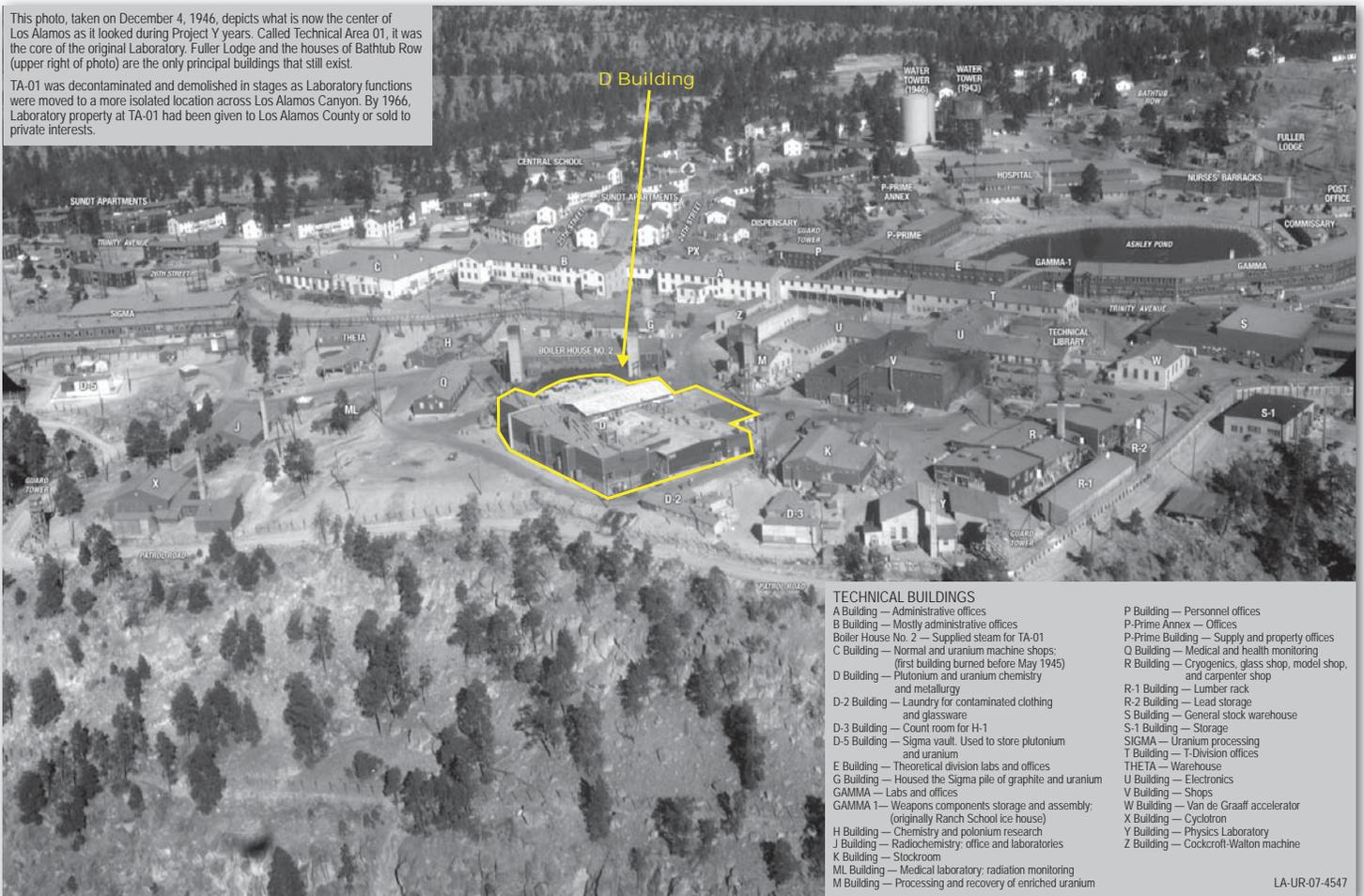
### MEI located off Laboratory property

For 2012, the off-site MEI dose was reported to be 0.58 mrem at the location of Los Alamos Inn on Trinity Drive. The dose is far below the 10-mrem EPA dose limit.

In the early days of Los Alamos (1944–1945), the plutonium facility, known as D Building, was situated just south of Ashley Pond near the location of the 2012 MEI. The buildings were constructed hurriedly and not to standard so as not to delay wartime efforts. Because waste was disposed of through a pipe that led out over the edge of Los Alamos Canyon, legacy plutonium-239 can be found on the surface of the south-facing slope of the canyon. The contamination extends out to approximately 10 yards and is localized, meaning the contamination is located in a specific area and is not moving. When the plutonium on the surface soil is resuspended by the wind, it is detected by a nearby AIRNET station.

