Environmental Surveillance at Los Alamos During 2006

Los Alamos NATIONAL LABORATORY EST.1943

LA-14341-ENV

It is the policy of Los Alamos National Laboratory that we will be responsible stewards of our environment.
It is our policy to:

Manage and operate our site in compliance with environmental laws and standards and in harmony with the natural and human environment

Meet our environmental permit requirements

Use continuous improvement processes to recognize, monitor and minimize the consequences to the environment stemming from our past, present, and future operations

Prevent pollution

Foster sustainable use of natural resources

Work to increase the body of knowledge regarding our environment

LA-14341-ENV
Issued: September 2007

ENVIRONMENTAL SURVEILLANCE AT LOS ALAMOS DURING 2006

Environment and Remediation Support Services Division
505-667-0808

Water Stewardship Program
505-667-0132

Corrective Actions Program
505-667-2623

Environmental Protection Division
505-667-2211

Ecology and Air Quality Group
505-665-8855

Water Quality and RCRA Group
505-665-0453

Los Alamos, New Mexico 87545

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ABSTRACT

Environmental Surveillance at Los Alamos reports are prepared annually by the Los Alamos National Laboratory (the Laboratory) environmental organization, as required by US Department of Energy Order 5400.1, *General Environmental Protection Program*, and US Department of Energy Order 231.1A, *Environment, Safety, and Health Reporting*.

These annual reports summarize environmental data that are used to determine compliance with applicable federal, state, and local environmental laws and regulations, executive orders, and departmental policies. Additional data, beyond the minimum required, are also gathered and reported as part of the Laboratory's efforts to ensure public safety and to monitor environmental quality at and near the Laboratory.

Chapter 1 provides an overview of the Laboratory's major environmental programs. Chapter 2 reports the Laboratory's compliance status for 2006. Chapter 3 provides a summary of the maximum radiological dose the public and biota populations could have potentially received from Laboratory operations and discusses chemical exposures. The environmental surveillance and monitoring data are organized by environmental media (Chapter 4, air; Chapters 5 and 6, water and sediments; Chapter 7, soils; and Chapter 8, foodstuffs and biota) in a format to meet the needs of a general and scientific audience. Chapter 9 provides a summary of the status of environmental restoration work around LANL. Chapter 10, new for this year, explains the risks and the actions taken to reduce risks at the Laboratory from environmental legacies and waste management operations. A glossary and a list of acronyms and abbreviations are in the back of the report. Appendix A explains the standards for environmental contaminants, Appendix B explains the units of measurements used in this report, Appendix C describes the Laboratory's technical areas and their associated programs, and Appendix D provides web links to more information.

In printed copies of this report or Executive Summary, we've also enclosed a disk with a copy of the full report in Adobe Acrobat (PDF) form and detailed supplemental tables of data from 2006 in Microsoft Excel format. These files are also available for download from the web.

Inquiries or comments regarding these annual reports may be directed to

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This report is also available on the World Wide Web at *http://www.lanl.gov/environment/air/reports.shtml*

Environmental Surveillance at Los Alamos During 2006

Executive Summary

Los Alamos NATIONAL LABORATORY EST. 1943

LA-14341-ENV

EXECUTIVE SUMMARY ➤ 2006

The Los Alamos National Laboratory (LANL or the Laboratory) is located in Los Alamos County, in north-central New Mexico (NM), approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (Figure ES-1). The 40-square-mile Laboratory is situated on the Pajarito Plateau, a series of mesas separated by deep east-to-west-oriented canyons cut by stream channels. Mesa tops range in elevation from approximately 7,800 ft on the flanks of the Jemez Mountains to about 6,200 ft above the Rio Grande at White Rock Canyon. Most Laboratory and Los Alamos County community developments are confined to the mesa tops. With the exception of the towns of Los Alamos and White Rock, the surrounding land is largely undeveloped, and large tracts of land north, west, and south of the Laboratory site are held by the Santa Fe National Forest, the US Bureau of Land Management, the Bandelier National Monument, the US General Services Administration, and Los Alamos County. In addition, the Pueblo de San Ildefonso borders the Laboratory to the east.

The mission of LANL is to develop and apply science and technology to (1) ensure the safety and reliability of the US nuclear deterrent, (2) reduce global threats, and (3) solve other emerging national security challenges. Meeting this diverse mission requires excellence in science and technology to solve multiple national and international challenges. Inseparable from the Laboratory's focus on excellence in science and technology is the commitment to environmental stewardship and full compliance with environmental protection laws. Part of LANL's commitment is to report on its environmental performance. This report

- characterizes LANL's environmental management,
- summarizes environmental occurrences and responses,
- describes compliance with environmental standards and requirements, and
- highlights significant programs and efforts.

Environmental Management System

As part of its commitment to protect the environment and improve its environmental performance, LANL implemented an Environmental Management System (EMS) pursuant to US Department of Energy (DOE) Order 450.1 and the international standard (ISO) 14000-2004. DOE defines an EMS as "a continuous cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental missions and goals." The EMS provides a systematic method for assessing mission activities, determining the environmental impacts of those activities, prioritizing improvements, and measuring results.

- *The Laboratory's environmental management system was fully certified to the international standard by an independent registrar.*
- *NNSA recognized the success of the EMS management by giving the Laboratory the 2006 NNSA "Best in Class" Award for EMS-developed projects.*

During 2006, the EMS was audited three times by an independent third-party ISO 14001 auditor. The auditors concluded that the LANL EMS meets all the requirements of the ISO 14001-2004 standard with no major nonconformities and recommended that LANL maintain full certification. On April 13, 2006, LANL received full certification of its EMS to the ISO 14001-2004 standard. LANL is the first DOE National Nuclear Security Agency (NNSA) national laboratory and the first University of California-operated facility to receive this distinction. NNSA recognized the success of the EMS management and the core teams' unique approach by giving the Laboratory the 2006 NNSA "Best in Class" Award for EMS-developed projects. The Laboratory's Pollution Prevention Program is an important component of the

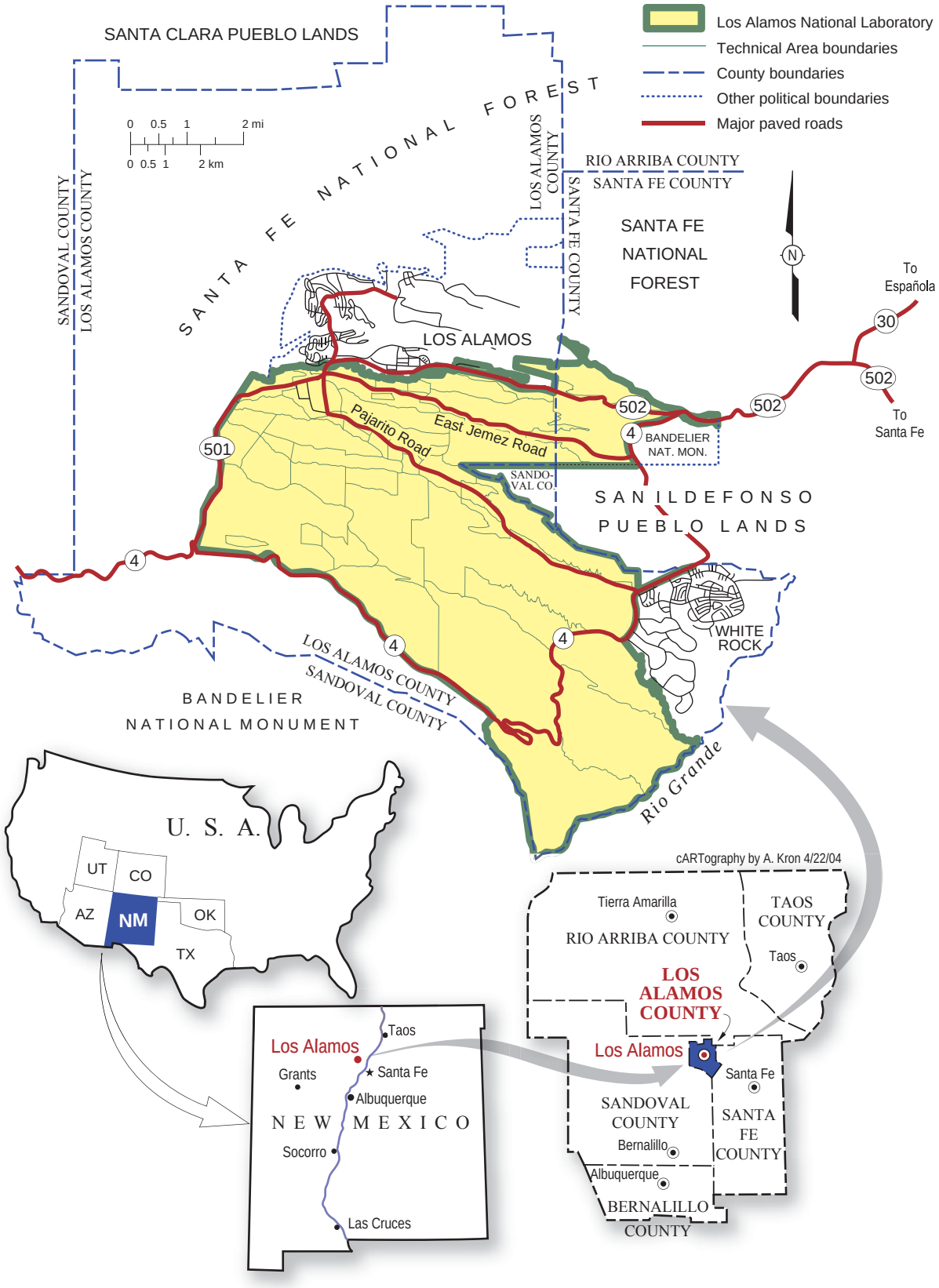

Figure ES-1. Regional location of Los Alamos National Laboratory.

EMS and received seven national NNSA Pollution Prevention awards for Laboratory projects in fiscal year 2006 (up from five awards in fiscal year 2005).

Federal Facility Compliance Agreement

During 2006, the DOE and the Laboratory continued to work under the requirements of a Federal Facility Compliance Agreement (FFCA) with the US Environmental Protection Agency (EPA) and the NM Environment Department (NMED). The agreement establishes a compliance plan for the regulation of storm water point source discharges from solid waste management units (SWMUs) and areas of concern at the Laboratory; the agreement will remain in effect until those sources are regulated by an individual storm water permit issued by EPA.

Compliance Order on Consent

The March 2005 Compliance Order on Consent (the Consent Order) between LANL, DOE, and the NMED is the principal regulatory driver the LANL's Environmental Restoration Program and the Water Stewardship Program. The Consent Order contains requirements for investigation and cleanup of SWMUs and areas of concern at the Laboratory. The major activities conducted by the Laboratory included investigations and cleanup actions. All major deliverables of the Consent Order were met by the Laboratory during 2006. The NMED issued three Notices of Violation to LANL and DOE pursuant to the Consent Order for alleged improper disposal of cleanup debris, failure to report a release of a groundwater contaminant, and improper storage of building debris.

➤ *The Consent Order is the principal regulatory driver for the Laboratory's Environmental Restoration Program and the Water Stewardship Program. It specifies actions that the Laboratory must complete to characterize contaminated sites and monitor the movement of contaminants.*

➤ *The Laboratory met all major deliverables of the Consent Order.*

➤ *The NMED issued three Notices of Violation to LANL and DOE related to the Consent Order for alleged improper disposal of cleanup debris, failure to report a release of a groundwater contaminant, and improper storage of building debris.*

Improvement Targets

Improvement goals for the Laboratory include continuing to improve Resource Conservation and Recovery Act (RCRA) compliance. The Laboratory improved its RCRA compliance in 2006. The Laboratory is improving processes, systems, and training to reduce the number of violations in the future. Under its new EMS, the Laboratory must identify and minimize environmental impacts and waste sources. Chromium discharged from a cooling tower in the 1960s through 1972 was discovered in the regional aquifer in early 2006 and LANL has installed monitoring wells to evaluate the extent of contamination. Though perchlorate and high explosives residues are no longer discharged, their movement from past effluent discharges is being monitored to determine if they could pose a threat to water sources.

Design of Surveillance System and Sample Locations

To achieve its mission activities, LANL uses a variety of materials, some of which are hazardous or radioactive. Experiments and mission activities result in air emissions, water discharges, and waste generation. These emissions and discharges have the potential to affect different receptors or components of the environment including people, air, water, soil, foodstuffs, plants, and animals by one or more pathways such as by inhalation of or contact with hazardous materials.

The Laboratory uses data from monitoring (surveillance) of known release points and multiple receptors (people, air, water, soil, foodstuffs, plants, and animals) over a long time period as a basis for policy and to identify actions to protect or improve the environment. We collect data from the surrounding region to establish baseline environmental conditions not influenced by LANL operations. Regional monitoring also indicates whether LANL operations are impacting areas beyond LANL's boundaries. Examples of regional monitoring include the radiological air-sampling network (AIRNET) and foodstuffs and biota (plants and animals) sampling locations. We also collect data at the Laboratory perimeter to determine if operations are impacting LANL or neighboring properties (e.g., pueblo and county lands). Perimeter monitoring also measures the highest potential impact to the public. To better quantify releases, we monitor at specific discharge or release points or other locations on LANL property that are known to or have the potential to result in emissions or discharges. Examples of locations with this type of monitoring include facility stacks, the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility, the Los Alamos Neutron Science Center (LANSCE), remediation sites where legacy waste is being managed, decontamination and decommissioning projects, Area G at Technical Area (TA-) 54 (where waste is being handled and stored), and water discharge locations (outfalls). We use these data to demonstrate compliance with applicable environmental laws and regulations. During 2006, the Laboratory collected more than 8400 environmental monitoring samples from 780 locations and requested almost 200,000 analyses or measurements on these samples.

Compliance

As a key indicator of its environmental performance, the Laboratory uses the status of compliance with environmental requirements. Federal and state regulations provide specific requirements and standards to implement these statutes and maintain environmental quality. The EPA and the NMED are the principal administrative authorities for these laws. The Laboratory also is subject to DOE requirements for control of radionuclides. Table ES-1 presents a summary of the Laboratory's status in regard to environmental statutes and regulations.

Unplanned Releases

There was one unplanned airborne release, of anhydrous ammonia, from LANL in 2006. There were no unplanned releases of radioactive liquids. There were six spills or releases of non-radioactive liquids which included fire suppression water (900 gal.), clean fill sediment from storm water runoff from a construction site, and potable water (44,000 gal.). All liquid releases were reported to NMED and will be administratively closed upon final inspection. A smoke opacity deviation of 24% (just above the permit limit of 20%) was observed at the asphalt plant.

➤ *Radiation dose to the hypothetical maximally exposed individual (MEI) was more than 13 times lower in 2006 compared to 2005 and was the lowest since 1999. LANSCE emissions, normally the largest source of public exposure, were greatly reduced because of new emissions controls systems.*

➤ *The MEI location was determined to be at the Los Alamos County Airport terminal. This location received a combination of low levels of radiation from stack emissions and low levels of contamination from the cleanup of an adjacent debris pile.*

Radiological Dose Assessment

Humans, plants, and animals potentially receive radiation doses from various Laboratory operations (Table ES-2). The DOE dose limits for the public and biota are the mandated criteria that are used to determine whether a measurement represents a potential exposure concern. Figure ES-2 shows doses to the hypothetical maximally exposed individual (MEI) over the last 13 years at an off-site location; this location was East Gate in all prior years but was determined to be at the Los Alamos County Airport terminal for 2006. The dose to the MEI was approximately 0.47 mrem,

Table ES-1
Environmental Statutes under which LANL Operates and Compliance Status in 2006

Federal Statute	What it Covers	Status
Resource Conservation and Recovery Act (RCRA)	Generation, management, and disposal of hazardous waste and cleanup of inactive, historical waste sites	NMED conducted one RCRA hazardous waste compliance inspection in 2006 but LANL received no further communication in 2006 regarding the inspection. The Laboratory completed 1,453 self-assessments that resulted in a nonconformance finding rate of 3.02%. The Consent Order replaces Module VIII of the Hazardous Waste Facility Permit. All deliverables required by the Consent Order were submitted to NMED on time. NMED issued three Notices of Violation to DOE and LANL that alleged improper disposal of cleanup debris, failure to report a release of a groundwater contaminant, and improper storage of building debris. The Laboratory is in compliance with groundwater monitoring requirements. Six alluvial characterization wells, one intermediate characterization well, and five piezometers (which measure water levels) were installed in Sandia Canyon in 2006.
Clean Air Act (CAA)	Air quality and emissions into the air from facility operations	The Laboratory met all permit limits for emissions to the air. Non-radiological air emissions were similar to the previous year. An smoke opacity deviation 4% greater than permit limits occurred at the asphalt plant. LANL continued to eliminate the use of refrigerants. The dose to the maximum exposed individual (MEI) from radioactive air emissions dropped to 0.47 mrem, the lowest level in eight years.
Clean Water Act (CWA)	Water quality and effluent discharges from facility operations	Only one (a total residual chlorine level) of 733 samples collected from industrial outfalls and none of the 113 samples collected from the Sanitary Wastewater Systems Plant's outfall exceeded effluent limits. About 94% of the Laboratory's permitted construction sites were compliant with National Pollutant Discharge Elimination System (NPDES) requirements contained in 57 construction site storm water pollution prevention plans. Institutional and programmatic controls were implemented to further improve and assure compliance under the Laboratory's construction general permit. The Laboratory continued to implement 15 Storm Water Pollution Prevention Plans covering 26 industrial facilities and site-wide SWMUs. This included sampling of storm water discharges from industrial activities and installing and maintaining Best Management Practices to manage pollutants and runoff at these locations.
Toxic Substances Control Act (TSCA)	Chemicals such as polychlorinated biphenyls (PCBs)	The Laboratory shipped 58 containers of PCB waste, 105 lbs of capacitors, and 2,661 lbs of fluorescent light ballasts for disposal or recycling in compliance with all manifesting, record keeping, and disposal requirements.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	Storage and use of pesticides	The Laboratory remained in compliance with regulatory requirements regarding use of pesticides and herbicides.
Emergency Planning and Community Right-to-Know Act (EPCRA)	The public's right to know about chemicals released into the community	The Laboratory reported releases, waste disposal, and waste transfers totaling 11,069 lbs of lead. A leak of anhydrous ammonia exceeded reporting thresholds and was reported as required. No updates to Emergency Planning Notifications were necessary in 2006. Chemical Inventory Reports were updated to the Los Alamos County fire and police departments for 36 chemicals or explosives.

Table ES-1 (continued)

Federal Statute	What it Covers	Status
Endangered Species Act (ESA) & Migratory Bird Treaty Act (MBTA)	Rare species of plants and animals	The Laboratory maintained compliance with the ESA and MBTA. The Laboratory prepared biological assessments for three projects and continued to monitor endangered species status.
National Historic Preservation Act (NHPA) and others	Cultural resources	The Laboratory maintained compliance with the NHPA. The laboratory identified 13 new archaeological sites and 166 historic buildings. Twenty-three archaeological sites and 65 historic buildings were determined eligible for the National Register of Historic Places.
National Environmental Policy Act (NEPA)	Projects evaluated for environmental impacts	The NEPA team prepared or reviewed two analyses: a new LANL Site-wide Environmental Impact Statement and an Environmental Assessment for the construction and operation of a Biosafety Level-3 facility. No non-compliances were reported.

Table ES-2
What are the Sources of Radiological Doses?

Source	Dose	Location	Trends
Background (includes man-made sources)	~470 mrem/yr	All sites	Not applicable
Air (humans)	0.47 mrem/yr	Los Alamos County Airport Terminal	Lowest since 1999; expected to remain low
Direct irradiation (humans)	1.1 mrem/yr	San Ildefonso – offsite	None
Food (humans)	<0.1 mrem/yr	All sites	None
Drinking water (humans)	<0.1 mrem/yr	All sites	None
All (terrestrial animals)	<20 mrad/day	TA-15 EF site, TA-21 material disposal area (MDA) B	None
All (aquatic animals)	<85 mrad/day	TA-50 Effluent Canyon	None
All (terrestrial plants)	<50 mrad/day	TA-21 MDA B	None

compared to 6.46 mrem in 2005 and a regulatory limit of 10 mrem (Figure ES-2). Cleanup of a slightly-contaminated debris pile next to the terminal contributed to this low dose. The Laboratory calculated potential radiological doses to members of the public that resulted from LANL emissions and discharges. During 2006, the population within 80 km of LANL received a collective dose of about 0.6 person-rem, which is a substantial decrease from the dose of 2.46 person-rem reported for 2005. The doses received in 2006 from LANL operations by an average Los Alamos residence and an average White Rock residence totaled about 0.0125 mrem and 0.0145 mrem, respectively (about one-ninth and one-fourth, respectively, of the doses in 2005). The decrease in these doses from 2005 was attributable to greatly reduced emissions from the LANSCE accelerator facility, which releases very short-lived radioactive gasses from a location relatively close to the LANL boundary. A leak repair and an improved emissions control system installed in 2005 both helped to reduce emissions.

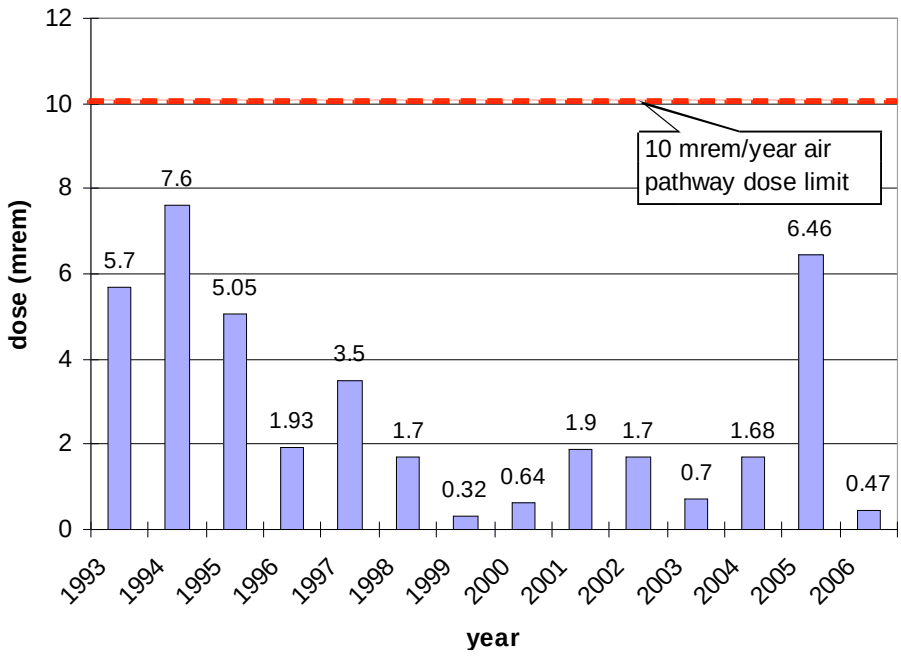

Figure ES-2. Annual airborne pathway dose (mrem) to the off-site MEI over the past 14 years. For the first time, the location of the calculated MEI changed from East Gate to the Los Alamos County Airport terminal.

Biota Dose

The DOE biota dose limits are intended to protect populations, especially with respect to preventing the impairment of reproductive capability within the biota population and are thus applied to biota populations rather than to individual plants and animals. We collected soil, sediment, vegetation, and small mammals from known contaminated areas (material disposal areas or MDAs), canyons, and operational sites (DAHRT). All radionuclide concentrations in terrestrial vegetation sampled were far below the 0.1 rad/day biota dose-based screening level (10% of 1 rad/day dose limit) and all radionuclide concentrations in terrestrial animals sampled were far below the 0.01 rad/day biota dose-based screening level (10% of 0.1 rad/day dose limit). A special dose assessment for plants and animals in Mortandad Canyon, based on new data collected as part of the canyon investigation, confirmed previous dose estimates and indicated the dose was about 0.007 rad/day to plants and 0.005 rad/day to animals, compared to limits of 1.0 rad/day and 0.1 rad/day, respectively.

