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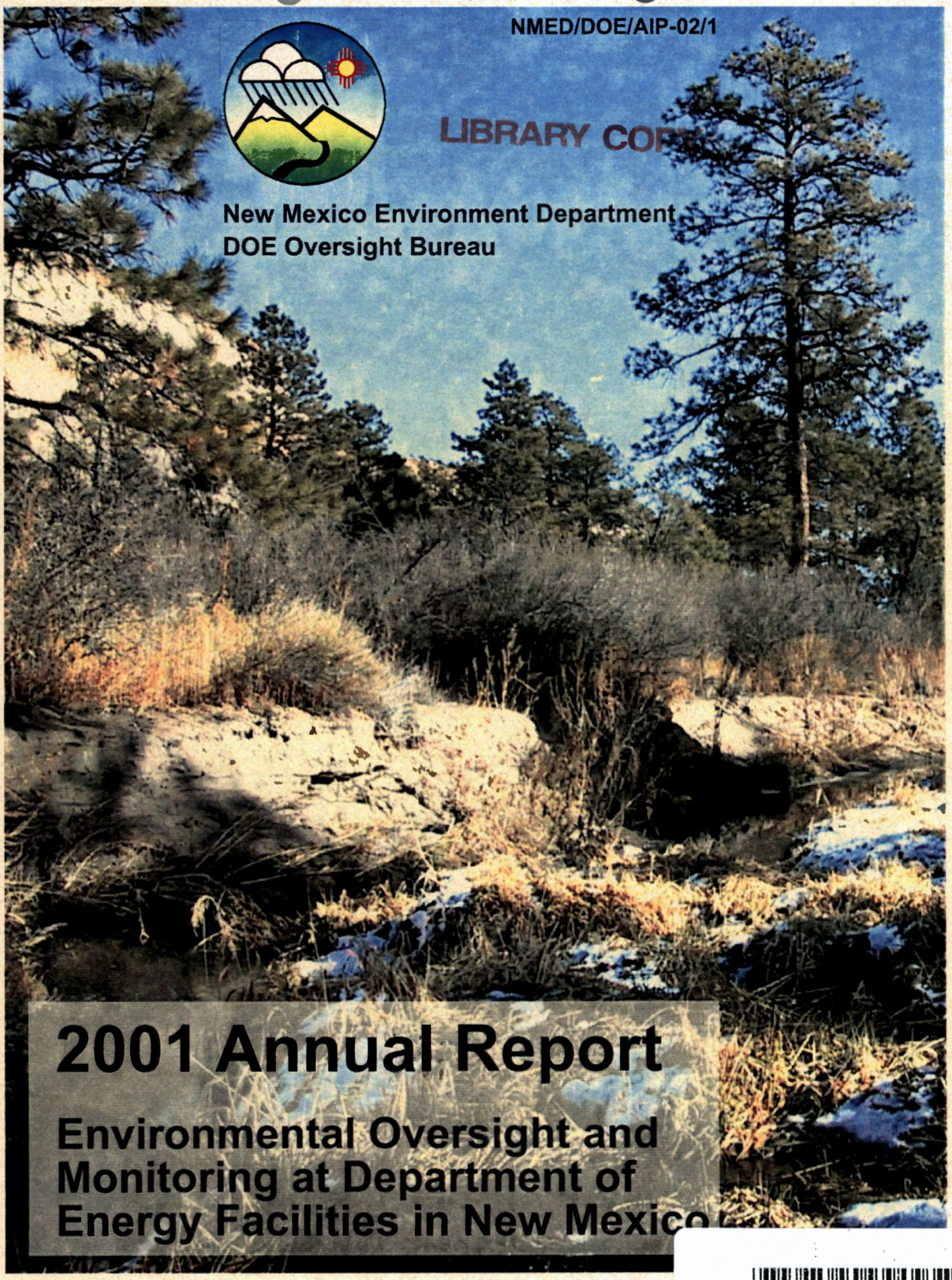

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New Mexico Environment Department
DOE Oversight Bureau

2001 Annual Report

Environmental Oversight and Monitoring at Department of Energy Facilities in New Mexico

The 2001 Annual Report is a publication of the New Mexico Environment Department DOE Oversight Bureau

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DOE Oversight Bureau Staff. From left to right, first row: Ed Vigil, Ralph Ford-Schmid, Steve Yanicak, Roger Kennett, Tim Michael. Second row: Mark Coffman, Tacy Van Cleave, Frances Martinez, Barbara Hoditschek, Yolanda Beltran, Antonette Cordova. Third row: Dave Englert, Kim Granzow, Kevin Vigil, Don Sleeman, John Parker, Bob Weeks. Not shown are Michael Dale and Lance Voss.

Contents

Executive Summary

The New Mexico Environment Department's DOE Oversight Bureau is funded by a grant from the U.S. Department of Energy with provisions set forth in an Agreement-in-Principle between the State of New Mexico and the U.S. Department of Energy. The agreement provides for state oversight of environmental impacts at four DOE facilities: Sandia National Laboratories and the Lovelace Respiratory Research Institute in Albuquerque, Los Alamos National Laboratory in Los Alamos, and the Waste Isolation Pilot Project near Carlsbad. The agreement was renewed in 2000 and will expire in 2005. This Annual Report highlights the activities of the DOE Oversight Bureau for calendar year 2001. Additional copies of this report may be obtained by contacting the Oversight Bureau. This report is also posted on the New Mexico Environment Department's website at www.nmenv.state.nm.us.

Although the Cerro Grande fire occurred during the previous year, the Oversight Bureau focused much of its 2001 work on investigations into the effects of the fire, and the DOE provided supplemental funding to pursue fire-related activities. In January, the Oversight Bureau hired Risk Assessment Corporation to perform an independent assessment of risks to public health associated with transport of Los Alamos National Laboratory contaminants as a result of the fire. Bureau investigators compiled and provided a substantial amount of information to the risk assessors. Throughout the year, the Bureau held progress meetings to provide the public an opportunity to provide input on draft risk assessment reports.

The Oversight Bureau continued to be involved with the cleanup of legacy wastes at Los Alamos and Sandia National Laboratories. At Los Alamos, the Laboratory's Environmental Restoration Project completed the cleanup of a tributary of Acid Canyon. This cleanup of radioactive contamination culminated years of work at this site and demonstrated the ability of the DOE, the U.S. Environmental Protection Agency, the Laboratory, Los Alamos County and the New Mexico Environment Department to work together in reducing risks to the public from the legacy of the development of the atom bomb.

We continued to participate in High Performing Teams intended to address cleanup of legacy wastes at Los Alamos and Sandia. The teams are composed of DOE, New Mexico Environment Department, and facility representatives. They are intended to develop technical consensus on cleanup plans at sites designated for corrective actions. Oversight Bureau staff at Sandia participated in public meetings held by Sandia seeking to get input in the development of long-term environmental stewardship plans. This planning process addresses the need to have management practices in place to assure that contamination remaining at the conclusion of the cleanup project will not pose unacceptable risks to the public.

The Mixed Waste Landfill at Sandia National Laboratories continued to attract public attention and generate controversy. In January 2001, the New Mexico Environment Department sponsored two public meetings to inform the public regarding cleanup plans for this site and receive comments from those in attendance. Oversight Bureau representatives planned and conducted the meetings and participated in the technical presentations.

Oversight Bureau investigators worked with Los Alamos National Laboratory, U.S. Environmental Protection Agency, and DOE representatives to assess the applicability of new analytical methods for PCBs and perchlorates. Methods currently used to analyze environmental samples for these compounds may not be adequate to assure protection of the environment and public health. Environmental radiation monitors were maintained by the Oversight Bureau on a quarterly basis at the Waste Isolation Pilot Plant and at select locations in the vicinity of Los Alamos and Sandia. Samples of environmental media including groundwater, surface water, sediment, air particulates, and biota were collected from locations in the vicinity of the National Laboratories.

Introduction and Program Overview

The mission of the New Mexico Environment Department's DOE Oversight Bureau is to help assure that activities at U.S. Department of Energy (DOE) facilities in New Mexico are protective of public health, safety, and the environment. The Oversight Bureau's activities are funded by a grant from the U.S. Department of Energy in accordance with the provisions set forth in the Agreement-in-Principle between the State of New Mexico and the U.S. Department of Energy for Environmental Oversight and Monitoring. This agreement focuses on state oversight of environmental impacts at the four DOE facilities in New Mexico: Sandia National Laboratories and the Lovelace Respiratory Research Institute in Albuquerque, Los Alamos National Laboratory in Los Alamos and the Waste Isolation Pilot Plant near Carlsbad.

