ERID-207521

# Los Alamos National Laboratory
# Environmental Report 2010
# *Summary*

Los Alamos
NATIONAL LABORATORY
EST. 1943

LA-14448-ENV


## Los Alamos National Laboratory Governing Policy for Environment

- We approach our work as responsible stewards of our environment to achieve our mission.
- We prevent pollution by identifying and minimizing environmental risk.
- We set quantifiable objectives, monitor progress and compliance, and minimize consequences to the environment, stemming from our past, present, and future operations.
- We do not compromise the environment for personal, programmatic, or operational reasons.

This report is a summary version of the LANL Environmental Report 2010 compiled by college students working at LANL. The full report is available on the web at www.lanl.gov/environment/all/esr.shtml.

# Contents

# What is the purpose of the Summary of the LANL Environmental Report 2010?

Every year, the Los Alamos National Laboratory (LANL or the Laboratory) produces an environmental report in compliance with the Department of Energy (DOE) order. This report:

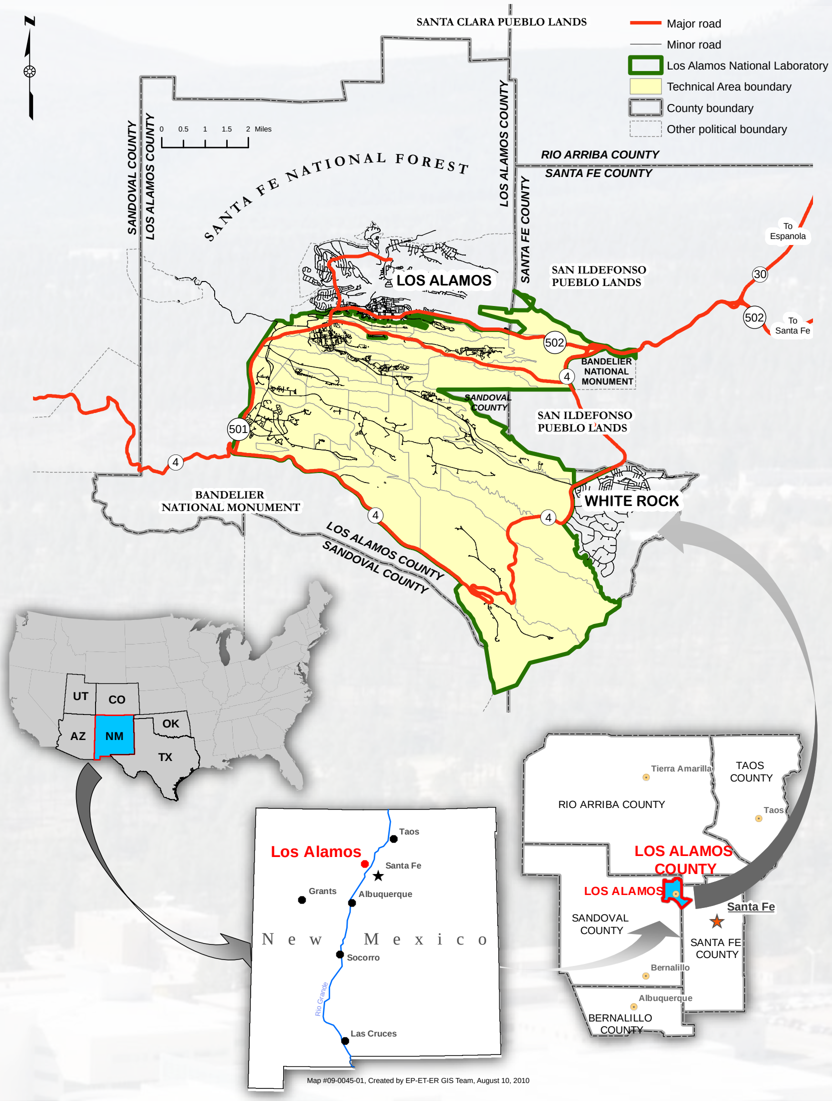
- Characterizes site environmental management performance, including effluent releases, environmental monitoring, and estimated radiological doses to the public from releases of radioactive materials.
- Summarizes environmental occurrences and responses reported during the calendar year.
- Confirms compliance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

# What is the history of LANL?

In March 1943, a small group of scientists came to Los Alamos for Project Y of the Manhattan Project. Their goal was to develop the world's first nuclear weapon. Although planners originally expected the task would require only 100 scientists, by 1945, when the first nuclear bomb was tested at Trinity Site in southern New Mexico, more than 3,000 civilian and military personnel were working at Los Alamos Laboratory. In 1947, Los Alamos Laboratory became Los Alamos Scientific Laboratory, which in turn became LANL in 1981.

# Where is LANL located?

The Laboratory is located in Los Alamos County, in north-central New Mexico, approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe. The 40-square-mile Laboratory is situated on the Pajarito Plateau, which 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.




# What is LANL's mission today?

With changes in technologies, priorities, and the world community, the Laboratory's original mission to design, develop, and test nuclear weapons has broadened. The current 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
- Solve other emerging national security challenges.

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.

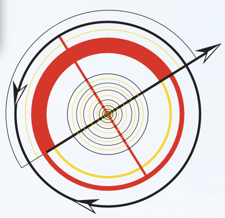
# Keeping impact As Low As Reasonably Achievable

The Laboratory is capable of achieving levels of contamination far below Environmental Protection Agency (EPA) standards. LANL strives to keep the dose to the public and the impact on the environment as low as possible. There are many examples of LANL demonstrating excellence in public safety and environmental awareness for the year 2010, including the following:

- New beam target installed at Los Alamos Neutron Science Center (LANSCE)–reducing airborne dose from stack emissions.
- Transuranic (TRU) Waste Program shipped a record amount of transuranic waste from Area G to the Waste Isolation Pilot Project (WIPP) in Carlsbad, New Mexico, reducing radioactive inventory.
- Establishing Zero Liquid Discharge as a goal, reducing the total number of outfalls and the amount of water discharged into canyons.
- Wildfire Reduction Efforts–tree thinning, erosion controls, and maintaining LANL fire roads.

LANSCE

Transporting waste to WIPP



**A**s
**L**ow
**A**s
**R**easonably
**A**chievable


**Compliance**

# What federal regulations did LANL comply with in 2010?

LANL is committed to protecting the environment while conducting its important national security and energy-related missions. In support of this commitment and as mandated by federal and state regulations and statutes, LANL complies with specific requirements and standards. The EPA and the New Mexico Environment Department (NMED) are the principal administrative authorities for these laws. The Laboratory is also subject to DOE requirements for control of radionuclides. By meeting the requirements and standards set by the EPA, NMED, and DOE, LANL is demonstrating our continuous protection of the public and the environment.

| Federal Statute | What it Covers | Status |
|---|---|---|
| Clean Air Act (CAA) | Requirements for air quality and air emissions from facility operations | • The Laboratory was in full compliance with all air permits and reporting deadlines.<br>• LANL did not have any permit deviations or excess emissions.<br>• LANL complied with all standards put forth by the asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP) in the renovation and demolition of 25 projects.<br>• LANL removed 5,873 lb of ozone-depleting refrigerants from inventory.<br>• The Laboratory provided the second annual greenhouse gas emissions report to NMED. |
| Clean Water Act (CWA) | Requirements for water quality and water discharges from facility operations | • 99% of the Laboratory's permitted construction sites were compliant with National Pollutant Discharge Elimination System (NPDES) requirements.<br>• Out of the 76 samples collected from the industrial outfalls, four exceeded effluent limits for residual chlorine levels and arsenic.<br>• LANL maintained 45 runoff gage stations and conducted over 1,000 rain event inspections at 290 sites. |
| Compliance Order on Consent | Requirements for investigation and cleanup of Solid Waste Management Units (SWMUs) and Areas of concern (AOCs) | • At the completion of extensive field work campaigns, LANL submitted all deliverables (reports, letters, plans) on time.<br>• The demolition of 24 buildings at Technical Area (TA)-21 was completed ahead of schedule and under budget. |

# The Laboratory's connection to the Northern New Mexico Community

LANL aims to be a positive and sustainable influence on our region's economy, education system, and quality of life in Northern New Mexico. The Environmental Communication and Public Involvement Program operates a proactive and interactive program that is inclusive and responsive to communities, tribes, agencies, and federal and state governments. The purpose is to increase public knowledge of environmental clean-up methodology and stewardship practices, to use stakeholder input to make better stewardship decisions, and to improve LANL's relationships and increase dialogue with the public. LANL conducts tours and public meetings and provides data collected by LANL and NMED through the Risk Analysis, Communication, Evaluation, and Reduction (RACER) database. Members of the public can visit LANL's Public Reading Room and view our environmental investigations and reports.

**Public Meeting Events Calendar:** http://www.lanl.gov/environment/calendar/index.htm

**Public Reading Room:** http://eprr.lanl.gov/oppie/service

**RACER:** http://www.lanl.gov/environment/all/racer.shtml

## Community Relations and the Environment

| Federal Statute | What it Covers | Status |
|---|---|---|
| Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) | Mitigation of pollution and contamination on LANL property | • The DOE and several other federal, state, and tribal entities in the region completed a pre-assessment screen towards completing a Natural Resource Damage Assessment for LANL.<br>• Two properties were transferred from LANL ownership. |
| Environmental Management System (EMS) | Continuous set of processes and practices undertaken to enable LANL to achieve environmental missions and goals. | • The Laboratory was in full compliance with its EMS.<br>• LANL maintained a high level of environmental compliance performance.<br>• A record number of transuranic waste shipments were correctly and safely shipped to the WIPP.<br>• LANL increased its public involvement events. |
| Emergency Planning and Community Right-to-Know-Act (EPCRA) | Public's right to know about chemicals released into the community | • LANL had no reportable leaks, spills, or other releases of chemicals into the environment.<br>• Chemical inventory reports were submitted to the Los Alamos County Fire and Police Departments for 20 chemicals or explosives.<br>• LANL was above the threshold of reporting the use of lead in 2010 mostly at an on-site firing range where security personnel conduct firearms training. |
| Endangered Species Act (ESA) and Migratory Bird Treaty Act (MBTA) | Protection of rare species of plants and animals and their habitat | • LANL reviewed 622 excavation permits and 148 project profiles for potential impacts to threatened or endangered species.<br>• LANL updated its Migratory Bird Best Management Practices Source Document. |
| National Environmental Policy Act (NEPA) | Projects evaluated for environmental impacts | • LANL verified the completion of an environmental assessment for the Sanitary Effluent Reclamation Facility and Environmental Restoration of Sandia Canyon. |
| National Historic Preservation Act (NHPA) | Projects evaluated for environmental impacts to historical sites | • The Laboratory conducted 44 projects that required field verification of previous cultural surveys.<br>• Three new archaeological sites and 19 new historical buildings were identified in 2010.<br>• Twelve historic buildings were determined eligible for the National Register of Historic Places. |
| Resource Conservation and Recovery Act (RCRA) | Regulates generation, transportation, treatment, storage of solid waste, hazardous waste, and underground tanks storing petroleum products and other hazardous substances | • NMED renewed the LANL Hazardous Waste Facility Permit.<br>• No hazardous waste management units at LANL underwent closure activities in 2010.<br>• The Laboratory completed 1,650 self-assessments.<br>• The Laboratory shipped approximately 76 cubic-meters of low-level mixed waste and 319 cubic meters of mixed transuranic waste for treatment and disposal.<br>• LANL recycled 8,594 metric tons of material.<br>• LANL discovered seven issues with the labeling of hazardous waste. All instances were corrected and did not result in actual or potential hazards to the environment or personnel. |

Radiation and Radioactive Material

Sun = **radioactive material/source**

Sun rays = **radiation**

Person on the beach = **receptor**

Sunburn on skin = **dose**

# The Direct Penetrating Radiation network

## What is radiation?

Radiation is the transfer of energy through space in the form of alphas, betas, gammas, and neutrons. It is measured in units of millirem (mrem).