Air Emissions and Air Quality

- *Measurable concentrations of radionuclides in ambient air were not detected at regional sampling locations nor at most perimeter locations.*
- *The highest mean air concentrations at perimeter locations were below 1% of the applicable EPA limits.*

The Laboratory measures the emissions of radionuclides at the emission sources (building stacks) and categorizes these radioactive stack emissions into one of four types: (1) particulate matter, (2) vaporous activation products (radioactive elements created by the LANSCE particle accelerator beam), (3) tritium, and (4) air activation products. Similarly, the Laboratory takes air samples at general locations within LANL boundaries, at the LANL perimeter, and regionally to estimate the extent and concentration of radionuclides that may be released from Laboratory operations. These radionuclides include plutonium, americium, uranium, and tritium.

Executive Summary

In 2006, gaseous activated air product emissions from the LANSCE stack were the lowest since 1999. Emissions from all other stacks were comparable to previous years or slightly lower. Total stack emissions during 2006 were approximately 1,290 curies (Ci). Of this total, tritium emissions composed about 893 Ci and short-lived air activation products from LANSCE stacks contributed nearly 398 Ci. Combined airborne emissions of materials, such as plutonium, uranium, americium, and thorium, were less than 0.00002 Ci and emissions of particulate/vapor activation products increased in 2006 to 2.3 Ci.

➤ *Emissions from the stacks at LANSCE, normally the source of most radionuclide emissions, were significantly lower in 2006 compared to 2005 because a leak that caused elevated emissions in 2005 was repaired and addition emissions controls were added.*

➤ *Emissions of radionuclides from other Laboratory stacks were comparable to previous years.*

Radionuclide concentrations from ambient air samples in 2006 were generally comparable with concentrations in past years. As in past years, the AIRNET system detected contamination from known areas of contamination below the Los Alamos Inn, at the Laboratory's waste disposal site at Area G, and from the former plutonium processing site at TA-21. New or increased airborne radioactivity was detected from cleanup operations at the Los Alamos County Airport, cleanup operations at MDA V at TA-21, and from disposal of the contaminated wastes at Area G. At regional locations away from Los Alamos, all air sample measurements were consistent with background. Annual mean radionuclide concentrations at all LANL perimeter stations were less than 1% of EPA limits for the public. Measurable amounts of tritium were reported at most on-site locations and at perimeter locations; the highest concentrations were measured at the Area G waste site in TA-54 after a decommissioned tank from TA-21 was moved to Area G. The tank was subsequently moved to the tritium shafts at Area G and tritium levels declined. The highest off-site tritium concentration (measured at the southwest LANL boundary) was 9 pCi/m^3 (0.6% of the EPA public dose limit of 1,500 pCi/m^3). Plutonium was detected at two LANL perimeter stations: near Los Alamos Inn at about 12 aCi/m^3 or about 1% of the EPA public dose limit (from historical activities at LANL's old main technical area), and near the Los Alamos County Airport (from remediation work at TA-21). On-site detections of plutonium occurred at TA-21 and at Area G (areas with known low levels of contamination) and were substantially below 0.2% of the DOE limit for workplace exposure. Americium-241 was detected only at TA-21 and at Area G at levels less than 0.001% of worker exposure limits. The maximum annual uranium concentrations were from natural uranium at locations with high dust levels from local soil disturbances such as dirt roads at the Los Alamos County Landfill and Area G. The regional and pueblo samples had higher average concentrations of uranium isotopes than the perimeter group at isotopic ratios that indicate natural sources. Depleted uranium (which has lower radioactivity than natural uranium) was detected in two samples from areas around LANL firing sites where depleted uranium was used in the past.

➤ *PM-10 and PM-2.5 particulate measurements in ambient air were well below EPA standards.*

➤ *Beryllium air concentrations for 2005 were similar to past years and were equal to or less than 2% of the NESHAP standard; a natural origin is indicated by the strong correlation with aluminum concentrations.*

Air monitoring for particles with diameters of 10 micrometers (µm) or less (PM-10) and for particles with diameters of 2.5 µm or less (PM-2.5) continued at one White Rock and two Los Alamos locations. The annual average at all locations for PM-10 was about 13 micrograms/m^3 and about 7 micrograms/m^3 for PM-2.5 and was mostly caused by natural dust and wildfire smoke. These averages are the same as in 2005 and well below the EPA standards. In addition, the 24-hour maxima for both PM-2.5 and PM-10 at all three locations were much less than the EPA standards.

The Laboratory analyzed filter samples from 23 sites for beryllium. These sites are located near potential beryllium sources at LANL or in nearby communities. Correlation with aluminum concentrations indicates that all measurements of beryllium are from naturally occurring beryllium in resuspended dust. Beryllium air concentrations for 2006 were similar to those measured in recent years. All values are equal to or less than 2% of the National Emission Standard for Hazardous Air Pollutants (NESHAP) standard.

Groundwater Monitoring

Groundwater at the Laboratory occurs as a regional aquifer (water-bearing rock) at depths ranging from 600 to 1,200 ft and as perched groundwater of limited thickness and horizontal extent, either in canyon alluvium or at intermediate depths of a few hundred feet (Figure ES-3). All water produced by the Los Alamos County water supply system comes from the regional aquifer and meets federal and state drinking water standards. No drinking water is supplied from the alluvial and intermediate groundwater.

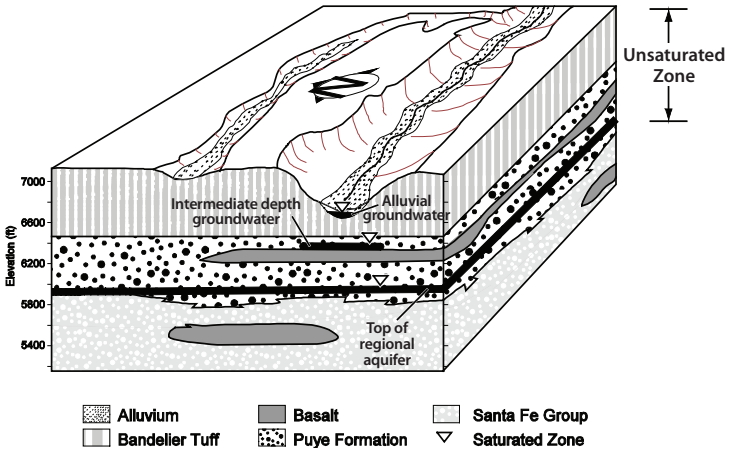

Figure ES-3. Illustration of geologic and hydrologic relationships in the Los Alamos area, showing the three modes of groundwater occurrence.

Laboratory contaminants have impacted deep groundwater, including intermediate perched zones and the regional aquifer, primarily through liquid effluent disposal. Since the early 1990s, the Laboratory has significantly reduced both the number of industrial outfalls (from 141 to 17 active) and the volume of water released (by more than 80%). For 1993 to 1997, total estimated average flow was 1300 million gal./yr; in 2006, the flow was 222 million gal. All discharges met applicable standards. Where Laboratory contaminants are found at depth, the setting is either a canyon where alluvial groundwater is usually present (perhaps because of natural runoff or Laboratory effluents) or a location where large amounts of liquid effluent have been discharged. Table ES-3 summarizes contaminants found in portions of the groundwater system.

➤ *In general, groundwater quality is improving as LANL:*
- *Eliminates outfalls,*
- *Reduces quantity of discharges, and*
- *Improves water quality of the discharges.*

➤ *Contamination may be discovered in additional locations, however, as groundwater characterization continues.*

Drainages that received liquid radioactive effluents in the past include Mortandad Canyon, Pueblo Canyon from its tributary Acid Canyon, and Los Alamos Canyon from its tributary DP Canyon; only Mortandad

Table ES-3
Where Can We See LANL Impacts on Groundwater that Result in Values Near or Above Regulatory Standards, Screening, or Risk Levels?

Chemical	On-Site	Off-Site	Significance	Trends
Tritium	Intermediate groundwater in Mortandad Canyon	No	Not used as a drinking water supply	Insufficient data to define trend
Other radionuclides	Alluvial groundwater in DP/Los Alamos, Pueblo, and Mortandad Canyons	No	Not used as a drinking water supply; radionuclides have not penetrated to deeper groundwater	Some constituents are fixed in location; some are decreasing as effluent quality increases
Chromium	Regional aquifer in Sandia and Mortandad Canyons, intermediate groundwater in Mortandad Canyon	No	Found in regional aquifer above groundwater standards; not affecting drinking water supply wells. Investigations and new wells are being installed to determine extent and predict future movement; source eliminated in 1972.	Insufficient data to define trends
Perchlorate	Alluvial and intermediate groundwater in Mortandad Canyon	No	Values near or above EPA Drinking Water Equivalent Level; supply well with values below risk level is permanently off line	Decreasing in Mortandad Canyon alluvial groundwater as effluent quality improves; insufficient data for other groundwater
Nitrate	Alluvial and Intermediate groundwater in Pueblo Canyon, regional aquifer in Sandia Canyon, intermediate groundwater and regional aquifer in Mortandad Canyon	Yes, in Pueblo Canyon	In Pueblo Canyon, may be due to Los Alamos County's Bayo Sewage Treatment Plant	Insufficient data in Mortandad Canyon, values in Pueblo Canyon are variable, values in Sandia Canyon rising
Molybdenum	Alluvial groundwater in Los Alamos Canyon	No	Not used as drinking water, limited in extent	Near NM groundwater limit for 10 years
Barium	Alluvial and intermediate groundwater in Cañon de Valle	No	Not used as drinking water, limited in area	Generally stable, seasonal fluctuations
RDX	Alluvial and intermediate groundwater in Cañon de Valle, alluvial groundwater in Pajarito Canyon	No	Limited in area	Generally stable

[a]Shallow groundwater includes alluvial and intermediate groundwater.

currently receives radioactive effluent from the Radioactive Liquid Waste Treatment Facility. For the past seven years, this facility has met all DOE radiological discharge standards in all but two months, all National Pollutant Discharge Elimination System (NPDES) requirements, and has voluntarily met NM groundwater standards for fluoride, nitrate, and total dissolved solids in all but two weeks.

The contaminated alluvial and intermediate perched groundwater bodies are separated from the regional aquifer by hundreds of feet of dry rock, so infiltration from the shallow groundwater occurs slowly. As a result, less contamination reaches the regional aquifer than the shallow perched groundwater bodies, and impacts on the regional aquifer are reduced.

➤ *LANL detected chromium contamination in the regional aquifer at concentrations above drinking water standards.*

➤ *The contamination is likely the result of discharges made in the mid-1950s through the early 1970s containing chromate in cooling tower discharges.*

➤ *No drinking water wells have been affected by the chromium contamination.*

Water Canyon and its tributary Cañon de Valle formerly received effluents produced by high explosives (HE) processing and experimentation. In past years, Los Alamos County has operated three sanitary treatment plants in Pueblo Canyon; currently only one plant is operating. The Laboratory also operated many sanitary treatment plants but currently operates only one plant that discharges into Sandia Canyon.

Figure ES-4 summarizes groundwater quality issues in the regional aquifer at the Laboratory. In 2006, the high explosive compound RDX was detected in the regional aquifer for the first time, at Pajarito Canyon well R-18. The concentration was near the analytical detection limit and at 2% of the EPA tap water screening level. RDX was not found in samples taken during 2005 from this well. Earlier detection of RDX in the regional aquifer at R-25 (to the south of R-18) was probably due to contamination from upper levels during well construction of this deep well. The Laboratory, in cooperation with NMED, is investigating these issues.

➤ *The Radioactive Liquid Waste Treatment Facility, which discharges into Mortandad Canyon, has met all DOE radiological discharge standards for 82 of the past 84 months; has met all NPDES requirements for seven consecutive years; and has met NM groundwater standards for fluoride, nitrate, and total dissolved solids for seven years except for fluoride in two weekly composite samples in 2003.*

The Laboratory found hexavalent chromium and nitrate in several monitoring wells. The hexavalent chromium is above the NM groundwater standard in one regional aquifer well and at 60% of the standard in another. Nitrate reaches 50% of the NM groundwater standard in two regional aquifer monitoring wells and fluoride is at 50% of the standard in one well. Traces of tritium and perchlorate are also found in the regional aquifer.

Naturally occurring uranium was the main radioactive element detected in the regional aquifer, springs, and wells throughout the Rio Grande Valley. High concentrations of naturally occurring arsenic are also found in groundwater samples from some regional aquifer wells and springs. Most other metals found at high concentrations in groundwater samples at LANL result from well sampling and well construction issues rather than from LANL contamination. The use of fluids to assist with well drilling and the use of other materials in well completion has affected the chemistry of some groundwater samples.

With one exception, drinking water wells in the Los Alamos area have not been adversely impacted by Laboratory discharges. The exception is well O-1 in Pueblo Canyon, where perchlorate is found at concentrations that average 1/10th of the EPA's Drinking Water Equivalent Level of 24.5 micrograms per liter (µg/L). This well is not used by Los Alamos County for water supply. All drinking water produced by the Los Alamos County water supply system meets federal and state drinking water requirements.

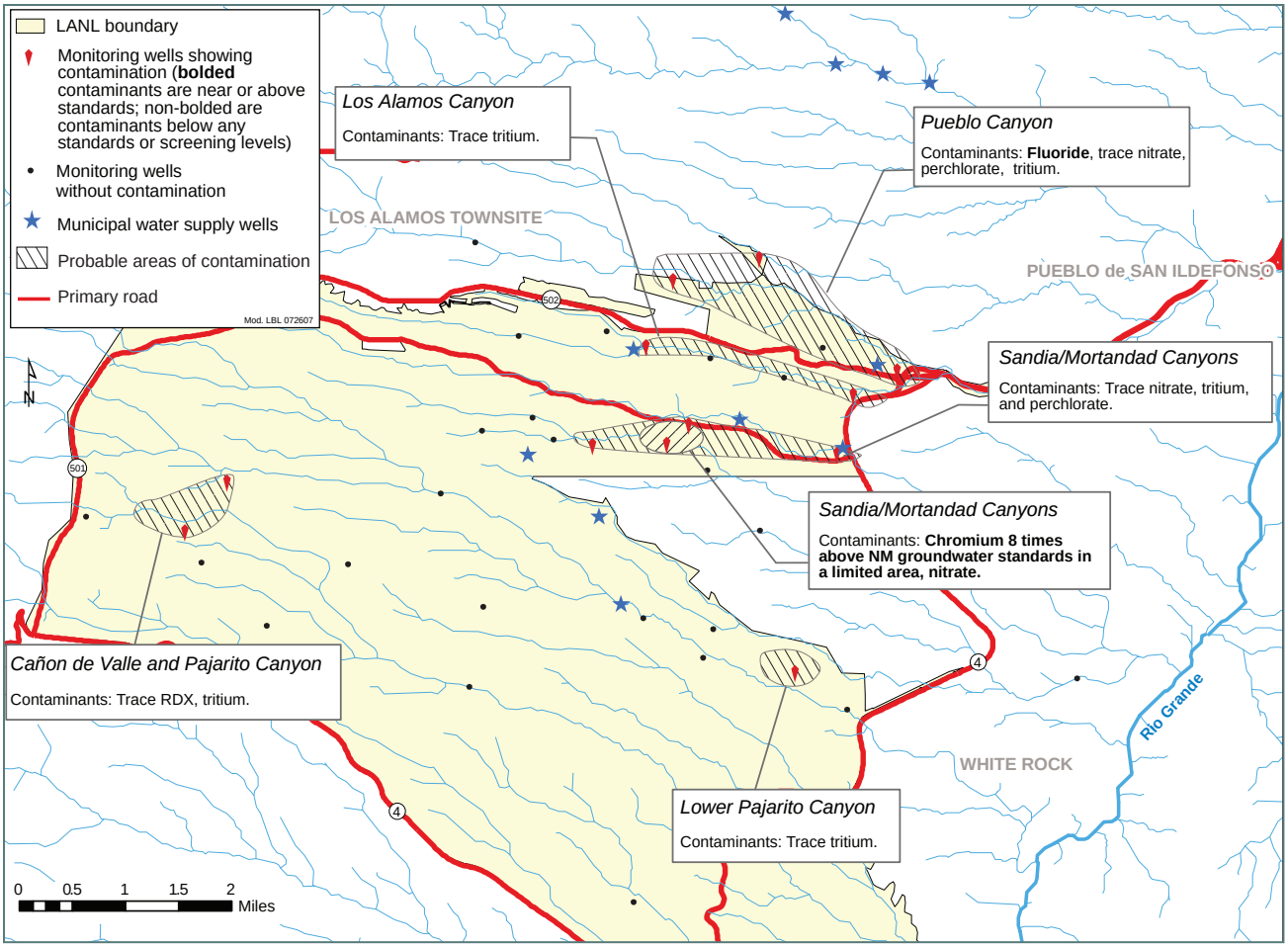

Figure ES-4. Summary of regional aquifer groundwater quality issues at Los Alamos National Laboratory.

The intermediate groundwater in various locations shows localized tritium, organic chemicals (RDX, chlorinated solvents, dioxane[1,4-]), and inorganic chemicals (hexavalent chromium, barium, boron, perchlorate, fluoride, and nitrate) from Laboratory operations. Dioxane[1,4-], a volatile organic compound used as a stabilizer for chlorinated organic solvents, was detected in two intermediate wells in Mortandad Canyon. The Laboratory, in cooperation with the NMED, is investigating this contamination.

The Laboratory uses federal and state drinking water and human health standards as "screening levels" to evaluate radionuclide concentrations in all groundwater, even though many of these standards only apply to drinking water. Only in the alluvial groundwater in portions of Mortandad and DP/Los Alamos Canyons does the total radionuclide activity from LANL activities exceed the guidance that is applicable to drinking water (4 mrem/yr). The maximum strontium-90 values in Mortandad Canyon and DP/Los Alamos Canyons alluvial groundwater were also above the EPA's drinking water standard.

Perchlorate is detected in most groundwater samples analyzed from across northern NM. The naturally-occurring perchlorate concentrations range from about 0.1 µg/L to 1.8 µg/L. Water samples from most LANL locations show low perchlorate concentrations in this range, but samples taken in Mortandad Canyon alluvial and intermediate groundwater show values near or above the EPA Drinking Water Equivalent of 24.5 µg/L. Discharge of perchlorate from the Radioactive Liquid Waste Treatment Facility dropped to near zero in 2002 and perchlorate values in alluvial groundwater downstream of the facility's discharge in Mortandad Canyon have been steadily declining.

Watershed Monitoring

Watersheds that drain LANL property are dry for most of the year. Of the more than 80 miles of watercourse, approximately two miles are naturally perennial, and approximately three miles are perennial water created by effluent discharges. No perennial surface water extends completely across the Laboratory in any canyon. Storm water runoff occasionally extends across the Laboratory but is short-lived. Wildlife drink from the stream channels when water is present but the water is not used for any other purpose.

➤ *The overall quality of most surface water within the Los Alamos area is very good.*

➤ *Of the more than 100 analytes, most are within normal ranges or at concentrations below regulatory standards or risk-based advisory levels.*

➤ *Nearly every major watershed, however, shows some effect from Laboratory operations.*

Hydrologic conditions in all LANL canyons have recovered to levels near those before the Cerro Grande Fire in 2000. However, flows in Pueblo Canyon continue to increase quickly after rainfall events, principally due to increased urbanization and changes to the storm drainage system that have occurred since the fire. Two near-100-year rainfall events in August 2006 led to record flows at some 20 stream gaging stations across the Pajarito Plateau. Despite the record flows, significant impacts to stream flow and water quality downstream of the Laboratory were not evident. The overall quality of most surface water in the Los Alamos area is very good, with low levels of dissolved solutes. Of the more than 100 constituents measured in sediment and surface water within the Laboratory, most are at concentrations far below regulatory standards or risk-based advisory levels. However, nearly every major watershed has some effect from Laboratory operations, often for just a few constituents.

Approximately eight of 10 surface water samples in 2006 contained gross alpha activity in the suspended sediment greater than the NM surface water standard for livestock watering. However, only alpha activity in Mortandad Canyon can regularly be attributed to Laboratory activities; the vast majority of all other results is due to natural sediment and soil carried in storm runoff. There is strong correlation between gross alpha activity and suspended sediment concentrations in the samples. Overall gross alpha levels in suspended sediments have declined over the past few years with the corresponding decrease in sediment load as fire-burned areas recover. The only radionuclide that is measured at more than 5% of the DOE biota concentration guide is radium-226, which is of natural origin.

➤ *Polychlorinated biphenyls (PCBs) are the most significant Laboratory-derived contaminants in surface water samples, with concentrations greater than the NM surface water standard often measured in Sandia and Los Alamos Canyons.*

➤ *Radioactive elements from past Laboratory operations are being transported by runoff events. All radionuclide levels are well below applicable guidelines or standards.*

➤ *PCBs and radionuclides adsorb onto sediment particles and thus overall water concentrations can probably be substantially reduced by slowing the stream flows.*

Laboratory activities have caused contamination of sediment in several canyons, mainly because of past industrial effluent discharges. These discharges and contaminated sediment also affect the quality of storm water runoff, which carries much of this sediment for short periods of intense flow. In some cases, sediment contamination is present from Laboratory operations conducted more than 50 years ago. Table ES-4 shows the locations of Laboratory-impacted surface water and sediment. All radionuclide levels are well below applicable guidelines or standards (Table ES-5).

The overall pattern of radioactivity in channel sediment, such as along lower Los Alamos Canyon, has not greatly changed in 2006. Sediment traps and other methods to slow or control sediment transport in these canyons reduce the potential for further transport down the canyons and potentially to the Rio Grande. Such a sediment trap, the Los Alamos Canyon Weir, has decreased transport of sediment from lower Los Alamos Canyon by about two thirds in 2005 and 2006.

Table ES-4
Where Can We See LANL Impacts on Surface Water and Sediment that Result in Values Near or Above Regulatory Standards or Risk Levels?

LANL Impact	On-Site	Off-Site	Significance	Trends
Specific radionuclides	No	No	Exposure potential is limited. Los Alamos Canyon surface water 40% of DOE biota concentration guide for year; dose mainly from radium-226 that is of natural origin.	None
Gross alpha radioactivity	Mortandad Canyon	No	80% of surface water results from all canyons greater than NM livestock watering standard. Major source is naturally occurring radioactivity in sediments, except in Mortandad Canyon where there is a LANL contribution.	Steady in Mortandad; downward in fire-affected canyons as stream flows recover to pre-fire levels; upward in Pueblo Canyon as flows remain elevated after the fire due to increased urbanization and drainage system changes.
Polychlorinated biphenyls (PCBs)	Detected in sediment in nearly every canyon. Detected in Sandia Canyon runoff and base flow above NM stream standards	Yes, particularly in the Los Alamos/ Pueblo Canyons	Wildlife exposure potential in Sandia Canyon. Elsewhere findings include non-Laboratory and Laboratory sources	None
Selenium	No	No	Half of surface water samples after the fire greater than NM wildlife habitat standard. However, none of 2006 samples above standard.	Downward
Dissolved copper	Detected in many canyons above NM acute aquatic life standards	Yes, in Los Alamos Canyon	Origins uncertain, probably several sources	None

Table ES-5
Estimated Annual Average Unfiltered Surface Water Concentrations of Radionuclides in Selected Canyons Compared with the Biota Concentration Guides

Radionuclide	BCGs[a] (pCi/L)	Pueblo above Acid	Lower Pueblo Canyon	DP Canyon below TA-21	LA Canyon between DP and State Road-4	LA Canyon at Rio Grande	Mortandad Canyon below Effluent Canyon	Max percent of BCG[a]
Am-241	400		0.01	0.1	0.5	0.01	9	2%
Cs-137[b]	20,000	0.1	0.2	2	2	0.3	33	0.2%
H-3	300,000,000		43	21	7	26	294	<0.01%
Pu-238	200		0.001	0.01	0.04	0.01	5	2%
Pu-239,240	200	0.01	0.3	0.1	0.5	0.04	7	4%
Sr-90	300	0.1	0.01	12	0.8	0.4	4	1%
U-234	200	0.3	0.4	0.6	1.3	1.5	2	1%
U-235,236	200	0.01	0.01	0.02	0.1	0.1	2	0.1%
U-238	200	0.4	1.0	0.4	1.3	1.4	0.1	1%
Ra-226	4	0.2	0.9	0.2	0.9	1.6	0.2	40%

[a] BCG = DOE Biota Concentration Guides

[b] The BCG for cesium-137 is a site-specific modified BCG

Blank cells indicate no analytical laboratory detection in 2006

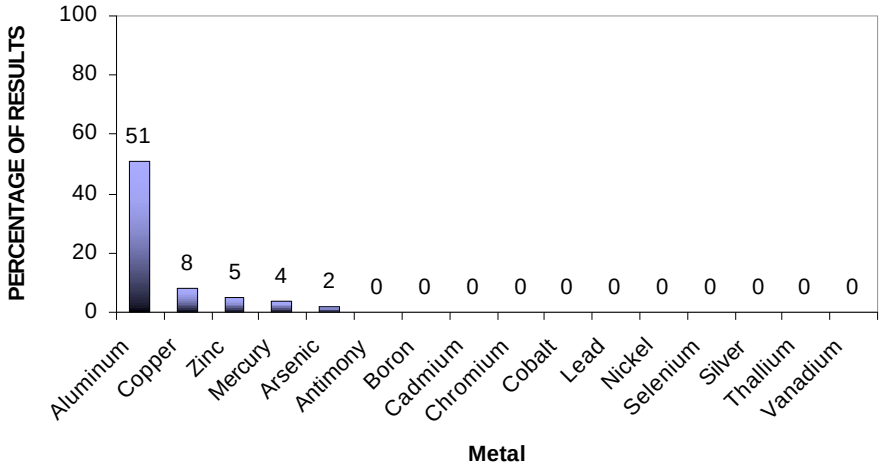

Figure ES-5. Frequency of metal results greater than the most restrictive NM stream standards.