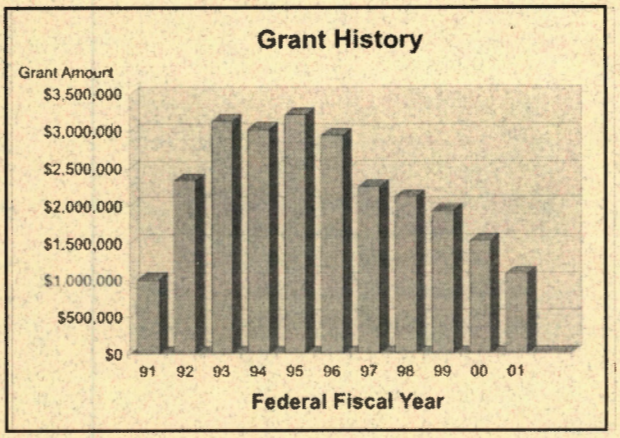
The New Mexico Agreement-in-Principle, effective beginning in October 1990, is part of a nationwide initiative by DOE to improve its accountability concerning public health, safety, and environmental protection. The State of New Mexico is provided resources to develop and implement a vigorous program of independent monitoring and oversight, to increase public knowledge of environmental matters about the facilities, and coordinate with local and tribal governments. The current agreement, signed in October 2000 by Governor Gary Johnson, Environment Department Secretary Peter Maggiore, and DOE Albuquerque Operations Manager Richard Glass, is effective through September 30, 2005.

Personnel and Administration

New Mexico Environment Department employees funded by the agreement are located at state offices in Santa Fe, and at site offices in White Rock and Kirtland Air Force Base in Albuquerque. In response to declining revenues, four positions were transferred from the Oversight Bureau in 2001, leaving 22 positions supported by the agreement.

Funding for the DOE's Environmental Management mission in New Mexico has declined significantly over the past five years. In addition to forestalling cleanup actions at the National Laboratories, declining funding has also resulted in significant decreases to the New Mexico Agreement-in-Principle grant. The figure shows the grants-of-award from 1991 through 2001.

The Environment Department is seeking to have the defense arm of the DOE, newly reorganized under the National Nuclear Security Administration (NNSA), underwrite some of the costs of state oversight. Working against such a proposal is the fact that the oversight agreements were the initiative of the DOE Environmental Management Division, and not therefore the responsibility of the NNSA. Support for NNSA funding comes from precedent established by the Texas Agreement-in-Principle, where NNSA provides a substantial portion of the funds received by Texas. In addition, the Environment Department is already providing independent oversight of non-Environmental Management operations at DOE facilities that may pose threats to the public health and environment.



In 2001, the DOE provided the Environment Department with additional funds for oversight of impacts from the Cerro Grande fire. These funds helped us to monitor impacts to Laboratory watersheds and assess to what degree, if any, contaminants were being mobilized and carried off of Laboratory property. In addition, the Department hired a consultant to perform an independent assessment of risks to the surrounding communities posed by the impacts of the fire.

Interagency Management Group

The DOE Oversight Bureau continues to participate in meetings of interagency management groups charged with overcoming technical, administrative, and regulatory barriers to the clean up of contamination at Sandia and Los Alamos National Laboratories. The Management Implementation Group is composed of representatives from the Environment Department, the U.S. Environmental Protection Agency (EPA), the DOE, and Los Alamos and

Sandia National Laboratories. Two subgroups were split off of this larger group in 2001, one for Sandia National Laboratories, and one for Los Alamos National Laboratory. These management teams meet every other month. The meetings continue to foster necessary communication to facilitate the work of high performing teams comprised of technical staff from the respective organizations working to address cleanup of priority sites at both Sandia and Los Alamos.

Intergovernmental Coordination and Public Outreach

During the year, we published two newsletters and an annual report to communicate our involvement in environmental issues. We continued to work with the Pueblos and other local governments and citizen groups. We conducted and regularly attended public meetings and made presentations to citizens and technical groups. We heard public concerns about the Cerro Grande fire. In response to those concerns, we initiated and managed a contract to investigate and communicate possible fire-related public health threats.

After the Cerro Grande Fire

Independent Cerro Grande Fire Risk Assessment

In January, the Environment Department through the Oversight Bureau, contracted with Risk Assessment Corporation (RAC) to do an independent assessment of risks from the Cerro Grande fire. The assessment is evaluating risks to public health resulting from the fire that burned over Los Alamos National Laboratory. RAC, headed by Dr. John Till, is a nationally recognized team of professionals that has done similar environmental health risk assessments at U.S. Department of Energy sites, including the Rocky Flats Environmental Technology Site in Colorado, and the Hanford Site in Washington. The Bureau also arranged for a team under Dr. Ward Whicker of Colorado State University to independently review draft reports as the assessment progresses.

Dr. John Till at Risk Assessment progress meeting.

Risk Assessment Corporation assembled data from burned areas on Laboratory property, and monitoring data that the Laboratory, the Environment Department, and others collected during and after the fire. The team is currently modeling the impacts of the fire on air and surface water, and using the modeling information to estimate risk. RAC has competed a draft report on estimated concentrations of chemicals and radionuclides in air, and on what public safety and health officials may learn from the fire about calculating and communicating risks.

The Bureau held informal public progress meetings, usually with Dr. Till and one or more members of his team in attendance. We have distributed draft documents, and have provided opportunities for public comment. Members of the RAC team have also met with public groups, including groups from Taos, Los Alamos, and Albuquerque. We held two general public meetings, one in Pojoaque in March, and one in Los Alamos in September. According to the current schedule, RAC will complete the risk assessment in June 2002.

Interagency Flood Risk Assessment Team

We assisted the Interagency Agency Flood Risk Assessment Team by providing them with data on sediments, ash, and storm water collected after the Cerro Grande fire. At a July meeting in Española, the team released the results of the first year's study. The team examined seven potential exposure pathways: drinking groundwater, eating crops and livestock, inhalation of particulates, ingestion of sediment and surface water, dermal contact with sediment and water, external irradiation, and consumption of fish from the Rio Grande and Cochiti Reservoir

The study concluded that the calculated risk and hazard values are generally not different from pre-fire values. There was no substantial change in potential adverse, chronic health effects as a result of the fire. Data from continued storm water and sediment monitoring will be used to evaluate changes in the risk and hazard values. More information can be found at the IFRAT website, http://www/IFRAT/index.html.

Cerro Grande Fire Presentations

During the year, Bureau representatives met with community groups, pueblos, and professional organizations to describe the data collected after the Cerro Grande fire.

They made presentations to the New Mexico Organic Farmers Exposition and the Southwest Geologic Society of America 2001 meeting, to a group known as Radiation Educators and Professionals, to representatives of San Ildefonso, Cochiti, Santa Clara, and Picuris Pueblos, and to a community group at Ojo Sarco.

The presentations described how we collected farm soils and produce from locations downwind from the fire, ash from the incinerated forest floors, and ash-laden sediments from canyons below the burned areas. Discussions described the analytical methods, the techniques used to describe the data, and the sensitivities and uncertainties associated with the radionuclide, trace metal, and chemical measurements made by commercial analytical laboratories.

The presentations concluded that farm soils in northern New Mexico downwind of the fire were not different than background reference conditions. Other sampling indicated that forest floor ash samples from the burned areas had higher-than-background concentrations of radionuclides and most metals, and concentrations in most sediment samples were reduced from background levels.

Local Government Involvement

San Ildefonso MOU and Technical Peer Review Committee

The four Accord Pueblos are Santa Clara, Jemez, San Ildefonso, and Cochiti. Each of these pueblos has a Memorandum of Understanding with the Laboratory for environmental monitoring on their lands. During 2001, we finalized a Memorandum of Understanding with the Pueblo of San Ildefonso and scheduled the signing for early 2002. The memorandum describes the roles and responsibilities regarding monitoring for radioactive contamination and other pollutants from Laboratory operations, on lands within the boundaries of the Pueblo.

In October, we received an invitation from San Ildefonso to participate on their Technical Peer Review Committee. The purpose of the committee is to evaluate their Department of Environmental and Cultural Preservation technical documents prior to submittal to other agencies or adoption by the Tribal Council. The committee is comprised of environmental professionals from diverse organizations who are familiar with the Pueblo's environmental and cultural considerations.

Jemez Watershed Evaluation

The Oversight Bureau and the Laboratory participated in a joint project with Jemez Pueblo to evaluate concentrations of radionuclides and trace metals in the upper Jemez River watershed and the Valles Caldera. We assisted in the design of the study, and participated in the sampling. As the analytical results of soil samples become available, we hope to include them into ongoing background studies.

Albuquerque/Bernalillo County Environmental Report Card

For the past two years, the Bureau has worked with a multi-agency group to develop an Environmental Health "Report Card" for the Albuquerque/Bernalillo County area. The group completed its work in 2001 and published the document. The environmental issues of air quality, food safety, drinking water quality, water quantity, surface water quality, solid waste, and vector borne diseases were selected for evaluation over time. The group selected indicators for each environmental issue. The document also discusses policy implications, and provides recommendations for action by government and community members. The report card may be obtained from either the Albuquerque City or Bernalillo County Environmental Health Departments.

Interagency Participation

Pajarito Plateau Watershed Partnership

The Oversight Bureau continues to participate in the Pajarito Plateau Watershed Partnership. It was formed in 1999 to address regional issues that concern landowners and managers throughout the watershed. Its mission was initially to address water quality issues and point and nonpoint sources of pollution on Laboratory property. The mission then expanded to coordinating stakeholders to achieve a common goal of planning and implementing programs aimed at identifying and resolving primary issues affecting water quality.