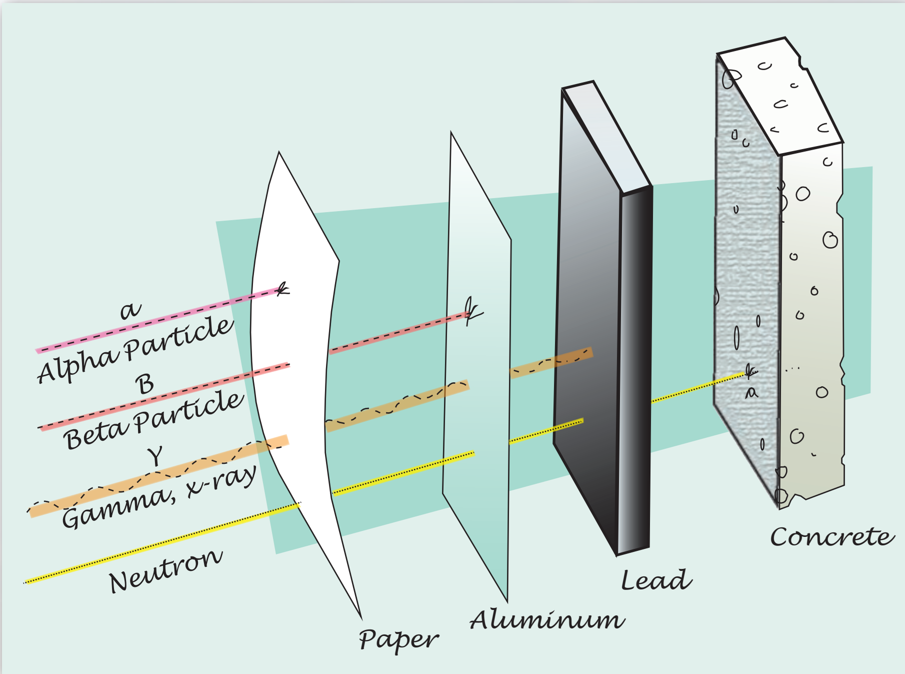
Radiation dose is also measured in mrem. Dose is a measure of the potential risk or harm. The risk or harm is caused by the energy transferred from the radioactive atom to a person, animal, or plant. "Direct penetrating radiation" is direct because it is the energy that causes the risk or harm.

## Is all radiation 'penetrating'?

Alphas will not penetrate the skin, so they can only do harm if the radioactive material is inside you.

Betas will not penetrate more than 20 feet of air, so they can only do harm if the source is close.

Gammas and neutrons, which are examples of "direct penetrating radiation," can penetrate more than 100 meters of air.




## Why does LANL monitor direct penetrating radiation?

There are known sources of radiation near Los Alamos. Because LANL wants to assure that the public is protected from these sources, LANL monitors the impact of gammas and neutrons on the surrounding environment.

## How does LANL monitor radiation?

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

These TLDs are placed at 98 locations around LANL, near known sources of radiation and at each AIRNET station, and are also worn by many LANL employees. They are analyzed quarterly for dose measurements.

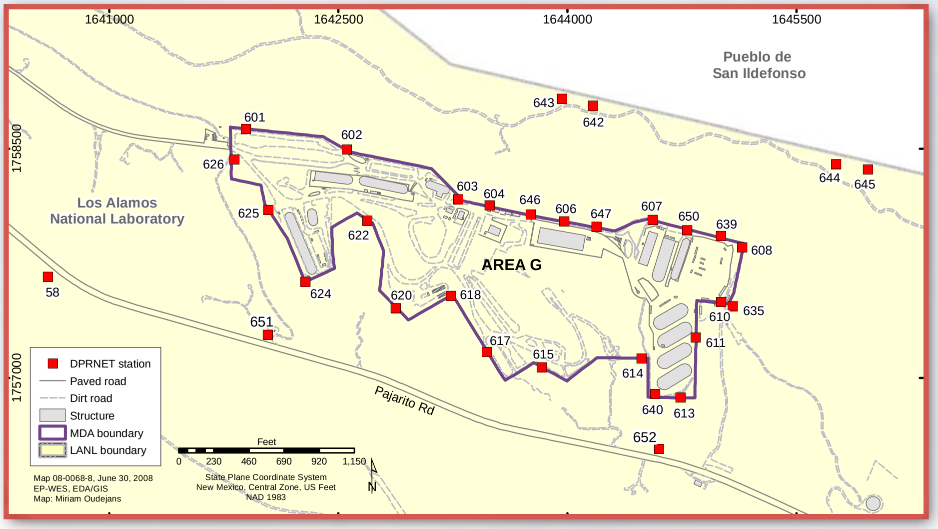
## Why do LANL workers wear TLDs and not the public?

Natural radiation is much larger than the radiation from LANL and is quite variable. A TLD would not be able to distinguish between the small amount from LANL and the large natural variations. Depending on work location and work activities, some LANL workers may work near large sources of radiation that are inaccessible to the public. These workers could expect to receive a dose from LANL.

## How can we distinguish LANL radiation from natural radiation?

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 is large, we can directly measure the dose where the people are; if it is a small amount, we calculate how much gets to the people.

Some of the LANL 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 gets to people, animals, or plants.




TLD stations around Area G

## Results

For 2010, the dose from direct penetrating radiation was 0.9 mrem/year (yr), which is far below the DOE dose constraint of 25 mrem/yr.

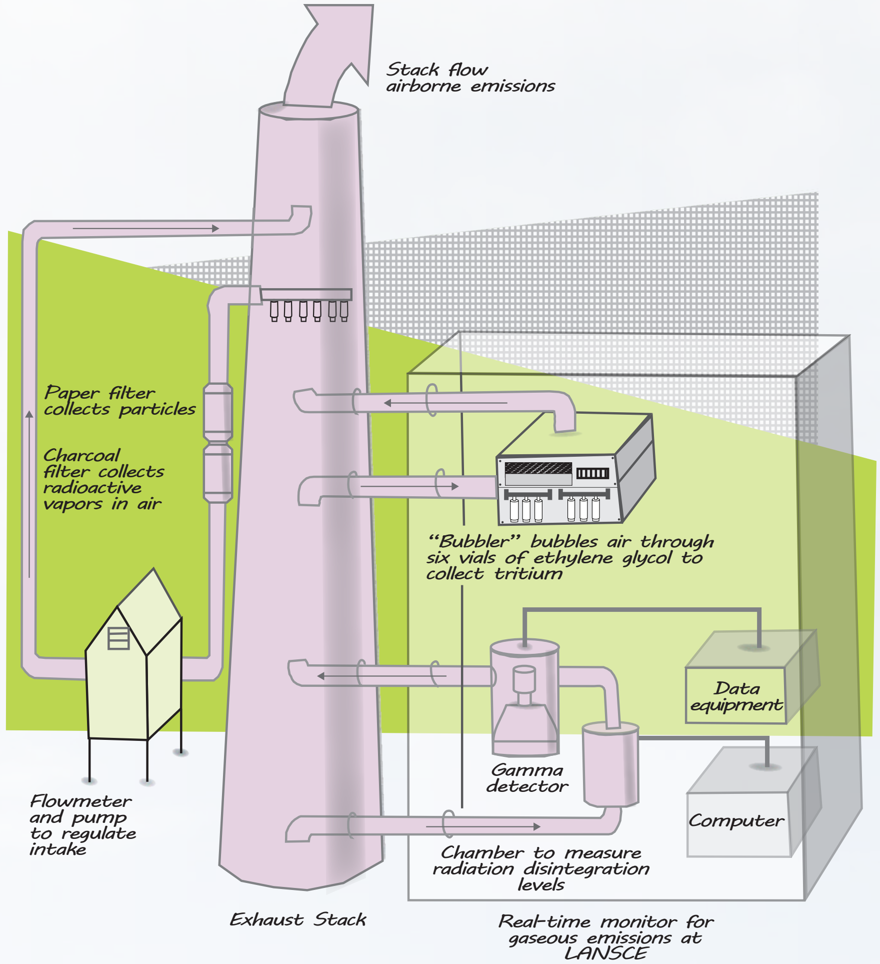
### What is Area G?

Area G is the Laboratory's primary radioactive waste storage and disposal facility.

Waste is contained in pits, shafts, or trenches in the bedrock, or stored in drums awaiting shipment off-site.

# Why does LANL monitor air?

LANL monitors many different pathways in order to assess their impact on workers, the public, animals, and plants. Of the different pathways monitored, air is the most significant. Air is important because once there is a release, it is impossible to contain.




## How does LANL monitor the air?

### Stack Monitoring

Stack monitoring measures the amount of radioactive material at the source of the emission to calculate the dose to the receptor.

Samples are taken from the air in the stack and then analyzed.

LANL monitors four different types of emissions:

a.) Particulate matter, such as plutonium and uranium particles

b.) Radioactive vapors, such as iodine-131

c.) Tritium, an isotope of hydrogen

d.) Radioactive gases, such as oxygen-15, nitrogen-13, and carbon-11

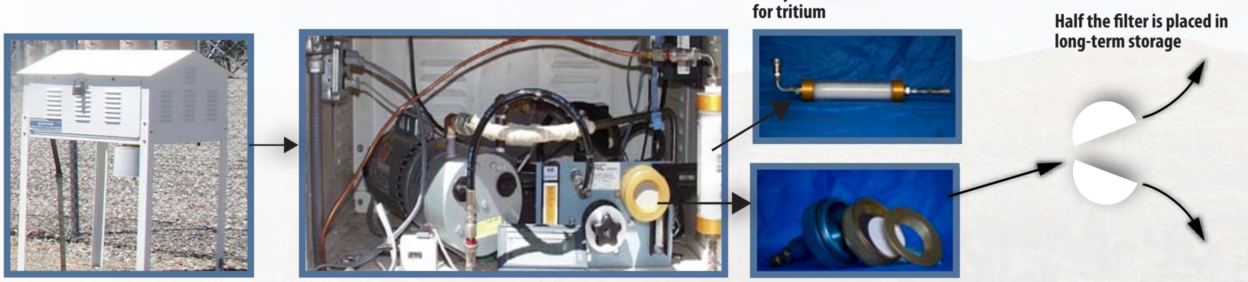
The computer model CAP88 then uses the emission data to calculate the dose to the public.

### AIRNET

The Los Alamos town site is downwind from LANL, so there are many monitoring stations in and around the town. The purpose of the air monitoring network (AIRNET) is to monitor locations where people live or work.

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

Half the filter is placed in long-term storage

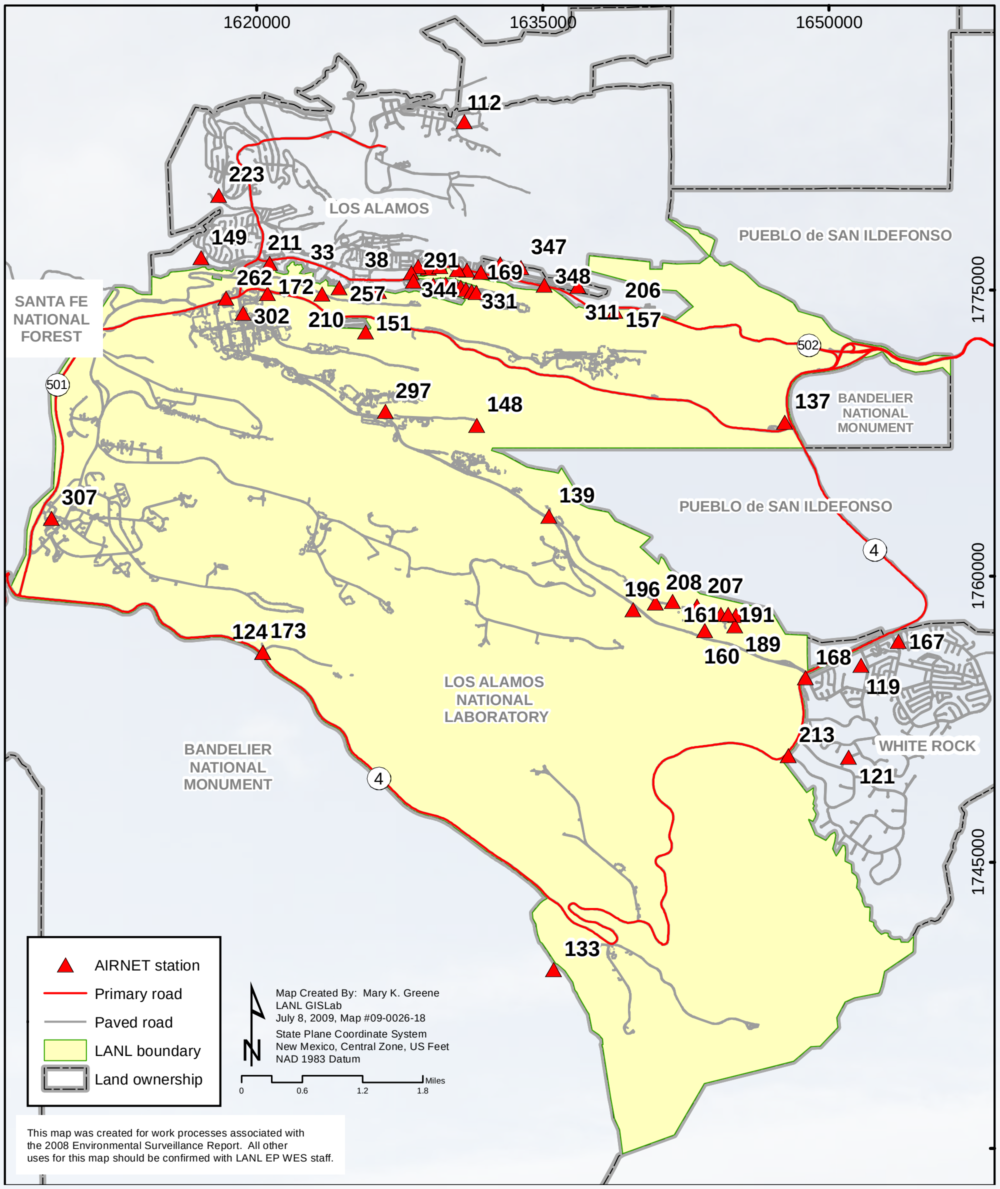


AIRNET stations monitor ambient air on-site and off-site

Inside the AIRNET station

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

After a three-month period, half-filters from the same station are tested for plutonium, americium, uranium, aluminum, beryllium, and calcium




Locations of AIRNET stations

## AIRNET Locations

In 2010, LANL operated approximately 60 AIRNET stations to sample for radionuclides. AIRNET stations monitor 24 hours a day, 365 days of the year.