In 2006, all metal concentrations in sediment were below screening levels for recreational and residential uses. In surface water, the vast majority of results were below the most stringent applicable state stream standards, other than for metals of natural origin (for example, aluminum; Figure ES-5). Selenium concentrations have progressively declined since the fire in 2000 and no values greater than the wildlife habitat standard were measured in 2006. The water quality trends indicate that the elevated selenium concentrations were due to natural sources, probably the ash from the fire.

The types of organic compounds tested for varied depending on the location and typically included the following suites: pesticides/polychlorinated biphenyls (PCBs), HE, volatile organics, and semi-volatile

organics. On average, more than 70 different compounds were assessed at each site. PCBs are the only class of organic compounds that were definitively detected at concentrations greater than the NM water quality standards and are likely Laboratory-derived. The sources of PCBs on Laboratory lands are likely predominantly from past spills and leaks of transformers, rather than current effluent discharges. Despite the higher PCB concentrations measured in runoff within the Laboratory, monitoring results show no measurable effects in the Rio Grande.

All measurements of radioactivity in the Rio Grande and in Cochiti Reservoir were orders of magnitude below recreational or residential screening levels. In river sediments, no appreciable differences in radioactivity were measured above and below the Laboratory. Plutonium-239,240 concentrations were below analytical detection limits in the Rio Grande at both the Frijoles and Otowi stations.

Flows from the Pajarito Plateau (from all canyons combined) into the Rio Grande were never more than 1/1000th the flow volume in the Rio Grande. Sediment transport loads in the Rio Grande are 100 to 1000 times that contributed by Los Alamos Canyon. Thus, any impact to the Rio Grande from the transport of contaminated sediment will be very difficult to discern.

Soil Monitoring

Surface soil (mesa top) samples were collected from 17 on-site locations (generally downwind of major facilities or operations at LANL and not from known contaminated areas), 11 perimeter locations (North Mesa, Sportsman's Club, Quemazon Trail, west airport, east airport, White Rock, San Ildefonso, Otowi, Tsankawi/PM-1, US Forest Service property across from TA-8, and south on Bandelier National Monument property near TA-49), and six regional or background locations (near Ojo Sarco, Dixon, Borrego Mesa near Santa Cruz dam, Rowe Mesa near Pecos, Youngsville, and Jemez).

- *LANL-derived radionuclides were detected in soils collected from areas generally downwind of major facilities or operations, including the former plutonium facility on DP Road (TA-21) and the waste management area at Area G, TA-54.*
- *No new areas of contamination were detected and levels are comparable to those measured in previous years.*
- *The detected levels of radionuclides in soils around the LANL boundary are all well below levels considered safe for residential uses.*

Table ES-6 summarizes contaminants found in soil around LANL. All radionuclide (activity) concentrations in soil collected from on site and perimeter areas in 2006 were low and most were either not detected or below regional statistical reference levels (RSRLs, equal to the average plus three standard deviations). The few detected radionuclides above RSRLs in soil collected from perimeter areas included cesium-137 and plutonium-239,240 at the TA-8 location; plutonium-239,240 at the west airport location; and uranium-234 and uranium-238 at the Tsankawi/PM-1 location. The locations where plutonium were detected lie north of the Laboratory and mostly downwind of the former plutonium processing facility at TA-21 or east of Area G at TA-54. The ratio of uranium-234 and uranium-238 in the soil at the Tsankawi/PM-1 location indicates the uranium is naturally occurring. All of the radionuclide concentrations in these samples were just slightly above the RSRLs and were below residential screening levels and thus do not pose a potential unacceptable dose to the public.

Nearly all of the inorganic chemical concentrations from on-site and perimeter areas were below RSRLs. The few heavy metals just above the RSRL included mercury at the Sportsman's Club north of LANL and thallium at the Two-Mile Mesa location at TA-6. The concentrations detected are far below the appropriate screening levels and do not pose a potential hazard to human health.

Table ES-6
Where Can We See LANL Impacts on Mesa-Top Surface Soil that Result in Values Near or Above Regulatory Standards or Risk Levels?

LANL Impact	On-Site	Off-Site	Significance	Trends
Tritium	Yes, above background at some sites, particularly TA-54, Area G	No	Far below residential screening levels	Consistently detected in the south sections of Area G, but not increasing
Plutonium-239,240	Yes, above background along State Road 502 at TA-73 (downwind of TA-21) and at Area G	Yes, above background along State Road 502 on the west side of the airport (downwind of TA-21)	Far below residential screening levels	Plutonium-239,240 downwind of TA-21 is highly variable from sample to sample but is generally not increasing. Also, consistently detected on the north and northeast sections of Area G, but not increasing
Other Radionuclides	Mostly depleted uranium at DARHT	One sample above background for cesium-137	Far below residential screening levels	Uranium-238 is increasing over time at DARHT
Inorganic Chemicals	Few detections: beryllium at DARHT is just above background	Few detections	Far below industrial and occupational screening levels	Steady
PCBs	All below detection limits except one sample at Area G at TA-54	No	Far below industrial and occupational screening levels	Insufficient data at TA-54; re-sampling to be conducted at same site in 2007
High Explosives	All below detection limits	No	Minimal potential for exposure	None
Semi-volatile Organic Compounds (SVOCs)	One sample along State Road 502 on TA-73 contained some SVOCs	No	Far below industrial and occupational screening levels; from asphalt (not a LANL source)	None

All PCBs, HE, and nearly all semi-volatile organics in soil from perimeter and on-site locations were below detection limits. Only one site showed some semi-volatile organic compounds; this site is located on the south side of State Road 502 and east of the Los Alamos Fire Department and contained considerable amounts of asphalt. Asphalt, a petroleum-based product, contains a host of polyaromatic hydrocarbons, but the amounts detected were all below the occupational screening levels and do not pose a potential risk to human health. Sampling of soil around Area G shows concentrations similar to past years, including above-background concentrations of tritium in soil along the southern portion of Area G where the tritium shafts are located; and above-background americium and plutonium along the perimeter of the northern, northeastern, and eastern sections. After a spill of contaminated soil (during moving operations at Area G), additional soil samples collected around the northwestern perimeter section of Area G contained tritium, americium, and plutonium two to nearly six times higher than previous results. However, all concentrations are below residential screening levels and do not pose a potential unacceptable dose to human health.

Concentrations of americium-241, plutonium-238, and plutonium-239,240 in most of the soil samples collected along a transect starting from the northeast portion of Area G and extending to the Pueblo de

San Ildefonso fence line are above RSRLs. All concentrations are far below residential screening levels, and concentrations of all radionuclides decrease to background levels within a short distance from the Pueblo fence line.

At DARHT, soil samples contain slightly elevated levels of beryllium and greatly elevated levels of depleted uranium near the firing point. However, the concentrations of these elements are not elevated past the DARHT perimeter fence line.

➤ *Soil samples from off-site locations show radionuclides and metals have not increased over the past years and are mostly at background levels.*

➤ *All PCBs, high explosives, and nearly all semi-volatile organics in soil from perimeter and on-site locations are below detection limits.*

An evaluation of beryllium from samples collected around the Laboratory since 1992 shows that all on-site areas, except for DARHT, contained no beryllium levels above RSRLs. There are no increasing trends over time at any of the on-site or perimeter sample sites.

Foodstuffs and Nonfoodstuffs Biota Monitoring

Data from past years on radionuclides in domestic crop plants (vegetables and fruits) from all communities surrounding the Laboratory are indistinguishable from natural or fallout levels. Similarly, all trace element concentrations in vegetable and fruit samples are within or similar to the RSRLs and show no increasing trends in concentrations.

Table ES-7 summarizes contaminants found in biota around LANL. Foodstuffs samples collected in 2006 included wild edible plants, common lambsquarters, and pigweed amaranth collected from within Mortandad Canyon on Pueblo de San Ildefonso land. Concentrations, trends, and doses were assessed. The only radionuclide detected above the RSRL in both common lambsquarters and pigweed amaranth was strontium-90 in samples from Mortandad Canyon. The levels are similar to levels in other wild food plants collected from this same location in previous years and may be related to the lower calcium content in the soil because both elements are chemically similar and the plants do not differentiate between the two. The highest strontium-90 concentrations are below levels that would result in a dose of 0.1 mrem for each pound of common lambsquarters and pigweed amaranth consumed, which is 0.4% of the DOE pathway dose constraint of 25 mrem/yr.

➤ *In vegetation collected at area G (TA-54), all radionuclide concentrations were indistinguishable from background reference levels except tritium and plutonium in samples from areas with known contamination.*

➤ *At DAHRT, uranium in overstory (but not in understory) vegetation appears to be increasing over the past seven years.*

➤ *All radionuclides in vegetation and other biota from Area G and DARHT, including bees, birds, and small mammals, were well below screening levels.*

All inorganic chemical concentrations in common lambsquarters and pigweed amaranth samples collected from within Mortandad Canyon on Pueblo de San Ildefonso land are not detected or below RSRLs.

Native understory vegetation was collected from 17 on-site, 11 perimeter, and six regional locations. Most concentrations of radionuclides in native understory plants collected from both on-site and perimeter areas were either not detected or below RSRLs. The very few detected radionuclides higher than RSRLs in vegetation are from on-site and perimeter areas including strontium-90 and plutonium-238 in a sample collected east of Area G at TA-54; cesium-137 in a sample collected east of White Rock; tritium in a sample collected along State Road 502 at TA-73; and plutonium-239,240 in a sample collected west of the former plutonium processing facility

Table ES-7
Where Can We See LANL Impacts on Foodstuffs and Nonfoodstuffs Biota that Result in Values Near or Above Regulatory Standards or Risk Levels?

Media	LANL Impact	On-Site	Off-Site	Significance	Trends
Wild edible plants	Radionuclides	Not collected in 2006, but historically slightly higher in Mortandad Canyon than background	Above background concentrations for strontium-90 in plants from Mortandad Canyon on Pueblo de San Ildefonso land	Far below screening level. Higher strontium-90 in wild plants is a function of low calcium in the soil and not to increased contamination levels	Steady
	Inorganic chemicals	Not collected in 2006	No	No data	Steady
Native vegetation	Radionuclides	Mostly tritium and plutonium-239,240 at Area G; and depleted uranium at DARHT	Few detections	Far below screening levels	Tritium and plutonium-239,240 are steady at Area G but uranium-238 in trees is increasing over time at DARHT
	Inorganic chemicals	Few detections: arsenic in one plant sample at DARHT	No	Above screening levels but other media show no arsenic problems so outlier is suspected	Steady for most metals
Small mammals, bees, and birds	Radionuclides	Depleted uranium at DARHT. Some radionuclides in biota upstream of the Los Alamos Canyon Weir and the Pajarito Canyon Flood Retention Structure	None collected	Far below screening levels	Steady for most radionuclides
	Inorganic chemicals	Some detections in a bird at DARHT	None collected	One sample out of two	Insufficient data

at TA-21. All of these detected concentrations are below screening levels (set at 10% of the relevant standard) and do not result in adverse effects to the vegetation.

Most inorganic chemicals in native vegetation from on-site and perimeter areas are below RSRLs. The few inorganic chemicals in native vegetation from on-site and perimeter areas above RSRLs included mostly zinc and cadmium at levels that do not pose a hazard to the plants.

In vegetation collected at Area G at TA-54, all radionuclide concentrations are indistinguishable from background reference levels, except tritium and plutonium in plants next to the disposal area, where results are similar to past years and correlate well with levels measured in soil. All concentrations of inorganic chemicals, with the exception of zinc in both vegetation samples, were either not detected or below the RSRLs.

At DARHT, all radionuclide concentrations in vegetation are indistinguishable from RSRLs, except for uranium in overstory vegetation collected from the north and east sides of the complex. The ratio of uranium-234 to uranium-238 is consistent with that of depleted uranium, which is used as a substitute for enriched uranium in the testing performed at the site. Uranium in overstory (but not in understory) vegetation appears to be increasing over the past seven years. The only inorganic chemical detected above RSRLs is arsenic in one overstory plant sample collected on the south side of the DARHT facility. No other arsenic detections occur in previous or concurrent samples and soil levels are normal.

Deer mice were collected from the north and northeast side of the DARHT facility. Only uranium-234 in the whole body of mice collected downwind of DARHT was detected above RSRLs. The level of uranium-234 is far below the screening level and does not pose a hazard to the mice. The distribution of uranium-234 and uranium-238 indicate the uranium in mice is depleted uranium.

All radionuclides in two composite samples of birds collected west of the DARHT facility are either not detected or below the RSRLs. In contrast, many inorganic chemicals were detected above RSRLs in one bird (a spotted towhee), including aluminum, barium, beryllium, iron, manganese, vanadium, arsenic, lead, and silver. The reason for the elevated levels in only one bird is not understood, but is probably from sources other than DARHT.

Most concentrations of radionuclides and all nonradionuclides in bees sampled from four hives located northeast of the DARHT facility are below RSRLs. The exception is uranium-234 and uranium-238 in three out of the four bee samples. The distribution of these isotopes shows that one of these samples contains depleted uranium.

In sediment upstream of the Los Alamos Canyon Weir, cesium-137, plutonium-238, plutonium-239,240, americium-241, silver, mercury, lead, and Aroclor-1260 were detected in concentrations higher than the RSRLs. Also, strontium-90, plutonium-239,240, americium-241, and lead in overstory plants and plutonium-239,240, americium-241, uranium-234, and uranium-238 in whole body mice are higher than RSRLs. All concentrations are below screening levels and do not pose a potential unacceptable dose to human health or to the biota sampled.

Upstream of the Pajarito Canyon Flood Retention Structure, sediment concentrations of cesium-137, plutonium-239,240, uranium-234, uranium-238, copper, cadmium, silver, mercury, and Aroclor-1254 are above RSRLs; vegetation has concentrations of uranium-234, uranium-238, lead, and silver above RSRLs; and the small mammals have concentrations of plutonium isotopes, americium-241, uranium-234, and uranium-238 above RSRLs. All concentrations of radionuclides and nonradionuclides in all media, however, are below screening levels and do not pose a potential unacceptable dose to human health or to the biota sampled.

➤ *All radionuclide concentrations in wild edible plants from Mortandad Canyon on Pueblo de San Ildefonso land were below levels that would result in 0.4% of the DOE pathway dose constraint of 25 mrem/yr.*

Along the north perimeter fence line of MDA B, four composite samples of tree shoot tips were collected from every tree growing along a 100-yard section starting from the east end. Most isotopes are not detected or below RSRLs. The few radionuclides above RSRLs—cesium-137 in one sample and plutonium-239,240 in another sample—are below screening levels used to assess the dose to the trees. Chromium and nickel in one sample and zinc and lead in another sample are above RSRLs; differences between MDA B trees and regional trees were small. All elements are below screening levels and do not cause a significant dose to the trees.

Environmental Restoration Program

Corrective actions proposed and/or conducted at LANL in 2006 follow the requirements of the Consent Order. The goal of the investigation efforts is to ensure that waste and contaminants from past operations do not threaten human or environmental health and safety. Accomplishments include the completion of investigation activities, approvals of proposed investigation activities, and approvals of the work completed at some sites. Field activities conducted in 2006 included: investigation activities at MDAs A, C, T, U and V; final remedy construction for the TA-73 Airport Landfill; field investigations in Pueblo Canyon, Guaje, Barrancas/Rendija Canyons Aggregate Area, North Canyons, and Pajarito Canyon; accelerated corrective actions at a former storage area with petroleum contamination; and investigations at a former petroleum-contaminated storage area, a site with an oil-water separator and drainline and a former high explosive storage magazine, a former experimental area with potential radionuclide and metals contamination, a former explosives processing site, a former vacuum-pump oil disposal and storage site, and the groundwater in Mortandad Canyon. During 2006, environmental restoration activities collected over 3,330 samples from over 1,100 locations and requested over 418,000 analyses or measurements on these samples.

- *Characterization and cleanup of sites contaminated or potentially contaminated by past LANL activities follow the Consent Order.*
- *16 investigation work plans and 14 investigation reports were submitted to NMED in 2006.*
- *28 sites were granted certificates of completion.*

Under the Consent Order, 16 investigation work plans and 14 investigation reports were submitted to NMED. In 2006, NMED approved a total of 10 investigation work plans and 10 investigation reports, some with modifications or directions. Of the documents approved, LANL submitted eight work plans and five reports in 2006; the other approved plans were submitted in previous years. A total of 28 SWMUs and areas of concern were granted certificates of completion, which signifies that the investigations have been completed. In addition, NMED is reviewing four work plans and three reports as of the end of the calendar year.

The investigation activities are designed to characterize SWMUs, areas of concern, consolidated units, aggregate areas, and watersheds. The characterization activities conducted include surface and subsurface sampling, drilling boreholes, geophysical studies, and installation of monitoring wells. Corrective action activities performed included the removal of structures (e.g., buildings, septic systems, sumps, and drainlines), excavation of contaminated media, and confirmatory sampling. These activities defined the nature and extent of contamination and determined the potential risks and doses to human health and the environment.

- *Investigations included drilling a substantial number of boreholes, collecting thousands of samples, and obtaining hundreds of thousands of analytical results.*
- *Cleanup activities included the removal of structures (e.g., buildings, septic systems, sumps, and drainlines), soil vapor extraction, excavation of contaminated media, and confirmatory sampling.*
- *In 2006, 28% of all environmental samples collected and 68% of all sample analyses were for environmental characterization and remediation work at LANL.*

Risk Reduction

Risk is evaluated either as current (present-day) or prospective (future) risk. The Laboratory assesses hazards and the corresponding risks by evaluating environmental data, measurements, inventories of buried or stored materials, and potential exposure pathways and scenarios. Models, data, and computer programs are used to assist with these estimates.

Over the years, the Laboratory has decreased its release of materials into the environment and has reduced the amount of legacy contamination. Examples include the reduction in both the number of outfalls (plant and process discharges) and the volume of water released from these, the reduction in air emissions, changes to effluent treatment processes at the Radioactive Liquid Waste Treatment Facility at TA-50, and the removal of contaminated material and waste at sites such as MDA P. These efforts together have significantly reduced or eliminated potential exposure and risk to workers, the public, and the environment.

Examples of ongoing risk reduction activities include: the transport of stored legacy transuranic waste from Area G to the Waste Isolation Pilot Plant (WIPP) in Carlsbad, NM; the planned cleanup and remediation of the former plutonium processing facility at TA-21; ongoing studies of groundwater contamination to evaluate future hazards and risks; additional emission controls added in 2005 to reduce radioactive gas emissions from LANSCE; and numerous investigations and corrective actions at potentially contaminated sites, such as cleanup of a legacy disposal area and landfill site next to the Los Alamos County Airport and the remediation activities at MDA V where three absorption beds and other contaminated soil and tuff were excavated.

The sensitivity of measurements obtained by LANL's environmental surveillance program can detect hazardous and radioactive materials and other contaminants during cleanup or normal operations at near and remote locations. Each possible pathway to people and the environment is monitored. The data from monitoring can be used to assist with possible mitigation of impacts. Air monitoring by the AIRNET system has regularly detected airborne contaminants where both known and unexpected contamination is present on the surface; in many cases, remediation was initiated to remove the source, though levels have never approached regulatory limits. The AIRNET system can detect low levels of radionuclides that are dispersed during cleanup operations and many additional samplers have been added in anticipation of upcoming cleanup operations. The Direct Penetrating Radiation network detects neutrons and gamma rays from the stored waste at Area G and is used to help keep radiation levels as low as reasonably achievable. Biota and foodstuffs monitoring is conducted to ensure there is no spread of contamination into plants and foods. The monitoring of constituents in groundwater keeps track of the movement of previously-released contaminants and their potential migration in the aquifers.

➤ *Past risk reduction successes include the reduction in the number of outfalls (plant and process discharges) and the volume of water released from them, the reduction in air emissions over the past several years, changes to effluent treatment processes at the Radioactive Liquid Waste Treatment Facility at Technical Area 50, and the removal of contaminated material and waste at former waste disposal sites.*

➤ *Ongoing risk reduction efforts include the transport of waste from Area G to permanent disposal at WIPP, studies of the movement of contaminants in groundwater, and planned or active cleanup operations at former waste and radionuclide processing sites.*

➤ *The environmental surveillance programs can detect very low levels of potential contaminants and thus enable the detection of new hazards and the evaluation of the associated level of risk.*

1. Introduction

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A. BACKGROUND AND REPORT OBJECTIVES

1. Introduction to Los Alamos National Laboratory

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 that 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 Los Alamos National Laboratory (LANL or the Laboratory) in 1981. Through May 2006, the Laboratory was managed by the Regents of the University of California (UC) under a contract administered by the National Nuclear Security Administration (NNSA) of the US Department of Energy (DOE) through the Los Alamos Site Office and the NNSA Service Center based in Albuquerque, N.M. In June 2006, a new management organization, Los Alamos National Security (LANS), LLC, took over management of the Laboratory.

The Laboratory's original mission to design, develop, and test nuclear weapons has broadened and evolved as technologies, US priorities, and the world community have changed. The current mission is to develop and apply science and technology to

- Ensure the safety and reliability of the US nuclear deterrent;
- Reduce global threats; and
- Solve other emerging national security challenges (LANL 2005a).

Los Alamos National Laboratory's vision is "Los Alamos, the premier national security science laboratory." The Laboratory has identified 12 strategic goals to implement its vision and mission:

- Make safety and security integral to every activity we do.
- Implement a cyber security system that reduces risk while providing exemplary service and productivity.
- Establish excellence in environmental stewardship.
- Assess the safety, reliability, and performance of LANL weapons systems.
- Transform the Laboratory and the nation's nuclear weapons stockpile to achieve the 2030 vision, in partnership with the Complex.

- Leverage our science and technology advantage to anticipate, counter, and defeat global threats and meet national priorities, including energy security.
- Be the premier national security science laboratory and realize our vision for a capabilities-based organization.
- Provide efficient, responsive, and secure infrastructure and disciplined operations that effectively support the Laboratory mission and its workforce.
- Implement a performance-based management system that drives mission and operational excellence.
- Deliver improved business processes, systems, and tools that meet the needs of our employees, reduce the cost of doing business, and improve the Laboratory's mission performance.
- Communicate effectively with our employees, customers, community, stakeholders, and the public at large.
- Develop employees and create a work environment to achieve employee and Laboratory success.