This photo, taken on December 4, 1946, depicts what is now the center of Los Alamos as it looked during Project Y years. Called Technical Area 01, it was the core of the original Laboratory. Fuller Lodge and the houses of Bathtub Row (upper right of photo) are the only principal buildings that still exist.

TA-01 was decontaminated and demolished in stages as Laboratory functions were moved to a more isolated location across Los Alamos Canyon. By 1966, Laboratory property at TA-01 had been given to Los Alamos County or sold to private interests.



TECHNICAL BUILDINGS	
A Building	— Administrative offices
B Building	— Mostly administrative offices
Boiler House No. 2	— Supplied steam for TA-01
C Building	— Normal and uranium machine shops
D Building	— Plutonium and uranium chemistry and metallurgy
D-2 Building	— Laundry for contaminated clothing and glassware
D-3 Building	— Count room for H-1
D-5 Building	— Sigma vault. Used to store plutonium and uranium
E Building	— Theoretical division labs and offices
G Building	— Housed the Sigma pile of graphite and uranium
GAMMA	— Labs and offices
GAMMA 1	— Weapons components storage and assembly; (originally Ranch School ice house)
H Building	— Chemistry and polonium research
J Building	— Radiochemistry; office and laboratories
K Building	— Stockroom
ML Building	— Medical laboratory; radiation monitoring
M Building	— Processing and recovery of enriched uranium
P Building	— Personnel offices
P-Prime Annex	— Offices
P-Prime Building	— Supply and property offices
Q Building	— Medical and health monitoring
R Building	— Cryogenics, glass shop, model shop, and carpenter shop
R-1 Building	— Lumber rack
R-2 Building	— Lead storage
S Building	— General stock warehouse
S-1 Building	— Storage
SIGMA	— Uranium processing
T Building	— T-Division offices
THETA	— Warehouse
U Building	— Electronics
V Building	— Shops
W Building	— Van de Graaff accelerator
X Building	— Cyclotron
Y Building	— Physics Laboratory
Z Building	— Cockcroft-Walton machine

LA-UR-07-4547

Los Alamos, 1946

# Environmental remediation programs

## The corrective action process

To ensure that past operations do not pose a potential risk to human health or the environment, the Laboratory uses the corrective action process to evaluate and remediate sites. The corrective action process identifies and addresses areas of legacy contamination by

1. removing the contamination;
2. stabilizing the contamination; and/or
3. breaking the pathways between the contamination and the receptor.

A corrective action is complete when the site no longer poses an unacceptable risk to human health or the environment, which is a decision made by NMED. In areas where materials remain, long-term stewardship activities such as surveillance and monitoring are implemented to ensure there are no changes in potential risk or concentrations.

## 920 cubic meters shipped to WIPP

As part of the Laboratory's long-term stewardship strategy, NMED and the DOE National Nuclear Security Administration created an agreement that calls for the accelerated shipment of TRU wastes from TA-54 to WIPP in Carlsbad, New Mexico. To complete the accelerated waste shipments within existing and anticipated budgets, NMED agreed to delay some work that would have normally taken place under the Compliance Order on Consent (Consent Order), such as cleanup and full-scale remediation of some Laboratory sites. As a result, fewer activities than originally scheduled under the Consent Order were performed in 2012.



A truck carrying TRU waste prepares to leave for WIPP.

## Corrective measures evaluation completed for MDA C

Following the closure of MDA B in 1948, MDA C, located along Pajarito Road, became the site for material disposal. MDA C was in operation from 1948 to 1968 and was used intermittently from 1968 until its closure in 1974. Waste disposed of at MDA C included uncontaminated classified materials, metals, hazardous materials, and radioactively contaminated materials. Vapor monitoring at MDA C was conducted 2 times during 2012 at 80 sampling ports within 18 vapor-monitoring wells. The data collected from vapor-monitoring wells were used to characterize the nature and extent of VOCs and tritium in the vadose zone.

In 2012, NMED directed the Laboratory to prepare a corrective measures evaluation report for MDA C to identify and evaluate potential remedial alternatives for MDA C. As a result of this evaluation, the recommended corrective measures alternative includes constructing an evapotranspiration cover over the pits and shafts to provide a barrier against human and ecological exposure to waste and contaminated soil.

## What is the Laboratory's long-term strategy for the environment?



Discussions and poster sessions demonstrate sustainability projects at the Laboratory's 2012 Sustainability Open House.