The partnership's membership includes representatives from San Ildefonso, Cochiti, and Santa Clara pueblos, Los Alamos County, Bandelier National Monument, Santa Fe National Forest, the U.S. Geological Survey, the EPA, the University of New Mexico, citizens groups, the DOE, the Laboratory, and the Environment Department. The partnership works closely with East Jemez Resource Council.

Early efforts focused on sharing information and resources among the membership. The group initiated a process of assessment and identification of priority areas for restoration activities. The Laboratory provided resources to develop this information.

The Cerro Grande fire significantly damaged the watershed and redirected the work of the partnership. In 2001, the partnership focused on developing and implementing projects designed to reduce negative impacts of the fire on the watershed. The group successfully competed for a Clean Water Act Section 319 grant from the EPA to fund various post-fire activities such as tree thinning, reseeding, and reforestation. In addition, as part of the 319 grant requirements, the partnership developed educational programs on natural resource topics emphasizing water quality and watershed management.

In November and December 2001, Oversight Bureau investigators conducted a study to demonstrate a method for monitoring changes in watersheds, and presented preliminary results of the study to the partnership.

Document Retrieval Project

We participated in the Historical Documents Retrieval and Assessment project that is directed by the Centers for Disease Control and Prevention. The purpose of the project is to locate and review all historical records that may contribute information about past off-site radionuclide and chemical releases from Los Alamos National Laboratory. In addition to attending the annual Historical Document Retrieval Project meeting in November, we provided project representatives with environmental and waste management documents.

Albuquerque Area Outreach

Public Meeting on the Mixed Waste Landfill

Sandia National Laboratories' Mixed Waste Landfill continued to attract public attention and generate controversy. In January 2001, the Environment Department sponsored two public meetings to address the concerns of the public and environmental activist groups. Oversight Bureau representatives planned and conducted the meetings and participated in the technical presentations.

The meetings were not a regulatory or administrative requirement, but were intended to inform the public about the understanding we have gained through oversight of the environmental investigation of the landfill. More importantly, we wanted to listen to the concerns of those in attendance regarding the proposed remedial landfill cover design.

Members of the Oversight Bureau and Hazardous Waste Bureau described the environmental setting for the landfill, and explained the regulatory process for site closure. In the early years of our review, the Department had similar concerns to those voiced at the meetings. We discussed the Department's perspective on results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation that addressed those concerns.

The meetings were well attended, with approximately 130 participants each night, and provided substantial public feedback and comments. Questions and comments were recorded at each meeting and are available, along with Environment Department responses, on the Department's website, www.nmenv.state.nm.us.

Roger Kennett fields questions about the Mixed Waste landfill at a January 2001 public meeting.

The Bureau also contributed to independent reviews of the RCRA Facility Investigation by two groups. The City of Albuquerque's Groundwater Protection Advisory Board reviewed the results and conclusions of Sandia's RFI process and concurred with those findings and recommendations. Our staff provided information about the state's perspective on the environmental investigations.

The Waste and Environmental Research Consortium, an independent organization that includes scientists from the University of New Mexico, New Mexico State University, and New Mexico Tech, conducted an additional independent review of the Mixed Waste Landfill investigations. The Bureau tracked the progress of the review, and in collaboration with the state's Hazardous Waste Bureau, contributed technical assistance and information on our past sampling efforts.

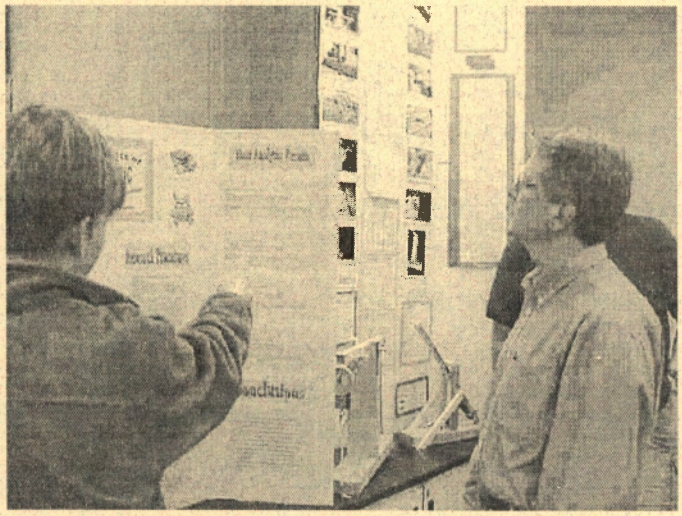
Environmental Careers at School to World

The Sandia Oversight Office participated in the School to World Career Fair held at the Albuquerque Convention Center. The fair offered middle school age students the

opportunity to learn about state government careers in environmental protection. Students use passports to record their "travels" through career clusters such as Medicine, Engineering, and in our case, Human/Public Service. At our booth, the students saw examples of our field activities. In conversations with students and their parents, we described the various scientific disciplines Environment Department employees work in, and the types of class work necessary to complete degrees in those disciplines.

Regional Science and Engineering Fair

An impressive group of young scientists presented their projects at the 2001 Northwest New Mexico Regional Science and Engineering Fair. This was the fourth year our Albuquerque staff served as judges, scoring projects in Junior Botany, Microbiology, and Environmental Sciences. In one project related to our work, a student tested his theory on the distribution of radionuclides as a result of the Cerro Grande fire. This year we also judged the Fall Science Expo at Rio Rancho High School. The emphasis the high school places on the sciences was apparent in the quality of projects and the manner in which the students conducted themselves.



A student explains his statistical methods to Roger Kennett at the Rio Rancho High School Science Expo.

Long-term Environmental Stewardship and Community Groups

Long-term Environmental Stewardship At Sandia

We continued our participation on three public working groups examining issues related to Long-term Environmental Stewardship (LTES) at Sandia National Laboratories. As Sandia moves toward completion of its Environmental Restoration Project, the need for stewardship at sites with residual contamination is becoming a reality. No Further Action status was granted at many environmental restoration sites on a risk evaluation based on future industrial or recreational land use. While these may be appropriate risk scenarios, a process needs to be in place to track and maintain conditions in line with such scenarios.

Each working group completed deliberations and prepared a report containing recommendations and values they deemed important to adequately perform stewardship of the closed sites at Sandia. The reports were delivered to DOE and Sandia for use in developing Sandia's LTES plan. Key issues addressed by the reports included stable, reliable funding, a comprehensive public outreach program, commitment to stewardship using the existing RCRA permit, and access to information. Our participating staff members attended the public meeting releasing the draft plan, and spoke with citizens regarding our perspective. We also participated in subsequent meetings with former working group members to encourage DOE to improve the draft as a functional plan and provide a clear commitment to stewardship components.

To keep abreast of technological applications to LTES, an Albuquerque staff member participated in the International Containment and Remediation Technology Conference, and the Long-term Monitoring Sensor/Analytical Methods workshop. The Bureau was also represented at the DOE sponsored 4th Annual Long-term Stewardship Workshop in Grand Junction, Colorado to better understand how the varied issues surrounding stewardship are being dealt with nationally.

Oversight representatives discuss Sandia's Long-term Environmental Stewardship Plan with former working group members.

Community Radiation Monitoring Group

Bureau representatives continue to facilitate meetings of the Community Radiation Monitoring Group, or CRMG. The major topic of discussion is the status of the NEWNET community radiation monitoring stations. Some of the stations are located at the Pueblos (Cochiti, Santa Clara, San Ildefonso, and San Juan), some are in nearby communities (Española, Los Alamos, and Santa Fe) and the remainder are on Los Alamos National Laboratory property. During the year, the Santa Fe station was relocated to the New Mexico School for the Deaf, and the Laboratory made progress in real-time alpha monitoring. Data is posted on the NEWNET web site, http://newnet.lanl.gov.

CAB Subcommittee

The Northern New Mexico Citizens Advisory Board subcommittees are small groups of stakeholders that meet monthly to address elements of the Board's annual workplan. Some of the elements are Environmental Restoration, Environmental Surveillance, and Waste Management.

In 2001, we participated in the Northern New Mexico Citizens' Advisory Environmental Monitoring and Surveillance subcommittee. We presented information on perchlorate, its detection at low concentration in ground water, and its occurrence at Los Alamos and other DOE sites. We helped develop a fact sheet on perchlorate. We contributed to a recommendation for a feasibility study to locate the shallow perched water in Mortandad Canyon using geophysical methods. We also discussed possible solutions to the continuing challenges that Los Alamos National Laboratory faces in the implementation of its Hydrogeologic Workplan.

Los Alamos National Laboratory

Legacy Waste Cleanup

Bureau investigators continue to participate in the work that Los Alamos National Laboratory is doing to clean up legacy wastes. We worked with the DOE, the Laboratory, and Los Alamos County to assure removal of contaminated sediments in the South Fork of Acid Canyon. After the Cerro Grande fire, the Laboratory and others took steps to control erosion below environmental restoration sites. We initiated a study designed to evaluate the effectiveness of the erosion controls. Bureau representatives helped collect data as the Laboratory began investigating human health and ecological risks in Cañon de Valle. We collaborated with Laboratory investigators to initiate a study of background concentrations of polychlorinated biphenyls.