Inseparable from the Laboratory's commitment to excellence in science and technology is its commitment to complete all work in a safe, secure, and environmentally responsible manner. The Laboratory uses Integrated Safety Management (ISM) to set, implement, and sustain safety performance and meet environmental expectations. In addition, the Laboratory uses an International Standards Organization (ISO) 14001-2004 registered Environmental Management System (EMS) as part of ISM to focus on environmental performance, protection, and stewardship (see Section D of this chapter for additional information). The foundation of the EMS and the demonstration of the Laboratory's commitment is the LANL environmental policy:

> *It is the policy of Los Alamos National Laboratory that we will be responsible stewards of our environment. It is our policy to: Manage and operate our site in compliance with environmental laws and standards and in harmony with the natural and human environment; Meet our environmental permit requirements; Use continuous improvement processes to recognize, monitor and minimize the consequences to the environment stemming from our past, present, and future operations; Prevent pollution; Foster sustainable use of natural resources; Work to increase the body of knowledge regarding our environment.*

2. Objectives

As part of the Laboratory's commitment to our environmental policy, we will monitor and report on how Laboratory activities are affecting the environment. The objectives of this environmental surveillance report, as directed by DOE Order 231.1 (DOE 2003a, DOE 2004), are to

- Characterize site environmental management performance including effluent releases, environmental monitoring, and estimated radiological doses to the public and the environment.
- Summarize environmental occurrences and responses reported during the calendar year.
- Confirm compliance with environmental standards and requirements.
- Highlight significant programs and efforts, including environmental performance indicators and/or performance measures programs.

Over and above the DOE requirements, the Laboratory establishes annual environmental objectives, targets, and key performance indicators through its EMS. The current objectives are to

- Ensure environmental compliance.
- Reduce waste.
- Improve Laboratory-wide energy and fuel conservation.
- Conduct Laboratory-wide cleanout activities to dispose of unneeded equipment, materials, chemicals, and associated waste by October 2011.
- Achieve zero liquid discharge by 2012.

B. ENVIRONMENTAL SETTING

1. Location

The Laboratory and the associated residential and commercial areas of Los Alamos and White Rock are located in Los Alamos County, in north-central New Mexico (NM), approximately 60 miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe (Figure 1-1). 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. Mesa tops range in elevation from approximately 7,800 ft on the flanks of the Jemez Mountains to about 6,200 ft near the Rio Grande Canyon. Most Laboratory and community developments are confined to the mesa tops.

The surrounding land is largely undeveloped, and large tracts of land north, west, and south of the Laboratory site are held by the Santa Fe National Forest, the US Bureau of Land Management, Bandelier National Monument, the US General Services Administration, and the Los Alamos County. Pueblo de San Ildefonso borders the Laboratory to the east.

2. Geology and Hydrology

The Laboratory lies at the western boundary of the Rio Grande Rift, a major North American tectonic feature. Three major potentially active local faults constitute the modern rift boundary. Studies indicate that the seismic surface rupture hazard associated with these faults is localized (Gardner et al., 1999). Most of the finger-like mesas in the Los Alamos area (Figure 1-2) are formed from Bandelier Tuff, which includes ash fall, ash fall pumice, and rhyolite tuff. Deposited by major eruptions in the Jemez Mountains volcanic center 1.2–1.6 million years ago, the tuff is more than 1,000 ft thick in the western part of the plateau and thins to about 260 ft eastward above the Rio Grande.

On the western part of the Pajarito Plateau, the Bandelier Tuff overlaps onto the Tschicoma Formation, which consists of older volcanics that form the Jemez Mountains. The tuff is underlain by the conglomerate of the Puye Formation in the central plateau and near the Rio Grande. The Cerros del Rio Basalts interfinger with the conglomerate along the river. These formations overlie the sediments of the Santa Fe Group, which extend across the Rio Grande Valley and are more than 3,300 ft thick.

Surface water in the Los Alamos region occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into the upper reaches of some canyons, but the volume is insufficient to maintain surface flows across the Laboratory property before the water is depleted by evaporation, transpiration, and infiltration.

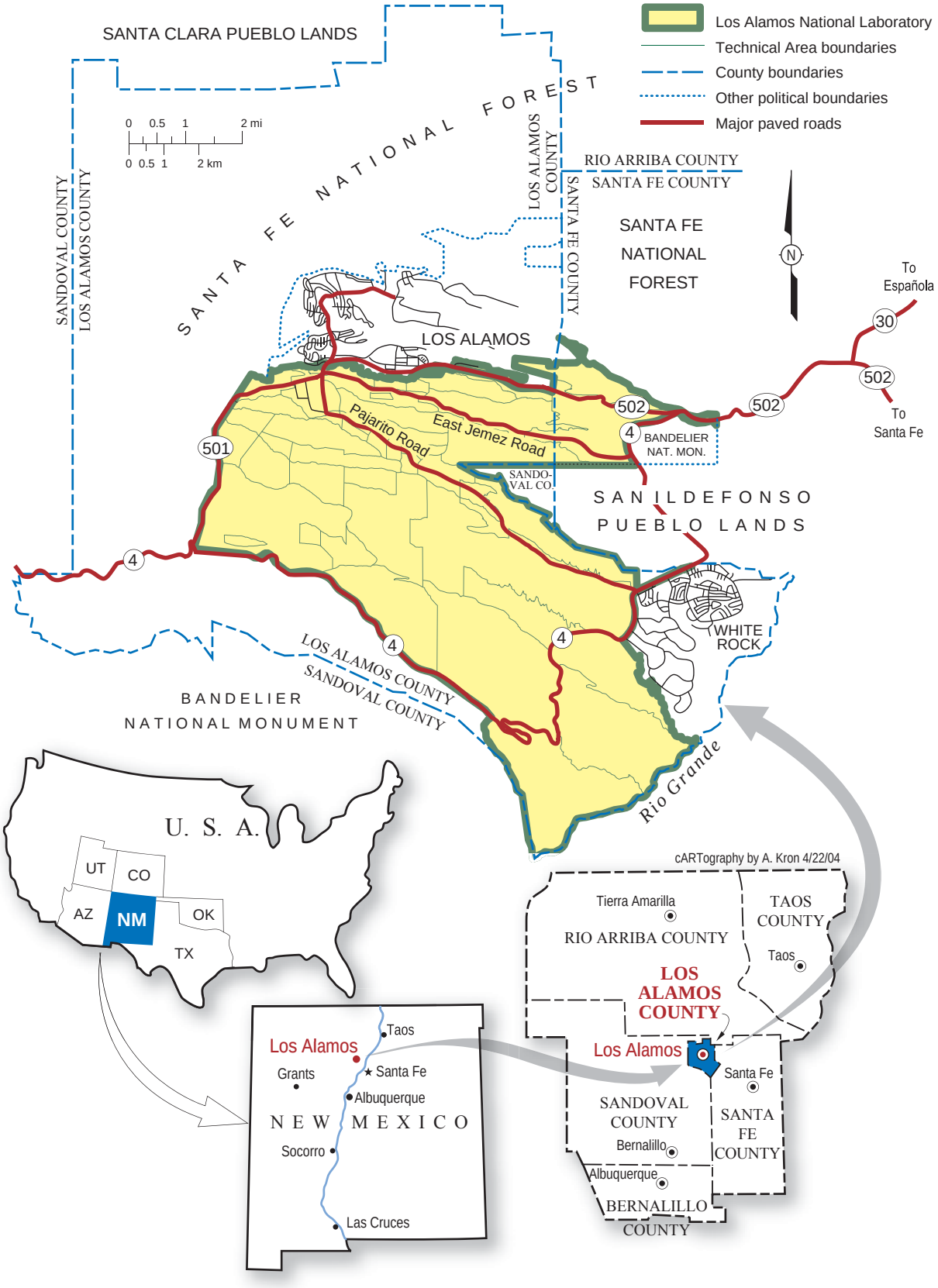

Figure 1-1. Regional location of Los Alamos National Laboratory.

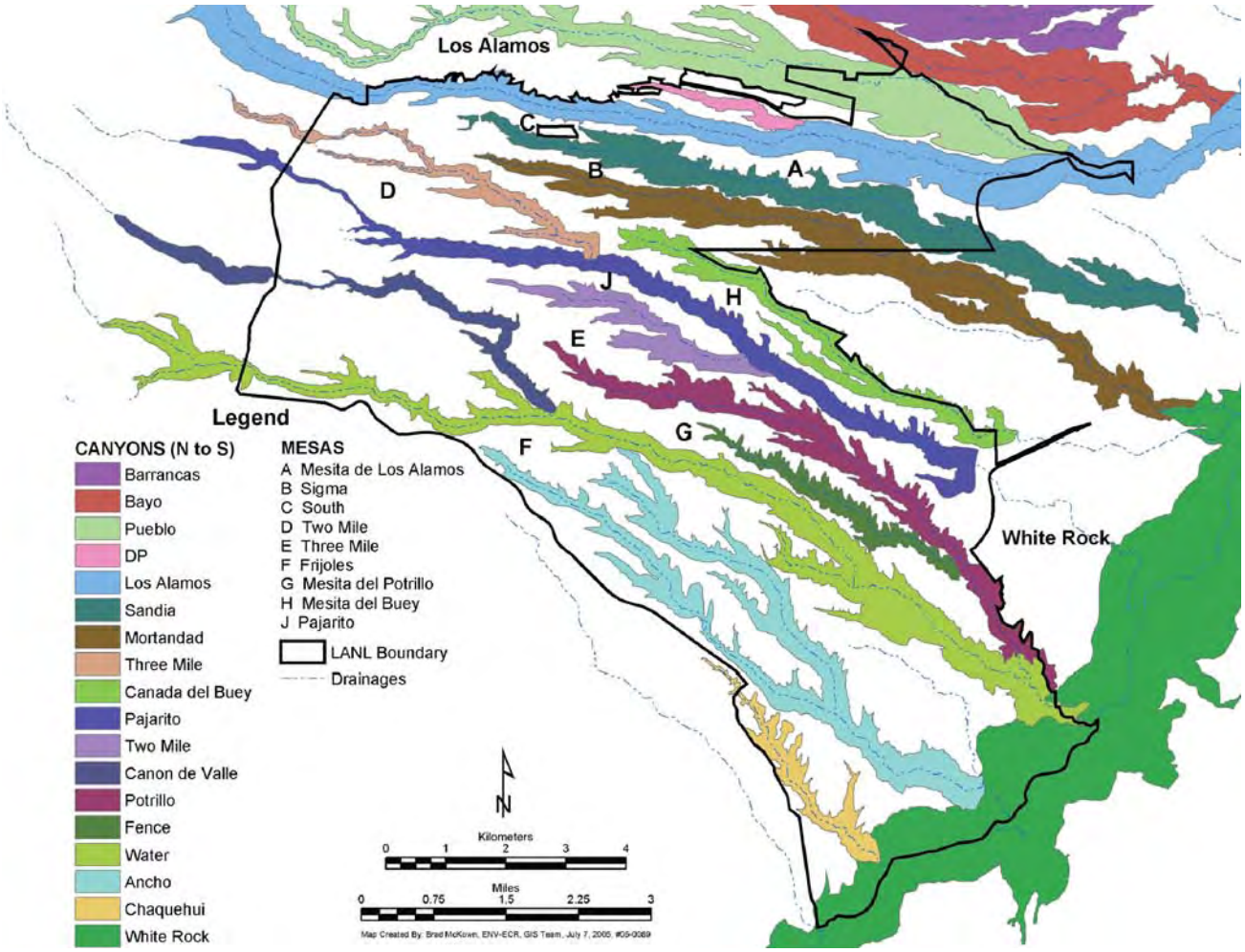

Figure 1-2. Major canyons and mesas on Laboratory land.

Groundwater in the Los Alamos area occurs in three modes: (1) water in shallow alluvium in canyons, (2) perched water (a body of groundwater above a less permeable layer that is separated from the underlying main body of groundwater by an unsaturated zone), and (3) the regional aquifer, which is the only aquifer in the area capable of serving as a municipal water supply. Water in the regional aquifer is in artesian conditions under the eastern part of the Pajarito Plateau near the Rio Grande (Purtymun and Johansen 1974). The source of most recharge to the aquifer appears to be infiltration of precipitation that falls on the Jemez Mountains. The regional aquifer discharges into the Rio Grande through springs in White Rock Canyon. The 11.5-mi reach of the river in White Rock Canyon, between Otowi Bridge and the mouth of Rio de los Frijoles, receives an estimated 4,300–5,500 ac-ft of water from the regional aquifer.

3. Biological Resources

The Pajarito Plateau, including the Los Alamos area, is biologically diverse. This diversity of ecosystems is due partly to the dramatic 5,000-ft elevation gradient from the Rio Grande on the east of the plateau up to the Jemez Mountains 12 mi (20 km) to the west and partly to the many steep canyons that dissect the area. Five major vegetative cover types are found in Los Alamos County. The juniper (*Juniperus monosperma* Englem. Sarg.)-savanna community is found along the Rio Grande on the eastern border of the plateau and extends upward on the south-facing sides of canyons at elevations between 5,600 and 6,200 ft. The piñon (*Pinus*

edulis Engelm.)-juniper cover type, generally between 6,200 to 6,900 ft in elevation, covers large portions of the mesa tops and north-facing slopes at the lower elevations. Ponderosa pine (*Pinus ponderosa* P. & C. Lawson) communities are found in the western portion of the plateau between 6,900 and 7,500 ft in elevation. These three vegetation types predominate, each occupying roughly one-third of the Laboratory site. The mixed conifer cover type, at an elevation of 7,500 to 9,500 ft, overlaps the Ponderosa pine community in the deeper canyons and on north-facing slopes and extends from the higher mesas onto the slopes of the Jemez Mountains. Spruce (*Picea* spp.)-fir (*Abies* spp.) is at higher elevations of 9,500 to 10,500 ft. Several wetlands and riparian areas enrich the diversity of plants and animals found on LANL lands.

In May 2000, the Cerro Grande fire burned over 43,000 ac of forest in and around LANL. Most of the habitat damage occurred on Forest Service property to the west and north of LANL. Approximately 7,684 ac, or 28% of the vegetation at LANL, was burned to varying degrees by the fire. However, few areas on LANL property were burned severely. Wetlands in Mortandad, Pajarito, and Water Canyons received increased amounts of ash and hydromulch runoff because of the fire.

The extreme drought conditions prevalent in the Los Alamos area and all of New Mexico from 1998 to the present have resulted directly and indirectly in the mortality of many trees. Between 2002 and 2005 more than 90% of the piñon trees greater than 10 ft tall have died in the Los Alamos area. Lower levels of mortality have also occurred in ponderosa and mixed conifer stands. Mixed conifers on north-facing canyon slopes at lower elevations have experienced widespread mortality. These changes likely will have long-lasting impacts to vegetation community composition and distribution.

4. Cultural Resources

The Pajarito Plateau is an archaeologically rich area. Approximately 86% of DOE land in Los Alamos County has been surveyed for prehistoric and historic cultural resources, and more than 1,800 sites have been recorded. During fiscal year (FY) 2006, sites that have been excavated since the 1950s were removed from the overall site count numbers. Thus, the number of recorded sites is less than in reports from previous years. More than 85% of the resources are Ancestral Pueblo and date from the 13th, 14th, and 15th centuries. Most of the sites are found in the piñon-juniper vegetation zone, with 80% lying between 5,800 and 7,100 ft. Almost three-quarters of all cultural resources are found on mesa tops. Buildings and structures from the Manhattan Project and the early Cold War period (1943–1963) are being evaluated for eligibility for listing in the National Register of Historic Places, and more than 320 buildings have been evaluated to date. In addition, "key facilities" (facilities considered of national historic significance) dating from 1963 to the end of the Cold War in 1990 are also being evaluated.

5. Climate

Los Alamos County has a temperate, semiarid mountain climate. Large differences in locally observed temperature and precipitation exist because of the 1,000-ft elevation change across the Laboratory site and the complex topography. Four distinct seasons occur in Los Alamos County. Winters are generally mild, with occasional winter storms. Spring is the windiest season. Summer is the rainy season, with occasional afternoon thunderstorms. Fall is typically dry, cool, and calm.

Daily temperatures are highly variable (a 23˚F range on average). On average, winter temperatures range from 30˚F to 50˚F during the daytime and from 15˚F to 25˚F during the nighttime. The Sangre de Cristo Mountains to the east of the Rio Grande Valley act as a barrier to wintertime arctic air masses that descend into the central United States, making the occurrence of local subzero temperatures rare. On average, summer temperatures range from 70˚F to 88˚F during the daytime and from 50˚F to 59˚F during the nighttime.

From 1971 to 2000, the average annual precipitation (which includes both rain and the water equivalent of frozen precipitation) was 18.95 in., and the average annual snowfall amount was 58.7 in. (NOTE: By convention, full decades are used to calculate climate averages [WMO 1984].) The months of July and August account for 36% of the annual precipitation and encompass the bulk of the rainy season, which typically begins in early July and ends in early September. Afternoon thunderstorms form as moist air from the Pacific Ocean and the Gulf of Mexico is convected and/or orographically lifted by the Jemez Mountains. The thunderstorms yield short, heavy downpours and an abundance of lightning. Local lightning density, among the highest in the United States, is estimated at 15 strikes per square mile per year. Lightning is most commonly observed between May and September (about 97% of the local lightning activity).

The complex topography of the Pajarito Plateau influences local wind patterns. Often a distinct diurnal cycle of winds occurs. Daytime winds measured in the Los Alamos area are predominately from the south, consistent with the typical upslope flow of heated daytime air moving up the Rio Grande valley. Nighttime winds (sunset to sunrise) on the Pajarito Plateau are lighter and more variable than daytime winds and typically from the west, resulting from a combination of prevailing winds from the west and downslope flow of cooled mountain air. Winds atop Pajarito Mountain are more representative of upper-level flows and primarily range from the northwest to the southwest, mainly because of the prevailing westerly winds.

C. LABORATORY ACTIVITIES AND FACILITIES

The Laboratory is divided into technical areas (TAs) that are used for building sites, experimental areas, support facilities, roads, and utility rights-of-way (Appendix C and Figure 1-3). However, these uses account for only a small part of the total land area; much of the LANL land provides buffer areas for security and safety or is held in reserve for future use. The Laboratory has about 2,000 structures with approximately 8.6 million square feet under roof, spread over an area of approximately 40 square miles.

In its 1999 Site-Wide Environmental Impact Statement (SWEIS) (DOE 1999), LANL identified 15 Laboratory facilities as "Key Facilities" for the purposes of facilitating a logical and comprehensive evaluation of the potential environmental impacts of LANL operations (Table 1-1). Operations in the Key Facilities represent the majority of exposures associated with LANL operations. In 2005, DOE/NNSA decided to prepare a new SWEIS. The new SWEIS will be completed in the summer of 2007, with a Record of Decision (ROD) scheduled to be issued in December 2007. Until a ROD is issued for the new SWEIS, LANL operations will continue to be conducted under the existing 1999 SWEIS ROD. The facilities identified as "key" for the purposes of the 1999 SWEIS are those that house activities critical to meeting work assignments given to LANL and also include the following:

- In-house operations that could potentially cause significant environmental impacts,
- Activities or operations of most interest or concern to the public based on SWEIS scoping comments, or
- Activities or operations that would be the most subject to change because of programmatic decisions.

In the 1999 SWEIS and in the new SWEIS, the remaining LANL facilities were identified as "Non-Key Facilities" because these facilities do not meet the above criteria. The Non-Key Facilities comprise all or the majority of 30 of LANL's 48 TAs and approximately 14,224 ac of LANL's 26,480 ac (Table 1-1). The Non-Key Facilities also currently employ about 42% of the total LANL workforce. The Non-Key Facilities include such important buildings and operations as the Nicholas C. Metropolis Center for Modeling and Simulation, the Nonproliferation and International Security Center (NISC), the new National Security Sciences Building (NSSB) that is now the main administration building, and the TA-46 sewage treatment facility.

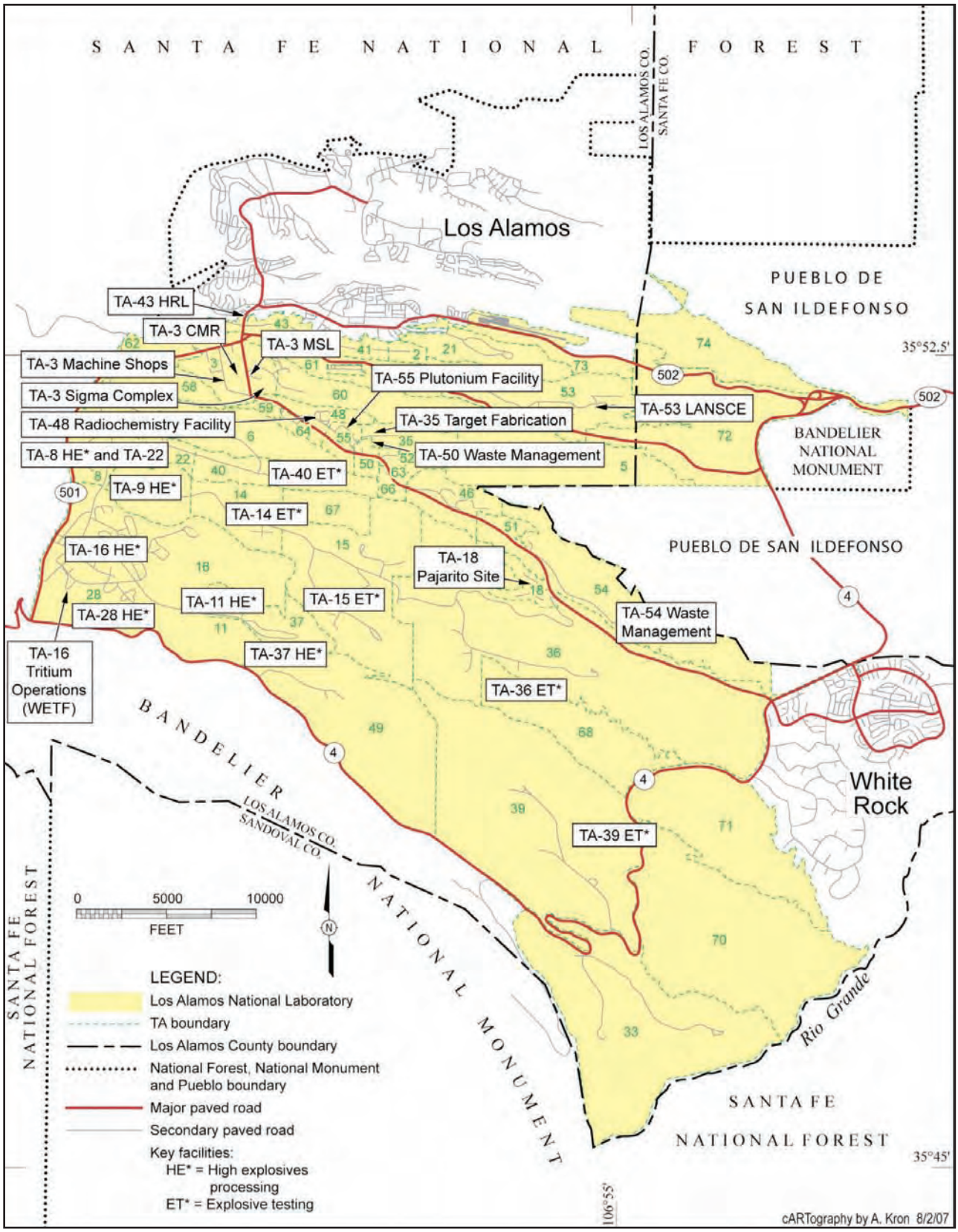

Figure 1-3. Technical Areas (TAs) and key facilities of Los Alamos National Laboratory in relation to surrounding landholdings.