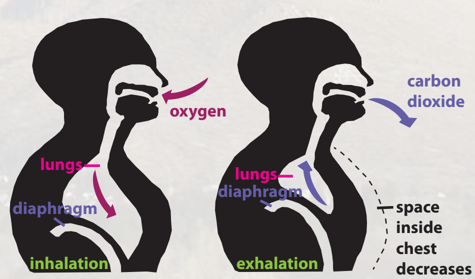
The monitoring stations take in air at roughly 100 liters/minute (L/min), which is approximately five times the rate at which humans breathe. The data LANL produces become more accurate because AIRNET samples a large amount of air.

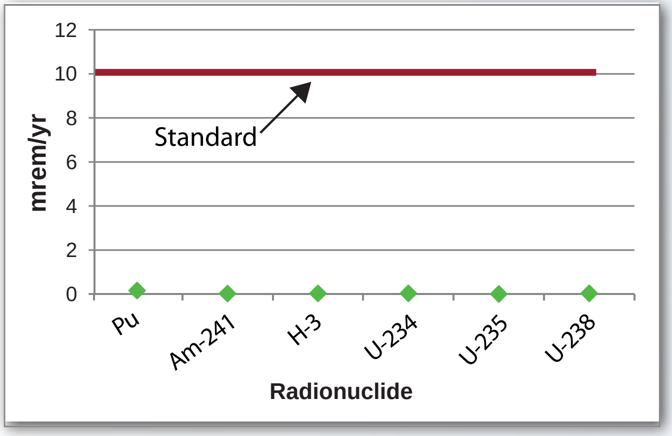
Particulates are collected on a filter and analyzed every two weeks for identification of analytes and assessment of the potential impact on the public.

### How much air do we breathe?

- *Tidal volume* refers to the volume of air in the lungs when a person takes a normal breath, or a breath requiring no extra effort.
- The tidal volume for an average person is approximately 1L.
- The average person breathes about 20 L/min.

### The Mechanics of Breathing






2010 dose by airborne analyte

# What analytes does LANL measure?

LANL expects to emit certain analytes to the air based on the materials that are used at each facility. The materials used include plutonium, americium, uranium, and tritium. For 2010, americium and uranium levels were similar to previous years and remained below EPA standards. The levels of plutonium were far below EPA standards. LANL also measured elevated tritium concentrations at a known source near Area G, but these concentrations were also far below EPA standards.

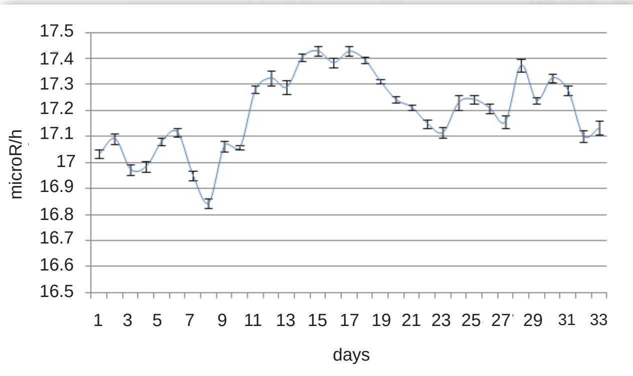
NEWNET station

## Does LANL do any special monitoring?

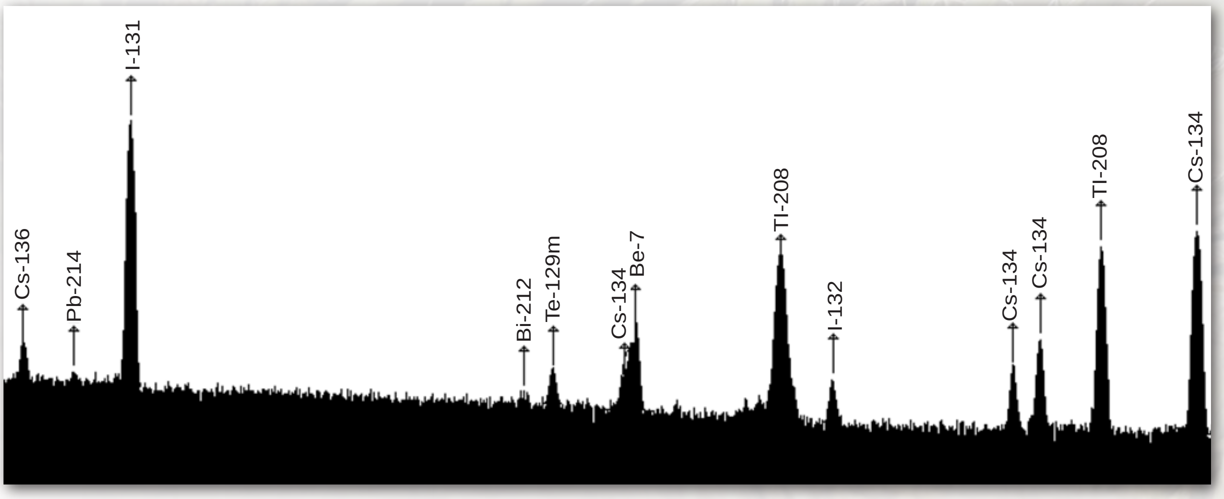
Following the March 11, 2011, earthquake and tsunami that damaged the Fukushima Daiichi nuclear plant in Japan, LANL implemented special air monitoring to assess the impact. Models predicted that a radioactive plume from the reactor would arrive in the United States on March 18 so LANL supplemented the routine air samplers using three high-volume samplers. These samplers have an air intake about 100 times the human breathing rate, and the filters are changed every three days.

The first indications were detected by the monitoring program known as the Neighborhood Environmental Watch Network (NEWNET). NEWNET is valuable because it updates every 15 minutes and is able to give early indications of increases in radiation due to radioactive particulates in the air. However, NEWNET only measures gammas and is not able to identify the specific isotope.

During March 19-21, NEWNET detected an increase of 0.2 microR/h, and then an additional increase of 0.1 microR/h on March 24.




The average radiation (microR/h) recorded by NEWNET from March 11 (day 1) through April 12 (day 33). An increase in radiation due to fission products from Fukushima Daiichi can be seen from day 9 (March 19) through day 23 (April 2).




This spectrum uses specific gamma energies to identify the analytes detected by NEWNET.

These observations were confirmed by the high-volume samplers, which detected cesium-134, cesium-136, cesium-137, tellurium-132, iodine-131, and iodine-132. These fission products have not been detected at LANL since the Chernobyl accident in 1986 and are unambiguous evidence of a leak from a nuclear reactor. The levels of these radionuclides peaked from March 24 to March 28, and then began to gradually decline. The data collected by LANL are consistent to those collected by the EPA and are far below levels of concern.

## Results

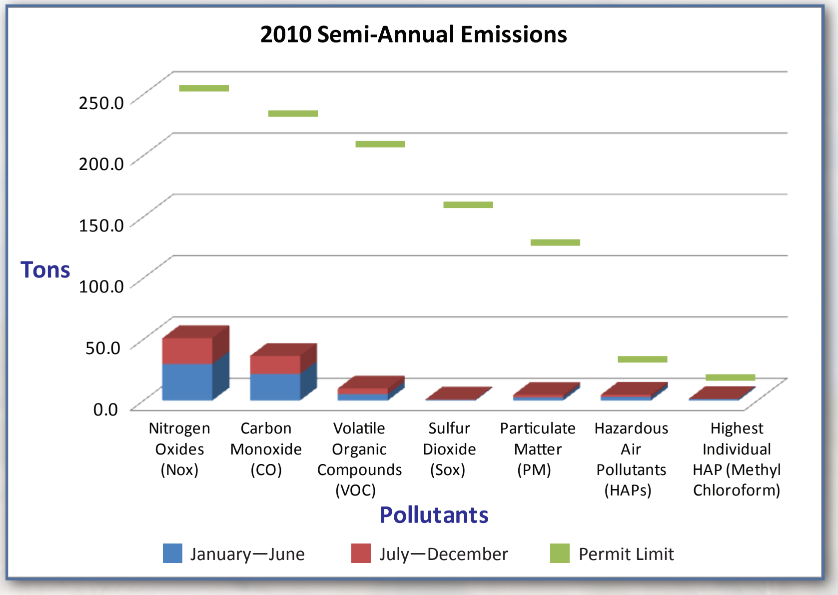
For 2010, LANL detected no airborne radioactivity that exceeded EPA standards. The largest dose to the public was 0.33 mrem, which is far below the airborne pathway dose limit of 10 mrem/year.

## What pollutants does LANL monitor?

In compliance with the CAA, LANL also does monitoring of non-radiological pollutants, such as carbon monoxide (CO), sulfur oxides (SOx), nitrogen oxides (NOx), volatile organic compounds (VOCs), and particulate matter (PM).

## Results

Emissions of these pollutants from 2006 to 2010 are relatively constant and remain far below permit limits. Meeting the permit limits ensures that LANL meets the EPA's National Ambient Air Quality Standards.




## What else does LANL monitor?

LANL also does a quarterly analysis of 38 sites for beryllium contamination because beryllium dust can affect our lungs. Similar to previous years, the 2010 concentrations were below 2% of the EPA standard.

- CO is the product of inefficient burning, such as from a motor vehicle.
- SOx, including sulfur dioxide, are 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.
- NOx, including nitrogen dioxide, are 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. When VOCs interact with sunlight, they create ozone.
- PM is a hazard to human health when the particle size becomes small enough to enter the lungs, e.g., smoke.

# What is dose?

Dose is a measure of the potential harm or risk. A large dose of any sort has the potential to be harmful. The doses reported here 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 $8 \times 10^{-7}$ per mrem received.

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

## How does LANL determine the dose to the public and environment?

LANL 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 can get into the body and the given pathway.

# What are 'pathways'?

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

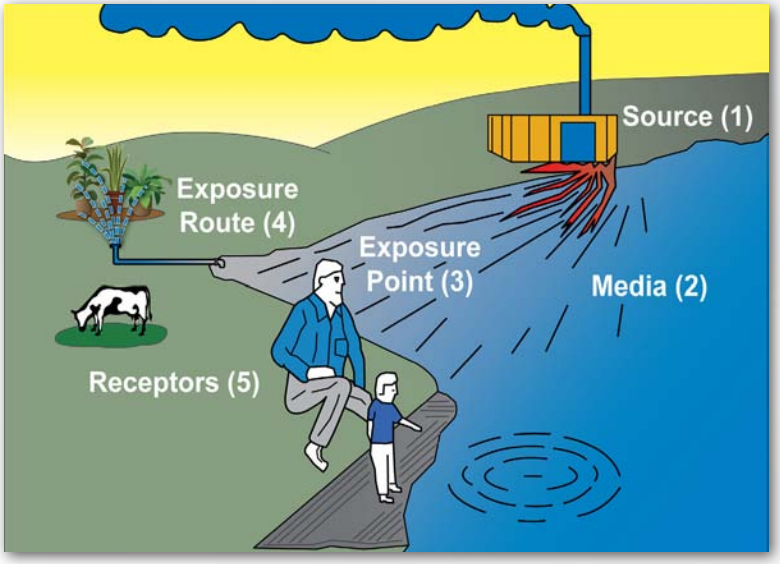
For the direct exposure pathway, radiation directly penetrates the body.

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 then a human eats the animal.
- Crops are irrigated with surface water, and then a human 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.




(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 the MEI?

LANL monitors the potential radiation dose to the public by calculating the dose to the maximally exposed individual (MEI). The MEI is a hypothetical person located offsite of LANL property, such as at a residence or place of business, who receives the greatest radiation dose from LANL 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 hypothetical person is also assumed to eat food grown at the location and drink water found at the location. LANL calculates doses for two different MEIs.

## The Airborne Pathway MEI

The airborne pathway MEI location is determined by using AIRNET data, stack sampling, and computer models to calculate the greatest potential airborne dose.

In previous years, the airborne pathway MEI was located at East Gate because of the radioactive emissions from the LANSCE stack. However, a new beam target was installed at LANSCE in early 2010. Because of this improvement, the stack emissions from LANSCE were significantly reduced, and the location of the airborne pathway MEI was changed.