Cleanup of Acid Canyon Tributary

In the fall of 2001, the Laboratory's Environmental Restoration Project completed the cleanup of a small tributary of the South Fork of Acid Canyon. This removal of radioactive contamination culminated years of investigations by the DOE and the Laboratory, and more recently by the New Mexico Environment Department and the EPA. Contamination in the canyon bottom was the result of discharges from a radioactive liquid waste treatment facility that had been located northeast of the intersection of Canyon Road and Central Avenue. The facility discharged untreated and treated radioactive effluents from 1944 until it was decommissioned in 1964. The site was decontaminated, cleaned up, and all of the buildings were removed except a vacant sewage lift station. The County of Los Alamos now owns the property and maintains recreational facilities in the area including an aquatics center, skate park, and hiking trails through the canyon.

In 1999, we investigated the area using detailed geomorphic mapping and radiation screening techniques developed by the Laboratory's Environmental Restoration project. We found plutonium contamination in discrete deposits. Our results, and additional sampling by the Laboratory, showed that plutonium concentrations approached 8,000 pCi per gram in some of the deposits. Although the average concentration over the length of the tributary was significantly lower, we were concerned about these areas of contamination in a publicly accessible area. The Environment Department recommended that the DOE clean up the contaminated areas. Concerned Citizens for Nuclear Safety and the Northern New Mexico Citizen Advisory Board made similar recommendations.

The Laboratory developed a cleanup strategy that targeted the removal of 228 cubic yards of material. The cleanup goal was based on the concept of ALARA, implying an overall reduction of radiation dose to levels that are "As Low As Reasonably Achievable." A team composed of representatives of the DOE, the Laboratory, and the Environment Department reached agreement on a cleanup level of 280 pCi per gram. Because of the difficulty of using heavy equipment in the narrow canyon bottom and its proximity to noise-sensitive residential areas, picks and shovels and a mobile vacuum system were used to move the contaminated sediment into steel roll-off bins for transport to the low-level radioactive waste disposal facility at TA-54.

Bob Weeks at left collects Acid Canyon verification samples.

Once the cleanup began, we monitored for radionuclide particulates in air, screened sediments for radiation during cleanup, and collected cleanup verification samples. Our air particulate data showed that there was no unacceptable radiation exposure to nearby residents or passers-by during the cleanup. We took independent screening measurements to improve our confidence in sediment removal decisions.

At the conclusion of the cleanup, the Laboratory had removed over 450 cubic yards of contaminated sediment, almost two times the original estimate. This larger volume

was due to U.S. Department of Transportation limits on the concentration of radioactive material allowed on public roads (additional soil was removed to dilute the more radioactive material), and the fact that the contamination was more extensive than originally estimated.

Development of Acid Canyon Cleanup Levels

Environmental investigators generally determine site cleanup levels using a risk assessment. When the contaminated materials are radionuclides, the assessment estimates cleanup levels that do not exceed radioactive dose limits established for the public. This dose assessment is based on factors that include contaminant toxicity, exposure pathways, and exposure scenarios.

In developing cleanup levels for Acid Canyon, a team of DOE, Laboratory, and Environment Department representatives first reached consensus on the parameters used in the dose assessment. Next, the group had to reach agreement on appropriate use scenarios, or probable patterns of use. One scenario was based on estimating dose to persons jogging or hiking trails through the canyon. Based on this "trail user" scenario, the dose in the canyon was less than the 15 mrem DOE threshold for unacceptable dose.

However, due to the proximity of the site to residential areas and recreational facilities, the Environment Department and the EPA questioned whether the "trail user" scenario was sufficiently conservative. Therefore, the team developed a scenario called the "extended backyard," which recognized that children play along the stream channel, using the canyon as an extension of their backyard. Based on sample data averaged throughout the entire site, the dose assessment calculated a dose of 12.7 mrem per year for a child. However, given the possibility that a child could play repeatedly in one location, and the distribution of contamination in hot spots, we questioned the appropriateness of averaging the data. If the data from only the hot spots were averaged, the calculated dose exceeded the 15 mrem per year threshold.

Using another approach to calculating cleanup goals, the Environment Department's Hazardous Waste Bureau evaluated risk using a screening method developed by the Laboratory's Environmental Restoration project for calculating single radionuclide soil guidelines. Based on a one in one hundred thousand (1:100,000) cancer risk, and using the same parameters as in the dose assessment, the Hazardous Waste Bureau calculated a single radionuclide soil guideline for plutonium-239 of 290 pCi per gram, compared to the 280 pCi per gram cleanup level derived from the 15 mrem per year annual dose threshold.

However, the difference between the two approaches was how the calculated levels were intended to be applied. The Environment Department viewed the calculated value as a remediation goal that should not be exceeded by cleanup verification samples. The Laboratory intended their value to be used as threshold that a weighted average of all cleanup verification sampling data should not exceed. Ultimately, these differences did not matter, because the Laboratory removed additional sediments due to limitations on the radioactivity of materials that could be transported on public roads.

Effectiveness of Erosion Controls

The Laboratory is not currently conducting cleanups at all contaminated sites because of resource limitations and scheduling priorities. Therefore, the Laboratory and the Oversight Bureau are working together to reduce erosion and limit the migration of material from contaminated sites.

As part of this work, the two organizations developed a document, formalized as Standard Operation Procedure 2.01. For the past two years, a group known as the Surface Water Assessment Team has used this procedure to evaluate erosion potential at contaminated sites. As a result of these evaluations, the Laboratory has stabilized hundreds of high or medium erosion potential sites.

After the erosion controls were put in place, the team made plans to evaluate the effectiveness of the stabilization measures. However, before the team accomplished this, the May 2000 Cerro Grande fire burned over portions of the Laboratory. It destroyed many of the existing erosion controls and required the installation of additional controls to stabilize burned areas.

In June 2001, Bureau investigators initiated a study to evaluate the effectiveness of some of the post-fire erosion controls. Working with Laboratory investigators, they began the first phase of a two-phase study designed to evaluate the effectiveness of stabilizations near environmental restoration sites. The study location is below Technical Area 46, or WA Site. TA-46 contains applied photochemistry and organic and materials chemistry laboratories, and the Sanitary Wastewater System Facility. Environmental management offices are also located here. The study area is located on a one-half square mile area of mesa slope that was severely to moderately burned. The area has three distinct zones of post-fire stabilization

Kim Granzow and Barbara Hoditschek sample sediment below Los Alamos TA-46.

treatment, containing various different types of erosion controls. The study was designed to evaluate the effectiveness of the erosion controls in reducing the transport of sediment and associated contaminants.

The investigators established two sampling corridors within each of the three post-fire stabilization zones. They documented each sampling corridor boundary and all soil and storm water sampling locations within the sampling corridor using a Global Positioning System unit, and used the positioning information to generate map overlays to illustrate and track the progress of the study. They installed single stage samplers upstream and downstream of erosion control structures in shallow erosion channels within each sampling corridor. They checked the samplers daily and collected samples after each rainfall.

From June through September 2001, they collected fifty-two storm water samples. An independent laboratory analyzed the samples for suspended sediment. The laboratory also analyzed the sediment for total calcium, manganese, zinc, and uranium. If the concentration of uranium exceeded background values, the laboratory further analyzed the sample for uranium isotopes. From three of the six sampling corridors, investigators collected soil from the upstream side of each erosion structure and had the soil samples analyzed for the same constituents as the storm water samples. Both the storm water and soil samples were analyzed for grain size distribution.

The investigators presented preliminary findings of the study at the Albuquerque Technical Information Exchange Workshop in November 2001. The first phase of the study showed that single stage samplers could be used to collect small amounts of storm water in erosion channels. Preliminary results indicated that the suspended sediment concentration of storm water samples can be used as a screening tool for the evaluation of sediment movement. Preliminary results also indicated that run-on is an important factor in determining what types of erosion control structures are most effective.

Barbara Hoditschek at left and Michael Dale at right, participate with LANL employees Pat Longmire and Don Hickmott in a TIE Workshop panel discussion.

Groundwater Sampling

Budgetary constraints limited our 2001 groundwater sampling. However, we were able to collect samples at 25 locations in the Los Alamos area. Twelve locations were co-samples with the Laboratory, and two were with Santa Clara Pueblo representatives. We collected the remainder of the samples independently. We assisted and observed EPA investigators in their sampling efforts, and in several instances the Laboratory co-sampled with them. As with previous years' monitoring results, samples showed low concentrations of strontium-90, tritium, perchlorate, and nitrate in the alluvial aquifers of DP, Los Alamos, and Mortandad Canyons. We found low concentrations of tritium and perchlorate in intermediate groundwater and in the source of drinking water, the regional aquifer beneath Pueblo, Los Alamos, and Mortandad Canyons. However, there are problems with perchlorate detection at low concentrations. (See the discussion on page 16).