Table 1-1
Key Facilities[a]

		Size (Acres)
Plutonium Complex	TA-55	93
Tritium Facilities	TA-16 & TA-21	312
Chemical and Metallurgy Research (CMR) Building	TA-03	14
Pajarito Site	TA-18	131
Sigma Complex	TA-03	11
Materials Science Laboratory (MSL)	TA-03	2
Target Fabrication Facility (TFF)	TA-35	3
Machine Shops	TA-03	8
High-Explosives Processing	TA-08, -09, -11, -16, -22, -28, -37	1,115
High-Explosives Testing	TA-14, -15, -36, -39, -40	8,691
Los Alamos Neutron Science Center (LANSCE)	TA-53	751
Biosciences Facilities (formerly Health Research Laboratory)	TA-43, -03, -16, -35, -46	4
Radiochemistry Facility	TA-48	116
Radioactive Liquid Waste Treatment Facility (RLWTF)	TA-50	62
Solid Radioactive and Chemical Waste Facilities	TA-50 & TA-54	943
Subtotal, Key Facilities		**12,256**
Non-Key Facilities	30 of 48 TAs	14,224
LANL Acreage		**26,480**

[a] Data from SWEIS Yearbook – 2003 (LANL 2004).

The operation of the 15 Key Facilities, together with functions conducted in other Non-Key Facilities, formed the basis of the description of LANL facilities and operations analyzed in the 1999 SWEIS for potential environmental impacts. For the purpose of the impact analysis provided by the new SWEIS, the identity of the LANL Key Facilities has been modified to reflect subsequent DOE decisions that resulted in changes to LANL facilities and operations. The Nicholas C. Metropolis Center for Modeling and Simulation (Metropolis Center) has been added as a Key Facility because of the amounts of electricity and water it may use. Security Category I and II materials and operations have been moved from the TA-18 Pajarito Site. Under either of the Action Alternatives evaluated in the new SWEIS, Security Category III and IV materials and operations would be removed from the Pajarito Site and it would be eliminated as a Key Facility. Under the No Action Alternative, the Pajarito Site would remain a Key Facility. Tritium operations at Technical Area 21 have ceased and both the Tritium Science Test Assembly Facility and Tritium Science and Fabrication Facility are planned for decontamination, decommissioning, and eventual demolition. When the ROD is issued in FY 2008, TA-21 will also no longer be a Key Facility.

D. MANAGEMENT OF ENVIRONMENT, SAFETY, AND HEALTH

Integrated Safety Management (ISM) provides the Laboratory with a comprehensive, systematic, standards-based performance-driven management system for setting, implementing, and sustaining safety performance and meeting environmental expectations. The term “integrated” is used to indicate that the safety and environmental management system is a normal and natural element of the performance of work. Safety, protection of the environment, and compliance with environmental, safety, and health (ES&H) laws and regulations are an integral part of how the Laboratory does business. ISM is the way that we meet the ethical

commitment to avoid injury to people and the environment and the business imperative to meet the safety and environmental requirements of the contract for managing and operating the Laboratory.

ISM is integral to accomplishing the Laboratory mission. The goal of ISM is to establish "safety" (used generically to encompass all aspects of environment, safety, and health) as a fundamental value for operating the Laboratory and that this value is reflected in the attitudes and behaviors of all workers. ISM is structured to manage and control work at the institutional, the facility, and the activity level. A seamless integration of ES&H with the work being done is fundamental. Inseparable from this concept is the important principle that line management is responsible for safety, with clear and unambiguous roles and lines of responsibility, authority, and accountability at all organizational levels and with full participation of the workforce. ISM requires that all work and all workers meet the safety and environmental requirements defined by the Laboratory requirements system.

1. Environmental Management Program

The Laboratory is committed to protecting the environment while conducting its important national security and energy-related missions. In support of this commitment, LANL has implemented a pollution-prevention-based EMS pursuant to DOE Order 450.1, Environmental Protection Program. An EMS is a systematic method for assessing mission activities, determining the environmental impacts of those activities, prioritizing improvements, and measuring results. DOE Order 450.1 defines an EMS as "a continuous cycle of planning, implementing, evaluating, and improving processes and actions undertaken to achieve environmental missions and goals." This DOE Order mandates that the EMS be integrated with an existing management system already established pursuant to DOE Policy 450.4. Although it significantly exceeds DOE Order 450.1 requirements, LANL pursued and achieved registration to the ISO 14001:2004 standard in April 2006.

The EMS program met several milestones in 2006. Implementing Procedures (IMP 401, 402, 403) governing communications, legal and other requirements, and environmental aspects were updated to reflect the new LANS management. These procedures defined EMS roles and responsibilities from the Laboratory Director to individual staff levels. In addition to these institutional policy changes, each Division Director was asked to sign an EMS charter for his/her Division that reiterated commitment to the process.

In 2006, the EMS process was executed by multi-disciplinary teams from each Division (all 31 LANL Divisions that existed until June 2006) and the security subcontractor (Protection Technologies Los Alamos [PTLA]). These organizations identified their activities, products, and services and their potential environmental aspects. They prioritized these aspects to determine which were significant and developed an Environmental Action Plan designed to prevent or eliminate the environmental risk associated with those aspects. The Division teams were aided by a trained support person from the EMS Core Team, whose members were trained in ISO 14001:2004 systems.

All 31 LANL Divisions and PTLA completed the Division Environmental Action Plans. Together, these plans commit to nearly 600 environmental improvement and pollution prevention actions beginning in FY 2006. The Laboratory also met the DOE Order 450.1 requirement to have an EMS implemented by December 31, 2005.

Registration to the ISO 14001:2004 standard requires extensive management review. External audits of the system have been conducted as follows:

- Kansas City Plant Pre-Audit, September 2004 (three auditors, three days)
- NSF-ISR (an independent third-party ISO 14001 registrar) Pre-Assessment, September 2005 (two auditors, three days)

- NSF-ISR Desk Audit, November 2005 (one auditor, two days)
- NSF-ISR Readiness Review, Phase 1 Audit, January 2006 (two auditors, three days)
- NSF-ISR Certification Audit, Phase 2 Audit, March 2006 (five auditors, five days)
- NSF-ISR Surveillance Audit 1, September 2006 (two auditors, three days)
- NSF-ISR Surveillance Audit 2, April 2007 (two auditors, three days)

These audits covered most of the Divisions and all major support contractors and included interviews conducted from the Director and Deputy Director level to individual staff and students chosen at random by the auditors. The auditors concluded that the LANL EMS meets all the requirements of the ISO 14001-2004 standard with no major nonconformities and recommended that LANL maintain full certification. On April 13, 2006, LANL received full certification of its EMS to the ISO 14001-2004 standard. LANL is the first NNSA national laboratory and the first University of California-operated facility to receive this distinction.

NNSA recognized the success of the EMS management and the core teams' unique approach by giving the Laboratory the 2006 NNSA "Best in Class" Award for EMS-developed projects. The Laboratory also received the DOE Pollution Prevention STAR Award for 2006.

A second important component of the EMS is the institutional environmental stewardship and management support programs. These programs, described below, assist with the integration of job and work-specific evaluations and ensure natural and cultural resources are managed from a Laboratory-wide perspective.

a. Waste Management Program. Research programs that support the Laboratory's mission generate contaminated waste that must be properly managed to avoid risks to human health, the environment, or national security. The Laboratory generates Resource Conservation and Recovery Act regulated waste, Toxic Substances Control Act regulated waste, low-level radioactive waste, mixed low-level waste, transuranic waste, wastewater, administratively controlled waste, medical waste, New Mexico Special Waste, and solid waste. Certain wastes are also treated and/or disposed of at the Laboratory.

The Laboratory's goal is to conduct waste management operations in a manner that minimizes hazardous and nonhazardous waste generation as much as is technically and economically feasible and maintains excellence in safety, compliance, environment, health, and waste management operations. This goal is accomplished through the following:

- Ensuring a safe and healthy workplace;
- Minimizing adverse impact to the general public;
- Minimizing adverse impact to the environment; and
- Ensuring compliance with all applicable laws, standards, and regulations governing environment, safety, and health.

b. Pollution Prevention Program. The Pollution Prevention (P2) Program implements waste minimization, pollution prevention, sustainable design, and conservation projects to enhance operational efficiency, reduce life-cycle costs, and reduce risk. Reducing waste directly contributes to the efficient performance of the Laboratory's national security, energy, and science missions. Specific P2 activities include the following:

- Collecting data and reporting on DOE P2 goals;
- Forecasting waste volume to identify P2 opportunities;

- Conducting P2 opportunity assessments for customer divisions;
- Funding specific waste reduction projects through the Generator Set-Aside Fund Program;
- Managing affirmative procurement efforts;
- Conducting an annual LANL P2 awards program to recognize achievements;
- Supporting sustainable design for the construction of new buildings; and
- Communicating P2 issues to the Laboratory community.

The Laboratory's P2 Program continues to be recognized for its accomplishments. The Laboratory received seven (up from five in FY 2005) national NNSA Pollution Prevention awards for Laboratory projects in FY 2006. Projects in FY 2006 yielded more than $5.2 million (up from more than $4 million in FY 2005) in savings to the Laboratory. The P2 Program was instrumental in incorporating preventive measures into the EMS, and the Laboratory received ISO 14001 certification. The pollution prevention efforts received an overall performance rating of "Good" for FY 2006. The projects collectively avoided the generation of more than 10,300 kg of hazardous waste, 680 kg of mixed low-level waste, 169 m3 of low-level waste, 55 m3 of transuranic waste, 170 m3 of industrial waste, 2200 kg of sand, and 1,500 gal. of storm water potentially contaminated with high explosives. Together the projects were responsible for the recycling of 40,000 gal. of oil, more than 1,000,000 lbs of scrap metal, 100 tons of concrete, 25,000 m3 of soil, and hundreds of m3 of furniture and equipment for reuse.

c. Environmental Restoration Programs. In mid-2006, the environmental programs were reorganized into several projects that have responsibility for different aspects of environmental restoration. The goal of these projects is to ensure that residual materials and contaminants from past Laboratory operations do not threaten human or environmental health and safety. To achieve this goal, the Laboratory is investigating and, as necessary, remediating sites contaminated by past Laboratory operations. Fieldwork at several sites was either implemented, ongoing, or completed in calendar year 2006. Much of the work under these projects is subject to the requirements in the Compliance Order on Consent (Chapter 2, Section B.1). Chapter 9 summarizes the cleanup work conducted or completed in calendar year 2006.

d. Compliance and Surveillance Programs. The Laboratory routinely collects samples of air particles and gases, water, soil, sediment, foodstuffs, and associated biota. For 2006, the Laboratory requested more than 617,000 analyses for chemical and radiochemical constituents on over 11,700 environmental samples from at least 1,888 sampling locations (Table 1-2). By far, the largest number of samples was collected to characterize or assess sites being investigated or cleaned up as part of environmental restoration efforts. The remainder of the analyses helps identify whether impacts occurred from LANL operations or whether emissions and releases are within limits. Trained personnel collect additional samples to obtain information about particular events, such as major surface-water runoff events, non-routine radiation releases, or special studies.

i. Air Resources. The Laboratory maintains a rigorous air quality compliance program for the emissions of both radionuclide and nonradionuclide air pollutants. The Laboratory operates under a number of air emissions permits issued by the New Mexico Environment Department (NMED) and approvals for construction of new facilities/operations by the US Environmental Protection Agency (EPA). These permits and approvals require pollution control devices, stack emissions monitoring, and routine reporting. This report describes these permits and reports; they are also available online at http://www.lanl.gov/environment/air/index.shtml. Proposals for new Laboratory operations and facilities are reviewed to determine the requirements for permitting, monitoring, and reporting of air emissions.

In addition to the compliance program, the Laboratory operates an extensive network of ambient air quality monitoring stations and direct penetrating radiation monitoring stations. The network includes station

Table 1-2
Approximate Numbers of Environmental Samples, Locations, and Analytes collected in 2006

Sample Type or Media	Locations	Samples	Analytes or Measurements
Ambient Air[a]	55	2,618	8,104
Stack Monitoring	29	3,173	26,485
Ground Water	195	567	105,784
Surface Water Base Flow	31	42	12,738
Surface Water Snowmelt	0	0	0
Surface Water Storm Runoff	163	969	31,048
NPDES Outfalls	17	82	1815
Sediment	61	61	5,416
Soil, Foodstuffs, and Biota	87	378	7,565
Neutron Radiation	50	200	200
Gamma Radiation	92	361	361
Environmental Restoration	1,108	3,332	418,250
Totals:	**1,888**	**11,783**	**617,766**

[a] Does not include particulate (in air) measurements made by six Tapered Element Oscillating Microbalance instruments that calculated particulate concentrations every half hour.

locations on site, in adjacent communities, and in regional locations. These stations are operated to ensure that air quality and ambient radiation doses meet EPA and DOE standards. These data are published in this report (Chapter 4) and online at http://www.lanl.gov/environment/air/index.shtml.

The Laboratory also works with and assists neighboring communities and pueblos in performing ambient air, direct penetrating radiation, and meteorological monitoring.

ii. Water Resources. The LANL Water Stewardship Program manages and protects groundwater and surface water resources (Chapters 5 and 6). The Laboratory conducts several activities to comply with the requirements of DOE Orders, NM and federal regulations, and the Consent Order.

Groundwater resource management and protection efforts at the Laboratory focus on (1) the regional aquifer underlying the plateau, (2) the perched groundwater found within canyon alluvium, and (3) the perched groundwater at intermediate depths above the regional aquifer. The objectives of the Laboratory's groundwater programs are to determine compliance with waste-discharge requirements and to evaluate any impact from Laboratory activities on groundwater resources. This program includes environmental monitoring, resource management, aquifer protection, and hydrogeologic investigations.

To evaluate the potential environmental effects of Laboratory operations, LANL's surface water protection efforts focus on monitoring surface water and stream sediment in northern NM. The objectives of the surface water program are to address water pollution control compliance, environmental surveillance, watershed management, surface and ground water protection, drinking water quality protection, pesticide protection obligations, and public assurance needs. The Laboratory analyzes samples for parameters such as radionuclides, high explosives, metals, a wide range of organic compounds, and general chemistry.

iii. Biological Resources. The LANL biological resources program focuses on assisting Laboratory projects and programs to comply with federal and state laws and regulations, DOE Orders, and LANL directives related to biological resources. DOE/NNSA and LANL administrators determined that management of natural resources strongly benefits the Laboratory (DOE 1996). The Mitigation Action Plan for the SWEIS for Continued Operation of Los Alamos National Laboratory (DOE 1999) formalized this effort by requiring

LANL to mitigate the danger of wildfire and develop a comprehensive plan for integrated natural resources management.

The current approach to managing biological resources at LANL includes developing an institutional Biological Resources Management Plan (LANL 2006). The plan is being developed to integrate short- and long-term mission activities and compliant and effective management of LANL's biological resources. The plan addresses the following elements: site planning, landscape management (including protection of wetlands and floodplains, and integration of forest fuels treatments into other biological resource protection objectives), species management (including federally threatened or endangered species and other sensitive species), and contaminants in biota.

LANL's Emergency Management and Response Division manages wildland fire, including fuels treatment on LANL property. One of the lasting results of past wildfires in and around LANL has been a significant increase in a regional, multi-agency approach to managing biological resources. Intensive forest management has been conducted under an institutional wildfire hazard reduction project that is implemented through the Wildfire Hazard Reduction Project Plan (LANL 2005b).

iv. Soil, Foodstuffs, and Non-foodstuffs Biota Resources. The Laboratory collects surface soil, foodstuffs, and non-foodstuffs biota from the Laboratory, perimeter communities (Los Alamos, White Rock, and surrounding pueblos), and regional (background) areas to determine whether there is an impact of Laboratory operations on human health via the food chain and the environment. The Laboratory conducts these programs to comply with the requirements of DOE Orders and New Mexico and federal regulations. Samples of the various media are collected on a three-year rotating basis and analyzed for radionuclides, heavy metals, and organic chemicals to determine concentrations and distribution in soil and potential uptake by plants, animals, and humans. Radiation doses to humans and biota (Chapter 3) and changes in concentrations over time are also measured and analyzed. These data are published in this report (Chapters 7 and 8) and other Laboratory publications.

v. Cultural Resources. The Laboratory manages the diverse cultural resources according to the requirements of the National Historic Preservation Act and the other federal laws and regulations concerned with cultural resources protection. Cultural resources include archaeological sites and associated artifacts, historic buildings and associated artifacts, and traditional cultural places of importance to Native American and other ethnic groups. The act's goal is for federal agencies to act as responsible stewards of our nation's resources when their actions potentially affect historic properties. Section 106 of the act requires federal agencies to take into account the effects their projects may have on historic properties and to allow review and comment by the State Historic Preservation Office and the Advisory Council on Historic Preservation. The Section 106 regulations outline a project review process that is conducted on a project-by-project basis.

The Laboratory has adopted a Cultural Resources Management Plan (LANL 2005c) as an institutional comprehensive plan that defines the responsibilities, requirements, and methods for managing its cultural properties. The plan provides an overview of the cultural resources program, establishes a set of procedures for effective compliance with applicable historic preservation laws, addresses land-use conflicts and opportunities, ensures public awareness of DOE's cultural heritage stewardship actions at LANL, and provides a 10-year road map that summarizes and prioritizes the steps necessary to manage these resources.

2. Organizations Implementing Environmental Management

Safety, environmental protection, and compliance with ES&H laws and regulations are underlying values of all Laboratory work. The Laboratory uses ISM to create a worker-based safety and environmental compliance culture in which all workers are committed to safety and environmental protection in their daily work.

Each Laboratory organization is responsible for its own environmental management and performance. Line management provides leadership and ensures ES&H performance is within the context of the Laboratory's values and mission. Laboratory managers establish and manage ES&H initiatives, determine and communicate expectations, allocate resources, assess performance, and are held accountable for safety performance.

During the first half of 2006, the Environmental Stewardship (ENV) Division developed and managed the Laboratory programs for environmental regulatory compliance. This work was conducted in five ENV Division groups: Meteorology and Air Quality (MAQ), Water Quality and Hydrology (WQH), Solid Waste Regulatory Compliance (SWRC), Ecology (ECO), and Environmental Characterization and Remediation (ECR). The Division was responsible for communicating environmental policies to Laboratory employees and made appropriate environmental training programs available. The ENV Division groups worked with line managers to prepare and review required environmental documentation. The five groups also initiated and managed Laboratory programs for environmental assessment and were responsible for executing environmental surveillance work under the auspices of the ENV Division's Environmental Protection Program.

In mid-2006, the Laboratory environmental programs were reorganized as part of the transition to LANS, LLC. Under the new organizational structure, environmental characterization, remediation, surveillance, and waste management programs are part of the Environmental Programs (EP) Directorate. Environmental permitting is managed within the Environmental Protection Division in the Environment, Safety, Health, and Quality (ESHQ) Directorate. An organizational chart and description is available at http://www.lanl.gov/organization/.

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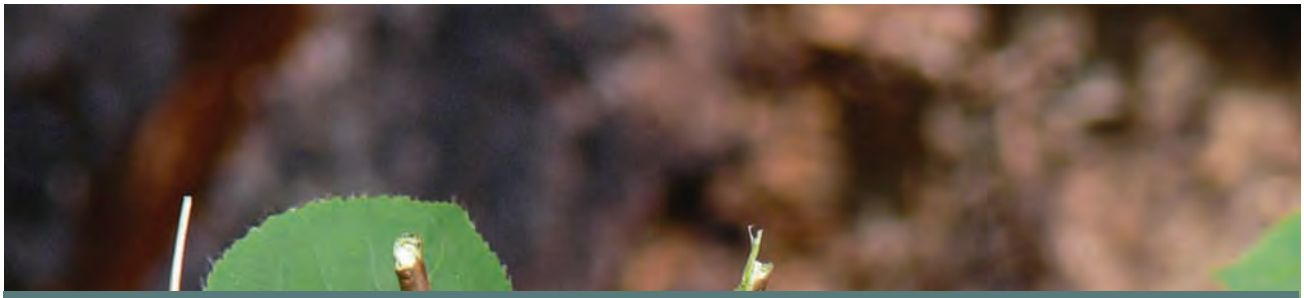

2. Compliance Summary

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A. INTRODUCTION

Many activities and operations at Los Alamos National Laboratory (LANL or the Laboratory) use or produce liquids, solids, and gases that may contain nonradioactive hazardous and/or radioactive materials. Laboratory policy implements US Department of Energy (DOE) requirements by directing employees to protect the environment and meet compliance requirements of applicable federal and state environmental regulations. Federal and state environmental laws address: (1) handling, transporting, releasing, and disposing of contaminants and wastes; (2) protecting ecological, archaeological, historic, atmospheric, soil, and water resources; and (3) conducting environmental impact analyses. Regulations provide specific requirements and standards to ensure maintenance of environmental quality. The US Environmental Protection Agency (EPA) and the New Mexico Environment Department (NMED) are the principal administrative authorities for these laws. DOE and its contractors are also subject to DOE-administered requirements for control of radionuclides. Table 2-1 presents the environmental permits or approvals the Laboratory operated under in 2006 and the specific operations and/or sites affected. Table 2-2 lists the various environmental inspections and audits conducted at the Laboratory during 2006. The following sections summarize the Laboratory's regulatory compliance performance during 2006.

B. COMPLIANCE STATUS

The Laboratory continues to meet requirements under the Clean Water Act. None of the 126 samples collected from the Sanitary Waste System Plant's outfall and only one (a residual chlorine measurement) of 949 samples collected from industrial outfalls exceeded Clean Water Act effluent limits. Compliance with National Pollutant Discharge Elimination System (NPDES) requirements at permitted construction sites improved in 2006 to 94% overall (from 93% in 2005). The Laboratory was well below all Clean Air Act permit limits for emissions to the air.

The Laboratory continued to conduct corrective actions in accordance with the March 2005 Compliance Order on Consent (Consent Order). The NMED issued three Notices of Violation (NOVs) to LANL and DOE pursuant to the Consent Order that alleged improper disposal of cleanup debris, failure to report a release of a groundwater contaminant, and improper storage of building debris. All of the Laboratory deliverables (plans and reports) required by the Consent Order were submitted on time to NMED, though one was later deemed substantially incomplete.