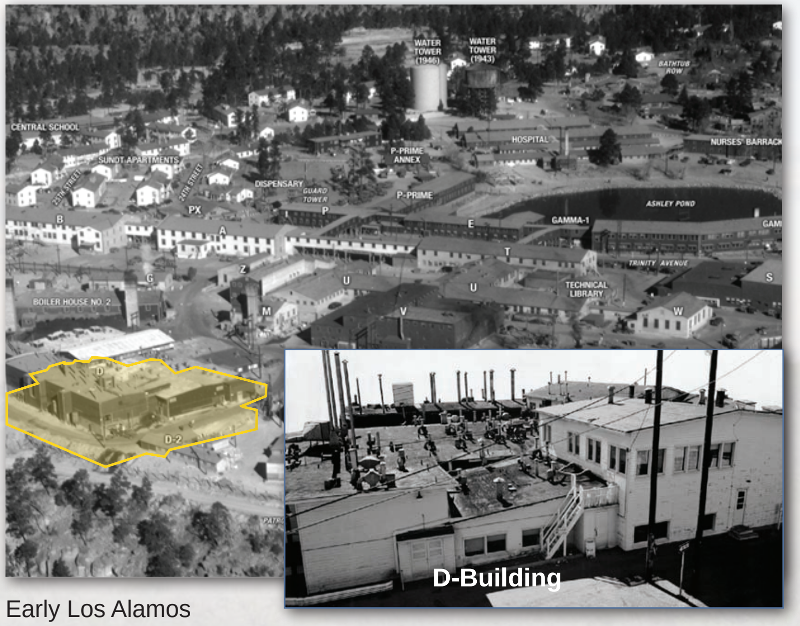
The 2010 MEI location for the airborne pathway is near the former Los Alamos Inn on Trinity Drive.

The primary contributor to the radiation dose at this location is plutonium-239 from the early days of Los Alamos (1944-1945). The plutonium facility, then known as D-Building, was situated south of Ashley Pond near the location for the 2010 MEI. The buildings were constructed hurriedly and not according to modern standards so as not to delay wartime efforts. The facility disposed of its waste through a pipe that led out over the edge of Los Alamos Canyon.

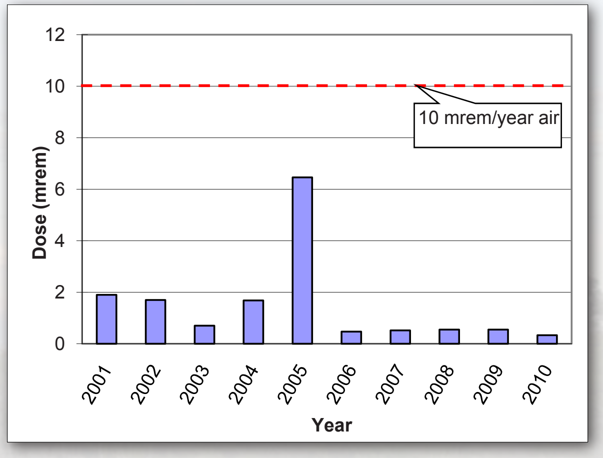
Plutonium-239 can be found on the surface of the south-facing slope of Los Alamos Canyon, on LANL property. The contamination extends out to approximately 10 yards from the AIRNET station and is localized, meaning the contamination is not moving and is located in a specific area.

## Results

AIRNET station 257 is located near this area of contamination. When the plutonium on the surface soil is resuspended by the wind, it is detected by the AIRNET station, and a dose can be calculated for this location. The AIRNET dose at this location is 0.174 mrem. When combined with the doses from the LANSCE emissions and all air emissions from LANL sources, the total MEI dose for 2010 is 0.33 mrem, which is far below the EPA standard of 10 mrem/yr.




Early Los Alamos

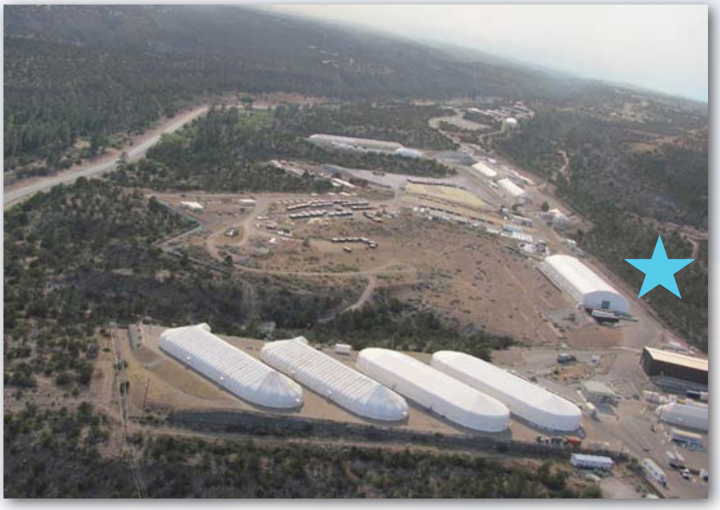



Annual airborne pathway (Rad-NESHAP) dose (mrem) to the MEI over the past 10 years

## The all-pathways MEI

The all-pathways MEI considers every possible way radiation from LANL might affect a human. To determine the dose for the all-pathways 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 (neutron) 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.



Area G in TA-54

## Results

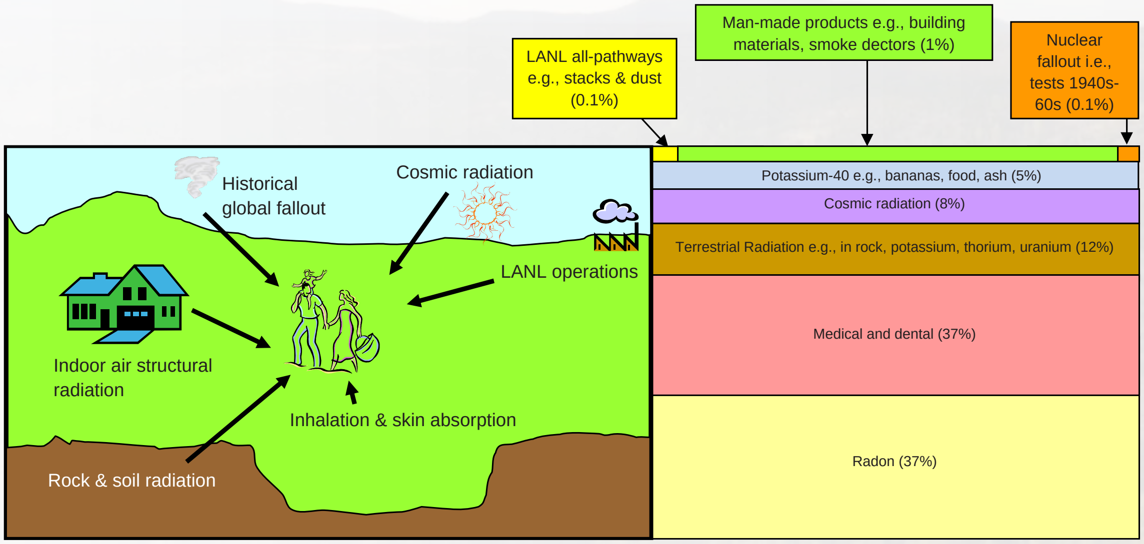
For 2010, the all-pathways MEI is located at the boundary between LANL and the Pueblo de San Ildefonso sacred area, near TA-54 (Area G). This has been the location for the all-pathways MEI in previous years. It is marked with the blue star on the figure above.

Because there is no residence or place of business, a standard occupancy factor of 1/16 is assumed, meaning that a person could be expected to spend about 1.5 hours per day at this location, every day of the year.

1. After subtracting background dose and applying the occupancy factor, the calculated neutron dose at this location is 0.7 mrem/yr.
2. Using measurements from the highest-dose AIRNET station in the area, the airborne pathway dose is calculated to be 0.2 mrem per year.
3. The dose to the ingestion pathway is too small to measure.

This results in a dose of approximately 0.9 mrem/yr, which is far below the 100 mrem/yr DOE dose limit.

**Background radiation ~750 mrem/year. Additional from LANL < 1 mrem/year.**




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

## How does LANL calculate the dose to biota?

Biota are the plant and animal life that inhabit a region. They are not usually eaten by humans and include native vegetation, small mammals, birds, and bees.

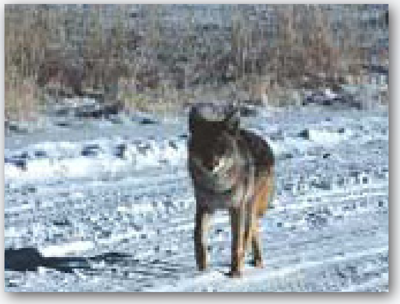
LANL monitors the dose to biota using data from soil and water samples and the computer program RESRAD-BIOTA. Dose limits are applied to whole biota populations, rather than an MEI.

The DOE dose limits for biota are

- Terrestrial animals: 0.1 rad/day (100 mrad/day)
- Terrestrial plants: 1 rad/day (1,000 mrad/day)

## Results

For 2010, all radionuclide concentrations in terrestrial animals and plants were less than 10% of the DOE dose limits.



Mexican Spotted Owl

## What is the difference between Standards, Screening Levels and Background Levels?

Standards are created to protect a defined group from a specific contaminant for a known exposure pathway during a specific time frame. Unique standards exist for different hazards, exposure pathways, and the extent and duration of exposure. The Laboratory compares concentrations of radioactive and chemical constituents in air and water samples with relevant standards or guidelines in regulations of federal and state agencies. When a standard is exceeded, action is required to treat or remove the contaminant.

The Laboratory also uses screening levels (SL) to raise awareness of the presence of a contaminant.

If a contaminant is above the SL or standard, it does not necessarily mean it poses a threat to human health. Rather, these levels are designed to protect the public health by identifying contaminant exposure at which there is no threat of harm with a large margin of error.

A background level refers to constituents that are not influenced by releases from LANL. These constituents are constantly present in the environment and are emitted by natural and artificial sources. Background levels provide a defensible reference point that can be used to evaluate whether or not a release from the site has occurred.

# Surface water at LANL

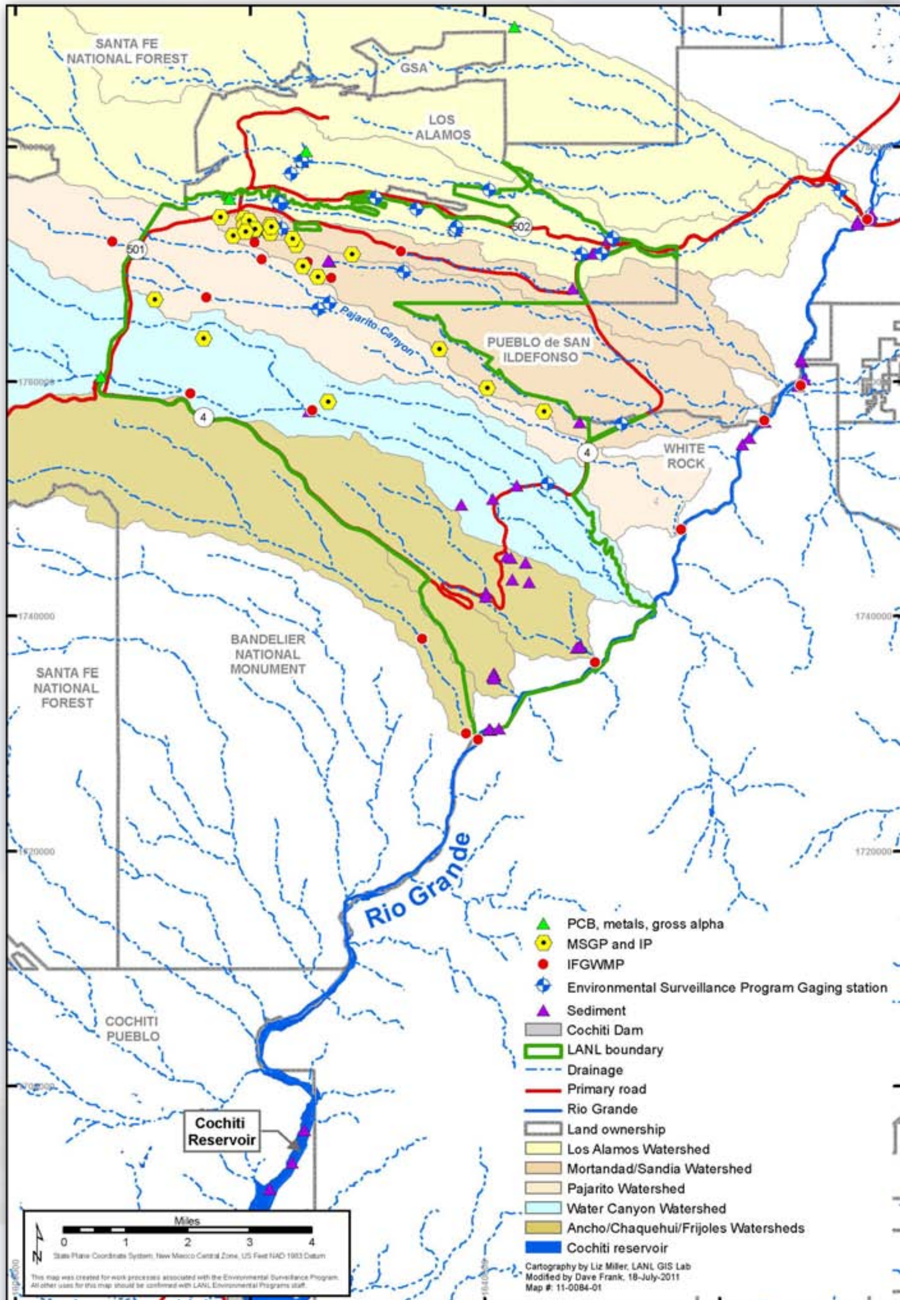
LANL monitors the quality of surface water, including storm water and stream sediment on Laboratory property and elsewhere in Northern New Mexico to evaluate the potential environmental effects of Laboratory operations on affected watersheds. LANL has several programs to ensure storm water runoff and stream sediment into canyons will not harm the environment. These programs are an important component of LANL's overall environmental surveillance program and ensure compliance with national and state requirements.