Investigations at Cañon de Valle

Bureau investigators worked with the 260 Outfall High Performing Team to complete an ecological risk assessment below TA-16 in Cañon de Valle. As has been discussed in previous year's annual reports, the cleanup of MDA-P, a seven-acre disposal site on the western edge of Laboratory property, began in 1999. By the close of 2001, the Laboratory had completed the Phase I removal of contaminated materials. Phase II activities, including confirmation sampling, and human and ecological risk assessments were in progress.

The Cañon de Valle ecological risk assessment will consider inputs from MDA-P, from MDA-R, the 260 outfall, and the silver outfall. Laboratory investigators completed field studies for the assessment. They collected small mammals for population and contaminant uptake studies, sediments for aquatic invertebrate toxicity studies, and aquatic insects for community assessments.

PCB Cooperative Study

The Laboratory and the Oversight Bureau worked together on a cooperative study on polychlorinated biphenyls (PCBs). The study was initiated as a result of concern about the distribution of PCBs on the Pajarito Plateau, and because of findings of PCBs in Cochiti Reservoir fish tissue. The purposes of the study are to evaluate the usefulness of high-resolution methods for the analysis of PCB congeners, and to determine if there is a background concentration that is useful in understanding analytical information from potentially contaminated areas. The study is ongoing, with sample collection and data analysis continuing.

Areas Of Concern

Bureau representatives continue to support the review of sites known as Areas of Concern. They provide technical review of documents and site-specific information. At this time approximately 300 sites have been reviewed.

MDA-H High Performing Team

Bureau representatives continued participation on the Material Disposal Area H high performing team. This disposal area, located in the northwest part of the low-level radioactive waste disposal facility at TA-54, consists of nine subsurface shafts that contain classified shapes contaminated with tritium, plutonium, and other hazardous constituents. The Laboratory is conducting a Corrective Measures Study to develop information for choosing the most cost efficient and effective method to remediate the site.

Environmental Monitoring

In 2001, we did significantly less soil, sediment, and biota sampling than we did immediately following the Cerro Grande fire. We did not analyze some of the sediment samples that we had collected due to lack of funding. We did analyze snowmelt and storm water samples to characterize the possible transport of contaminants resulting from increased post-fire runoff. As reported in the legacy waste section, we began a study of the effectiveness of erosion controls installed after the fire. Also, we initiated an investigation of stream channel characteristics in lower Pueblo Canyon to begin to understand current conditions and future changes that the canyon may undergo as the result of increased erosion.

Ralph Ford-Schmid and David Englert taking measurements in Lower Pueblo Canyon.

Much of our work involved consolidating data and preparing it for use by Risk Assessment Corporation in the independent Cerro Grande fire risk assessment and by the Interagency Flood Risk Assessment team. We also began entering environmental monitoring data into a database developed with the help of the Laboratory.

Database Development

Over the ten years the Oversight Bureau has been in existence the monitoring data that has accumulated has brought out the need for a centralized system for data storage and retrieval. Therefore, in 2001 we began working with Los Alamos National Laboratory to develop an environmental database with systems for receipt of electronic deliverables. We used a template developed by the Laboratory's Water Quality and Hydrology Group, ESH-18. There were a number of advantages to using the ESH-18 template. First, at no cost, we started with an existing operating database. Second, ESH-18 personnel were available to help us as we made modifications. And

finally, the use of a similar database encourages communication and data sharing. At year's end, with the assistance of ESH-18 personnel, the database was operational and we were developing systems for electronic data importation.

Bureau representatives have also been participating in a Department initiative to automate activity tracking, permitting, compliance, and environmental monitoring through a Department-wide integrated database. Modules are being developed to store environmental data. Having made progress in developing our own database, the Bureau's data will be more readily imported into the Department database.

Ionizing Radiation and Air Particulate Monitoring

Operations at Los Alamos generate ionizing radiation in the form of gamma radiation and high-energy particles. We monitor gamma radiation at 12 locations, 11 on or near the Laboratory boundary and one in Santa Fe using thermoluminescent dosimeters. Our results for 2001 were consistent with the Laboratory's. The measurements were within the range of natural background for our region.

High-energy particles include alpha and beta particles and neutrons. Laboratory activities such as instrument calibration, criticality experiments, and accelerator operations generate photon radiation and neutrons. The Laboratory monitors for photon radiation and neutron around the perimeter of the TA-18 Critical Assembly Facility, and until recently considered this to be the location of maximum potential exposure to an on-site member of the public. In 1999, the Laboratory reviewed all sources of direct penetrating radiation, and concluded that exposures near an instrument calibration facility (TA-3-130) at the intersection of Diamond Drive and Pajarito Road could be higher than the exposures near TA-18. As a result, beginning in 2000 and continuing into 2001, Laboratory and Bureau investigators placed dosimeters that were sensitive to photon radiation and neutrons at the perimeter of the facility.

Using the TA-3-130 monitoring data, the Laboratory estimated annual dose to a member of the public who was walking by the facility. The dose was conservatively estimated by assuming that a receptor might be exposed for 90 minutes per day every day of the year. This is conservative for two reasons. First, the facility does not operate continuously, and second, people normally would not spend 90 minutes passing by. Based on these conservative assumptions the Laboratory estimated annual dose to a member of the public who was walking by the facility during 2000 to be 13 mrem.

This is greater than the 1999 estimate of 3 mrem for the maximally exposed on-site member of the public, based on exposures near TA-18. While it is less than DOE's 100-mrem per year limit to a member of the public for exposure from all pathways, the Oversight Bureau and others had concerns regarding unnecessary exposures to members of the public. At the close of 2001, the Laboratory moved the calibration facility to a more remote location at the TA-36 Kappa Site.

Alpha particles have a short range in air, and are not measured with dosimeters. However, technological advances have made it practical to collect air particulates and continuously measure alpha emissions from the particulates. With the encouragement of the Bureau and members of the Community Radiation Monitoring Group, the Laboratory is in the process of installing test alpha monitors at TA-35.

We measured radionuclides in air particulates at five Laboratory boundary locations. The sample filters were composited quarterly and analyzed for isotopes of uranium, plutonium, and americium. The results were consistent with the Laboratory's, with low values for plutonium and americium, and slightly higher values for naturally occurring uranium. All values were below applicable health standards.

We measured tritium at the same five locations. Our results were lower, but consistent with Laboratory measurements and are comparable to local background levels. Near the end of 2001, we worked with the Laboratory's Air Quality Group to help improve the accuracy for reporting our quarterly tritium results. Currently, our measurements are lower than the Laboratory's by about a third each quarter.

Air Monitoring in Acid Canyon

During the fall of 2001, the Laboratory's Environmental Restoration Project removed plutonium-contaminated sediment from a tributary of Acid Canyon located on Los Alamos County property. According to our usual protocol, we requested permission from the county to monitor air particulates for radionuclides while the cleanup proceeded.

We operated high-volume air monitors during work hours and collected two sets of samples, one while the most contaminated sediment was being removed, and the second

set while less contaminated material was being removed. We analyzed the samples for radioactive isotopes of plutonium, uranium, americium, cesium, and strontium.

The data indicated that if a hypothetical person remained at the cleanup site during the duration of the cleanup, approximately 10 weeks or 400 hours, that person would receive a dose of 8 mrem. The data also indicated that the dose to a resident living above the site was less than 0.2 mrem. Under the National Emission Standard for Hazardous Air Pollutants for Radionuclides, EPA limits the effective dose equivalent to any member of the public from radioactive airborne releases to 10 mrem per year.

Contaminants in Fish

Bureau investigators continue to evaluate results of fish samples collected to monitor low levels of environmental contaminants.

Many chemicals and potential contaminants occur at low concentration in the environment. In water, the concentration may be so low that the contaminant is not detectable. However, in a process known as biomagnification, the concentration may increase as the contaminants are moved up the food chain. Contaminants often concentrate in fish, which are near the top of the aquatic food chain. High concentrations in fish may also indicate a threat to the fish themselves or other organisms, including humans.

Two groups of contaminants are most easily monitored by analyzing fish tissue. Both groups are ubiquitous and persistent in the environment, hazardous at low concentrations, increase in concentration as they move up the food chain, and have been found at contaminated sites at Los Alamos. The first is mercury and one of its organic compounds, methyl mercury. The second is a group of related chlorine-containing compounds that includes polychlorinated biphenyls (PCBs), dioxins, and furans. The chlorine-containing compounds are generally synthetic, although some are formed through the incineration of waste and in natural fires.

Low levels of mercury can be measured in fish using standard analytical methods, although special handling may be required to prevent sample contamination. However, low levels of PCB compounds cannot be well quantified using standard analytical methods. Special high-resolution methods can resolve PCB congeners, which are different forms of PCB compounds. These methods are approximately five times more expensive than standard methods.

We are currently evaluating the results of fish samples collected last year from Cochiti and Abiquiu Reservoirs, and a control site, McAllister Lake. We compared our results to species-specific average concentrations found in the National Contaminant Biomonitoring Program (NCBP) fish database compiled by the U.S. Geological Survey and the National Bioaccumulation Study (NBS) published by the EPA. We also compared our results to 1995 EPA Screening Values (SVs) and 2001 New Mexico Environment Department Fish Consumption Guidance.