Table 2-1
Environmental Permits or Approvals under which the Laboratory Operated during 2006

Category	Approved Activity	Issue Date	Expiration Date	Administering Agency
RCRA[a] Hazardous Waste Facility	Hazardous Waste Facility Permit and Mixed-Waste Storage and Treatment Permit	November 1989	November 1999**	NMED[b]
	TA-3, Building 29 Chemistry and Metallurgy Research Building Part B Permit Renewal Application, Revision 0.0	Submitted January 1999	—	NMED
	TA-50 Part B Permit Renewal Application Revision 3.0	Submitted August 2002	—	NMED
	General Part B Permit Renewal Application, Revision 2.0	Submitted August 2003	—	NMED
	TA-54 Part B Permit Renewal Application, Revision 3.0	Submitted June 2003	—	NMED
	TA-16 Part B Permit Renewal Application, Revision 4.0	Submitted June 2003	—	NMED
	TA-55 Part B Permit Application, Revision 2.0	Submitted September 2003	—	NMED
	General Part A Permit Application, Revision 5.0	Submitted April 2006	—	NMED
HSWA[c]	RCRA corrective activities	March 1990	December 1999**	NMED
Consent Order	Legacy and contaminated waste site investigations, corrective actions, and monitoring.	March 1, 2005	September 20, 2015	NMED
CWA[d]/NPDES[e]	Outfall permit for the discharge of industrial and sanitary liquid effluents	February 1, 2001	January 31, 2005**	EPA[f]
	MSGP[g] for the discharge of stormwater from industrial activities	October 30, 2000	October 30, 2005**	EPA
	Federal Facility Compliance Agreement for storm water discharges from Solid Waste Management Units (SWMUs)	February 5, 2005	—	EPA
	Construction General Permits (19) for the discharge of stormwater from construction activities	varies	July 1, 2008*	EPA

Table 2-1 (continued)

Category	Approved Activity	Issue Date	Expiration Date	Administering Agency
CWA Sections 404/401	COE[h] Nationwide Permits (3)	varies	varies	COE/NMED
Groundwater Discharge Plan, TA-46 SWWS Plant[i]	Discharge to groundwater	January 7, 1998	January 7, 2003**	NMED
Groundwater Discharge Plan, TA-50, Radioactive Liquid-Waste Treatment Facility	Discharge to groundwater	Submitted August 20, 1996	Approval pending	NMED
Groundwater Discharge Plan, Domestic Septic Systems	Discharge to groundwater	Submitted April 27, 2006	Approval pending	NMED
Air Quality Operating Permit (20.2.70 NMAC[j])	LANL air emissions Operating Permit Modification 1	April 30, 2004 June 15, 2006	April 29, 2009	NMED
Air Quality (20.2.72 NMAC)	Portable rock crusher Retired and removed from operating permit Permit number will remain active to track exempt sources at LANL	June 16, 1999 June 15, 2006	None	NMED
	TA-3 Power Plant Permit revision Permit modification	September 27, 2000 November 26, 2003 July 30, 2004	None	NMED
	Generator at TA-33	October 10, 2002	None	NMED
	Asphalt Plant at TA-60	October 29, 2002	None	NMED
	Data disintegrator	October 22, 2003	None	NMED
	Chemistry and Metallurgy Research Replacement (CMRR)	September 16, 2005	None	NMED
	Radiological Laboratory, Utility, Office Building		None	NMED
	TA-11 Fuel/wood fire testing	March 29, 2005	Canceled January 12, 2006	NMED
	TA-16 flash pad TA-36 sled track	March 29, 2005	Canceled January 12, 2006	NMED
Air Quality (NESHAP[k])	Beryllium machining at TA-3-141	October 30, 1998	None	NMED
	Beryllium machining at TA-35-213	December 26, 1985	None	NMED
	Beryllium machining at TA-55-4	February 11, 2000	None	NMED
	Radiological air emissions at CMRR	July 14, 2005	None	EPA
	Radiological Laboratory, Utility, Office Building		None	EPA

Table 2-1 (continued)

Category	Approved Activity	Issue Date	Expiration Date	Administering Agency
Open Burning	TA-11 Fuel/wood fire testing	December 27, 2002	Canceled March 6, 2006	NMED
	TA-14 Burn cage	December 27, 2002	Canceled March 6, 2006	NMED
	TA-16 Flash pad	December 27, 2002	Canceled March 6, 2006	NMED
	TA-36 Sled track and open burn area	December 27, 2002	Canceled March 6, 2006	NMED

[a] Resource Conservation and Recovery Act
[b] New Mexico Environment Department
[c] Hazardous and Solid Waste Amendments
[d] Clean Water Act
[e] National Pollutant Discharge Elimination System
[f] Environmental Protection Agency
[g] Multi-Sector General Permit
[h] US Army Corps of Engineers
[i] Sanitary Wastewater Systems Plant
[j] New Mexico Administrative Code
[k] National Emission Standards for Hazardous Air Pollutants

*Construction General Permit (CGP) expiration date
**Permit was administratively continued for all of 2006

Table 2-2
Environmental Inspections and Audits Conducted at the Laboratory during 2006

Date	Purpose	Performing Agency
4/03/06–4/12/06	Hazardous waste compliance inspection (closeout 5/9/2006)	NMED[a]
7/14/2006	PCB[b] inspection for compliance with TSCA[c] requirements	EPA[d] Region 6
10/18/2006	CGP[e] compliance inspection, TA-3 Security Perimeter Project	NMED
10/19/2006	CGP compliance inspection, TA-55 CMRR Project	NMED
2/03/06	Asbestos management inspection of building TA-59-1, response to complaint regarding respiratory protection	NMED
2/08/06	Asbestos management inspection of building TA-16-193, Standard project inspection	NMED
2/08/06	Asbestos management inspection of multiple buildings at TA-3. Standard project inspection	NMED
9/16/06	Asbestos management inspection of roofing job at TA-53 sector J, G, & F. Standard project inspection	NMED
9/18/06	Title V Operating Permit compliance inspection	NMED
10/25/06	Asbestos management inspection of ash pile at Los Alamos Airport	NMED

(No Federal Insecticide, Fungicide, and Rodenticide Act; Section 401/404; or Groundwater Discharge Plan inspections were conducted in 2006.)

[a] New Mexico Environment Department

[b] Polychlorinated biphenyls

[c] Toxic Substances Control Act

[d] Environmental Protection Agency

[e] Construction General Permit

1. Resource Conservation and Recovery Act

a. Introduction. The Laboratory produces a variety of hazardous wastes, mostly in small quantities relative to industrial facilities of comparable size. RCRA, as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, establishes a comprehensive program to regulate hazardous wastes from generation to ultimate disposal. The EPA has authorized the State of New Mexico to implement the requirements of the program, which it does through the New Mexico Hazardous Waste Act and state regulations found in the New Mexico Administrative Code (NMAC) Title 20, Chapter 4, Part 1, as revised October 1, 2003 (20.4.1 NMAC). Federal and state laws regulate management of hazardous wastes based on a combination of the facility's status; large- or small-quantity generation; and the types of treatment, storage, and disposal conducted by the facility.

Certain operations may require an operating permit, called a hazardous waste facility permit, or a RCRA permit. The LANL hazardous waste facility permit expired in 1999 but was administratively continued beyond the expiration date as allowed by the permit and by 20.4.1.900 NMAC. In anticipation of the permit's expiration, and by agreement with NMED, the Laboratory submitted preliminary permit renewal applications for NMED review starting in 1996. The permit renewal applications are pending and have been revised as needed.

b. RCRA Permitting Activities. The Laboratory submitted proposed modifications to the LANL hazardous waste facility permit in 2006. These included Class I permit modifications for minor revisions to the facility inspection plan (February), the contingency plan (April, May, and December), Module III, Attachment F and Attachment G (October), and to identify LANS as the new co-operator of LANL (April). Additional

permit-related activities included the May submittal to NMED of the LANL RCRA Permit Application Unit Assessment. This assessment was conducted at the request of the NMED to clarify the history of waste management units at the Laboratory. The assessment provided a listing of all hazardous waste management units at LANL, a brief history of each unit, and their current status (active, closed, withdrawn, etc.).

New closure plans for the waste management units at Technical Areas (TAs) 16, 50, 54, and 55 were also submitted as part of the permit renewal process in September. NMED issued final approval of the closure of TA-55-PF4-B38 in January 2006. Closure certification reports were completed and submitted for the Area L 36 and 37 lead stringer shafts (September) and the TA-54 Area L treatment tanks (December).

c. Other RCRA Activities. The compliance assurance program performed Laboratory self-assessments to determine whether hazardous and mixed waste is managed to meet the requirements of federal and state regulations, DOE orders, and Laboratory policy. The program communicated findings from these self-assessments to waste generators, waste-management coordinators, and waste managers who help line managers implement appropriate actions to ensure continual improvement in LANL's hazardous waste program. In 2006, the Laboratory completed 1,453 self-assessments with a nonconformance rate of 3.02%.

d. RCRA Compliance Inspection. From April 3, 2006 to April 12, 2006, NMED conducted a hazardous waste compliance inspection at the Laboratory (see Table 2-2). The Laboratory received no further communications in 2006 regarding this inspection.

e. Site Treatment Plan. In October 1995, the State of New Mexico issued a Federal Facility Compliance Order to the DOE and the University of California (UC), requiring compliance with the Site Treatment Plan. On June 1, 2006, LANS replaced UC as the operating contractor at LANL at which time LANS assumed responsibility for compliance with the order. The plan documents the use of off-site facilities for treating and disposing of mixed waste generated at LANL and stored for more than one year. The Laboratory met all 2006 Site Treatment Plan deadlines and milestones by treating and disposing of more than 1.2 m^3 of Site Treatment Plan low-level mixed waste.

f. Solid Waste Disposal. LANL sends sanitary solid waste (trash) and construction and demolition debris for disposal to the Los Alamos County landfill on East Jemez Road. The DOE owns the property and leases it to Los Alamos County under a special-use permit. Los Alamos County operates this landfill and is responsible for obtaining all related permits for this activity from the state. The landfill is registered with the NMED Solid Waste Bureau. Laboratory trash placed in the landfill in 2006 included 1954 metric tons of trash and 170 metric tons of construction and demolition debris. Through LANL recycling efforts, 2532 metric tons of material did not go to the landfill in 2006.

g. Compliance Order on Consent (Consent Order). The Consent Order requires LANL-wide investigation and cleanup of SWMUs and areas of concern (AOC) pursuant to stipulated procedures and schedules. (Schedules in the Consent Order may be adjusted to account for delays in NMED approvals, or to accommodate requests from DOE or its authorized contractor for time extensions.) The Consent Order applies to SWMUs and AOCs subject to RCRA and HSWA requirements. Radionuclides are regulated by DOE under the Atomic Energy Act. To avoid duplication of completed work, the Consent Order does not apply to those SWMUs and AOCs that received "no further action" decisions from EPA when it had primary regulatory authority. Following the investigation phase for subject SWMUs or AOCs, and upon NMED determination that corrective measures are needed, a corrective measure evaluation report must be prepared. After NMED authorizes a remedy, the corrective measure is implemented. After completing the remedy, a remedy completion report must be prepared and submitted to NMED for approval.

Details of the history and status of SWMUs and AOCs listed in the Consent Order may be found in the Site-Wide Environmental Impact Statement (SWEIS) for LANL and a description of the work done in 2006 may be found in Chapter 9 of this report.

All of the Laboratory deliverables (plans and reports) required by the Consent Order were submitted on time to NMED (see Tables 9-1 and 9-2 in Chapter 9 of this report). The MDA C Investigation Report, although submitted on time, was deemed substantially incomplete and the NMED assessed stipulated penalties against LANL in early 2007.

In July 2006, the NMED Hazardous Waste Bureau issued a Notice of Violation (NOV) to DOE and LANS alleging that disposal of debris from SWMU 73-002 in the Los Alamos County landfill violated the approved workplan, and, therefore, was a violation of the Consent Order. NMED proposed to assess a penalty of $88,930. After the parties met, DOE and LANS agreed to pay a penalty of $50,930 to resolve the matter.

In September 2006, NMED issued a second NOV to DOE and LANS alleging a failure to report the release of a groundwater contaminant (chromium) in accordance with the Consent Order. NMED proposed to assess a penalty of $795,620. The parties negotiated a resolution to the NOV and, without admitting the allegations, DOE and LANS agreed to pay a penalty of $251,870.

In October 2006, NMED issued a third NOV to DOE and LANS alleging three counts of improper storage of building debris that contained a small volume of listed waste. NMED proposed to assess a penalty of $402,600. After the parties met, DOE and LANS, without admitting any of the allegations, agreed to pay a penalty of $119,845 to resolve the matter.

2. Comprehensive Environmental Response, Compensation, and Liability Act

No lands were transferred from DOE to other agencies in 2006 under the Land Conveyance and Transfer Project. Environmental Baseline Survey Reports were initiated for tracts A-8-a and A-11 in anticipation of scheduled transfers in 2007. These reports contain the Comprehensive Environmental Response, Compensation, and Liability Act 120(h) information required to transfer these properties to private or municipal ownership and indicate that "no hazardous substances exist on these sites," that "all remedial action necessary to protect human health and the environment has been taken," or that certain restrictions on use are required.

3. Emergency Planning and Community Right-to-Know Act

a. Introduction. The Laboratory is required to comply with the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 and Executive Order 13148, *Greening the Government Through Leadership in Environmental Management*. Executive Order 13148 was superseded in January 2007 by Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*.

b. Compliance Activities. For 2006, the Laboratory submitted two annual reports to fulfill its requirements under EPCRA, as shown in Table 2-3 and described below.

Emergency Planning Notification. Title III, Sections 302–303, of EPCRA require the preparation of emergency plans for more than 360 extremely hazardous substances if stored in amounts above threshold limits. The Laboratory is required to notify state and local emergency planning committees (1) of any changes at the Laboratory that might affect the local emergency plan or (2) if the Laboratory's emergency planning coordinator changes. No updates to this notification were made in 2006.

Table 2-3
Compliance with Emergency Planning and Community Right-to-Know Act during 2006

Statute	Brief Description	Compliance
EPCRA Sections 302–303 Planning Notification	Requires emergency planning notification to state and local emergency planning committees.	No changes to the notification have been made since the July 30, 1999 notification and an update in 2000.
EPCRA Section 304 Release Notification	Requires reporting of releases of certain hazardous substances over specified thresholds to state and local emergency planning committees and to the National Response Center.	LANL submitted a Release Notification on August 31, 2006 for a leaking pressure vessel of anhydrous ammonia. There were no other leaks, spills, or other releases of chemicals into the environment that required EPCRA Section 304 reporting during 2006.
EPCRA Sections 311--312 Material Safety Data Sheets and Chemical Inventories	Requires facilities to provide appropriate emergency response personnel with an annual inventory and other specific information for any hazardous materials present at the facility over specified thresholds.	The presence of 36 hazardous materials stored at LANL over specified quantities in 2006 required submittal of a hazardous chemical inventory to the state emergency response commission and the Los Alamos County Fire and Police Department.
EPCRA Section 313 Annual Toxic Release Inventory	Requires all federal facilities to report total annual releases of listed toxic chemicals used in quantities above reportable thresholds.	Use of lead exceeded the reporting thresholds in 2006, requiring submittal of Toxic Chemical Release Inventory Reporting Forms (Form Rs) to the EPA and the state emergency response commission.

Emergency Release Notification. Title III, Section 304, of EPCRA requires facilities to provide emergency release notification of leaks, spills, and other releases of listed chemicals into the environment, if these chemicals exceed specified reporting quantities. Releases must be reported immediately to the state and local emergency planning committees and to the National Response Center. On August 31, 2006, the Laboratory submitted a release notification for a leaking pressure vessel of anhydrous ammonia. The exact quantity of ammonia that leaked from the vessel is unknown. However, the capacity of the vessel was up to 150 lb and therefore, the Laboratory assumed that the reportable quantity of 100 lb for ammonia was exceeded. There were no other leaks, spills, or other releases of chemicals into the environment that required EPCRA Section 304 reporting during 2006.

Material Safety Data Sheet/Chemical Inventory Reporting. Title III, Sections 311–312, of EPCRA require facilities to provide an annual inventory of the quantity and location of hazardous chemicals above specified thresholds present at the facility. The inventory includes hazard information and storage location for each chemical. The Laboratory submitted a report to the state emergency-response commission and the Los Alamos County fire and police departments listing 36 chemicals and explosives at the Laboratory stored on-site in quantities that exceeded reporting threshold limits during 2006.

Toxic Release Inventory Reporting. Executive Order 13148 requires all federal facilities to comply with Title III, Section 313, of the EPCRA. This section requires reporting of total annual releases to the environment of listed toxic chemicals that exceed activity thresholds. Beginning with reporting year 2000, new and lower chemical-activity thresholds were put in place for certain persistent, bioaccumulative, and toxic chemicals and chemical categories. The thresholds for these chemicals range from 0.1 g to 100 lb. Until this change went into effect, the lowest threshold was 10,000 lb. LANL exceeded one threshold in 2006 and therefore was required to report the uses and releases of this chemical. The reported material was lead. The largest use of reportable lead is at the on-site firing range where security personnel conduct firearms training. Table 2-4 summarizes the reported releases for lead in 2006.

Table 2-4
Summary of 2006 Reported Releases under EPCRA Section 313

	Lead (lb)
Air Emissions	10.6
Water Discharges	2
On-Site Land Disposal	8,878
Off-Site Waste Transfers	2,178

4. Toxic Substances Control Act

Because the Laboratory's activities are research and development (R&D) rather than the manufacture of commercial chemicals, the Laboratory's main concern under the Toxic Substances Control Act (TSCA) is the regulations covering polychlorinated biphenyls (PCBs) and import/export of R&D chemical substances. The PCB regulations govern substances including, but not limited to, dielectric fluids, contaminated solvents, oils, waste oils, heat-transfer fluids, hydraulic fluids, slurries, soil, and materials contaminated by spills.

During 2006, the Laboratory shipped 58 containers of PCB waste off site for disposal or recycling. The quantities of waste disposed of included 105 lb (48 kg) of capacitors and 2,661 lb (1207 kg) of fluorescent light ballasts. The Laboratory manages all wastes in accordance with 40 Code of Federal Regulations (CFR) 761 manifesting, record keeping, and disposal requirements. PCB wastes go to EPA-permitted disposal and treatment facilities. Light ballasts go off-site for recycling. The primary compliance document related to 40 CFR 761.180 is the annual PCB report that the Laboratory submits to EPA Region 6.

The renewal request for the Area G PCB disposal authorization was withdrawn in 2006. During 2006, EPA performed one PCB site inspection, and approximately 34 TSCA reviews were conducted on imports and exports of chemical substances for the Laboratory's Property Management Group Customs Office.

5. Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act regulates the manufacturing of pesticides and the protection of workers who use these chemicals. Sections of this act that apply to the Laboratory include requirements for certification of workers who apply pesticides. The New Mexico Department of Agriculture has the primary responsibility to enforce pesticide use under the act. The New Mexico Pesticide Control Act applies to the Laboratory's licensing and certification of pesticide workers, record keeping, application of pesticides, inspection of equipment, and the storage and disposal of pesticides.

The New Mexico Department of Agriculture did not conduct assessments or inspections of the Laboratory's pesticide application program in 2006. The Laboratory conducted four quarterly inspections of the pesticide storage area in 2006 and found that the storage area was maintained in accordance with RCRA regulations.

Table 2-5 shows the amounts of pesticides the Laboratory used during 2006.

6. Clean Air Act

Pursuant to the federal Clean Air Act (CAA) Amendments and Title 20 of NMAC, Chapter 2, Part 70, Operating Permits (20.2.70 NMAC), LANS is authorized to operate applicable air emission sources at LANL per the terms and conditions as defined in Operating Permit No. P100-M1. The operating permit conditions mirror existing source-specific permit conditions applicable to operating requirements, record keeping,

Table 2-5
Herbicides and Pesticides used at LANL in 2006

Herbicides		Insecticides	
VELPAR L (Liquid)	177 gal	TEMPO 20 WP	23.4 oz
Roundup Pro	115 oz	MAXFOURCE ANT BAIT	6.5 oz
		TALSTAR F	11 oz
		WASP FREEZE	37 oz
		BAYGON 250 (Aerosol)	4 oz
		BAYGON 250 (Canister)	48 oz
		565 Plus XLO	22 oz
		ULD-BP-100 (Liquid)	10 oz

monitoring, and reporting. Compliance with the conditions of the Title V Operating Permit is deemed to be compliance with any applicable air requirements existing at the date of permit issuance.

As part of the Title V Operating Permit program, LANL reports emissions from sources included in the Operating Permit twice a year. These sources include multiple boilers, two steam plants, a data disintegrator, carpenter shops, three degreasers, and asphalt production. LANL also reports emissions from chemical use associated with R&D and permitted beryllium activities.

According to reporting requirements in the Title V Operating Permit's terms and conditions, the Laboratory must submit an Annual Compliance Certification report to NMED. In the 2006 Compliance Certification report, a permit deviation for the TA-60 Asphalt Plant was reported. On May 1, 2006, smoke opacity of 24% was observed at the Asphalt Plant. This is slightly above the opacity limit of 20% stated in the permit. An excess emissions report was submitted to NMED identifying the details of this deviation. LANL demonstrated full compliance with all other permit applicable terms and conditions and met all reporting requirement deadlines.

In 2006, LANL received a modification to Operating Permit No P100. This permit modification, P100-M1, was issued on June 15, 2006. The modification incorporated permit conditions from the combustion turbine New Source Review (NSR) Permit 2195B-M1, incorporated permit conditions from the data disintegrator NSR Permit 2195H, and removed the rock crusher from the Title V permit.

According to the terms and conditions of NSR air quality permit 2195B-M1, LANL started construction of a low emission combustion turbine, which will supply power to various buildings in the TA-3 area in the event of commercial power loss. The combustion turbine is expected to start operation in 2007.

Under the Title V Operating Permit program, LANL is a major source, based on the potential to emit nitrogen oxides (NO_X), carbon monoxide (CO), and volatile organic compounds (VOCs). In 2006, the TA-3 steam plant and boilers located across the Laboratory were the major contributors of NO_X, CO, and particulate matter (PM). R&D activities were responsible for most of the VOC and hazardous air pollutant emissions. Table 2-6 summarizes these data.

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LANL staff calculates air emissions using emission factors from source tests, manufacturer's data, and EPA documentation. Calculated emissions are based on actual production rates, fuel usage, and/or material throughput. To satisfy requirements set forth in Title 20 of NMAC, Chapter 2, Part 73, Notice of Intent and

Table 2-6
Calculated Actual Emissions for Regulated Pollutants Reported to NMED for Operating Permit Compliance

	Pollutants, tons					
Emission Units[a]	**NO_x**	**SO_x**	**PM**	**CO**	**VOC**	**HAPs**
Asphalt Plant	0.03	0.005	0.01	0.4	0.008	0.008
TA-21 Steam Plant	1.5	0.02	0.1	1.3	0.08	0.03
TA-3 Steam Plant	17.8	0.3	2.3	12.3	1.7	0.6
Regulated Boilers	5.1	0.03	0.5	3.6	0.3	0.1
R&D Chemical Use	NA	NA	NA	NA	10.1	4.8
Degreaser	NA	NA	NA	NA	0.02	0.02
Data Disintegrator	NA	NA	0.4	NA	NA	NA
Carpenter Shops	NA	NA	1.1	NA	NA	NA
Storage Tanks	NA	NA	NA	NA	0.007	NA
Stationary Standby Generators[b]	18.4	4.1	0.9	4.1	0.9	0.005
Miscellaneous Small Boilers	19.2	0.1	1.5	16.1	1.1	0.4
TA-33 Generator	0.09	0.01	0.003	0.07	0.002	< 0.001
TOTAL	**62.1**	**4.6**	**6.8**	**37.9**	**14.3**	**6.0**

[a] NOx = nitrogen of oxygen. SOx = Sulfur dioxide. PM = particulate matter. CO = carbon monoxide. VOC = volatile organic compounds. HAPs = hazardous air pollutants.

[b] Emissions from these source categories were reported for the first time in 2004, as required by the Title V Operating Permit. Emissions units in these categories are exempt from construction permitting and annual emission inventory reporting requirements and are not included in Figure 2-1.

Emissions Inventory Requirements (20.2.73 NMAC) and the Title V Operating Permit, LANL submits an annual Emissions Inventory Report and semi-annual Emissions Report, respectively, to NMED. Figure 2-1 depicts a five-year history of criteria pollutant emissions. Emissions for 2005 and 2006 are very similar and remain relatively constant following a sharp emissions decline in 2004.

a. New Mexico Air Quality Control Act.

i. Permits. LANL reviews plans for new and modified projects, activities, and operations to identify all applicable air quality requirements including the need to revise the operating permit application, to apply for construction permits, or to submit notifications to NMED. During 2006, the Laboratory performed approximately 190 air quality reviews and submitted an NSR air quality permit for three generators to be used at TA-33. A technical revision was also requested and received for a change in the type of furnace used in TA-55 beryllium operations. Also, as mentioned in Section 6, Clean Air Act, above, LANL received a modification to the LANL Operating Permit. LANL submitted 10 exemption notifications to NMED. The exemptions were primarily for small boilers, small generators, and storage tanks. LANL currently operates under the air permits listed in Table 2-1.

ii. Open Burning. LANL only performed open burns during the first two months of 2006. The burns were performed under both 20.2.60 and 20.2.72 NMAC regulations. LANL had four open burning permits (20.2.60 NMAC) for operational burns conducted to thermally treat or dispose of high explosives or material contaminated with high explosives and to test accident scenarios involving fire. All operational burns in 2006 were conducted within the terms specified in the permits. To document compliance with permit requirements, the Laboratory reports the results of these operations to NMED.

