LA-13047-ENV

Environmental Surveillance at Los Alamos during 1994

Los Alamos
NATIONAL LABORATORY
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Aerial view looking westward toward the Valle Grande in the Jemez Mountains. Extending eastward from the mountains, the Pajarito Plateau is cut into numerous narrow mesas divided by southeast-trending canyons. The Los Alamos townsite is on the mesas in the right half of the photograph and Los Alamos National Laboratory is on those in the left. The Laboratory's main technical area (TA-3) is in the top center, at the foot of the mountains, and the Los Alamos Meson Physics Facility (LAMPF) is in the lower center.

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Environmental Surveillance at Los Alamos during 1994

Environmental Assessments and Resource Evaluations Group

Los Alamos
NATIONAL LABORATORY
Los Alamos, New Mexico 87545

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Acknowledgments

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"Environmental Surveillance at Los Alamos" reports are prepared annually by the Los Alamos National Laboratory (the Laboratory) as required by US Department of Energy Order 5400.1, entitled "General Environmental Protection Program."

These annual reports summarize environmental data that characterize the Laboratory's compliance with applicable federal, state, and local environmental laws and regulations, executive orders, and departmental policies. Additional data, beyond the minimum required, is 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.

These annual reports are written to be useful to the many individuals, organizations, and governmental entities interested in environmental monitoring at the Laboratory. Significant environmental efforts, special studies, and environmental quality trends of interest are highlighted. This year's report contains improved maps and new graphs designed to further clarify important issues. A glossary of terms, a listing of report contributors, and other supplementary information are included to aid the reader. Comments on how to improve the annual reports are encouraged.

This report is prepared by the Los Alamos National Laboratory, Environment, Safety, and Health Division, for the US Department of Energy.

Inquires or comments regarding these annual reports may be directed to the US Department of Energy, Office of Environment and Projects, 528 35th Street, Los Alamos, NM, 87544, or to the Los Alamos National Laboratory, Environment, Safety, and Health Division, P.O. Box 1663, MS K491, Los Alamos, NM, 87545.

Foreword

This report was written for both the lay person and the scientist. Readers may have limited or comprehensive interest in this report. We have tried to make it accessible to all without compromising its scientific integrity. Following are directions advising each audience on how best to use this document.

1. Lay Person with Limited Interest. Read Section I, the Executive Summary, which describes the Laboratory's environmental monitoring programs for this year. The report emphasizes radiological emissions, dose calculations, and environmental regulatory compliance. A glossary and a list of acronyms and abbreviations in the back of the report define relevant terms and acronyms.

2. Lay Person with Comprehensive Interest. Follow directions for the "Lay Person with Limited Interest" given above. Summaries of each section of the report are in boldface type preceding the technical text; read summaries of those sections that interest you. Further details are provided in the text following each summary. Appendix A, Standards for Environmental Contaminants; Appendix B, Units of Measurement; and Appendix C, Description of Technical Areas and Their Associated Programs, may also be helpful.

3. Scientists with Limited Interest. Read Section I, the Executive Summary, to determine the parts of the Laboratory's environmental program that interest you. Then read the summaries and technical details of these sections in the body of the report. Sections IX and X contain lists of publications issued in 1994 and references, respectively.

4. Scientists with Comprehensive Interest. Read Section I, the Executive Summary, which describes the Laboratory's environmental programs this year. Read the major subdivisions of the report; detailed data tables are included in each section. Appendix D contains supplementary environmental information.

For further information about this report, contact the Los Alamos National Laboratory's Environmental Assessments and Resource Evaluations Group:

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I. Executive Summary	K. Lyncoln
II. Introduction	
A. Los Alamos National Laboratory	K. Lyncoln
B. Geographic Setting	A. Stoker
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D. Climatology	G. Stone
E. Ecology	T. Haarmann
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B. National Environmental Policy Act Assessments	B. Sinha
C. Other Significant Environmental Activities at Los Alamos	L. Anderman, M. Burns, R. Conrad, M. Cox, R. Ferenbaugh, P. Fresquez, B. Gallaher, T. Haarmann, D. Hollis, D. Kraig, M. Maes, S. McLin, R. Rangel, D. Rogers, G. Stone
V. Environmental Radiological Program Information	D. Armstrong, R. Beers, P. Fresquez, B. Gallaher, K. Jacobson, S. McLin, R. Rangel, D. Rogers
VI. Environmental Nonradiological Program Information	M. Alexander, R. Beers, P. Fresquez, B. Gallaher, K. Jacobson, S. McLin, M. Saladen
VII. Groundwater Protection Management Program	A. Adams, B. Gallaher, F. Goff, P. Longmire, M. Maes, S. McLin, D. Rogers, A. Stoker
VIII. Quality Assurance And Sampling Procedures	P. Beaulieu, J. Johnston

ENVIRONMENTAL SURVEILLANCE AT LOS ALAMOS DURING 1994

ABSTRACT

This report describes the environmental surveillance program at Los Alamos National Laboratory (LANL or the Laboratory) during 1994. The Laboratory routinely monitors for radiation and for radioactive and nonradioactive materials at (or on) Laboratory sites as well as in the surrounding region. LANL uses the monitoring results to determine compliance with appropriate standards and to identify potentially undesirable trends. Data were collected in 1994 to assess external penetrating radiation; quantities of airborne emissions and liquid effluents; concentrations of chemicals and radionuclides in ambient air, surface waters and groundwaters, municipal water supply, soils and sediments, and foodstuffs; and environmental compliance. Using comparisons with standards, regulations, and background levels, this report concludes that environmental effects from Laboratory operations are small and do not pose a demonstrable threat to the public, Laboratory employees, or the environment.

Los Alamos National Laboratory (LANL or the Laboratory) began as Project Y of the Manhattan Engineer District during World War II with the specific responsibility of developing the world's first nuclear weapon. The University of California (UC) manages the Laboratory for the Department of Energy (DOE). The Laboratory's focus has evolved over the years in response to changes in national policy. The Laboratory's vision is to be a world-class laboratory solving complex problems of national importance where science makes a difference; its mission is to apply science and technology to the nation's security and well-being.

The Laboratory's policy directs its employees to protect the public, employees, and the environment from harm that could be caused by Laboratory activities. Laboratory policy also directs us to reduce the environmental impact of our activities as much as is feasible. The DOE requires that we monitor the Laboratory site and the surrounding region for radiation, radioactive materials, and hazardous chemicals.

Our environmental surveillance program strives to fulfill these policies and requirements. Throughout the year, we routinely monitor the Laboratory's and surrounding region's air, water, foodstuffs, and soil for radiation, radioactive materials, and hazardous chemicals. Every year, the data are summarized in an environmental surveillance report.

The Laboratory uses more than 450 sampling stations for routine monitoring of the environment. Table I-1 presents the number of each type of environmental monitoring station used in 1994. Each year more than 11,000 environmental samples are the subject of over 200,000 analyses for radioactive and nonradioactive constituents.

Table I-1. Number of Sampling Locations for Routine Monitoring of the Ambient Environment

Type of Monitoring	Off Site: Regional	Off Site: Perimeter Area	On Site: Laboratory	On Site: Waste Disposal Area	Total
External radiation	4	23	51	88	166
Air	6[a]	13	22	9	50[b]
Surface waters[c,d]	6	10	12	0[e]	28
Groundwater[c]	0	32	19	15	66
Soils	7	6	9	1	23
Sediments	11	19	29	21	80
Foodstuffs	13	11	21	1	46
Meteorology	0	1	7	0	8

[a]Includes three pueblo monitoring locations.
[b]Includes three stations that monitor only nonradioactive air emissions.
[c]Samples from an additional 17 special surface water and groundwater stations related to the Fenton Hill Geothermal Program and 13 wells at the Pueblo of San Ildefonso were also collected and analyzed as part of the monitoring program.
[d]Does not include National Pollutant Discharge Elimination System (NPDES) outfalls sampled to demonstrate regulatory compliance.
[e]Means not counted separately from on-site Laboratory locations.

Estimated Doses and Risks from Radiation Exposure

Many of the activities that take place at the Laboratory involve handling radioactive materials and operating radiation-producing equipment. This report documents the monitoring results, which assess the potential exposures to the public from Laboratory-related radiation sources.

Radiation Doses. Radiological doses are calculated to estimate the potential health impacts of any releases of radioactivity to the public. Standards exist which limit the maximum effective dose equivalent (EDE or simply "effective dose") to the public. The DOE's public dose limit (PDL) is 100 mrem/yr EDE received from all pathways, and the Environmental Protection Agency (EPA) restricts the EDE received by air to 10 mrem/yr. These values are in addition to those from normal background, consumer products, and medical sources. Both standards apply to locations of maximum probable exposure to an individual in an off-site, uncontrolled area.

In CY94, the estimated maximum committed EDE due to Laboratory operations was 3.5 mrem, taking into account shielding by buildings (30% reduction) and occupancy (100% for residences, 25% for businesses). It is 3.5% of DOE's 100 mrem/yr PDL for all pathways. This dose resulted mostly from external radiation from short-lived, airborne emissions from a linear particle accelerator at Los Alamos Meson Physics Facility (LAMPF). Figure I-1 presents a summary of the estimated maximum individual and maximum Laboratory boundary doses from external penetrating radiation generated by the Laboratory for the last 10 years. Table I-2 presents a summary of the annual EDEs attributable to 1994 Laboratory operations. The estimated maximum EDE from Laboratory operations is about 1% of the 348 mrem received from background radiation and radioactivity in Los Alamos during 1994 (Figure I-2).

The EPA-approved method of calculating EDE, which is used to demonstrate compliance with National Emissions Standards for Hazardous Air Pollutants requirements, does not allow the Laboratory to take into account shielding or occupancy factors. In 1994, that EDE was 7.62 mrem, which is in compliance with EPA standards of 10 mrem/yr from the air pathway.

Risk Estimates. One way of understanding the effect of radiation released by Laboratory operations is by calculating the number of additional cases of cancer that will probably occur because of this radiation. In the US,

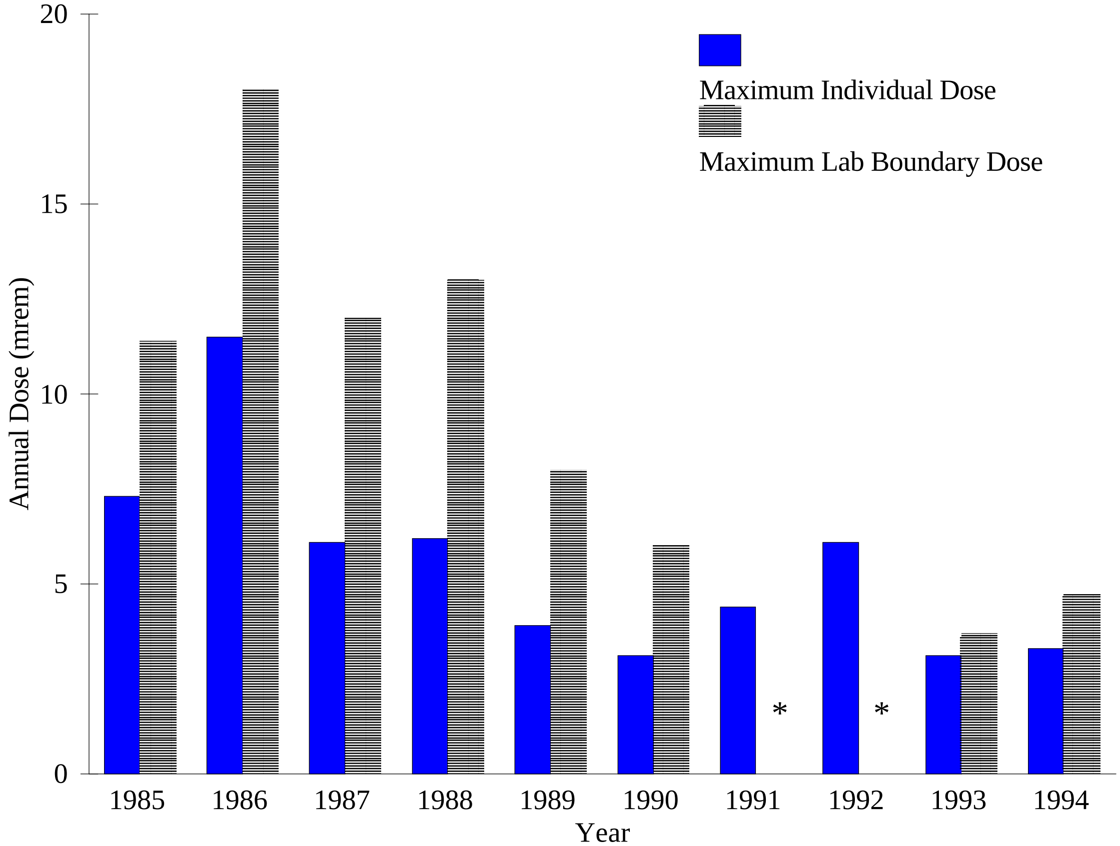

Figure I-1. Summary of estimated maximum individual and maximum Laboratory boundary doses from external penetrating radiation generated by Laboratory operations (excluding contributions from cosmic, terrestrial, and medical diagnostic sources). Maximum individual dose calculated with DOE-approved methods that take building shielding and occupancy into account.
*No above-background Laboratory boundary doses were recorded during 1991 or 1992.

Table I-2. Summary of Annual Effective Dose Equivalents Attributable to 1994 Laboratory Operations

	Maximum Dose to an Individual[a,b]	Average Dose to Nearby Residents[b]		Collective Dose to Population within 80 km of the Laboratory[b]
		Los Alamos	White Rock	
Dose	3.5 mrem	0.27 mrem	0.06 mrem	4 person-rem
Location	Residence north of TA-53	Los Alamos	White Rock	Area within 80 km of the Laboratory
Background	348 mrem	348 mrem	336 mrem	72,000 person-rem
DOE Public Dose Limit	100 mrem	—	—	—
Percentage of Public Dose Limit	3.5%	0.27%	0.06%	—
Percentage of Background	1.0%	0.077%	0.018%	0.006%

[a]Maximum individual dose is the dose to any individual at or outside the Laboratory where the highest dose rate occurs. Calculations take into account occupancy (the fraction of time a person is actually at that location), self-shielding, and shielding by buildings.

[b]Doses are reported at the 95% confidence level.

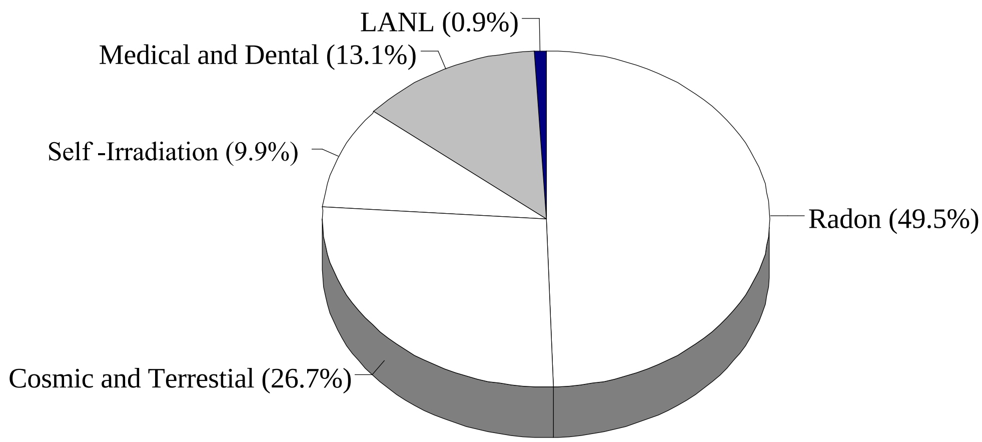

Figure I-2. Total contributions to 1994 dose at the Laboratory's maximum exposed individual location.

the risk of contracting some form of cancer is 1 chance in 4. Because of the radiation released by 1994 Laboratory operations, Los Alamos and White Rock residents may have an added risk of contracting cancer; that additional risk is less than 1 chance in 1,000,000 (Table I-3).

Environmental Monitoring and Compliance Activities

External Penetrating Radiation Monitoring. LANL measures external penetrating radiation using thermoluminescent dosimeters (TLDs) at 166 stations located both on and off site. Annual averages for the TLDs were generally the same in 1994 as in 1993, consistent with the variability in natural background radiation observed at the monitoring stations. The current detection limit of the TLD system is 3.0 mrem.

Radioactive Air Monitoring. The sampling network for ambient airborne radioactivity consisted of more than 50 continuously operating air sampling stations in 1994. Ambient air is routinely sampled for tritium, plutonium, americium, uranium, radioiodine, and gross alpha and beta activity. Total radioactive airborne emissions during 1994 increased slightly from those in 1993. Table I-4 presents both the 1993 and 1994 radionuclide releases from Laboratory operations.

Radionuclide National Emission Standards for Hazardous Air Pollutants. Under 40 CFR 61, Subpart H, EPA limits the EDE to any member of the public from radioactive airborne releases from any DOE facility, including LANL, to 10 mrem/yr. For 1994, the maximum dose to a member of the public of 7.62 mrem from airborne releases was calculated using the EPA-approved computer program CAP-88. More than 95% of the modeled 1994 EDE was due to gaseous activation products released from LAMPF. Air submersion was the primary pathway of exposure (versus inhalation or ground deposition).

In 1991, the DOE reported to EPA that LANL did not meet the requirements of 40 CFR 61, Subpart H. In response, EPA issued LANL a Notice of Noncompliance (NON). As a result of the NON, the DOE and EPA initiated negotiations to enter into a Federal Facilities Compliance Agreement (FFCA). The FFCA will include schedules that the Laboratory will follow to come into compliance with the Clean Air Act and will continue to address the issues raised in the 1991 NON.

Unplanned Airborne Releases. There were three unplanned airborne radiological releases reported during 1994. Each EDE was less than 0.1% of DOE's PDL of 100 mrem/yr from all pathways and less than 1% of the EPA's 10 mrem/yr limit for the air pathway.

Nonradioactive Air Monitoring. The Laboratory operates monitors to measure nonradiological ambient air quality; this includes monitoring for beryllium, acid precipitation, and visibility. These data are collected for environmental surveillance reasons and are not required by federal or state environmental regulations.

Table I-3. Added Individual Lifetime Cancer Mortality Risks Attributable to 1994 Radiation Exposure

Exposure Source	EDE Used in Risk Estimate (mrem)[a]	Added Risk to an Individual of Cancer Mortality (chance)
Average Exposure from Laboratory Operations		
Los Alamos townsite	0.27	less than 1 in 1,000,000
White Rock area	0.06	less than 1 in 1,000,000
Natural Radiation		
Cosmic, terrestrial, self-irradiation, and radon exposure[b]		
Los Alamos	348	1 in 7,000[c]
White Rock	336	1 in 8,000[c]
Medical X-Rays (Diagnostic Procedures)		
Average whole-body exposure	53	1 in 43,000

[a]1 mrem = 0.01 mSv.

[b]An EDE of 200 mrem (2.00 mSv) was used to estimate the risk from inhaling ^{222}Rn and its transformation products.

[c]The risks from natural radiation from nonradon sources were estimated to be 1 chance in 15,000 in Los Alamos and 1 chance in 17,000 for White Rock. The risk of lung cancer from radon exposure was estimated to be 1 chance in 14,000 for both locations. Risk estimates are derived from the NRC BEIR IV and BEIR V reports and the NCRP Report 93 (BEIR IV 1988, BEIR V 1990, NCRP 1987a).

Table I-4. Comparison of 1993 and 1994 Radionuclides from Laboratory Operations

Airborne Emissions[a]

		Activity Released		**Ratio**
Radionuclide	**Units**	**1993**	**1994**	**1994:1993**
Tritium	Ci	2,100	1,100	0.5
Uranium	μCi	270[b]	380[b]	1.4
Plutonium	μCi	6	13	2.2
Gaseous mixed activation products	Ci	32,100	50,200	1.6
Mixed fission products	μCi	1,360	450	0.3
Particulate/vapor activation products	Ci	13	0.4	0.03
Total	Ci	34,200	51,300	

Liquid Effluents

		Activity Released (mCi)		**Ratio**
Radionuclide	**Units**	**1993**	**1994**	**1994:1993**
Tritium	mCi	2,660.00	2,230.00	.84
^{82,85,89,90}Sr	mCi	7.64	37.00	4.84
^{137}Cs	mCi	8.17	8.5	1.04
^{234}U mCi	0.12	.12		1
^{238,239,240}Pu	mCi	1.08	3.25	3.01
^{241}Am	mCi	11.20	3.06	.273
Total	mCi	2,688.21	2,281.93	

[a]Detailed data are presented in Tables V-4 and V-5 for airborne emissions.

[b]Does not include dynamic testing.

Compliance with the Federal Clean Air Act and the New Mexico Air Quality Control Act. These acts establish ambient air quality standards, require permits for new and modified sources, set acceptable emissions limits and require operational controls on some Laboratory processes. During 1994, the Laboratory's operations that emit nonradioactive air pollutants were in compliance with all applicable federal and state air quality regulations.

Surface Water and Groundwater Monitoring. The Laboratory monitors surface waters and groundwaters to detect potential or known transport of contaminants from the Laboratory. Measureable concentrations of radionuclides from Laboratory operations (primarily historical) are transported by surface water off site in Pueblo and Los Alamos canyons. The perched alluvial groundwater in off-site reaches of Pueblo and Los Alamos canyons also shows the influence of both industrial and sanitary effluents. The intermediate-depth perched groundwater beneath Pueblo Canyon at two locations (Test Well 2A on county land and Test Well 1A near the eastern Laboratory boundary) shows both radioactive and chemical quality influences from historical releases. The main aquifer shows the presence of recent recharge (less than 30 to 50 yr) at one location beneath Pueblo Canyon (Test Well 1), and one location beneath Mortandad Canyon (Test Well 8).

Measurements of tritium by extremely low-detection-limit analytical methods show the presence of some recent recharge (meaning within the last four decades) in water samples from two wells into the main aquifer at the Laboratory and two wells in Los Alamos Canyon. The concentrations measured range from less than 2% to less than 0.01% of current drinking water standards and are all less than levels that could be detected by the EPA-specified analytical methods normally used to determine compliance with drinking water regulations. Low concentrations of tritium were also detected at three wells and one spring associated with the intermediate-depth perched aquifer beneath Pueblo and Los Alamos canyons and at four household wells at the Pueblo of San Ildefonso.

Compliance with the Clean Water Act. The three primary programs at the Laboratory established to comply with the Clean Water Act (CWA) are the National Pollutant Discharge Elimination System (NPDES) program, the Spill Prevention Control and Countermeasure (SPCC) program, and the sewage sludge monitoring program.

The Laboratory's new NPDES permit became effective August 1, 1994. The new NPDES permit included additional monitoring requirements and more stringent effluent limits. In CY94, the Laboratory was in compliance with the NPDES permit in 100% of the analyses sampled at sanitary wastewater discharges and 98.6% at the industrial wastewater discharges.

The Laboratory has an SPCC Plan, as required by 40 CFR 112. This plan provides the Laboratory with specific requirements for secondary containment and spill prevention for aboveground storage tanks, drums, other containers, and material handling operations to control accidental oil and chemical spills from reaching the environment.

In 1994, sewage sludge generated at the Laboratory's Technical Area (TA) 46 Sanitary Waste Stream Consolidation plant was in full compliance with the federal standards (40 CFR Part 503) governing the beneficial reuse and land application of sewage sludge.

Storm Water Discharges. On November 16, 1990, the EPA promulgated the final rule for NPDES Regulations for Storm Water Discharges and modified 40 CFR 122, 123, and 124. This rule was required to implement Section 402(p) of the CWA (added by Section 405 of the Water Quality Act of 1987).

On September 9, 1992, EPA published the final General Permits for storm water discharges associated with industrial and construction activity. The Laboratory chose to apply for coverage under the General Permit. Currently the Laboratory has five NPDES General Permits for its storm water discharges. One permit is for the Laboratory site and includes the following industrial activities: hazardous waste treatment, storage, or disposal facilities, operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA), (this category includes solid waste management units); landfills, land application sites, and open dumps including those that are subject to regulation under Subtitle D of RCRA; and steam electric power generating facilities. The other four permits are for construction activities disturbing more than five acres. These projects are the TA-53 Lagoon Elimination project; the Los Alamos Integrated Communication System project; the Dual Axis Radiographic Hydrotest facility; and the Small Arms Firing Range remediation.

Compliance with the Safe Drinking Water Act. Samples are collected and analyzed from the Laboratory, Los Alamos County, and Bandelier National Monument water distribution systems and the Laboratory's water supply wellheads on a routine basis in order to determine the levels of microbiological organisms, organic and inorganic chemical constituents, asbestos, and radioactivity in the drinking water. During 1994, all parameters regulated under the Safe Drinking Water Act were in compliance with the maximum containment levels established by regulation, with the exception of a microbiological violation in January 1994.

Unplanned Liquid Releases. There was one unplanned potential radioactive liquid release reported during 1994. At TA-21, Building 3 a corroded radioactive liquid waste line was found to have a hole. Further investigation revealed that the corroded line was contained by a concrete trench. Discharge from the leaking line did not reach the environment.

There were 23 unplanned nonradioactive liquid releases reported during 1994. These releases were minor in nature and were contained on Laboratory property; none was found to be of any threat to health or the environment.

Soil Monitoring. Soils are monitored both on and off site for radioactive tritium, strontium, cesium, uranium, plutonium, americium, alpha and beta particles, and gamma rays. All levels were within acceptable values, and no action was required to reduce levels of any radioactive element in the soil. In soil samples, one on-site higher-than-background concentration of plutonium was recorded, but this concentration was still far below the screening action level. Soils are analyzed for trace and heavy metals, such as iron, lead, mercury, and aluminum. In 1994, all samples were within acceptable levels for the Los Alamos region. Although some on-site readings for beryllium and arsenic were above background levels, the sources were natural; therefore, no action was required by the Laboratory.

Sediments Monitoring. Measurements of radioactivity and chemicals in samples of sediments provide data on indirect pathways of exposure. Areas within Pueblo, Los Alamos, and Mortandad canyons all had concentrations of radioactivity in sediments at levels higher than those attributable to natural terrestrial sources or worldwide fallout. Cesium, plutonium, and strontium in Mortandad Canyon result from effluents from a liquid waste treatment plant. No runoff or sediment transport has been detected beyond the Laboratory boundary in Mortandad Canyon since effluent release into the canyon started. However, some radioactivity in sediments in Pueblo Canyon (from pre-1964 effluents) and Los Alamos Canyon (from post-1952 treated effluents) has been transported to the Rio Grande. Theoretical estimates, confirmed by measurements, show that the incremental effect on Rio Grande sediments is about 10% of the concentrations attributable to worldwide fallout in soils and sediments.

Surface runoff has transported some low-level radioactive contamination from the active waste disposal area and several of the inactive areas into canyons within the Laboratory boundary. Analyses of toxic metals in surface sediments in these canyons indicate that no constituents exceed EPA threshold criteria for determining hazardous waste.

Compliance with the Resource Conservation and Recovery Act. This act regulates hazardous wastes from generation through disposal. As of 1994, the EPA has given full authority for administering the RCRA, with the exception of the Hazardous and Solid Waste Amendments of 1984, to NMED. NMED administers its hazardous waste program under RCRA and NM Hazardous Waste Act (NMHWA) authorities. LANL had frequent interactions with federal and state RCRA/NMHWA personnel during 1994. DOE and the EPA signed an FFCA addressing mixed waste storage and treatment subject to land disposal restrictions on March 15, 1994. NMED conducted its annual waste compliance inspection the week of September 14, 1994. NMED issued a RCRA compliance order (CO) to DOE/LANL in 1994 based upon a self-reported incident; another CO was issued as a result of findings from the 1993 multimedia inspection, which included NMED's annual RCRA compliance inspection. Proposed fines totaled $273,000. All required actions were completed. The final negotiated penalties totaled $75,770.

No underground storage tanks were removed during 1994. During 1994, the Laboratory's Environmental Restoration program submitted four RCRA facility investigation (RFI) work plans and two addenda to RFI work plans. Other laws regulating hazardous material management and disposal, storage, and treatment include

- Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act
- Emergency Planning and Community Right-to-Know Act

- Toxic Substances Control Act
- Federal Insecticide, Fungicide, and Rodenticide Act

Foodstuffs Monitoring. Foodstuffs are collected from Laboratory and surrounding communities to determine the impact of LANL operations on the human food chain. Most produce, milk, fish, and honey samples from Laboratory and/or perimeter locations showed no radioactivity distinguishable from that attributable to natural sources or worldwide fallout. Some honey samples from on-site locations, particularly from TA-53, had elevated tritium concentrations (1,300 pCi/mL) as compared to background (0.37 pCi/mL). However, honey from hives on Laboratory property is not available for public consumption.

Resource Assessments. In accordance with the National Environmental Policy Act of 1969, federal agencies must consider the environmental impacts of proposed activities. In 1994, the Laboratory's Environmental Assessments and Resource Evaluations group reviewed 953 actions proposed to be undertaken at the Laboratory. Other requirements concerning cultural and biological resources that are reviewed at the Laboratory include

- National Historic Preservation Act
- Endangered Species Act
- Executive Order 11988, Floodplain Management
- Executive Order 11990, Protection of Wetlands

A. Los Alamos National Laboratory

In March 1943, a small group of scientists came to Los Alamos, located on a remote mesa high above the Rio Grande, northwest of Santa Fe 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 be completed by a hundred 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.

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. Los Alamos is a multiprogram laboratory with the central mission of reducing the nuclear danger. The central mission at the Laboratory has evolved beyond the nuclear weapons research, development, and testing role to now include five major elements:

- environmental stewardship of the Department of Energy (DOE) complex;
- nuclear materials stewardship through protection, disposition, and fabrication technologies;
- stockpile stewards;
- support for the enduring stockpile; and
- prevention, detection, and analysis of nuclear weapons proliferation.

Today we use the core technical competencies developed for defense programs to carry out both our national security responsibilities and our broadly based programs to improve

- the quality of the environment;
- energy recovery and usage;
- our national infrastructure;
- our economic and industrial competitiveness;
- leadership in research; and
- the quality of science and technology through improved education and research opportunities and training.

We emphasize an intermediate role for the Laboratory—between academic and industrial research—that will help expedite the development and commercialization of emerging technologies. In all our programs, we continue to maintain an intellectual environment that is open to new ideas. In addition, we are committed to ensuring that all our activities are designed to protect employees, the public, and the environment (LANL 1994).

The operating cost of the Laboratory for fiscal year 1994 (FY94) was $1,002 million, with an additional $43 million for capital equipment and $5 million for construction. In FY94, $868 million of the operating cost was spent on DOE programs, including $388 million on defense programs, $192 million on Environmental Restoration and Waste Management, and $86 million on Nonproliferation and International Security. Approximately $134 million is spent on work for others, including $78 million on Department of Defense projects.

In August 1994, the Laboratory employed more than 6,500 persons in permanent positions; approximately 39% of these employees are technical staff members, 7% are managers, 12% are support staff members, 26% are technicians, and 16% are either office or general support. The Laboratory also employed another 2,500 people in special programs such as work-study programs, graduate research positions, and limited-term employees. In addition, more than 4,150 people are employed by contractors providing support services, protective force services, and specialized scientific and technical services.

The Laboratory contract is administered through the DOE Los Alamos Area Office and the Albuquerque Operations Office. The Laboratory Director is ultimately responsible for all Laboratory activities. However, technical and administrative responsibility and authority have been delegated to directorates and technical and support offices.

II. Introduction

During 1994, the Laboratory's organization structure was altered in an effort to eliminate several layers of management. The Director is supported by a Deputy Director; both the Director and the Deputy Director are supported by Special Assistants. The current Laboratory management structure consists of 18 division offices, 10 program offices, and 6 institutional offices.

The Environmental Management (EM) Division was also reorganized and renamed during 1994. Groups that had been involved in environmental protection and surveillance activities were reorganized as follows:

- The Waste Management Group (EM-7) first became part of the Chemical Science & Technology (CST) Division and was further divided into groups within the Division that correlated roughly to the sections in the original EM-7 Group:

CST-5	Chemical and Mixed Waste Science
CST-7	Transuranic Characterization & Treatment & Decontamination
CST-13	Liquid Waste & Radioactive Liquid Waste Treatment Facility Project Office
CST-14	Radioactive Waste
CST-16	Thermal Destruction Science & Technology
CST-18	Technology Implementation
CST-27	Facility Management Office

- The Environmental Protection Group (EM-8) first became part of the newly organized Environmental, Safety, and Health (ESH) Division and was further divided into groups that correlate roughly to sections in the original EM-8 Group.

ESH-17	Air Quality
ESH-18	Water Quality & Hydrology
ESH-19	Hazardous & Solid Waste
ESH-20	Environmental Assessments and Resource Evaluations

In addition, two project offices were created

Site-Wide Environmental Impact Statement (SWEIS); and
Order Compliance & Self-Assessment.

- The Environmental Chemistry Group (EM-9) first became CST-9 and was later divided into smaller groups:

CST-3	Analytical Services
CST-9	Inorganic Trace Analysis
CST-11	Nuclear & Radiochemistry
CST-12	Organic Analysis

In 1994, the ESH Division was the primary Laboratory support program for environmental protection and surveillance activities. Groups in ESH Division initiate and promote Laboratory programs for environmental protection and are responsible for environmental surveillance and regulatory compliance. Although the Laboratory Director has primary responsibility for ESH management, ESH Division provides line managers with assistance in preparing and completing environmental documentation such as reports required by the National Environmental Policy Act (NEPA) of 1969 and the federal Resource Conservation and Recovery Act and its NM counterpart, the NM Hazardous Waste Act. With assistance from the Laboratory Counsel, ESH Division helps to define and recommend Laboratory policies with regard to applicable federal and state environmental regulations and laws and DOE orders and directives.

The ESH Division is responsible for tracking radiological airborne emissions from stacks around the Laboratory, for maintaining stack emission plans and quality assurance documentation, for preparing annual reports, and for communicating environmental policies to Laboratory employees and ensuring that appropriate environmental training programs are available.

Several committees provide environmental reviews for Laboratory operations. The Laboratory's ESH Identification Process, which in 1994 replaced the Environmental, Safety, and Health Questionnaire Review Committee, provides reviews of proposed projects to ensure that appropriate environmental, as well as health and safety, issues are properly addressed. In 1994, the committee reviewed 234 questionnaires. The Laboratory Environmental Review Committee reviews NEPA documentation for projects before submitting the documents to DOE. The Environmental, Safety, and Health Council provides senior management level oversight of environmental activities and policy development.

The Emergency Management Office is responsible for the Laboratory's Emergency Management Plan, which is designed for prompt mitigation of all incidents, including those with environmental impact, and provides the means for coordinating all Laboratory resources in the mitigation effort.

B. Geographic Setting

The Laboratory and the associated residential areas of Los Alamos and White Rock are located in Los Alamos County, in north central New Mexico, approximately 100 km (60 mi) north-northeast of Albuquerque and 40 m (25 mi) northwest of Santa Fe (Figure II-1). The 111-km^2 (43-mi^2) Laboratory site 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 intermittent streams (Figure II-2). Mesa tops range in elevation from approximately 2,400 m (7,800 ft) on the flanks of the Jemez Mountains to about 1,900 m (6,200 ft) at their eastern termination above the Rio Grande Canyon.

Most Laboratory and community developments are confined to mesa tops (see the inside front cover). The surrounding land is largely undeveloped, with large tracts of land north, west, and south of the Laboratory site being held by the Santa Fe National Forest, Bureau of Land Management, Bandelier National Monument, General Services Administration, and Los Alamos County (see the inside back cover). The Pueblo of San Ildefonso borders the Laboratory to the east.

The Laboratory is divided into technical areas (TAs) that are used for building sites, experimental areas, waste disposal locations, roads, and utility rights-of-way (see Figure II-3 and Appendix C). However, these uses account for only a small part of the total land area. Most land provides buffer areas for security and safety and is held in reserve for future use.

DOE controls the area within Laboratory boundaries and has the option to completely restrict access. The public is allowed limited access to certain areas of the Laboratory. An area north of Ancho Canyon (see Figure II-4) between the Rio Grande and State Road 4 is open to hikers, rafters, and hunters, but woodcutting and vehicles are prohibited. Portions of Mortandad and Pueblo canyons are also open to the public. Archaeological sites at Otowi Tract northwest of State Road 502 near White Rock and in Mortandad Canyon are open to the public, subject to restrictions protecting cultural resources.

In August 1977, the Laboratory site was dedicated as a National Environmental Research Park (NERP), a program managed by DOE in response to recommendations from environmental visionaries to set aside land for ecosystem preservation and study. In addition to Los Alamos, six other NERPs are located at DOE facilities and associated with national laboratories. The ultimate goal of programs associated with this regional facility is to encourage environmental research that will contribute to understanding how people can best live in balance with nature while enjoying the benefits of technology. Recent research emphasizes understanding the fundamental processes governing the interaction of ecosystems and the hydrologic cycle on the Pajarito Plateau. The following specific data sets and database information have been developed as part of this program:

- Maps, including topographical and aerial photographs at several scales.
- Habitat characterization/population dynamics, including lists of plant, fish, reptile, bird, and invertebrate species.
- Life history studies of Rocky Mountain mule deer, elk, and small mammals.
- Endangered species studies of the gramma grass cactus, peregrine falcon, and Jemez Mountain salamander.
- Fire ecology, including nutrient cycling and long-term fire succession.
- Long-term water and nutrient dynamics on piñon-juniper habitats.
- Computer-based interactive overlay mapping system.

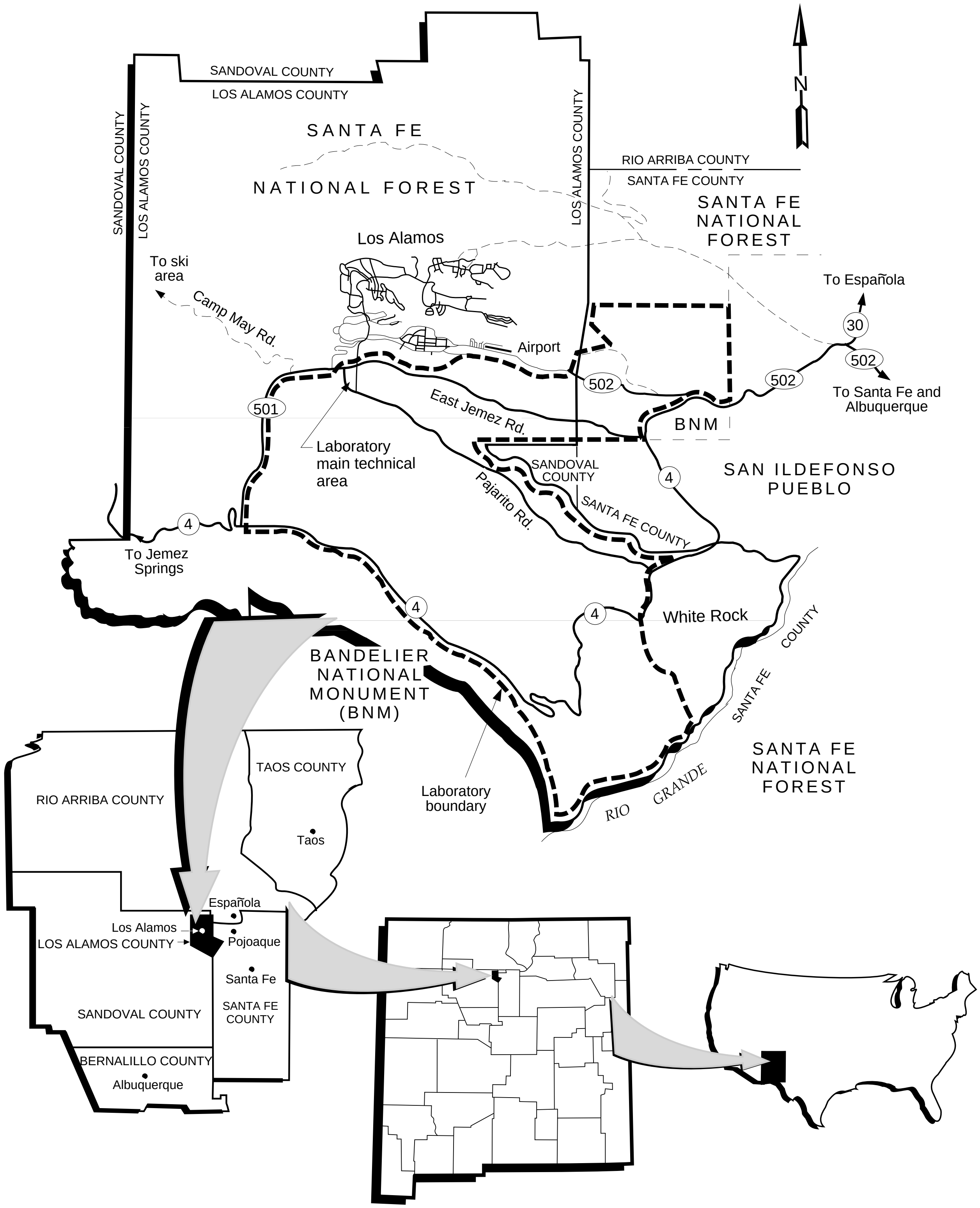

Figure II-1. Regional Location of Los Alamos National Laboratory.

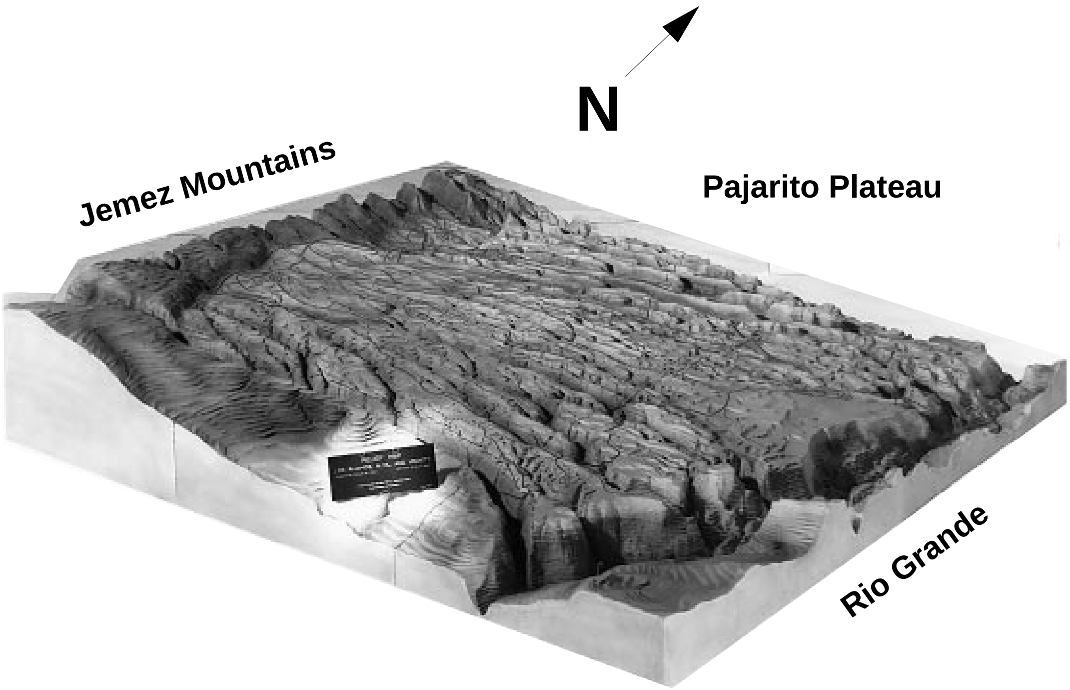

Figure II-2. Topography of the Los Alamos area.

- Climatology data, including 45 years of precipitation data and 23 years of wind data and solar radiation.
- Soil surveys.
- A long-term environmental surveillance database on radionuclides and stable elements in environmental media.
- Long-term vegetation map with species occurrences.
- Root distributions of native plants.

The NERP program was inactive in 1994 because of funding constraints.

Environmental Impact Statement. An environmental impact statement that assessed potential cumulative environmental impacts associated with then, known future, and continuing activities at the Laboratory was completed in 1979 (DOE 1979). The report provided environmental input for decisions regarding continuing activities at the Laboratory. Since then, the environmental impacts of major new or revised Laboratory projects and facilities have been evaluated individually under NEPA.

In 1994, DOE initiated work on an updated SWEIS for the LANL facility. In November 1994, DOE held a series of public meetings throughout northern New Mexico in order to identify issues and concerns that would be addressed in the new LANL SWEIS. In December, the Laboratory established its SWEIS Project Office in order to support DOE and to be a single point of contact within the Laboratory in both collecting and disseminating information.