## How is the surface water and sediment regulated?

New Mexico's surface water standards are intended to protect water quality through a three-step process: (1) designating uses for rivers, streams, lakes and other surface waters, (2) setting criteria to protect those uses, and (3) establishing anti-degradation provisions to preserve water quality. NMED has established concentration standards for non-radionuclides and selected radionuclides in surface water. DOE has established radiological dose limits for surface water to protect biota.

Surface water at LANL is protected for wildlife, aquatic life, and secondary contact such as boating or fishing. The NMED and EPA have issued permits to protect waters for these uses. The permits are for monitoring all surface water discharges on Laboratory properties. Snowmelt runoff, storm water, base flow on Laboratory property, and base flow along the Rio Grande are surface water discharges included in the permits. Surface water within the Laboratory is not used as drinking water, municipal, industrial, or irrigation water. However, wildlife may use surface waters within the Laboratory, and standards are set at levels to protect wildlife habitat.

A LANL employee clears sediment from a water monitoring shoot after heavy rainfall.





Sediment sampling

## How does LANL demonstrate that we are protecting surface water and sediment?

LANL collects surface water and sediment samples in all major canyons that cross present and former Laboratory lands, some short tributary drainages, and along the Rio Grande. Additionally, surface water and sediment are sampled at several locations on the Pueblo de San Ildefonso lands in canyons that occasionally have storm water flows from the Laboratory.

### Different Types of Surface Water

- Base flow—continual stream flow but not necessarily present year round.
- Snowmelt runoff—flowing water present because of melting snow.
- Storm water runoff—flowing water present in response to rainfall.

Automated storm water sampler in use

## Protection of the Rio Grande

The City of Santa Fe and Santa Fe County completed the construction of the Buckman Direct Diversion (BDD) Project in December 2010. The BDD Project takes surface water from the Rio Grande and then treats and distributes these waters to the city and the county through their drinking water distribution systems. An independent peer review of the potential exposure to LANL contaminants through the drinking water pathway concluded that there is no health risk to people from drinking BDD tap water.

To address public concerns, LANL installed a monitoring system in lower Los Alamos Canyon. Through the use of remote telemetry, the system automatically notifies the BDD Project of storm water flows entering the Rio Grande. The BDD Project can then choose to temporarily discontinue water intake from the Rio Grande. Storm water flows entered the Rio Grande from Los Alamos and Pueblo canyons on two occasions during 2010. The system successfully notified the BDD Project in each case.

## Summary of results

Of the more than 100 analytes reported in sediment and surface water within the Laboratory, most are at concentrations below standards or screening levels. However, every major watershed has some impact from Laboratory operations. The overall quality of most surface water in the Los Alamos area is good.

There are contaminated sediments in Los Alamos, Pueblo, Delta Prime (DP), and Mortandad Canyons from historic discharges of liquid effluents containing radionuclides. The concentrations of radionuclides decrease with distance from the points of discharge. Evaluations of contaminants in sediment across LANL have indicated that they do not currently pose risks to human health or ecosystems. Engineered structures have now been constructed in each canyon to reduce the transport of contaminants to low levels.

Of special concern to NMED and the public has been the presence of polychlorinated biphenyls (PCBs) in sediments. During rainfall events, contaminated sediments are suspended into storm water. PCBs are specifically regulated because sediments are ingested by bottom dwelling fish, which then can be caught and ingested by humans. (See sidebar – What are PCBs?) LANL has constructed sediment traps in Mortandad and Los Alamos canyons. Grade control structures were constructed in DP and Pueblo canyons in 2010 to stabilize sediments and contaminants in place and reduce transport of PCBs towards the Rio Grande.

LANL is conducting a study to determine the regional distribution of PCBs on the Pajarito Plateau. The study is being done cooperatively by DOE, NMED, and the Laboratory. The main objective of this study is to determine background and baseline concentrations of PCBs in regional and local surface waters. This study will be published in 2011.

## What are LANL's mitigation activities?

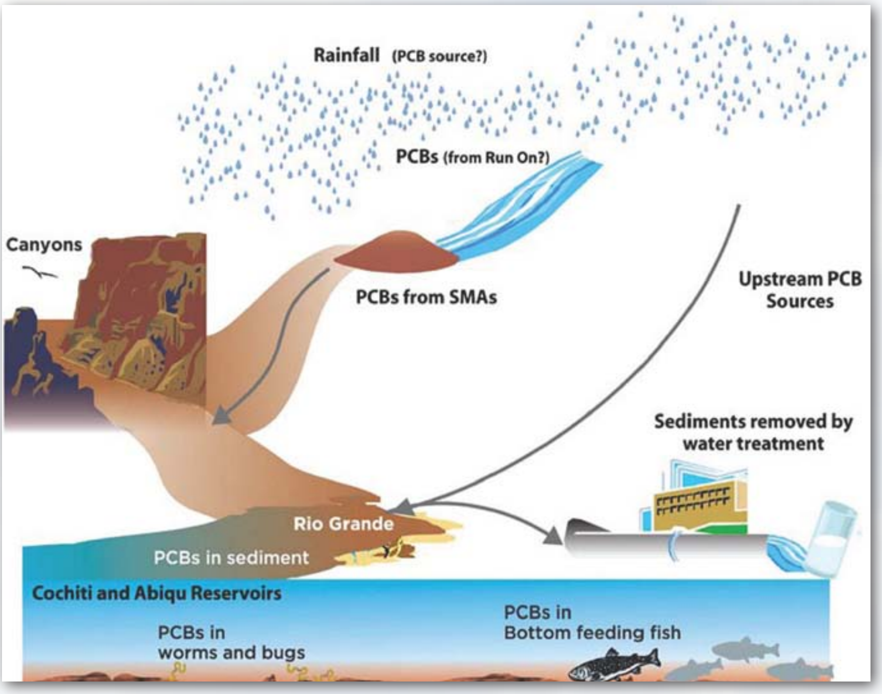
An additional objective of monitoring is to evaluate the effects of sediment transport mitigation activities. LANL has completed projects in Pueblo and DP canyons in 2010 to reduce the transport of contaminated sediments. Sediment controls function to remove and retain sediment from surface water discharges. Controls include compost mulch, rock check dams, sediment traps, and grade control structures.


Rock check dams reduce the velocity of concentrated storm water flows and are an effective aid in trapping sediment particles by virtue of the ability to pond runoff.


Wood mulch is an engineered erosion control material used to prevent wind erosion and rill formation and promote revegetation.


Gabion sediment traps prevent offsite sediment migration.

# PCB transport and exposure pathways




### What are PCBs?

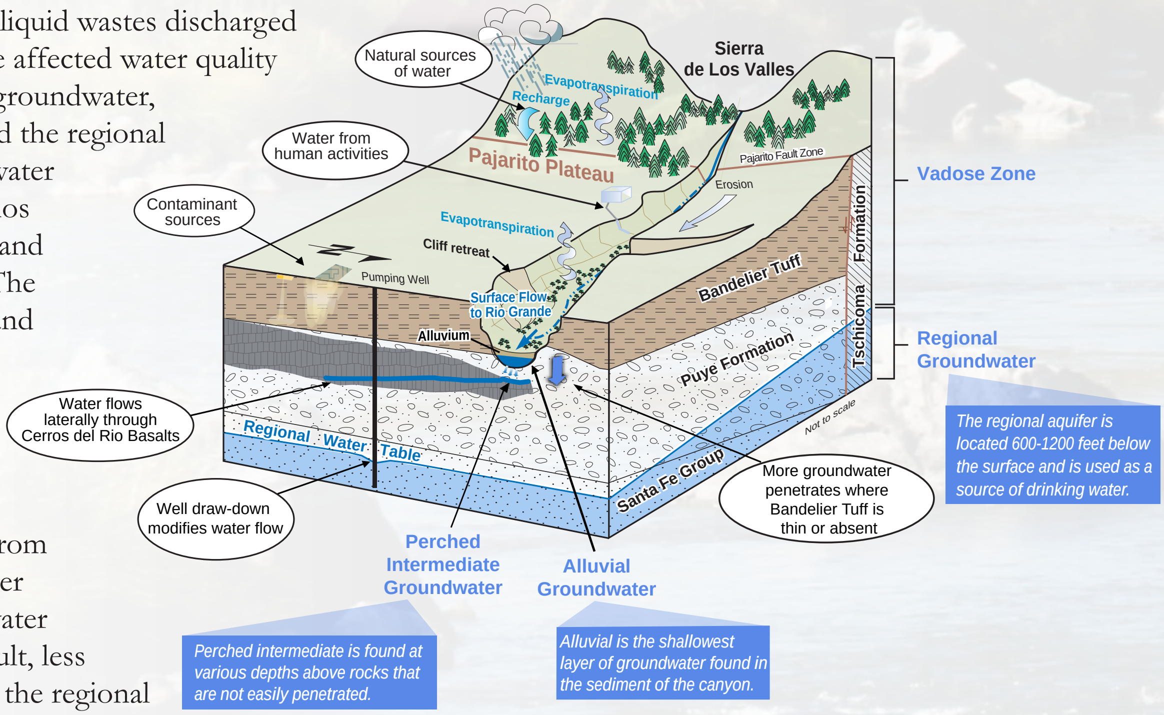
PCBs are a type of long-lived synthetic organic chemical. Because of their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications. Such applications included electrical heat transfer and hydraulic equipment; as plasticizers in paints, plastics, and rubber products; in pigments, dyes and carbonless copy paper; and for many other uses. Although banned in 1977, PCBs continue to enter the environment from various sources including leaks, landfills, urban runoff, sewage sludge, incineration of municipal refuse, and illegal disposal. Due to their chemical structure, PCBs tend to accumulate in sediment and fatty tissues in fish.

*LANL has several programs to ensure storm water runoff and stream sediment into canyons will not harm the environment.*

# Why does LANL monitor groundwater?

Over the last 60 years, liquid wastes discharged by the Laboratory have affected water quality in the shallow alluvial groundwater, intermediate zones, and the regional aquifer. The drinking water produced by Los Alamos County meets all state and federal requirements. The contaminated alluvial and intermediate perched groundwater bodies are separated from the regional aquifer by 350 to 900 feet of dry rock, so drainage from the shallow groundwater to the deeper groundwater occurs slowly. As a result, less contamination reaches the regional aquifer than is found in the shallow perched groundwater bodies, and impacts on the regional aquifer are usually reduced or not present.