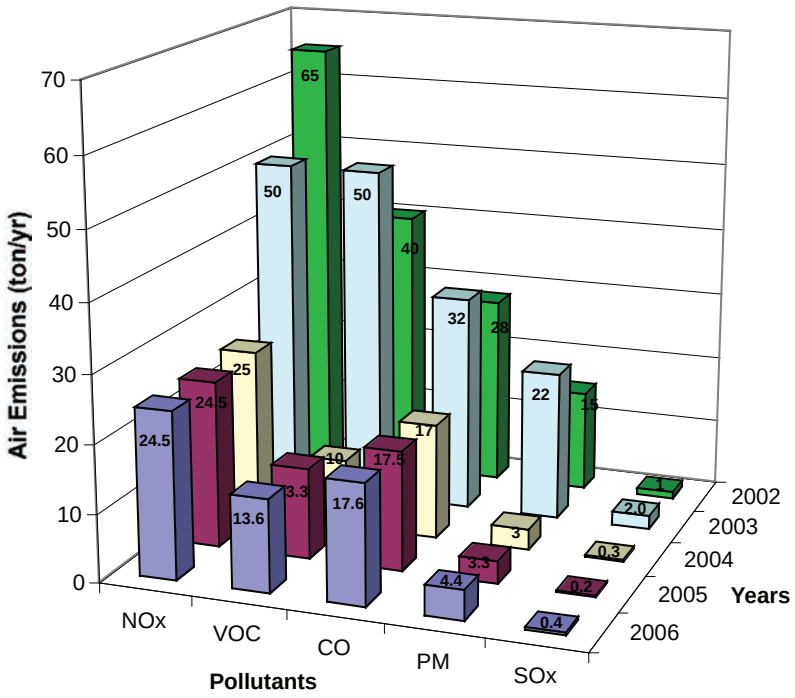

Figure 2-1. LANL Criteria Pollutant Emissions from 2002 to 2006 for Emissions Inventory Reporting.

In 2006, LANL requested the cancellation of the four open burn permits mentioned above. The DOE is developing a strategic plan for missions at its national laboratory complex. In view of these events, and as part of its transition in operations contractor, the Laboratory undertook a review of the testing and activities anticipated at the sites covered by the permits. The Laboratory completed this review and determined that, for the foreseeable future, it no longer needed to perform the types of testing and activities authorized by the permits. The cancellation of the permits was effective on March 6, 2006.

iii. Asbestos. The National Emission Standard for Hazardous Air Pollutants (NESHAP) for Asbestos requires that LANL provide advance notice to NMED for large renovation jobs that involve asbestos and for all demolition projects. The asbestos NESHAP further requires that all activities involving asbestos be conducted in a manner that mitigates visible airborne emissions and that all asbestos-containing wastes be packaged and disposed of properly.

LANL continued to perform renovation and demolition projects in accordance with the requirements of the asbestos NESHAP. Major activities in 2006 included 14 large renovation jobs and demolition projects of which NMED received advance notice. These projects, combined with other smaller activities, generated 1058.69 m^3 of asbestos waste. All asbestos wastes were properly packaged and disposed of at approved landfills.

To ensure compliance, the Laboratory conducted internal inspections of job sites and asbestos packaging approximately monthly. In addition, NMED conducted five inspections during the year and identified no violations.

b. Federal Clean Air Act.

i. Ozone-Depleting Substances. Title VI of the Clean Air Act contains specific sections that establish regulations and requirements for ozone-depleting substances (ODS), such as halons and refrigerants. The

main sections applicable to the Laboratory prohibit individuals from knowingly venting an ozone-depleting substance into the atmosphere during maintenance, repair, service, or disposal of halon fire-suppression systems and air-conditioning or refrigeration equipment. All technicians who work on refrigerant systems must be EPA-certified and must use certified recovery equipment. The Laboratory is required to maintain records on all work that involves refrigerants and the purchase, usage, and disposal of refrigerants. The Laboratory's standards for refrigeration work are covered under Criterion 408, "EPA Compliance for Refrigeration Equipment," of the Operations and Maintenance manual.

The Laboratory continued to work at eliminating the use of Class 1 ODS in order to meet DOE's goal to eliminate the use of these refrigerants by 2010. In 2006, the Laboratory removed a total of 33,962 pounds of Class 1 ODS from active inventory.

ii. Radionuclides. Under Rad-NESHAP, the EPA limits the effective dose equivalent of radioactive airborne releases from a DOE facility, such as LANL, to any member of the public to 10 mrem/yr. The 2006 dose to the maximally exposed individual (MEI) (as calculated using EPA-approved methods) was 0.47 mrem. The location of the highest dose was at the Los Alamos County Airport Terminal. Operations at TA-74 during the ash pile cleanup, now completed, contributed about half of this dose; the remainder came from Laboratory stack emissions.

7. Clean Water Act

a. NPDES Industrial Point Source Outfall Self-Monitoring Program. The primary goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The act established the requirements for NPDES permits for point-source effluent discharges to the nation's waters. The NPDES outfall permit establishes specific chemical, physical, and biological criteria that the Laboratory's effluent must meet before it is discharged.

From January 1 through May 31, 2006, UC and the DOE/National Nuclear Security Administration (NNSA) were co-permittees of the NPDES permit covering Laboratory operations. From June 1 through December 31, 2006, LANS and the DOE/ NNSA were co-permittees. EPA Region 6 in Dallas, Texas, issues and enforces the permit. NMED certifies the EPA-issued permit and performs some compliance-evaluation inspections and monitoring for the EPA. The Laboratory's current industrial point-source NPDES permit contains 21 permitted outfalls that include one sanitary outfall and 20 industrial outfalls. To view the Laboratory's NPDES permit, go online to http://www.lanl.gov/environment/h2o/cw_npdes.shtml.

The Laboratory's long-term objectives require that outfall owners continue evaluating outfalls for possible elimination and that new construction designs and modifications to existing facilities provide for reduced or no-flow effluent discharge systems. No NPDES outfalls were deleted in 2006; however, four outfalls were eliminated and not included in the Laboratory's NPDES Permit re-application submitted to EPA on July 30, 2004. The Laboratory's new NPDES point-source permit is anticipated to be issued in 2007 and will include one sanitary outfall and 16 industrial outfalls for a total of 17 permitted outfalls (Table 2-7).

The Laboratory's NPDES outfall permit requires weekly, monthly, and quarterly sampling to demonstrate compliance with effluent quality limits. The Laboratory also collects annual water-quality samples at all outfalls. The Laboratory reports analytical results to EPA and NMED at the end of the monitoring period for each respective outfall category. During 2006, none of the 113 samples collected from the Sanitary Wastewater Systems (SWWS) Plant's outfall exceeded effluent limits; however, one of the 733 samples collected from industrial outfalls exceeded effluent limits (see discussion below). Monitoring data obtained from sampling at NPDES permitted outfalls are in data supplement Table S2-1 (on included Compact Disk) and available online at http://wqdbworld.lanl.gov/.

Table 2-7
Volume of Effluent Discharge from NPDES Permitted Outfalls in 2006

Outfall Number	TA-bldg	Description	Watershed (Canyon)	2006 Discharge (gal.)
02A129	21-357	TA-21 Steam Plant	Los Alamos	21,945,000
03A047[a]	53-[b]	LANSCE Cooling Tower	Los Alamos	0
03A048	53-963/978	LANSCE Cooling Tower	Los Alamos	19,741,000
03A049[a]	53-[b]	LANSCE Cooling Tower	Los Alamos	0
03A158	21-209	TA-21 CoolingTower	Los Alamos	483,360
051	50-1	TA-50 Radioactive Liquid Waste Treatment Facility	Mortandad	1,633,000
03A021	3-29	CMR Building Air Washers	Mortandad	553,000
03A022	3-2238	Sigma Cooling Tower	Mortandad	1,498,330
03A160	35-124	National High Magnetic Field Laboratory Cooling Tower	Mortandad	31,536,000
03A181	55-6	Plutonium Facility Cooling Tower	Mortandad	2,759,860
13S	46-347	Sanitary Wastewater Treatment Plant	Sandia	103,246,000
001	3-22	Power Plant	Sandia	9,191,000
03A024[a]	3-187	Sigma Press Cooling Tower	Sandia	0
03A027	3-2327	Strategic Computing Complex Cooling Tower	Sandia	10,764,000
03A113	53-293/952	LANSCE Cooling Tower	Sandia	423,570
03A199	3-1837	Laboratory Data Communications Center	Sandia	17,009,000
03A028	15-202	PHERMEX Cooling Tower	Water	300
03A130	11-30	TA-11 Cooling Tower	Water	1,757
03A185	15-312	DARHT Cooling Tower	Water	907,300
05A055	16-1508	High Explosives Wastewater Treatment Facility	Water	12,818
05A097[a]	11-52	TA-11 Drop Pad/HE Testing	Water	0
			2006 Total:	**221,705,295**

[a] Requested deletion from permit.

[b] Structure removed.

The following is a summary of the corrective actions taken by the Laboratory during 2006 to address the NPDES outfall permit noncompliance cited above.

TA-15-312 Outfall 03A185. On September 18, 2006, a total residual chlorine concentration of >2200 µg/L exceeded the NPDES daily maximum permit limit of 11 µg/L and the minimum quantification level (MQL) of 100 µg/L in NPDES Permit NM0028355. The noncompliance was attributed to a malfunctioning chemical feed pump and check valve that feeds the chlorine neutralizer to the cooling tower outfall discharge. The pump was fixed immediately and a new check valve was installed. The feed pump is used infrequently (several times per year when chlorine is introduced into the cooling tower basin for algae control). The pump will be inspected more frequently to ensure proper operation.

b. NPDES Sanitary Sewage Sludge Management Program. The Laboratory's TA-46 SWWS Plant is an extended-aeration, activated-sludge sanitary wastewater treatment plant. The activated-sludge treatment process requires periodic disposing of excess sludge (waste-activated sludge) from the plant's clarifiers to synthetically lined drying beds. After air-drying for a minimum of 90 days to reduce pathogens, the dry sludge

is characterized and disposed of as a New Mexico Special Waste. Monitoring data obtained from routine characterization of SWWS Plant sludge is available online at http://wqdbworld.lanl.gov/. During 2006, the SWWS Plant generated approximately 27.5 dry tons (54,971 dry lb) of sewage sludge. All of this sludge was disposed of as a New Mexico Special Waste at a landfill authorized to accept this material.

c. NPDES Industrial Point Source Permit Compliance Evaluation Inspection. There were no Compliance Evaluation Inspections performed in 2006.

d. NPDES Storm Water Construction Permit Program. The NPDES Construction General Permit (CGP) Program regulates storm water discharges from construction activities disturbing one or more acres, including those construction activities that are part of a larger common plan of development collectively disturbing one or more acres.

LANL and the general contractor apply individually for NPDES CGP coverage and both are permittees at most construction sites. Compliance with the NPDES CGP includes the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) before soil disturbance can begin and site inspections once soil disturbance has commenced. A SWPPP describes the project activities, site conditions, best management practices (BMPs), and permanent control measures required for reducing pollution in storm water discharges and protecting endangered or threatened species and critical habitat. Compliance with the NPDES CGP is demonstrated through periodic inspections that document the condition of the site and identify corrective actions required to keep pollutants from moving off the construction site. Data collected from these inspections is tabulated weekly, monthly, and annually in the form of Site Inspection Compliance Reports.

During 2006, the Laboratory implemented and maintained 57 construction site SWPPPs and SWPPP addendums and performed 609 storm water inspections. The Laboratory uses a geographic information system to manage project information and generate status reports that facilitate reporting under the Director's Portfolio Reviews. The overall CGP compliance record in 2006 was 94% at all inspections compared to 93% in 2005. During the summer months, when most high-intensity precipitation events occur, the compliance record was 93% in 2006. At the end of 2006, 100% of the Laboratory's permitted sites were in compliance with the CGP.

The LANL storm water team continued to support project personnel with CGP compliance by finding new solutions to the problems associated with stabilizing disturbed landscapes. The solutions for preventing noncompliances have been incorporated into the team's Quality Assurance Improvement Performance Report. To further reduce future CGP noncompliances and to increase awareness of CGP requirements, the storm water team updated the Engineering Standards Manual, revised subcontractor document language, and briefed subcontractors on CGP requirements at pre-bid and pre-construction meetings. In addition, construction site representatives, LANL project managers, or their subcontractor technical representatives are also required to attend storm water inspections and ensure appropriate corrective measures are taken. A new form developed by the storm water team certifies that project representatives have been notified of any potential deficiencies or noncompliances immediately upon completion of an inspection. Mitigating factors can then be developed and implemented more quickly.

e. NPDES Industrial Storm Water Program. The NPDES Industrial Storm Water Permit Program regulates storm water discharges from identified regulated industrial activities (including SWMUs) and their associated facilities. These activities include metal fabrication; hazardous waste treatment, storage, and disposal; landfill operations; vehicle and equipment maintenance; recycling activities; electricity generation; and asphalt manufacturing.

UC and the DOE were co-permittees under the EPA 2000 NPDES Storm Water Multi-Sector General Permit for Industrial Activities (MSGP-2000). The MSGP-2000 expired October 30, 2005, without EPA issuing a new permit. Administrative continuance of the MSGP-2000, which requires continued compliance with the

expired permit requirements, was granted to existing permit holders. This continuance will remain in effect until a new permit is issued. There is currently no identified date for issuance of a new permit.

On December 1, 2005, EPA issued a draft MSGP. Proposed changes to the permit include increased storm water monitoring requirements, changes in benchmark monitoring parameters, increased inspection frequencies, additional SWPPP content requirements, and increased requirements for BMP selection, implementation, and maintenance.

MSGP-2000 required the development and implementation of site-specific SWPPPs, which must include identification of potential pollutants and activities and the implementation of BMPs. Permit requirements also include the monitoring of storm water discharges from permitted sites. In 2006, LANL implemented and maintained 15 SWPPPs under the MSGP-2000 requirements, covering 26 facilities and site-wide SWMUs. Compliance with the MSGP-2000 requirements for these sites is achieved primarily by implementing the following:

- Identifying potential contaminants and activities that may impact surface water quality and identifying and providing structural and non-structural controls (BMPs) to limit the impact of those contaminants.
- Developing and implementing facility-specific SWPPPs.
- Monitoring storm water runoff at facility gauging stations for industrial sector-specific benchmark parameters, and visually inspecting storm water runoff to assess color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of storm water pollution.

f. Federal Facility Compliance Agreement/ Administrative Order. On February 3, 2005, DOE entered into a compliance agreement with EPA to protect surface water quality at the Laboratory through a FFCA. The FFCA establishes a compliance program for the regulation of storm water discharges from SWMUs and AOCs until such time as those sources are regulated by an individual storm water permit pursuant to the NPDES Permit Program. All SWMUs and certain AOCs (collectively, Sites) are covered by this agreement. On March 30, 2005, EPA issued an Administrative Order (AO) to the Laboratory that coincides with the FFCA.

The FFCA/AO establishes a schedule for monitoring and reporting requirements and requires the Laboratory to minimize erosion and the transport of pollutants or contaminants from Sites in storm water runoff. The FFCA also requires DOE and the Laboratory to comply with all requirements of the Laboratory's Multi-Sector General Permit (MSGP).

The FFCA/AO requires two types of monitoring at specified sites, pursuant to two monitoring management plans, including: 1) watershed sampling at approximately 60 automated gauging stations at various locations within the canyons pursuant to a Storm Water Monitoring Plan (SWMP), and 2) site-specific sampling at approximately 294 Sites, on a rotating basis pursuant to a SWMU SWPPP over a four year period. The purpose of storm water monitoring is to determine if there is a release or transport of contaminants into surface water that could cause or contribute to a violation of applicable surface water quality standards. If a release or transport occurs, it may be necessary to implement BMPs to reduce erosion or to re-examine, repair, or modify existing BMPs to reduce erosion. The SWMU/SWPPP must also describe an erosion control program to control and limit contamination migration and transport from Sites and to monitor the effectiveness of controls at the Sites.

In 2006, the Laboratory completed the following tasks:

(1) Submitted the annual modification of the SWPPP for SWMU/AOCs that describes watershed-scale monitoring, site-specific monitoring, and the erosion control program at SWMU/AOCs;

(2) Continued negotiations with EPA and NMED on the development of an individual permit for storm water discharges from SWMUs;

(3) Submitted all monthly water screening action level exceedance reports and quarterly status reports required by the FFCA on schedule;

(4) Completed the following fieldwork:

- Installed 42 new site-specific samplers to bring the total to 122;
- Collected 400 storm water samples at site-specific locations;
- Collected 186 storm water samples at gage locations;
- Conducted 902 inspections at 279 Sites;
- Completed maintenance of BMPs at all FFCA Sites;
- Completed 290 Annual Comprehensive Site Compliance Evaluation inspections (ACSCE).

The ACSCE inspections were conducted by qualified personnel as required under the MSGP to assess the presence of existing industrial materials, leaks and spills, offsite tracking of sediment, tracking/blowing of industrial materials, and evidence of pollutants entering into receiving waters. The annual inspections also included an evaluation of the existing structural BMPs at each Site.

g. Aboveground Storage Tank Compliance Program. The Laboratory's Aboveground Storage Tank (AST) Compliance Program is responsible for ensuring compliance with the requirements established by EPA (CWA, 40 CFR, Part 112) and NMED Petroleum Storage Tank Bureau Regulations (20.5 NMAC). During 2006, the Laboratory was in full compliance with both EPA and NMED requirements.

Spill Prevention Control and Countermeasures (SPCC) Plans fulfill the federal requirements for the AST Compliance Program, as required by the CWA (40 CFR, Part 112, Oil Pollution Prevention Regulations). Comprehensive SPCC Plans are developed to meet EPA requirements that regulate water pollution from oil spills.

EPA proposed additional extensions to compliance deadlines for meeting new regulatory requirements under the federal Clean Water Act (40 CFR, Part 112). Proposed new regulations will require the Laboratory to modify and implement its SPCC Plans by July 1, 2009. The primary modifications address AST storage capacity, inspection frequency, and integrity testing requirements. The Laboratory continued the process of completing all modifications to existing and new SPCC Plans and implementing those modifications.

On August 15, 2003, NMED implemented new regulations that combined requirements for underground storage tanks and ASTs (20.5 NMAC). The Laboratory continues to maintain and operate ASTs in compliance with 20.5 NMAC. In July 2006, the Laboratory paid annual AST registration fees of $100 per AST.

During 2006, the Laboratory continued to work on removing and decommissioning ASTs that were no longer in service. In 2006, the Laboratory continued the quarterly assessment program for AST systems to assist AST owners and operators in meeting regulatory compliance requirements and associated deadlines.

On February 21, 2002, the Laboratory notified EPA, NMED, and the National Response Center of a discharge of approximately 48,000 gallons of diesel fuel into the environment from a tank at TA-21-57. Soil removal and sampling were performed in accordance with Laboratory, state, and federal regulatory requirements to determine the extent of the leak. The Laboratory completed characterization of the release in December 2003 and is continuing to work with NMED on a path forward for mitigation efforts. In 2006, the Laboratory continued efforts to implement a Sampling and Analysis Plan to conduct additional characterization of the

TA-21-57 diesel release site to further evaluate subsurface diesel contamination. Additional characterization will provide information needed for establishing current conditions for the subsurface diesel contamination. Upon evaluation of additional characterization, the Laboratory intends to develop applicable processes for site mitigation.

On April 3, 2003, the Laboratory notified NMED of the discovery of diesel-contaminated soil near the TA-3 Power Plant AST (TA-3-26). The Laboratory completed initial characterization of the diesel-contaminated soil in April 2004 and is continuing to work with NMED on a path forward for additional characterization and mitigation efforts. In 2006, the Laboratory implemented a Sampling and Analysis Plan to conduct secondary characterization at TA-3-26. Results from secondary characterization work will help determine a path forward for corrective actions.

h. Dredge and Fill Permit Program. Section 404 of the CWA requires the Laboratory to obtain permits from the US Army Corps of Engineers to perform work within perennial, intermittent, or ephemeral watercourses. Section 401 of the CWA requires states to certify that Section 404 permits issued by the Corps will not prevent attainment of state-mandated stream standards. NMED reviews Section 404/401 joint permit applications and issues separate Section 401 certification letters which may include additional permit requirements to meet state stream standards for individual Laboratory projects. In addition, the Laboratory must comply with 10 CFR 1022, which specifies how DOE sites comply with Executive Order 11988, Floodplain Management, and Executive Order 11990, Protection of Wetlands.

During 2006, three Section 404/401 permits were issued to the Laboratory:

- Omega Road Erosion Repair Project in Los Alamos Canyon (Nationwide Permit No. 13, Bank Stabilization),
- Stream Gage Maintenance Project in Two-Mile, Canada del Buey, Pajarito, Sandia, Water, Los Alamos, and Mortandad Canyons (Nationwide Permit No. 5, Scientific Measurement Devices), and
- Stream Gage Construction Project in Ancho, Fence, Canyon de Valle, Sandia, and Los Alamos Canyons (Nationwide Permit No. 5, Scientific Measurement Devices).

In addition, LANL reviewed 745 excavation permits and 81 project profiles for potential impacts to watercourses, floodplains, or wetlands. No Floodplain/Wetland Assessments were prepared in 2006. No violations of the DOE Floodplains/Wetlands Environmental Review Requirements were recorded. NMED and the Corps of Engineers did not inspect active sites permitted under the Section 404/401 regulations during 2006.

8. Safe Drinking Water Act

Los Alamos County, as owner and operator of the Los Alamos water supply system, is responsible for compliance with the requirements of the federal Safe Drinking Water Act (SDWA) and the New Mexico Drinking Water Regulations (NMEIB 2002). The SDWA requires Los Alamos County to collect samples from various points in the water distribution systems at the Laboratory, Los Alamos County, and Bandelier National Monument to demonstrate compliance with SDWA maximum contaminant levels (MCLs). EPA has established MCLs for microbiological organisms, organic and inorganic constituents, and radioactivity in drinking water. The State has adopted these standards in the New Mexico Drinking Water Regulations. EPA has authorized NMED to administer and enforce federal drinking water regulations and standards in New Mexico. Information on the quality of the drinking water from the Los Alamos County Water Supply System is in the County's annual Consumer Confidence Report, available online at: http://www.lac-nm.us/.

In 2006, the Laboratory conducted additional confirmation monitoring of the Los Alamos County water supply system for quality assurance purposes. Chapter 5 presents these data.

9. Groundwater

a. Groundwater Protection Compliance Issues. Under requirements of DOE Order 450.1 the Laboratory prepared a groundwater protection management plan to protect groundwater resources in and around the Los Alamos area and ensure that all groundwater-related activities comply with the applicable federal and state regulations. The Consent Order requires the Laboratory to establish a groundwater monitoring system, conduct investigations to determine the nature and extent of contamination in the groundwater, and remediate the groundwater if necessary. Characterization wells in the intermediate and regional aquifers are shown in Figure 2-2.

New Mexico Water Quality Control Commission (NMWQCC) regulations control liquid discharges onto or below the ground surface to protect all groundwater in New Mexico. Under the regulations, when required by NMED, a facility must submit a groundwater discharge plan and obtain NMED approval (or approval from the New Mexico Oil Conservation Division for energy/mineral-extraction activities). Subsequent discharges must be consistent with the terms and conditions of the discharge plan.

In 2006, the Laboratory had one approved groundwater discharge plan (see Table 2-1) for the TA-46 SWWS Plant and two groundwater discharge plans pending NMED approval for the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) and the Laboratory's 14 domestic septic systems. On August 27, 2002, the Laboratory submitted a renewal application for the SWWS Plant groundwater discharge plan; NMED approval was pending at the end of 2006. On August 20, 1996, the Laboratory submitted a groundwater discharge plan application for the RLWTF at TA-50. On April 27, 2006, the Laboratory submitted a groundwater discharge plan application for the discharge of domestic wastewater from 14 domestic septic systems. Approval of these two discharge plan applications were still pending at the end of 2006.

b. Compliance Activities. The Laboratory performed most groundwater compliance work in 2006 pursuant to the Consent Order. These activities included groundwater monitoring, groundwater investigations, and groundwater well construction.