The purpose of the new SWEIS is to provide a comprehensive and cumulative look at the environmental impacts of both ongoing Laboratory activities and projected future activities of the Laboratory. The SWEIS will address operations and planned activities foreseen within the next five to ten years. It will enable the Laboratory to become a better steward of the environment and a better planner for the future. The SWEIS will describe the major activities at the Laboratory and the most important impacts as determined through a scoping process involving the

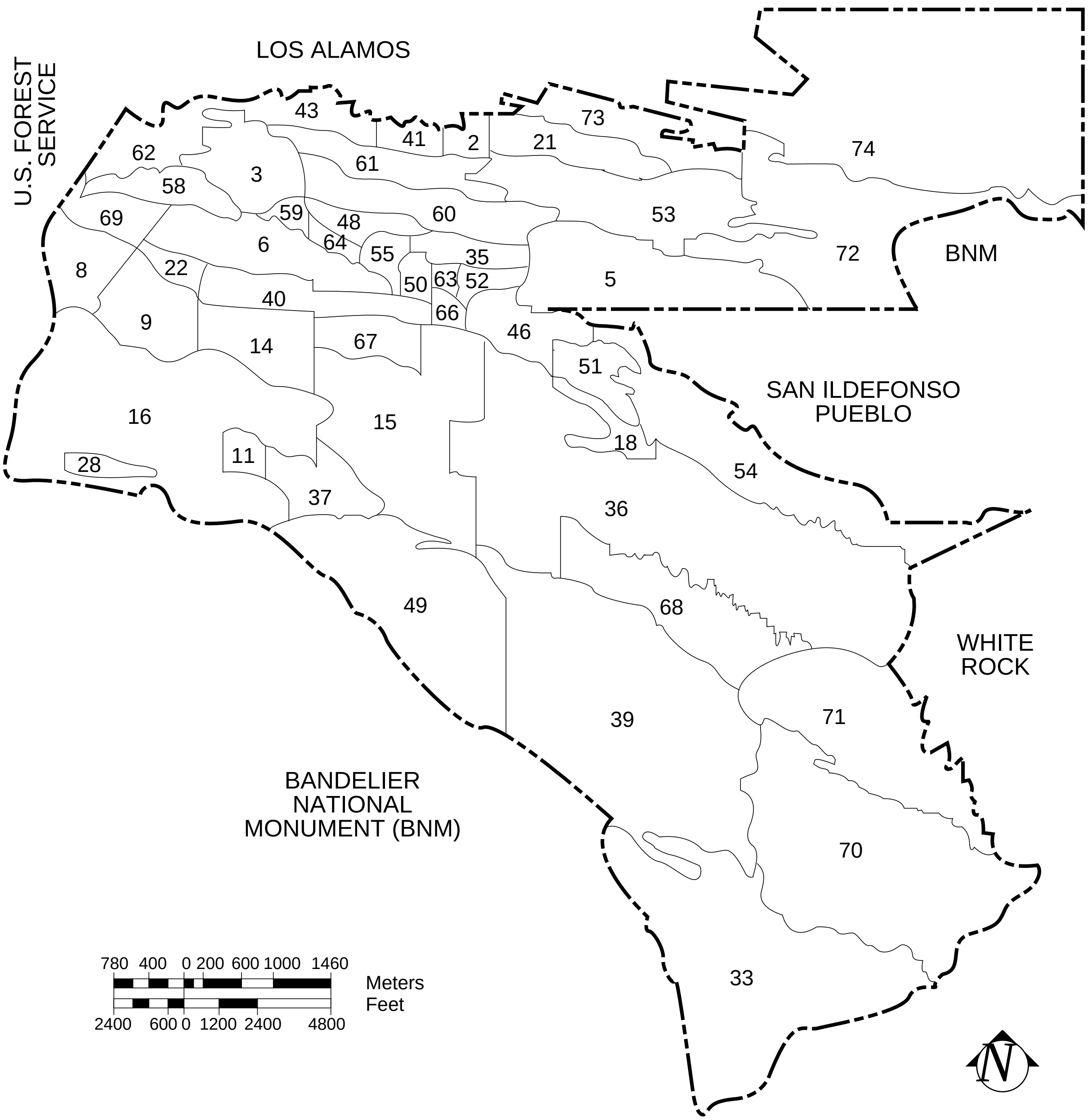

Figure II-3. Technical areas (TAs) of Los Alamos National Laboratory in relation to surrounding landholdings.

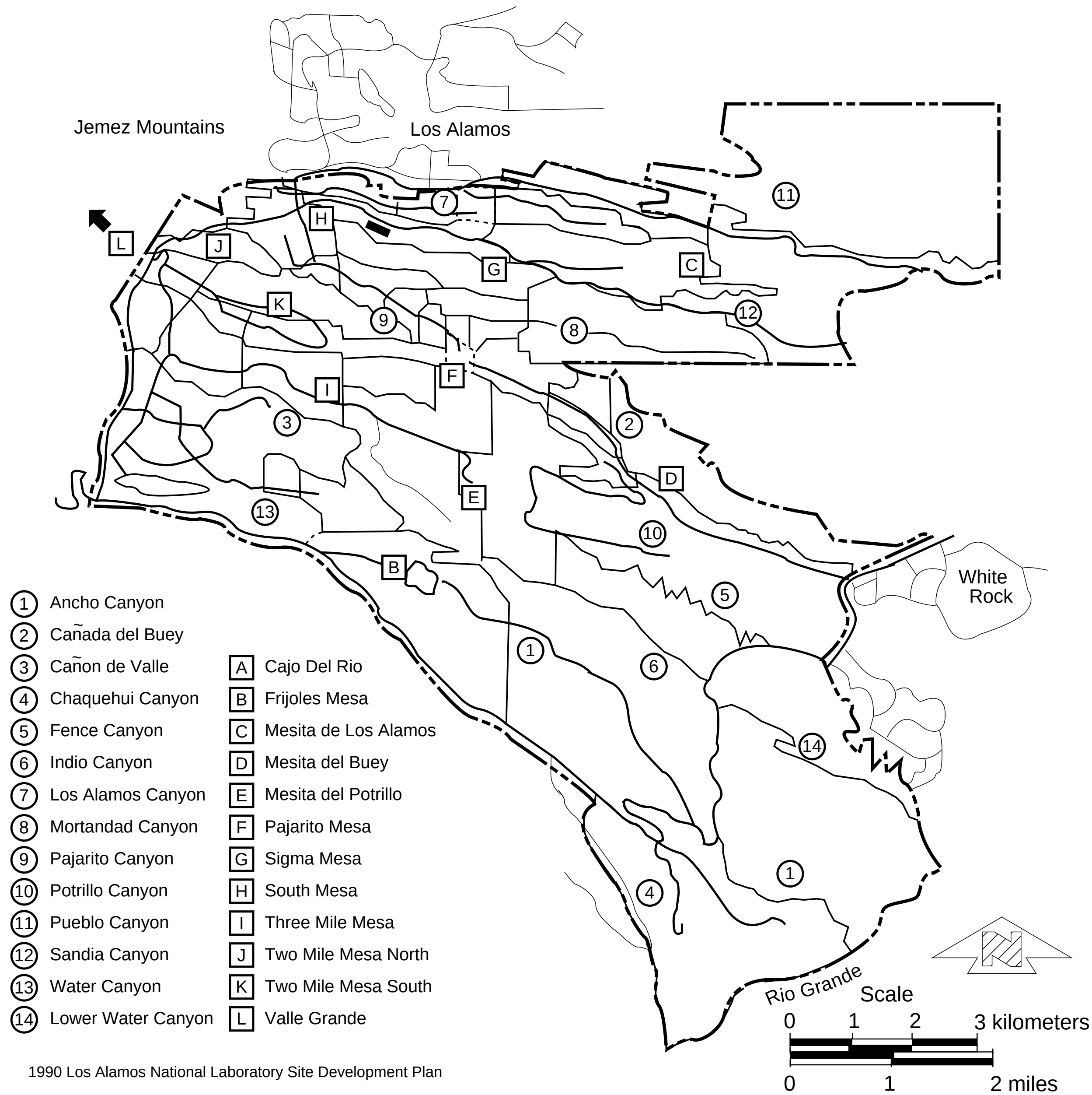

Figure II-4. Major canyons and mesas.

public. While the SWEIS is in preparation during 1995 and 1996, major new initiatives cannot take place unless they are justified independently and are the subject of separate NEPA documentation.

C. Geology and Hydrology

Most of the finger-like mesas in the Los Alamos area are formed from Bandelier Tuff, which includes ash fall, ash fall pumice, and rhyolite tuff (Figure II-5). The tuff, ranging from nonwelded to welded, is more than 300 m (1,000 ft) thick in the western part of the plateau and thins to about 80 m (260 ft) eastward above the Rio Grande. It was deposited as a result of major eruptions in the Jemez Mountains volcanic center about 1.2 to 1.6 million years ago.

The 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 (Figure II-5) in the central and eastern edge along the Rio Grande. Chino Mesa basalts interfinger with the conglomerate along the river. These formations overlay the sediments of the Santa Fe Group, which extend across the Rio Grande Valley and are more than 1,000 m (3,300 ft) thick. The Laboratory is bordered on the east by the Rio Grande, within the Rio Grande Rift. Because the rift is slowly widening, the area experiences frequent but minor seismic disturbances.

Surface water in the Los Alamos area occurs primarily as short-lived or intermittent reaches of streams. Perennial springs on the flanks of the Jemez Mountains supply base flow into upper reaches of some canyons, but the volume is insufficient to maintain surface flows across the Laboratory site before they are depleted by evaporation, transpiration, and infiltration. Runoff from heavy thunderstorms or heavy snowmelt reaches the Rio Grande several times a year in some drainages. Effluents from sanitary sewage, industrial waste treatment plants, and cooling-tower blowdown enter some canyons at rates sufficient to maintain surface flows for varying distances.

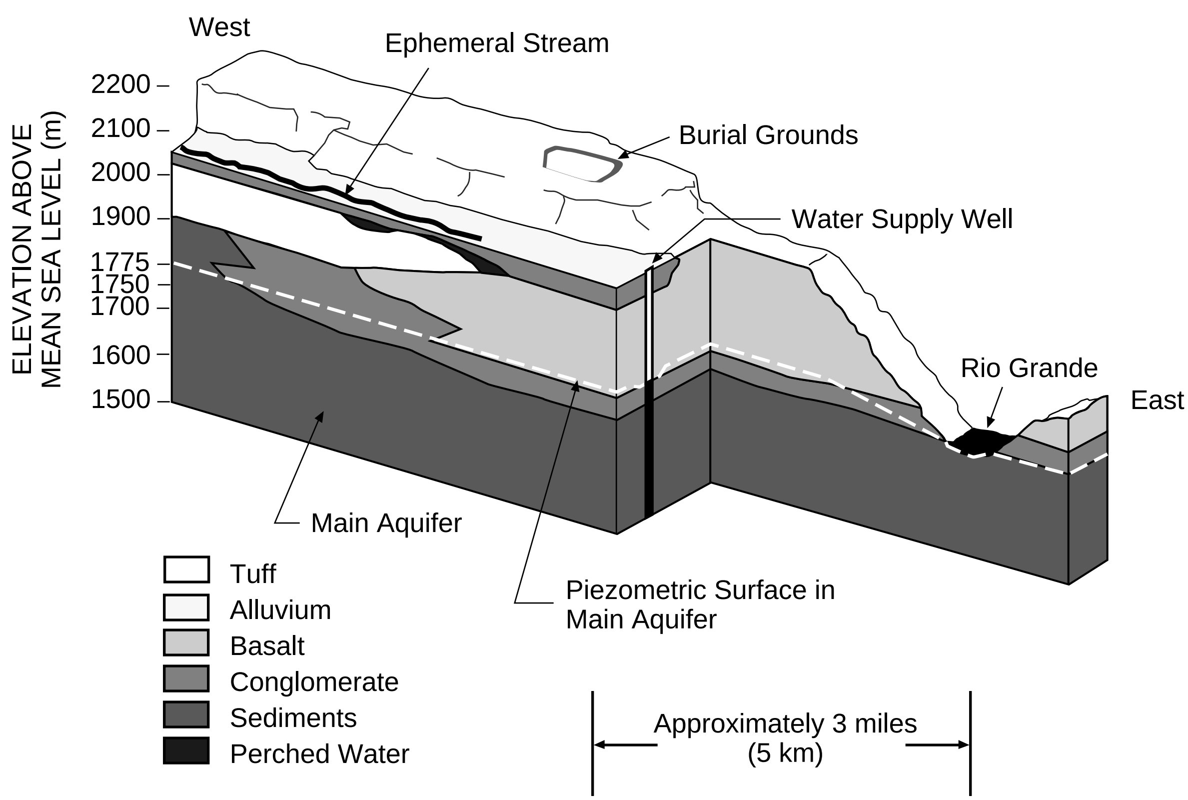

Figure II-5. Conceptual illustration of geologic and hydrologic relationship in Los Alamos area.

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 main aquifer of the Los Alamos area.

Ephemeral and interrupted streams have deposited alluvium that ranges from less than 1 m (3 ft) to as much as 30 m (100 ft) in thickness. Runoff in canyons infiltrates the alluvium until its downward movement is impeded by layers of weathered tuff and volcanic sediment that are less permeable than the alluvium. This creates shallow bodies of perched groundwater that move down gradient within the alluvium. As water in the alluvium moves down the canyon, it is depleted by evapotranspiration and movement into underlying volcanics (Purtymun 1977). The chemical quality of the perched alluvial groundwaters show the effects of discharges from the Laboratory.

Perched groundwater occurs at intermediate depths in conglomerates and basalts beneath the alluvium in portions of Pueblo, Los Alamos, and Sandia canyons. It has been found at depths of about 37 m (120 ft) in the midreach of Pueblo Canyon, about 45 to 60 m (150 to 200 ft) beneath the surface in lower Pueblo and Los Alamos canyons near their confluence, in basalts in Los Alamos Canyon at 61 to 76 m (200 to 250 ft) (Figure II-5), and in Sandia Canyon near the eastern Laboratory boundary at a depth of about 137 m (450 ft). This intermediate-depth perched water has one known discharge point at Basalt Spring in Los Alamos Canyon. The intermediate-depth groundwaters communicate with the overlying perched alluvial groundwaters and show the effects of radioactive and inorganic contamination from Laboratory operations.

The main aquifer of the Los Alamos area is the only aquifer in the area capable of serving as a municipal water supply. The surface of the aquifer rises westward from the Rio Grande within the Tesuque Formation into the lower part of the Puye Formation beneath the central and western part of the plateau. Depth to the main aquifer is about 300 m (1,000 ft) beneath the mesa tops in the central part of the plateau. The main aquifer is separated from alluvial and perched waters by about 110 to 190 m (350 to 620 ft) of tuff and volcanic sediments with low (<10%) moisture content.

Water in the main aquifer is under artesian conditions near the Rio Grande (Purtymun 1974b). Continuously recorded data on water levels collected in test wells since fall 1992 indicate that the main aquifer exhibits confined aquifer response to barometric and earth tide effects at several locations across the plateau. Major recharge to the main aquifer is probably from the west because the piezometric surface slopes downward to the east. The main aquifer discharges into the Rio Grande through springs in White Rock Canyon. The 18.5-km (11.5-mi) reach of the river in White Rock Canyon between Otowi Bridge and the mouth of Rito de los Frijoles receives an estimated 5.3 to 6.8 x 10^6 m^3 (4,300 to 5,500 ac-ft) annually from the aquifer.

D. Climatology

Bowen (1990) published a comprehensive climatology of the Los Alamos area based on observations at several meteorological-observing stations within the Laboratory's boundary. This early work was followed by a summary document (Bowen 1992) that used more recent observations. These documents should be consulted for detailed analyses and station-to-station comparisons.

The climate description presented here summarizes some of the Bowen analyses supplemented with recent observations of wind patterns in Los Alamos canyon and evapotranspiration. The material is organized in sections that discuss the meteorological variables related to (1) the state of the atmosphere (its temperature, pressure, and moisture), (2) precipitation, (3) wind conditions, and (4) the exchange of energy at the surface. Normal values are based on observations taken at the official Los Alamos meteorological-observing station from 1961 to 1990. When extremes are given, the entire record is used. Although the location of the "official" station has changed over the years, all locations are within 30 m (100 ft) of each other in elevation and 5 km (3 mi) in distance. The composite record from the official station is used to describe the climate of the Pajarito Plateau, at an elevation of approximately 2,250 m (7,400 ft) above sea level.

In general terms, Los Alamos has a temperate mountain climate with four distinct seasons. Spring tends to be windy and dry. Summer begins with warm, often dry, conditions in June, followed by a two-month rainy season. In the autumn there is a return to drier, cooler, and calmer weather. And in winter, mid-latitude storms drop far enough south to keep the ground covered with snow for about two months. Details of the climate are presented below.

Atmospheric State. In July, the warmest month of the year, the temperature ranges from an average daily high of 27.2˚C (81˚F) to an average daily low of 12.8˚C (55˚F). The extreme daily high temperature in the record is 35˚C

(95˚F). In January, the coldest month, the temperature ranges from an average daily high of 4.4˚C (40˚F) to a low of –8.3˚C (17˚F). The extreme daily low temperature in the record is –27.8˚C (–18˚F). The large daily range in temperature results from the site's relatively dry, clear atmosphere, which allows strong solar heating during the daytime and rapid radiative cooling at night.

Although the dry atmosphere promotes rapid nighttime cooling near the ground, this cooling is somewhat counterbalanced by the flux of heat from above, generated by turbulence in the drainage flow. Therefore, the strong surface-based temperature inversions often observed in valleys are not observed on the Pajarito Plateau. Inversions of 3˚C (5.4˚F) more than 100 m (328 ft) are typical, and these are generally destroyed in less than 2 hours after sunrise.

Average atmospheric pressure at the official observing station is 776 mbar (22.92 in. of mercury), which is 76% of standard sea level pressure. The average near-surface air density for the site is 0.958 kg/m^3; this is based on a calculation using the mean pressure and temperature at the official observing station.

Although relative humidity can vary considerably over 24 hours, monthly average values vary little during the year. Monthly average relative humidity ranges from a low of 39% in June to a high of 56% in December, averaging 51% over the entire year. Absolute humidity, a better indicator of atmospheric moisture content, ranges from a low of 2.4 g of water/m^3 of air in January to a high of 8.7 g/m^3 in July and August, when moist, subtropical air invades the region during the rainy season. Fog in Los Alamos is very rare, occurring less than five times a year on average.

Precipitation. ***T***he average annual precipitation (rainfall plus the water-equivalent of frozen precipitation) is 47.6 cm (18.7 in.). However, the annual total fluctuates considerably from year to year; the standard deviation of these fluctuation is 12.2 cm (4.8 in.). The lowest recorded annual precipitation is 17.3 cm (6.8 in.) and the highest is 77.1 cm (30.3 in.). The maximum precipitation recorded for a 24-h period is 8.8 cm (3.5 in.). The maximum 15-min precipitation in the record is 2.3 cm (0.9 in.).

Because of the eastward slope of the terrain, there is a large east-to-west gradient in precipitation across the plateau. White Rock often receives 13 cm (5.1 in.) less annual precipitation than does the official observing station, and the eastern flanks of the Jemez often receive 13 cm (5.1 in.) more.

About 36% of the annual precipitation falls from convective storms during July and August. Most of these convective storms are of the single-cell type; local conditions do not support the development of supercells and the severe weather associated with them.

This summertime precipitation maximum is often referred to as the "monsoon" season. However, the signature of a true monsoon circulation, namely large and persistent changes in wind direction, is not observed. "Rainy season" is probably a more accurate characterization of the July–August period.

Lightning occurs frequently in Los Alamos. In an average year Los Alamos experiences 61 thunderstorm days a year, about twice the national average. (A thunderstorm day is defined as a day on which thunder is heard or a thunderstorm occurs.) Only in the southeastern part of the country is this frequency exceeded. In addition to lightning, hail often accompanies these summertime convective storms. Hailstones of 0.6 cm (0.25 in.) are common, but stones of 2.54 cm (1 in.) have been reported. Hail has caused significant damage to property and vegetation, and localized accumulations of 7.6 cm (3 in.) have been observed.

Winter precipitation occurs mostly as snow; freezing rain is rare. The snow is generally dry; on average 20 units of snow is equivalent to 1 unit of water. Annual snowfall averages 150 cm (59 in.) but is quite variable. The standard deviation of fluctuations in the annual value is 71 cm (28 in.). The highest recorded snowfall for one season is 389 cm (153 in.), and the highest recorded snowfall for a 24-h period is 56 cm (22 in.). In a typical winter season, snowfalls equal to or exceeding 2.6 cm (1 in.) occur on 14 days, and snowfalls equal to or exceeding 10.2 cm (4 in.) occur on four days. The extreme single-storm snowfall in the record is 122 cm (4 ft).

Wind Conditions. Los Alamos winds are generally light, having an annual average (at the Technical Area [TA] 6 station) of 2.5 m/s (5.5 mi/h). However, the period from mid-March to early June is apt to be windy. During this windy period, sustained wind speeds exceeding 4 m/s (8.8 mi/h) occur 20% of the time during the daytime, and the daily maximum wind gust exceeds 14 m/s (31 mi/h) about 20% of the time. The highest wind gust in the record is 34.4 m/s (77 mi/h). High winds are associated with frontal passages, thunderstorms, and mid-latitude storm systems. No tornadoes are known to have touched ground in the Los Alamos area; however, funnel clouds have been observed in Los Alamos and Santa Fe counties.

Winds over the plateau show considerable spatial structure and temporal variability. The relatively dry climate promotes strong solar heating during the daytime and radiative cooling by night. And because the topography is very complex, the heating and cooling rates are uneven over the area. When the large-scale pressure gradient is weak, thermally generated local flows develop and respond to the heating/cooling cycle.

During sunny, light-wind days, an upslope flow often develops over the plateau in the morning hours. This flow is more pronounced along the western edge of the plateau, where it is 200 to 500 m (650 to 1,650 ft) deep. By noon, southerly flow usually prevails over the entire plateau.

The prevailing nighttime flow over the western portion of the site is west-southwesterly to northwesterly. These nighttime westerlies result from cold air drainage off the Jemez Mountains and the Pajarito Plateau; the drainage layer is typically 50 m (165 ft) deep in the vicinity of TA-6. At stations farther from the mountains, the nighttime direction is more variable but usually has a relatively strong westerly component. Just above the drainage layer, the prevailing nighttime flow is southwesterly.

Analysis of observations taken at TA-41 in Los Alamos Canyon shows that atmospheric flow in canyons is quite different from flow over the plateau. During the nighttime, down-canyon drainage flow is observed about 75% of the time. This gravity flow is steady and continues for an hour or two after sunrise, when it abruptly ceases and is followed by an unsteady up-canyon flow for a couple of hours. The up-canyon flow usually gives way to the development of what appears to be a rotor that fills the canyon when the wind over the plateau has a strong cross-canyon component. When the rotor occurs, southwesterly (or southeasterly) flow over the plateau results in northwesterly (or northeasterly) flow at the canyon bottom. Down-canyon flow begins again around sunset, but the onset time appears to be more variable than cessation time in the morning. Rotors have been observed at night, but they are very rare.

Turbulence intensity—when expressed as the standard deviation of fluctuations in the horizontal wind direction—has a median value of 22° during the day. Other things being equal, this value is larger than would be observed over flatter, smoother sites. At night, when the atmosphere is stable, the median value of the standard deviation of wind direction fluctuations drops to 15°.

Atmospheric dispersion potential is often related to a stability parameter that ranges from A to F (good to poor mixing potential). When this parameter is based on wind direction fluctuations measured at the TA-6 station, the frequency of occurrence of different stability parameter values is A: 16.5%, B: 11.8%, C: 15.7%, D: 22.5%, E: 14.2%, and F: 19.3%. Statistics vary from station to station.

Energy Exchange at the Surface. Solar irradiance measurements show that Los Alamos receives more than 75% of possible sunshine annually. (Possible sunshine is defined as the amount received when the sky is cloud-free.) During most of the year, when there is no snow on the ground, about 80% of this incoming solar energy is absorbed at the surface. About half of this absorbed shortwave energy is offset by longwave radiation to space. The remainder of the radiant energy, called the net all-wave radiation, is dissipated by heating the soil, heating the lower layer of the atmosphere, and evaporating water from the soil and plants (called evapotranspiration). Preliminary analyses suggest that monthly total evapotranspiration reaches a maximum value of 6.4 cm (2.5 in.) in July. Monthly totals during the winter months are less than 0.6 cm (0.25 in.). Over the entire year, it appears that evapotranspiration totals approximately 90% of the annual precipitation.

E. Ecology

The diversity of ecosystems in the Los Alamos area is due partly to the dramatic 1,500 m (5,000 ft) elevation gradient from the Rio Grande on the east to the Jemez Mountains 20 km (12 mi) to the west and partly to the many steep canyons that dissect the area. Six major vegetative complexes or community types are found in Los Alamos County: juniper-grassland, piñon-juniper, ponderosa pine, mixed conifer, spruce-fir, and subalpine grassland. The juniper-grassland 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 1,700 and 1,900 m (5,600 to 6,200 ft). The piñon-juniper community, generally in the 1,900- to 2,100-m (6,200- to 6,900-ft) elevation range, covers large portions of the mesa tops and north-facing slopes at the lower elevations. Ponderosa pines are found in the western portion of the plateau in the 2,100- to 2,300-m (6,900- to 7,500-ft) elevation range. These three communities predominate, each occupying about one-third of the Laboratory site. The mixed conifer community, at an elevation of 2,300 to 2,900 m (7,500 to 9,500 ft), overlaps the ponderosa pine community in the deeper canyons and on north slopes and extends from the higher mesas onto the slopes of the Jemez Mountains. The subalpine grassland community is mixed with the spruce-fir communities at higher elevations of 2,900 to 3,200 m (9,500 to 10,500 ft).

Because of the variety of complex, interlocking ecotones in the Los Alamos area, no single ecological structure of food webs can characterize all the associations of flora and fauna in the area. Food web relations for the biota of the Laboratory environs have been studied only enough to provide information for general descriptions and expectations. Generally, larger mammals and birds are wide ranging and utilize large habitats, from the dry mesa and canyon country at lower elevations to the high mountain tops west of the Laboratory. Smaller mammals, reptiles, invertebrates, and vegetation are more sensitive to variations in elevation and are thus confined to generally smaller habitats.

As a result of past and present use of the Laboratory environs, some areas of vegetation are undergoing secondary succession. This process has important consequences for natural systems. Farming by prehistoric Indians and by Spanish and Anglo settlers before establishment of the Laboratory created open, grassy areas on the mesas that have not yet returned to climax plant communities. These areas provide feeding areas for herbivores, especially deer and elk, and the adjacent timbered canyon slopes provide cover.

F. Cultural Resources

Approximately 65% of DOE land in Los Alamos County has been surveyed for prehistoric and historic cultural resources, and close to 1,500 sites have been recorded. More than 85% of the ruins date from the 14th and 15th centuries. Most of the sites are found in the piñon-juniper vegetation zone, with 80% lying between 1,760 and 2,150 m (5,800 and 7,100 ft) in elevation. Almost three-quarters of all ruins are found on mesa tops, which are also the preferred locations for development at the Laboratory today.

G. Population Distribution

In 1994, the estimated population of Los Alamos County was approximately 18,000 (USBC 1991). Two residential and a few commercial areas exist in the county (Figure II-1). The Los Alamos townsite (the original area of development, which now includes residential areas known as Eastern Area, Western Area, North Community, Barranca Mesa, and North Mesa) had an estimated population of 12,000. The White Rock area (including the residential areas of White Rock, La Senda, and Pajarito Acres) had about 6,000 residents. About 40% of the people employed by UC, DOE, and Laboratory contractors commute from outside Los Alamos County. It is estimated that approximately 234,000 persons lived within an 80-km (50-mi) radius of the Laboratory in 1994 (Table II-1).

Table II-1. Projected 1994/1995 Population within 80 km of Los Alamos National Laboratory[a]

	Distance from TA-53 (km)									
Direction	**0-1**	**1-2**	**2-4**	**4-8**	**8-15**	**15-20**	**20-30**	**30-40**	**40-60**	**60-80**
N	7	68	240	129	0	13	87	917	786	566
NNE	7	61	83	16	2	10	2,311	386	646	296
NE	4	7	0	0	1	1,185	14,165	2,436	2,363	3,483
ENE	0	0	0	0	540	1,456	4,282	3,426	1,369	1,493
E	0	0	0	1	313	1,291	3,852	362	21	401
ESE	0	0	0	0	7	11	652	7,408	679	2,108
SE	0	1	0	4,552	496	0	947	69,214	7,129	640
SSE	2	3	0	604	354	0	289	5,397	2,444	101
S	3	3	0	0	21	0	15	127	381	2,962
SSW	3	3	0	0	31	1	711	1,244	6,463	49,597
SW	3	11	0	0	4	1	0	0	2,037	164
WSW	1	16	29	0	7	0	26	355	2,340	4
W	0	3	83	216	0	6	61	267	57	68
WNW	2	15	969	6,155	0	0	24	28	58	2,427
NW	5	31	887	1,407	0	2	23	47	418	553
NNW	7	63	639	288	0	5	19	253	154	284
1995 Pop. Distribution	44	285	2,930	13,368	1776	3,981	27,464	91,867	27,345	65,147

[a]Total projected 1994/1995 population within 80 km of Los Alamos National Laboratory is 234,207.

Los Alamos National Laboratory (LANL or the Laboratory) operates under multiple federal and state environmental statutes, regulations, and permits that mandate compliance standards for environmental protection.

LANL had frequent interactions with federal and state Resource Conservation and Recovery Act (RCRA) and NM Hazardous Waste Act (NMHWA) personnel during 1994. The Department of Energy (DOE) and the Environmental Protection Agency (EPA) signed a Federal Facilities Compliance Agreement (FFCA) addressing mixed waste storage and treatment subject to land disposal restrictions (LDRs) on March 15, 1994. Seventeen of the FFCA's 47 milestones requiring studies, work-off plans, design of new facilities, and on- and off-site treatment of backlogged wastes in storage were due during 1994. DOE and LANL successfully complied with all 17 milestones on time. DOE and LANL received two RCRA/NMHWA compliance orders (COs) from the New Mexico Environment Department (NMED) during 1994. NMHWA COs 94-09 and 94-12 alleged violations of the act, required corrective actions, and proposed fines totaling $273,000. All required corrective actions were implemented on time or were resolved through negotiations. The final negotiated penalties totaled $75,770.

No underground storage tanks (USTs) were removed or installed during the year. An UST inspection was conducted on January 25, 1994, by the NMED. DOE received a field notice of violation (NOV) on February 24, 1994, from the inspection. The finding from the NOV was corrected on March 4, 1994. There was no petroleum release associated with this finding.

In 1994, the Laboratory was in compliance with its on-site liquid discharge requirements in 100% of the samples from its sanitary effluent outfalls and in 98.6% of the samples from its industrial effluent outfall. Concentrations of chemical and radiological constituents in the drinking water distribution system remained within federal and state water supply standards. In January, the Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) for bacteria at the North Community Fire Station (FS No. 4) and Ponderosa Estates subdivision were exceeded. The coliform contamination was eliminated by flushing the distribution systems serving these areas. Sewage sludge generated in 1994 at the Laboratory's Technical Area (TA) 46 Sanitary Waste Stream Consolidation (SWSC) plant was in full compliance with the federal standards (40 CFR Part 503) governing the beneficial reuse and land application of sewage sludge.

In September 1994, the Laboratory received notice from the Army Corps of Engineers that erosion from a road and sewer line was causing damage to Sandia Canyon wetlands. The Laboratory plans to complete the erosion control for this area in 1995.

The Laboratory was in compliance with all federal nonradiological ambient air quality standards. The Laboratory's 1994 radioactive emissions were in compliance with EPA's effective dose equivalent (EDE) limitation of less than 10 mrem/yr to members of the public from airborne emissions. The EDE is calculated to be 7.62 mrem using EPA-approved methods.

During 1994, the Laboratory prepared 131 DOE Environmental Checklists (DECs) for the National Environmental Policy Act (NEPA) and submitted them to DOE. In addition, Laboratory archaeologists evaluated 904 proposed actions for possible effects on cultural resources, which required 32 intensive field surveys. Laboratory biologists reviewed 395 proposed actions for potential impacts on threatened and endangered species; 59 actions required additional study. During 1994, 465 proposed actions were reviewed for effect on floodplains and wetlands. Two proposed projects may be inside floodplain or wetland boundaries; floodplain or wetland assessments are being prepared for these projects.

III. Compliance Summary

A. Introduction

Many Laboratory activities and operations involve or produce liquids, solids, and gases that contain radioactive and/or nonradioactive hazardous materials. Laboratory policy directs its employees to protect the environment and address compliance with applicable federal and state environmental protection regulations. This policy fulfills DOE requirements to protect the public, environment, and worker health and to comply with applicable environmental laws, regulations, and orders.

Federal and state environmental laws address handling, transport, release, and disposal of contaminants, pollutants, and wastes, as well as protection of ecological, archaeological, historic, atmospheric, and aquatic resources. Regulations provide specific requirements and standards to ensure maintenance of environmental qualities. Table III-1 presents a list of the major environmental legislation that affects the activities of the Laboratory and serves as an outline for the first section of this chapter. EPA, DOE, and NMED are the principal authorities administering the regulations to implement these laws. The environmental permits issued by these organizations and the specific operations and/or sites affected are presented in Table III-2.

The Compliance Summary is divided into two sections: Compliance Status and Current Issues and Actions. The Compliance Status section discusses the major environmental acts that the Laboratory operated under in 1994. The Current Issues and Actions section discusses other compliance issues that are not covered under the Compliance Status section.

B. Compliance Status

1. Resource Conservation and Recovery Act.

a. Introduction. EPA or an authorized state grants RCRA permits to specifically regulate hazardous waste and the hazardous component of radioactive mixed waste. A RCRA Part A permit application identifies (1) facility location, (2) owner and operator, (3) hazardous or mixed wastes to be managed, and (4) hazardous waste management units and methods. A facility that has submitted a RCRA Part A permit application for an existing unit is allowed to manage hazardous or mixed wastes under transitional regulations known as the Interim Status Requirements pending issuance of a RCRA Operating Permit (Note: The term unit as it is used in this section refers to RCRA hazardous waste management areas). The RCRA Part B permit application consists of a detailed narrative description of all facilities and procedures related to hazardous or mixed waste management that require permitting. DOE/UC was granted a hazardous waste facility permit on November 8, 1989. Table D-1 lists the hazardous waste management facilities at the Laboratory.

The EPA granted base RCRA authorization to New Mexico on January 25, 1985, transferring regulatory authority over hazardous wastes under RCRA to the NMED. State authority for hazardous waste regulation is created in the NMHWA and Hazardous Waste Management Regulations (HWMR). However, NMED has not yet obtained authorization for implementing the majority of the 1984 Hazardous and Solid Waste Amendments (HSWA). The HWMR has adopted, with a few minor exceptions, the federal codification for regulations in effect on July 1, 1993, concerning the generation and management of hazardous waste. On July 25, 1990, the State of New Mexico’s Hazardous Waste Program was authorized by the EPA to regulate mixed waste in lieu of the federal program. A Part A permit application for mixed waste storage and treatment units throughout the Laboratory was submitted on January 25, 1991, within the required six-month period. Part B permit applications were submitted for three surface impoundments in July 1991 and for several planned new hazardous and mixed waste facilities in October 1993. Negotiations with NMED on the submittal of permit modifications for the interim status units are continuing.

The Laboratory is currently negotiating with NMED a schedule to submit permit applications and modifications. The applications will address several categories of waste handling units, including the following: development of new treatment capabilities and associated support units for compliance with the EPA FFCA and Federal Facilities Compliance Act (FFCAct); proposed new construction units to handle waste currently being generated; and proposed units under development for the handling of wastes generated by the Environmental Restoration (ER) Project. Competition for funding of these permitting activities is driven by compliance needs. The permit modification for the retrieval of mixed transuranic (TRU) waste from TA-54, Area G, storage pads 1, 2, and 4 was conditionally approved by NMED on May 11, 1994.

Table III-1. Major Environmental Acts under which the Laboratory Operated in 1994

Legislation	Federal Regulatory Citation	Responsible Agency	Related Legislation and Regulations
Resource Conservation and Recovery Act (RCRA)	40 CFR 257, 258, 260–268, 270–272, 280, and 281	EPA/NMED	Hazardous and Solid Waste Amendments Federal Facilities Compliance Act Amendments NM Hazardous Waste Act NM Hazardous Waste Management Regulations NM Solid Waste Act NM Solid Waste Regulations NM Groundwater Protection Act NM Underground Storage Tank Regulations
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	40 CFR 300–311	EPA	Superfund Amendments and Reauthorization Act (SARA) Designation, Reportable Quantities, and Notification NM Emergency Management Act
Emergency Planning and Community Right-to-Know Act (EPCRA)	40 CFR 350–373	EPA	Executive Order 12856
Toxic Substances Control Act (TSCA)	40 CFR 700–766	EPA	
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	40 CFR 150–189	EPA/NM Department of Agriculture	NM Pest Control Act
Clean Water Act (CWA)	40 CFR 121–136 40 CFR 400–424	EPA	National Pollutant Discharge Elimination System (NPDES)
		NMED/WQCC	NM Water Quality Control Commission Regulations NM Liquid Waste Disposal Regulations NM Oil Conservation Division - Groundwater Discharge Plan, Fenton Hill NM Water Quality Act Water Quality Standards for Interstate & Intrastate Streams in NM
	40 CFR 110–113	EPA	Oil Pollution Prevention Spill Prevention Control and Countermeasures (SPCC)
	40 CFR 116	EPA	Designation of Hazardous Substances

Table III-1. Major Environmental Acts under which the Laboratory Operated in 1994 (Cont.)

Legislation	Federal Regulatory Citation	Responsible Agency	Related Legislation and Regulations
Clean Water Act (CWA) (Cont.)	40 CFR 117	EPA	Determination of Reportable Quantities for Hazardous Substances
Safe Drinking Water Act (SDWA)	40 CFR 141–148	EPA/NMED	NM Water Supply Regulations
Federal Clean Air Act (CAA)	40 CFR 50–99	EPA/NMED	
National Environmental Policy Act (NEPA)	40 CFR 1500–1508, 10 CFR 1021	Council on Environmental Quality/DOE	
National Historic Preservation Act (NHPA)	36 CFR 800	State Historic Preservation Officer	NM Cultural Properties Act
		National Advisory Council on Historic Preservation	EO 11593
Archaeological Resources Protection Act (ARPA)	43 CFR 7	Not Applicable	
American Indian Religious Freedom Act (AIRFA)	None	Not Applicable	
Native American Graves Protection and Repatriation Act (NAGPRA)	None	Not Applicable	
Endangered Species Act	50 CFR 402	U.S. Fish and Wildlife/ NM Game and Fish	Fish and Wildlife Coordination Act NM Wildlife Conservation Act NM Endangered Plant Species Act
Floodplain Management	Executive Order 11988	DOE	10 CFR 1022 Clean Water Act, Section 404, Rivers and Harbors Act
Protection of Wetlands	Executive Order 11990	DOE	10 CFR 1022 Clean Water Act, Section 404, Rivers and Harbors Act
Atomic Energy Act		Nuclear Regulatory Commission/DOE/EPA	

Table III-2. Environmental Permits or Approvals under which the Laboratory Operated in 1994

Category/Agency	Approved Activity	Issue Date	Expiration Date	Administering
RCRA hazardous waste facility[a]	Hazardous waste storage, treatment, and disposal permit	November 1989	November 1999	NMED
	Postclosure care	Application submitted September 1988		NMED
	RCRA Mixed Waste	Part A application submitted January 1991		NMED
		Part B application submitted July 1991 (TA-53 Surface Impoundments [3])	—	NMED
		Revised Part A application submitted October 1993	—	NMED
	Two RD&D Permits for Packed Bed Reactor/ Silent Discharge Plasma Treatment Unit and Hydrothermal Processing Unit	Both issued on April 21, 1994		NMED
HSWA	RCRA Corrective Activities	March 1990	December 1999	EPA
PCBs[b]	Disposal of PCBs at TA-54, Area G	June 5, 1980	—	EPA
PCB oil (TSCA)	Incineration of PCB oils[c]	October 9, 1992	October 9, 1997	EPA
NPDES[d], Los Alamos	Discharge of industrial and sanitary liquid effluents	Modified permit New permit effective August 1, 1994	March 1, 1991[e]	EPA
	Storm water associated with industrial activity	General permit submitted September 29, 1992 authorization received August 25, 1993	October 1, 1997	EPA

Table III-2. Environmental Permits or Approvals under which the Laboratory Operated in 1994 (Cont.)

Category/Agency	Approved Activity	Issue Date	Expiration Date	Administering
	Storm water associated with construction activity	A-53 Sanitary Pipeline submitted October 1, 1992	[f]	EPA
		US West Ductbank submitted October 1, 1992	[f]	EPA
		DARHT Facility submitted May 20, 1994	[f]	EPA
		Small Arms Firing Range submitted August 18, 1994	[f]	EPA
NPDES, Fenton Hill	Discharge of industrial liquid effluents	October 15, 1979	June 30, 1983[d]	EPA
NMLWD Regulations[g]	Discharge of sanitary effluents from septic tank systems into soil	[f]		NMED
Groundwater discharge plan, Fenton Hill	Discharge to groundwater	July 9, 1990	June 5, 1995	NMOCD[h]
Groundwater discharge plan, TA-46 Sanitary Wastewater Treatment Plant	Discharge to groundwater	July 20, 1992	July 20, 1997	NMED
Air Quality (NESHAP)[i]	Construction and operation of five beryllium facilities	December 26, 1985; March 19, 1986[j]; September 8, 1987; July 1, 1994		NMED

Table III-2. Environmental Permits or Approvals under which the Laboratory Operated in 1994 (Cont.)

Category/Agency	Approved Activity	Issue Date	Expiration Date	Administering
Open Burning (AQCR 301)	Fuel fire for ordnance testing, TA-11	June 16, 1994	June 16, 1995	NMED
Open Burning (AQCR 301)	Burning of scrap wood from experiments, TA-36	June 14, 1993 July 21, 1994	June 14, 1994 July 21, 1995	NMED NMED
Open Burning (AQCR 301)	Burning of HE-contaminated materials, TA-14	December 2, 1993	December 2, 1993	NMED
Open Burning (AQCR 301)	Burning of HE-contaminated materials, TA-16	December 2, 1993	December 2, 1993	NMED
Open Burning (AQCR 301)	Burning of wood for Light Imaging Radar Testing, TA-33 and TA-39	August 11, 1994	August 11, 1995	NMED
Open Burning (AQCR 301)	Burning of metals for ordnance testing, TA-41	August 11, 1994	August 11, 1995	NMED

[a]See Table D-1 for specific permitted activities.
[b]Polychlorinated biphenyls.
[c]No incineration occurred during 1993 even though the activity was permitted.
[c]National Pollutant Discharge Elimination System.
[d]Permit administratively extended while new permit is pending.
[f]Dates vary depending on individual permits.
[g]New Mexico Liquid Waste Disposal Regulations.
[h]New Mexico Oil Conservation Division.
[i]National Emission Standards for Hazardous Air Pollutants.
[j]Two permits issued on same date.

Current permitting issues include the acceptance and approval by NMED of permit modifications requested by LANL in April 1993. Among them is the “off-site waste” issue. This issue involves LANL’s ER Project’s need to bring hazardous and mixed waste generated at the Los Alamos townsite and other off-site locations in Los Alamos County and immediate environs to the Laboratory’s permitted waste handling locations at TA-54.

The application LANL submitted for the modification of TRU pads 1, 2, 4 and the addition of TRU storage domes A, B, C, and D was conditionally approved. A waste analysis plan and a schedule for further characterization of the TRU wastes on pads 1, 2, and 4 that will respond to all of the state’s requirements will be provided to NMED by March 31, 1995.

The application for the Hazardous Waste Treatment Facility (12 storage tanks) and the Chemical Plating Waste Skid was withdrawn and is being revised. This revision involves the addition of two storage buildings, several storage sheds, and the addition of design information not included in the RCRA Part A application submitted on October 8, 1993, as well as updates due to organizational changes at the Laboratory.

LANL is in the process of developing an application for a RCRA-permitted treatment, storage, and disposal (TSD) facility that will be used primarily for the disposal of mixed wastes generated by the ER Project. The complex will consist of waste and wastewater treatment facilities, treatment, and associated storage. The submittal date was previously fall 1994; the delay in the schedule is due to the revision of the Title I Design to include treatment. Because this is a new construction project, completion of an application will depend on the development of construction drawings. Preliminary plans have been completed and final design plans are underway, at least in part, to finalize the application.

An emergency permit was granted to the Laboratory on June 2, 1994, by NMED in response to an application submitted earlier for the treatment of nitrated cheesecloth rags. All of the waste was treated, the facility was closed, and the permit has expired.

A set of modifications are being prepared for the permit to address changes in design at the TRU Waste Inspectable Storage Project (TWISP). These design changes were required as a result of the completion of the Fire Hazard Analysis. DOE orders require all buildings over 5,000 ft^2 to have fire suppression systems in place. The changes necessary to comply with this requirement demand substantial changes to the RCRA Part A application that was submitted for this project.

Other RCRA permitting activities currently underway include the following:

- possible submission of modifications to the permit to address changes that have occurred at the Controlled Air Incinerator (CAI);
- revision of the 1988 application for the TA-16 Open Burning/Open Detonation units;
- development of an application for the TA-67 facility that includes a landfill, storage in tanks and containers, treatment by thermal desorption and stabilization, and a wastewater treatment operation to handle the leachate collected from the landfill.