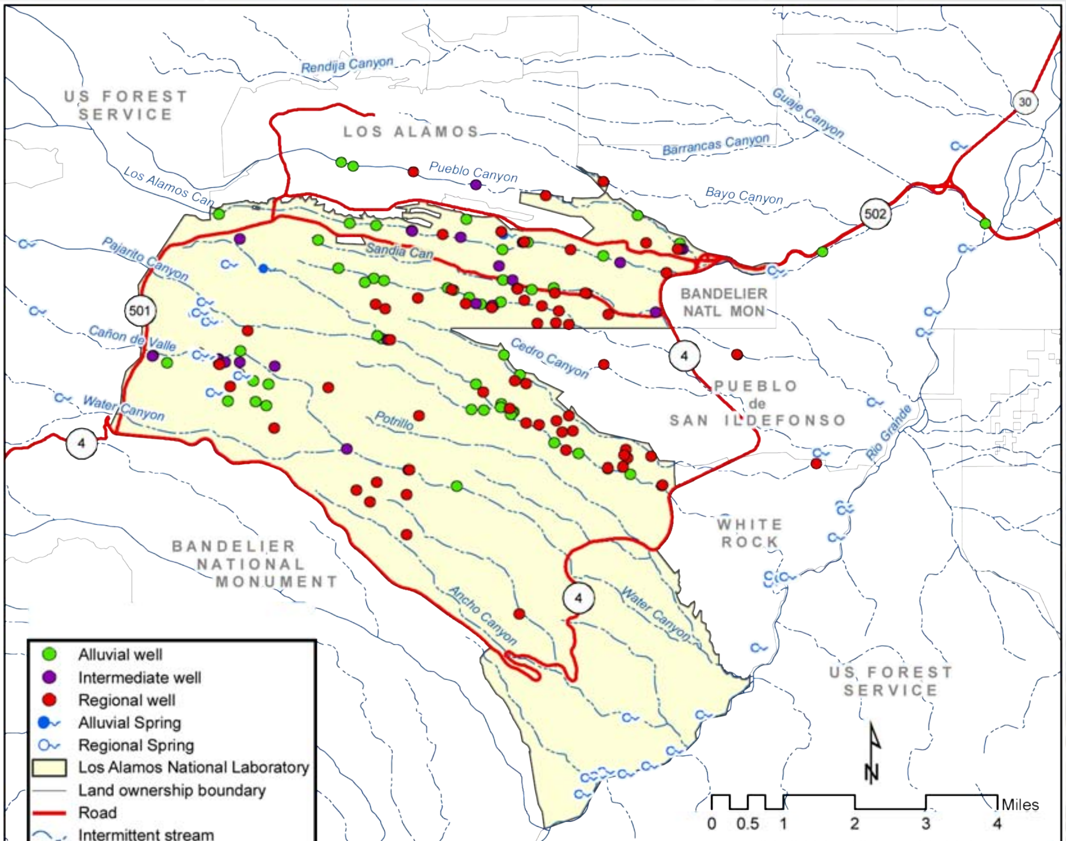
Water Flow Model on the Pajarito Plateau Groundwater Zones




# Why is protecting the groundwater important?

The groundwater in Los Alamos is crucial to the community as it provides all of their drinking water. LANL routinely analyzes groundwater samples to monitor water quality and to identify contamination issues that could impact human health or harm the ecosystem. The Laboratory conducts groundwater monitoring to comply with the requirements of the DOE Orders and state and federal regulations.

The Laboratory uses federal and state drinking water and human health standards as "screening levels" to evaluate concentrations in all groundwater, even though many of these standards only apply to drinking water.



Groundwater Sampling Locations

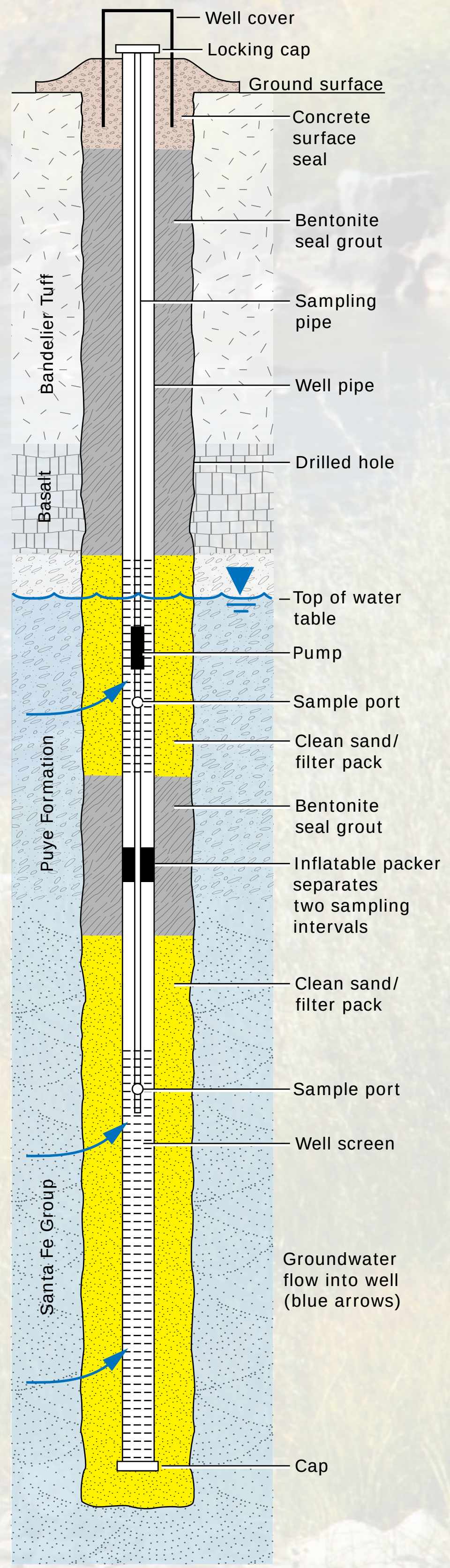
# How is groundwater monitored?

In 2010, LANL sampled 232 groundwater wells, well ports, and springs in 561 separate sampling events. LANL also installed two perched-intermediate monitoring wells and 12 regional monitoring wells. Eight older wells not needed for monitoring were plugged and abandoned.

Groundwater is monitored at various depths, thus enabling LANL to find contaminants and observe trends. Some wells sample more than one groundwater zone through separate screens. The screens are separated inside the well by inflatable packers allowing water to be drawn from each screen and preventing cross contamination between aquifers. Prior to collecting a sample, the well must be purged to remove stagnant water and ensure the sample is an accurate representation of the nearby groundwater.

*LANL routinely analyzes groundwater samples to monitor water quality and to identify contamination issues that could impact human health or harm the ecosystem.*

Monitoring Well




Typical structure of a monitoring well

### LANL's investigation of chromium in groundwater

The Laboratory is monitoring the presence of chromium from former Laboratory activities that has made its way into groundwater beneath Laboratory property. Chromium from former Laboratory activities has not affected drinking water. In cooperation with NMED, the Laboratory is continuing to monitor levels of chromium as part of a larger work plan for remediation in the area.

### Does LANL impact the City of **Santa Fe's Buckman Well field?**

In 2010, LANL sampled three wells in the City of Santa Fe's Buckman Well field. As in past samples, these wells contain natural uranium that is below the New Mexico groundwater standard. Naturally occurring metals such as arsenic and boron were also high in some wells. None of these contaminants are due to LANL discharges.

## What LANL contaminants were found in groundwater near or above screening levels in 2010?

The table below lists contaminants found in groundwater during 2010 that met one or more of the following criteria:

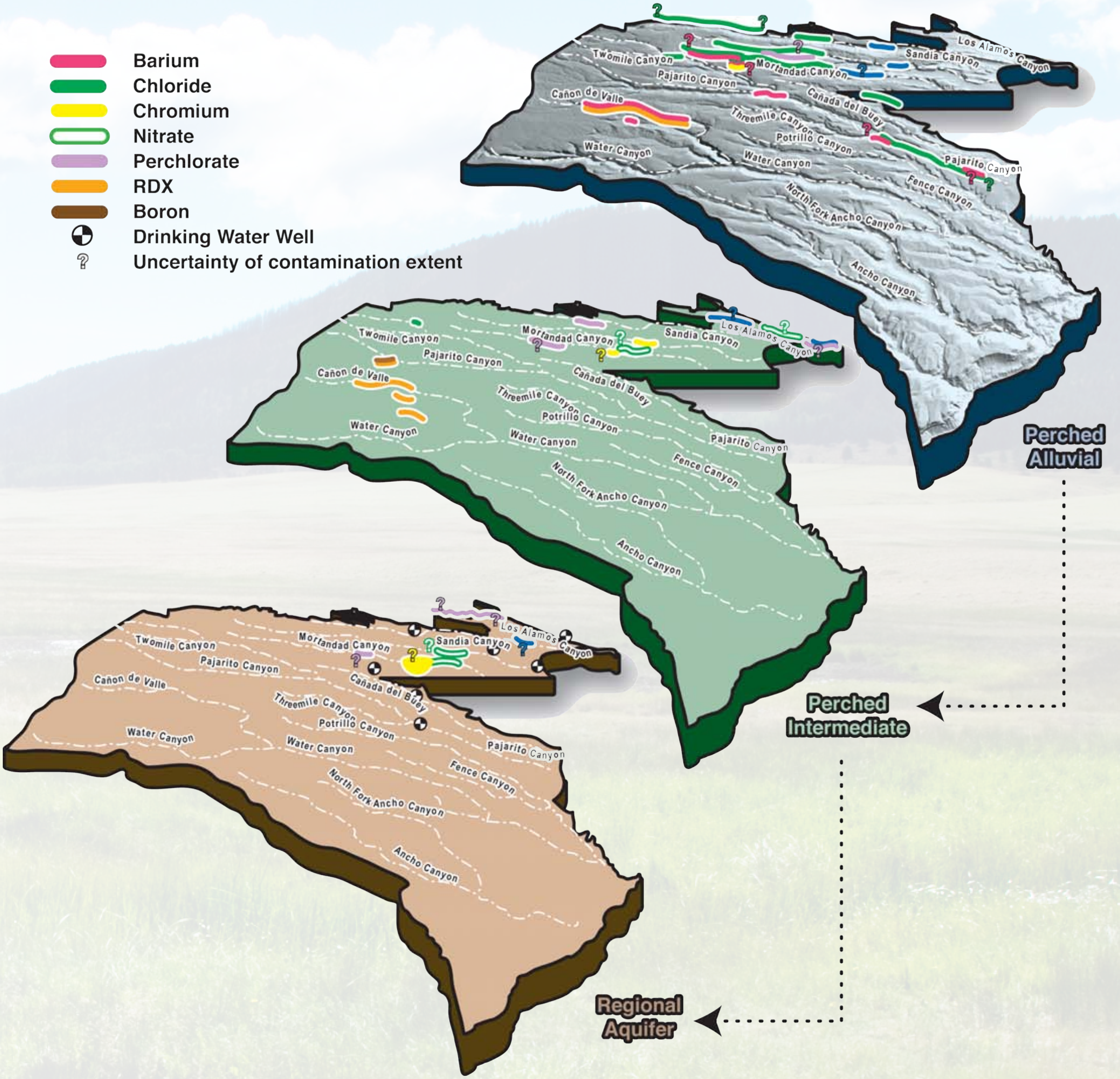
- The contaminant is found above one half of the drinking water standards in the regional aquifer and is water soluble.
- The contaminant is above the New Mexico groundwater standards and is water soluble.
- NMED has directed a Corrective Measure for the contaminant.

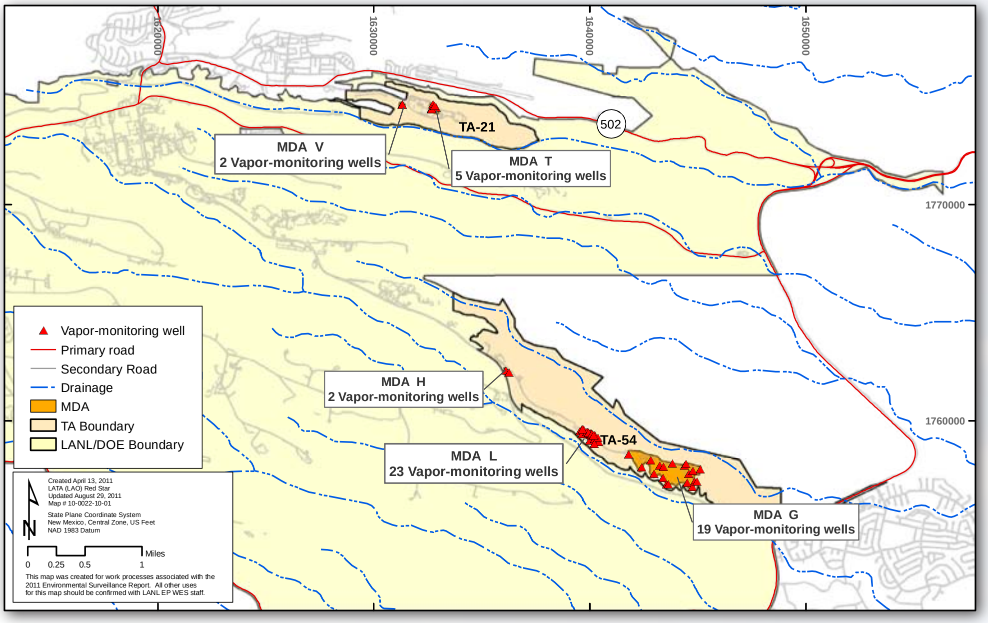
| Chemical | Off-site | Trends | Characteristics |
|---|---|---|---|
| Barium | | Generally stable in Cañon de Valle, in others likely due to cation-exchange caused by road salt | Not in drinking water; limited in contamination to alluvial groundwater. |
| Boron | | Generally stable, seasonal fluctuations | Not in drinking water; limited in contamination to alluvial and intermediate groundwater. |
| Chloride | ● | Values generally highest in winter or spring samples | Due to road salt in snowmelt runoff. |
| Chromium | | Increasing in Mortandad intermediate groundwater. Fairly steady over five years at other locations. | Found in regional aquifer above groundwater standards; not affecting drinking water supply wells; source eliminated in 1972. |
| Nitrate | ● | Generally variable in Pueblo, steady in Sandia, decreasing in Mortandad Canyon | Due to past LANL effluent discharges; otherwise due to Los Alamos County's Sewage Treatment Plant in Pueblo Canyon. |
| Perchlorate | ● | Decreasing in Mortandad Canyons alluvial groundwater due to effluent quality improvement | Reflects historical discharges that no longer occur. |
| RDX | | Generally stable, seasonal fluctuations | Not in drinking water. |

## What were the results of groundwater monitoring in 2010?

In 2010, 99.8% of contaminant values were below screening levels.