In 2006, the NMED approved the Laboratory's Interim Facility-Wide Groundwater Monitoring Plan. The plan specifies that monitoring be conducted by watershed, and specifies the wells, frequency of monitoring, and analytical suites. Groundwater monitoring by watershed following this plan began in June 2006. Periodic monitoring reports on these monitoring events by watershed were submitted to NMED beginning in November 2006. Results of groundwater monitoring are presented in Chapter 5.

Sample analytical, water-level, well-construction, and other groundwater data can be reviewed online on the Laboratory's Water Quality Database website, http://wqdbworld.lanl.gov/. Periodic monitoring reports can be found on the Laboratory's Environment website, http://www.lanl.gov/environment/h2o/reports.shtml.

The Laboratory completed the groundwater investigation of Mortandad Canyon during 2006. This work was submitted to NMED in October 2006 as part of the Mortandad Canyon Investigation Report (LANL 2006a). In addition, the Laboratory submitted the Interim Measures Report for Chromium Contamination in Groundwater to NMED in November 2006 (reference). These investigations are summarized in Chapter 9.

In 2006, LANL installed six alluvial characterization wells, one intermediate characterization well, and five piezometers (Table 2-8) in Sandia Canyon as part of the Interim Measures Work Plan for Chromium

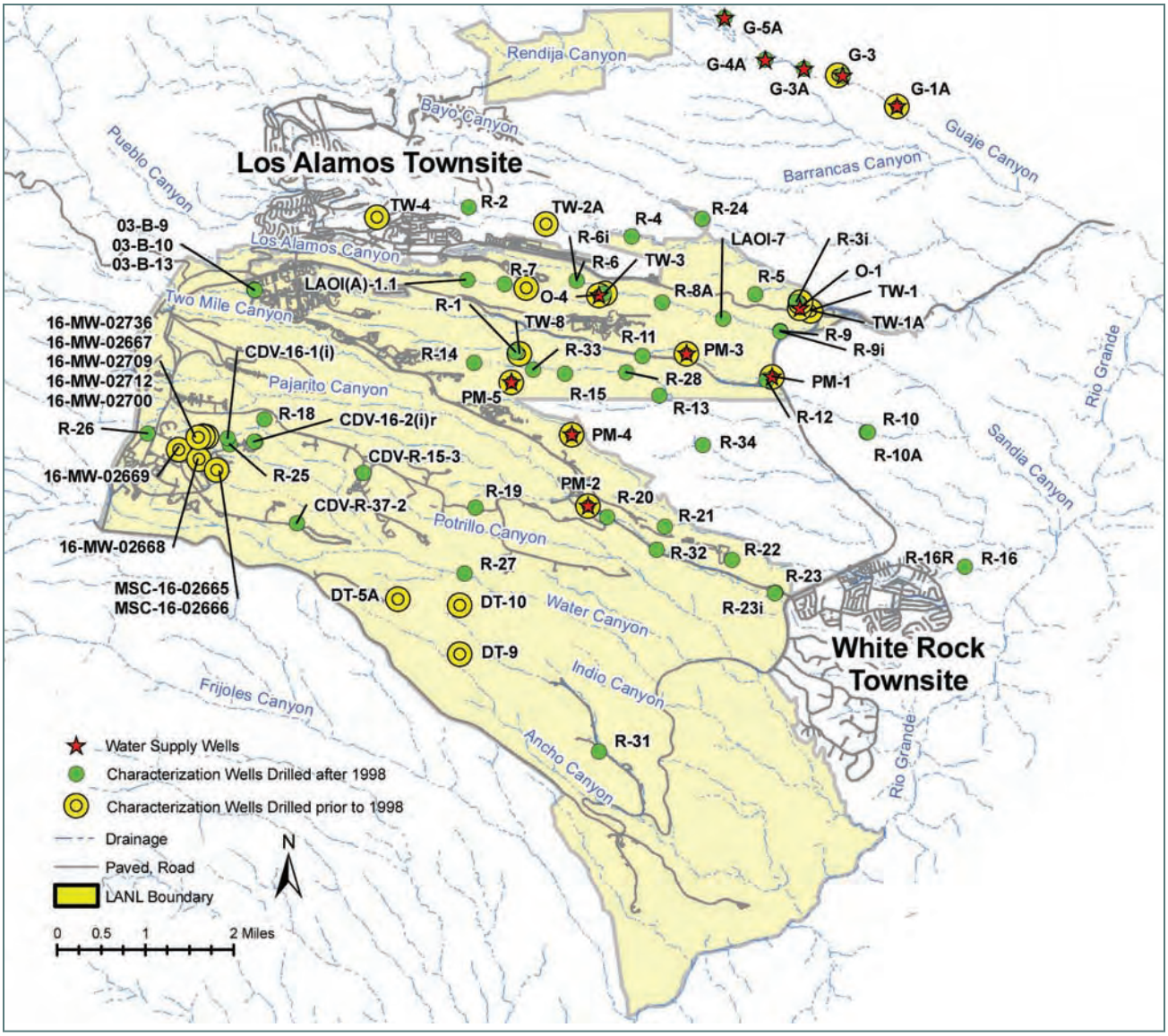

Figure 2-2. Intermediate-perched and regional aquifer characterization wells at LANL and vicinity.

Contamination in Groundwater (LANL 2006b). The alluvial wells were installed to determine the extent of alluvial saturation, determine the nature and extent of chromium contamination within the alluvial aquifer, and obtain data to calculate chromium inventory.

A total of five piezometers were installed in three separate boreholes. Piezometers SCP-1 (a), (b), and (c) were installed in a single borehole located six ft west of alluvial well SCA-4; piezometers SCP-2(a) and 2(b) were installed in separate boreholes located approximately 5 and 10 ft east of alluvial well SCA-3, respectively.

The interim measures work plan called for the drilling and sampling of six characterization boreholes to determine nature and extent of chromium in the upper vadose zone and obtain data to calculate chromium inventories. Six boreholes (SCC-1 to SCC-6) were drilled with air rotary techniques; core samples were collected at 20-ft intervals. Cuttings were collected at 5-ft intervals between the core runs. Water samples were collected from four of the borehole locations during drilling. An intermediate well, designated SCI-1, was installed in the SCC-1 borehole, located in lower Sandia Canyon, north of East Jemez Road and between the SCA-2 and SCA-3 alluvial well locations. This hole was 400 ft below ground surface (bgs)

Table 2-8
Wells and Boreholes Installed in 2006

Type [a]	Identifier	Watershed (Canyon)	Total depth (ft bgs)	Screened interval (ft bgs)	Water level (ft bgs)	Comments
I	LAOI-3.2a	Los Alamos	266.9	181.4–191	172.9	Near confluence with DP Canyon. Drilled to determine if perched water was present below 165 ft, to install a screen below the total depth of adjacent well LAOI-3.2, and to drill to 300 ft which was the original target depth of LAOI-3.2
I	SCI-1	Sandia	377.9	358.4–377.9	366.66	Lower Sandia Canyon, north of East Jemez Road and between alluvial wells SCA-2 and SCA-3.
A	SCA-1	Sandia	2.2	1.3–1.9	0.02	Hand-augered in upper canyon in wetlands near headwaters.
A	SCA-2	Sandia	19	10.3–15	14.36	Hand-augered in lower canyon on the south side of East Jemez Road. The well was bailed dry during development after removing 0.6 gallons of water.
A	SCA-3	Sandia	58.5	27.6–32	32.1	South of East Jemez Road and west of regional well R-11. Developed but no aquifer test due to the small saturated interval in the well.
A	SCA-4	Sandia	42	37–41.5	37.91	South of East Jemez Road and west of regional well R-11.
A	SCA-5	Sandia	64.9	55–64.4	57.8	Lower Sandia Canyon, north of East Jemez Road and immediately west of the firing range.
A	SCP-1(a)	Sandia	43.8	37.8–38.3	37.64	Located 6 ft west of alluvial well SCA-4. Piezometer installation in same borehole as SCP-1(b) and (c). .
A	SCP-1(b)	Sandia	43.8	39.4–39.9	37.76	Piezometer in same borehole as SCP-1(b) and (c).
A	SCP-1(c)	Sandia	43.8	41.2–41.7	37.45	Piezometer in same borehole as SCP-1(b) and (c).
A	SCP-2(a)	Sandia	45.6	44.5–45	32.04	Located 10 ft east of alluvial well SCA-3. Piezometer.
A	SCP-2(b)	Sandia	51.5	49.5–50	34.45	Located 5 ft east of alluvial well SCA-3. Piezometer.

[a] A = alluvial aquifer well; I = intermediate aquifer well.

and 9.5 ft into the Cerros del Rio basalt. Alluvial groundwater was encountered from 33.5 ft to 58 ft bgs. Intermediate-perched water was encountered in the Puye Formation at approximately 366 ft bgs. The screened interval of the intermediate well extended from 358.4 to 377.9 ft bgs. After construction of SCI-1 and during development, the contractor determined that filter pack sand was being bailed from the well. A camera survey determined that the bottom of the sump, constructed of polyvinyl chloride (PVC), had been knocked from the bottom of the well. With LANL and NMED approval, a permanent cylindrical PVC plug was placed into the bottom of the sump.

10. National Environmental Policy Act

The intent of the National Environmental Policy Act (NEPA) (42 U.S.C. 4331 et seq.) is to promote productive harmony between humans and the environment. Federal agencies such as the DOE/NNSA must consider the environmental impacts of proposed projects and ensure public participation as part of the decision-making process. The Laboratory's Risk Reduction Office devotes considerable resources to assist NNSA in compliance with the NEPA, pursuant to DOE Order O451.1B. Proposed projects and actions at LANL are reviewed to determine if there are resource impacts, and the appropriate coverage under NEPA, and these recommendations are provided to NNSA. The following NEPA analyses were prepared or reviewed in 2006.

a. New LANL Site-Wide Environmental Impact Statement. DOE NEPA implementing regulations (10 CFR Part 1021.330[d]) require a SWEIS to be reviewed at least every five years and a Supplemental Analysis performed to examine whether the SWEIS still adequately covers site operations. The local DOE site office produced a Supplement Analysis in September 2004 that was reviewed by DOE headquarters. In October 2004, DOE headquarters made the decision to expand the Supplement Analysis to a Supplemental SWEIS. In April 2005, DOE headquarters decided to convert the Supplemental SWEIS to a full SWEIS and consider three alternatives for future operations at LANL. The new SWEIS will consider operations for a period of five years, 2008–2012. The three SWEIS alternatives considered were:

The No Action Alternative: This alternative would continue operations at current levels. This alternative considers the levels of operation covered in the 1999 SWEIS Record of Decision Expanded Operations Alternative. This alternative would include updates on the operations of the 15 Key Facilities defined in the 1999 SWEIS to anticipate operational levels over the next five years and consideration of new facilities proposed for construction over this period.

The Expanded Operations Alternative: This alternative would include the No Action Alternative plus new or enhanced facilities for ongoing operations. Waste management levels would increase. The major change in this alternative would be the increase in pit production to 50 pits/year in the current TA-55 facilities.

The Reduced Operations Alternative: This alternative would include operational reductions at certain facilities while enhancing some facilities for ongoing operations. Pit production would remain at the 1999 SWEIS Record of Decision levels of 20 pits/year. The major changes considered in this alternative are the closing of LANSCE (Los Alamos Neutron Science Center) and a reduction in operations of approximately 20% for Dual-Axis Radiographic Hydrodynamic Test (DARHT) and a 20% reduction in firing site operations.

The three alternatives were analyzed and the Expanded Operations Alternative was selected as the preferred alternative. On July 7, 2006 NNSA published a Notice of Availability for the draft SWEIS and announced a 60-day public comment period. A Record of Decision on the new SWEIS is expected to be issued in late 2007 or early 2008.

b. Environmental Impact Statement for Operation of a BSL-3 Facility at LANL. In 2000, the DOE/NNSA initiated the National Environmental Policy Act (NEPA) process to prepare an Environmental Assessment (EA) for the construction and operation of a Biosafety Level-3 (BSL-3) facility. On February 23, 2002, DOE/NNSA released a final EA and associated Finding of No Significant Impact (FONSI) for the facility. The construction of the 3,200 ft^2 facility, which began in the summer of 2002, was substantially completed in the fall of 2003.

Upon further internal review, DOE determined that it was necessary to conduct additional seismic analysis because the facility was constructed on top of fill material on a slight slope. Therefore, in early 2004, DOE withdrew the portion of the FONSI that dealt with the operation of the facility and decided to prepare a separate Environmental Impact Statement (EIS) to evaluate reasonable alternatives for operation.

On November 29, 2005, DOE/NNSA published a Notice of Intent (NOI) in the Federal Register announcing its intent to prepare an EIS for the facility. The NOI stated that the public scoping period would end on December 29, 2005. Three public scoping meetings were held—one each in Los Alamos, Santa Fe, and Española, New Mexico. Because of comments received during these meetings, NNSA extended the public scoping period through January 17, 2006.

A draft EIS was prepared and submitted to NNSA for concurrence review (DOE/EIS-0388). The EIS evaluated three alternatives:

- Proposed Action Alternative: This alternative analyzed operation of the BSL-3 facility at LANL at the level permitted by Centers for Disease Control guidelines for a BSL-3 facility. BSL-2 work would also be done in parts of the facility.
- BSL-2 Alternative: This alternative analyzed operation of the facility at the level permitted for a BSL-2 facility; and
- No-Action Alternative: Under this alternative, the already constructed facility would not be operated as a biosafety facility, but would be used instead for non-BSL laboratory work.

A Notice of Availability for the approved draft EIS is expected to be published in 2007 for public review and comment.

11. Endangered Species Act

The Endangered Species Act requires federal agencies to protect populations and habitats of federally listed threatened or endangered species. The Laboratory contains potential habitat for two federally endangered species (Southwestern willow flycatcher, *Empidonax traillii extimus*, and black-footed ferret, *Mustela nigripes*), two federally threatened species (bald eagle, *Haliaeetus leucocephalus,* and Mexican spotted owl, *Strix occidentalis lucida*), and one candidate species (yellow-billed cuckoo, *Coccyzus americanus*). The Southwestern willow flycatcher and black-footed ferret have not been observed on Laboratory property. In addition, there are several federal species of concern and state-listed species potentially occurring within LANL (Table 2-9).

The Laboratory meets its requirements for threatened and endangered species protection through implementation of its Threatened and Endangered Species Habitat Management Plan and review of excavation permit requests and project profiles. During 2006, LANL reviewed 752 excavation permits and 95 project profiles for potential impacts to threatened or endangered species. The Laboratory conducted annual surveys for Mexican spotted owl, Southwestern willow flycatcher, and bald eagle. During 2006, LANL prepared biological assessments for three projects that required consultation with the US Fish and Wildlife Service regarding potential impacts on federally-listed threatened or endangered species:

- Site-Wide Environmental Impact Statement
- Effluent Reduction Ponds
- Monitoring and Maintenance of Monitoring Stations and Wells

Table 2-9
Other Sensitive Species Occurring or Potentially Occurring at LANL

Scientific Name	Common Name	Protected Status[a]	Potential to Occur[b]
Gila pandora	Rio Grande Chub	NMS	Moderate
Plethodon neomexicanus	Jemez Mountains Salamander	NME, FSOC	Moderate
Falco peregrinus anatum	American Peregrine Falcon	NMT, FSOC	High
Falco peregrinus tundrius	Arctic Peregrine Falcon	NMT, FSOC	Moderate
Accipiter gentiles	Northern Goshawk	NMS, FSOC	High
Lanius ludovicianus	Loggerhead Shrike	NMS	High
Vireo vicinior	Gray Vireo	NMT	Moderate
Plegadis chihi	White-faced Ibis	S1	Moderate
Myotis ciliolabrum melanorhinus	Western Small-footed Myotis Bat	NMS	High
Myotis volans interior	Long-legged Bat	NMS	High
Euderma maculatum	Spotted Bat	NMT	High
Plecotus townsendii pallescens	Townsend's Pale Big-eared Bat	NMS, FSOC	High
Nyctinomops macrotis	Big Free-tailed Bat	NMS	High
Myotis thysanodes thysanodes	Fringed Bat	NMS	High
Myotis yumanensis yumanensis	Yuma Bat	NMS	High
Myotis evotis evotis	Long-eared Bat	NMS	High
Bassariscus astutus	Ringtail	NMS	High
Vulpes vulpes	Red Fox	NMS	Moderate
Ochotona princeps nigrescens	Goat Peak Pika	NMS, FSOC	Low
Zapus hudsonius luteus	New Mexico Meadow Jumping Mouse	NMT, FSOC	Moderate
Lilium philadelphicum var. andinum	Wood Lily	NME	High
Cypripedium calceolus var. pubescens	Greater Yellow Lady's Slipper	NME	Moderate
Speyeria Nokomis nitocris	New Mexico Silverspot Butterfly	FSOC	Moderate

NMS = New Mexico Sensitive Taxa (informal); S1 = Heritage New Mexico: Critically Imperiled in New Mexico; NMT = New Mexico Threatened; NME = New Mexico Endangered; FSOC = Federal Species of Concern.

[b] Low = No known habitat exists on LANL; Moderate = Habitat exists, though the species has not been recorded recently; High = Habitat exists and the species occurs at LANL.

12. Migratory Bird Treaty Act

Under the provisions of the Migratory Bird Treaty Act, it is unlawful "by any means or manner to pursue, hunt, take, capture [or] kill" any migratory birds except as permitted by regulations issued by the US Fish and Wildlife Service. Personnel from LANL received retraining for migratory bird protection measures at the annual New Mexico Avian Protection Workshop and continued to recommend best management practices for migratory bird protection to LANL projects during project reviews. Special emphasis was placed on protection of migratory birds on power line and pole structures.

13. Cultural Resources

The goal of the National Historic Preservation Act (NHPA) of 1990 is to have federal agencies act as responsible stewards of the nation's resources when their actions affect historic properties. NHPA Section 106

requires federal agencies to take into account the effects projects may have on historic properties and to allow for comment by the Advisory Council on Historic Preservation. Section 106 regulations outline a project review process conducted on a project-by-project basis.

In 2006, the Laboratory conducted 21 projects that required some field verification of previous survey information. In addition to the 13 new archaeological sites identified in 2006, we identified 166 historic buildings. Twenty-three archaeological sites and 65 historic buildings were determined eligible for the National Register of Historic Places.

The Laboratory began the fifth year of a multiyear program of archaeological excavation in support of the Land Conveyance and Transfer project. The DOE/NNSA is in the process of conveying to Los Alamos County approximately 2,000 acres of Laboratory lands. Thirty-nine archaeological sites have been excavated during the five field seasons, with more than 200,000 artifacts and 2,000 samples collected. Together, these sites provide new insights into past activities on the Pajarito Plateau from 5000 BC to AD 1943. From a compliance perspective, these excavations resolve the anticipated adverse effects to archaeological sites from the future development of lands to be acquired by Los Alamos County. These sites are also ancestral places to the Pueblo people and representatives from the Pueblos of San Ildefonso and Santa Clara acted as tribal consultants and monitors on the project.

In support of LANL's fiscal year 2006 decontamination and decommissioning program, the Laboratory conducted historic building assessments and other documentation work related to two proposed projects as required under the provisions of the NHPA. Buildings included in these projects are located at TAs-8, -9, -14, -15, -22, -36, -39, -40, -60, and -69. This work included field visits to historic properties (including interior and exterior inspections), digital and archival photography, and architectural documentation (using standard LANL building recording forms). Additional documentation included the production of location maps for each of the evaluated projects. Historical research was also conducted using source materials from the LANL archives and records center, historical photography, the Laboratory's public reading room, and previously conducted oral interviews.

The long-term monitoring program at the ancestral pueblo of Nake'muu was completed as part of the DARHT Facility Mitigation Action Plan (DOE 1996). Nake'muu is the only pueblo at LANL that still contains its original standing walls. During the nine-year monitoring program, the site has experienced a 0.9% displacement rate of chinking stones and 0.3% displacement of masonry blocks. Statistical analyses indicate these displacement rates are significantly correlated with annual snowfall, but not with annual rainfall or explosive tests at the DARHT facility.

Native American consultation is ongoing with respect to identifying and protecting traditional cultural properties, human remains, and sacred objects in compliance with the NHPA and Native American Graves Protection and Repatriation Act. Work for the Land Conveyance and Transfer Project included consultation with San Ildefonso and Santa Clara Pueblos for project monitoring, the implementation of a Native American Graves Protection and Repatriation Act intentional excavation agreement, identification of potential reburial locations, protection of Traditional Cultural Properties, and student internships. In fiscal year 2006, a total of 38 sets of culturally affiliated human remains and associated funerary objects or objects of cultural patrimony were repatriated to the Pueblo de San Ildefonso. These represent remains and objects variously encountered and collected from LANL property between the period of 1956 and 2005. Other projects include the Nake'muu noise vibration study, the development of a final management plan for the TA-3 University House Traditional Cultural Properties, and the Cerro Grande Rehabilitation Project.

Protection and Repatriation Act. Work for the Land Conveyance and Transfer Project included consultation with San Ildefonso and Santa Clara Pueblos for project monitoring, the implementation of a Native American Graves Protection and Repatriation Act intentional excavation agreement, identification of potential reburial

locations, protection of Traditional Cultural Properties, and student internships. In fiscal year 2006, a total of 38 sets of culturally affiliated human remains and associated funerary objects or objects of cultural patrimony were repatriated to the Pueblo de San Ildefonso. These represent remains and objects variously encountered and collected from LANL property between the period of 1956 and 2005. Other projects include the Nake'muu noise vibration study, the development of a final management plan for the TA-3 University House Traditional Cultural Properties, and the Cerro Grande Rehabilitation Project.

C. UNPLANNED RELEASES

1. Air Releases

There were two unplanned air releases during 2006.

- A smoke opacity of 24% was observed at the TA-60 Asphalt Plant on May 1, 2006. The permit limit for opacity is 20%.
- A release of ammonia equal to or in excess of the reportable quantity was reported under Section 304 of EPCRA. The reportable quantity for ammonia is 100 pounds.

2. Water releases

There were no unplanned releases of radioactive liquids in 2006. There were six unplanned releases of non-radioactive liquids in 2006:

- Approximately 300 gal. of fire suppression water into upper Sandia and Los Alamos Canyons.
- Approximately four yd^3 of clean fill sediment from storm water runoff from a construction site at TA-50 into upper Ten Site Canyon.
- Approximately 1,000 gal. of potable water from TA-54-215 into Canada Del Buey.
- Approximately 2,000 gal. of potable water into the run-on diversion channel at MDA-T and SWMU 21-0016(a)-99.
- Greater than 41,000 gal. of potable water into the diversion channel around MDA-T, into Consolidated Unit 21-016(a)-99, and into DP Canyon.
- Approximately 600 gal. of fire suppression water into upper Sandia Canyon.

The Laboratory investigated all unplanned releases of liquids as required by the NMWQCC Regulations 20.6.2.1203 NMAC. Upon cleanup, the NMED and the DOE Oversight Bureau inspected the unplanned release sites to ensure adequate cleanup. In 2006, the Laboratory was in the process of administratively closing out all releases for 2006 with the DOE Oversight Bureau and anticipates these unplanned release investigations will be closed out after final inspections.

D. REFERENCES

DOE 1996: "Dual-Axis Radiographic Hydrodynamic Test Facility Final Environmental Impact Statement Mitigation Action Plan," United States Department of Energy report USDOE/EIS-0228 (January 1996).

LANL 1998: Water Quality and Hydrology Group, "Hydrogeologic Workplan," Final Version, Los Alamos National Laboratory (May 1998).

LANL 2006a: "Mortandad Canyon Investigation Report," Los Alamos National Laboratory document LA-UR-06-6752, ID 094160 (October 2006).

LANL 2006b: "Interim Measures Work Plan for Chromium Contamination in Groundwater," Los Alamos National Laboratory document LA-UR-06-1961, Los Alamos, New Mexico. (LANL 2006, 091987) (March 2006).

NMEIB 2002: New Mexico Environmental Improvement Board, State of New Mexico, "Drinking Water Regulations" (as amended through December 2002), found at 20.7.10 NMAC.