The Laboratory received two approved Research, Development, and Demonstration permits from NMED in 1994. The permits for the Packed Bed Reactor/Silent Discharge Plasma Unit at TA-35 and the Hydrothermal Processing Unit at TA-9, were received on April 21, 1994. The permit applications for these units were submitted to NMED in December 1992 and March 1993, respectively. These permits will allow the Laboratory to test two new and innovative technologies for the treatment of hazardous waste. The two units, however, did not begin to conduct treatment operations with hazardous waste in 1994.

A permit modification is in preparation to reflect the relocation of the Packed Bed Reactor/Silent Discharge Plasma Unit to another building within TA-35. The unit was moved without NMED notification or approval and without NEPA review. A modification request has been written and is being reviewed. A NEPA review is pending.

b. Solid Waste Disposal. The Laboratory has a Special Waste Subtitle D landfill located at TA-54, Area J. This landfill also has three active disposal shafts that receive administratively controlled or classified waste from Laboratory operations. LANL/DOE completed the required Solid Waste Facility Annual Report for calendar year (CY) 93. The TA-54, Area J landfill received 287 m^3 (10,131 ft^3) of solid waste in 1994. The landfill is used as a staging area for nonradioactive asbestos (approximately 165 m^3 [5,824 ft^3]) that is shipped off site to an approved commercial disposal site. Radioactive asbestos and asbestos suspected of being contaminated with radioactive material continue to be disposed into a monofill-constructed disposal cell at TA-54, Area G. Monofill means this cell receives only one type of waste.

On October 11, 1994, LANL/DOE submitted a suspension of groundwater monitoring requirements request to NMED for this landfill. The suspension request offered vadose zone (the subsurface above the main aquifer) monitoring in place of groundwater monitoring. LANL also disposes of sanitary solid waste and rubble at the Los Alamos County landfill on East Jemez Road, DOE property that is operated under a special use permit with the Los Alamos County. Los Alamos County has day-to-day operating responsibility for the landfill and is responsible for obtaining all related permits for this activity with the state. LANL contributed approximately 18% of the total volume of trash landfilled at this site during CY94 with the remainder contributed by Los Alamos County residents. DOE works with both LANL and Los Alamos County landfill managements regarding operations, permit applications, and LANL waste stream acceptance criteria. LANL also sent 6,558 tons of concrete/rubble, 400,090 tons of construction and demolition debris, 74 tons of brush for composting, and 126 tons of metal for recycling to the county landfill construction and demolition area.

Table III-3 presents a summary of the materials recycled by Johnson Controls, Inc. (JCI), the Laboratory's support services subcontractor, in FY94. This waste minimization program, which continues to be expanded, conforms to RCRA Subtitle D requirements.

Table III-3. Johnson Controls World Services, Inc. FY94 Recycling Volumes

Type	Volume	
Paper	337,667 kg	(742,868 lb)
Photographic film	1,490 kg	(3,280 lb)
Lead	28,727 kg	(63,200 lb)
Lead acid batteries	7,425 kg	(16,335 lb)
Electric cable	156,338 kg	(343,944 lb)
Aluminum shavings	1,100 kg	(2,420 lb)
Scrap steel/tin	352,553 kg	(775,616 lb)
Aluminum solid	10,252 kg	(22,555 lb)
Copper	749 kg	(1,648 lb)
Stainless steel	15,244 kg	(33,537 lb)
Brass	459 kg	(1,009 lb)
Tires	9,363 kg	(20,600 lb)
Waste oil	50,386 L	(13,100 gal.)

c. RCRA Closure Activities. Several solid waste management units (SWMUs) are subject to both the HSWA Module VIII corrective action requirements and the closure provisions of RCRA. The corrective action process occurs concurrently with the closure process, thereby satisfying both sets of regulations. NMED is the lead regulatory agency for these sites. The status of these sites is given below.

TA-35, Surface Impoundments. Closure plans for the two surface impoundments for waste oil that are associated with Buildings 85 and 125 at TA-35 were submitted in October 1988, and the state subsequently gave oral approval to proceed with closure activities. All contents of the impoundments and underlying soil were removed and disposed of as hazardous waste. Sampling to verify the removal of contaminants from the area was completed in October 1989. Preliminary results of the sampling effort revealed that the criteria for clean closure had been met. The impoundments were backfilled and revegetated at that time. Upon receipt of the final analytical results, it was found that the allowed sample holding times had been exceeded; consequently, the data could not be verified. The closure plan was modified to reflect the events of the field work that occurred and to include bore sampling to be used as the final verification of clean closure. Bore sampling performed in December 1990 determined that the levels of contamination found to remain after this cleanup effort did not exceed the EPA's health-based, risk-based cleanup levels. By achieving these cleanup levels, the Laboratory could still achieve clean closure status for these two units and no post-closure care would be necessary.

The closure report and closure certification letters for the TA-35-125 surface impoundment were completed as of July 31, 1991, and were submitted to NMED in August 1991. The closure report and closure certification letters for TA-35-85 were submitted on December 20, 1991. The NMED sent a Notice of Deficiency (NOD) to DOE in

July 1992 regarding the closure of surface impoundment TA-35-125. The NOD denied approval of clean closure of the unit on two grounds: (1) the Laboratory had failed to delineate the vertical extent of the contamination, and (2) the Laboratory had failed to demonstrate that releases from the unit to the surrounding soil or surface waters were below health-based risk levels. An amended closure plan was submitted to the state on September 4, 1992, to address these concerns. In accordance with this plan, the Laboratory and NMED split samples from Ten-Site Canyon. The sample results indicated that no contamination above health-based risk levels resulted from the release of contaminants to that canyon. The amended closure report was submitted to NMED in April 1993. The Laboratory received final regulatory approval from NMED in September 1993 on the TA-35-125 amended closure report. NMED indicated that the Laboratory met all of the requirements for closure by removal on TA-35-125. No further action is required for this surface impoundment.

An amended closure plan for TA-35-85 was submitted to NMED for approval on November 1, 1993. The plan proposed additional sampling and analysis or a revised technical approach with a schedule for the duration of each technical activity proposed. The Laboratory is still waiting for regulatory approval from NMED for the TA-35-85 closure.

An NOD was received for the TA-35-85 surface impoundment from NMED in May 1994. LANL requested extensions to the 30-day required response time, which were granted by NMED. All NOD comments were addressed and submitted to NMED by mid-August 1994. Additional field work to support closure is scheduled for 1995.

TA-40, Scrap Detonation Site. On September 13, 1991, the NMED notified the Laboratory that the closure plan for the TA-40 Scrap Detonation Site had been approved. The start date of the closure plan was September 30, 1991. This closure is proceeding behind schedule because the original closure plan did not anticipate contamination, which was detected above action levels at several different locations during the sampling phase. The closure plan modification and clean closure equivalency demonstration included risk assessments for the areas where contamination was detected above action levels and was submitted to NMED in May 1993. The Notice of Intent (NOI) to close the site and terminate interim status was issued by NMED on November 1, 1993, which started a 30-day period for receiving comments from the public.

An amendment to the closure plan was submitted to NMED in February 1993. Additional closure activities were conducted between September and December 1994 to remove localized contamination. A closure report was to be submitted to NMED in March 1995.

TA-54, Waste Oil Storage Tanks. After discovering hazardous waste in six aboveground waste oil storage tanks, the Laboratory pumped and disposed of the contents as hazardous waste. The tanks were moved to TA-54, Area G to make room for needed facilities at TA-54, Area L. In April 1990, the Laboratory elected to proceed with the closure of these vessels in anticipation of receiving an approved closure plan. After the tanks had been cleaned several times, the final decontamination was completed in August. A final closure plan/report that reflected the closure process of these units was submitted in June 1991. An addendum to the final closure plan was submitted in July 1992. NMED approved the plan in August 1992. Soil sampling at TA-54, Area L to demonstrate clean closure will be performed in conjunction with the HSWA permit corrective measures study scheduled during 1999.

TA-16, Landfill at Material Disposal Area, Area P. Closure and post-closure-care plans for the Area P landfill were submitted on November 25, 1985. In late 1987, these plans were modified to incorporate standards that this unit would be subject to once the Laboratory received its RCRA permit. Since that time, the ER Project, which oversees closures, has been established. The Laboratory requested an extension of the closure deadlines for this and other units that appear within the HSWA Module of the RCRA permit. An extension of the closure window would allow the ER Project to incorporate the results of the RCRA facility investigation (RFI)/Corrective Measures Study into the closure process. The NMED rejected this approach and requested a revised closure plan by September 1993. NMED indicated that it would allow an extension for evaluation of the outstanding issues.

The Laboratory submitted an amended closure plan on August 31, 1993, proposing additional sampling around the landfill to verify that there is no potential for migration of contaminants during snowmelt or storm events. Pending NMED approval, a lined surface water diversion channel around the landfill was constructed in November 1993. Sampling will commence upon NMED approval of the amended closure plan to be followed by final design and construction of a landfill cap.

An NOD for the August 1993 closure plan was received in June 1994. Responses to the NOD, as well as a request for a 120-day extension to address groundwater issues, was submitted to NMED. NMED issued a notice to the public in early August 1994 that LANL intended to close TA-16, material disposal area (MDA), Area P per the

1993 closure plan. During this time, LANL conducted a brief cost/benefit study on clean closing versus capping TA-16, MDA, Area P. The study concluded that clean closing the landfill would be the most cost effective and environmentally sound option. Therefore, LANL withdrew the August 1993 closure plan. A new closure plan was submitted to NMED in early February 1995, and identifies TA-16, Area P as a waste pile to allow for clean closure under 40 CFR 265.250. The closure plan is currently under review by NMED.

TA-53, Surface Impoundments. A closure plan for two of the three surface impoundments located at TA-53 was submitted to NMED in February 1993. This plan was submitted as an alternative to permitting the units as mixed waste units. NMED's comments on the Laboratory closure plan proposing clean closure for the two TA-53 surface impoundments were addressed by the Laboratory in a January 14, 1994, submittal.

A revised closure plan for the two surface impoundments was submitted to NMED in early September 1994. An NOD on this closure plan was received by LANL in late October 1994. A response to the NOD was submitted to NMED in mid December 1994. Additional clarifying information on the closure plan was submitted to NMED in early March 1995.

TA-50, Batch Waste Treatment Unit and Container Storage Area. Closure of this unit is proceeding pursuant to the closure plan as outlined in the 1989 RCRA permit. This unit is located in Building 1 at TA-50 and consists of an enclosed 1,923 L (508 gal.) pressure vessel. The vessel has been removed from service and is presently in the process of internal and external wash downs as part of the closure process. Final closure activity information was submitted to NMED in a final closure report on September 1, 1994. NMED acknowledged the clean closure on September 15, 1994.

d. Underground Storage Tanks. The Laboratory's USTs are regulated under the New Mexico Underground Storage Tank Regulations (USTR). At the end of CY94, the Laboratory has 13 regulated USTs. Out of those 13 USTs, 11 USTs and their ancillary equipment must be upgraded or taken out of service by the end of CY98.

No USTs were removed in CY94. USTs TA-55-17 and TA-16-205, which were removed in CY93, finally met the USTR closure requirements in CY94.

UST TA-18-PL30, contained 2,117 L (560 gal.) of diesel fuel and was removed in September 1993. The UST site is still under corrective action for site contamination. Because of shallow groundwater (approximately 4.6 m [15 ft] below land surface) two groundwater monitoring wells were installed in March 1994. For three quarters of CY93, groundwater data were collected in CY93 from this former UST site. The groundwater data show concentrations of benzo-a-pyrene and naphthalenes below the concentration found in Part 3 of the New Mexico Water Quality Control Commissions (NMWCC) regulations.

In July 1994, the top of UST TA-16-1456 (containing 37,800 L [9,980 gal.] of unleaded gasoline) was excavated to conduct routine repairs on the tank. During the excavation, light soil staining and a faint odor of gasoline in the soil near the UST's fuel inlet pipe and vent line were noted. On August 3, 1994, NMED was notified regarding gasoline release from UST TA-6-1456. Several factors were determined to be the source of the gasoline contamination, but the main factor was that two other USTs had been located in the same area as UST TA-16-1456 in the 1980s prior to their removal. In 1987, UST TA-16-196 was removed. This UST formerly held 15,120 L (3,992 gal.) of leaded gasoline. Upon removal, it was observed that the UST was extensively corroded and was leaking. Remediation actions involved the removal of several truckloads of contaminated soil from the site, but removal of all the soil was unsuccessful. Currently, the UST site is still under investigation to determine the extent of the former UST TA-16-196 gasoline contamination.

A UST inspection was conducted on January 25, 1994, by the NMED. From this inspection, DOE received one notice of violation (NOV) on February 24, 1994. The NOV contained one finding that stated that the line leak detector on UST TA-16-197 had not been adequately tested. On March 4, 1994, a test was conducted on the capability of a line leak detector. The test determined that the leak detector was functioning properly. On June 28, 1994, a Certification of Compliance document was sent to NMED with a check for $100 for the fine associated with the NOV. There was no petroleum release associated with this NOV finding.

e. Other RCRA Activities. TA-54, Area L, located on Mesita del Buey, had been used for disposal of hazardous waste prior to the time when such disposal became regulated under RCRA/NMHWA. TA-54, Area G has been used for the disposal of radioactive waste. Information related to a groundwater monitoring waiver request for both Areas L and G has been submitted to NMED. Vadose zone (the subsurface above the main aquifer) monitoring is being conducted quarterly throughout Areas L and G to identify any releases from the disposal units. This type of monitoring is used to detect the presence of organic vapor in the vadose zone.

A RCRA-permitted CAI for treating hazardous wastes is located at TA-50-37. A trial burn was conducted in October 1986. The raw data were submitted to NMED in December 1986, and a final report for the test burn was submitted on March 5, 1987. These data and the report were used to support the Laboratory's application for a hazardous waste permit for this facility. The permit was issued in November 1989, but waste treatment operations have not been conducted in the CAI since that time. The CAI has been upgraded to improve its reliability so that waste can be routinely burned. A modification to the permit incorporating the upgrades has been submitted and must be approved before the facility can be restarted, and a public hearing must be held in connection with the permit modification application. NMED is kept aware of changes in the permit through scheduled meetings and has agreed to this process in order to get the CAI permit current.

f. RCRA Compliance Inspection. NMED conducted its annual hazardous waste compliance inspection September 14–22, 1994. NMED inspectors visited hazardous waste satellite accumulation, storage, and treatment facilities located throughout the Laboratory. Several potential issues were identified by the inspectors, including unlabeled or improperly labeled containers, storage of certain wastes in excess of regulatory time limits, incomplete records, insufficiency of decontamination equipment, and other potential issues.

EPA Multimedia Inspection. Between August 3 and 12, 1993, the EPA conducted a site-wide multimedia inspection of the Laboratory, which encompassed regulations promulgated pursuant to RCRA, Clean Water Act (CWA), SDWA, Clean Air Act (CAA), Toxic Substances Control Act (TSCA), and Emergency Planning and Community Right-to-Know Act (EPCRA) (see Table III-4). The EPA-led team was headed by a representative of Region 6 and was staffed by personnel working for the EPA National Enforcement Investigations Center and for the NMED. The EPA-led team visited many satellite and less-than-90-day storage sites as well as long-term storage facilities at TA-3, TA-54, and TA-55, and treatment facilities at TA-14, TA-16, TA-36, TA-54, and TA-55. During the inspection outbriefing on August 12, 1993, several apparent RCRA findings were reported involving noncompliance including inadequately labeled containers, open containers, inadequate training records, incomplete waste characterization, and missing notifications. None of the findings appear to have a significant impact on human health or the environment.

Table III-4. Environmental Inspections and Audits Conducted at the Laboratory in 1994

Date	Purpose	Performing Agency
January 11, 1994	Annual inspection of permitted and registered beryllium machining operations	NMED
January 25, 1994	UST inspection at TA-16	NMED
April 22, 1994	Spill cleanup investigations	NMED/AIP
July 11-15, 1994	Waste Stream Characterization Program/ NPDES permit program evaluation	DOE/AL
July 21, 1994	NPDES permit program evaluation	EPA
September 8, 1994	NPDES permit program evaluation	EPA
September 14–22, 1994	Hazardous waste compliance inspection	NMED
September 26-27, 1994	Use study tour of the Laboratory's canyons	USFWS[a]
October 17–27, 1994	Monitoring of environmental programs	DOE/AL
October 27–28, 1994	NPDES permit compliance inspection	NMED
November 16, 1994	FIFRA inspection	NMDA[b]

[a]US Fish and Wildlife Service.
[b]New Mexico Department of Agriculture.

NMHWA Order 94-09, issued on September 2, 1994, documented the RCRA findings from the EPA-led multimedia inspection. NMHWA Order 04-09 alleged some 45 violations of waste characterization, disposal, labeling, storage, manifesting, safety equipment, and other hazardous waste management requirements. It required 28 corrective actions and proposed a fine of $247,000. Corrective actions were implemented on time or were otherwise resolved, and the final negotiated penalty amount was $62,750.

DOE and LANL received a second RCRA CO from the State of New Mexico during 1994. NMHWA Order 94-12 was issued on August 12, 1994, following a self-reported incident involving the placement of soils from an ER Project into a non-RCRA-permitted low-level radioactive waste landfill on site. LANL subsequently discovered the soils had contained trace quantities of volatile organic constituents (VOCs). The CO alleged violations of RCRA transportation and disposal requirements. It required corrective actions and proposed a fine of $26,040. Corrective actions were implemented on time. The final negotiated penalty amount was $13,020.

g. RCRA Training. During 1994, ESH Training (ESH-13), in conjunction with Hazardous & Solid Waste (ESH-19), updated the Laboratory's RCRA training program. In addition to RCRA personnel training, a five-hour introductory course for TSD and less-than-90-day storage area workers, the RCRA refresher training course began in October. RCRA personnel must take refresher training courses annually. The 1994–95 RCRA refresher training course focuses on changes to statutes, regulations, permits, permit applications, and Laboratory policies that affect work assignments of facility personnel that relate to RCRA; organizational changes affecting the Laboratory's waste management structure and processes; a review of characterization of hazardous and mixed waste; and identifying recurring problems of noncompliance with the RCRA-required inspection process. During 1994, 285 workers were trained in RCRA personnel training, and 78 received the RCRA Refresher Training course between October 1994 and the end of the year. Both courses will be given monthly throughout 1995.

In 1994, 1,026 workers were trained in Waste Generation Overview, instruction for hazardous and mixed waste generators. Waste Documentation Forms, the "how to" course on forms completion, underwent major revisions beginning at the end of 1994 to reflect changes to the forms themselves. A workshop, entitled Waste Documentation Update, was designed to acquaint current users of the forms with the revised forms; 412 workers were trained in both courses during 1994.

A RCRA facility-specific training workshop took place in early 1994, and 39 training coordinators attended. This workshop was designed to acquaint training personnel at the facilities with the RCRA permit itself, and permit application training requirements, particularly those additional facility-specific topics for which training must be offered and documented.

RCRA TSD personnel who must take Hazardous Waste Operations (HAZWOPER) training have been doing so at LANL for the last several years. In October 1994, ESH-13 developed a HAZWOPER refresher course specific to TSD workers. The course meets the regulatory requirements for both HAZWOPER and RCRA refresher training and is offered monthly throughout the year.

The RCRA training program, as described in the Hazardous Waste Facility Permit, is complete and will only undergo modifications and revisions in 1995 to reflect regulatory, organizational, and programmatic changes.

Generator Handbook. ESH-19 completed a regulatory handbook for hazardous waste generators. The handbook comprises a comprehensive set of flowcharts and supporting documentation and covers virtually every waste type generated at the Laboratory. Information includes waste identification and characterization, documentation, packaging, and shipping and directs generators to the proper Laboratory organization. The handbook was distributed to waste management coordinators and waste generators in 1994.

h. Waste Minimization. Subchapter I of the Solid Waste Disposal Act states that the generation of hazardous waste is to be reduced or eliminated as soon as possible. All hazardous waste must be handled in ways that minimize the present and future threat to human health and the environment. The act promotes recovery, recycling, and treatment as alternatives to land disposal of hazardous wastes.

The rates of hazardous and mixed waste generation during 1994 were significantly higher than 1993 because during the first part of 1993, there was a moratorium on the generation of mixed waste. A total of 182,714 kg (401,971 lb) of hazardous waste was generated in 1994 versus 70,420 kg (154,923 lb) in 1993. A total of 68,372 kg (150,418 lb) of mixed waste was generated in 1994 versus 7,517 kg (16,537 lb) in 1993. A full description of the moratorium is found in "Environmental Surveillance at Los Alamos during 1993" (EARE 1995b).

i. HSWA Compliance Activities. In 1994, the ER Project remained in compliance with Module VIII of the RCRA permit. In April 1994, EPA transmitted a revised copy of the permit to incorporate new language based on the Class 3 permit modification submitted by the ER Project in February 1993. The permit was again updated in September 1994 to incorporate minor changes identified by the ER Project.

During 1994, four RFI work plans and two addenda to RFI work plans were submitted to EPA. Ten work plans were approved by EPA in 1994, and two more were approved in early 1995. In May 1995, an RFI work plan addressing Los Alamos and Pueblo canyons will be submitted. Another RFI work plan addressing issues common to all canyons will be submitted in October 1995. All upcoming work plans specific to individual canyons will tier to this document. Depending on the availability of funding, an RFI work plan for Mortendad Canyon will be submitted in November 1995.

A Class 3 permit modification will be submitted in early March 1995 to remove 89 SWMUs that require no further action (NFA). In addition, 23 SWMUs will be added to the permit at EPA's request, based on its review of RFI work plans. Approximately 280 Areas of Concern that are not on the HSWA permit will be recommended for NFA during the same public comment period.

Progress continued in the design of the Laboratory's proposed Mixed Waste Disposal Facility. The facility is planned to treat and dispose of mixed waste generated during the ER Project remediation process. The facility will exclude Laboratory operational waste. The Title I Design was revised in 1994 to include waste treatment in the scope of the project. The Value Engineering Study was completed in 1994. By the end of 1994, drilling of the initial boreholes and test wells neared completion. The Environmental Assessment (EA) and a draft Performance Assessment for the facility are currently underway.

2. Comprehensive Environmental Response, Compensation, and Liability Act.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 mandates actions for certain releases of substances into the environment. LANL has not been listed on the EPA's National Priority List.

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

Title III, Section 313, of the EPCRA requires facilities that meet certain standard industrial classification (SIC) code criteria to submit an annual toxic chemical release inventory (TRI) report. This TRI report describing the use of and emissions from Section 313 chemicals must be submitted to EPA and the New Mexico Emergency Management Bureau every July for the preceding CY.

Although the Laboratory does not meet the SIC code criteria for reporting, it has voluntarily submitted annual TRI reports since 1987. All research operations at the Laboratory are exempt under provisions of the regulation, and only pilot plants, production, or manufacturing operations at the Laboratory are reported. Regulated chemical use at the Plutonium Processing Facility (TA-55) is the only operation at the Laboratory for which chemical releases are reported under Section 313. This facility uses a reportable chemical (nitric acid) in amounts greater than the Section 313 reporting threshold.

On August 3, 1993, the President of the United States issued Executive Order 12856 requiring all federal facilities regardless of SIC code to report under Title III, Section 313, of EPCRA. Research operations remain exempt. This requirement does not go into effect until the July 1995 reporting deadline for the preceding 1994 CY. The Laboratory, along with the DOE, elected to begin reporting under the new guidelines, beginning with the 1994 report. Two additional chemicals, in addition to nitric acid, required release reporting: chlorine for water treatment and sulfuric acid used to deionize water at the power plant (TA-3-22).

The 1994 report presented here covers the releases of chlorine, nitric acid, and sulfuric acid during 1993. About 6,091 kg (13,400 lb) of nitric acid were used for plutonium processing, resulting in air emissions of approximately 78 kg (171 lb). The amount of nitric acid released to the atmosphere was estimated using EPA emission factors and good engineering judgment. The remaining nitric acid was either consumed in chemical reactions or was completely neutralized in wastewater treatment operations. In addition, 9,613 kg (21,149 lb) of chlorine were used in water purification operations involving noncontact cooling water, sewage treatment, and drinking water, resulting in air emissions of 381 kg (839 lb) of chloroform and 12 kg (26 lb) of chlorine. An estimated 2,482 kg (5,460 lb) of chlorine were released with the discharged water. Finally, 24,430 kg (53,745 lb) of sulfuric acid were used to deionize water at the Laboratory's main power plant, resulting in less than a pound of air emissions. The remaining sulfuric acid was completely neutralized before discharge to the environment.

4. Toxic Substances Control Act.

Unlike other statutes which regulate chemicals and their risk after they have been introduced into the environment, the Toxic Substances Control Act (TSCA) was intended to require testing and risk assessment before a chemical is introduced into commerce. TSCA also establishes record keeping and reporting requirements for new information regarding adverse health and environmental effects of chemicals; governs the manufacture, use, storage, handling, and disposal of polychlorinated biphenyls (PCBs); and sets standards for PCB spill clean ups. Because the Laboratory's activities are in the realm of research and development, the PCB regulations (40 CFR 761) have been the Laboratory's main concern under TSCA. Substances that are governed by the PCB regulations include but are not limited to dielectric fluids, contaminated solvents, oils, waste oils, heat transfer fluids, hydraulic fluids, slurries, soils, and materials contaminated as a result of spills. Most of the provisions of the regulations apply to transformers, capacitors, and other PCB items with concentrations above a specified level. For example, the regulations regarding storage and disposal of PCBs generally apply to items with PCB concentrations of 50 ppm or greater.

In 1994, 17 transformers containing greater than 500 ppm PCBs were replaced with non-PCB transformers and 6 low concentration (50-500 ppm PCBs) transformers were reclassified to non-PCB status. The remaining 7 high concentration PCB transformers are scheduled for replacement in 1995. Specifications for the reclassification of the remaining 18 low concentration PCB transformers will be written in 1995.

The Laboratory's inventory of PCB-containing items is constantly changing as items are disposed and new items are discovered during the on-going survey. Eighty-three PCB items were added to the survey in 1994. This brought the total number of PCB items at LANL to 418. The types of items inventoried by the survey include transformers, various pumps, oil-filled switches, light ballasts, generators, small transformers, and capacitors. Most items are scheduled for disposal as soon as they are discovered. The survey for PCB items at LANL involves record searches, sample collection, and laboratory analytical testing.

Analytical testing for PCBs is also performed for other TSCA compliance activities such as waste characterizations and transformer concentration verifications. A total of 340 samples was analyzed for PCBs at the Laboratory in 1994. Analytical results are attached to waste tracking forms and the item tested is appropriately marked.

Once identified, inventoried, and marked, waste materials with 50 ppm PCBs or greater which do not contain radioactive constituents are transported off site for treatment and disposal in accordance with TSCA. In 1994, the Laboratory had 16 off-site shipments of PCB waste. The total weight of PCBs in those shipments was 101,355 kg (222,981 lbs). The PCB waste is sent to EPA-permitted disposal and treatment facilities. The wastes disposed were 61 capacitors, 20 drums of light ballasts, 18 transformers, 5 drums of water, 5 electrical chokes and switches, 29,439 kg (64,766 lb) of PCB oil, and 13 drums of concrete or other debris. All wastes are tracked from the point of generation to final disposal. Documentation, such as waste manifests and verification of shipment receipts, is kept on file. Certificates of Destruction for each waste are sent to the Laboratory by all treatment or disposal facilities.

Liquids containing greater than 50 ppm PCBs and radioactive constituents are stored at the TA-54, Area L TSCA storage facility. These wastes must be stored due to the lack of any EPA-approved disposal facility for this type of waste. Many of these items have exceeded TSCA's one year storage limit. This noncompliance issue is well documented and numerous communications have been taking place between EPA Region 6 and LANL/DOE representatives. Nonliquid wastes containing greater than 50 ppm PCBs and radioactive constituents are disposed at the Laboratory's EPA-authorized TSCA landfill located at TA-54, Area G.

The Laboratory's TSCA disposal facility at TA-54, Area G disposed 13.6 kg (30 lb) of radioactively contaminated PCB waste during 1994. Although the volume of this type of waste is expected to be minimal over the next several years, there are few if any other disposal options for this waste. LANL has therefore requested renewal of the 1980 EPA authorization for on-site PCB waste disposal. Representatives of the Laboratory met with EPA officials in the fall of 1994 to discuss renewal conditions. The new authorization is expected to be final in the fall of 1995.

Compliance documents pertaining to the above activities are compiled and written on a routine basis. The two primary compliance documents are the Annual PCB Document (includes the annual inventory log and disposal records required by 40 CFR 180) and the Semi-annual PCB Report (required by Condition 6 of the EPA approval for LANL to operate a PCB Landfill).

5. Federal Insecticide, Fungicide, and Rodenticide Act.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates the manufacturing of pesticides, with requirements on registration, labeling, packaging, record keeping, distribution, worker protection, certification, experimental use, and tolerances in foods and feeds. Sections of this act that are applicable to the Laboratory include recommended procedures for storage and disposal and requirements for certification of workers who apply pesticides. The Laboratory is also regulated by the New Mexico Pest Control Act, administered by the New Mexico Department of Agriculture (NMDA), which regulates pesticide use, storage, and certification. NMDA conducts annual inspections of JCI's compliance with the act. The application, storage, disposal, and certification of these chemicals is conducted in compliance with these regulations. JCI certified applicators apply pesticides under the direction of the Laboratory's Pest Control Program Administrator. The Laboratory Pest Control Management Plan, which includes programs for vegetation, insects, and small animals, was established in 1984 and is revised by the Pest Control Oversight Committee, a committee established to review and recommend policy changes in the overall pest management program at the Laboratory.

An annual inspection conducted by the NMDA found no deficiencies in the Laboratory's pesticide application program and certified application equipment.

Table VI-21 presents data on the amount of herbicides, insecticides, and rodenticides used at the Laboratory during 1994.

6. Clean Water Act.

a. National Pollutant Discharge Elimination System. The primary goal of the CWA (33 U.S.C. 446 *et seq*.) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The act established the National Pollutant Discharge Elimination System (NPDES) that requires permitting point-source effluent discharges to the nation's waters. The NPDES permits establish specific chemical, physical, and biological criteria that an effluent must meet before it is discharged. Although most of the Laboratory's effluent is discharged to normally dry arroyos, the Laboratory is required to meet effluent limitations under the NPDES permit program.

LANL has seven NPDES permits: one covering the effluent discharges at Los Alamos, one covering the hot dry rock geothermal facility located 50 km (30 mi) west of Los Alamos at Fenton Hill, and five covering storm water discharges (Table III-2). The University of California (UC) and DOE are co-owners on the permits covering Los Alamos. The permits are issued and enforced by EPA Region 6 in Dallas, Texas. However, NMED performs some compliance evaluation inspections and monitoring for EPA through a Section 106 water quality grant.

During 1994, the Laboratory's NPDES permit for Los Alamos included 2 sanitary wastewater treatment facilities and 122 industrial outfalls. A summary of these outfalls is included in Table D-2. The NPDES permit for the geothermal facility at Fenton Hill includes only one industrial outfall. Under the Laboratory's existing NPDES permit for Los Alamos, samples are collected for analysis on a weekly basis, and results are reported at the end of the monitoring period for each representative outfall category to EPA and NMED. During 1994, effluent limits were not exceeded in any of the 154 samples collected from the sanitary wastewater facilities. Effluent limits were exceeded 28 times in the 2,045 samples collected from the industrial outfalls. As shown in Figure III-1, overall compliance for the sanitary and industrial waste discharges during 1994 was 100% and 98.6%, respectively. Tables D-3 through D-6 present monitoring standards and Laboratory exceedances from those standards. There was no discharge from the industrial outfall at the geothermal facility at Fenton Hill during 1994. On November 10, 1994, the Laboratory received a copy of EPAs Federal Facilities Compliance Report (Region 6) for the period July 1, 1994 through September 30, 1994. The Laboratory was removed from the list of significantly noncompliant federal facilities for CWA violations.

b. Business Plan for NPDES Permit Compliance and Outfall Reduction. The Water Quality and Hydrology Group (ESH-18) in coordination with DOE/LAAO developed a Business Plan for NPDES permit compliance and outfall reduction as a result of the Administrative Order (AO) received in 1994 for repetitive non-compliances. The Business Plan enhanced the Laboratory's existing plan to ensure compliance with regulations and outlined the program necessary to achieve 100% compliance, improve environmental awareness across the Laboratory, and establish ownership for compliance. It also instills accountability within the Laboratory, sets aggressive goals for employees and divisions, and improves root cause analysis of occurrences. A primary function of the Business Plan is to establish cross-functional teams to address and improve operational, technical, and regulatory facets of the Laboratory's NPDES compliance record.

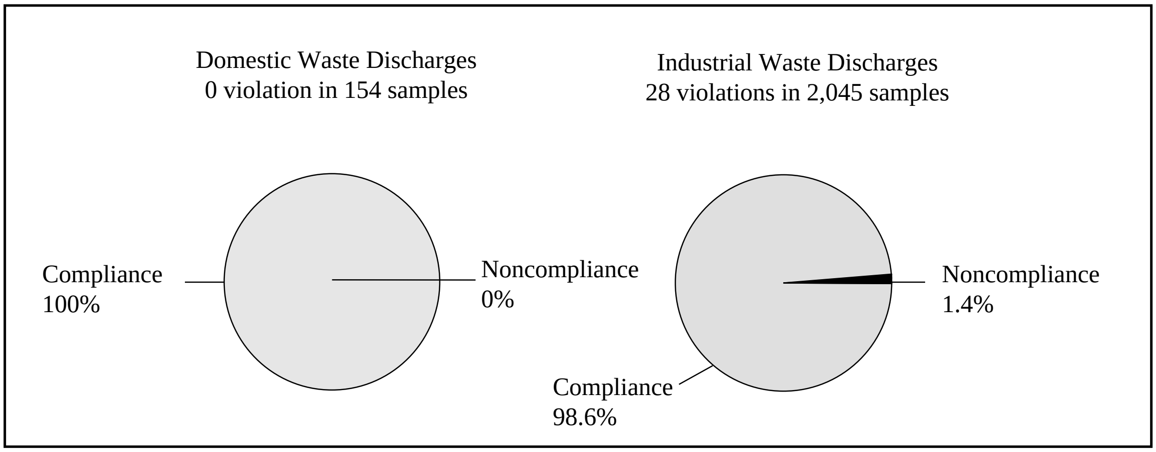

Figure III-1. Overall compliance for the sanitary and industrial waste discharges during 1994.

c. Waste Stream Characterization. The Waste Stream Characterization (WSC) program is a Laboratory-wide effort to identify noncomplying waste streams and potential unpermitted outfalls that discharge to the environment contrary to those authorized in the Laboratory's NPDES permit. The WSC program is required by AO Docket No. VI -94-1242, which allowed for the continued operation of noncomplying facilities until WSC studies and final reports were completed.

ESH-18 provided assistance to the Laboratory's operating groups in identifying noncomplying waste streams and potential unpermitted outfalls that discharge to the environment. Preliminary copies of each WSC report, including the findings and recommendations, were reviewed by ESH-18 and facility representatives in 1993 and 1994. Additional follow-up investigations were conducted in 1994 if discrepancies were noted during the reviews. Eighty-three WSC reports were finalized and distributed to the responsible Division Directors for facilities under their management in March 1994. Target dates and contact persons were requested so that corrective actions could be documented, tracked, and submitted by ESH-18 to EPA, as required by the AO.

Seventy-five unpermitted outfalls were found throughout the Laboratory during the WSC surveys. DOE and EPA requested that the Laboratory eliminate these unpermitted outfalls by the end of 1994. The Laboratory successfully eliminated 74 of the 75 unpermitted outfalls by December 31, 1994; the last unpermitted outfall was eliminated in January 1995.

AO Docket No. VI-94-1242 required the Laboratory to complete 25% of the corrective actions that were recommended by the WSC study by September 1994 and 50% by September 1995. Both of these requirements have been met. The Laboratory must be in 100% compliance by October 1, 1997, pursuant to the AO.

The Laboratory has secured funding of approximately $3 million dollars to complete some of the corrective actions needed to bring facilities into compliance with the NPDES permit program. ESH-18 is managing this funding to complete the highest priority projects before the October 1, 1997, deadline. Operating groups will be responsible for corrective actions not completed by this funding. ESH-18 has developed a database for tracking the WSC corrective actions.

d. Storm Water Discharges. On November 16, 1990, the EPA promulgated the final rule for NPDES Regulations for Storm Water Discharges and modified 40 CFR 122, 123, and 124. This rule was required to implement Section 402(p) of the CWA (added by Section 405 of the Water Quality Act of 1987).

On September 9, 1992, EPA published the final General Permits for storm water discharges associated with industrial and construction activity. The Laboratory chose to apply for coverage under the General Permit. Currently the Laboratory has five NPDES General Permits for its storm water discharges (Table III-2). One permit is for the Laboratory site and includes the following industrial activities: hazardous waste treatment, storage, or disposal facilities, operating under interim status or a permit under Subtitle C of RCRA and NMHWA, (this category includes SWMUs); landfills, land application sites, and open dumps including those that are subject to regulation under Subtitle D of RCRA; and steam electric power generating facilities. The other four permits are for construction activities disturbing more than five acres. These projects are the TA-53 Lagoon Elimination project, the Los Alamos Integrated Communication System project, the Dual Axis Radiographic Hydrotest (DARHT) facility, and the Small Arms Firing Range remediation.

The conditions of the General Permit require the development and implementation of a Storm Water Pollution Prevention (SWPP) Plan. During 1994, ESH-18 developed and initiated implementation of 18 SWPP Plans for SWMUs. ESH Division has assumed ownership of SWMUs that are regulated under the NPDES General Permit and the subsequent SWPP Plans.

Under the General Permit, monitoring activities are required of EPCRA facilities and land disposal units/ incinerators. In 1994 monitoring was conducted at TA-54, Area G with proposed monitoring sites in 1995 at TA-55; TA-54, Area J; and at two SWMU landfills. This analytical data must be submitted annually to EPA in the form of a Discharge Monitoring Report (DMR). The Laboratory submitted its 1994 DMR to EPA on October 28, 1994.

The installation and operation by the US Geological Survey stream monitoring stations on the canyons entering and leaving the Laboratory is another project related to the NPDES Storm Water Program. In 1994, there were a total of 16 stations on the various watercourses at the Laboratory. Information gathered by the USGS will be published in the NM Water Resources Data, Water Year 1994.

e. Spill Prevention Control. The Laboratory has a Spill Prevention Control and Countermeasures (SPCC) Plan, as required by the CWA in accordance with 40 CFR 112. This plan requires that secondary containment be provided for all aboveground storage tanks. There are approximately 40 major containment structures at the Laboratory. The plan also provides for spill control on drum and container storage, transfer, and loading/unloading areas. Training is provided for the user group's designated Spill Coordinator on the requirements of the SPCC Plan. The Spill Coordinator plays the major role in implementation of the SPCC Plan at the group level. The third version of the SPCC Plan was completed in September 1993; a training course for Spill Coordinators was presented in 1994 and is offered quarterly.

f. Sanitary Sewage Sludge. In December 1992, the EPA promulgated 40 CFR Part 503: *The Standards for Use or Disposal of Sewage Sludge*. The purpose of these regulations is to establish numerical, management, and operational standards for the beneficial use or disposal of sewage sludge through land application or surface disposal. Under the Part 503 regulations, the Laboratory is required to collect representative samples of sewage sludge in order to demonstrate that it is not a hazardous waste and that it meets the minimum federal standards for pollutant concentrations. In addition, sewage sludge is monitored for radioactivity in order to demonstrate that it meets the standards set forth in the Laboratory's Administrative Requirement (AR) 3-5. During 1994, approximately 26 dry tons of sewage sludge were generated at the TA-46 Sanitary Wastewater System Consolidation (SWSC) Plant as part of routine wastewater treatment operations; analytical monitoring of this sludge in 1994 demonstrated 100 percent compliance with the minimum federal and Laboratory standards for land application.

Also during 1994, approximately 20.3 dry tons of sewage sludge generated at the SWSC plant in 1993 were land applied at TA-54, Area G.

7. Safe Drinking Water Act, Municipal and Industrial Water Supplies.

This program includes sampling from various points in the Laboratory, Los Alamos County, and Bandelier National Monument water distribution systems and from the Laboratory's water supply wellheads to ensure compliance with the federal SDWA (40 CFR 141). The DOE provides drinking water to Los Alamos County and Bandelier National Monument. The EPA has established MCLs for microbiological organisms, organic and inorganic constituents, asbestos, and radioactivity in drinking water. These standards have been adopted by the State of NM and are included in the NM Water Supply Regulations (NMEIB 1991). The NMED has been given authority by EPA to administer and enforce federal drinking water regulations and standards in New Mexico.

Compliance samples are analyzed at four state certified laboratories: NM Health Department's Scientific Laboratory Division (SLD) in Albuquerque for VOCs, synthetic organic constituents (SOCs), inorganic constituents, and radioactivity; the Soil, Water, and Air Testing (SWAT) Laboratory at New Mexico State University in Las Cruces, New Mexico, for SOCs; Triangle Laboratories in Durham, North Carolina, for dioxin; and QuanTEM Laboratories in Oklahoma City, Oklahoma, for asbestos. The SLD and SWAT laboratories report their analytical results directly to NMED. Triangle and QuanTEM laboratories report their analytical results to ESH-18, who, in turn, transmit the results to NMED. The JCI Environmental (JENV) Laboratory also collects samples from the Laboratory, Los Alamos County, and Bandelier National Monument's distribution systems and tests them for microbiological contamination, as required under the SDWA. The JENV Laboratory is certified by NMED for microbiological testing of drinking water.

During 1994, all chemical, radiological, and microbiological parameters regulated under the SDWA were in compliance with the MCLs established by regulation, with the exception of a four-day microbiological violation in January 1994. The analytical results for SDWA compliance sampling in 1994 are presented in the following tables: radioactivity (Table V-22), radon (Table V-23), inorganic constituents (Table VI-9), total trihalomethanes (Table VI-10), lead and copper (Table VI-11), VOCs (Table VI-12), SOCs (Table VI-13), asbestos fibers (Table VI-14), and bacteria (Table VI-15).

Radon sampling was performed at wellheads and points of entry of water from the two well fields into the distribution system. This sampling was done to collect information prior to the issuance of a final EPA regulation governing radon in drinking water. The sampling indicates that radon treatment may be required if EPA finalizes the radon standard with the same 300 pCi/L limit contained in the proposed rule. Depending on the final rule's provisions, waters from some well fields may need radon treatment by extended storage to allow radioactive decay or adsorption removal.

Each month during 1994, an average of 48 microbiological samples was collected at designated sample taps in the Laboratory, County, and Bandelier National Monument's water distribution systems. The microbiological samples are analyzed for free chlorine residual and the presence or absence of total coliform, fecal coliform, and noncoliform bacteria. Sample collection and analysis were performed by personnel from the JENV Laboratory. During 1994, of the total of 581 samples analyzed, 5 indicated the presence of total coliforms, and 2 indicated the presence of fecal coliforms. Noncoliforms were present in 27 of the microbiological samples. Monthly data for 1994 is presented in Table VI-15. Noncoliform bacteria are not regulated, but their presence in repeated samples may serve as indicators of biofilm growth in water pipes.

Coliforms are the standard indicators of sewage pollution because they inhabit the intestinal tract of humans and other animals and therefore may indicate the presence of sewage or animal waste in the water. They are generally easier and safer to culture than specific pathogens. Fecal coliforms are defined as a subclass of coliforms that can be cultured on specific media at an elevated temperature (44.5°C). The fecal coliform test methods are intended to select for bacteria that originate in the intestines of warm-blooded animals. Biofilms are colonies of bacteria that are normally present in drinking water pipes and that may include coliforms and noncoliforms, as well as other types of bacteria.

In January 1994, there was a violation of the SDWA MCL for coliform bacteria at the North Community Fire Station (FS #4) and the Ponderosa Estates subdivision adjacent to FS #4 in the North Community. Drinking water samples collected from a janitor's mop sink at FS #4 on January 10, 1994, showed the presence of total and fecal coliform bacteria. On January 13, a sample collected from a new residence in the Ponderosa Estates subdivision showed the presence of total coliform bacteria.

The coliform contamination at FS #4 and Ponderosa Estates subdivision are believed to be separate, coincidental, episodes caused by local contamination. The source of contamination at FS #4 was identified as a hose connected to the janitor's sink; the hose provided a direct conduit for the transmission of bacteria from a mop bucket to the sink faucet where the sample was collected. The contamination at the Ponderosa Estates subdivision was attributed to a lack of line flushing, the presence of dirt in the distribution lines, and a low free chlorine residual in the drinking water (<1.0 mg/L Cl_2). Ponderosa Estates, at that time, had very few occupied houses served by the affected line. Lack of use allowed water in the pipe to stagnate.

Repeat samples collected from the janitor's sink at FS #4 on January 11, 12, and 13, 1994, showed the absence of both total and fecal coliforms. Samples collected on those same days at several other taps at FS #4 showed no coliform contamination, suggesting that the problem was localized to the janitor's sink piping.

The coliform contamination at the Ponderosa Estates subdivision was eliminated by the flushing of the subdivision's water mains. A repeat sample collected from the Ponderosa Estates subdivision on January 14, 1994, showed an absence of total coliform contamination and a free chlorine residual of 0.2 mg/L Cl_2. The Laboratory has suggested that Los Alamos County implement a corresponding flushing program for the County's portion of the distribution system. No other violations were noted in the Laboratory's municipal and industrial water supply program in 1994.