The concentration of mercury in fish from both Cochiti and Abiquiu reservoirs was greater than the average concentration found in the NCBP and NBS studies. The concentration in the one fish from McAllister was higher than the NBS average but lower than the NCBP average. Our findings were similar or lower than the data used to develop the current New Mexico mercury fish consumption advisories. However, we found elevated mercury in northern pike and white bass from Cochiti and small mouth bass from Abiquiu that may indicate a need for additional consumption advisories.

The concentrations of total PCBs of all samples were higher than the NBS averages but lower than the NCBP averages. Eight of the fourteen samples from Cochiti and Abiquiu reservoirs exceeded the EPA Screening Level for total PCBs of 10 parts-per-billion. The sum of the 12 dioxin-like PCB congeners (TEQ) in six of the fourteen samples from Cochiti and Abiquiu reservoirs exceeded the EPA screening value for dioxins.

New Mexico fish consumption advisories can be found at **http://www/swqb/Fish_Consumption_Guidlines_for_Mercury_08-2000.pdf.**

General Information on mercury in New Mexico can be found at **http://www/swqb/hg_white.html**

Information on PCBs, dioxins, and furans can be found at **http://www.epa.gov/opptintr/pcb/effects.htm**
http://www.cfpub.epa.gov/ncea/cfm/dioxin.cfm

The concentration of dioxins and furans in all samples was lower than the species-specific average concentrations found by both the NCBP and NBS studies. The concentrations of dioxins and furans in all samples were below the EPA Screening Level (TEQ) for dioxins of 0.7 parts-per-trillion. There are no New Mexico fish consumption advisories for PCBs or for dioxins and furans.

Los Alamos National Laboratory investigators helped us collect our samples and also analyzed fish samples using high-resolution methods, and are currently evaluating their data. We encourage continued monitoring of PCBs, dioxins, and furans in fish from New Mexico waters using high-resolution methods. Future monitoring should focus on contaminants in fish of the same species, size, and age class. We will continue to share our findings with State Environment, Health, and Game and Fish Department representatives.

At the close of 2001, the Laboratory and the Oversight Bureau began developing a cooperative study on PCBs. The purpose of the study is to evaluate the usefulness of the high-resolution analytical methods for PCB congeners, to measure PCB concentrations in storm water runoff and sediment in selected watersheds, and to measure PCB concentrations in northern New Mexico watersheds not affected by the Laboratory.

Surface Water Monitoring

We sampled storm water and snowmelt to evaluate the condition of Los Alamos watersheds after the Cerro Grande fire and to monitor for the transport of contaminants from the Pajarito Plateau.

During the spring snowmelt season, we collected ten samples from six watersheds on Laboratory property and water and sediment samples from three watersheds that had been burned by the Viveash fire in the Pecos. Before the summer storm water season, we collected a baseline sample from the Rio Grande at Otowi Bridge.

We also collected 19 storm water samples in the Los Alamos vicinity, in Pueblo, Los Alamos, Water, and Pajarito canyons. The samples were analyzed for total and dissolved radionuclides and metals, cyanide, general water chemistry, nutrient, suspended sediment, and total dissolved solids. Suspended sediments were separated and analyzed for total radionuclides and metals, cyanide, and total organic carbon. Risk Assessment Corporation used many of the results from this sampling in its independent Cerro Grande fire risk assessment. The Interagency Flood Risk Assessment Team also used the data in its evaluations.

Surface Water Assessment Team

The Surface Water Assessment Team was formed to assess the potential for water transport of hazardous or radioactive materials from contaminated sites at Los Alamos. The team, which includes Laboratory and the Environment Department representatives, typically meets monthly to review data and make recommendations regarding erosion control devices.

The team is focusing its attention on two major projects. The first is the stabilization of environmental restoration sites that may be contaminated with PCBs. Because these compounds are persistent in the environment and can become more concentrated as they move through aquatic food chains, the potential for transport by surface water into aquatic systems is of particular concern. After assembling the necessary information, the team will evaluate whether the potential for transport by erosion has been sufficiently addressed at these sites.

Polychlorinated biphenyls (PCBs) are a class of highly stable, non-corrosive and relatively non-flammable chemicals that were first manufactured on a commercial scale in 1929. For several decades they were used extensively in a wide range of industrial applications, including cutting oils, sealants, caulking compounds, inks, carbonless copy paper, paint additives, and, in particular, as coolants and lubricants in closed electrical applications, such as transformers and capacitors. PCBs are persistent in the environment, and tend to be found in higher concentrations in animals near the top of the food chain.

Studies have identified trace levels of PCBs everywhere in the environment, throughout the world. This is thought to be due to improper disposal practices, accidental releases from the 1930s to the 1970s, and subsequent long-range transport by global air currents.

Twelve of the PCB congeners cause physiological responses similar to dioxins and the World Health Organization recommends using Toxic Equivalency Factors (TEFs) to convert concentrations of those 12 PCB congeners to dioxin Toxic Equivalency Quotients (TEQs).

Perchlorate is both a man-made and a naturally occurring chemical. Man-made perchlorate entered the environment during the 1940's as an ingredient in rocket and missile systems. Since then, it has been used in many industrial processes including nuclear reactors, electroplating, paint manufacturing, and chemical analytical operations. It is soluble in water and persistent in the environment, particularly in surface and ground water.

Perchlorate became a health issue in the early 1990's, when the Environmental Protection Agency (EPA) conducted a preliminary toxicological risk assessment. Although the overall health impact of low doses of perchlorate is currently not well defined, the EPA found that ingestion of perchlorate-contaminated water may cause adverse health affects.

At this time there are no federal health standards for perchlorate, but several states including Texas and California have issued actions levels of 4 and 18 part per billion (ppb) respectively. In 1998, EPA added perchlorate to its Safe Drinking Water Act Contaminant Candidate List, and set a provisional action level range of 4 to 18 ppb. EPA recently conducted an additional toxicity assessment for perchlorate that is in draft form and is currently available for review by the public and the scientific community. EPA concludes that a draft estimate for drinking water would be set at 1 ppb. Additional information concerning EPA's latest toxicity assessment can be found at www.epa.gov/safewater/.

The second project concerns the Laboratory's Storm Water Pollution Prevention Plan for solid waste management units (SWMUs). The plan is a requirement of the facility's Multi-Sector Storm Water Permit for nearly 1,000 SWMUs defined as an industrial activity under the Clean Water Act. The plan has been modified to reflect the sites impacted by the Cerro Grande fire. Representatives of the Oversight Bureau have requested that the Laboratory submit specific plans as part of the planning and documentation of site-specific environmental restoration activities in addition to the Storm Water Pollution Prevention Plan.

Environmental Restoration Sampling

In January we collected four sediment samples from Graduation Canyon and analyzed them for metals, PCBs, and pesticides. This was done to support the Laboratory's investigation below a former sewage treatment facility. The results indicated concentrations of pesticides and mercury, which prompted the Laboratory to conduct a limited removal of sediment near the former outfall.

We collected nine samples of aquatic insects from seven locations in Cañon de Valle. The samples will be used in population studies to support an ecological risk assessment, and for a reference collection.

Perchlorates in Water

During 2001, the only measured Laboratory perchlorate releases were from the TA-50 Radioactive Liquid Waste Treatment Facility. The facility discharges about 20,000 gallons per day of wastewater into Mortandad Canyon. Starting in 2000, the Laboratory began monitoring the waste stream for perchlorate and found that concentrations averaged about 250 parts per billion (ppb). The Laboratory is in the process of installing an ion exchange system to reduce concentrations to levels near the detection limit of 1 to 4 ppb.

The Laboratory detected perchlorate in surface water samples from several canyons during the 2001 snowmelt and summer thunderstorm seasons; however, the bulk of their samples showed concentrations less than the 1 - 4 ppb detection limit. The highest level in surface water (100 ppb) was found in a sample that was collected just downstream of the TA-50 effluent outfall. Environmental Surveillance monitoring results for 2000 and 2001 can be found on the Laboratory's Water Quality Database at http://wqdbworld.lanl.gov/. Data for the 2000 sampling year can be found in the Laboratory's 2000 Environmental Surveillance Report.

Detections in groundwater were primarily restricted to the shallow alluvial aquifer down gradient of TA-50 in Mortandad Canyon; levels ranged from less than 4 to 220 ppb. Perchlorate was detected in intermediate ground water (300- 700 feet) beneath Mortandad Canyon at levels as high as 145 ppb. The deep drinking-water aquifer (1000 feet or greater) beneath the Laboratory has shown levels ranging from about 0.5 to 3 ppb. During the fall of 2000, the Laboratory for the first time analyzed samples for perchlorate from springs that discharge from the drinking-water aquifer to the Rio Grande in White Rock Canyon. The samples included an apparent detection of perchlorate at 8.5 ppb. The Laboratory resampled the springs in the early 2001 and found perchlorate at levels much lower than the previous year's sampling.

In September of 2001, the Laboratory notified the Environment Department of the perchlorate detections. In early November the Environment Department and the EPA sampled the springs. The results show that perchlorate is or was present; however, due to analytical uncertainties, the actual or true concentration of the contaminant is unknown. The Laboratory, the Environment Department, and the EPA will collect samples at these springs as well as other stations during 2002.