# Locations of contaminants near or above screening levels






## Why is LANL interested in subsurface vapor monitoring?

Vapor monitoring is conducted to determine whether there is a threat to the groundwater from VOCs and tritium vapors from legacy wastes buried at historic MDAs. The Laboratory periodically monitors subsurface vapor at 56 monitoring wells at a total of 196 ports. The ports are located from a few feet below the ground surface to as much as 700 feet below the ground surface.

### What are MDAs at LANL?

MDAs are sites where material was disposed of below the ground surface in excavated pits, trenches, or shafts. LANL currently has only one active disposal area, TA-54, Area G.

### What is soil-vapor extraction?

Soil-vapor extraction is a process for soil remediation in which contamination, in the form of vapors, is removed from the soil above the water table. Vapors are the gases that form when chemicals evaporate. The vapors, mixed with air, are extracted from the ground by a vacuum that pulls them through the soil and up to the surface. The vapors are then separated from the air and disposed of safely, and clean air is released to the atmosphere.

## What were the vapor monitoring results in 2010?

### MDA G, L, and H at TA-54

Vapor monitoring data collected in 2010 indicate that VOCs are present in the subsurface at TA-54's MDA G and L and that VOC concentrations at MDA H are low or not detected. The primary VOCs of concern at MDA G and L are trichloroethane (TCA) and trichloroethylene (TCE). TCA and TCE are colorless liquids commonly used as industrial solvents. Most of the mass of the VOC vapors below each of the TA-54 MDAs is contained within 200 feet of the surface, within the Bandelier Tuff, and is quite stable. Although it does not appear that soil vapors are moving downward toward the groundwater, soil vapor extraction was recommended as a corrective measure for VOCs at MDA G and MDA L.

Subsurface tritium vapors at TA-54 were found primarily at MDA G, which has active tritium waste disposal activities.

### MDA T and V at TA-21

Vapor monitoring data collected in 2010 indicate that VOCs and tritium are present at low concentrations in the subsurface at MDAs T and V. VOCs and tritium consistently peak at the same depths below the ground surface at MDAs T and V. The consistent locations of the peak vapor concentrations indicate that the VOCs and tritium vapors remain several hundred feet above the water table. LANL completed remediation activities at MDA V in 2005; however, the extent of tritium in subsurface vapors was not determined, therefore, periodic monitoring is conducted and will continue until remediation activities are completed at nearby MDA B.

# Why does LANL monitor soil?

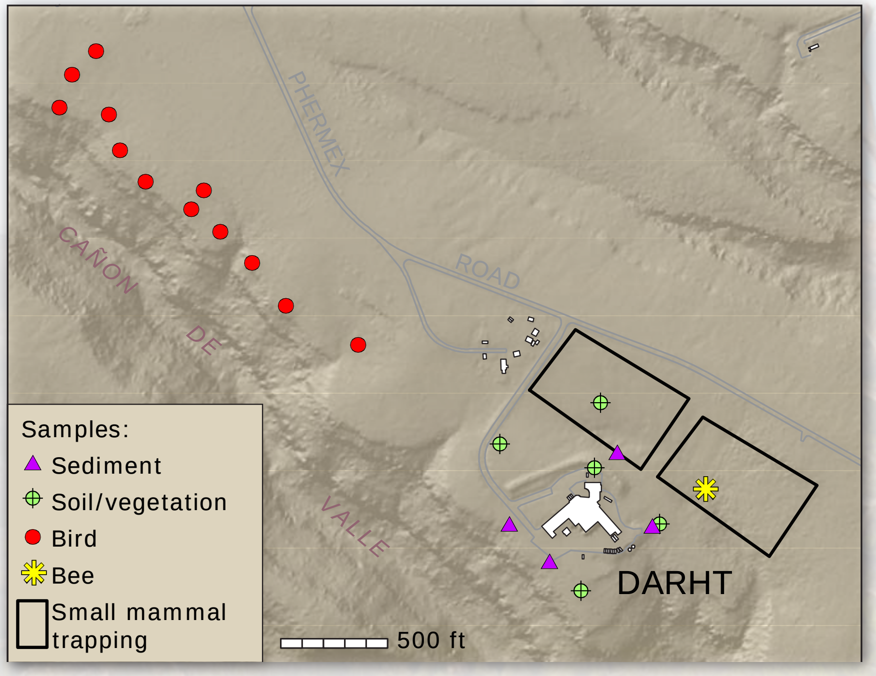
LANL conducts large-scale soil sampling within and around the perimeter of LANL every three years to help determine the impacts of Laboratory operations on human health (human food chain) and the environment. In general, results of the 2009 investigation showed that soil samples from on-site and perimeter areas contained radionuclides at very low concentrations, and most PCBs, high explosives, and semi-volatile organic compounds were not detected.

In response to a request from the Pueblo de San Ildefonso, in 2010 LANL collected two perimeter soil samples for radionuclides and metals on Pueblo lands that are downwind of Area G. The Laboratory also conducted soil and sediment monitoring at the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility in 2010.

## Results

At Area G, all measured levels of radionuclides and metals were within levels considered safe for residential occupancy and thus do not pose a potential unacceptable dose to the public.

With the exception of uranium, most measured levels of radionuclides around the perimeter of the DARHT facility were either not detected or below screening levels. The uranium levels detected above background levels were less than in previous years and have been decreasing since 2007 when the Laboratory began conducting high-explosive test shots in containment vessels.



Monitoring sites around DARHT

### What is DARHT?

- Location where scientists simulate nuclear explosions by using electron accelerators to create two-dimensional images.
- Allows LANL to make progress to keep the nuclear arsenal safe without conducting underground nuclear tests.
- Most experiments are contained in steel vessels to prevent environmental contamination

LANL employees collecting fruit samples from neighboring communities

# Why does LANL monitor foodstuffs?

Foodstuffs are edible products such as fruits, vegetables, and various animal tissues. LANL monitors foodstuffs within and around LANL to determine whether Laboratory operations are impacting human health via the food chain. In 2010, we collected 107 fruit and vegetable samples, goat's milk from non-commercial farms, chicken eggs from three perimeter areas surrounding LANL and two regional background areas, honey from bee hives located at TA-54 east of Area G, at the Los Alamos town site, and at a regional background site near Pojoaque, New Mexico, and two road killed elk and deer.

## Results

In general, all radionuclides and metals in the samples were very low and most were either not detected or detected below background levels. Tritium and natural uranium were detected in some produce samples, however the concentrations were far below screening levels and do not pose a harmful dose to humans who may ingest these fruits and vegetables. In the two elk collected, uranium concentrations were found above background levels, but were determined to be naturally occurring.

# Why does LANL monitor biota?

LANL monitors biota to determine if Laboratory operations are impacting the environment. Nonfoodstuffs biota are organisms not eaten by humans and include native vegetation, small mammals, birds, and bees. In 2010, branches and needles from trees around Area G and the DARHT facility were sampled. At DARHT, field mice, bees, and birds were also collected for sampling.

## Results

Most radionuclides and metals were either not detected or were below background levels. At Area G, all the detected levels of tritium found in branches and needles were below screening levels and did not result in adverse doses to the plants.

Field mice samples from DARHT resulted in uranium concentrations just slightly above their background levels, but the amounts were orders of magnitude below screening levels and do not pose a potential unacceptable dose to the biota sampled.

# Does LANL impact the Rio Grande?

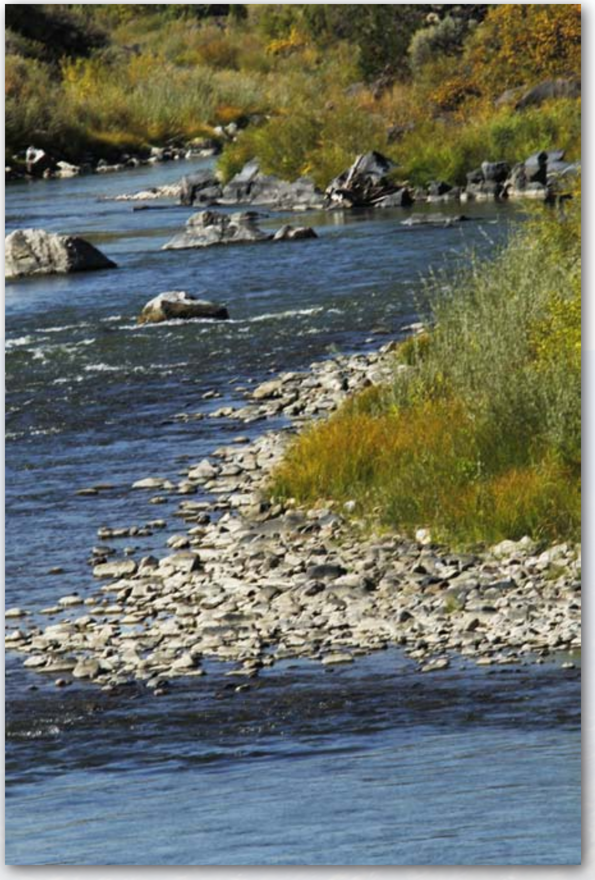
Groundwater at LANL discharges to springs along the Rio Grande. Stream flow resulting from heavy storms and snowmelt also has the potential to reach the Rio Grande. To assess LANL's impact on the river, samples of sediment, water, and foodstuffs were collected both upstream and downstream from the Laboratory and were tested for a variety of contaminants including radionuclides, metals, organic compounds, and inorganic compounds.

Water quality in the Rio Grande adjacent to LANL is good. Average values of contaminants are below screening levels. Naturally occurring radionuclides are found in Rio Grande surface water samples; no LANL-derived radionuclides were identified. Suspended sediment flux from LANL into the Rio Grande was below average in 2010. The flux of PCB contaminated sediments into the Rio Grande is about 1-3% of the PCB sediment load in the Rio Grande. Foodstuffs irrigated with Rio Grande water upstream and downstream from LANL did not contain LANL contaminants or they were below regional background levels. Crayfish were collected from the Rio Grande within upstream and downstream reaches and analyzed for contaminants; concentrations of contaminants were below screening levels.

Due to concern about potential LANL impacts to the Rio Grande, risk assessments have been conducted to evaluate 1) LANL impacts to the Rio Grande following the 2000 Cerro Grande fire and; 2) LANL impacts to the Rio Grande that may affect the BDD Project.

An independent subcontractor estimated that the potential cancer risk to the public from chemicals and radioactive materials released from the Cerro Grande fire to be less than 3 in 1 million for exposure. This is well below the EPA target excess cancer risk level of one in 100,000.

The BDD Project was completed in December 2010. The project takes surface water from the Rio Grande and then treats and distributes these waters to the city and the county through their drinking water distribution systems. A BDD Project subcontractor prepared an independent risk assessment, regarding LANL contaminants. The risk assessment concluded that there is no health risk to people drinking BDD-derived tap water.



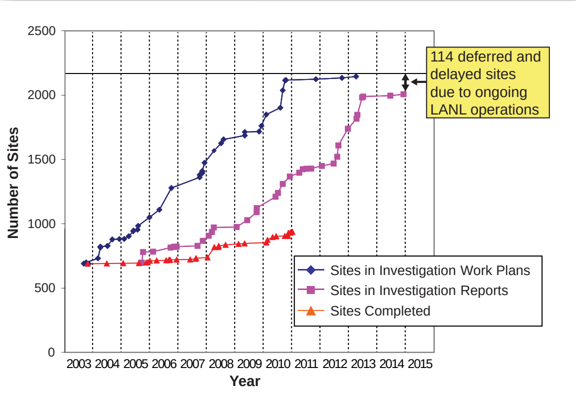
Rio Grande

Collection of crayfish samples from the Rio Grande

# Environmental Restoration Programs

## The Corrective Action Process

The Corrective Action Process identifies contamination that must be addressed by (1) removing the contamination, (2) stabilizing the contamination so it does not impact the public, plants, or animals in the future, or (3) breaking the pathways between contamination and the public, plants, or animals.




Consent Order site status

## The Consent Order

The Consent Order between LANL, DOE, and the NMED is the principal regulatory driver for the Laboratory's environmental restoration programs. The Consent Order ensures that legacy environmental problems are cleaned up in a timely manner enforceable by the State of New Mexico.