8. Groundwater.

a. Groundwater Protection Compliance Issues. Groundwater monitoring and protection efforts at the Laboratory have evolved from the early programs initiated by the USGS to present efforts. As a DOE facility, the Laboratory is required to conduct its operations in an environmentally safe manner. DOE Order 5400.1 establishes environmental protection program requirements, authorities, and responsibilities for all DOE facilities. The goal of this order is to ensure that operations at DOE facilities comply with all applicable environmental laws and regulations, executive orders, and departmental policies. The major regulations, orders, and policies pertaining to groundwater are as follows.

DOE Order 5400.1. DOE Order 5400.1 requires the Laboratory to prepare a Groundwater Protection Management Program Plan (GWPMPP). The program was required by the order to (1) document the groundwater regime with respect to quantity and quality; (2) design and implement a groundwater monitoring program to support resource management and comply with applicable environmental laws and regulations; (3) establish a management program for groundwater protection and remediation, including specific SDWA, RCRA and CERCLA actions; (4) summarize and identify areas that may be contaminated with hazardous substances; (5) develop strategies for controlling sources of these contaminants; (6) establish a remedial action program that is part of the site CERCLA program required by DOE 5400.4; and (7) have in place decontamination and decommissioning and other remedial programs contained in DOE directives.

The Laboratory completed a major revision of the draft GWPMPP in 1994. The GWPMPP focuses on protection of groundwater resources in and around the Los Alamos area and ensures that all groundwater-related activities comply with the applicable federal and state regulations.

The GWPMPP also fulfills the requirements of Chapter IV, Section 9 of DOE Order 5400.1. This section requires development of a Groundwater Monitoring Plan (GMP) as a specific element of the GWPMPP. The GMP identifies all DOE requirements and regulations applicable to groundwater protection and includes monitoring strategies for sampling, analysis, and data management. The general requirements outlined in Section 9b for the GWPMPP include: (1) determination of baseline groundwater quality and quantity conditions; (2) demonstration of compliance with, and implementation of, all applicable regulations and DOE orders; (3) providing data that will allow early detection of groundwater pollution or contamination; (4) providing a reporting mechanism for detection of groundwater pollution or contamination; (5) identifying existing and potential groundwater contamination sources and to maintain surveillance of these sources; and (6) providing data upon which decisions can be made concerning land disposal practices and the management and protection of groundwater resources.

The GWPMPP contains a business plan in which a prioritized list of activities and studies addresses these above requirements. The business plan also shows the suggested organization for accomplishing the tasks, the proposed funding sources, and a preliminary cost estimate.

Section 9c of Chapter IV of the DOE Order 5400.1 requires that groundwater monitoring needs be determined by site-specific characteristics and, where appropriate, groundwater monitoring programs be designed and implemented in accordance with 40 CFR Part 264, Subpart F, or 40 CFR Part 265, Subpart F. The section also requires that monitoring for radionuclides be in accordance with DOE Orders in the 5400 series dealing with radiation protection of the public and the environment.

RCRA Permit/HSWA Module. LANL's RCRA/NMHWA Part B Operating Permit requires the Laboratory to follow specific procedures in the handling, treatment, monitoring, and disposal of hazardous wastes.

Module VIII of the RCRA Operating Permit, i.e. the HSWA Module, Task III requires the Laboratory to collect information to supplement and verify existing information on the environmental setting at the facility and collect analytical data on groundwater contamination. Under Task III, Section A.1, the Laboratory is required to conduct a program to evaluate hydrogeologic conditions. Under Task III, Section C.1, the Laboratory is required to conduct a groundwater investigation to characterize any plumes of contamination at the facility.

The Laboratory continued an ongoing study of the hydrogeology and stratigraphy of the region. In 1993, two bore holes (LADP-3 and LADP-4) were drilled near TA-21 to investigate the occurrence of intermediate perched groundwater zones and to add to the knowledge of the geology of the area.

The Laboratory updated results of analyses of groundwater samples for tritium (Refer to Section VII or EARE 1994b for more information). The analyses were performed using a new method that enabled detection of very minute amounts of tritium. This data helps to further understand various hydrogeologic characteristics as required by the HSWA Module and DOE Order 5400.1.

The Laboratory also completed part of an ongoing study of environmental geochemistry for surface and subsurface waters in the Pajarito Plateau and outlying areas (Blake 1995). The study included major element, trace element, and isotope analyses of 130 water samples from 94 different springs, wells, and water bodies in the area. This study contributes information needed to understand background water quality and recharge information required by the HSWA Module.

A study of fracture characterization of the Bandelier Tuff was also completed in 1994 (Wohletz 1995). This study focused on fractures in the Tshirege Member in Los Alamos Canyon. This study contributes information needed to understand the occurrence and nature of fractures as required by the HSWA Module.

New Mexico Water Quality Control Commission Regulations. NMWQCC regulations control liquid discharges onto or below ground surface to protect all groundwater of the State of New Mexico. Under the provisions, a groundwater discharge plan must be submitted to the NMWQCC by the facility and approved by the commission director. Subsequent discharges must be consistent with the terms and conditions of the plan.

NMWQCC regulations require site-specific background information for the groundwater discharge plans including site characterization, depth to groundwater, geologic stratigraphy, and the number of wells. The Laboratory also needs to determine potential pathways through which effluent could enter the regional aquifer or the intermediate and alluvial perched groundwater zones. The regulations also protect surface waters that are fed by groundwater inflow.

New Mexico Solid Waste Management Regulations. SWMR requires that landfills establish groundwater monitoring programs and that other solid waste facilities demonstrate that groundwater will be protected. The Laboratory has several Solid Waste Disposal Areas which operate under SWMR regulations. During 1994 the Laboratory submitted documentation for a groundwater monitoring suspension request for MDA J at TA-54 and proposed a vadose zone monitoring plan instead. The plan proposed would emplace a vadose zone monitoring network to detect any downward movement of contaminants. Because groundwater is at a depth of 305 m (1,000 ft) beneath unsaturated tuff, the Laboratory maintains that vadose zone monitoring would be more efficient in detecting possible contamination migration before it could reach the regional aquifer than the groundwater monitoring required under the SWMR.

Safe Drinking Water Act. The SDWA requires that the Laboratory and Los Alamos County water distribution systems meet specific standards for maximum contaminant levels for organic, inorganic and radiochemical constituents.

The Laboratory conducts annual sampling at many points in the distribution system. In addition, the Laboratory also samples annually groundwater from all supply wells. These samples are analyzed for the organic, inorganic, and radioactive constituents required by the SDWA.

National Pollutant Discharge Elimination System Permit. NPDES was established by the CWA and requires permitting of all point-source effluent discharges into the nation's waters. The primary goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Specific criteria for an effluent must be met before that effluent can be discharged into the environment.

Anticipated Regulatory Requirements. The Laboratory needs to be able to comply with anticipated state regulatory requirements. Under the NMWQCC regulations, which pertain to industrial and municipal discharges onto or below the surface of the ground, the NMED can request a Groundwater Discharge Plan for new and existing facilities. The plan would require a site investigation, characterization of the waste stream, and justification that discharge activities will not degrade groundwater.

The Laboratory has two sanitary treatment facilities and more than 100 industrial outfalls. A Groundwater Discharge Plan could be requested by the NMED for any of these facilities, and the Laboratory would need to comply within 120 days after the request.

The Laboratory has two approved Groundwater Discharge Plans to meet NMWQCC regulations, one for TA-57 (Fenton Hill) and one for the TA-46 Sanitary Wastewater Treatment Plant which is the location for the sanitary wastewater systems consolidation (SWCS) Project (DOE 1992).

In addition, 10 CFR 834 is scheduled to become law. It is anticipated that the content will be similar to DOE Order 5400.5, which addresses radiation doses to the public. Ninety days after the document is presented for public review, it could become law. LANL will be required to be in compliance with the specified date stated in 10 CFR 834.

9. Federal Clean Air Act and the New Mexico Air Quality Control Act.

a. Federal Regulations. The Laboratory is subject to a number of federal air quality regulations. These include

- National Emission Standards for Hazardous Air Pollutants (NESHAP)**;**
- National Ambient Air Quality Standards;
- New Source Performance Standards,
- Stratospheric Ozone Protection (SOP); and
- Operating Permit Program.

All of the above requirements that are applicable to LANL, except the NESHAP for radionuclides and provisions relating to SOP, have been adopted by the State of New Mexico as part of its State Implementation Plan. Therefore, all of these regulations, except the radionuclide NESHAP and SOP, are discussed in Subsection b, State Regulations.

Radionuclide NESHAP. Under 40 CFR 61, Subpart H, the EPA limits the effective dose equivalent to any member of the public from radioactive airborne releases from DOE facilities, including LANL, to 10 mrem/yr. The 1994 effective dose equivalent to a member of the public was 7.62 mrem/yr, primarily from the LAMPF operations. Any construction or modifications undertaken at LANL that will increase airborne radioactive emissions require preconstruction approval from EPA. In 1994, 102 such projects were received by Air Quality (ESH-17) or Environmental Protection (ESH-8) for Laboratory review; only four of these were determined to require preconstruction approval.

In 1991, the EPA determined that LANL did not meet the requirements of 40 CFR 61, Subpart H, and issued LANL a Notice of Noncompliance. As a result of the NON, the DOE is negotiating a FFCA with EPA Region 6. The FFCA will include schedules that the Laboratory will follow to come into compliance with the Clean Air Act and will continue to address the issues raised in the 1991 NON.

Stratospheric Ozone Protection. Effective July 1, 1992, Section 608 (National Emission Reduction Program) of the Clean Air Act Amendments (CAAA) of 1990 prohibits individuals from knowingly venting ozone depleting substances (ODS) used as refrigerants into the atmosphere while maintaining, servicing, repairing, or disposing of air conditioning or refrigeration equipment. Johnson Controls Incorporated (JCI) recovers and recycles all ODS during servicing and repair of all refrigeration equipment at the Laboratory and does not vent ODS to the atmosphere. Final regulations concerning the type of recovery/recycling equipment to be used and the procedures for using this equipment became effective on July 13, 1993.

Section 609 (Servicing of Motor Vehicle Air Conditioners) of the CAAA established standards and requirements related to recycling equipment used in the servicing of motor vehicle air conditioners, and training and certification of technicians providing such services. JCI provides all servicing and maintenance relating to automotive air conditioning equipment at the Laboratory in full compliance with these regulations.

Section 611 (Labeling of Products Using ODS) of the CAAA established requirements that no container containing Class I or II ODS or any product containing Class I ODS may be shipped across state lines unless it bears an appropriate warning label. This regulation came into effect on November 11, 1993. ESH-17 worked with groups that ship ODS products and ODS-containing waste off site to ensure that the proper labeling requirements are met.

b. State Regulations. The NMED preserves air quality through a series of air quality control regulations (AQCRs). The AQCRs relevant to Laboratory operations are discussed below.

AQCR 301—Regulation to Control Open Burning. AQCR 301 regulates the open burning of materials. Under this regulation, open burning of explosive materials is permitted when transport of these materials may be dangerous. Provisions of this regulation allow DOE and the Laboratory to burn waste explosives. In 1994, the Laboratory had six open burning permits: one for the open burning of jet fuel for ordnance testing at TA-11, K Site; another for the open burning of metals for ordnance testing at TA-11, K Site; one for the open burning of explosive-contaminated materials at TA-14; one for the open burning of explosive-contaminated materials at TA-16; one for burning explosive-contaminated wood at TA-36; and one for burning small piles of wood for Light Imaging Radar testing at TA-33 and TA-39 (Table III-2).

AQCR 401—Regulations to Control Smoke and Visible Emissions. AQCR 401 limits the visible emissions allowed from the Laboratory boilers to less than 20% opacity. Opacity is the degree to which emissions reduce the transmission of light and obscure the view of a background object. Because the Laboratory boilers are fueled by clean-burning natural gas, exceeding this standard is unlikely. It may, however, occur during start-up with oil, the backup fuel for the boilers. Although oil is used infrequently, the boilers must be periodically switched to oil to ensure that the backup system is operating properly. Opacity is read during these switches. Only one exceedance of the opacity standard occurred in 1994; it occurred at the TA-16 steam plant. Notification procedures as required by AQCR 801 were followed, thereby preventing any compliance actions.

AQCR 501—Asphalt Process Equipment. Provisions of AQCR 501 set emission standards according to process rate and require the control of emissions from asphalt-processing equipment. The asphalt concrete plant operated by JCI is subject to this regulation. The plant, which has a 68,162 kg/h (75 ton/h) capacity, is required to meet an emission limit of 15 kg (33 lb) of particulate matter per hour. A stack test of the asphalt plant in August 1992 indicated an average emission rate of 1.9 kg/h (4.2 lb/h) and a maximum rate of 2.3 kg/h (5.1 lb/h) over three tests (Kramer 1993a). Although the plant is old and is not required to, it meets NSPS stack emission limits for asphalt plants.

AQCR 507—Oil Burning Equipment-Particulate Matter. This regulation applies to an oil burning unit having a rated heat capacity greater than 2.5×10^8 Btu/hr. Oil burning equipment of this capacity must emit less than 0.03 lb per million Btu of particulate. Although the Laboratory boilers use oil as a backup fuel, all have maximum rated heat capacities below this level; consequently, this regulation does not apply. The TA-3 power plant operates the three highest heat capacity boilers, each of which had an observed maximum capacity of 210 million Btu/h.

AQCR 604—Gas Burning Equipment-Nitrogen Dioxide. Provisions of AQCR 604 require gas burning equipment built before January 10, 1972, to meet an emission standard of 0.3 lb of NO_2 per million Btu when natural gas consumption exceeds 10^{12} Btu/yr/unit. Only the TA-3 steam plant has the capacity to operate at this level. While the TA-3 steam plant has the capacity to operate at this level, it never has and is therefore not an applicable source for this regulation. However, stack tests done in 1994 indicate that the TA-3 power plant meets the emission standard.

AQCR 605—Oil Burning Equipment-Sulfur Dioxide. This regulation applies to oil burning equipment having a heat input of greater than 1×10^{12} Btu/yr. Although the Laboratory uses oil as a backup fuel, no oil-fired equipment exceeds this threshold heat input rate. Therefore, this regulation did not apply during 1994 to the Laboratory fuel burning equipment. Should such equipment operate above the heat input limit, emissions of sulfur dioxide would be required to be less than 0.34 lb per million Btu.

AQCR 606—Oil Burning Equipment-Nitrogen Dioxide. This regulation applies to oil burning equipment having a heat input of greater than 1×10^{12} Btu/yr. Although the Laboratory uses oil as a backup fuel, no oil-fired equipment exceeds this threshold heat input rate. Therefore, this regulation did not apply during 1994 to the Laboratory fuel burning equipment. Should such equipment operate above the heat input limit, emissions of nitrogen dioxide would be required to be less than 0.3 lb per million Btu.

AQCR 702—Permits. Provisions of AQCR 702 require permits for any new or modified source of potentially harmful emissions if they exceed threshold emission rates. More than 500 toxic air pollutants are regulated, and each chemical's threshold hourly rate is based on its toxicity. The Laboratory reviews each new and modified source and makes conservative estimates of maximum hourly chemical usage and emissions. These estimates are compared with the applicable AQCR 702 limits to determine if additional permits are required. During 1994, more than 100 source reviews were conducted. None of these sources required permits under AQCR 702.

AQCR 707—Prevention of Significant Deterioration. These regulations have stringent requirements that must be addressed before the construction of any new, large stationary source can begin. Under this regulation, wilderness areas, national parks, and national monuments receive special protection. For the Laboratory, this mainly impacts Bandelier National Monument's Wilderness Area. Each new or modified source at the Laboratory is reviewed to determine whether this regulation applies; however, none of the new or modified sources in 1994 have resulted in emission increases considered "significant," and they were therefore not subject to this regulation.

AQCR 751—Emission Standards for Hazardous Air Pollutants. In this regulation, NMED adopts by reference all of the federal NESHAP, except those for radionuclides and residential wood heaters. The impact of each applicable NESHAP is discussed below:

Asbestos. Under the NESHAP for asbestos, the Laboratory must ensure that no visible asbestos emissions to the atmosphere are produced by asbestos removal operations at the Laboratory. During 1994, no Laboratory operation produced visible asbestos emissions.

The Laboratory is also required to notify NMED of asbestos removal activities and disposal quantities. Such activities involving less than 15 m^2 (160 ft^2) or 74 m (260 lin ft) are covered by an annual small job notification to NMED. For projects involving greater than these amounts of asbestos, separate notification to NMED is required in advance of each project. NMED is notified of asbestos wastes (both small and large jobs) on a quarterly basis, which includes any material contaminated, or potentially contaminated, with radionuclides. Radioactively contaminated material is disposed of on site in a designated radioactive asbestos burial area. Nonradioactive asbestos is transported off site to designated asbestos disposal areas.

During 1994, LANL shipped off site for disposal 36.62 m^3 (1,292 ft^3) of small job asbestos waste. JCI disposed of approximately 16.85 m^3 (595 ft^3) of potentially radioactive contaminated material from small job activity during 1994. One large decontamination and decommissioning job that was begun in 1993 accounted for an additional 83.6 m^3 (2,950 ft^3) of potentially radioactive, friable and nonfriable, asbestos waste during the year. No material from the large job was shipped off site.

Beryllium. The beryllium NESHAP includes requirements for notification, emission limits, and stack performance testing for beryllium sources. The Laboratory has previously received five beryllium permits from NMED (Table III-2) and has registered several additional facilities. The registered facilities do not require permits under the regulations because they existed before the adoption of the federal NESHAP. One permitted beryllium processing operation, TA-3-35, has not yet been constructed, so the permit is not active. The beryllium machining operations conducted at TA-55 were modified to allow diamond-saw cutting. This and other minor modifications were approved by NMED on July 1, 1994.

NMED inspected three permitted beryllium operations and reviewed filter testing records on all permitted operations in January 1994. There were no findings resulting from this audit. Exhaust air from each of the beryllium operations passes through air pollution control equipment before exiting from a stack. A fabric filter controls emissions from TA-3-39. The other operations use high-efficiency particle airfilters to control emissions, with efficiencies of 99.95%. Source tests for the existing operations have demonstrated that all beryllium operations meet the permitted emission limits set by NMED and have a negligible impact on ambient air quality.

AQCR 770—Operating Permits. The NMED Operating Permit Program was approved by EPA in December 1994. This regulation requires major sources of air pollution to obtain an operating permit with the NMED. Because of LANL's potential to emit regulated air pollutants (primarily from the steam plants), LANL is considered a major source. The permit will specify the operational terms and limitations required to meet all federal and state air quality regulations. During 1993 and 1994, the Laboratory began to examine its emission sources to determine what applicable requirements will need to be included in its operating permit and is working with NMED to develop a plan to ensure compliance with the resulting operating permit conditions. The Laboratory's operating permit application is due to the NMED in December 1995.

AQCR 771—Fees. As part of the new Operating Permit Program, the State of NM will begin to charge yearly fees to sources of air pollution that are required to obtain an operating permit. Fees will depend on the amount of air pollutants described in the source's permit.

AQCR 801—Excess Emissions during Malfunction, Start-up, Shutdown, or Scheduled Maintenance. This provision allows for excess emissions from process equipment during malfunction, start-up, shutdown, or scheduled maintenance, provided the operator verbally notifies the NMED either before or within 24 hours of the occurrence, followed by written notification within 10 days of the occurrence. One incident of excess particulate emissions was recorded in 1994. This occurred at the TA-16 steam plant during fuel switching procedures. Notification procedures as required by AQCR 801 were followed. New training procedures initiated in 1993 reduced the likelihood of excess emissions from the testing of the oil-fired backup system.

In addition to the existing federal programs, the CAAA of 1990 mandates new programs that may affect the Laboratory. The new requirements include control technology for hazardous air pollutants, enhanced monitoring, prevention of accidental releases, and chlorofluorocarbon replacement. The Laboratory will track new regulations written to implement the act, determine their effects on Laboratory operations, and implement programs as needed.

10. National Environmental Policy Act.

a. Introduction. NEPA of 1969 (42 U.S.C. 4331 *et seq.*) mandates that federal agencies consider the environmental impact of their proposed major actions and allow public input before making a final decision on what actions to take. The DOE is the sponsoring agency for most LANL activities, and it is DOE's policy to follow the letter and spirit of NEPA. DOE uses the regulations for implementing NEPA published by the Council on Environmental Quality at 40 CFR Parts 1500 –1508 and its own NEPA Implementing Procedures as published at 10 CFR Part 1021. Under these regulations and DOE Orders 5440.1D and 5440.1E, DOE reviews proposed LANL activities and determines whether the activity is categorically excluded from the requirements or if one of the following need to be prepared:

- an EA, evaluating environmental impacts, leading to either a finding of no significant impact (FONSI) if the impacts are indeed found to be not significant or requiring an Environmental Impact Statement (EIS) if the impacts are significant,
- an EIS, in which impacts of proposed and alternative actions are evaluated and mitigation measures proposed. The EIS is followed by a record of decision in which the agency decides if and how to proceed with a project.

If an EA or and EIS is required, the DOE is responsible for directing its preparation.

LANL project personnel initiate NEPA reviews by completing environment, safety, and health identification documents, which form the basis of a DEC written by the Environmental Assessments and Resource Evaluation group (ESH-20) using the format specified by the DOE Albuquerque Field Office (DOE/AL). As part of the NEPA review process, proposed projects are evaluated for possible effects on cultural resources (archeological sites or historic buildings), in accordance with the National Historic Preservation Act (NHPA) of 1966. In addition, proposed projects are evaluated for potential impact on threatened, endangered, or sensitive species, in accordance with the Endangered Species Act, and on floodplains or wetlands, in accordance with relevant executive orders. The DEC is submitted to DOE Los Alamos Area Office (DOE/LAAO), which uses it to assist DOE in determining the appropriate level of NEPA documentation. In 1994, LANL prepared 131 DECs for DOE review. Also in 1994, DOE categorically excluded 103 actions and determined that 10 other actions were covered under existing NEPA documents. Other actions were awaiting DOE decisions. DOE issued one FONSI in 1994. DOE did not require an EA on any projects for which a DEC was submitted in 1994, but it did determine that six projects for which DECs were submitted in previous years would require EAs. A short description of projects requiring an EA or EIS is given in Section IV.B

11. National Historic Preservation Act and Native American Graves Protection and Repatriation Act.

In accordance with the Native American Graves Protection and Repatriation Act, LANL cultural resource staff began an inventory of all burial remains excavated from DOE land since 1943. One tour of archaeological artifacts removed from DOE land and now curated at the Museum of New Mexico in Santa Fe was conducted for tribal representatives from the Pueblo of San Ildefonso. Final report preparation and further consultation will continue into 1995 and 1996.

12. Endangered, Threatened, and Protected Species.

The DOE and the Laboratory must comply with the Endangered Species Act, the Migratory Bird Treaty Act, and the Bald Eagle Protection Act. The Laboratory also considers plant and animal species listed under the New Mexico Conservation Act and the Endangered Species Act. During 1994, ESH-20 reviewed 395 proposed Laboratory actions for potential impact on threatened and endangered species. Of these, 185 proposed actions were identified through the ESH Questionnaire system. The Ecological Studies Team (EST) of ESH-20 identified 40 projects that required reconnaissance surveys (Level I surveys). These surveys are designed to evaluate the amount of previous development or disturbance at the site and to determine the presence of any surface water or floodplains in the site area. EST also identified 15 projects that required quantitative surveys (Level II surveys) to determine if the appropriate habitat types and habitat parameters were present to support any threatened or endangered species. In addition, EST identified four projects (Table III-5) that required an intensive survey designed to determine the presence or absence of a threatened or endangered species at the project site (Level III

Table III-5. Projects Identified in 1994 that Require a Species Specific Survey

Project Name	Species Surveyed
Site Characterization, OU 1079, ISF gas line	Peregrine falcon Mexican spotted owl Jemez Mountains salamander
High-Explosive Wastewater Treatment Facility	Goshawk Southwestern Willow flycatcher Mexican spotted owl
RCRA Mixed Waste Disposal Facility, TA-67	Goshawk Mexican spotted owl
Site Characterization, OU 1098	Mexican spotted owl

survey). The Laboratory adhered to protocols and permit requirements of the New Mexico State Game and Fish Department.

EST identified projects requiring a survey by first reviewing a literature database that compiles all habitat requirements of federal and state endangered, threatened, and candidate species. After the surveys were completed, the habitat characteristics of the surveyed sites were compared with the habitat requirements of the species in question. Biological evaluations are being prepared for projects requiring a Level II or Level III survey, and consultation with US Fish and Wildlife for written concurrence of findings, as required under the Endangered Species Act, will be undertaken.

No species protected at state or federal level were confirmed within any of the proposed project sites surveyed in 1994. However, highly suitable habitat exists for many of these species (e.g., goshawk, Jemez Mountains salamander, meadow jumping mouse) within some project sites.

13. Floodplain and Wetland Protection.

The Laboratory must comply with EO 11988, Floodplain Management, and EO 11990, Protection of Wetlands (EPA 1989a). During 1994, 465 proposed Laboratory actions were reviewed for impact to floodplains and wetlands. Two proposed projects will require a Floodplain and Wetland Assessment: the High-Explosive (HE) Wastewater Treatment Facility and the Printed Circuit Board Facility. Both projects involve eliminating effluent outfalls that support man-induced wetlands (artificially created wetlands from Laboratory effluents). In compliance with 10 CFR 1022, a Floodplain and Wetland Notice of Involvement and Statement of Findings for these projects were submitted to the DOE in October and November of 1994.

In September 1994, the Laboratory received notice from the Army Corps of Engineers that erosion from a road and sewer line crossing was causing damage to Sandia Canyon wetlands. This represents noncompliance with soil stabilization requirements under the Nationwide Permit, which authorized the construction of the road and sewer line across the Sandia Canyon wetland. Pursuant to Section 404 of the CWA, the Corps requested that the Laboratory repair the erosion and stabilize the slopes in question. The Laboratory plans to complete the erosion control project for this area in 1995.

C. Current Issues and Actions

1. Compliance Agreements.

a. Mixed Waste FFCA. On May 14, 1992, DOE/LAAO, with support from a Laboratory team, began negotiations with EPA Region 6 for an FFCA to ensure complete compliance with the LDR storage prohibition for mixed waste (hazardous and radioactive waste) found in Section 3004(j) of the RCRA and 40 CFR Section 268.50. The draft FFCA was released for public review and comment on July 27, 1993. The FFCA was signed by DOE and EPA on March 15, 1994. The FFCA provides a plan and schedule for the treatment of mixed wastes; it includes some 47 specific compliance milestones, 17 of which were due in 1994. DOE and LANL successfully complied with all 17 milestones. Under a mandate in the FFCAct, DOE has been negotiating, with the State of New Mexico, issues similar to those negotiated in the FFCA. A Consent Agreement or CO implementing the FFCAct is expected to be in effect in late 1995.

b. NPDES FFCA and AO. In March 1993, EPA proposed an FFCA, Docket No. VI-92-1305 to DOE that eliminated the discrepancies between LANL's existing AO (Docket No. VI-94-1242) and the previous DOE FFCA (Docket No. VI-91-1328). The FFCA was reviewed by DOE and UC, but not finalized by EPA. The FFCA still does not reflect the schedules for the new AO (Docket VI-94-1242). The schedules for completing the HE Wastewater Treatment Facility and the Waste Stream Characterization (WSC) projects required under the AO are presented in Table D-7.

In May 1993, EPA served AO Docket No. VI-93-0178 on the Laboratory stipulating a 30-day compliance schedule for two categories of outfalls with effluent violations during the previous six-month period.

On December 6, 1993, EPA, Region 6, issued AO, Docket No. VI-94-1210 to UC. The AO stated that LANL had failed to meet the HE Wastewater Treatment Facility schedule for outfall 05A. The AO included a revised compliance schedule for completion of the WSC project. This order replaced AO Docket No. VI-92-1306, which was closed on December 6, 1993.

AO Docket No. VI-94-1242, issued to the Laboratory on June 15, 1994, incorporated the revised HE Wastewater Treatment Facility schedule and the schedule for completion of the remaining corrective actions for the WSC Project. This order replaced AO Docket No. VI-92-1210, which was closed on June 15, 1994. AO Docket No. VI-94-1051 was issued to the Laboratory on July 6, 1994. The scope of this AO required the Laboratory to present corrective actions and plans to eliminate the NPDES permit violations that occurred at the Laboratory from 1990 through 1993 in a "show cause" meeting. The show cause meeting took place in Dallas, Texas, at EPA Region 6 on August 25, 1994. No further action was taken by EPA.

c. NESHAP FFCA. In 1991 and 1992 the Laboratory received two NONs from the EPA for not meeting all provisions of 40 CFR 61, Subpart H. Specific findings of the NONs included deficiencies in LANL's identification and evaluation of release sources, noncompliant stack monitoring equipment on all point release sources, incomplete quality assurance programs, and incomplete reporting. As well, the 1992 NON stated that LANL had used a shielding factor without prior EPA approval and as such exceeded the 10 mrem/yr standard. Currently, the Laboratory is negotiating an FFCA with EPA Region 6, which will provide an enforceable mechanism to bring the Laboratory into compliance with these requirements. However, the Laboratory has been actively engaged in a program to achieve compliance with the provisions of 40 CFR 61, Subpart H as the FFCA is being finalized. Progress toward full compliance includes the following:

- A comprehensive inventory of point release sources has been completed. An inventory of diffuse (nonpoint) release sources has begun. These inventories identify and describe sources of radioactive air emissions. Both inventories are continually updated as new information is received and old information is revised.
- Stack monitoring equipment at LAMPF has been upgraded to meet the requirements of 40 CFR 61, Subpart H, monitoring requirements. All tritium stacks are in physical compliance. As scheduled, upgrades have begun on stack monitoring equipment at TA-3, TA-48, TA-50, and TA-55; these upgrades are in various stages of completion. Upgrades at other facilities throughout the Laboratory are scheduled.
- For monitoring radioactive air emissions at LAMPF, a quality assurance (QA) project plan has been completed, approved by DOE, and implemented. This plan has been audited by DOE and found to be in compliance. QA project plans are being developed for monitoring radioactive air emissions and tritium facilities. In addition, an overall QA project plan has been drafted for the management of radioactive air emissions; necessary procedures have been written, approved, and updated.

LANL ceased using the shielding factor in 1992. The LANL dose to the public has not exceeded the 10 mrem/yr standard since 1991. The FFCA is expected to be completed and signed in 1995.

d. Environmental Oversight and Monitoring Agreement. The Environmental Oversight and Monitoring Agreement (known as the Agreement in Principle or AIP) between DOE and the State of New Mexico provides technical and financial support by DOE for state activities in environmental oversight, monitoring, access, and emergency response. The Agreement was originally signed in October 1990 and covers Los Alamos and Sandia National Laboratories, the Waste Isolation Pilot Project, and the Inhalation Toxicology Research Institute. NMED is the lead state agency under the Agreement. The AIP is up for renewal in 1995; DOE and NMED are negotiating a five-year extension to this agreement.

During 1994, the NMED AIP staff conducted oversight of several of the Laboratory's environmental programs. Highlights of these activities are presented below (NMED 1995).

Hydrogeological: NMED AIP staff continued development of an updated conceptual hydrogeological model for the site.

Spill Closures: NMED AIP staff accompanied the ESH-18 staff during unplanned liquid release cleanup verifications. Upon verification of adequate cleanup of release sites, the NMED AIP staff administratively closed out the spills. In 1994, NMED AIP staff administratively closed 22 of 24 releases which occurred in 1994.

Sampling: Extensive sampling activities were conducted at LANL in 1994. Sampling is done in coordination with the LANL Environmental Surveillance Program and NPDES Permit Program in order to obtain split or duplicate samples. Split samples are submitted to the state SLD and independent laboratories for analysis. The activities included sampling of groundwater, NPDES outfalls, springs, stream bed sediment, snowmelt and rainwater runoff, and foodstuffs.

Samples were collected from approximately 50 environmental monitoring stations at LANL, 5 independent stations, and 5 stations at the Pueblo of San Ildefonso. No soil samples were collected in 1994. NMED AIP personnel continued study of aquatic life in the perennial reaches of interrupted streams at LANL. In 1994, two environmental sampling and surveillance trips in White Rock Canyon were conducted. Analytical results of sampling activity in 1994 at LANL revealed no unexpected concerns.

Environmental Restoration: One of the major accomplishments of the AIP program in 1994 was the ranking and prioritization of individual potential disposal sites in order to focus on the most serious sites among the more than 2,000 that exist in LANL's ER Project.

NMED/AIP staff at LANL developed recommendations on the content and format of LANL ER reports in order to standardize and clarify reports to the state. NMED/AIP-initiated national ER electronic communications system received added support from DOE in 1994, and the effort to broaden the availability of "best ideas" in the ER Project continued.

Waste Management: NMED/AIP staff reviewed reports of the Laboratory's Waste Stream Characterization program for compliance with the NPDES permit. The reports verify proper identification of all waste streams at LANL.

Quality Assurance: NMED/AIP staff reviewed internal QA and quality control procedures for environmental monitoring activities in 1994. AIP staff made recommendations to ESH-20 regarding standardization of the site selection process that were implemented to facilitate inter-canyon comparisons. NMED/AIP staff recalculated public doses from a proposed waste drum facility at TA-54 as part of reviewing a LANL application to EPA; dose calculations were in agreement with those reported by LANL.

Releases and Corrective Actions: On November 29, 1994, a hole in a radioactive liquid waste line located at TA-21-3 North was found. The hole was found during an investigation to determine the reason for decreased flow to the TA-21 radioactive liquid waste collection system. AIP personnel were involved in the planning of corrective activities for the leaking pipe. The sinks and drains associated with the leaking pipe were all disconnected. The leaking pipe was contained by a concrete containment trench.

2. Corrective Activities.

- *HE Wastewater Treatment Facility.* This project consists of an HE Wastewater Treatment Facility. No collection system will be utilized; all wastewater will be trucked to the treatment facility. Title I design for the facility was completed in FY94; construction is planned for FY96. Upgrading the HE wastewater facilities is required under the Laboratory's NPDES FFCA and AO.

- *Water Supply and Cross Connection Controls (CCC) Survey.* The CCC Survey continued in 1994. As of the end of December, 114 of the 363 Laboratory buildings with potable water service, or about 31%, had been surveyed. In 1994, the CCC Survey completed three critical buildings in the survey: Chemistry and Metallurgy Research; Sigma; and TA-59, Building 01. These buildings are among the largest and most complex buildings at LANL, and their completion was a significant milestone for the survey. As of the end of

December, 844 potential cross connections or other identifiable plumbing deficiencies had been identified by the survey; 430 of the most critical problems have been fixed, while the remaining 414 problems have been backlogged pending the availability of additional resources.

- *Drinking Water Lead Survey.* This survey was initiated in 1993 by ESH-18 as a best management practice and Tiger Team Corrective Action because some drinking fountains at the Laboratory had demonstrated lead levels higher than the EPA action level of 15 parts per billion (ppb). In the summer of 1994, 1,300 drinking water taps at the Laboratory were sampled for lead; 61 of those taps sampled demonstrated lead levels equal to or greater than the EPA action level of 15 ppb and were resampled for confirmation purposes in the fall of 1994. Final reports and recommended corrective actions will be issued in early 1995.

- *Waste Stream Characterization Survey.* This survey of all Laboratory buildings was completed on October 8, 1993. Reports were finalized in March 1994 and distributed to Division Directors for facilities under their management. ESH-18 has been working with user groups to complete the remaining corrective actions recommended in the WSC reports. See Table D-7 for schedule for completion of corrective activities required by AO Docket No. VI-94-1242.

3. Emergency Planning

In accordance with DOE Orders in the 5500 series, it is the Laboratory's policy to develop and maintain an emergency management system that includes emergency planning, emergency preparedness, and effective response capabilities for responding to and mitigating the consequences of an emergency. The Laboratory's Emergency Management Plan is a document that describes of the entire process of planning, responding to, and mitigating the potential consequences of an emergency. The most recent revision of the plan was distributed in July 1993; future revisions will be distributed on an as-needed basis.

4. Waiver or Variance Requests.

Groundwater monitoring is required for all RCRA surface impoundments, landfills, waste piles, and treatment units. This requirement may be waived if it can be demonstrated that there is little or no potential for a release from the units to migrate to the uppermost aquifer, as has been demonstrated for several units located at TA-16, 35, 53, and 54. All but the demonstration at TA-53 have been provided to the state's Hazardous Waste Program for review. The surface impoundments at TA-53 are currently planned for clean closure under RCRA and therefore will not require groundwater monitoring.

5. Significant Accomplishments.

The LANL Air Quality Group (ESH-17) and the DOE have made significant progress toward obtaining an FFCA with EPA Region 6. Publication of the draft FFCA and Compliance Plan is anticipated for the summer of 1995 followed by public comment.

ESH-17 has made significant progress in developing the CAA Operating Permit Application. Under the guidance of NMED, ESH-17 is developing an application that will include voluntary emission caps that will better define the Laboratory's emissions of regulated air pollutants. The Operating Permit Application is due to the NMED by December 1995. It is anticipated that LANL will meet this deadline.

LANL was successful in obtaining formal EPA approval of representative sampling and the use of the shrouded probe as an alternative radionuclide sampling method. This new technology may be used in some of LANL's facilities to demonstrate compliance with 40 CFR 61, Subpart H "Radionuclide Emission Other than Radon from DOE Facilities."

ESH-19 was proactive in supporting DOE in complying with the mixed waste FFCA requirements and with completion of DOE's draft FFCA with EPA. LANL successfully developed 17 documents that were both timely and complete to comply with the FFCA. Other accomplishments include the approval of modifications to the RCRA permit for the TWISP at TA-54, Area G and issuance of an emergency RCRA permit for treatment of cheesecloth rags that had been nitrated at TA-55.

ESH-18 continued to identify all waste streams that may potentially enter NPDES outfalls and to verify that each is included in the proper outfall category. Implementation of this program has allowed the Laboratory to comply with its NPDES permit under the previous AO. Specific accomplishments of the Laboratory's WSC program include

- elimination of 74 unpermitted outfalls discovered through the WSC program,
- finalized 83 WSC reports documenting WSC findings,
- developed a WSC corrective action tracking data base, and
- completed 25% of the WSC corrective actions.

In addition, the Laboratory's new NPDES permit was approved and issued by EPA.

The NEPA staff in ESH-20 implemented a more effective method for identifying and reviewing new Laboratory projects was implemented. The ESH-20 EST published three reports: "Radionuclide Concentrations in Game and Nongame Fish Upstream and Downstream of Los Alamos National Laboratory," "Tritium Concentrations in Bees and Honey at Los Alamos National Laboratory," and "Aquatic Macroinvertebrates and Water Quality of Sandia Canyon," Los Alamos National Laboratory.

The LANL Site-Wide Environmental Impact Statement (SWEIS) project office was opened in October 1994 in order to support DOE and its contractor by identifying baseline environmental, programmatic, facility and operations, project-specific, and socioeconomic data. The project office is expected to be operational for two and a half years during the course of the development, drafting, and approval of the SWEIS.

6. Significant Problems.

a. Lawsuits. In late 1994 local citizen's groups sued DOE seeking to enjoin construction of DARHT on the basis that NEPA had not been complied with. In early 1995 an injunction was granted pending completion of an EIS already in progress.

In 1994, a citizen's group sued the DOE and the Laboratory under the Clear Air Act. The group is concerned about the time it is taking for the Laboratory to achieve compliance with 40 CFR 61 Subpart H.

b. Other Issues. NMED notified DOE and LANL that they did not have a waste analysis plan that would properly characterize the waste stored on the TRU pads at TA-54, Area G. LANL has prepared a new waste analysis plan that should meet the criteria identified by NMED in their NOD . That plan will be submitted by March 31, 1995.

7. Tiger Team Assessment.

The Tiger Team Assessment was conducted at LANL from September 23 to November 8, 1991, under the auspices of the Office of Special Projects, Office of the Assistant Secretary for Environment, Safety and Health, DOE Headquarters. The objectives of the Environmental Subteam of the Tiger Team were to assess the effectiveness of environmental programs and program management at the Laboratory, the Laboratory's compliance with applicable regulations, and the effectiveness of best management practices within specific technical disciplines.

The Tiger Team did not identify any environmental deficiencies that could be considered an immediate danger to worker or public health and safety. The Tiger Team identified individual findings within nine technical disciplines. These individual findings were evaluated to determine four key findings-findings that summarize the most significant deficiencies in the Laboratory's environmental program. The key findings were

- inadequate site-wide programs for managing wastes;
- inadequate identification, monitoring, and control of effluent releases;
- inadequate strategies for and management of regulatory permits; and
- lack of oversight for environmental activities.

The Tiger Team also identified some positive aspects of the Laboratory's environmental programs. In particular, the Tiger Team identified the high quality of environmental professionals at the Laboratory and their dedicated efforts to provide adequate and defensible programs and to meet regulatory requirements.

The Laboratory prepared action plans to address the environmental deficiencies identified by the Tiger Team. The plans were submitted to DOE for review and approval on March 31, 1992. The Tiger Team Corrective Action Plan was signed by the Secretary of Energy on October 28, 1992.

The Laboratory was restructured in 1994. Of the 49 action plans (comprising 90 Tiger Team findings) for which the Laboratory's former Environmental Management Division was responsible, 18 action plans (31 findings) have been transferred to other divisions. Of the 31 action plans (59 findings) remaining in the Environment, Safety and Health (ESH) Division, 17 are of high priority and 14 are lower priority.

Of the high-priority action plans, 2 are closed, 11 are open and behind schedule (with no work reported completed), 1 is open but on schedule, and 3 are in various stages of completion (some findings completed, some late). Of the low priority action plans, none are late, 1 is closed, 1 is reported completed (awaiting paperwork to close), 11 are open but on schedule, and 1 is partly completed.

Because of limited indirect funding, a number of action plans that were initially designated as high priority did not receive funding in accordance with completion schedules. For this and other reasons, work has not progressed in accordance with original schedules. Nevertheless, some Tiger Team work was accomplished in 1994.

Tiger Team action plans are being incorporated into activity data sheets (ADSs) with other activities of similar nature and impact in the FY96-2000 ESH Management Plan (formerly the Five-Year Plan). The ADSs are subjected to the Laboratory's risk/cost-benefit prioritization process, which results in funding the higher priority activities. Where ADSs were funded, some funding was applied to Tiger Team action plans. The budget process has been modified to the extent that indirect funds no longer assign specific program codes to Tiger Team Action Plans. This allows the ESH Division more discretion in applying indirect funding to essential projects. Where possible, work is continuing in pursuit of resolving important environmental, safety, and health, and compliance-related activities in both funded and unfunded action plans. In the latter case, existing operational resources are used wherever possible.

8. DOE/HQ Audits and Assessments.

The DOE Albuquerque Field Office prepares an Annual Performance Appraisal of Los Alamos each year. The 1994 report ranked the overall environmental management program at the Laboratory as "meeting expectations." The environmental protection programs were described as "meeting expectations" and "showing improvement" over the 1993 performance.

IV. Environmental Program Information

The Los Alamos National Laboratory (LANL or the Laboratory) supports an ongoing environmental surveillance program that includes routine monitoring for radiation, radioactive materials, and hazardous chemical substances on the Laboratory site and in the surrounding area. Over 450 sampling locations are used for routine surveillance of the environment. Each year, more than 11,000 environmental samples are analyzed.

The Laboratory managed approximately 2,675 m^3 (94,428 ft^3) of radioactive wastes, 255 m^3 (9,000 ft^3) of hazardous wastes, and 1,500 m^3 (52,950 ft^3) of nonhazardous wastes.

The Environmental Restoration (ER) Project continued its mandate to identify the extent of contamination at the Laboratory and to determine appropriate means of cleaning it up under applicable laws and regulations.

No new draft Environmental Assessments (EAs) were submitted to US Department of Energy (DOE) for review during 1994; several EAs were being revised according to DOE comments. During 1994, DOE published an Advance Notice of Intent (ANOI) to prepare a Site-Wide Environmental Impact Statement (SWEIS) for the Laboratory in the Federal Register.

In addition to routine environmental surveillance activities, the Laboratory carried out a number of special studies during 1994, which provide valuable supplementary environmental information.

A. Major Environmental Programs

1. Environmental Protection Program.

The Environment, Safety, and Health (ESH) Division was in charge of performing environmental measurements and activities to help ensure that Laboratory operations did not adversely affect public health or the environment and that the Laboratory conformed with applicable environmental regulatory requirements as required by DOE Orders 5400.1 (DOE 1988a) and 5484.1 (DOE 1990a).

Personnel in the LANL environmental protection programs prepare permits, interpret regulations, provide technical advice, and conduct cultural and biological investigations across the site. They are responsible for environmental monitoring: collecting, analyzing, and interpreting samples of air, water, soil, sediments, food, and hazardous materials. Data are also gathered from measurements of natural radiation and LANL radiation sources. Weather conditions are monitored to assess the transport of airborne contaminants to the environment. The results of these analyses help identify impacts of LANL operations on the environment.