Work with Santa Clara Pueblo

After the Cerro Grande Fire, representatives of the Santa Clara Pueblo environmental program were concerned about impacts of the fire on Santa Clara canyon. We showed them the results of post-Cerro Grande ash samples that we had collected. As a result, they expressed concerns that storm water might carry high levels of radionuclides and trace metals, and that increases in storm water flows might affect downstream resources. They asked what tools and equipment were necessary to safely collect samples during high storm water flows.

In response to these concerns, we helped the pueblo investigators develop sampling and analytical strategies, and loaned them an automatic water sampler. After initial training, installation, and programming of the sampler, we assisted in continued equipment maintenance. We also worked with pueblo representatives by reviewing their groundwater sampling procedures and providing recommendations to improve sampling methods.

In early 2001, we worked with the pueblo to hand-auger four shallow boreholes on pueblo land along the Rio Grande to assess potential water-quality impacts to local groundwater as a result of the Cerro Grande Fire and to better understand the distribution of man-made radionuclides in Rio Grande sediments.

Water-quality results from the monitoring well and open borehole showed that all constituents, except dissolved manganese and gross alpha/beta, were at levels less than their applicable standards, and there appeared to be no fire-related effects on the groundwater. However, at the monitoring well, the gross alpha and beta activity concentrations exceeded the Safe Drinking Water Standard of 15 and 20 picocuries per liter respectively. Other investigations in this area have also shown elevated levels of naturally occurring alpha emitting radionuclides in groundwater. The sediments contained background levels of radionuclides, beryllium, and mercury.

Discharges and Emissions

Plans for Waste Management

Near the end of 2001, a work plan for waste management oversight at Los Alamos National Laboratory was developed in collaboration with DOE and the Laboratory. A final work plan will be developed in 2002 to be implemented depending on fiscal year 2003 funding. The program will initially focus on radioactive, mixed (radioactive and hazardous) and hazardous waste streams from the TA-50 Radioactive Liquid Waste Treatment Facility and the TA-54 Low-level Radioactive Waste Disposal site, as well as on spills and releases. Our goal is that this program will expand to cover other waste management facilities and associated waste streams.

Sandia National Laboratories

Legacy Waste Cleanup

The Bureau's Sandia oversight office participated in environmental restoration work ranging from advanced project planning, field implementation, independent sampling, and evaluation of No Further Action requests, through Bureau sponsored public meetings on the Mixed Waste Landfill, to Long-term Environmental Stewardship planning.

We continued to participate on High Performing Teams formed to work on certain projects based on their importance and complexity. The teams include state regulators, and DOE and Sandia representatives. We worked with teams that focused on the Chemical Waste Landfill closure, Tijeras Arroyo Groundwater Investigation, and permit modifications for site closures.

The Bureau again participated in the evaluation of draft No Further Action documents in support of Sandia's path to completion of its environmental restoration project. Information used to justify No Further Action at individual sites may be found in various documents spanning years of project development. Such documents include workplans and reports, Environment Department Requests for Supplemental Information, and Sandia responses. As decision documents for closure of a given site, our reviews of the final No Further Action proposal often recommended summarizing information from older documents to clarify technical adequacy and improve public acceptability or usability.

The Environment Department's Hazardous Waste Bureau granted No Further Action status to a total of thirty environmental restoration sites in 2001, formalized by a Class 3 modification to Sandia's Hazardous Waste Permit. Bureau staff participated in a citizen's review group through the Community Resource and Information Outreach office during the public review and comment period. We also attended the formal Sandia sponsored public meeting to offer further insight on the proposals and respond to public questions.

The progress demonstrated by Sandia through the No Further Action process makes Long-Term Environmental Stewardship planning and decisions all the more critical. Throughout the year, we were actively involved in the evolving Sandia National Laboratories stewardship initiative. Staff members contributed to three public based working groups. Each group reported recommendations to DOE and Sandia for the development of the technical requirements for Sandia's stewardship plan. Key issues addressed by the reports included stable, reliable funding, a comprehensive public outreach program, commitment to stewardship through the existing permit, and information access. The Bureau shared the public consensus that the resulting draft plan failed to provide either a functional plan or a clear commitment to future stewardship.

Over the past two years, a total of 94 Solid Waste Management Units have been granted No Further Action status according to the Sandia's RCRA permit. Many of the units were granted NFA status on an industrial or recreational basis. While these may be appropriate risk scenarios, the process to track and maintain conditions in line with such scenarios should be documented and communicated to the Environment Department and stakeholders.

Progress at the Chemical Waste Landfill and CAMU

During 2001, Sandia completed excavation of the Chemical Waste Landfill down to the 12-foot depth in all four primary areas that received waste from 1962 until 1985. Sandia began the excavation as a Voluntary Corrective Measure in September 1998, and has removed and characterized

Aerial view of the CWL in 2001 following excavation of all four areas.

approximately 45,000 cubic yards of waste. The four disposal areas contained wastes contaminated with various organic compounds (solvent wastes), polychlorinated biphenyls (PCBs), chromium, tritium, radioactive materials, containers, assorted debris, and gas cylinders. The landfill excavation is conducted pursuant to a Closure Plan approved by the New Mexico Environment Department in March 1997.

Sandia did not have a complete description of what was in the landfill. Therefore, as the excavation proceeded, the project required modifications in the way various waste types were handled. The changes made it challenging to keep the project on schedule. As members of the High Performing Team for the project, we worked on several issues including developing management or treatment pathways for various waste types such as debris shredding, gas cylinder processing, contaminated soil stabilization, and low-temperature thermal desorption. We also played a key role in the technical development of an approved risk-based approach that will allow soils that pass Environment Department risk levels to be returned as backfill to the landfill.

Sandia found unexpected high concentrations of polychlorinated biphenyls (PCBs) below the 12-foot level in the southwest corner of the landfill. Concentrations ranged up to 1,500 part per million. After Sandia excavated the area to a depth of 20 feet, Bureau members entered the landfill to visually examine the extent of the exposed contamination. We verified there were obvious layers of oily soil ranging up to six inches thick at different levels on the walls of the excavation, and noted a strong petroleum odor. We discussed potential methods for further investigation and remediation with Sandia investigators. Indicative of the complexity of the project, Sandia must manage PCB contaminated soil at these concentrations under the Toxic Substances Control Act administered by the EPA. Subsequent subsurface investigation revealed that the PCB contamination dissipates at a depth of 30 feet. Sandia plans to remove remaining PCB contamination to that depth in this specific area.

Sandia investigator describes plans for high PCB concentrations in SW Area of CWL to Roger Kennett.

During 2001, we completed our verification soil sampling within the Chemical Waste Landfill excavation in the East-Central, Southwest, North Pit, and Southeast Pit areas. As sample results become available, we will compare our results to Sandia's to confirm whether any remaining contamination poses unacceptable risk to human health and the environment. A major goal of the excavation Voluntary Corrective Measure is to remove materials that can be a continued source of groundwater contamination. Project personnel separated many different sized containers, some with contents still intact, by waste type and repackaged the containers for off-site disposal. We reviewed a proposed gas cylinder treatment process intended to safely remove any associated liquid or solid wastes, and agreed it did not constitute RCRA treatment, allowing for its timely implementation. Three hundred twenty-four gas cylinders were characterized, processed, and recycled using this process. The excavation contractor also segregated wood, metal, and various soft debris. Sandia will have to characterize this debris and gain approval from the Environment Department Hazardous Waste Bureau for its proper disposal. In an effort to minimize generation of secondary wastes, the Bureau reviewed and supported a Class 1 modification to the Closure Plan that allows exhumed rocks to be decontaminated using a dry decontamination method.

At the nearby Corrective Action Management Unit, or CAMU, Sandia continued waste storage operations in preparation for treatment operations planned for late summer of 2002. By the end of 2001, the CAMU's Bulk Waste Storage Area held approximately 45,000 cubic yards of contaminated soils. Sprung structures housed various waste types including repackaged hazardous waste containers prior to off-site shipment.

Sandia completed their baseline sampling for the CAMU Vapor Monitoring System during 2001. We met with CAMU project staff to review vadose zone vapor results. Data from our split samples generally agreed with Sandia's, and indicated low-level volatile organic carbon concentrations, attributed to the Chemical Waste Landfill.

Mixed Waste Landfill

As state regulators evaluated a proposed landfill cover design and requested that Sandia conduct a Corrective Measures Study, the Bureau adjusted its monitoring activities at the Mixed Waste Landfill based in part on issues raised at the two public meetings the Department held in January 2001. Some members of the public were concerned that uranium detected in groundwater samples over the years may have come from the landfill. Questions were also raised regarding very low concentrations of organic chemicals in past groundwater samples. Sandia expanded the groundwater monitoring program at the landfill with the installation of two additional down-gradient monitor wells, MW-5 and MW-6. Our split samples from these new wells indicate that local groundwater has not been impacted by the landfill.