The Laboratory uses our Long-Term Strategy for Environmental Stewardship and Sustainability. Protecting the environment into the future requires that, as a national laboratory, we address some significant and as yet unsolved environmental grand challenges. The strategy is to accomplish our national security mission while providing impeccable environmental stewardship. We protect human and environmental health by

1. cleaning up or stabilizing historical releases to the environment;
2. controlling current programs to ensure an impact to the environment that is as low as reasonably achievable; and
3. creating a sustainable future through pollution prevention, waste elimination, and reducing our use of energy and water.

We approach the strategy through two linked perspectives, a broad-reaching vision to set long-term environmental goals and the day-to-day examination of decisions to choose those actions that are most protective.

### Environmental Grand Challenges

### Significant Progress in 2012



Collaborate with our stakeholders and tribal governments to ensure that the Laboratory's impact on the environment is as low as reasonably achievable

We collaborated with stakeholders to create low-impact design storm water controls. We shared the strategy and requested community input.



Remove or stabilize pollutants from the Manhattan Project and Cold War eras

We removed 920 cubic meters of TRU waste in 230 shipments and constructed 1847 storm water controls to manage run-on and runoff from areas of concern.



Protect water resource quality and reduce water use

We opened the Sanitary Effluent Reclamation Facility that recycles 500 acre-feet of water for cooling computing centers.



Eliminate industrial emissions, discharges, and releases to the environment

We closed 6 additional water outfalls, keeping 11 open while using only 7 of these.



Protect human and environmental health by managing and restoring lands

We deployed a multilayered geographic information system tool to assist managers in making daily decisions on land use that are protective, coordinated, and low in environmental impact.



Produce zero radioactive, hazardous, liquid, or solid wastes

We created a strategy for zero liquid discharges and began investigating how to make it possible.



Use energy efficiently while creating sustainable energy solutions

We installed meters on biggest energy users and selected 31 buildings to retrofit with energy-saving technology.

## A message from the students



From the left, Burgandy Brock and Kari Schoenberg are overlooking the Rio Grande.

This has been my third year writing the Environmental Report Summary, and I would have to say it has been the best so far. Over the last few years, I have had the chance to become familiar with the Laboratory's commitment to environmental stewardship and the tools and methods used to fulfill that commitment. I was able to develop a vision for this document and make it come to life—a process that has been extremely rewarding. It is my ultimate goal that the Environmental Report Summary sparks your curiosity and increases your desire to learn. I hope you will want to know more! I am grateful for the opportunity I have been given to really grow and develop through authoring the Environmental Report Summary over the past 3 years, and I am thankful for being given the chance to educate others on subjects that I am so passionate about.

*Burgandy Brock*

Growing up in Los Alamos and having a dad working at the Laboratory led me to believe I had a good understanding of the work. While working here as a post-graduate student, I soon came to realize how little I really knew. My knowledge grew as I accompanied biologists in the field and worked on different environmental projects. As time went on, I came to realize and understand just how much the Laboratory does to protect the environment in and around the Los Alamos area.

I have always been extremely passionate about the environment and was excited to find out the Laboratory's role in its protection. It was a very fun and rewarding experience to be a part of preparing the Environmental Report 2012 Summary, and I hope others like reading it as much as I liked putting it together. It is my hope that this document will provide others with a greater insight and understanding into the Laboratory's efforts to monitor and protect the environment and surrounding communities. I express my greatest gratitude to all those involved who helped make this a great experience for me and thank you for letting me be part of your team on this wonderful publication.

*Kari Schoenberg*

Graphics, maps, and illustrations by Lorrie Bonds Lopez, CGA-CO; David Frank, ET-ER; Donald Montoya, IRM-CAS; and Winters Red Star, ENV-EDA

Content photography by Tanner Johnson, BPS-COM; Phil Noll, ENV-ES; and Laboratory staff photographers

Reviewed by Jeanne Fair, ENV-ES, and Michael McNaughton, ENV-ES

Edited by Pamela Maestas, REG-SP

Composition, layout, and design by Elaine Forbes, BPS-COM

### How to learn more and contact us:

Visit the Laboratory's environmental website and sign up for e-mail notification: [www.lanl.gov/environment](http://www.lanl.gov/environment)

Explore the Long-Term Strategy for Environmental Stewardship and Sustainability: [www.lanl.gov/projects/envplan](http://www.lanl.gov/projects/envplan)

Visit the electronic Public Reading Room: <http://epr.lanl.gov>

Visit the print Public Reading Room:

94 Cities of Gold Road, Pojoaque, NM

Call the Environmental Outreach Office: 505-667-0216

E-mail the Environmental Outreach Office: [envoutreach@lanl.gov](mailto:envoutreach@lanl.gov)

Write us: Environmental Outreach

Los Alamos National Laboratory

P.O. Box 1663, MS M996

Los Alamos, NM 87545

View all sampling data from the Laboratory: [www.intellusNMdata.com](http://www.intellusNMdata.com)

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