Monitoring and sampling locations for various types of environmental measurements were organized into two groups:

- Off-site locations included

  Regional stations were located within the five counties surrounding Los Alamos County (Figure II-1) at distances up to 80 km (50 mi) from the Laboratory. They provided a basis for determining conditions beyond the range of potential influence from normal Laboratory operations.

  Perimeter stations were located within about 4 km (2.5 mi) of the Laboratory boundary, and many were in residential and community areas. They were used to document conditions in areas regularly occupied by the public and potentially affected by Laboratory operations.

- On-site stations were within the Laboratory boundary, and most were in areas accessible only to employees during normal working hours. They measured environmental conditions at the Laboratory where public access is limited.

Over 450 sampling locations were used for routine environmental monitoring (Table IV-1). The general location of all monitoring stations is presented in maps in the text. For off-site perimeter and on-site stations, specific location coordinates are presented in Appendix D.

Samples of air particles and gases, water, soils, sediments, and foodstuffs were routinely collected at the monitoring stations for subsequent analyses. External penetrating radiation from cosmic, terrestrial, and Laboratory sources was also measured. Meteorological conditions were continually monitored to assess the transport of contaminants in airborne emissions to the environment as well as to aid in forecasting local weather conditions.

Additional samples were collected and analyzed to obtain information about particular events, such as major surface runoff events, nonroutine releases, or special studies. Each year, over 200,000 analyses for chemical and radiochemical constituents were conducted on more than 11,000 environmental samples. Data from these analyses were used for dose calculations, comparisons with standards and background levels, and interpretations of the relative risks associated with Laboratory operations, as presented in Sections V, VI, and VII.

Methods and procedures for acquiring, analyzing, and recording data are presented in Section VIII. Comprehensive information about environmental regulatory standards is presented in Appendix A. Supplemental environmental data tables are given in Appendix D.

2. Waste Management Program.

The waste management function at LANL was formed in 1948 as part of the Los Alamos Area Office of the Atomic Energy Commission. Waste management activities have been focused on minimizing the adverse effects of radioactive wastes on the environment, maintaining compliance with regulations and permits, and ensuring that wastes are managed safely. The Chemical Sciences and Technology Division at LANL became responsible for waste management activities during 1994.

Wastes generated at LANL are divided into categories based on the radioactive and chemical content. No high-level radioactive wastes are generated at LANL. Major categories of waste managed at the Laboratory are presented below:

Low-Level Radioactive Waste. The level of radioactive contamination in low-level waste (LLW) is not strictly defined. Rather, LLW is defined by what it is not. It does not include nuclear fuel rods, wastes from processing nuclear fuels, transuranic (TRU) waste, or uranium mill tailings.

LLW at LANL includes solid waste contaminated with radioactive materials, including plutonium, americium, uranium, or tritium from weapons design and test work; tracer and medical isotopes from scientific studies; mixed fission materials from nuclear energy work; and activation products from physics experiments. (Activation

Table IV-1. Number of Sampling Locations for Routine Monitoring of the Ambient Environment

	Off Site		On Site		Total
Type of Monitoring	Regional	Perimeter Area	Laboratory	Waste Disposal Area	
External radiation	4	23	51	88	166
Air	6[a]	13	22	9	50[b]
Surface waters[c,d]	6	10	12	0[e]	28
Groundwater[c]	0	32	19	15[e]	66
Soils	7	6	9	1	23
Sediments	11	19	29	21	80
Foodstuffs	13	11	21	1	46
Meteorology	0	1	7	0	8

[a]Includes three monitoring stations located on pueblos.

[b]Includes three stations that monitor only nonradioactive air emissions.

[c]Samples from an additional 17 special surface water and groundwater stations related to the Fenton Hill Geothermal Program and 13 wells at the Pueblo of San Ildefonso were also collected and analyzed as part of the monitoring program.

[d]Does not include National Pollutant Discharge Elimination System (NPDES) outfalls sampled to demonstrate regulatory compliance.

[e]Means not counted separately from on-site Laboratory locations.

products are formed when a substance is struck by protons or neutrons. The atoms of the original substance are converted to another element that is unstable and, therefore, radioactive.)

LLW includes items such as equipment, paper, rags, radiation protective clothing, demolition debris from decontamination and decommissioning activities, and contaminated soils and debris from environmental cleanup activities. LLW handled at LANL may require special handling and shielding to protect workers and the public. Most LLW generated at LANL is disposed of on site in pits and shafts designed and engineered for this purpose within Technical Area (TA) 54, Area G. Approximately 2,460 m^3 (86,838 ft^3) of LLW were managed at the Laboratory in FY94.

Transuranic Waste. TRU waste consists or rags, equipment, solidified wastewater treatment sludge, paper, and protective clothing that contain radioactive elements heavier than uranium above a designated threshold. The major radioactive contaminants at LANL, plutonium and americium, both have long half-lives. Less than 100 m^3 (3,530 ft^3) of TRU waste were managed at LANL during FY94

Mixed Waste. Mixed waste contains low-level radioactive elements mixed with nonradioactive hazardous waste. Low-level mixed waste (LLMW) at LANL includes gases, liquids, and solids, such as gas cylinders of hydrogen with a tracer radioactive isotope; contaminated solvents and oils; spent solutions from electroplating operations; contaminated lead shielding; or solid chemicals that react violently with water. Solid LLMW is stored at the site pending the availability of off-site commercial treatment or the development of technologies to treat those wastes that cannot be treated by the commercial sector. Liquid LLMW generated at LANL is stored on site. TRU mixed wastes at LANL are solids. The major hazardous component is solvent contamination or the presence of heavy metals like cadmium or lead. Approximately 115 m^3 (4,060 ft^3) of mixed waste were managed at the Laboratory in FY94.

Hazardous Waste. Hazardous special wastes are defined by regulations under the Resource Conservation and Recovery Act (RCRA) and the NM Hazardous Waste Act (NMHWA). Hazardous wastes at LANL include gases, liquids, and solids such as compressed gas cylinders containing combustible gases; acids, bases, solvents; out-of-date laboratory chemicals; and lead bricks. At present, no disposal facility for hazardous chemical waste exists at LANL. Hazardous wastes are shipped off site for further treatment and disposal to facilities designated in accordance with RCRA.

Nonhazardous Special Waste. Nonhazardous waste is waste that does not fall under the technical definition of hazardous waste but still requires special handling. Other regulations apply to some of these wastes, such as asbestos, infectious wastes, oils, coolants, and other materials that are controlled for reasons of health, safety, or security. Approximately 1,500 m^3 (52,950 ft^3) of nonhazardous waste were managed by LANL in FY94.

3. Environmental Restoration Project.

In 1989, DOE created the Office of Environmental Restoration and Waste Management whose goal is to implement the DOE's policy to ensure that its past, present, and future operations do not threaten human or stakeholders' environmental health and safety (DOE 1990b). The Laboratory's ER Project was established to identify the extent of contamination at the Laboratory and the appropriate means of cleaning it up under applicable laws and regulations. The project provides formal and informal mechanisms through which all interested parties (e.g., DOE, Environmental Protection Agency [EPA], and New Mexico Environment Department [NMED]) can participate in the corrective action review process at the Laboratory. The ER Project is part of the Environmental Management Division.

The ER Project at the Laboratory is regulated by RCRA, which governs the day-to-day operations of hazardous waste management treatment, storage, and disposal facilities; establishes a permitting system; and sets standards for all hazardous waste-producing operations at these facilities. Under this law, the Laboratory must have a permit to operate its facilities. RCRA, as amended by Hazardous and Solid Waste Amendments (HSWA) in 1984, prescribes a specific corrective action process for all potentially contaminated sites. In accordance with these laws, the Laboratory's operating permit included provisions for mitigating releases from facilities currently in operation and for cleaning up inactive sites. More than 2,000 potential release sites (PRSs) have been identified at the Laboratory. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a framework for remediating Laboratory sites containing radioactive materials not covered by RCRA.

The Laboratory is obligated to meet the hazardous waste management requirements of RCRA and HSWA; however, compliance with CERCLA is a voluntary measure on the part of DOE and the University of California, who recognize that contaminants not covered by RCRA are of concern and should not be separated from concerns about hazardous wastes.

The Laboratory follows a three-step corrective action process at all of its PRSs:

- *The RCRA facility investigation* is designed to identify the nature and extent of contamination that could lead to exposure of human and environmental receptors. This step involves characterizing the extent of contamination in the detail necessary so that corrective measures, if any, that need to be taken can be determined. This approach focuses on answering only those questions relevant to determining further actions in a cost-effective manner. In certain circumstances, the Laboratory will take voluntary corrective action, which is an option for accelerated cleanup.
- If investigation indicates that corrective measures are needed, *a corrective measures study* will evaluate cleanup alternatives to reduce risks to human and environmental health and safety in a cost-effective manner.
- *Corrective Measures Implementation* carries out the chosen remedy, verifies its effectiveness, and establishes ongoing control and monitoring requirements.

The approach to the corrective action process at the Laboratory includes making decisions based on risk that take into account the great variety of PRSs and the complexity of the natural environment of the Pajarito Plateau. Chapter 4 of the "Installation Work Plan for Environmental Restoration" for LANL provides a detailed account of the process (IWP 1993).

In accordance with regulatory requirements, the RCRA facility investigations will be completed by approximately May 1995 and the corrective measures studies by approximately May 2000. Section III.B presents information on the accomplishments of the ER Project during 1994.

B. National Environmental Policy Act Activities

The National Environmental Policy Act (NEPA) mandates that federal agencies consider the environmental impacts of their actions before final decision-making. NEPA establishes the national policy of creating and maintaining conditions where people and nature can exist in productive and enjoyable harmony and fulfill the social, economic, and other requirements of present and future generations. The sponsoring agency, DOE for LANL activities, is responsible for preparation of NEPA documents.

An EA presents the purpose of the proposed action, then describes the proposed action and reasonable alternatives. The EA includes a description of the affected environment and evaluates impacts to air quality (radioactive and nonradioactive emissions), water quality, and human health. The impacts to cultural and biological resources are discussed. The DOE submits draft EAs to the NMED and to potentially affected Native American tribes for review before making a determination. After that decision—a Finding of No Significant Impact (FONSI) or an Environmental Impact Statement (EIS)—has been made, DOE places copies of the EAs in public reading rooms in Los Alamos and Albuquerque. The depth and breadth of analysis of impacts in an EIS is greater than in an EA, and there are more opportunities for public input.

Table IV-2 presents the status of the Laboratory's major NEPA documentation as of December 1994. A description of each project follows the table. One project received a FONSI in 1994. No new draft EAs for proposed actions were submitted to DOE for review during 1994. Several EAs were being revised according to DOE comments during 1994. DOE published an ANOI to prepare the SWEIS in the Federal Register on August 10, 1994, as discussed in Section III. In the ANOI, nine specific projects were proposed to be included in the SWEIS. Of those projects, one had previously been determined to require an EIS, and the remaining eight had previously been determined to require an EA.

Radioactive Liquid Waste Treatment Facility. The proposed action is to build and operate a new facility to replace an existing 30-year-old radioactive wastewater treatment plant. The existing plant is still capable of operating safely and reliably for a few more years but is approaching the end of its design life and cannot be upgraded to meet the more stringent discharge limits. The proposed new treatment facility would be designed to more effectively segregate, treat, and minimize radioactive liquid waste streams consolidated at the facility from throughout the Laboratory. The alternative actions include building the facility at a Laboratory location other than the preferred TA-50 site, treating waste streams at the source, or continuing to use the existing plant until closure is required. Environmental, safety and health issues include worker exposure to radiation, air quality, water quality,

Table IV-2. Status of NEPA Documentation as of December 30, 1994

Status	Project
Project for which DOE determined in 1993 that an EIS would be required; EIS not initiated by LANL in 1994	Radioactive Liquid Wastewater Treatment Facility[a]
EA that received FONSI during 1994	Low-Level Waste Drum Staging Facility
EA submitted in 1993; project on hold	Uranium Oxide Reduction
EAs submitted to DOE before 1994; being reviewed by DOE in 1994	Actinide Source-Term Waste Test Program (formerly TRU Waste Source-Term Test Program) Deactivate, Disassemble, and Decontaminate the High-Pressure Tritium Laboratory[a] Expansion of TA-54, Area G[a] Hazardous Waste Treatment Unit and Mixed Waste Receiving and Storage Facility High-Explosive Materials Test Facility[b] Low Energy Accelerator Laboratory (formerly Accelerator Prototype Laboratory) Medical Radioisotope Production[c] Mixed Waste Disposal Facility[a] TRU Waste Drum Storage Building[d] Weapons Component Testing Facility Relocation
EA being written (still in draft form) during 1994	High-Explosive Wastewater Treatment Facility
Projects for which DOE determined in 1994 that an EA would be required; EA not completed in 1994	Chemical and Metallurgy Research Building Upgrades-Phase II[a] Expanded Operations at the CAI[a] Fire-Resistant Pit Program[a] New Sanitary Landfill[a] Nuclear Material Storage Facility Upgrade[a]

[a]Project included in ANOI.
[b]Project cancelled in 1994.
[c]Scope change in 1994.
[d]Future uses included in ANOI.

cumulative long-term impacts, and waste management. The DOE had previously determined that an EIS is required for the proposed action. Rather than preparing a separate EIS, the construction and operation of this proposed treatment facility was identified in the ANOI for the Laboratory's SWEIS as an action that would be analyzed in the SWEIS.

Low-Level Waste Drum Staging Facility. The proposed action is to erect a 10-ft by 15-ft building adjacent to the Weapons Engineering Tritium Facility (WETF) to hold several 55-gal. drums of solid waste contaminated with small amounts of tritium. Waste would be accumulated until several drums could be moved in a single truckload to LANL's on-site LLW disposal area at TA-54. The waste would consist of metal parts and other noncompactable equipment used in tritium experiments at the WETF. At present, this waste is placed in a drum in the WETF laboratory space. Due to the demands on that space, single drums must be trucked to TA-54 as they are filled. Implementing the proposed action would increase the efficiency of LLW transportation and make more of the WETF laboratory space useable for experiments. The alternative action is to not build the staging facility. Environmental issues include the very small quantity of tritium that would be emitted from the drum each time it is opened, either in the WETF laboratory work space or in the isolated staging facility. The tritium emissions to the environment would be the same for either alternative.

Uranium Oxide Reduction. Small nuclear reactors may be needed as power sources in some of the research programs that the US may pursue, such as to power an earth-orbiting station or a manned base on the moon. These reactors use uranium fuel rods as a long-term, safe, compact, and reliable source of heat from nuclear fission. Fuel composition requirements for the reactors are design-specific. The proposed project is to produce up to 75 kg (165 lb) of reduced uranium oxide fuel materials per year, enriched to any specifications needed, in the existing Plutonium Facility Building. The alternatives considered are to produce the reduced uranium oxides at another facility and not to produce the materials at all. Environmental issues include radioactive air emissions, radioactive waste management, worker exposures, and public health.

Actinide Source-Term Waste Test Program. The Actinide Source-Term Waste Test Program is a two- to five-year study designed to provide data on the behavior of actinide elements (chemically similar radioactive materials with atomic numbers ranging from 89-103) in actual TRU waste immersed in brine. The proposed study is required to fulfill EPA requirements for the Waste Isolation Pilot Plant. The tests would be conducted in a controlled and enclosed environment within the basement of Wing 9 of the Chemistry and Metallurgy Research (CMR) Building in TA-3 at the Laboratory. Alternatives to the proposed action include taking no action (no testing), conducting tests at facilities outside LANL, and conducting the tests at other laboratories at LANL. Potential environmental, safety, and health issues include radioactive air emissions, radiation exposures to workers and the public, and generation and disposal of radioactive wastes. This EA is in the final revisions and is expected to receive a FONSI early in 1995.

Deactivate, Disassemble, and Decontaminate the High-Pressure Tritium Laboratory. The proposed action is to remove and dispose of all materials and equipment from the High-Pressure Tritium Laboratory (HPTL), (Building 86 at TA-33), decontaminate it, and demolish the shell. All tritium repackaging activities in the HPTL were suspended in October 1990 and were subsequently transferred to the new Weapons Engineering Tritium Facility. Since that time, the HPTL has been steadily emitting a small amount of tritiated water vapor to the air. Implementing the proposed action would eliminate one source of airborne contamination and the costs required to maintain and monitor the empty building. Alternative actions include leaving the building as is but continuing the maintenance and monitoring activities, delaying one or more steps for an indefinite period, and reusing the building after the equipment has been removed. Environmental issues include radiation doses and risks to individuals from the emissions of tritiated water vapor and the volume of solid LLW that would be disposed. Rather than preparing a separate EA, the deactivation, disassembly, and decontamination of the High-Pressure Tritium Laboratory was identified in the ANOI for LANL’s SWEIS as an action that would be analyzed in the SWEIS.

Expansion of TA-54, Area G. Routine activities at the Laboratory generate solid LLWs that are disposed of or stored at TA-54, Area G. For some types of waste, burial is the only feasible disposal method that complies with all regulations. The useful lifetime of the existing TA-54, Area G, 63-acre site, which is limited by the area suitable for pit construction, is estimated to be one year. The proposed action is to expand TA-54, Area G onto adjacent acreage on Mesita del Buey in order to provide adequate facilities to accommodate disposal of solid LLW after the currently active part of TA-54, Area G has been filled. Alternatives to expanding TA-54, Area G include installing specialized aboveground storage structures at the existing TA-54, Area G site; developing an alternative disposal site within the Laboratory; or transporting future solid LLW off site. Potential environmental, safety, and health issues include operational safety, transportation, and ensuring environmental protection as part of long-term solid LLW management. Rather than preparing a separate EA, the expansion of Area G was identified in the ANOI for LANL’s SWEIS as an action that would be analyzed in the SWEIS.

Hazardous Waste Treatment Unit and Mixed Waste Receiving and Storage Facility. The proposed action is to construct a new Hazardous Waste Treatment Unit (HWTU) and a Mixed Waste Receiving and Storage Facility (MWRSF) within the Laboratory complex at TA-63. The construction and operation of these facilities have been identified as critical milestones in the RCRA Federal Facilities Compliance Agreement (FFCA) at LANL. The proposed HWTU would provide a central location for use of existing hazardous and mixed waste treatment processes and a location for development of alternative treatment processes for existing and future wastes that would otherwise be stored. The proposed MWRSF would complement the HWTU by providing a centralized location for receiving and storing wastes identified for treatment in the HWTU. Alternatives to building the HWTU and MWRSF include transporting untreated wastes off site, developing and utilizing alternative waste treatment processes at various sites throughout the Laboratory, and continuing to manage the waste using current treatment and storage procedures. Potential environmental, safety, and health issues include radioactive and hazardous air emissions, radioactive and hazardous effluents, transportation, and cumulative, long-term impacts associated with operation of the proposed facility.

High-Explosive Materials Test Facility. The proposed action is to consolidate mechanical testing of high-explosive (HE) materials in a new facility to enhance process efficiency, increase operational safety, and decrease maintenance costs. Tests of HE components include measurement of mechanical properties (such as tensile strength), thermal properties, and high-speed machining. Alternatives to construction of a new facility include continued testing in buildings currently used for these activities or in buildings that would be upgraded for greater efficiency and operational safety. Potential environmental issues include operational safety, threatened and endangered species, and solid and liquid waste management. This project has been canceled, so no further activity is expected on the draft EA.

Low-Energy Accelerator Laboratory (**formerly **Accelerator Prototype Laboratory). The proposed action is to erect a 100-ft by 70-ft preengineered metal building that would contain a high-bay area where physicists could conduct research and develop linear particle injection systems. A linear particle injection system is the first part of a linear particle accelerator. The next generation of higher power particle accelerators must have a higher flux of subatomic particles, or beam current, supplied by an improved injection system, in order to operate. The linear particle injection systems to be developed would not create any radioactive wastes or air activation products; the energy would be dissipated in the form of heat and x-rays. Shielding inside the building would protect personnel from exposure to x-rays. Alternative actions include construction and operation at another location and not constructing nor operating the facility. Environmental issues include discharge of cooling water, land use, and personnel safety.

Medical Radioisotope Production. Molybdenum-99 and ^{125}I radioisotopes are extensively used in human medical diagnosis and treatment. Several radiopharmaceutical supply firms have asked DOE to provide a backup source of supply because only one reactor in Canada now supplies the entire needs of North America. The proposed action is for DOE to use the production technologies that are registered with the US Food and Drug Administration Master Drug File and produce these radioisotopes. During 1994, the project was rescoped. DOE proposes to produce targets at LANL. Highly enriched ^{235}U would be electroplated inside target tubes in the CMR Building at TA-3. The sealed tubes would be irradiated in the Annular Core Research Reactor at Sandia National Laboratories and the desired radioisotopes would be separated from the mixed fission products in the adjacent hot cell facility. The ^{99}Mo and ^{125}I radioisotopes would be packaged for shipment to commercial radiopharmaceutical suppliers for final purification. Alternatives considered were production at other sites and no production. Environmental concerns include radioactive air emissions, liquid wastes, mixed fission product and other solid radioactive waste management, worker exposure to highly radioactive material, transportation, and public exposures.

Mixed Waste Disposal Facility. The ER Project anticipates generating approximately 363,375 m^3 (12,827,000 ft^3) of mixed waste as a result of cleanup activities scheduled by DOE and EPA for the LANL site. LANL currently lacks a facility capable of treating and disposing this waste in a manner that complies with the RCRA Land Disposal Restrictions. The proposed Mixed Waste Disposal Facility would be located at TA-67 and would receive, treat, and dispose of ER Project-generated mixed waste. This facility would include a large disposal pit area with several cells, three separate treatment units, and several facility support structures. Alternatives to the proposed action include no action, building the facility at another LANL site, and shipping the wastes off site for treatment and disposal. Potential environmental, safety, and health issues include radiation exposure to workers and the public, water and air quality impacts, loss of critical wildlife habitat, and transportation. Rather than preparing a separate EA, the future use of the proposed Mixed Waste Disposal Facility to treat and dispose of operational (non-ER generated) mixed wastes was identified in the ANOI for LANL's SWEIS as an action that would be analyzed in the SWEIS.

TRU Waste Drum Storage Building. The proposed action is designed to increase safety and minimize the volume of waste generated at the Laboratory's Plutonium Processing Facility at TA-55. This action consists of using a prefabricated, concrete-floored, metal building for temporary storage of drums of solid TRU waste that is pending certification and transport to a longer term storage area. Alternatives to the proposed action include constructing a new building or continuing operations under current conditions. Some of the potential environmental, safety, and health issues include air emissions, worker safety, on-site TRU waste management, and TRU waste transportation.

Weapons Component Testing Facility Relocation. The Weapons Component Testing Facility (WCTF) is one of the primary component instrumentation, diagnostics, and testing laboratories at LANL. The proposed action is to relocate the WCTF from Building 450 to Building 207, both at TA-16. Relocation would allow the WCTF operations to become more efficient and productive by increasing the useable space, consolidating with similar testing operations, and increasing the testing capabilities for larger components. Increased efficiency and productivity would allow the WCTF to better fulfill a LANL programmatic responsibility to maintain weapons development capability and test stored weapons components. The alternative is to keep the WCTF operations at their existing location. No changes in current operations of the WCTF are anticipated as a result of the relocation; no new waste would be generated in the operations after the relocation. The relocation would not change the quantity of sanitary effluent.

High-Explosive Wastewater Treatment Facility. LANL proposes to improve its current management of wastewater contaminated with HE residues and solvents. Improvements to existing wastewater management is necessary to ensure that discharges conform to LANL's NPDES permit. The proposed action would consist of minimizing the use of water in HE processes and treating all remaining HE-contaminated water at a new treatment facility. No untreated wastewater would be released to the environment. The proposed treatment facility would remove organic contaminants by passing the water through activated carbon filters. The alternative would consist of constructing two treatment facilities and a system of pipes to collect HE-contaminated wastewater and deliver it to the treatment facilities. This alternative would not minimize water use in HE processes. The principal issues include air and water quality, soils, wetlands, wildlife, and safety.

Chemical and Metallurgy Research Building Upgrades. The CMR Building was constructed as a major chemical research and analysis laboratory facility for radioactive materials in 1952. Despite some repairs and upgrades since that time, the CMR Building does not meet current DOE regulations governing construction of a new nonreactor nuclear facility. LANL proposes to extend the life of the building 20 years by upgrading several major systems including seismic upgrades, ventilation system replacements and confinement zone separations, acid vents and drain line replacements, and electrical system upgrades. The alternative action is not to upgrade the facility. Environmental issues include worker safety while the work is performed and LLW disposal. Rather than preparing a separate EA, the CMR Building upgrades were identified in the ANOI for LANL's SWEIS as an action that would be analyzed in the SWEIS.

Expanded Operations at the Controlled Air Incinerator. LANL proposes to expand the function of the Controlled Air Incinerator (CAI) beyond research and development activities to treat wastes by incineration and to vitrify ash on a regular and continuing basis. Operation of the CAI in an expanded mode would permit LANL to treat mixed waste with an approved technology and to comply with EPA requirements for storage, treatment, and disposal of mixed waste. Alternatives to expanded CAI operation include incineration with limited ash vitrification, biodegradation or pressurized water oxidation followed by solids stabilization, and off-site shipment for treatment and disposal. The principal environmental issues to be considered include air quality and health impacts to workers and the public. Rather than preparing a separate EA, the expanded operations at the CAI were identified in the ANOI for LANL's SWEIS as an action that would be analyzed in the SWEIS.

Fire-Resistant Pit Program. The proposed action is to determine the melting and neutron generation characteristics of a disarmed plutonium weapons device, called a pit, when it is exposed to high temperatures typical of a fire. Alternative actions include performing the research in other locations and not performing the research. Environmental issues include worker protection from the exposure to neutrons, possible air emissions, transportation impacts, and radioactive waste management. The plutonium would be stored; it would not be a waste product. Rather than preparing a separate EA, the fire-resistant pit program was identified in the ANOI for LANL's SWEIS as an action that would be analyzed in the SWEIS.

New Sanitary Landfill. The proposed action is to construct and operate a new sanitary landfill for nonradioactive, nonhazardous waste. The existing landfill is jointly used by the Laboratory and Los Alamos County. At present, decisions are in flux about whether a new facility would be jointly used or for Laboratory use only. Rather than preparing a separate EA, the new sanitary landfill was identified in the ANOI for LANL's SWEIS as an action that would be analyzed in the SWEIS.

Nuclear Material Storage Facility Upgrade. The Nuclear Material Storage Facility was originally designed and constructed to consolidate radioactive materials needed for LANL mission objectives from several on-site storage vaults. The facility has not been used yet. The proposed action is to upgrade the heat load capability from the current 20 kW to 75 kW, so that the facility could store more material and/or material with a higher rate of heat production. Alternative ways to transfer heat to the environment and to not upgrade the facility are being considered. Environmental issues include radiation doses to workers and heat transfer. Rather than preparing a separate EA, the Nuclear Material Storage Facility upgrade was identified in the ANOI for LANL's SWEIS as an action that would be analyzed in the SWEIS.

C. Other Significant Environmental Activities at Los Alamos

1. Studies to Measure External Radiation. (Rubén Rangel, ESH-17)

a. Comparison of Thermoluminescent Dosimeters. In addition to the Laboratory's external penetrating radiation monitoring program described in Section V.B.1, special studies were conducted during 1994. One such study is a continuation of work initiated in 1990 to compare results of LANL thermoluminescent dosimeters (TLDs) with those of TLDs obtained from a commercial vendor.

The study involves placing vendor environmental dosimeters next to Laboratory dosimeters. There are a total of 42 vendor TLDs collocated with LANL TLDs at TLDNET locations. The vendor's TLDs are set out and collected following the vendor's specifications and in conjunction with the LANL TLD changeout schedule. No information is provided to the vendor regarding the TLD locations and possible environmental radiation fields. The vendor TLDs are analyzed and processed by the commercial vendor. The analytical results are later provided to LANL.

In previous environmental surveillance reports, the LANL TLD results were graphically compared with contract vendor's TLD results. If the response of the LANL TLDs was within the range of the values reasonably expected to be received by a collocated vendor's TLD, then the two TLD programs were assumed to produce similar results. To more definitively compare the data, the comparison is now made by using a paired t-test, which is very sensitive to systematic differences in sample sets. To ensure that the full power of the paired t-test is used, the TLD results from each program that are spatially and temporally comparable are used. Individual quarterly data were evaluated this year instead of the summed annual results used in previous years. For the first time since the program was initiated, there was a statistical and systematic difference in the results of the two data sets. Considering 146 paired data values, the vendor TLDs were indicating an average of 5 mrem/qtr higher exposure than that indicated by the collocated LANL TLDs. LANL scientists will continue to study the results of this intercomparison program in an attempt to determine the cause of the apparent discrepancy.

b. Highly Sensitive Dosimeters. Current literature indicates that the new dosimeters under study by LANL are nearly 30 times more sensitive than the presently used lithium fluoride (LiF) type of dosimeter. The test TLDs are composed of Al_2O_3 and are located next to the regular Los Alamos Meson Physics Facility (LAMPF) TLDs at the Laboratory boundary north of LAMPF (Figure V-1). The test TLDs are placed so that they will monitor LAMPF emissions during a run cycle. Preliminary data from this study indicate that the particular batch of dosimeters that were used were not as sensitive as expected and produced results with higher than expected uncertainty values. Laboratory scientists will continue to evaluate this new technology with a new batch of dosimeters, and the results will be forthcoming in future reports as data are compiled and analyzed.

2. Meteorological Monitoring. (Greg Stone, ESH-17)

a. Program Description. As required by DOE, the Laboratory conducts a routine meteorological monitoring program. This program provides the data needed to characterize the Laboratory's meteorological environment. Dispersion calculations, which use the wind data, are used for emergency planning, measuring the effects of routine emissions, and for estimating the consequences of accidental releases of hazardous and radioactive materials. The database is also extensively used in a variety of other applications, including environmental assessments, hydrological and biological studies, engineering design, and guiding weather-sensitive operations.

The program consists of four major components: measurements, data management, analysis, and plume modeling. Details of these program components are given in section 13 of the current "Los Alamos Environmental Monitoring Plan" (EARE 1995a). The measurements activity includes routine operation of a network of five towers, an acoustic wind profiler, and three supplementary precipitation stations. In all, this network consists of approximately 100 instruments. All instrumentation is operated continuously to high standards, achieving better than 95% good data recovery.

Data management includes all the software development, computer systems management, routine data processing and reporting, and maintaining the archive. The program annually archives approximately 55 MB of data. The data are collected every 15 minutes and summarized in plots and tables that are available at the Internet address http://weather.lanl.gov.

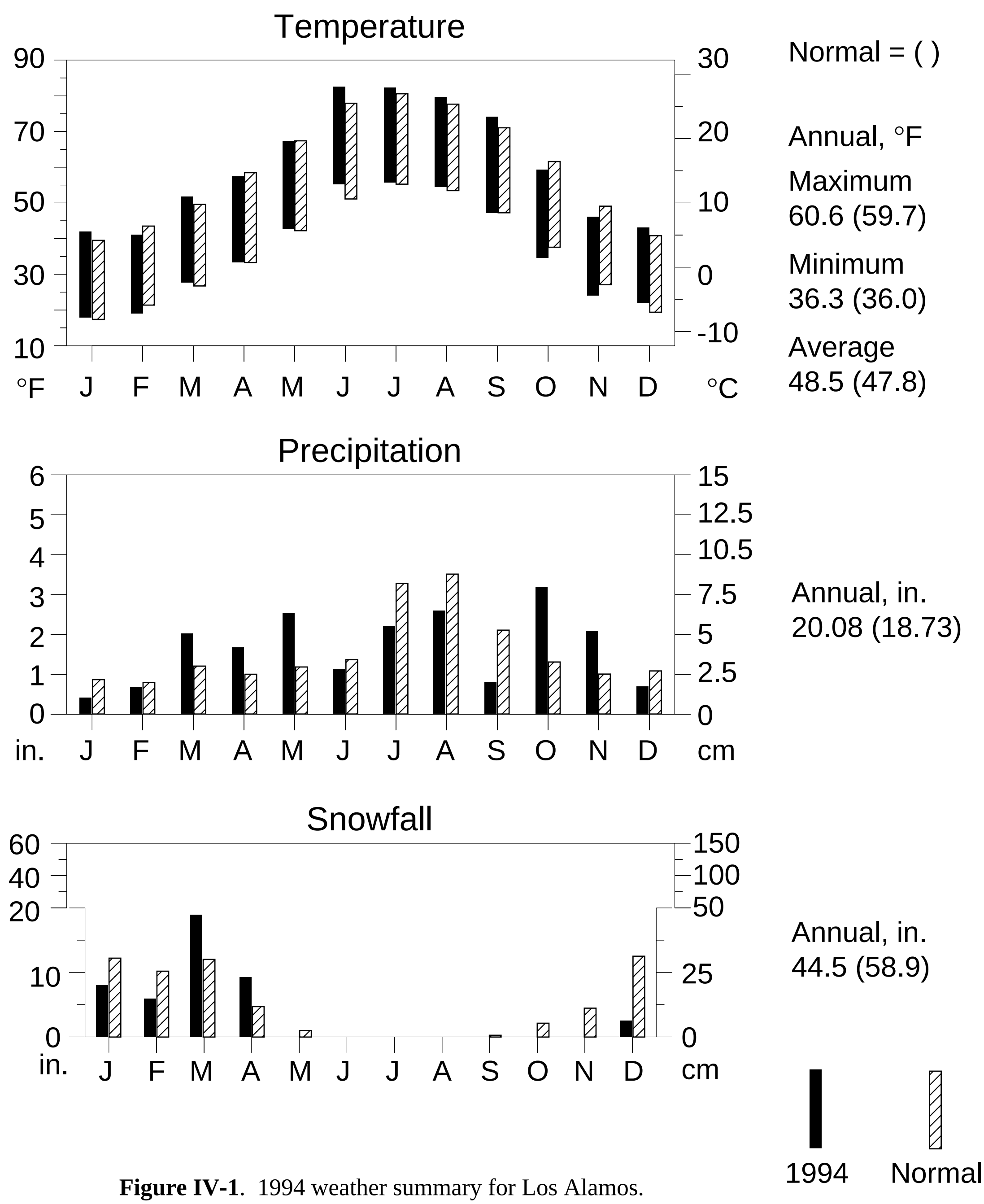

Figure IV-1. 1994 weather summary for Los Alamos.

Program meteorologists conduct special analysis projects—usually on an as-time-permits basis. For example, in 1994, special meteorological input files were developed for the radioactive lanthanum dose reconstruction project. When conditions warrant, special weather forecasts are developed to guide weather-sensitive activities such as scheduling construction, snow removal operations, etc.

The plume modeling activity centers around the Meteorological Information Dispersion Assessment (MIDAS) system. This system is designed to quickly compute dose or toxicity from accidental releases using observed meteorological conditions. Several new features were added to the MIDAS system in 1994.

b. Monitoring Results for 1994. A summary of the temperature and precipitation pattern during 1994 is given in Figure IV-1. On the average, the year was slightly warmer and wetter than normal. Snowfall for the year totaled 113 cm (44.5 in.), which is only 76% of the normal amount. More than 60% of the snow fell in March and April. Other significant departures from climatic normals are as discussed below.

The spring months were unusually wet, with May precipitation totaling twice the normal amount for that month. Summer was much warmer and drier than usual. During June, the average daily maximum temperature was 2.8°C (5°F) higher than normal, and three new high-temperature records were set. Although fall began with warm and very dry weather in September, both October and November were colder and wetter than normal. October was especially wet, with precipitation totaling 2.4 times the normal precipitation for that month. The winter months were unusually dry and somewhat warmer than normal.

Statistics of the wind measured 11 m (36 ft) above the ground for 1994 are presented in Figures IV-2 and IV-3. In these wind rose plots, the length of each spoke is proportional to the amount of time that the wind blew from the indicated 22.5 degree sector. The spoke representing each wind direction sector is partitioned into segments, and the length of each segment is proportional to the percentage of time the wind speed fell within the indicated range.

3. Water Monitoring at the Fenton Hill Site. (Bruce Gallaher and Max Maes, ESH-18)

The Laboratory operates a program to evaluate the feasibility of extracting thermal energy from the hot dry rock geothermal reservoir at the Fenton Hill Geothermal Site (TA-57), which is located about 45 km (28 mi) west of Los Alamos on the southern edge of the Valles Caldera. The hot dry rock energy concept involves drilling two deep holes, connecting these holes by hydraulic fracturing, and bringing geothermal energy to the surface by circulating water through the system. Environmental monitoring is performed adjacent to the site to assess any impacts from the geothermal operations.

The chemical quality of surface water and groundwaters in the vicinity of TA-57 (Figure IV-4,) has been monitored for use in geohydrologic and environmental studies. These water quality studies began before the construction and testing of the hot dry rock project (Purtymun 1974d).

Water samples from Fenton Hill have routinely been collected during periods of base flow (low surface water discharge) in late November or early December. In 1994 the samples were collected on December 1 and 21.

The results of the radiological analyses are presented in Tables IV-3 and IV-4; the results of the general chemical analyses are presented in Tables IV-5 and IV-6; and the results of trace metal analyses are presented in Tables IV-7 and IV-8.

All radiological results are below the DOE derived concentration guides (DCGs) that limit potential exposure to the public from ingestion of water to levels below the DOE public dose limit (PDL) (see Appendix A). The majority of the results are near or below the detection limits of the analytical methods used. The chemical quality of surface waters and groundwaters among the individual stations varied slightly from data collected during previous years; however, these variations are within typical seasonal fluctuations observed in the past (Purtymun 1988a). There were no significant changes in the chemical quality or trace metal quality of surface water and groundwater at the individual stations from previous years (Purtymun 1988a).

4. Environmental Studies at the Pueblo of San Ildefonso. (David Rogers, Stephen McLin, and Max Maes, ESH-18)

To document the potential impact of Laboratory operations on lands belonging to the Pueblo of San Ildefonso, DOE entered into a memorandum of understanding (MOU) with the Pueblo and the Bureau of Indian Affairs (BIA) to conduct environmental sampling on pueblo land. The agreement, entitled "Memorandum of Understanding Among the Bureau of Indian Affairs, the Department of Energy, and the Pueblo of San Ildefonso Regarding Testing

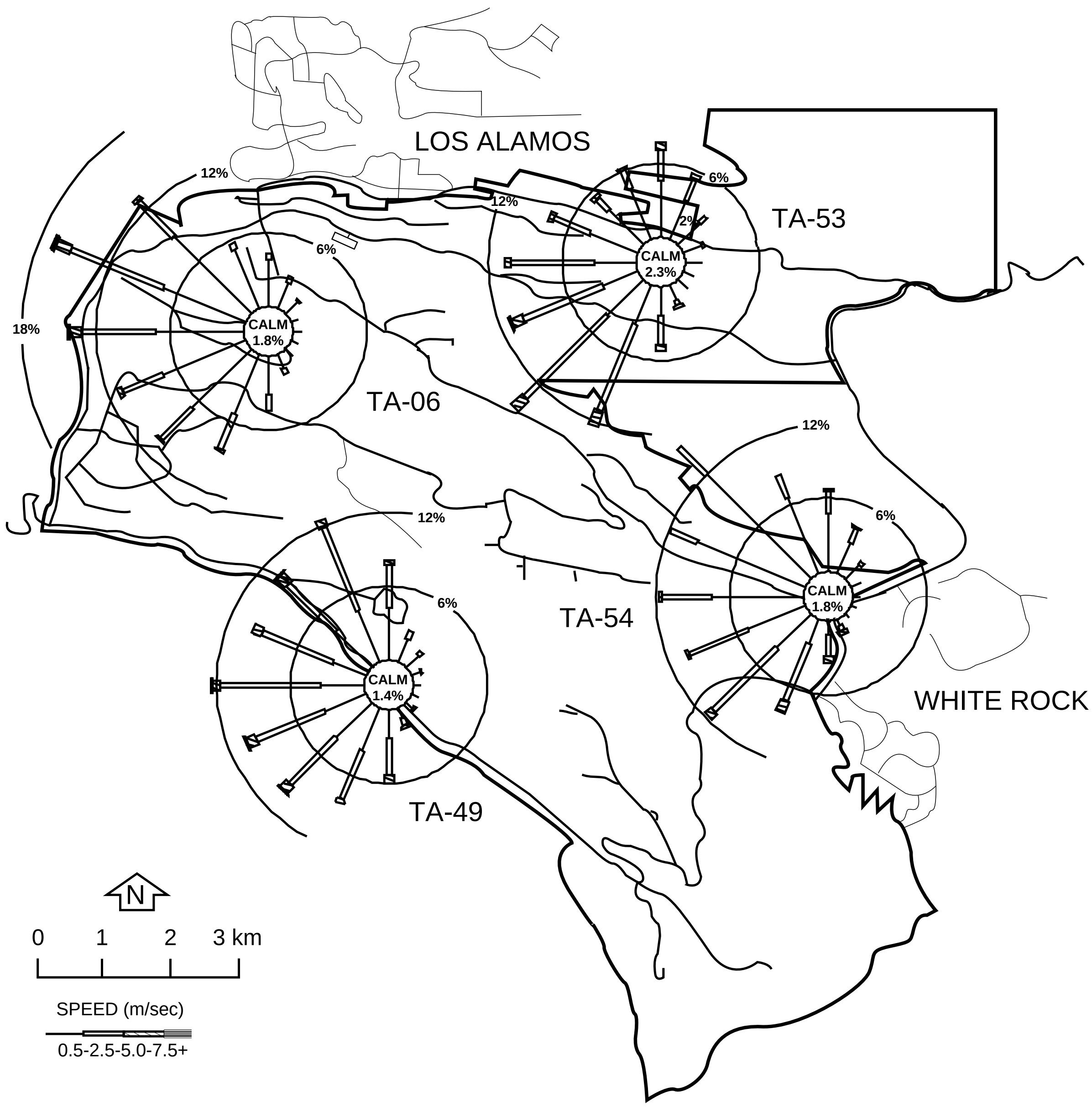

Figure IV-2. Nighttime wind roses for 1994, based on winds measured at 11 m (36 ft) above the ground on the Pajarito Plateau.

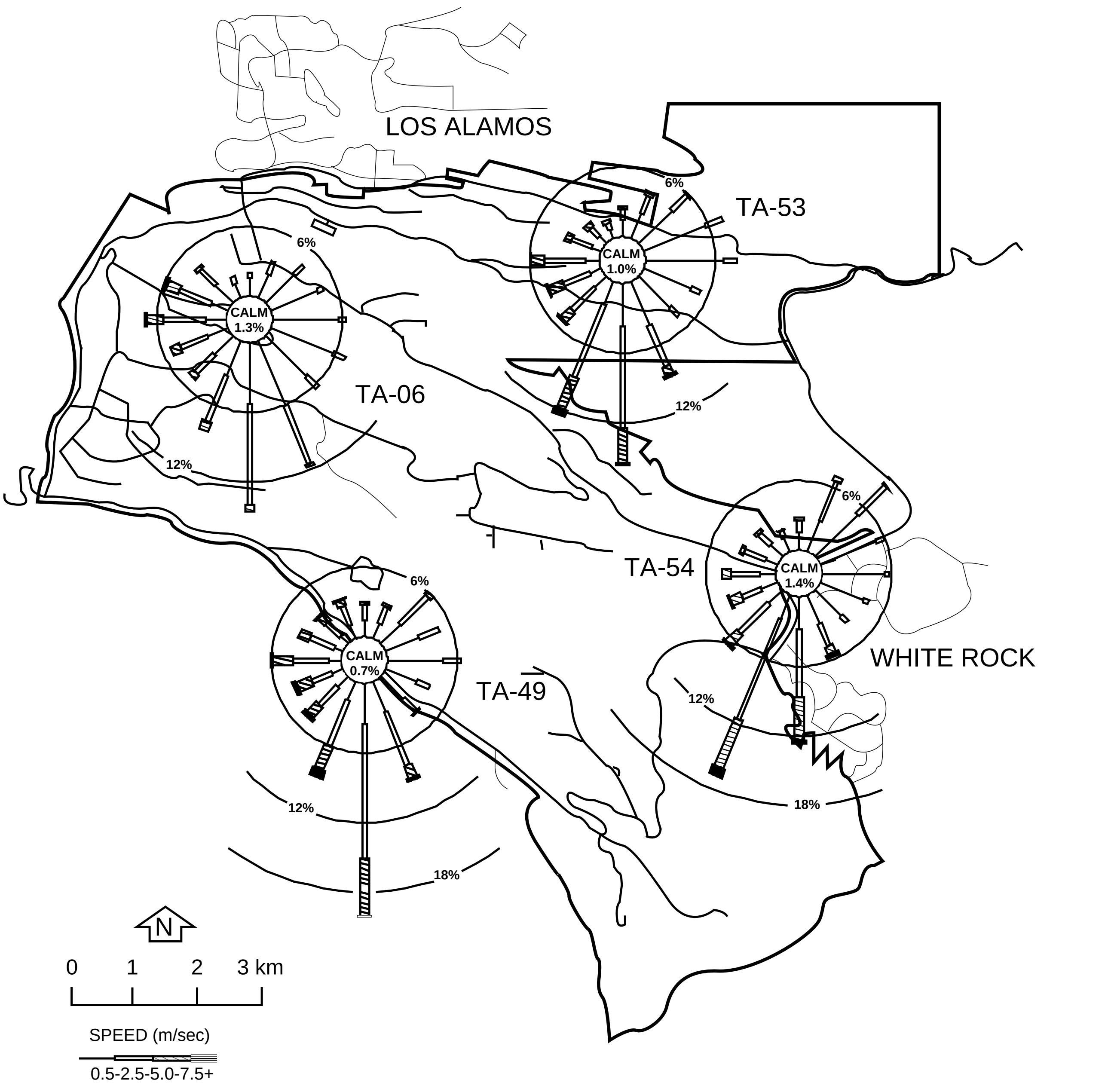

Figure IV-3. Daytime wind roses for 1994, based on winds measured at 11 m (36 ft) above the ground on the Pajarito Plateau.