## Corrective Actions Program

LANL is characterizing and remediating sites, as necessary, to ensure that past operations do not threaten human health or the environment. The Corrective Actions Program addresses the remediation of sanitary waste lines and sewage treatment facilities; industrial waste lines, storm drains and outfalls; contaminated areas; landfills and surface disposal areas located primarily within the Laboratory boundaries and some historical sites that are now located within the Los Alamos town site. Activities include soil and sediment sampling, groundwater monitoring, storm water and surface water monitoring. In 2010, the Laboratory reported the results of sampling investigations conducted on the Upper Los Alamos Canyon Aggregate Area, Upper Mortandad Canyon Aggregate Area, North Ancho Canyon Aggregate Area, and Middle Canada del Buey Aggregate Area as well as Sandia Canyon, Canada de Buey, and North Canyons. The TA-16, 260 outfall, Corrective Measures Implementation (CMI) plan remediation and investigation activities were completed in 2010; a CMI monitoring plan was submitted to NMED.

TA-54, Area G

## Closure of TA-54

TA-54, Area G, is the Laboratory's current radioactive waste storage and disposal facility. Waste is contained in pits, shafts, or trenches in the bedrock or stored in drums awaiting shipment off-site. Following the closure of MDA G, a new facility will be built to serve as a staging area for newly generated TRU waste. Activities conducted in 2010 involved monitoring of the groundwater and vapor below ground and the development of corrective measures. In 2010, new boreholes were drilled and samples were collected to monitor for tritium and organic compounds.

## Closure of TA-21

Located east of downtown Los Alamos on DP Road, TA-21 was the site of plutonium processing from 1945 to the early 1970s. It was also the site of a tritium processing and handling facility. Activities conducted in 2010 included removal and remediation of early Laboratory waste, collection of vapor samples, geologic investigations, collection of soil samples, and installation of groundwater monitoring wells. By the end of 2010, TA-21 buildings totaling more than 175,000 square feet were demolished.

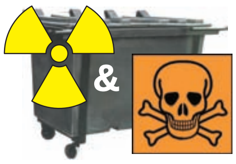
TA-21, MDA B, was used from 1944-1948 and is the Laboratory's oldest waste disposal site. The inventories of hazardous and radioactive material at MDA B is not well characterized because few records of waste disposal exist from the 1940s and the Manhattan Project. To address those challenges and to ensure safety, the excavation of MDA B has occurred inside sturdy metal enclosures. Approximately 50% of the excavation was completed by the end of 2010.

## Waste at LANL

LANL is in the process of cleaning up many former disposal areas used during the Cold War and Manhattan Project. Most of this historical waste—and all hazardous waste—will be shipped off site for disposal in licensed facilities.

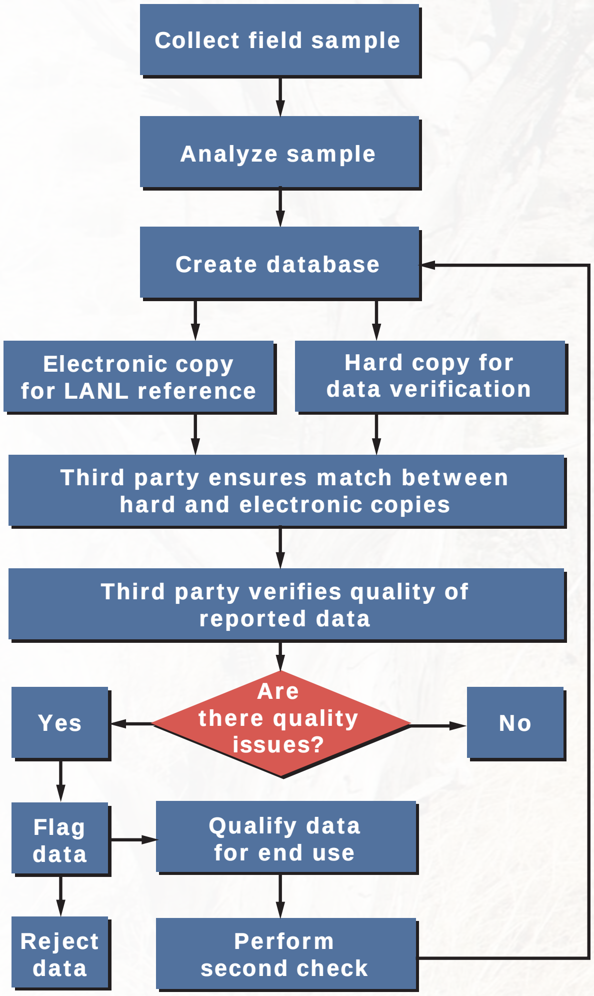
The TRU waste disposition program expedites the disposal of legacy TRU waste to WIPP. TRU waste processing facilities are located at TA-50 and TA-54. TA-54, Area G, stores radioactively contaminated waste and other contaminated materials in aboveground storage. To reduce both the current and prospective risk at Area G, LANL is steadily reducing its inventory of TRU waste by transporting drums of radioactive material to WIPP. In 2010, the Laboratory shipped approximately 700 $m^3$ of TRU to WIPP. The DOE/LANL goal is to ship all legacy LANL TRU waste to WIPP by the end of 2015.

The Laboratory will begin design of a new TRU waste staging facility at TA-63 in 2011 to replace the existing facilities at TA-50 and TA-54. Final construction of TA-63 is to be completed in 2015. This facility will replace the buildings and fabric domes currently used to process TRU waste, and thus reduce the consequences from potential accidents.

| | | | | | |
|---|---|---|---|---|---|
|  | **Low-level** Waste such as paper, building rubble, and soil that is contaminated with radionuclides (but is not transuranic or high-level waste) |  | Disposed of in pits and shafts which are then covered with soil and planted with native grasses on top |   | Most low-level waste is currently shipped off site for disposal. |
|  | **Mixed low-level** Waste that is contaminated with both radionuclides and hazardous components as defined by the EPA |  | Stored in drums and then large domes to protect them from the weather |  | Shipped off LANL property to commercial disposal facilities |
|  | **Transuranic** Waste that contains more that 100 nanocuries per gram of a man-made element whose atomic number is greater than uranium (such as Pu or Am) and has a half-life over 20 years |  | Stored in drums and then large domes to protect them from the weather |  | Shipped off LANL property to Waste Isolation Pilot Plant (WIPP) if it meets requirements; if not, contents of container are processed to meet requirements |

## LANL's Wildland Fire Management Plan

LANL is located in a fire-prone region where the potential for wildfires is high. The Laboratory maintains a Wildland Fire Management Plan to protect the public and the environment from catastrophic wildfires. Fire protective measures include tree thinning, maintenance of LANL fire roads, and erosion controls. During 2010, the Laboratory performed tree thinning operations on 380 acres of LANL property. These mitigation efforts were extremely important in minimizing the extent of LANL lands burned (only 2 acres) during the 2011 Las Conchas fire (additional details to be presented in the LANL Environmental Report 2011).




Analytical Data Process–Validation and Verification

## How does LANL ensure the quality of data?

LANL uses many standard operating procedures to ensure the quality of data, and the correctness and completeness of documentation. Sample analyses for LANL are conducted by five independent commercial laboratories. These laboratories are authorized by the LANL Analytical Services Statement of Work (SOW), and they are required to produce legally defensible data packages. LANL assesses data to verify they are defensible and of known quality. A second validation of data packages is conducted by the independent DOE contractor Analytical Quality Associates, Inc., to determine if the data are usable.

LANL also conducts a performance assessment of analytical laboratories. The SOW provides general quality assurance guidelines for the laboratories, as well as specific requirements for analyzing samples. The analytical laboratories undergo an evaluation of their ability to perform the required analyses, and must be certified by the National Environmental Laboratory Accreditation Program. The DOE Contract Analytical Program also conducts annual audits to confirm the laboratories meet the requirements to produce acceptable data.

For 2010, 2% of the approximately 1.4 million analyses were rejected for not meeting quality assurance requirements.

LANL data are available to the public in the RACER database. None of the data are censored or removed. www.racernm.org

# A message from the students

From left to right: Burgandy Brock, Ria Cruz, Anita Lavadie

This report was prepared by college students working at LANL during the summer of 2011. We asked college students to write the summary version of the Laboratory Environmental Report to clearly communicate to a public audience the results of our environmental programs during 2010.

The students were mentored by Mike McNaughton, WES-EDA, Lorrie Bonds Lopez, BPS-COM, and Jean Dewart, WES-EDA.

## Burgandy Brock

Being a part of the Environmental Report 2010 Summary project was a very fun and rewarding experience. I enjoyed having the opportunity to become more educated about the environment in and around Los Alamos. This summer I really had the chance to see how difficult it is to effectively communicate technical information in a way that will not only captivate but also educate the public. My hope is that this summary will open new doors of interest for the public and that people will desire to know more.

## Ria Cruz

Growing up in Santa Fe with a father employed by LANL, I thought I had a good understanding of what the facility did. As I began my work as a summer intern, I soon realized how little I really knew about LANL. My knowledge grew as I interviewed professionals, accompanied scientists in the field, and toured impressive laboratory facilities. I was pleasantly surprised to learn how much time, effort, and money is devoted to protecting and bettering the environment in the Los Alamos area.

Helping to prepare the Environmental Report 2010 Summary has been an incredibly rewarding experience. It is my hope that this document will clearly communicate LANL's efforts to monitor and protect the environment and the surrounding communities. I hope you enjoy reading it as much as I enjoyed writing it. I express my greatest gratitude to my fellow student authors and mentors for all their support and dedication.

## Anita Lavadie

Having been born and raised in northern New Mexico, my attention to the health and wellness of my birthplace and livelihood is of great importance. To better understand how to protect this environment, I received my undergraduate degree in Forestry at New Mexico Highlands University (NMHU) and am currently pursuing a Master's degree in Natural Resource Management also at NMHU. Prior to my employment at LANL, I was unaware of the environmental challenges surrounding the Laboratory. However, I became quickly immersed in a community of hard working individuals who genuinely care about the place we all live.

It is my hope this booklet will allow the northern New Mexican communities and the diverse cultures within them to recognize LANL's remarkable efforts to protect that which is unique to New Mexico and sacred to all who reside in and near the Laboratory. With the relationships and support of local, state, federal and tribal entities, LANL strives to provide northern New Mexico and neighboring regions with air that is breathable, water that is drinkable, land that is safe to recreate, and a place to continue the traditions within each culture that make up New Mexico's unique and rare land of enchantment.

# Acronyms

| | |
|---|---|
| AIRNET | air-monitoring network |
| ALARA | As Low as Reasonably Achievable |
| AOC | Areas of Concern |
| BDDP | Buckman Direct Diversion Project |
| CAA | Clean Air Act |
| CERCLA | Comprehensive Environment Response, Compensation, and Liability Act |
| CMI | Corrective Measures Implementation |
| CO | carbon monoxide |
| CWA | Clean Water Act |
| DARHT | Dual-Axis Radiographic Hydrodynamic Test |
| DOE | Department of Energy |
| DP | Delta Prime |
| DPRNET | Direct Penetrating Radiation Monitoring Network |
| EMS | Environmental Management System |
| EPA | Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right-to-Know-Act |
| ESA | Endangered Species Act |
| LANSCE | Los Alamos Neutron Science Center |
| LANL | Los Alamos National Laboratory |
| MEI | maximally exposed individual |
| MBTA | Migratory Bird Treaty Act |
| MDA | Material Disposal Area |
| MREM | millirem |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emission Standard for Hazardous Air Pollutants |
| NEWNET | Neighborhood Environmental Watch Network |
| NHPA | National Historic Preservation Act |
| NMED | New Mexico Environment Department |
| NMHU | New Mexico Highlands University |
| NOx | nitrogen oxides |
| NPDES | National Pollutant Discharge Elimination System |
| pCi | picocuries |
| PCBs | Polychlorinated Biphenyls |
| PM | particulate matter |
| RACER | Risk Analysis, Communication, Evaluation, and Reduction |
| RCRA | Resource Conservation and Recovery Act |
| SL | screening level |
| SOW | Statement of Work |
| SOx | sulfur oxides |
| SWMUs | Solid Waste Management Units |
| TA | Technical Area |
| TCA | trichloroethane |
| TCE | trichloroethylene |
| TLDs | thermoluminescent dosimeters |
| TRU | transuranic |
| VOCs | volatile organic compounds |
| WIPP | Waste Isolation Pilot Project |

Graphics, maps, and illustrations by James Cruz, Brenda Devargas, IRM-CAS; and David Frank, WES-EDA

Photography by Tanner Johnson, BPS-COM, and LANL staff photographers

Edited by Caroline Spaeth, IRM-CAS

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



It is available electronically on the Web at www.lanl.gov/environment/all/esr.shtml.

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Office of Scientific and Technical Information
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Oak Ridge, TN 37831
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It is available to the public from
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US Department of Commerce,
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Springfield, VA 22616

Los Alamos
NATIONAL LABORATORY
EST. 1943