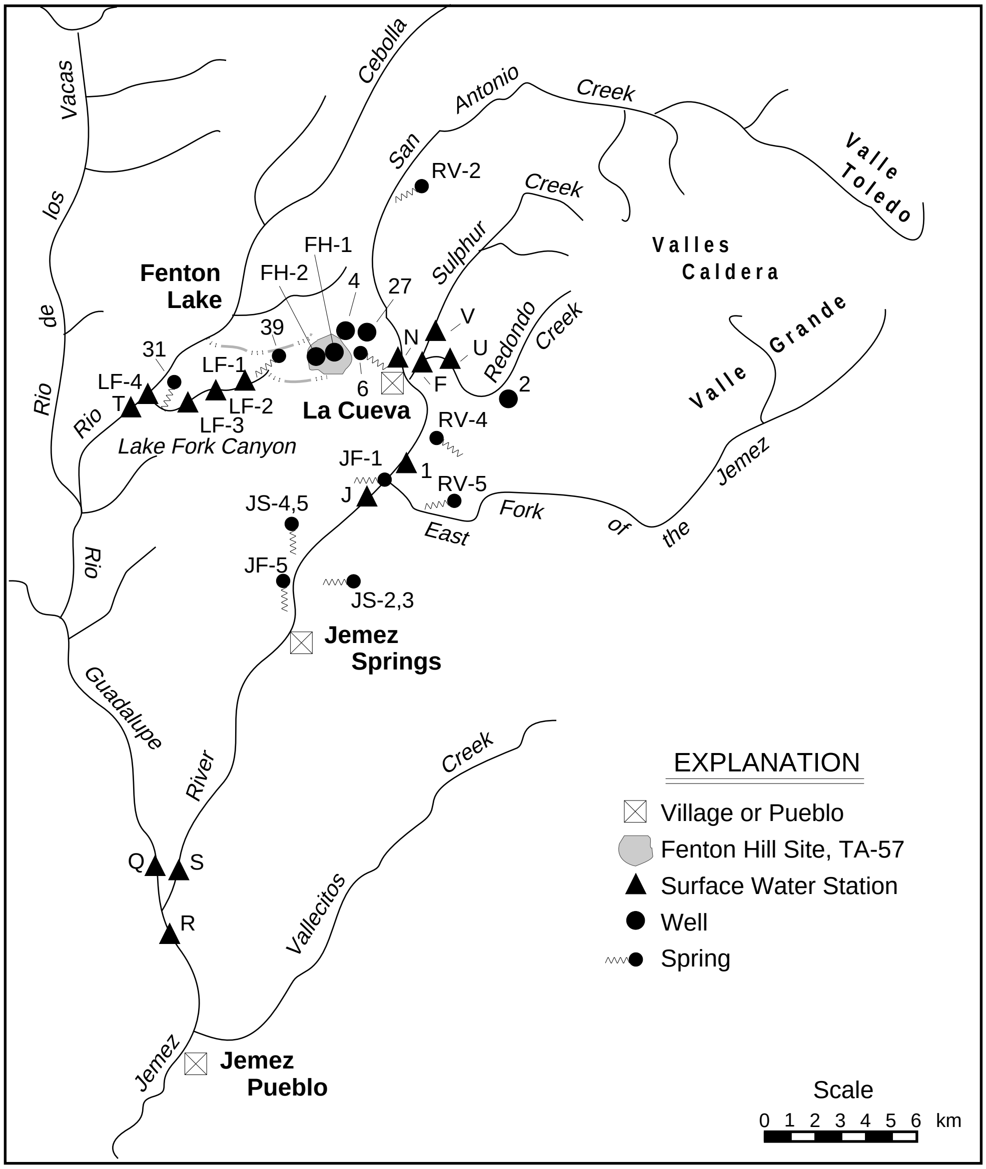

Figure IV-4. Sampling stations for surface water and groundwater near the Fenton Hill Site (TA-57). (Map denotes general locations only.)

Table IV-3. Radiochemical Analysis of Surface Water near Fenton Hill for 1994

Location	^{3}H (nCi/L)	^{90}Sr (pCi/ L)	^{137}Cs (pCi/ L)	Total Uranium (mg/ L)	^{238}Pu (pCi/ L)	$^{239,240}Pu$ (pCi/ L)	^{241}Am (pCi/ L)	Gross Alpha (pCi/ L)	Gross Beta (pCi/ L)	Gross Gamma (pCi/ L)
(J) Jemez River at Battleship Rock	0.0 (0.3)[a]	-0.4 (1.0)	< 0.3[b]	0.5 (0.1)	0.013 (0.011)	0.047 (0.016)	0.020 (0.017)	1 (1)	2 (0)	70 (50)
(N) San Antonio Creek	-0.2 (0.3)	0.3 (0.9)	0.8 (0.3)	0.4 (0.0)	-0.003 (0.010)	0.005 (0.010)	0.008 (0.021)	1 (1)	3 (0)	60 (50)
(Q) Rio Guadalupe	0.1 (0.3)	0.7 (0.9)	< 1.1	3.6 (0.4)	-0.008 (0.002)	0.009 (0.010)	0.023 (0.014)	5 (1)	4 (1)	20 (50)
(S) Jemez River Above Rio Guadalupe	0.0 (0.3)	0.2 (1.0)	< 0.8	0.6 (0.1)	0.015 (0.009)	0.014 (0.010)	0.033 (0.020)	19 (4)	16 (2)	40 (50)
(LF-1) Lake Fork 1	-0.4 (0.3)	1.4 (0.9)	2.0 (0.7)	2.0 (0.3)	0.025 (0.018)	0.049 (0.020)	0.024 (0.015)	5 (1)	8 (1)	60 (50)
(LF-2) Lake Fork 2	-0.5 (0.3)	0.0 (1.0)	< 1.1	0.5 (0.1)	0.023 (0.015)	0.045 (0.017)	0.037 (0.021)	1 (1)	3 (1)	40 (50)
(LF-3) Lake Fork 3	-0.5 (0.3)	-0.2 (1.1)	< 0.5	0.4 (0.0)	-0.001 (0.010)	0.028 (0.014)	0.040 (0.021)	-0 (0)	3 (0)	70 (50)
(LF-4) Lake Fork 4	-0.2 (0.3)	-0.9 (0.8)	< 0.7	0.4 (0.0)	0.006 (0.008)	0.043 (0.017)	0.031 (0.017)	-0 (0)	2 (0)	20 (50)
Limits of Detection[c]	0.4	1	2	0.1	0.02	0.02	0.02	3	3	
DOE DCG for Public Dose[c]	2,000	1,000	3,000	800	40	60	30			
DOE Drinking Water System DCG[c]			120		1.6	1.2	1.2			
EPA Primary Drinking Water Standard[c]	20	8		20				15		
EPA Screening Level[c]									50	

[a]Radioactivity counting uncertainties are shown in parentheses.
[b]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.
[c]Standards given here for comparison only, see Appendix A.

Table IV-4. Radiochemical Analysis of Groundwater near Fenton Hill

	Location	^{3}H (nCi/L)	^{90}Sr (pCi/ L)	^{137}Cs (pCi/ L)	Total Uranium (mg/ L)	^{238}Pu (pCi/ L)	$^{239,240}Pu$ (pCi/ L)	^{241}Am (pCi/ L)	Gross Alpha (pCi/ L)	Gross Beta (pCi/ L)	Gross Gamma (pCi/ L)
JS-4,5	Jemez Village Spring										
	Forest Service Office	0.2 (0.3)[a]	0.8 (1.1)	0.7 (0.4)	1.0 (0.1)	-0.001 (0.010)	0.009 (0.010)	0.024 (0.017)	2 (1)	4 (1)	10 (50)
(FH-1)	Fenton Hill (Well)	<0.0 (0.1)[b]	N/A[c]	<2.0	N/A	0.003 (0.005)	0.002 (0.004)	N/A	9 (5)	7 (3)	N/A
JF-1	Jemez Canyon Hot Spring										
	Limestone Spring	0.0 (0.3)	0.5 (1.1)	0.7 (0.4)	16.4 (1.6)	0.007 (0.011)	-0.009 (0.007)	-0.021 (0.017)	-31 (7)	18 (2)	70 (50)
JF-5	Jemez Canyon Hot Spring										
	Soda Dam	-0.1 (0.3)	0.6 (1.3)	1.6 (0.6)	3.5 (0.7)	0.050 (0.018)	0.072 (0.020)	0.015 (0.016)	-9 (2)	660 (70)	200 (50)
(4)	La Cueva Spring										
	Hofhein's House	-0.3 (0.3)	0.2 (3.5)	1.0 (0.5)	0.5 (0.1)	-0.006 (0.008)	0.011 (0.011)	0.041 (0.015)	1 (1)	4 (1)	80 (50)
(6)	La Cueva Spring										
	Little Shed	-0.3 (0.3)	0.8 (0.8)	0.6 (0.3)	1.4 (0.2)	0.000 (0.016)	0.049 (0.050)	0.092 (0.023)	2 (1)	5 (1)	60 (50)
(RV-4)	Spence Hot Spring	-0.5 (0.3)	0.6 (1.0)	<1.1	0.7 (0.1)	0.016 (0.012)	0.007 (0.009)	-0.018 (0.012)	0 (1)	1 (0)	100 (50)
(31)	Cold Spring Lake										
	Fork Canyon	-0.2 (0.3)	0.0 (0.8)	0.9 (0.4)	3.9 (0.4)	0.040 (0.016)	0.023 (0.014)	0.048 (0.019)	3 (1)	5 (1)	100 (50)
(39)	Lake Fork Tank										
	(Spring)	-0.1 (0.3)	-0.4 (1.0)	<0.9	0.0 (0.1)	0.006 (0.011)	0.139 (0.026)	0.052 (0.019)	-0 (0)	2 (0)	30 (50)
Limits of Detection		0.4	1	2	0.1	0.02	0.02	0.02	3	3	
DOE DCG for Public Dose[d]		2,000	1,000	3,000	800	40	60	30			
DOE Drinking Water System DCG[d]				120		1.6	1.2	1.2			
EPA Primary Drinking Water Standard[d]		20	8		20				15		
EPA Screening Level[d]										50	
NMWQCC Groundwater Limit[d]					5,000						

[a]Radioactivity counting uncertainties are shown in parentheses.
[b]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.
[c]N/A means analysis not performed, lost in analysis or not completed.
[d]Standards given here for comparison only, see Appendix A.

Table IV-5. Chemical Quality of Surface Waters near Fenton Hill for 1994

	Location	SiO_2	Ca	Mg	K	Na	Cl	F	CO_3	HCO_3	PO_4-P	SO_4	NO_3-N	CN	TDS[a]	Hardness as $CaCO_3$	pH[b]	Conductivity mS/cm
(J)	Jemez River at Battleship Rock	57	13	2.7	3	15	5	1.1	<5[c]	61	0.0	16	0.13	<0.01	154	43	7.9	169
(N)	San Antonio Creek	59	11	1.8	1	11	3	1.4	<5	54	0.0	9	<0.04	<0.01	142	35	7.9	335
(Q)	Rio Guadalupe	26	52	6.0	3	13	9	0.5	<5	177	0.1	8	<0.04	<0.01	198	150	8.2	340
(S)	Jemez River Above Rio Guadalupe	54	35	4.5	12	60	84	1.2	<5	134	<0.0	12	0.04	<0.01	392	110	8.5	577
(LF-1)	Lake Fork 1	54	26	5.2	5	11	4	1.1	<5	66	0.2	6	0.11	<0.01	144	86	7.1	136
(LF-2)	Lake Fork 2	54	15	2.6	3	10	4	1.1	<5	66	0.1	7	0.17	<0.01	190	48	7.1	131
(LF-3)	Lake Fork 3	54	15	2.5	3	11	4	1.1	<5	67	0.0	6	0.27	<0.01	166	47	7.5	135
(LF-4)	Lake Fork 4	54	16	2.6	3	11	4	1.1	<5	69	<0.0	6	0.19	<0.01	254	50	7.6	134
EPA Primary Drinking Water Standard[d]								4					10	0.2				
EPA Secondary Drinking Water Standard[d]							250					250			500		6.8-8.5	
EPA Health Advisory[d]						20												
NMWQCC Groundwater Limit[d]							250	1.6										

[a]Total dissolved solids.

[b]Standard units.

[c]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.

[d]Standards given here for comparison only, see Appendix A.

Table IV-6. Chemical Quality of Groundwater near Fenton Hill for 1994 (mg/L)

	Location	SiO_2	Ca	Mg	K	Na	Cl	F	CO_3	HCO_3	PO_4-P	SO_4	NO_3-N	CN	TDS[a]	Hard-ness as $CaCO_3$	pH[b]	Conduc-tivity (µS/cm)
JS-4,5	Jemez Village Spring Forest Service Office	83	26	4.3	3	39	18	1.2	<5	152	<0.0	10	0.24	<0.01	310	82	7.9	343
(FH-1)	Fenton Hill Well	29	76	8.5	6	25	53	<0.1	<10	203	<0.0	10	1.60	0.03	<386	226	7.9	570
JF-1	Jemez Canyon Hot Spring Limestone Spring	20	51	22.0	18	310	3	2.2	46	682	0.2	53	<0.04	<0.01	908	220	9.1	1250
JF-5	Jemez Canyon Hot Spring Soda Dam	49	290	23.0	220	860	372	3.7	<5	1,260	<0.0	32	<0.04	<0.01	395	811	6.5	5900
(4)	La Cueva Spring Hofhein's House	68	21	3.8	4	14	4	0.5	<5	81	<0.0	6	0.95	<0.01	226	68	7.1	163
(6)	LaCueva Spring Little Shed	63	26	8.0	5	17	12	0.5	<5	115	0.1	12	3.20	0.02	296	97	7.2	246
(RV-4)	Spence Hot Spring	71	5	1.6	<1	41	7	0.7	<5	113	0.0	12	<0.04	<0.01	242	18	8.4	230
(31)	Cold Spring Lake Fork Canyon	50	19	2.9	4	9	3	1.2	<5	57	0.0	5	0.20	<0.01	250	59	7.7	123
(39)	Lake Fork Tank (Spring)	25	15	3.0	2	6	6	0.1	<5	42	1.0	16	0.19	<0.01	158	49	6.5	128
EPA Primary Drinking Water Standard[d]								4					10	0.2				
EPA Secondary Drinking Water Standard[d]							250					250		500		6.8-8.5		
EPA Health Advisory[d]						20												
NMWQCC Groundwater Limit							250	1.6										

[a]Total dissolved solids

[b]Standard Units

[c]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.

[d]Standards given here for comparison only, see Appendix A.

Table IV-7. Total Recoverable Trace Metals in Surface Water near Fenton Hill for 1994 (mg/L)

	Location	Ag	Al	As	B	Ba	Be	Cd	Co	Cr	Cu	Fe	Hg*
(J)	Jemez River at Battleship Rock	<0.01[a]	0.74	0.009	0.020	0.027	<0.003	<0.003	<0.008	<0.009	<0.010	0.37	<0.0002
(N)	San Antonio Creek	<0.01	0.76	<0.003	<0.010	0.034	<0.003	<0.003	<0.004	<0.007	<0.010	0.45	<0.0002
(Q)	Rio Guadalupe	<0.01	0.55	<0.003	0.047	0.110	<0.003	<0.003	<0.005	<0.006	<0.010	0.31	<0.0002
(S)	Jemez River Above Rio Guadalupe	<0.01	0.75	0.076	0.680	0.064	<0.003	<0.003	<0.004	<0.004	<0.010	0.38	<0.0002
(LF-1)	Lake Fork 1	<0.01	11.00	0.010	0.029	0.370	<0.003	<0.003	0.012	0.011	0.008	29.00	<0.0002
(LF-2)	Lake Fork 2	<0.01	1.00	<0.002	<0.010	0.045	<0.003	<0.003	<0.004	<0.004	<0.004	2.20	<0.0002
(LF-3)	Lake Fork 3	<0.01	0.12	<0.002	<0.010	0.023	<0.003	<0.003	<0.004	<0.004	0.005	0.29	<0.0002
(LF-4)	Lake Fork 4	<0.01	<0.10	<0.002	0.012	0.022	<0.003	<0.003	<0.004	<0.004	0.005	0.15	<0.0002
EPA Primary Drinking Water Standard[b]				0.05		2.0	0.004	0.005		0.1			0.002
EPA Secondary Drinking Water Standard[b]			0.05-0.2									0.3	
EPA Action Level[b]											1.3		
Livestock Wildlife Watering Limit[b]			5.0	0.2	5.0			0.05	1.0	1.0	0.5		0.01

*Additional data on additional trace metals in surface waters are presented on the following page.

Table IV-7. Total Recoverable Trace Metals in Surface Water near Fenton Hill for 1994 (mg/L) (Cont.)

	Location	Mn	Mo	Ni	Pb	Sb	Se	Sn	Sr	Tl	V	Zn
(J)	Jemez River											
	at Battleship Rock	0.016	<0.020[a]	<0.01	<0.002	<0.002	<0.001	<0.03	0.068	<0.002	<0.01	<0.02
(N)	San Antonio Creek	0.016	<0.008	<0.03	<0.002	<0.002	<0.001	<0.03	0.058	<0.002	<0.01	<0.02
(Q)	Rio Guadalupe	0.019	<0.008	<0.02	<0.002	<0.002	0.001	<0.03	0.210	<0.002	0.01	<0.02
(S)	Jemez River Above											
	Rio Guadalupe	0.029	<0.008	<0.02	0.003	<0.002	<0.001	<0.03	0.160	0.003	0.01	<0.02
(LF-1)	Lake Fork 1	4.300	<0.008	<0.02	0.031	<0.001	0.004	<0.03	0.140	<0.001	0.02	0.14
(LF-2)	Lake Fork 2	0.400	<0.008	<0.01	0.003	<0.001	<0.001	<0.03	0.073	<0.001	<0.00	<0.02
(LF-3)	Lake Fork 3	0.042	<0.008	<0.01	0.008	<0.001	<0.001	<0.03	0.071	<0.001	<0.00	<0.02
(LF-4)	Lake Fork 4	0.018	<0.008	<0.01	<0.001	<0.001	<0.001	<0.03	0.073	<0.001	<0.00	<0.02
EPA Primary Drinking												
Water Standard[b]				0.1		0.006	0.05			0.002		
EPA Secondary Drinking												
Water Standard[b]		0.05										5.0
EPA Action Level[b]					0.015							
EPA Health Advisory[b]									25-90		0.08-0.11	
Livestock Wildlife												
Watering Limit[b]					0.1						0.1	25.0

[a]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.
[b]Standards given here for comparison only, see Appendix A.

Table IV-8. Total Recoverable Trace Metals in Groundwater near Fenton Hill for 1994 (mg/L)

	Location	Ag	Al	As	B	Ba	Be	Cd	Co	Cr	Cu	Fe	Hg*
JS-4,5	Jemez Village Spring												
	Forest Service Office	<0.0100a	<0.100	0.0300	0.1600	0.0380	<0.0030	<0.0030	<0.0040	<0.0060	0.0140	<0.10	<0.0002
(FH-1)	Fenton Hill Well	<0.0040	< 0.013	<0.0050	0.7180	<0.1550	<0.0010	<0.0026	<0.0040	<0.0042	<0.0020	0.23	<0.0002
JF-1	Jemez Canyon Hot Spring												
	Limestone Spring	<0.0100	55.000	0.0160	0.3900	0.3800	<0.0030	<0.0030	0.0310	0.0690	0.0340	48.00	<0.0002
JF-5	Jemez Canyon Hot Spring												
	Soda Dam	<0.0100	<0.100	1.3000	12.0000	0.4100	0.0050	<0.0030	<0.0040	<0.0040	0.0070	<0.10	<0.0002
(4)	La Cueva Spring												
	Hofhein’s House	<0.0100	0.140	<0.0020	0.0130	0.0460	<0.0030	<0.0030	<0.0040	<0.0040	0.0120	0.45	<0.0002
(6)	La Cueva Spring												
	Little Shed	<0.0100	< 0.100	0.0030	0.0110	0.2600	<0.0030	<0.0030	<0.0040	<0.0040	0.0050	0.29	<0.0002
(RV-4)	Spence Hot Spring	<0.0100	0.160	0.0530	0.0930	<0.0040	<0.0030	<0.0030	<0.0040	<0.0040	<0.0100	< 0.10	<0.0002
(31)	Cold Spring Lake												
	Fork Canyon	<0.0100	4.700	0.0020	<0.0100	0.0690	0.0040	<0.0030	<0.0040	<0.0040	0.0130	4.90	<0.0002
(39)	Lake Fork Tank (Spring)	<0.0100	<0.100	<0.0020	<0.0100	0.0230	<0.0030	<0.0030	<0.0040	<0.0040	0.0050	<0.10	<0.0002
EPA Primary Drinking Water Standard[b]				0.05		2.0	0.004	0.005		0.1			0.002
EPA Secondary Drinking Water Standard[b]			0.05-0.2									0.3	
EPA Action Level[b]											1.3		
Livestock Wildlife Watering Limit[b]			5.0	0.2	5.0			0.05	1.0	1.0	0.5		0.01
NMWQCC Groundwater Limit[b]		0.05		0.1	0.75	1.0		0.01	0.05	0.05	1.0		0.002

*Additional data on trace metals in groundwater are presented on the following page.

Table IV-8. Total Recoverable Trace Metals in Groundwater near Fenton Hill for 1994 (mg/L) (Cont.)

	Location	Mn	Mo	Ni	Pb	Sb	Se	Sn	Sr	Tl	V	Zn
JS-4,5	Jemez Village Spring											
	Forest Service Office	<0.0030[a]	0.013	<0.0200	<0.0020	<0.0020	<0.0010	<0.030	0.160	0.0030	< 0.01	0.200
(FH-1)	Fenton Hill Well	<0.0034	< 0.027	<0.0307	0.0057	<0.0030	<0.0040	<0.001	0.268	<0.0014	< 0.01	4.630
JF-1	Jemez Canyon Hot Spring											
	Limestone Spring	0.8700	0.016	0.0450	0.0400	<0.0020	0.0010	<0.030	0.330	0.0050	0.13	0.200
JF-5	Jemez Canyon Hot Spring											
	Soda Dam	0.5200	< 0.008	<0.0200	0.0040	<0.0020	0.0060	<0.030	1.400	0.0050	< 0.00	<0.020
(4)	La Cueva Spring											
	Hofhein's House	0.0070	< 0.008	<0.0100	0.0110	<0.0010	<0.0010	<0.030	0.100	0.0010	0.01	1.100
(6)	La Cueva Spring											
	Little Shed	0.0380	< 0.008	<0.0100	<0.0010	<0.0010	<0.0010	<0.030	0.140	<0.0010	0.01	<0.020
(RV-4)	Spence Hot Spring	<0.0030	0.049	<0.0200	<0.0020	<0.0020	<0.0010	<0.030	0.023	<0.0020	< 0.01	<0.020
(31)	Cold Spring Lake											
	Fork Canyon	0.3700	< 0.008	<0.0200	0.0150	<0.0010	0.0030	<0.030	0.098	<0.0010	< 0.01	0.054
(39)	Lake Fork Tank (Spring)	<0.0030	< 0.008	<0.0100	0.0130	<0.0010	<0.0010	<0.030	0.086	<0.0010	< 0.00	<0.020
EPA Primary Drinking Water Standard[b]				0.1		0.006	0.05			0.002		
EPA Secondary Drinking Water Standard[b]		0.05										5.0
EPA Action Level[b]					0.015							
EPA Health Advisory[b]									25-90		0.08-0.11	
Livestock Wildlife Watering Limit[b]					0.1						0.1	25.0
NMWQCC Groundwater Limit[b]			1.0		0.05		0.05					

[a]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.
[b]Standards given here for comparison only, see Appendix A.

for Radioactive and Chemical Contamination of Lands and Natural Resources Belonging to the Pueblo of San Ildefonso," No. DE-GM32-87AL37160, was concluded in June 1987. The agreement calls for both hydrologic pathway sampling (including air, water, soils, and sediments) and foodstuff sampling. This section deals with the hydrologic pathway. The foodstuff sampling results are presented in Section V.B.7 of this report. See Section V.B.1 for TLD measurements. See Section V.B.2 for air measurements. From 1987 to 1993, water, soil, and sediment samples were collected in accord with the agreement (Purtymun 1988b, ESG 1989, EPG 1990, EPG 1992, EPG 1993, EPG 1994, EARE 1995b). Additional information relating to groundwater age dating and low-level tritium sampling results are presented in Section VII.E.1.b of this report.

High nitrate levels were discovered in samples taken during 1994 from several Los Alamos area test wells and from water supply wells at Pueblo of San Ildefonso. These results are discussed in Section VII.E.5.

The Los Alamos Well Field, located on Pueblo of San Ildefonso lands east of the Laboratory in Los Alamos Canyon, is no longer used as the Los Alamos water supply. The last production of water for the Los Alamos distribution system was in September 1991. Three of the wells (Figure IV-5) have been turned over to the Pueblo of San Ildefonso: LA-1B (to be used cooperatively with BIA as a long-term monitoring well), LA-2 (as a possible production well), and LA-5 (which was refitted with a smaller diameter casing and equipped with a pump to supply water to the houses at Totavi). The other wells in the field (LA-1, LA-3, LA-4, and LA-6) were plugged in 1993 in accordance with NM State Engineer Office regulations. Another well, LA-1A (also known as GT-1) is also used as an observation well. LA-1A was drilled in March 1946, to a depth of 122 m (400 ft), to evaluate water production potential for what became the Los Alamos Well Field (Purtymun 1995a).

In 1994, water samples were collected from 13 groundwater wells on Pueblo of San Ildefonso lands (Figure IV-5). Samples were collected by Laboratory personnel in the company of personnel from the Pueblo of San Ildefonso Governor's Office, the BIA, and the NMED DOE Oversight Bureau on July 27, 28, and August 2. The BIA did not collect duplicate samples in 1994. Water samples were taken from the Don Juan Playhouse, Eastside

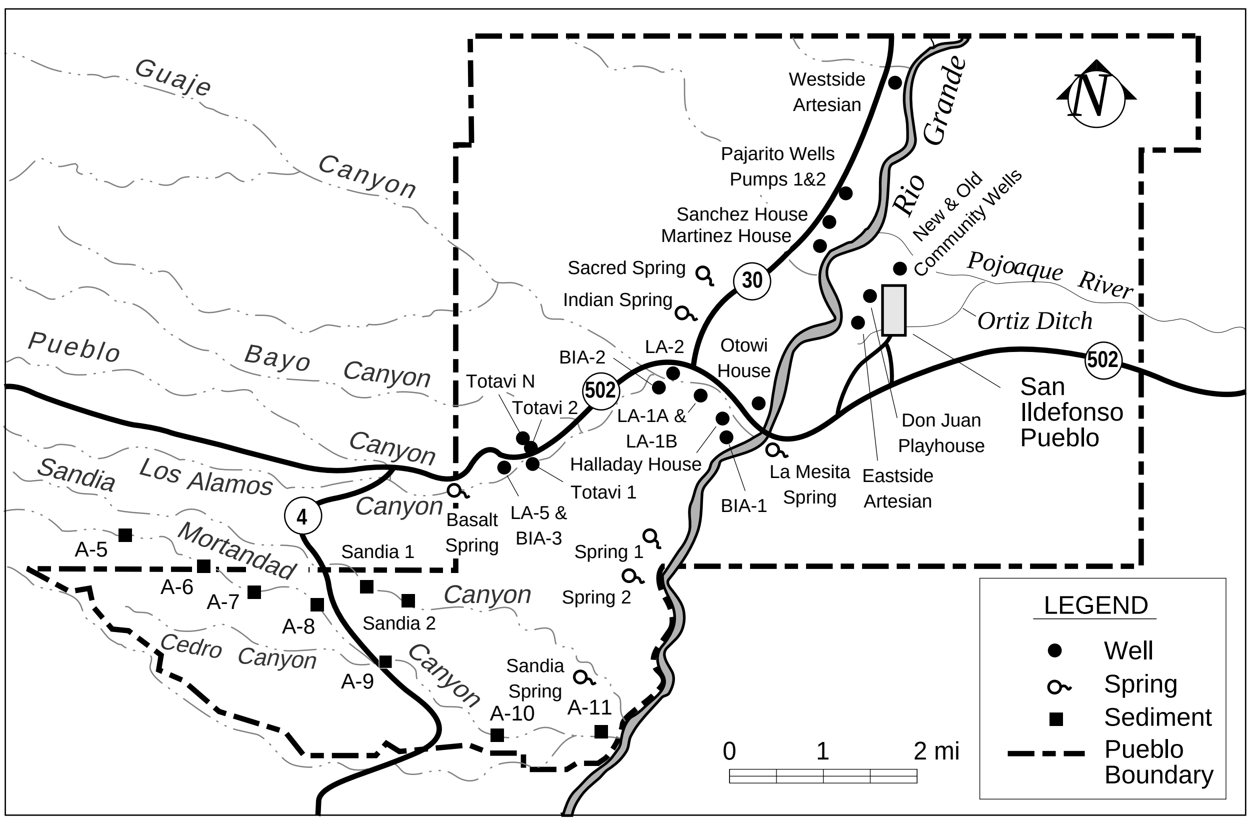

Figure IV-5. Sediment and groundwater stations and springs on Pueblo of San Ildefonso land. (Map denotes general locations only; see Table IV-9 for cross-referencing to specific loactions.)

Artesian, Pajarito Pump No. 1, Old Community, Martinez House, Westside Artesian, Pajarito Pump No. 2, and the Sanchez House wells on July 27; from Sacred, La Mesita, and Basalt Spring, the Otowi House and Halladay House wells, and Los Alamos Well Field Well LA-5 on July 28; and from Los Alamos Well Field Wells LA-1A and LA-1B on August 2.

Alluvial Observation Wells BIA #1, BIA #2, BIA #3, Totavi BIA North, and Totavi BIA in lower Los Alamos Canyon were not sampled in 1994. The Totavi BIA alluvial groundwater monitoring wells were installed by the BIA to investigate leaks in an underground storage tank at the site of an old gasoline station at Totavi. The BIA alluvial groundwater observation wells were installed to monitor water quality in the alluvium of lower Los Alamos Canyon. Each of the BIA wells is located near one of the three former Los Alamos Well Field Wells, LA-1B, LA-2, and LA-5.

On July 27, 1994, sediments from Mortandad Canyon were collected from seven permanent sampling stations, as seen in Figure IV-5. The results of these sample analyses for radiochemicals and trace metals are generally comparable to sediment data collected from these same stations in previous years; furthermore, these results are comparable to sediment samples collected in adjacent canyons. There are no trends apparent in the 1994 sediment data, and the results do not indicate the presence of any contaminants from Laboratory operations. These findings are consistent with current and previous measurements of sediments from these canyons where they exit the Laboratory facility at State Road 502.

The MOU also specifies collection and analysis of 5 other water samples and 11 other sediment samples from sites that have long been included in the routine environmental sampling program, as well as special sampling of storm runoff in Los Alamos Canyon. These locations are identified in Table IV-9 to permit cross-referencing with other sections of this report.

a. Groundwater. Radiochemical analyses of the 1994 groundwater samples are shown in Table IV-10. As reported for 1993 (EARE 1995b), the major difference from previous results are the ^{137}Cs measurements, which

Table IV-9. Locations on Pueblo of San Ildefonso Land for Water and Sediment Sampling that are Included in the Routine Monitoring Program

Station Identification	Map	See this Table for Results
Water Sampling Locations		
Surface Water		
Rio Grande at Otowi	Figure V-13, No. 3	V-20, and VI-8, -9
Springs in White Rock Canyon		
Sandia Spring	Figure IV-8	VII-1, -2, -3
Spring 1	Figure IV-8	VII-1, -2, -3
Spring 2	Figure IV-8	VII-1, -2, -3
Sanitary Effluent Flow in Mortandad Canyon		
Mortandad at Rio Grande	Figure V-13, No. 38	IV-18, -19, -20
Sediment Sampling Locations		
Guaje at SR 502	Figure V-16, No. 12	IV-9, -10
Bayo at SR 502	Figure V-16, No. 13	IV-9, -10
Los Alamos Canyon		
Los Alamos at SR 4	Figure V-16, No. 35	IV-9, -10
Los Alamos at Totavi[a]	Figure V-16, No. 36	IV-9, -10
Los Alamos at LA-2[a]	Figure V-16, No. 37	IV-9, -10
Los Alamos at Otowi	Figure V-16, No. 38	IV-9, -10
Sandia Canyon		
Sandia at SR 4	Figure V-16, No. 14	IV-9, -10
Sandia at Rio Grande	Figure V-16, SANDIA	IV-9, -10

[a]Not required by MOU but routinely sampled and reported.

are all much lower than reported prior to 1992. The ^{137}Cs measurements for 1992 –1994 were made using an improved method with a lower detection limit (see Section VIII.C on analytical chemistry methods and quality assurance for details). These results confirmed previous expectations that the levels of ^{137}Cs reported in the 1990 and 1991 surveillance reports (EPG 1992, EPG 1993) were artifacts of the older analytical method, which had a higher detection limit. None of the ^{137}Cs values measured in 1994 exceed the DOE DCG for water supply systems or the proposed EPA maximum contaminant level; all were less than about 3% of the DCG of 120 pCi/L.

In 1992 (EPG 1994), analyses of several of the samples for plutonium and americium indicated that they contained levels exceeding the average detection limits of the analytical method. Those for Pajarito Pump No. 1, Pajarito Pump No. 2, Otowi House, Sanchez House, and Martinez House were as much as 2 to 3 times the detection limit, and those for the New Community Well and the Halladay House were up to 15 times the detection limit. The sampling or the analytical method were suspected of inaccuracies for two principal reasons: (1) none of the previously sampled locations had shown the presence of these isotopes, and (2) results of BIA duplicate samples for 1992 sent to an independent laboratory did not confirm the results.

Five results from the 1994 samples show levels above detection limits (0.02 pCi/L) for samples taken at the following locations (all the same wells were sampled in July 1994): for ^{238}Pu, the Westside Artesian, Martinez House, Otowi House, and Pajarito Pump No. 1 wells, and for americium, the Westside Artesian well. The largest of the ^{238}Pu values (0.085 pCi/L) is just 5.3% of the DOE DCG of 1.6 pCi/L, and the americium value (0.050 pCi/L) is 4.2% of the DOE DCG of 1.2 pCi/L. The analytical uncertainty (standard deviation) for all of these values is $\pm$0.03 pCi/L. Thus, the 1994 data appear to confirm the 1992 result that samples for the Martinez House, Otowi House, and Pajarito Pump No. 1 wells contained levels of plutonium exceeding the average detection limits.

The Westside Artesian, Old Community, and LA-1A wells had uranium concentrations near or exceeding the EPA primary drinking water standard of 20 µg/L. Uranium concentrations at the Pajarito Pump No. 1 and Sanchez House wells were about half of the EPA standard. These measurements are consistent with the levels in previous samples and with relatively high levels of natural uranium in other wells and springs in the area (EPG 1993, EPG 1994, EARE 1995b).

The gross alpha level in samples from the Old Community and Sanchez House wells exceeded the EPA primary drinking water standard of 15 pCi/L. Gross alpha levels in the samples from the Eastside Artesian, Otowi House, LA-1B, and LA-1B wells are greater than the 5 pCi/L screening level, which would require analyses for radium if the levels could not be explained by correspondingly high levels of uranium.

The chemical quality of the groundwater, shown in Table IV-11, is consistent with previous observations. The samples from the Westside Artesian, Pajarito Pump No. 1, Sanchez House, and LA-1B wells exceeded or were near the drinking water standard for total dissolved solids (TDS); these levels are similar to those previously measured (EPG 1993, EPG 1994, EARE 1995b). The fluoride values for these four wells (Westside Artesian, Pajarito Pump No. 1, Sanchez House, and LA-1B) are near or (for Westside Artesian and LA-1B) greatly exceed the New Mexico Water Quality Control Commission (NMWQCC) groundwater standard of 1.6 mg/L, again similar to previous values (EPG 1994, EARE 1995b). Several of the wells have alkaline pH values, above the EPA secondary standard range of 6.8–8.5; again, these values do not represent a change from those previously observed in the area (EPG 1993, EPG 1994, EARE 1995b).

Trace metal analyses are shown in Table IV-12. As was reported for 1993 (EE 1995), several wells and springs show high values for trace metals, exceeding values previously reported (EPG 1994). We believe that the high trace metal values are due to several factors: (1) the samples were not filtered before analysis, (2) the technique by which samples were prepared for analysis is for total recoverable metals, which partially digests the suspended sediment, and (3) these elements are commonly either adsorbed onto suspended sediments, or (4) several of these metals are constituents of the suspended sediment particles themselves. In particular, aluminum, iron, and manganese values for some of the samples were high.

Well LA-1B and Pajarito Pump No. 1 had arsenic values of about 0.04 mg/L, just below the EPA drinking water standard of 0.05 mg/L. A similar value was reported for LA-1B in 1993 (EARE 1995b). The arsenic concentration for Pajarito Pump No. 1 appears to have increased since 1991: the values for recent years were <0.03 mg/L in 1990, 0.005 mg/L in 1991, and 0.0186 mg/L in 1992. The well was not sampled in 1993.

Boron values in two wells exceeded the NMWQCC groundwater limit of 0.75 mg/L: Westside Artesian and Pajarito Pump No. 1. These values are similar to those of past years. Antimony concentrations in the Eastside Artesian and Pajarito Pump No. 2 wells exceeded the EPA primary drinking water standard of 0.006 mg/L. Three

Table IV-10. Radiochemical Analysis of Groundwater on Pueblo of San Ildefonso Land for 1994

Location	^{3}H (nCi/L)	^{90}Sr (pCi/L)	^{137}Cs (pCi/L)	Total Uranium (µg/L)	^{238}Pu (pCi/L)	^{239,240}Pu (pCi/L)	^{241}Am (pCi/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Gross Gamma (pCi/L)
San Ildefonso Wells										
Don Juan Playhouse	0.0 (0.3)[a]	0.6 (0.6)	1.2 (0.6)	6.1 (0.6)	0.000 (0.03)	0.004 (0.02)	-0.003 (0.030)	4 (2)	2 (0)	10 (50)
Eastside Artesian Well	0.1 (0.3)	0.3 (0.7)	1.9 (0.8)	2.8 (0.3)	-0.014 (0.03)	0.008 (0.02)	0.003 (0.030)	9 (5)	2 (1)	0 (50)
Westside Artesian Well	0.3 (0.3)	0.2 (0.8)	1.2 (0.7)	18.5 (2.2)	0.050 (0.03)	0.020 (0.02)	0.050 (0.030)	-1 (1)	15 (2)	-10 (50)
Halladay Well	0.3 (0.3)	0.5 (0.8)	<0.4[b]	1.3 (0.1)	0.003 (0.03)	0.009 (0.02)	0.030 (0.030)	0 (1)	2 (0)	60 (50)
Martinez Well	0.3 (0.3)	0.0 (0.9)	<1.1	7.0 (0.7)	0.047 (0.03)	0.010 (0.02)	0.022 (0.030)	1 (0)	7 (1)	30 (50)
Old Community Well	0.2 (0.3)	0.6 (0.6)	2.2 (0.7)	35.2 (4.2)	-0.012 (0.03)	0.004 (0.02)	0.012 (0.030)	21 (5)	17 (2)	30 (50)
Otowi House Well	0.1 (0.3)	0.4 (0.8)	<0.9	3.6 (0.4)	0.042 (0.03)	0.020 (0.02)	0.009 (0.030)	5 (2)	6 (1)	70 (50)
Pajarito Well Pump 1	0.4 (0.3)	0.1 (0.7)	1.9 (0.7)	10.7 (1.3)	0.085 (0.03)	0.024 (0.02)	0.031 (0.030)	-7 (2)	13 (2)	60 (50)
Pajarito Well Pump 2	0.0 (0.3)	0.4 (0.7)	1.2 (0.5)	6.0 (0.6)	0.003 (0.03)	0.023 (0.02)	-0.004 (0.030)	-150 (70)	6 (1)	-10 (50)
Sanchez House Well	0.2 (0.3)	0.4 (0.6)	<1.2	10.8 (1.1)	-0.002 (0.03)	0.000 (0.02)	0.027 (0.030)	40 (10)	11 (1)	20 (50)
LA-1A	-0.1 (0.3)	0.6 (0.8)	<0.7	16.2 (1.6)	0.025 (0.03)	0.023 (0.02)	0.010 (0.017)	10 (5)	9 (1)	20 (50)
LA-1B	0.3 (0.3)	1.7 (0.7)	<0.8	3.8 (0.5)	-0.013 (0.03)	-0.012 (0.02)	0.002 (0.011)	9 (5)	8 (1)	50 (50)
LA-5	0.1 (0.3)	0.1 (0.7)	<0.7	1.0 (0.1)	-0.014 (0.03)	0.023 (0.02)	0.028 (0.030)	1 (1)	4 (1)	50 (50)
Springs										
Basalt Spring	0.3 (0.3)	0.4 (0.8)	<0.9	0.6 (0.1)	-0.011 (0.03)	0.014 (0.02)	0.038 (0.030)	1 (1)	8 (1)	20 (50)
Indian Spring	-0.1 (0.3)	0.6 (0.7)	<1.1	0.6 (0.1)	-0.009 (0.03)	-0.021 (0.02)	0.037 (0.017)	0 (2)	6 (1)	40 (50)
La Mesita Spring	0.1 (0.3)	1.6 (0.8)	1.0 (0.5)	14.7 (1.5)	0.053 (0.03)	0.028 (0.02)	0.016 (0.030)	12 (3)	10 (1)	40 (50)
Sacred Spring	-0.3 (0.3)	0.7 (0.8)	<1.1	0.8 (0.1)	0.006 (0.03)	0.040 (0.02)	0.026 (0.030)	1 (0)	3 (1)	30 (50)
Limits of Detection	0.4	1	2	0.1	0.02	0.02	0.02	3	3	
DOE DCG for Public Dose[c]	2,000	1,000	3,000	800	40	60	30			
DOE Drinking Water System DCG[c]			120		1.6	1.2	1.2			
EPA Primary Drinking Water Standard[c]	20	8		20				15		
EPA Screening Level[c]									50	
NMWQCC Groundwater Limit[c]				5,000						

[a]Radioactivity counting uncertainties are shown in parentheses

[b]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.

[c]Standards given here for comparison only, see Appendix A.

Table IV-11. Chemical Quality of Groundwater on Pueblo of San Ildefonso Land for 1994 (mg/L)

Location	SiO_2	Ca	Mg	K	Na	Cl	F	CO_3	HCO_3	PO_4-P	SO_4	NO_3-N	CN	TDS[a]	Hardness as $CaCO_3$	pH[b]	Conductivity (µS/cm)
San Ildefonso Wells																	
Don Juan Playhouse Well	25	7	0.5	1	64	3	0.7	14	143	<0.0[c]	14	2.90	<0.01	262	16	8.9	309
Eastside Artesian Well	21	3	0.2	<1	85	3	0.9	15	193	<0.0	16	8.60	<0.01	278	8	9.1	390
Westside Artesian Well	24	15	0.8	2	350	355	5.2	<5	326	<0.0	80	5.70	<0.01	1,174	41	8.3	1,900
Halladay Well	29	5	<0.0	<1	42	5	0.5	<5	86	<0.0	13	1.10	<0.01	138	11	8.8	195
Martinez Well	42	51	3.0	5	54	17	0.6	<5	156	0.0	32	15.80	<0.01	384	140	8.0	474
Old Community Well	22	63	5.1	4	25	9	0.3	<5	182	<0.0	18	2.00	<0.01	290	180	8.1	405
Otowi House Well	62	85	6.2	4	43	42	0.3	<5	222	0.0	22	10.80	<0.01	382	235	7.5	560
Pajarito Well Pump 1	34	61	6.4	6	330	210	1.9	<5	563	0.1	48	7.70	<0.01	1,118	180	7.9	1,670
Pajarito Well Pump 2	37	30	1.7	2	95	37	1.1	<5	201	<0.0	20	19.00	<0.01	418	80	8.0	528
Sanchez House Well	40	40	2.8	3	100	40	1.5	<5	215	<0.0	56	9.50	<0.01	488	110	8.0	640
LA-1A	36	31	0.8	3	85	13	0.6	<5	196	0.0	27	1.50	<0.01	408	80	8.1	436
LA-1B	40	7	0.3	3	130	16	3.3	<5	294	<0.0	31	6.30	<0.01	518	18	8.2	596
LA-5	43	21	0.8	2	14	4	0.5	<5	75	<0.0	6	0.76	<0.01	174	55	8.8	169
Springs																	
Basalt Spring	72	37	9.4	8	46	35	0.3	<5	92	0.2	21	15.00	<0.01	330	130	7.3	419
Indian Spring	55	37	5.7	3	26	21	0.5	<5	97	<0.0	7	0.83	<0.01	206	115	7.9	259
La Mesita Spring	30	38	2.8	4	31	8	0.3	<5	127	0.0	14	5.80	0.01	188	105	7.6	269
Sacred Spring	22	25	0.9	4	24	3	0.6	<5	106	2.5	6	1.80	<0.01	140	65	7.3	190
EPA Primary Drinking Water Standard[d]							4					10	0.2				
EPA Secondary Drinking Water Standard[d]						250					250			500		6.8-8.5	
EPA Health Advisory[d]					20												
NMWQCC Groundwater Limit[d]						250	1.6					10					

[a]Total dissolved solids.
[b]Standard Units.
[c]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.
[d]Standards given here for comparison only, see Appendix A.

Table IV-12. Total Recoverable Trace Metals in Groundwater on Pueblo of San Ildefonso Lands for 1994 (mg/L)

Location	Ag	Al	As	B	Ba	Be	Cd	Co	Cr	Cu	Fe	Hg*
San Ildefonso Wells												
Don Juan Playhouse Well	<0.010[a]	<0.10	0.006	0.080	<0.004	<0.001	<0.003	<0.004	0.013	<0.004	<0.10	<0.0001
Eastside Artesian Well	<0.010	<0.10	0.009	0.130	<0.004	<0.001	<0.003	<0.004	<0.004	<0.004	1.10	<0.0001
Westside Artesian Well	<0.010	<0.10	0.008	1.700	0.041	<0.001	<0.003	<0.004	<0.004	<0.004	0.20	<0.0001
Halladay Well	<0.200	<0.10	0.011	0.044	0.037	<0.003	<0.003	<0.004	0.013	<0.004	0.14	0.0001
Martinez Well	0.040	<0.10	0.010	0.130	0.200	<0.003	<0.003	<0.004	<0.004	0.011	<0.10	<0.0001
Old Community Well	0.044	<0.10	0.002	0.031	0.170	<0.003	<0.003	<0.004	<0.004	0.009	<0.10	<0.0001
Otowi House Well	<0.200	<0.10	0.004	0.047	0.330	<0.003	<0.003	<0.004	0.008	<0.004	0.32	0.0001
Pajarito Well Pump 1	<0.030	<0.10	0.041	1.600	0.130	<0.003	<0.004	<0.004	0.008	0.006	9.60	<0.0001
Pajarito Well Pump 2	<0.030	<0.10	0.014	0.320	0.120	<0.003	<0.003	<0.004	0.006	0.007	<0.10	<0.0001
Sanchez House Well	0.040	<0.10	0.013	0.230	0.110	<0.003	<0.003	<0.004	<0.004	0.015	<0.10	<0.0001
LA-1A	<0.200	1.90	0.003	0.170	0.230	<0.003	<0.003	<0.004	0.023	<0.004	5.60	<0.0001
LA-1B	<0.200	<0.10	0.042	0.240	0.040	<0.003	<0.003	<0.004	0.027	<0.004	0.44	0.0001
LA-5	<0.200	<0.10	0.003	<0.010	0.058	<0.003	<0.003	<0.004	0.026	<0.004	0.21	0.0001
Springs												
Basalt Spring	<0.020	0.14	0.005	0.210	0.084	<0.003	<0.003	<0.004	0.005	<0.004	0.18	0.0001
Indian Spring	<0.200	<0.10	0.004	0.020	0.100	<0.003	<0.003	<0.004	<0.004	<0.004	<0.10	0.0001
La Mesita Spring	<0.020	4.70	0.002	0.038	0.160	<0.003	<0.003	0.007	0.019	<0.004	4.40	0.0001
Sacred Spring	<0.020	0.75	0.002	0.031	0.180	<0.003	<0.003	<0.004	0.005	<0.004	0.73	0.0001
EPA Primary Drinking Water Standard[b]			0.05		2.0	0.004	0.005		0.1			0.002
EPA Secondary Drinking Water Standard[b]		0.05-0.2									0.3	
EPA Action Level[b]										1.3		
Livestock Wildlife Watering Limit[b]		5.0	0.2	5.0			0.05	1.0	1.0	0.5		0.01
NMWQCC Groundwater Limit[b]	0.05		0.1	0.75	1.0		0.01	0.05	0.05	1.0		0.002

*Additional data on trace metals in groundwaters on Pueblo of San Ildefonso lands is presented on the following page.

Table IV-12. Total Recoverable Trace Metals in Groundwater on Pueblo of San Ildefonso Lands for 1994 (mg/L) (Cont.)

Location	Mn	Mo	Ni	Pb	Sb	Se	Sn	Sr	Tl	V	Zn
San Ildefonso Wells											
Don Juan Playhouse Well	<0.002[a]	<0.008	0.01	<0.002	<0.002	0.002	<0.030	0.092	<0.002	0.02	<0.020
Eastside Artesian Well	0.017	<0.008	<0.01	<0.002	0.008	<0.002	<0.030	0.041	<0.002	0.01	<0.020
Westside Artesian Well	0.011	0.047	<0.01	<0.002	<0.002	<0.002	<0.030	0.330	<0.002	0.01	<0.020
Halladay Well	<0.003	<0.008	<0.20	<0.005	0.002	0.002	<0.030	0.130	<0.001	0.02	<0.030
Martinez Well	<0.003	<0.008	<0.01	<0.002	<0.002	0.005	<0.030	0.650	<0.002	0.02	0.040
Old Community Well	<0.003	<0.008	<0.01	<0.002	<0.002	<0.002	<0.030	0.480	<0.002	<0.00	<0.020
Otowi House Well	0.004	<0.008	<0.20	<0.005	<0.001	<0.002	<0.030	0.950	<0.001	0.01	0.097
Pajarito Well Pump 1	0.008	<0.008	<0.01	0.006	<0.002	0.003	<0.030	1.500	<0.002	0.06	0.190
Pajarito Well Pump 2	<0.003	<0.008	<0.01	<0.002	0.007	0.003	<0.030	0.490	<0.002	0.03	<0.020
Sanchez House Well	<0.003	0.014	<0.01	0.003	<0.002	<0.002	<0.030	0.390	<0.002	0.01	0.027
LA-1A	0.140	<0.008	<0.20	<0.005	<0.001	0.002	<0.030	0.740	<0.001	0.02	0.034
LA-1B	0.019	0.021	<0.20	<0.005	<0.001	0.002	<0.030	0.150	<0.001	0.04	<0.030
LA-5	0.008	<0.008	<0.20	<0.005	<0.001	<0.002	<0.030	0.210	<0.001	0.01	0.086
Springs											
Basalt Spring	0.036	<0.020	<0.01	0.001	0.001	<0.002	<0.030	0.200	<0.001	0.01	0.022
Indian Spring	<0.003	<0.008	<0.20	<0.005	0.002	0.002	<0.030	0.380	<0.001	0.01	0.450
La Mesita Spring	0.110	<0.020	<0.01	0.004	<0.001	0.002	<0.030	0.860	<0.001	0.02	0.019
Sacred Spring	0.042	<0.020	<0.01	0.001	<0.001	<0.002	<0.003	0.530	<0.001	<0.00	0.025
EPA Primary Drinking Water Standard[b]			0.1		0.006	0.05			0.002		
EPA Secondary Drinking Water Standard[b]	0.05										5.0
EPA Action Level[b]				0.015							
EPA Health Advisory[b]								25-90		0.08-0.11	
Livestock Wildlife Watering Limit[b]				0.1						0.1	25.0
NMWQCC Groundwater Limit[b]		1.0		0.05		0.05					

[a]The less than symbol (<) means the analysis was below the specified detection limit of the analytical method.
[b]N/A means analysis not performed, lost in analysis, or not completed.

wells showed silver concentrations of 0.04 mg/L, just below the NMWQCC groundwater limit of 0.05 mg/L: the Martinez House, Old Community, and Sanchez House wells.

b. Sediments. The radioactive waste treatment plant at TA-50 periodically releases treated liquid effluent into the upper reaches of Mortandad Canyon. This surface water effluent, containing traces of radionuclides and other chemicals, commingles with natural runoff. These combined flows travel along the canyon floor for several miles before they infiltrate directly into channel bedrock or alluvial sediments below the stream channel. These waters enter the shallow groundwater perched on the underlying tuff in the upper and middle reaches of the canyon within Laboratory boundaries. Most of the radionuclides present in the effluent are quickly adsorbed or attached to the sediments in the stream channel. Hence the principal means of radionuclide migration is from sediment transport via surface runoff. The Mortandad Canyon watershed is completely contained on the Pajarito Plateau, with headwaters originating within TA-3. The watershed is long and narrow, with a small catchment area. The channel alluvium thickens in the middle and lower reaches of the canyon. The small drainage area and the thick section of unsaturated alluvium in the middle reach of the canyon have retained all the runoff affected by effluent releases since 1963, when the treatment plant began operating.

In accordance with the MOU, sediments from Mortandad Canyon were collected on July 27, 1994, from seven permanent sampling stations, as seen in Figure IV-5. Station A-5 is located slightly west of the Pueblo of San Ildefonso-Laboratory boundary, while the remaining six locations (i.e., stations A-6 through A-11) are within the Pueblo. The results of these sample analyses for radiochemicals and trace metals are shown in Tables IV-13 and IV-14, respectively. Results from adjacent canyon stations are reported in Tables V-24 and VI-19, respectively. Overall, there are no trends apparent in the 1994 Mortandad Canyon sediment data, and results are generally comparable to sediment data collected from these same stations in previous years. Furthermore, these results are within the ranges expected from worldwide fallout or are comparable to natural background concentrations.

The tritium values for moisture in sediments collected at Stations A-8, A-10, and the composite sample collected near station A-6 along the San Ildefonso-Laboratory boundary in Mortandad Canyon and at Stations 2 and 3 in Sandia Canyon, are somewhat elevated (0.5 to 1.9 nCi/L) above the limit of detection for tritium in water (0.400 nCi/L). While these tritium concentration values are well below the Laboratory's ER Screening Action Level (SAL) as seen in Table IV-13, the exact source of these slightly elevated values is unknown. They suggest, however, a Laboratory origin because natural levels in precipitation are much lower (a mean of about 0.06 nCi/L). Nevertheless, these tritium values are still comparable to historical data collected at these same locations. For the interested reader, a more complete discussion of these SALs is presented in Section V.B.5 (Sediment Monitoring).

None of the Pueblo of San Ildefonso sediment stations in Mortandad Canyon showed levels of ^{90}Sr, ^{137}Cs, total uranium, ^{241}Am, gross alpha, gross beta, or gross gamma concentrations that exceeded the statistically derived comparison values for fallout in soils and sediments in northern New Mexico. The highest level of ^{239,240}Pu was obtained at Station A-7 (located on Pueblo of San Ildefonso property adjacent to the boundary with the Laboratory). This sample contained about twice the statistically derived ^{239,240}Pu comparison value for fallout in northern New Mexico. Similarly, the ^{238}Pu values for Stations A-7 and A-8 were between three and four times larger than the comparison value for fallout in northern New Mexico. Except for Station A-7 with a plutonium isotope (^{239,240}Pu/^{238}Pu) ratio of 2.16, no other ratios for these samples were computed because individual isotope concentrations are either at or below the respective limits of detection (see Table D-14). Hence this computation would not be sufficiently accurate. In sediment samples dominated by worldwide fallout at these low concentration levels, considerable variability is expected because of different particle size distributions in grab samples (Purtymun 1990b). Samples with a large percentage of small particles typically exhibit higher mass concentrations of plutonium because of their high adsorption capacity. The sediments in this part of Mortandad Canyon are more like soils because there has been very little runoff to separate silt from the clay-size particles that typically show higher concentrations of plutonium.

Results of samples from the Pueblo of San Ildefonso sediment sampling locations in Bayo, Sandia, and Mortandad canyons are all within the range of values expected from worldwide fallout. These results do not indicate the presence of any contaminants from Laboratory operations. These findings are consistent with current and previous measurements of sediments from these canyons where they exit the Laboratory facility at or near State Road 502. The samples of sediments collected from the Pueblo of San Ildefonso in 1994 were also analyzed for trace metals, as reported in Table IV-14. The results, which are within the general ranges expected for geologic materials, will provide a basis for future comparisons.

Table IV-13. Radioactivity in Sediments on Pueblo of San Ildefonso Land for 1994

Location	^{3}H (nCi/L)	^{90}Sr (pCi/g)	^{137}Cs (pCi/g)	Total Uranium (μg/g)	^{238}Pu (pCi/g)	$^{239,240}Pu$ (pCi/g)	^{241}Am (pCi/g)	Gross Alpha (pCi/g)	Gross Beta (pCi/g)	Gross Gamma (pCi/g)
PERIMETER STATIONS (OFF SITE)										
Other Areas										
Bayo at SR-4	N/A[a]	0.1 (0.1)[b]	<0.0[c]	2.2 (0.2)	0.008 (0.001)	0.005 (0.001)	0.003 (0.001)	2 (1)	2 (0)	2 (0)
Sandia Canyon										
Station 1	-0.1 (0.3)	-0.3 (0.6)	<0.0	1.4 (0.2)	0.001 (0.001)	0.002 (0.001)	0.006 (0.002)	3 (1)	2 (0)	1 (0)
Station 2	1.9 (0.7)	0.3 (0.2)	0.0 (0.0)	2.4 (0.2)	<0.001 (0.001)	0.002 (0.004)	0.002 (0.001)	5 (1)	3 (0)	2 (0)
Station 3	1.9 (0.7)	0.0 (0.2)	<0.0	1.7 (0.2)	0.002 (0.001)	0.002 (0.001)	0.003 (0.001)	3 (1)	2 (0)	1 (0)
Mortandad Canyon on San Ildefonso Lands										
Mortandad A-6	0.1 (0.4)	N/A	0.2 (0.1)	1.2 (0.1)	0.000 (0.000)	0.005 (0.001)	N/A	N/A	N/A	N/A
Mortandad A-7	-0.2 (0.3)	0.3 (0.2)	0.1 (0.0)	2.1 (0.2)	0.019 (0.003)	0.041 (0.004)	0.010 (0.002)	4 (1)	5 (1)	2 (0)
Mortandad A-8	1.1 (0.3)	0.3 (0.2)	0.2 (0.1)	3.6 (0.4)	0.025 (0.005)	0.013 (0.002)	0.005 (0.001)	8 (2)	6 (1)	3 (0)
Mortandad at SR-4 (A-9)	N/A	0.1 (0.4)	<0.0	2.1 (0.3)	0.003 (0.001)	0.002 (0.001)	0.004 (0.001)	3 (1)	3 (0)	2 (0)
Mortandad A-10	0.5 (0.3)	0.1 (0.2)	0.0 (0.0)	1.6 (0.2)	0.002 (0.001)	0.002 (0.001)	0.002 (0.001)	3 (1)	3 (0)	0 (0)
Mort SI Sed Transect94 COMP	0.5 (0.3)	0.8 (0.3)	0.3 (0.1)	3.8 (0.4)	0.001 (0.001)	0.015 (0.002)	0.005 (0.002)	10 (2)	8 (1)	3 (0)
ON-SITE STATIONS										
Acid-Pueblo Canyons										
Pueblo at State Route	0.2 (0.3)	5.0 (0.4)	<0.1	3.2 (0.7)	0.019 (0.004)	0.925 (0.022)	0.031 (0.005)	4 (1)	2 (0)	7 (1)
DP-Los Alamos Canyons										
Los Alamos at SR-4	N/A	0.2 (0.1)	0.6 (0.1)	1.9 (0.2)	0.014 (0.002)	0.091 (0.005)	0.072 (0.006)	4 (1)	4 (0)	3 (0)
Mortandad Canyon										
Mortandad at MCO-13 (A-5)	0.2 (0.3)	0.0 (0.2)	0.5 (0.1)	2.9 (0.3)	0.004 (0.001)	0.020 (0.002)	0.006 (0.002)	7 (1)	6 (1)	3 (0)
Background[d]		0.87	0.44	4.4	0.006	0.023				7.9
SAL[e]	20.0	5.9	4.0	95.0	20.0	18.0	17.0			

[a]N/A means analysis not performed, lost in analysis or not completed.
[b]Radioactivity counting uncertainties are shown in parentheses.
[c]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.
[d]W.D.Purtymun 1987; standards given here for comparison only. Background is defined as mean plus two times the standard deviation.
[e]Screening Action Level, Environmental Restoration Group 1994 FIMAD database; standards given here for comparison only.

Table IV-14. Total Recoverable Trace Metals in Sediments on Pueblo of San Ildefonso Land for 1994 (µg/g)

Location	Ag	Al	As	B	Ba	Be	Cd	Co	Cr	Cu	Fe	Hg
PERIMETER STATIONS (OFF SITE)												
Other Areas												
Bayo at SR-4	<1.0[a]	2,000.0	0.4	2.9	32.0	<0.08	<0.4	1.9	2.8	3.0	3300.0	<0.02
Sandia Canyon												
Station 1	<1.0	1,600.0	0.8[b]	3.0	18.0	<0.08	<0.4	1.2	4.6	2.2	2400.0	<0.02[b]
Station 4	<1.0	1,900.0	1.0[b]	<1.0	27.0	0.08	<0.4	2.1	6.2	2.6	2900.0	<0.02[b]
Station 3	<1.0	2,800.0	10.0[b]	1.0	39.0	0.11	<0.4	1.9	3.0	2.7	3300.0	<0.02[b]
Mortandad Canyon												
Mortandad A-6	<1.0	1,400.0	<0.5	1.0	15.0	0.17	<0.4	1.0	1.2	<0.5	4200.0	<0.02
Mortandad A-7	<1.0	3,600.0	2.0[b]	<1.0	61.0	0.47	<0.4	3.0	3.2	3.8	5900.0	<0.02[b]
Mortandad A-8	<1.0	4,000.0	2.0[b]	<1.0	63.0	0.46	<0.4	2.8	3.3	3.5	5600.0	<0.02[b]
Mortandad at SR-4 (A-9)	<1.0	3,900.0	1.3	3.0	62.0	0.22	<0.4	5.0	9.2	6.2	4800.0	<0.02
Mortandad A-10	<1.0	5,900.0	2.0[b]	<1.0	100.0	0.60	<0.4	5.0	5.0	5.0	7200.0	<0.02[b]
Mortandad Transect 94 COMP	<1.0	6,300.0	2.4[b]	<1.0	110.0	0.89	0.7	5.9	5.5	7.7	9200.0	<0.02[b]
ON-SITE STATIONS												
Acid-Pueblo Canyons												
Pueblo at State Route	<1.0	1,300.0	0.6	<1.0	14.0	0.02	<0.4	1.7	6.1	2.5	25000.0	<0.02
DP-Los Alamos Canyons												
Los Alamos at SR-4	<1.0	2,300.0	0.6	2.5	22.0	<0.08	<0.4	1.4	3.1	3.0	3900.0	<0.02
Mortandad Canyon												
Mortandad at MCO-13 (A-5)	<1.0	2,900.0	1.0[b]	<1.0	35.0	0.24	<0.4	2.8	2.4	3.1	3600.0	<0.02[b]

Location	Mn	Mo	Ni	Pb	Sb	Se	Sn	Sr	Tl	V	Zn
PERIMETER STATIONS (OFF SITE)											
Other Areas											
Bayo at SR-4	110.0	1.40	2.0	<4.0	<0.2	<0.3	<4.0	7.5	<0.2	5.6	11.0
Sandia Canyon											
Station 1	97.0	<0.90	2.0	5.0	<0.3	0.3	6.0	2.9	<0.3	2.7	18.0
Station 2	140.0	<0.90	2.0	9.0	<0.3	0.5	6.0	3.5	<0.3	3.5	22.0
Station 3	160.0	<0.90	2.0	4.0	<0.3	0.6	4.0	6.8	0.3	4.5	20.0
Mortandad Canyon											
Mortandad A-6	160.0	<2.00	<2.0	<4.0	N/A[c]	N/A	N/A	N/A	N/A	N/A	N/A
Mortandad A-7	300.0	<0.90	4.0	10.0	<0.3	0.6[b]	4.0	9.4	<0.3	7.6	33.0
Mortandad A-8	290.0	1.00	3.0	9.0	<0.3	0.4[b]	6.0	8.8	<0.3	7.1	31.0
Mortandad at SR-4 (A-9)	300.0	2.50	4.6	8.2	<0.2	<0.3	<4.0	7.8	<0.2	6.9	18.0
Mortandad A-10	310.0	<0.90	5.0	9.0	<0.3	0.5[b]	6.0	18.0	<0.3	12.0	34.0
Mortandad Transect 94 COMP	420.0	1.10	4.0	15.0	<0.3	0.5[b]	5.0	20.0	<0.3	12.0	330.0
ON-SITE STATIONS											
Acid-Pueblo Canyons											
Pueblo at State Route	520.0	14.00	<2.0	8.1	<0.2	<0.3	<4.0	2.6	<0.2	13.0	140.0
DP-Los Alamos Canyons											
Los Alamos at SR-4	160.0	1.80	<2.0	9.5	<0.2	<0.3	<4.0	4.8	<0.2	3.7	31.0
Mortandad Canyon											
Mortandad at MCO-13 (A-5)	150.0	<0.90	<2.0	6.2	<0.3	0.5	5.8	6.8	0.3	4.7	23.0

[a]Less than symbol (<) means measurement was below the specified limit of detection of the analytical method.
[b]Result is the mean of more than one sample analysis.
[c]N/A means analysis not performed, lost in analysis or not completed.

5. Sampling of Perimeter Surface Soils at Technical Area 54, Area G. (Ron Conrad, ESH-19)

During FY94, 110 surface soil samples were collected from the perimeter of TA-54, Area G. The locations of these surface soil samples were established so that they could indicate whether contaminants were moving outside the Area G perimeter fence under the influence of surface water runoff. That is, each sampling point was located in an obvious (but small) drainage channel just outside the perimeter fence. These sampling locations were thus biased to best determine movement of contaminated soil being carried by surface water runoff from within the confines of Area G to beyond the Area G fence (Conrad 1995).

During FY94, the radioactive constituents measured in these surface soil samples included ^{241}Am, ^{137}Cs, isotopic plutonium, total uranium, and tritium. In addition, 21 soil samples were analyzed for the metals silver, arsenic, barium, beryllium, cadmium, chromium, mercury, nickel, lead, and selenium.

The analytical results of the FY94 surface soil sampling are found in Tables IV-15 and IV-16. Table IV-15 indicates that the perimeter soils at Area G are generally elevated above background levels for tritium and plutonium. The most elevated concentrations of tritium in soils are prevalent in the locations that are adjacent to the tritium shafts (sample series G-27-33) and the TRU pads (sample series G-38-50). Isotopic plutonium and ^{241}Am activity appear to be only slightly elevated in those perimeter locations adjacent to the TRU pads. Cesium-137 and uranium are uniformly distributed in the perimeter locations, and there is no evidence for localized elevated levels of either of these constituents in the perimeter soils sampled.

The concentrations of metals on those soils sampled indicated that there is no elevated distribution of any of the metals on the perimeter soils (Table IV-16).

The results of the perimeter surface soil sampling performed during FY94 indicate that in the areas of the tritium shafts and TRU pads, soils, contaminated to varying degrees by tritium and plutonium, are being moved by surface water runoff from the TA-54, Area G disposal area to outside the perimeter fence. These findings are consistent with analogous measurements taken in FY93.

The perimeter sampling will continue in FY95.

6. Radionuclide Concentrations in Vegetation at Radioactive Waste Disposal Area G during the 1994 Growing Season. (Philip R. Fresquez, ESH-20)

Overstory (piñon pine) and understory (grass and forb) vegetation (unwashed) samples were collected within and around selected points at TA-54, Area G, a low-level radioactive solid waste disposal facility at Los Alamos National Laboratory for the analysis of tritium, ^{90}Sr, ^{238}Pu and ^{239}Pu, ^{137}Cs, ^{241}Am, and total uranium (Fresquez 1995a).

Results of the analysis are presented in Table IV-17. In general, most of the radiological concentrations in overstory and understory vegetation collected from within and around Area G were higher than upper-limit background values. The upper-limit background concentration is defined as the analytical result plus two sigma. Tritium ranged in concentration from 2.5 to 5,800 pCi/mL and from 35.6 to 952.5 pCi/mL in overstory and understory samples, respectively. The highest tritium concentration was detected in an overstory sample collected just outside the fence west of the tritium shafts; this suggests some subsurface migration of tritium out of Area G.

Tritium has been reported to be moving from the tritium shafts in the vapor phase along the contact points of two ash flows (penetrated by the tritium shafts), open joints, and open pores in the tuff matrix (Purtymun 1973b). In 1985, from 2,200 to 4,800 pCi/mL in overstory vegetation was reported in this same tritium shaft area (Jacobson 1992).

Concentrations of ^{90}Sr ranged from 2.0 to 11.2 pCi/g ash in vegetation collected from within and around Area G. Most samples were around two times the background levels for ^{90}Sr; however, there was one sample, a grass and forb composite sample collected just north of the fence line from the TRU waste pads, that contained ^{90}Sr levels over five times the background level.

Total uranium concentrations in vegetation collected from Area G ranged from 0.89 to 3.29 μg/g ash. Most vegetation samples collected over Area G contained approximately five times more uranium than background samples. The highest amount of uranium was detected in piñon trees growing near the new waste pit. In 1980, total uranium in vegetation collected within and around Area G ranged from 0.09 to 1.0 μg/g ash (Mayfield 1983).

Concentrations of both ^{238}Pu and ^{239}Pu were highest in understory vegetation samples collected outside the fence north of TRU pads. Values of ^{238}Pu and ^{239}Pu collected north of the TRU pads measured 0.452 and 0.153 pCi/g ash, respectively, which were approximately 110 and 50 times background. Overstory and understory

Table IV-15. Radionuclide Analysis of Surface Soil Samples Taken from Technical Area 54, Area G Perimeter in 1994

Sampling[a] Location	^{3}H pCi/L	^{241}Am pCi/g	^{137}Cs pCi/g	Total U µg/g	^{238}Pu pCi/g	^{239}Pu pCi/g
G-5-1	690	0.075	<.52[b]	7	0.03	0.094
G-5-2	620	0.014	<.28	5.4	0.006	0.024
G-6-1	600	0.005	<.23	3.7	0.004	0.006
G-7-1	840	0.003	<.33	4.1	0.005	0.007
G-8-1	370	0.006	<.32	3.8	0.001	0.007
G-8-2	540	0.03	<.36	4.4	0.001	0.01
G-9-1	1,000	0.03	<.56	5.6	0.007	0.1
G-10-1	520	0.102	<.38	4.6	0.004	0.009
G-10-2	920	0.026	<.39	5.1	0.007	0.067
G-11-1	620	0.007	<.3	4.2	0.007	0.013
G-12-1	1,170	0.013	<.21	4	0.003	0.012
G-12-3	1,360	0.03	<.47	4.5	0.007	0.09
G-13-1	1,010	0.007	<.34	3.8	0.0007	0.02
G-13-9	970	0.011	<.3	5.1	0.005	0.028
G-14-1	590	0.013	<.16	2.6	0.007	0.008
G-15-1	790	0.014	<.31	5	0.016	0.043
G-15-2	1,550	0.018	0.58	4.1	0.015	0.06
G-15-2R	1,130	0.01	<.34	4.1	0.02	0.031
G-16-1	2,110	0.011	0.32	3.4	0.004	0.019
G-17-1	1,800	0.008	<.36	4.3	0.004	0.006
G-17-2	2,360	0.021	<.36	5.1	0.009	0.079
G-17-3	2,070	0.013	<.26	4.4	0.004	0.029
G-18-1	1,430	0.01	<.38	5.2	0.004	0.024
G-19-1	1,240	0.134	<.37	5	0.011	0.037
G-19-2	2,490	0.008	<.31	3.5	0.003	0.01
G-20-1	5,470	0.017	1.05	4.5	0.009	0.038
G-20-2	4,410	0.006	<.26	4.2	0.003	0.009
G-21-1	2,560	0.013	0.84	4	0.014	0.013
G-21-1R	2,340	0.016	<.34	4	0.02	0.028
G-22-1	3,630	0.003	<.33	3.6	0.005	0.002
G-23-1	2,180	0.003	<.36	4.1	0.002	0.007
G-23-2	8,550	0.015	<.3	4	0.007	0.042
G-24-1	2,490	0.007	<.33	3.8	0.005	0.012
G-24-2	2,520	0.01	<.36	4.3	0.006	0.027
G-25-1	2,590	0.021	1.68	4.9	0.007	0.057
G-26-1	3,310	0.018	1.75	4.8	0.006	0.065
G-27-1	13,330	0.017	1.4	4.2	0.004	0.033
G-28-1	19,960	0.01	<.33	3.5	0.004	0.023
G-28-2	30,760	0.015	<.37	4.1	0.009	0.029
G-29-1	253,300	0.009	<.22	2.8	0.023	0.011
G-29-2	1,097,620	0.018	<.4	4.4	0.026	0.045
G-29-3	1,715,560	0.006	<.39	4.4	0.005	0.015
G-30-1	205,310	0.007	<.31	3.3	0.009	0.025
G-31-1	404,100	0.032	1.89	5.4	0.024	0.117
G-31-1R	403,030	0.027	0.81	4.8	0.019	0.096
G-31-2	201,950	0.006	<.31	4.3	0.009	0.01
G-31-3	115,680	0.006	<.26	3	0.007	0.01
G-32-1	53,840	0.076	<.39	5.4	0.022	0.392

Table IV-15. Radionuclide Analysis of Surface Soil Samples Taken from Technical Area 54, Area G Perimeter in 1994 (Cont.)

Sampling [a] Location	^{3}H pCi/L	^{241}Am pCi/g	^{137}Cs pCi/g	Total U μg/g	^{238}Pu pCi/g	^{239}Pu pCi/g
G-32-2	47,160	0.01	<.32	4.1	0.007	0.027
G-32-3	31,130	0.025	<.31	4.5	0.01	0.058
G-33-1	14,100	0.02	<.38	4.4	0.016	0.122
G-34-1	6,320	0.008	<.39	4	0.006	0.012
G-34-2	4,700	0.016	<.33	4.4	0.005	0.046
G-34-3	3,900	0.008	<.28	4.8	0.004	0.04
G-34-4	4,200	0.016	<.28	4.4	0.02	0.05
G-34-5	8,210	0.017	<.39	3.3	0.05	0.049
G-34-6	2,870	0.015	<.52	4.7	0.017	0.088
G-34-7	5,110	0.007	<.4	3.8	0.009	0.023
G-34-8	4,210	0.033	<.46	4.8	0.008	0.048
G-34-9	6,400	0.012	<.36	4.7	0.008	0.065
G-34-10	3,830	0.412	0.7	4.7	0.106	2.773
G-34-11	3,980	0.09	<.54	4.9	0.052	0.542
G-34-12	4,140	0.006	<.39	4	0.006	0.007
G-34-13	17,690	0.012	<.44	4.1	0.259	0.028
G-34-14	4,080	0.006	<.43	3.2	0.098	0.022
G-34-15	3,820	0.011	<.48	3.7	0.157	0.028
G-35-1	5,480	0.084	1.26	4.2	0.01	0.125
G-35-2	8,660	0.053	<.31	4.1	0.016	0.643
G-36-1	2,730	0.053	0.54	5.1	0.009	0.122
G-36-1R	3,070	0.047	0.65	4.5	0.014	0.115
G-36-2	3,120	0.015	<.35	4.1	0.005	0.034
G-38-1	3,920	0.014	<.48	4	0.005	0.031
G-38-2	79,620	0.181	<.39	4.5	0.211	0.982
G-39-1	11,430	0.042	<.39	3.7	0.681	0.203
G-39-2	8,100	0.021	<.43	3.1	0.042	0.068
G-40-1	4,490	0.068	<.55	5.1	2.489	0.281
G-40-2	3,020	0.059	<.39	4.6	3.434	0.295
G-41-2	3,170	0.051	<.46	4.4	1.163	0.156
G-42-1	5,110	0.082	<.42	4.5	0.385	1.031
G-43-1	8,200	0.249	<.46	4.2	0.574	1.814
G-43-1R	9,410	0.106	<.47	4.3	0.687	0.481
G-43-2	9,240	0.119	<.48	3.9	0.508	0.711
G-44-1	158,550	0.242	<.44	4.3	15.778	0.588
G-45-1	436,560	0.27	<.46	4.4	1.266	0.639
G-46-1	49,400	0.336	<.43	5.2	16.683	1.173
G-46-2	27,750	0.249	<.53	4.5	1.863	1.093
G-47-1	4,800	0.242	<.46	3.7	0.078	1.782
G-48-1	5,400	0.05	<.68	4.3	0.131	0.297
G-48-2	5,070	0.103	<.69	4.8	0.081	0.579
G-48-3	4,990	0.126	<.45	4.3	0.085	1.157
G-49-1	1,870	0.055	<.42	2.7	0.028	0.216
G-50-1	31,160	1.546	<.14	3.8	0.142	1.063
G-50-2	30,100	0.102	<.12	3.9	0.033	0.075
G-51-1	5,420	0.015	<.14	4.5	0.017	0.031
G-52-1	4,200	0.008	<.14	4.3	0.006	0.011
G-52-2	5,990	0.007	<.14	3.2	0.009	0.031

Table IV-15. Radionuclide Analysis of Surface Soil Samples Taken from Technical Area 54, Area G Perimeter in 1994 (Cont.)

Sampling [a] Location	^{3}H pCi/L	^{241}Am pCi/g	^{137}Cs pCi/g	Total U µg/g	^{238}Pu pCi/g	^{239}Pu pCi/g
G-52-3	6,690	0.02	<.14	3.9	0.031	0.05
G-53-1	2,330	0.014	0.89	4.5	0.015	0.043
G-54-1	6,760	0.007	0.29	4.2	0.016	0.019
G-54-2	3,900	0.012	<.16	4.1	0.008	0.033
G-55-1	3,530	0.014	0.23	3.7	0.007	0.044
G-55-1R	2,190	0.02	<.13	3.9	0.006	0.098
G-57-1	1,900	0.012	1.14	4.4	0.008	0.037
G-58-1	2,420	0.008	0.3	4.2	0.052	0.025
G-59-1	1,280	0.01	1.17	5.4	0.005	0.029
G-60-1	930	0.009	0.58	4.4	0.003	0.022
G-62-1	760	0.003	<.18	4.6	0.002	0.013
G-64-1	830	0.012	<.22	5.2	0.005	0.029
G-65-1	530	0.013	1.28	4.1	0.006	0.057
G-65-2	860	0.006	<.17	4.5	0.003	0.008

[a]Samples were taken between July 14–21, 1994.
[b]Less than symbol (<) means measurement was below the specified detection limit of the analytical method.

Table IV-16. Metal Analysis (µg/g) of Surface Soil Samples Taken from Technical Area 54, Area G Perimeter in 1994

Sampling[a] Location	Ag	As	Ba	Be	Cd	Cr	Hg	Ni	Pb	Se
G-9-1	<.63[b]	3.3	110	<.88	<1	6.5	<.02	<3.8	23.8	<.63
G-10-1	<.62	<1.9	86.9	1.7	<.47	6.8	0.22	<4.2	13.9	<.62
G-17-3	<.61	<1.9	74.3	<.74	<.9	8.5	<.02	<5.2	11.6	<.61
G-21-1	<.61	<1.4	44.9	<.41	<.53	3.5	<.04	<1.2	7	<.61
G-21-1R	<.6	<1	44	<.39	<.52	3.1	<.03	<2	6.2	<.6
G-24-2	<.64	3.1	178	1.7	<1.4	13.7	<.02	9.2	15.7	<.64
G-34-2	<.61	<1.4	70.5	<.65	<.58	3.7	0.14	<1.3	8.4	<.61
G-35-2	<.61	<1.7	116	<.74	<.78	6	<.04	<3.5	12.8	<.61
G-38-1	<.61	3.4	87.2	<.89	<.6	5.8	<.02	<5.8	8.4	<.61
G-38-2	<.61	<1.5	78.5	<.52	<.68	4.3	<.02	<3.8	8.9	<.61
G-40-2	<.61	<2	51.1	<.5	<.37	2.8	<.02	<3.6	7.6	<.61
G-43-1	0.62	<1.3	59	<.55	<.21	3.5	<.02	<3.1	8.6	<.62
G-43-1R	<.62	<.83	57.7	<.49	<.51	4.3	<.02	<3.4	8.7	<.62
G-44-1	<.61	<1.4	<31.8	<.34	<.2	2.6	<.02	<1.2	5.9	<.61
G-45-1	<.61	2.8	52.6	<.51	<.75	4	<.02	<2.3	9.7	<.61
G-46-1	<.94	<1.8	58.6	<.47	<.48	7.7	<.02	<4.1	14.9	<.62
G-48-3	<.62	2.4	74	<.46	<.77	5.6	<.02	<4.2	11.7	<.32
G-50-2	<.6	<.84	51.1	<.42	<.36	3.9	<.02	<1.9	5.9	<.6
G-51-1	<.61	2.5	99.7	<.81	<.52	5.6	<.02	<4.4	11.9	<.61
G-54-1	<.6	<1.3	45.3	<.5	<.25	4.1	<.02	<1.5	7.5	<.6
G-58-1	<.6	2.9	65.7	<.53	<.39	4.9	<.02	<3.5	9.6	<.6

[a]Samples were taken between July 14–21, 1994.
[b]Less than symbol (<) means measurement was below the specified detection limit of the analytical method.

Table IV-17. Radionuclide Concentrations in Vegetation Collected from Technical Area 54, Area G during the 1994 Growing Season

Location	Tritium (pCi/mL)[a]	^{90}Sr (pCi/g ash)	Uranium (mg/g ash)	^{238}Pu (pCi/g ash)	^{239,240}Pu (pCi/g ash)	^{137}Cs (pCi/g ash)	^{241}Am (pCi/g ash)
Radioactive Waste Disposal Area G							
#1 Tritium Shafts (south of the shafts just outside the fence)							
Overstory	119.1 (7.2)[b]	4.0 (0.6)	1.19 (0.26)	0.003 (0.002)	0.007 (0.002)	0.22 (0.22)	0.004 (0.002)
Understory	201.1 (0.0)	3.5 (0.4)	2.05 (0.58)	0.023 (0.006)	0.021 (0.004)	0.21 (0.18)	0.010 (0.006)
#2 Tritium Shafts (west of the shafts just outside the fence)							
Overstory	5,800.0 (200.0)	5.0 (0.6)	1.31 (0.52)	0.003 (0.001)	0.006 (0.002)	0.25 (0.26)	0.003 (0.002)
Understory	328.0 (13.8)	5.4 (0.8)	1.58 (0.32)	0.006 (0.002)	0.013 (0.004)	0.36 (0.24)	0.008 (0.002)
#3 Waste Pits (east of the new pit inside the fence)							
Overstory	9.2 (1.0)	2.6 (0.4)	3.29 (1.72)	0.028 (0.006)	0.024 (0.006)	0.15 (0.16)	0.006 (0.002)
Understory	38.2 (3.8)	4.2 (0.6)	0.89 (0.18)	0.022 (0.004)	0.013 (0.004)	0.16 (0.16)	0.003 (0.002)
#4 TRU Pads (north of pads just outside the fence)							
Overstory	2.5 (1.0)	6.0 (0.8)	0.94 (0.18)	0.044 (0.008)	0.012 (0.004)	0.05 (0.06)	0.008 (0.002)
Understory	35.6 (3.6)	11.2 (1.4)	1.62 (0.92)	0.452 (0.040)	0.153 (0.016)	0.39 (0.24)	0.090 (0.010)
#5 TRU Pads (west side of the pad)							
Understory	177.3 (9.2)	3.3 (0.4)	1.23 (0.24)	0.012 (0.004)	0.014 (0.004)	0.07 (0.08)	0.008 (0.002)
#6 TRU Pads (east side of the pad)							
Understory	952.5 (30.6)	2.0 (0.4)	1.72 (0.34)	0.003 (0.002)	0.009 (0.001)	0.14 (0.14)	0.006 (0.002)
Regional (Background)							
Overstory	1.2 (0.6)	2.0 (0.4)	0.33 (0.06)	0.000 (0.002)	0.000 (0.002)	0.10 (0.10)	0.002 (0.002)
ORSRL[c]	1.8	2.4	0.39	0.002	0.002	0.20	0.004
Understory	1.1 (0.8)	1.8 (0.4)	0.36 (0.08)	0.002 (0.002)	0.001 (0.002)	0.13 (0.14)	0.002 (0.002)
URSRL[d]	1.9	2.2	0.44	0.004	0.003	0.27	0.004

[a]mL of tissue moisture.

[b](±2 counting uncertainty); values are the uncertainty of the analytical results at the 95% confidence level.

[c]ORSRL = Overstory regional statistical reference level (i.e., the upper-limit background concentration based on the mean + 2 counting uncertainties).

[d]URSRL = Understory regional statistical reference level (i.e., the upper-limit background concentration based on the mean + 2 counting uncertainties).

vegetation collected from this general location north of the TRU pads in 1980 contained ^{239}Pu at concentrations ranging from 0.57 to 3.28 and from 0.52 to 1.55 pCi/g ash, respectively (Mayfield 1983). Mayfield and Hanson (1983) attributed the higher ^{239}Pu levels in understory vegetation collected from Area G, compared with vegetation collected from background areas, to occasional spills during disposal operations and/or to surface storage and holding practices.

Cesium-137 ranged in concentration from 0.07 to 0.39 pCi/g ash in vegetation collected from Area G. With the exception of two understory samples, one collected west of the tritium shafts and the other collected outside the fence north of the TRU pads, most vegetation samples were within or very close to background levels. Similarly, most ^{241}Am concentrations in vegetation samples collected at Area G were within or just above background ^{241}Am levels. The highest ^{241}Am value was detected in understory vegetation collected just outside the fence line north of the TRU pads.

7. Air Quality Impacts Analysis for Technical Area 54, Area G. (Dave Kraig, ESH-17)

During 1994, a study was performed to evaluate the impact of diffuse (nonstack) radioactive emissions from the disposal site, TA-54, Area G, in support of site characterization for the Area G performance assessment and for radioactive air emissions management. Diffuse emissions of tritiated water and contaminated windblown dust were considered. Data from an extensive field measurement program were used to estimate annual emissions of tritiated water. Dust models were used to calculate estimates of the annual emissions of windblown dust. These estimates were combined with data on contamination levels in surface soils to develop annual emission rates for specific radionuclides: tritium, ^{238}U, ^{137}Cs, ^{238}Pu, ^{239,240}Pu, and ^{90}Sr. The CAP-88 (EPA 1990b) atmospheric transport model was used to predict areas potentially affected by long-term dust deposition and atmospheric concentrations.

The annual emission rate of tritiated water was estimated from the field data to be 14 Ci/yr (520 Gbq/yr). The emission rate of soil-borne radionuclides from open areas and from soils-handling operations totaled less than 1×10^{-4} Ci/yr (3.7 Mbq/yr). The CAP-88 results were used to develop EDEs for receptor locations downwind of Area G. All EDEs were several orders of magnitude below the national standard of 10 mrem/yr. Diffuse air emissions from Area G were found not to pose a significant health threat to persons living or working downwind of the facility.

8. Measurement of Air Quality within Storage Domes in Technical Area 54, Area G. (Dave Kraig, ESH-17)

Concentrations of volatile organic compounds (VOCs) and tritium inside storage domes at TA-54, Area G were measured to assess worker exposure and to support TA-54 site characterization. Samples were collected at 2 or 3 locations within domes 48, 49, and 153 on up to six days during the summer of 1994. Samples were collected to evaluate three scenarios: (1) normal working activities with the domes open; (2) after domes were closed overnight; and (3) after domes were closed for three days. Eight-hr integrated samples were collected and analyzed in analytical laboratories.

Tritium activities from 17.1 to 69,900 pCi/m^3 (0.63 Bq to 2.59 kBq) were measured. About two dozen individual VOCs were identified in each sample, but most of the concentration levels were very low (e.g., <1 to 10 ppbv). The highest concentrations measured were bromomethane (56.5 ppbv), 1,1,1-trichloroethane (75.4 ppbv), propane (958 ppbv), methylene chloride (1,450 ppbv), and toluene (22.8 ppbv). The measured VOC concentrations were well below the action levels developed by the NMED, and the measured tritium concentrations were well below the DOE's derived air concentration. The variability in concentration within a dome during a single sampling episode was small. The concentrations were about 10 times higher after the domes had been closed overnight than when the domes were open. Closing the domes over the weekend did not result in significantly higher concentrations (e.g., >20%) than when the domes were closed only overnight. The data were used to generate estimated annual dome emission rates of 0.3 Ci/yr (11 Bq/yr) of tritium and less than 100 lb/yr of VOCs.

The measured VOC concentrations were collected during the warmest months of the year and therefore should represent worst-case air impacts. Based on the results of this study, the domes are relatively insignificant emitters of VOCs and tritium. The air quality within the domes does not pose a significant health risk to workers nor does it contribute a significant portion of the allowable annual exposure.

9. Measurement of Emission Fluxes from Technical Area 54, Areas G and L. (Dave Kraig, ESH-17)

As a part of the Area G site characterization for the Area G performance assessment and for radioactive air emissions management, emission fluxes (mass/time-area) of tritiated water, radon, and VOCs from TA-54 were measured. Emission fluxes of tritium were measured at over 180 locations during the summers of 1993 and 1994, including randomly selected locations across Area G, three areas of suspected contamination at Area G, and the property surrounding TA-54. Emission fluxes of radon were measured at 6 locations, and emission fluxes of VOCs were measured at 30 locations. Monitoring was performed at each location over a several-hour period using the US EPA flux chamber approach. Separate samples for tritiated water, radon, and VOCs were collected and analyzed in off-site laboratories.

The tritiated water emission fluxes varied over several orders of magnitude, from background levels of about 3 $pCi/m^2 \cdot min$ (0.1 $Bq/m^2 \cdot min$) to 9.69 ± 10^6 $pCi/m^2 \cdot min$ (359 kBq·min) near a disposal shaft. Low levels of tritiated water were found to have migrated into Pajarito Canyon, directly south of Area G. The tritium flux data were used to generate an estimated annual emission rate of 14 Ci/yr for all of Area G, with the majority of this activity being emitted from relatively small areas near several disposal shafts. The estimated total annual release is less than 1% of the total tritium release from all LANL in 1992 and results in a negligible off-site dose. Based on the limited data available, the average emission flux of radon from Area G is estimated to be 8.1 $pCi/m^2 \cdot min$ (0.30 $Bq/m^2 \cdot min$). The measured emission fluxes of VOCs were <100 $mg/m^2 \cdot min$, which is small compared with fluxes typically measured at hazardous waste landfills.

10. Ambient Monitoring of Volatile Organic Compounds at Technical Area 54, Areas G and L. (Dave Kraig, ESH-17)

Ambient air monitoring of VOCs at TA-54 was conducted to characterize nonradioactive air emissions. This study was performed to determine if the Laboratory's waste operations are releasing significant amounts of VOCs to the ambient environment. Samples were collected at four locations along the northern fence line (dominant downwind side) of Areas G and L and at a background site located in Bandelier National Monument. Eight-hour integrated samples were collected in evacuated canisters during daylight hours on each of eight days during the summer of 1994, for a total of 40 samples. The samples were analyzed by gas chromatography, following EPA Method TO-14, for a target list of 68 analytes.

In general, about two dozen VOCs were identified in each sample, including those collected at the background site, but the concentration levels were very low. The average total nonmethane hydrocarbon concentration ranged from 4.3 to 22.8 ppbv at the Area G and L sites, compared with an average of 4.2 ppbv at the background site. The measured concentrations were compared with action levels developed by NMED and were well below the action levels in all cases. Methanol and benzene were the only compounds that ever exceeded 1% of the action level. The measured VOC concentrations were collected during the warmest months of the year and therefore should represent worst-case air impacts. Based on the results of this study, VOC emissions from Areas G and L have an insignificant impact on local air quality and pose negligible health risk to workers or nearby populations.

11. Evaluation of Site-Specific Acceptability of AIRNET Stations. (Dave Kraig, ESH-17)

The AIRNET program evaluated site-specific characteristics of all ambient air sampling stations to assess whether airflow around the stations' locations was being affected by nearby obstacles or topography. The stations were compared with the criteria from applicable sections in DOE/EH-0173T (DOE 1991a) and 40 CFR 58 App. E (EPA 1992).

The primary site-specific criteria were favorable surface characteristics, no airflow obstructions, and good topography. A favorable surface is one that is stabilized by vegetation or other cover such that the local generation of wind-borne dusts and dust-loading of the air filters are minimized. The criteria applied to trees, buildings, topography, and other potential obstructions are intended to ensure that airflow from a source or sources toward the sampler is not obstructed.

As a result of the study, several stations were relocated to better sites and some sites were modified, primarily by trimming or removing nearby vegetation. LANL plans to review the stations each year to ensure optimal airflow and sampling.

12. Performance Assessments. (Diana Hollis, CST-14)

DOE Order 5820.2A, Radioactive Waste Management, became effective in September 1988. Section III of this order established policies, guidelines, minimum requirements, and performance criteria for LLW and mixed waste (LLW that also contains nonradioactive hazardous waste components) management at DOE facilities. The order requires a performance assessment (PA) of each active LLW disposal site to demonstrate compliance with specific performance objectives to accomplish the following:

- protecting public health and safety;
- ensuring external exposure to the waste and concentrations of radioactive material that may be released into surface water, groundwater, or the soil or that may be transmitted through contact with plants or animals result in an effective dose equivalent (EDE) that does not exceed 25 mrem/yr to any member of the public;
- ensuring that the committed EDEs received by individuals who inadvertently intrude into the waste disposal facility after the period of active institutional control (100 yrs) will not exceed 100 mrem/yr for continuous exposure or 500 mrem for a single acute exposure; and
- protecting groundwater resources, consistent with federal, state, and local requirements.

The nominal compliance period considered for the PA is 10,000 years postclosure. This compliance period assumes that the federal government maintains active institutional control over the site for 100 years after closure, then loses control, such that members of the public may inadvertently use the site under various scenarios. Dose projections are made for hypothetical human receptors outside the facility boundary for the entire compliance period, and for inadvertent intruders between 100 and 10,000 years postclosure. The doses are calculated according to exposure pathways and land use scenarios appropriate for evaluating compliance for the various performance objectives. All pathways are evaluated, including ingestion, inhalation, and immersion.

The PA is a "living" document describing the continuous process of evaluating the radiological performance of the TA-54, Area G LLW Disposal Facility over its operational lifetime; the PA will be considered final only after facility closure. The analysis is updated as often as necessary to address changing requirements, increasing inventory, enhanced modeling capabilities, additional site characterization data, etc.

The PA is reviewed by the DOE Peer Review Panel (PRP), which advises DOE/HQ as to the adequacy of the analysis. The PRP includes subject matter experts from both the DOE and the EPA and Nuclear Regulatory Commission.

Performance Assessment for TA-54, Area G. TA-54, Area G is the Laboratory's only active site for the disposal of solid radioactive wastes. The PA for TA-54, Area G was initiated in 1989.

A preliminary draft PA was submitted to the PRP in August, 1995. Assuming approval from the PRP, the PA of the LANL TA-54, Area G LLW Disposal Facility, Revision 0, will be forwarded to DOE/HQ in December 1996.

The results of the preliminary analysis show that LANL is in compliance with all of the performance objectives, with a large margin of safety. In particular, only two radionuclides are shown to enter the deep aquifer within the compliance period—^{14}C and ^{237}Np. The doses projected to evaluate the protection of hypothetical off-site receptors are 4 to 50 times less than the applicable performance objectives. Those doses estimated to evaluate the protection of hypothetical inadvertent intruders are between 2 and 100 times less than the performance objectives, depending on the land use scenario considered. The radionuclides contributing to the intruder doses are largely decay products of ^{235}U and ^{238}U. Table IV-18 shows the application of PA performance objectives to TA-54, Area G.

Performance Assessment for the Mixed Waste Disposal Facility (MWDF). The principal goal of the MWDF is to dispose of solid mixed waste in compliance with the regulatory and operational requirements of RCRA and DOE. The PA for the MWDF, proposed to be located at TA-67, was initiated in 1992. It was suspended in 1995, pending resolution of funding.

Based on the results of the TA-54, Area G PA, and the proposed cementitious waste form, the TA-67 MWDF PA can be expected to show complete compliance with the performance objectives. Complete compliance can be expected because the radionuclides in the TA-67 inventory will be the same as those in the TA-54 inventory, most of which become less mobile in the presence of cement, because of its high inorganic mineral content, and its effect on chemical properties of water that may percolate through it.

Table IV-18. Application of Department of Energy Performance Assessment Performance Objectives to Technical Area 54, Area G

Hypothetical Receptor	Exposure Pathway	Performance Objective	Time Period
maximally exposed off-site resident	all[a]	25 mrem/yr	all
maximally exposed off-site resident	atmospheric	10 mrem/yr	all
nearest off-site resident	groundwater	4 mrem/yr	all
inadvertent on-site intruder	all		
	chronic exposure	100 rem/yr	post-institutional control
	acute exposure	500 mrem	

[a]Ingestion, inhalation, immersion

13. Preoperational Studies. (Philip Fresquez, ESH-20)

Preoperational studies are required under DOE Order 5400.1 for areas where a new facility or process may significantly impact the environment (DOE 1988a). This order requires that chemical, physical, and biological characteristics be assessed before the site is disturbed.

A comprehensive study was conducted over an area that will house two proposed facilities: the Radioactive Liquid Waste Treatment Facility at TA-63 and the Hazardous Waste Treatment Facility at TA-52 (Fresquez 1993).

A description of floodplains/wetlands; threatened, endangered, and sensitive species; vegetative understory (grass and forbs) and overstory (trees); invertebrates (insects); and wildlife (birds and small mammals) inhabiting these areas can be found in Haarmann (1995). In general, the proposed construction sites are in a relatively disturbed area bordered by roads and technical sites. There are no floodplains or wetlands found in the area and the proposed sites have little likelihood of containing habitat for any threatened, endangered, or sensitive species.

Also, soil samples from the area(s) were collected and analyzed for baseline concentrations of various radionuclides and heavy metals (Tables IV-19 and IV-20). In general, tritium, ^{90}Sr, and ^{137}Cs activity in all soil samples were within regional statistical reference (background) levels. Some individual sites, however, contained uranium, ^{238}Pu, ^{239}Pu and ^{241}Am levels above background concentrations. Americium-241 levels, in particular, were from 9 to 17 times higher than background. Levels of silver, arsenic, cadmium, nickel, antimony, and selenium were all within background concentrations; whereas, barium, beryllium, mercury, and lead appear to be slightly higher than regional background concentrations.

Table IV-19. Baseline Radiochemical Analyses of Soils Collected from Around the Proposed Radioactive Liquid Waste Treatment Facility at Technical Area 63 and the Hazardous Waste Treatment Facility at Technical Area 52

Location	Tritium (pCi/mL)	^{90}Sr (pCi/g)	^{137}Cs (pCi/g)	Total Uranium (μg/g)	^{238}Pu (pCi/g)	$^{239, 240}$Pu (pCi/g)	^{241}Am (pCi/g)
Site 1	1.3 (0.3)	0.5 (0.7)	0.36 (0.11)	4.5 (0.31)	0.007 (0.003)	0.093 (0.014)	0.28 (0.09)
Site 2	1.2 (0.3)	0.4 (0.7)	0.19 (0.09)	3.4 (0.24)	0.004 (0.002)	0.013 (0.004)	0.21 (0.09)
Site 3	1.5 (0.4)	0.3 (0.7)	0.29 (0.10)	4.8 (0.34)	0.006 (0.003)	0.079 (0.012)	0.36 (0.10)
Site 4	1.1 (0.3)	0.4 (0.8)	0.54 (0.12)	4.4 (0.31)	0.009 (0.003)	0.105 (0.012)	0.39 (0.10)
Site 5	3.0 (0.5)	0.4 (0.8)	0.67 (0.14)	7.1 (0.50)	0.008 (0.003)	0.260 (0.020)	0.40 (0.10)
RSRL[b]	7.2	0.88	1.10	3.4	0.005	0.025	0.02

[a](+2 counting uncertainty); values are the uncertainty of the analytical result at the 95% confidence level.

[b]Regional Statistical Reference Level; this is the upper limit background concentration (mean + 2 std dev) from Purtymun 1987a.

Tables IV-20. Total Recoverable Trace and Heavy Metals (μg/g) (ppm) in Soils Collected from Around the Proposed Radioactive Liquid Waste Treatment Facility at Technical Area 63 and the Hazardous Waste Treatment Facility at Technical Area 52[a]

Location	Ag	As	Ba	Be	Cd	Cr	Hg	Ni	Pb	Sb	Se
Site 1	<1[b]	3.4	610	1.78	<0.7	20.1	0.01	9	23	<4	0.2
Site 2	<1	3.1	615	1.68	<0.7	20.2	0.01	10	21	<4	0.2
Site 3	<1	3.8	617	1.74	<0.7	20.0	0.01	9	21	<4	0.2
Site 4	<1	3.3	590	1.80	<0.7	19.2	<0.01	9	24	<4	<0.3
Site 5	<1	2.4	477	1.84	<0.7	14.7	<0.01	7	25	<4	<0.2
RSRL[c]	<3.9	6.4	228	0.96	<0.5	17.9	<0.04	16	22	<0.30	<1.3

[a]Analysis by EPA Method 3051 for total recoverable metals.
[b]The less than symbol (<) means the analysis was below the specified detection limit of the analytical method.
[c]Regional Statistical Reference Level; this is the upper-limit background concentration (mean + 2 std dev) from Fresquez 1995.

14. Biological Resource Evaluations. (Kathryn Bennett, James Biggs, David Keller, Tim Haarmann, Saul Cross, and Daniel Dunham, ESH-20)

a. Introduction. The Ecological Studies Team (EST) began monitoring selected biota and sensitive habitats to provide long-term data in accordance with the Endangered Species Act, Floodplain and Wetland Executive Orders, NEPA, and DOE Order 5400.1 (DOE 1988a). Monitoring studies on birds, reptiles and amphibians, small mammals, and invertebrates continued through 1994.

Aquatic Invertebrates. For the past five years, EST conducted field studies of stream macro-invertebrate communities associated with outfalls of organic and industrial waste in Sandia Canyon. During the 1993 study, two extra stations were added for a total of five sampling stations. Results of the Sandia Canyon study were similar to those obtained in previous years. Data obtained from the stations indicated that the number and diversity of macroinvertebrate communities in Sandia Canyon are a function of water quality and physical characteristics of the stream. Diversity of macroinvertebrates generally increased with increased distance from a outfall area. In 1994, EST started sampling aquatic invertebrates associated with other industrial outfalls in numerous areas of the Laboratory.

In addition to the study in Sandia Canyon, EST began collecting aquatic macroinvertebrates from three sampling stations in Los Alamos and Guaje Canyon. The data collected from these stations will provide baseline data of aquatic macroinvertebrates in these locations. In addition, data comparisons were made between Los Alamos Canyon (on-site canyon) and Guaje Canyon (off-site canyon). Initial data analysis show that aquatic communities are more diverse and richer in Guaje Canyon. The data also suggest that within each canyon, diversity and richness decrease with distance downstream. Fluctuations in stream flow appeared to be a major reason for decreases in diversity and richness. Periodic drought was seen at several sampling stations. Tables D-9 and D-10 list all the macroinvertebrates that have been collected and identified in these studies.

Terrestrial Invertebrates. EST conducted studies of terrestrial insects in Los Alamos Canyon, Guaje Canyon, and Puye Mesa during 1994. Pit traps for terrestrial insects yielded large numbers of insect orders, genera, and species. More than 15,000 individual arthropods were trapped and identified. The results of the analysis indicated that, at a 95% confidence interval, there is no significant difference in the arthropods of Los Alamos Canyon and those in Guaje Canyon for equivalent time periods and equivalent number of trapping days. Table IV-21 is a list of the insect families that have been collected on LANL property as of December 1994, and Table IV-22 lists the noninsect anthropods collected.

Reptiles and Amphibians. During 1994, the populations of reptiles and amphibians were monitored in Pajarito Canyon. The plateau whiptail lizard was the most abundant reptile captured, and the chorus frog was the most abundant amphibian. Table IV-23 lists the species captured during the 1994 field season.

Birds. During the 1994 field season, 8 bird surveys were performed. Surveys covered areas of Los Alamos, Guaje, Cañada del Buey, Sandia, Pajarito Canyons, and Puye Mesa, and 73 species of resident birds were encountered. Table IV-24 lists the species identified in these surveys.

Table IV-21. Terrestrial Insects Found on Los Alamos National Laboratory Property as of December 1994

ORDER	FAMILY	COMMON NAME
Thysanura (Bristletails)	Lepismatidae	Silverfish
	Machilidae	Jumping bristletail
Collembola (Springtails)	Sminthuridae	Globular springtail
	Entomobryidae	Slender springtail
	Isotomidae	Smooth springtail
	Hypogastruridae	Elongate-Bodied springtail
Odonata (Dragon and damselflies)	Aeshnidae	Darner
	Libellulidae	Common skimmer
	Coenagrionidae	Narrow-winged damselfly
	Gomphidae	Clubtail
Phasmida (Walkingsticks)	Heteronemiidae	Common walkingstick
Orthoptera (Grasshoppers and crickets)	Acrididae	Short-horned grasshopper
	Gryllacrididae	Camel cricket
	Gryllidae	True cricket
Plecoptera (Stoneflies)	Perlidae	Common stonefly
Dermaptera (Earwigs)	Forficulidae	Common earwig
Thysanoptera (Thrips)	Thripidae	Common thrip
Hemiptera (True bugs)	Belostomatidae	Giant water bug
	Miridae	Plant bug
	Reduviidae	Assassin bug
	Phymatidae	Ambush bug
	Lygaeidae	Seed bug
	Cydnidae	Burrower bug
	Scutelleridae	Shield-backed bug
	Pentatomidae	Stink bug
	Anthocoridae	Minute pirate bug
	Coreidae	Squash bug
	Nabidae	Damsel bug
Homoptera (Cicadas and kin)	Cicadidae	Cicada
	Aphididae	Aphids
	Cercopidae	Spittlebugs
	Cicadellidae	Leafhoppers
	Coccidae	Soft Scales
	Delphacidae	Planthoppers
	Eriosomatidae	Gall-making aphids
	Psyllidae	Jumping plantlice
Neuroptera (Net-veined insects)	Myrmeleontidae	Antlion
	Hemerobiidae	Brown Lacewings
	Raphidiidae	Snakefly
Coleoptera (Beetles)	Cicindelidae	Tiger beetle
	Carabidae	Ground beetle
	Silphidae	Carrion beetle
	Lampyridae	Firefly
	Cantharidae	Soldier beetle
	Lycidae	Net-winged beetle
	Buprestidae	Metallic wood-boring beetle

Table IV-21. Terrestrial Insects Found on Los Alamos National Laboratory Property as of December 1994 (Cont.)

ORDER	FAMILY	COMMON NAME
	Staphylinidae	Rove beetle
	Erotylidae	Pleasing fungus beetle
	Nitidulidae	Sap beetle
	Coccinellidae	Ladybird beetle
	Tenebrionidae	Darkling beetle
	Meloidae	Blister beetle
	Cerambycidae	Long-horned beetle
	Lucanidae	Stag beetle
	Scarabaeidae	Scarab beetle
	Chrysomelidae	Leaf beetle
	Curculionidae	Weevil
	Dermestidae	Dermestid beetle
Lepidoptera (Butterflies, moths)	Papilionidae	Swallowtail
	Lycaenidae	Copper
	Hesperiidae	Skipper
	Pieridae	White, sulphur, and orange
	Nymphalidae	Brush-footed butterfly
	Satyridae	Satyr, nymph, and artic
	Noctuidae	Noctuid moth
	Sphingidae	Sphinx moth
	Saturniidae	Giant silkworm moth
	Gelechiidae	Gelechiid moth
	Geometridae	Measuring worms
	Pterophoridae	Plume moth
Diptera (Flies)	Tabanidae	Horse and deer flies
	Therevidae	Stiletto fly
	Asilidae	Robber fly
	Bombyliidae	Bee fly
	Syrphidae	Hover fly
	Tachinidae	Tachinid fly
Siphonaptera (Fleas)	Pulicidae	Dog fleas
Hymenoptera (Bees, ants, wasps)	Ichneumonidae	Ichneumonid wasp
	Cynipidae	Gall wasp
	Mutillidae	Velvet ant
	Scoliidae	Scoliid wasp
	Formicidae	Ant
	Pompilidae	Spider wasp
	Eumenidae	Euminid wasp
	Vespidae	Vespid wasp
	Sphecidae	Sphecid wasp
	Halictidae	Metallic wasp
	Megachilidae	Leafcutting bee
	Apidae	Honey and bumble bees

Table IV-22. Noninsect Terrestrial Arthropods Found on Los Alamos National Laboratory Property as of December 1994

CLASS/ORDER	FAMILY
Chilopoda (centipedes)	Geophilidae
	Lithobiidae
Diplopoda (millipedes)	Julidae
Arachnida/Acarina (spiders/mites)	Bdellidae
	Ascidae
	Bryobiidae
	Calligonellidae
	Cryptognathidae
	Cunaxidae
	Erythraeidae
	Eupodidae
	Gymnodamaeidae
	Laelapidae
	Nanorchestidae
	Paratydaeidae
	Phytoseiidae
	Rhagidiidae
	Rhaphignathidae
	Scutacaridae
	Stigmaeidae
	Tenuipalpidae
	Terpnacaridae
	Trombidiidae
	Tydeidae
	Tarsonemidae
	Zerconidae
Archnida/Araneida	Agelenidae
	Amaurobiidae
	Anyphaenidae
	Araneidae
	Clubionidae
	Dictynidae
	Gnaphosidae
	Hahniidae
	Linyphiidae
	Lycosidae
	Micryphantidae
	Miryphantidae
	Oonopidae
	Pholcidae
	Tetragnathidae
	Salticidae
	Theridiidae
	Thomisidae
Arachnida/Opiliones	Phalangiidae

In addition to these surveys, a systematic survey was conducted on LANL lands for the northern goshawk, a candidate under the federal Endangered Species Act. Additionally in 1994, surveys were begun to determine the presence of the Mexican spotted owl and the southwestern willow flycatcher, species protected under the federal Endangered Species Act, in all suitable habitat. Following the 1995 survey season all suitable habitat will have been surveyed for these species. No nesting goshawks were found on LANL lands; however, portions of LANL lands were determined to be northern goshawk post-fledgling management areas. No Mexican spotted owls or southwestern willow flycatchers were found to be nesting on LANL lands in 1994. The lands of LANL do nevertheless contain suitable nesting habitat for these species. All areas of the Laboratory with suitable threatened endangered or sensitive species habitat will continue to be monitored and managed.

Small Mammals. Small mammals were sampled at two waste burial sites (Sites 1 and 2) at TA-54, Area G and a control site outside Area G (Site 3) to identify radionuclides that may be present within surface and subsurface soils, to compare the amount of radionuclide uptake at waste burial sites to a control site, and to identify the primary mode of contamination to small mammals. Three composite samples of at least five animals per sample were collected at each site. Pelts and carcasses of each animal were separated and analyzed independently. Samples were analyzed for ^{241}Am, ^{90}Sr, ^{238}Pu, ^{239}Pu, total uranium, and gamma spectroscopy (including ^{137}Cs). Significantly higher (parametric t-test at $p = 0.05$) levels of total uranium, ^{241}Am, ^{238}Pu, ^{239}Pu, and ^{40}K were detected in pelts as compared to the carcasses of small mammals at TA-54. Concentrations of remaining radionuclides in carcasses were nearly equal to or exceeded the mean concentrations in the pelts. Site 1 had significantly higher total uranium concentrations in carcasses than Sites 2 and 3. Site 2 had significantly higher ^{239}Pu concentrations in carcasses than either Site 1 or Site 3. A significant difference in ^{90}Sr concentration existed between Sites 1 and 2. Concentrations of ^{40}K at Site 1 were significantly different from Site 3. Deer mice (*Peromyscus maniculatus*) was the only species captured at Sites 1 and 2. Deer mice and piñon mice (*P. trueii*) were captured at the control site. The highest densities of animals occurred on Sites 1 and 2 with very low capture rates at the control site. Density estimates of rodents occurring at Sites 1 and 2 were calculated by regressing the number of daily captures onto the cumulative number of captures for each day and based on a 100 x 100 m grid with an additional 5-m boundary strip to help account for animals being drawn into the grid due to the bait.

Small mammals were trapped in Mortandad Canyon, and their tissues were analyzed for contaminants. Three 10 x 10 m grids were set up in the canyon, and animals were collected and processed similar to those in Area G. This is the first of two years of data collection, and therefore, the results will be reported in the 1995 Environmental Surveillance Report. In June of 1994, the EST conducted field surveys on Puye Mesa within Los Alamos Laboratory property for an ecological risk assessment. The trapping sites were located in one habitat type: piñon pine/juniper. Three replicate webs with 148 trap stations at each were laid out, and Program DISTANCE was used to estimate density of each web and all webs combined. Very poor capture rates were experienced during trapping, which was not only evident in these trapping locations but elsewhere at the Laboratory during other live-trap sampling. Deer mice, brush mice (*Peromyscus boylii*), and piñon mice were the most commonly captured species. There were almost twice as many males captured than females. Since this was the first year of data collection on mesa tops and only one mesa top selected for sampling, yearly and locational comparisons could not be made. This area will be sampled in the future.

Table IV-23. Species of Amphibians and Reptiles Captured in Pajarito Canyon during 1994

Scientific Name	Common Name	Number Caught	Relative Abundance
Cnemidophorous velox	Plateau whiptail	73	52.14%
Eumeces multivirgatus	Many-lined skink	34	24.29%
Pseudacris triseriata	Chorus frog	12	8.57%
Thamnophis elegans	Western terrestrial garter snake	9	6.43%
Sceloporous undulatus	Eastern fence lizard	5	3.57%
Spea couchii	Couch’s spadefoot toad	3	2.14%
Bufo woodhousii	Woodhouse toad	2	1.43%
Ambystoma tigrinum	Tiger salamander	1	0.71%
Eumeces obsoletus	Great Plains skink	1	0.71%
TOTAL		140	

Table IV-24. Species Identified in Bird Surveys during 1994

Scientific Name	Species Code	Common Name
Melanerpes formicivorus	ACWO	Acorn Woodpecker
Falco sparverius	AMKE	American Kestrel
Turdus migratorius	AMRO	American Robin
Myiarchus cinerascens	ATFL	Ash-throated Flycatcher
Hirundo rustica	BASW	Barn Swallow
Archilochus alexandri	BCHU	Black-chinned Hummingbird
Polioptila caerulea	BGGN	Blue-gray Gnatcatcher
Molothrus ater	BHCO	Brown-headed Cowbird
Pheucticus melanocephalus	BHGR	Black-headed Grosbeak
Guiraca caerulea	BLGR	Blue Grosbeak
Euphagus cyanocephalus	BRBL	Brewer's Blackbird
Selasphorus platycercus	BTHU	Broad-tailed Hummingbird
Psaltriparus minimus	BUSH	Bushtit
Pipilo fuscus	CATO	Canyon Towhee
Catherpes mexicanus	CAWR	Canyon Wren
Spizella passerina	CHSP	Chipping Sparrow
Nucifraga columbiana	CLNU	Clark's Nutcracker
Hirundo pyrrhonota	CLSW	Cliff Swallow
Accipiter cooperii	COHA	Cooper's Hawk
Corvus corax	CORA	Common Raven
Junco hyemalis	DEJU	Dark-eyed Junco
Picoides pubescens	DOWO	Downy Woodpecker
Empidonax oberholseri	DUFL	Dusky Flycatcher
Sturnus vulgaris	EUST	European Starling
Otus flammeolus	FLOW	Flamulated Owl
Bubo virginianus	GHOW	Great-horned Owl
Empidonax wrightii	GRFL	Gray Flycatcher
Dendroica graciae	GRWA	Grace's Warbler
Picoides villosus	HAWO	Hairy Woodpecker
Catharus guttatus	HETH	Hermit Thrush
Carpodacus mexicanus	HOFI	House Finch
Passer domesticus	HOSP	House Sparrow
Troglodytes aedon	HOWR	House Wren
Passerina cyanea	INBU	Indigo Bunting
Carduelis psaltria	LEGO	Lesser Goldfinch
Anas platyrhynchos	MALL	Mallard Duck
Oporornis tolmiei	MAWA	MacGillivray's Warbler
Parus gambeli	MOCH	Mountain Chickadee
Zenaida macroura	MODO	Mourning Dove
Colaptes auratus	NOFL	Northern Flicker
Mimus polyglottos	NOMO	Northern Mockingbird
Gymnorhinus cyanocephalus	PIJA	Piñon Jay
Carduelis pinus	PISI	Pine Siskin
Parus inornatus	PLTI	Plain Titmouse
Sitta pygmaea	PYNU	Pygmy Nuthatch
Sitta canadensis	RBNU	Red-breasted Nuthatch
Regulus calendula	RCKI	Ruby-crowned Kinglet
Pipilo erythrophthalmus	RSTO	Rufous-sided Towhee
Buteo jamaicensis	RTHA	Red-tailed Hawk

Table IV-24. Species Identified in Bird Surveys during 1994 (Cont.)

Scientific Name	Species Code	Common Name
Selasphorus rufus	RUHU	Rufous Hummingbird
Agelaius phoeniceus	RWBL	Red-winged Blackbird
Sayornis saya	SAPH	Say's Phoebe
Aphelocoma coerulescens	SCJA	Scrub Jay
Melospiza melodia	SOSP	Song Sparrow
Vireo solitarius	SOVI	Solitary Vireo
Cyanocitta stelleri	STJA	Steller's Jay
Piranga ruber	SUTA	Summer Tanager
Myadestes townsendi	TOSO	Townsend's Solitaire
Cathartes aura	TUVU	Turkey Vulture
Tachycineta thalassina	VGSW	Violet-green Swallow
Vermivora virginiae	VIWA	Virginia's Warbler
Vireo gilvus	WAVI	Warbling Vireo
Sitta carolinensis	WBNU	White-breasted Nuthatch
Sialia mexicana	WEBL	Western Bluebird
Tyrannus verticalis	WEKI	Western Kingbird
Piranga ludoviciana	WETA	Western Tanager
Sphyrapicus thyroideus	WISA	Williamson's Sapsucker
Wilsonia pusilla	WIWA	Wilson's Warbler
Zonotrichia albicollis	WTSP	White-throated Sparrow
Aeronautes saxatalis	WTSW	White-throated Swift
Contopus sordidulus	WWPE	Western Wood-Pewee
Dendroica petechia	YEWA	Yellow Warbler
Dendroica coronata	YRWA	Yellow-rumped Warbler

In July and August of 1994, the EST conducted field surveys in Guaje and Los Alamos Canyons, as a continuation of data collected in 1993 for the ecological risk assessment. It included conducting live-capture and release studies on rodent populations. The trapping sites were located in two habitat types: Mixed conifer and Ponderosa pine, and a transition zone of these two. Six 12 x 12 grids with 144 trap stations at each were laid out in the canyon bottoms. Program CAPTURE was used to estimate population size and density. Very poor capture rates were experienced during 1994. Analysis (ANOVA and SNK multiple range test) showed that the mean daily capture rates observed during the four consecutive years are statistically different (alpha = 0.05). Capture rates for 1991 were significantly higher than the subsequent years, and 1992 rates were significantly higher than 1993 and 1994. Capture rates were not significantly different between 1993 and 1994. Deer mice were captured in all trapping locations except middle Los Alamos Canyon. Shrews and voles were only captured in the upper locations of each canyon and deer mice and a small number of harvest mice were the only species captured in the Ponderosa pine habitat of the lower portions of each canyon. The upper portions of the canyon systems had a much higher species diversity and a much greater number of captures compared to the lower areas resulting in higher population estimates and densities in those locations. The relative percentage of males was much higher than females, but overall mean body weights appeared similar. The mean body weights of males ranged from 9.8 g for harvest mice to 19.3 g, 14.4 g, and 27.3 g for brush mice, deer mice, and long-tailed voles, respectively. Mean body weights for females ranged from 8.7 g, 22.3 g, 15.6 g, and 31 g, for harvest mice, brush mice, deer mice, and long-tailed voles, respectively. The upper areas of both canyons had the highest species diversity with essentially only one species being recorded in the middle portions of each canyon. The overall species diversity was similar for both canyons. The mean body weights of all nocturnal species combined were compared between canyons and by year. There were no significant differences in 1993 between upper Guaje Canyon and upper Los Alamos Canyon, and there were no significant differences between the mean body weights of lower Guaje Canyon and lower Los Alamos Canyon. However, there was a significant difference in the mean body weights between the upper canyon sites compared to the lower canyon sites. In 1994, there were no significant differences in mean body weights between sites.

Small mammal studies were also conducted in Sandia Canyon. Three trapping webs were used to estimate densities and species composition. Physical characteristics were recorded along with a complete body composition analysis (percent body fat, lean body mass, percent body water). This was the first of at least two years of data collection, therefore, the results will be reported in the "Environmental Surveillance at Los Alamos during 1995." Table IV-25 lists small mammal species captured during the 1994 studies by location.

15. Ecological Risk Assessment. (Roger Ferenbaugh, EES-15)

During 1994, the focus of the Ecological Risk Assessment program had two objectives. One was to perform the preliminary ecological risk screening assessments for all of the Environmental Restoration Project operable units (OUs). The other was to develop the methodology that will be needed to perform ecological risk assessments in those cases when the preliminary ecological risk screening assessment cannot support a No Further Action alternative at a given PRS.

The first step in performing the preliminary risk screening assessments was to develop Ecotoxicological Screening Action Levels (ESALs) against which to compare soil concentrations of Contaminants of Potential Concern (COPCs) at a PRS. The ESALs are based on toxicological data obtained from the EPA's IRIS and HEAST toxicology databases. The toxicological information obtained from these databases was incorporated into a spreadsheet model using body weights, metabolic rates, and fraction of food ingested as soil to obtain ESALs for mammals, birds, and reptiles of different sizes and feeding habits.

After the ESALs were calculated, preliminary soil data comparisons were made for those OUs for which soil data was present in the Facility Information Management, Analysis, and Display system. Twenty-four preliminary screening reports were issued in October 1994, one for each OU (e.g., Ebinger 1994). The appendices in these screening reports contain detailed information on how the ESALs were calculated, as well as extensive tables of ESALs as a function of COPC, animal type (mammal/bird/reptile), feeding habits, and body weight.

Development continued on two ecological models that will be used for ecological risk assessment. The Ecological Risk Assessment Model (ERAM) is a somewhat more sophisticated screening tool than the spreadsheet model previously described. It is a deterministic model that estimates transport of potential contaminants through ecological food chains using partition coefficients either found in the literature or determined experimentally. (A partition coefficient is the ratio of the concentration of a potential contaminant in one trophic level to the concentration in a lower trophic level. It is an estimate of the extent to which a contaminant moves through the food chain.) The ERAM output indicates which species are at risk and which species may cause species in a higher trophic level to be at risk. The model is more versatile than the spreadsheet model in that it can incorporate additional information such as the percentage of an animal's home range that lies within the PRS.

ECOTRAN is a dynamic simulation model that contains eight modules representing climate, air, soil, hydrogeology, aquatic systems, plants, animals, and humans. The modules feed information back and forth, and

Table IV-25. Small Mammals Captured during 1994 Surveys

	Location			
Species	**Guaje Canyon**	**Los Alamos Canyon**	**Area G**	**Puye Mesa**
Deer mouse	x	x	x x[a] x	x
Piñon mouse			x	x
Brush mouse	x	x		x
Mexican woodrat	x			x
Long-tailed vole	x	x		
Harvest mouse		x		
Vagrant shrew	x			
Water shrew	x			
unidentified shrew		x		
Weasel		x		

[a]Area G includes 3 sites

the model can simulate ecological conditions through time as well as spatially. The major drawback of this model is that it is data intensive. However, it can be used to perform very sophisticated ecosystem simulations, and it also can be used to perform probabilistic risk assessments using distribution functions of input parameters in what is essentially a Monte Carlo-type process.

16. Stakeholder Involvement.

In order to develop a more open and participatory culture, the Laboratory has committed itself to ensuring that stakeholders receive appropriate information on existing and planned facilities, programs, and technologies. Successful interaction and dialogue are based upon honesty and forthrightness, and enable stakeholders to understand issues important to their welfare, to participate in the decision-making process, and to interact with the Laboratory in a climate fostering trust and cooperation.

Recognizing that an increase in public involvement initiatives would require carefully planned and coordinated efforts, in November 1993, the Laboratory established the Stakeholder Involvement Office (SIO) to form strong and lasting relationships with internal customers and external stakeholders that are based on mutual respect and trust. The Laboratory's stakeholders include neighboring individuals and groups, local and state governments, tribal governments, special interest groups, the UC, DOE, federal agencies, and Laboratory staff.

One of the primary responsibilities of the SIO was to oversee the public involvement-related activities of Laboratory programs from an institutional perspective to ensure consistency and quality across programs, and that technical information be provided at a level appropriate for its intended audience. Other core responsibilities in 1994 included the following:

- stakeholder involvement guidance and support to technical divisions, program offices, operational divisions, resources organizations, and for institutional efforts;
- development and implementation of Laboratory policy and vehicles for stakeholder involvement and information dissemination;
- stakeholder inreach and relationship building with DOE, LANL, and UC;
- communication and relationship building with tribal governments, local governments, and special interest groups; and
- administration of the Laboratory's Native American Program.

Public Involvement Policy

In July 1994, the SIO office drafted a Public Participation Policy, for the Laboratory Director's signature that defined public participation in the Laboratory planning and decision-making processes. The policy establishes SIO as the central office to handle public involvement contacts from other institutions, and to encourage and support interactive communication between the Laboratory and the public.

Public Meetings

During 1994, the SIO successfully planned and coordinated 82 public meetings on topics such as the Mixed Waste Site Treatment Plan; environment, safety and health vulnerability related to plutonium; the Dual Axis Radiographic Hydrotest Facility (DAHRT); and strategic thinking. This was up from 20 public meetings in 1993.

The SIO coordinated and managed public involvement for 47 projects, including the formation of the Northern New Mexico Citizens' Advisory Board to DOE and LANL; the Laboratory's Diversity Strategic Plan and Strategic Thinking Process; and the DOE's five PEISs, pre-scoping meetings for the SWEIS, and the DAHRT EIS.

The SIO will continue to collaborate with Laboratory technical programs to sponsor special public briefings and tours of waste management facilities, sampling sites for the ER Project, facilities selected in the non-nuclear consolidation of the DOE Weapons Complex, and facilities for aboveground experimentation.

Tribal Government Liaison

Through the Tribal Government Liaison, the SIO supports the LANL/Tribal Environmental Quality Working Group and the Tribal Cooperative Agreement Implementation Team.

Rio Grande Intergovernmental Council

The SIO played a key role in the establishment of the Rio Grande Intergovernmental Council, composed of government representatives from eleven municipalities and five counties within a 60-mile radius. Monthly meetings address issues of mutual concern to local governments and the Laboratory.

Tours and Queries

The SIO is the primary Laboratory recipient of queries having environmental, safety, and health; technical; or programmatic content; and all queries from local and tribal governments and special interest groups. Some vehicles for involvement include public and special meetings, and specialized tours. The SIO provided tours for interested members of neighboring pueblos, special interest groups, local government officials and community leaders, of facilities or areas related to issues such as aboveground testing, expedited cleanup, expansion of a waste disposal site, and hyrodynamic testing.

Community Reading Room

In June 1993, the Laboratory relocated its Community Reading Room to a more visible and accessible location in the Los Alamos Museum Parke Center. As a result, visitation increased from 225 visitors in 1992 at the old location to 1,249 in 1994. The Reading Room serves as a repository for documents of interest to the public about the Laboratory's activities. Other repositories for information were established in public libraries in Santa Fe, Española, Taos, and Las Vegas.

Public Information

Some primary vehicles for information dissemination include the Community Reading Room, fact sheets, special publications, quarterly reports, briefings, advertisements, stakeholder mail list and data base, and access to SIO via electronic bulletin board/Internet. In addition to primary telephone banks, toll-free telephone lines are maintained for receiving queries (1-800-508-4400).

The new Los Alamos National Laboratory Home Page on the Internet presents an opportunity to reach a world-wide audience for the Laboratory, while at the same time posing a challenge to put forth public information in a way that is timely, appropriate, and unique from other DOE national laboratories. The SIO is committed to using this type of communication tool to create a viable access point for the public to the Laboratory and disseminating information that is accurate, complete, and timely.

Our Common Ground

Four years ago, a group of Laboratory employees saw a need for an environmental ethic that would change our perspective and guide our decisions and actions. From that concern grew the employee initiative known as Our Common Ground which reached out to the public and adopted the new spirit of openness that has been championed by the Secretary of Energy.

In 1994, Our Common Ground

- in conjunction with the SIO and the ESH Division, co-sponsored two talks and panel discussions featuring Dr. Helen Caldicott. There were approximately 150 people at each session.
- with the SIO, Public Affairs, and the National Security Working Group, co-sponsored a public forum titled, "Los Alamos, National Security, and the Next 50 Years: Involving the Public and the Media."
- made suggestions for the DOE gas pipeline project on how to prevent the excess clearing of trees as the pipeline was being installed.

The basic principles upon which Our Common Ground is built are that we must address the environmental consequences of past Laboratory operations and engage in open and respectful dialogue with co-workers, other organizations and the public. To pursue these ends, Our Common Ground will communicate openly and honestly with the public, conveying uncertainties as well as facts and judgments, and listen to and learn from the public.

17. Waste Minimization and Pollution Prevention. (Michelle Burns, EM/WM-P^{3}O)

Today, DOE and the LANL conduct business in an atmosphere of sharply declining budgets and increasing public scrutiny, which mandate that operations become both more cost effective and environmentally aware.

Incorporation of waste minimization (WMin) methodologies into the daily conduct of operations can provide significant returns in avoided waste management costs, both for the waste generating programs and the LANL Waste Management (WM) Program, as well as increases in employee productivity.

The existence of a functional, proactive, pollution prevention program is necessary to comply with the New Mexico State HSWA permit, the FFCA, RCRA Subtitle A, Superfund Amendments and Reauthorization Act (SARA) Subtitle 313, DOE Order 5400.1, and other regulations. As such, pollution prevention is an essential element of the LANL Waste Management Program. Additionally, due to the limited amount of waste disposal capacity remaining in current WM on-site facilities, pollution prevention is a primary component in WM strategic planning. The LANL Pollution Prevention Program Office (P^3O) activities provide for a comprehensive program designed to address the requirements of DOE orders as well as Federal environmental regulations and executive orders.

The organization of the LANL pollution prevention program is modeled after the guidance provided in the DOE Pollution Prevention Crosscut Plan. This plan sets forth the responsibilities of the various DOE departments and establishes what activities they are responsible for funding. As a result, the P^3O utilizes a variety of funding sources to conduct, coordinate, and track waste minimization/pollution prevention (WMin/PP) efforts at LANL. Pollution prevention accomplishments at LANL during 1994 include

- continuation of LANL recycling efforts;
- initiated recycling of used fluorescent light bulbs, and identified nonhazardous bulbs to be used for replacements;
- reduction in LANL annual sulfuric acid use by 12,727 kg (28,000 lb) (an approximate 50% reduction);
- reduction in annual hydrochloric acid use by 318 kg (700 lb);
- reduction in tetrachloroethylene use from 2,727 kg (6,000 lb) to only 72 kg (158 lb);
- elimination of lead melting and casting operations reduced LANL lead emissions by 99% as compared to 1991 levels;
- elimination of the use of all toluene-based paints;
- development of a Pollution Prevention Action Plan, including the identification of priority waste types and priority waste generating facilities;
- establishment of a LANL waste generation baseline and development of methods to track avoided wastes;
- completion and submittal to DOE of the CY93 Annual Report of Waste Generation and Waste Minimization Progress (DOE cited the LANL report as a model for other DOE-complex sites to emulate);
- conducted pollution prevention awareness efforts, such as funding environmental science competitions in the public schools, presentation of Earth Day exhibits, development and publication of a pollution prevention newsletter, implemented an employee cash incentive awards program, and improvement of LANL ESH training for WMin/PP;
- development and implementation of the WMin/PP chargeback system to provide a financial incentive for WMin/PP actions at LANL by assessing a “tax” on wastes generated, as well as to provide a pool of funding to support the accomplishment of specific waste reduction activities;
- completion of the WM-200 WMin Annual Work Plan in compliance with FFCA requirements;
- completion and submittal to DOE of the LANL Pollution Prevention Awareness Plan;
- participation in a DOE-wide avoidable waste management costs study;
- initiation of Pollution Prevention Opportunity Assessments on all LANL mixed waste generating processes; and

- review of Safe Operating Procedures and ESH Questionnaire forms for pollution prevention concerns.

18. Environmental, Safety, and Health Training. (Meg Cox, ESH-13)

The Laboratory maintains an extensive training program of ESH courses that meet compliance requirements under Occupational Safety and Health Act (OSHA), EPA, and Department of Transportation (DOT) regulations, as well as the DOE orders and LANL's Radiological Control Manual. These courses are designed, developed, delivered, and/or coordinated by the ESH Training Group (ESH-13). In 1994, training was available in the following categories: radiation safety training, including courses for radiological workers and radiological control technician; safety training, including courses on electrical safety, cranes, forklifts, lasers, lockout/tagout, and OSHA standards; health training, including courses on a variety of chemical hazards, first aid/CPR, and respirators; and environment training, including courses on waste management, spill coordination, and hazardous waste operations.

All new employees, contractors, affiliates, long-term visitors, students, and current employees working at sites governed by DOE Order 5480.20 are required to take General Employee Training, which consists of introductory information covering Laboratory ESH topics, including OSHA Rights and Responsibilities, Industrial Hygiene, Industrial Safety, Fire Protection, Emergency Management, General Employee Radiological Training, and Occupational Medicine.

All internally developed Laboratory-wide training is done in conjunction with subject matter experts who validate technical content. All training materials are reviewed by Training and Development staff for essential instructional elements.