It was suggested that Sandia's and our previous analytical methods were not appropriate to determine if uranium detected in groundwater samples was natural or man caused. The method we used previously was normal for environmental investigations and indicated uranium concentrations at background levels. To address public concerns, we collected two samples from MW-4, the monitor well drilled at an angle beneath the landfill, and one sample from each of the new wells, MW-5 and MW-6. These samples were analyzed for uranium using a method giving better resolution of the U-238 and U-235 isotopes. All our samples resulted in ratios that are consistent with the expected natural isotopic ratio for uranium.

> Uranium is a naturally occurring element. The activity ratio between the isotopes uranium-238 to uranium-235 is a constant 21.76 in nature. The average ratio calculated from the Bureau's three groundwater samples taken from monitor well MW-4 was 21.41, within 2% of the expected value. Uranium concentrations averaged 2.0 pCi/L for U-238, and 0.094 pCi/L for U-235, consistent with the background values established for Sandia.

Of the detections of organic chemicals in groundwater, we were able to verify that the majority of the samples in question were false positives or due to laboratory contamination. However, toluene has been intermittently reported in well MW-4 since a packer was installed in 1994. The chemical is known to be a component in the fabrication of the packer, and similar toluene detections have been reported in association with the packer devices at sites other than Sandia. The Bureau actively participated in resolving the source of the toluene detections, beginning with observing the removal of the packer from the well for inspection of the packer's bladder assembly. The assembly appeared discolored and deteriorating, supporting the theory that the toluene detections are packer related. The packer was returned to the manufacturer for repair. The refurbished packer, equipped with an inert Teflon cover, was installed in the well in September. Following the reinstallation, we worked with Sandia to develop a comprehensive pumping and sampling program at MW-4 to further evaluate the toluene detections. Subsequent samples have been toluene free and the Bureau intends to continue monitoring this situation.

The original path forward for closure of the landfill included the installation of an alternative landfill cover, with continued monitoring and evaluation of the site for potential future excavation. The proposed alternative cover is an evapotranspiration-based design, which would incorporate redundant surface and subsurface moisture monitoring systems. Installation of the cover would act to both isolate the waste from potential surface exposure and minimize any moisture infiltration and transport of contaminants away from the landfill. We observed the installation, calibration and testing of an innovative fiber optic moisture sensor network in a test plot near the landfill.

Lurance Canyon Burn Site

The Lurance Canyon Burn Site is an active fire burn testing facility at Sandia National Laboratories. Facility upgrades were completed in 2001 to support its continuing mission that includes fire survivability testing of transportation containers, weapons components, simulated weapons, and satellite components. From an environmental restoration perspective, past testing activities resulted in identification of a total of 16 Solid Waste Management Units, or SWMUs at the Burn Site. To date, No Further Action status has been granted for thirteen of these sites. The Bureau was involved with oversight of field activities at site 94H, and evaluation of NFA proposals for sites 94B and 94F.

SWMU 94F is suspected as a source of groundwater contamination in the Lurance Canyon area. Following the excavation of petroleum-contaminated soil at SWMU 94F in 2000, we reviewed a preliminary version of the No Further Action proposal. Although we concurred with terminating and backfilling the excavation in 2000, we expressed concern about residual petroleum hydrocarbons in the zone above the water table. We recommended Sandia obtain specific information about the vadose zone to quantify any continued source of groundwater

contamination, and to support closure of the site based on monitored natural attenuation.

As a new release discovered during an upgrade of the piping system in 2000, SWMU 94H was the subject of a Voluntary Corrective Action to remove soils containing diesel-range organics. We monitored the collection of subsurface soil samples used to bound contamination horizontally and vertically. Based on field screening results it appeared that the contamination was largely contained above bedrock. Sandia excavated an area about 50 feet in diameter to a depth of about 20 feet. We observed that the excavation was consistent with the subsurface sample data. Pending review of soil sample data from the bottom of the excavation, the corrective action appeared to be successful in removing the contamination.

From the late 1960s through the early 1980s, the Lurance Canyon area was used as an explosives test area. The Burn Site includes:

SWMUs 65 A - E: explosives tests
SWMUs 94 A -H: fuel fire burn tests
SWMUs 12 A - B: burial sites
SWMU 13: unlined surface impoundment

The 10,000 ft blast radius contains ER Sites 65 A - E. In the early 1980s, the area began to be used for fuel fire burn tests (ER Sites 94 A - H). ER Sites 12 A - B consisted of two burial sites located in an arroyo running northeast to southwest through the complex. The burial activity at Site 12 may have been associated with site 65 explosive testing or with Burn Site facility construction activities. ER Site 13 was an unlined surface impoundment, associated with testing conducted at the large open burn pit, and was operational through the mid 1980s.

Tijeras Arroyo Groundwater Investigation High Performing Team

One of the High Performing Teams on which the Bureau participates is looking into an area of groundwater contamination in the northern portion of Kirtland Air Force Base. The Tijeras Arroyo Groundwater Investigation High Performing Team is a comprehensive, integrated groundwater assessment project including participants from Sandia, the Air Force, the City of Albuquerque, Bernalillo County, and the Hazardous Waste Bureau. The purpose of the team is to bring together the technical expertise as well as the range of potentially responsible parties necessary to characterize and assess the groundwater contamination. The geographic area of concern includes potential contaminant source areas controlled by Sandia, Kirtland AFB, or the City of Albuquerque. Contaminants of concern include trichloroethane and nitrate.

The team is working to develop the data quality objectives and information requirements necessary to effectively characterize contaminant plumes, aquifer characteristics, identify sources of the contamination, and evaluate remedial options for the groundwater unit. Through the coordinated work of the team, an improved hydrogeologic model of the Tijeras Arroyo groundwater has been developed. This model will be used to identify the data required for the complete characterization and remediation of impacted area aquifers. The resulting team management process and decision criteria will also be applied to other groundwater assessment projects at Sandia, including TA-5 and the Burn Site.

Environmental Monitoring

Airborne Radionuclides

We continuously monitor for radionuclides associated with airborne particulates or water vapor at three locations on the perimeter of Kirtland Air Force Base. A fourth monitor on the campus of the University of New Mexico samples a location not affected by Sandia operations. Based on public concern that Sandia's Mixed Waste Landfill (MWL) might be a source of airborne radioactive contamination, we developed a plan to relocate the University station. We chose to move this station since ten years of operation at the same location have provided an adequate radiological baseline. We planned and coordinated the move with DOE, Sandia, and the City of Albuquerque.

The City of Albuquerque also plans to monitor air quality near the landfill for hazardous constituents such as volatile organic compounds nitrates, and tritium, a radioactive isotope of hydrogen. We coordinated with the city and

The three on-site monitoring stations are located at the Four Hills community near the northern base boundary, the U.S. Geological Survey Albuquerque Seismological Laboratory at southern base boundary, and the southwestern corner of the base. The University of New Mexico station represents a location not affected by Sandia operations. Each pump draws about four liters per minute, which approximates the volume of air inhaled by a typical adult in the same period of time.

Sandia to ensure there was enough power to run all equipment. The DOE requested that we complete a National Environmental Policy Act questionnaire detailing any environmental impact or physical hazards of placing our equipment onsite.

At each air monitoring station, we collect particulates on filters and water vapor in a silica gel filled cartridge. Once every three months, we send all samples to an independent analytical laboratory. The filter is analyzed for gross alpha and beta activity, and various radioactive elements by a method known as gamma spectroscopy. The water vapor caught in the silica gel is analyzed for tritium.

In preparation for the move, we modified our analytical suite for the 3rd quarter 2001 to include isotopic plutonium and uranium analysis at all stations. This established the radiological baseline data for plutonium and uranium at each station prior to any changes to the monitoring project. Due to budget constraints, we will perform the isotopic analysis at only two stations including the one at the landfill.

At the close of the year, we completed the move of the University station to near the northeast corner of the Mixed Waste Landfill. Starting in 2002 we will compare data at each of our three air monitoring stations located along the perimeter of Kirtland Air Force Base to that from the MWL station. Isotopic plutonium and uranium data from the U.S. Geological Survey station will be compared to the isotopic analysis information from the MWL Station. Our data along with that from the City of Albuquerque should help resolve questions concerning migration of airborne contaminants from the landfill.

Air monitoring station near the Mixed Waste Landfill.

Ambient Gamma Monitoring

Gamma radiation is part of the environment. This form of ionizing radiation constantly bombards us. Thermoluminescent dosimeters are a passive means of quantifying an ambient gamma dose. Through the year 2001, we measured ambient gamma at twelve locations on Kirtland Air Force Base, and the greater Albuquerque area. These twelve locations coincide with approximately one-third of the total Sandia monitoring locations. We compare our results to Sandia's from the same locations to verify the effectiveness of its monitoring program.

In late 2000 we switched to a new dosimeter service provider. To ensure the new service provider was giving us reliable results, the Bureau conducted a quality assurance test on the dosimeters. Sandia allowed us to expose two monitors from each Bureau site to a cesium-137 source resulting in known radiation levels. The artificially exposed monitors were sent for analysis with the normal field monitors. The data from the exposed monitors indicated that our dosimeters tend to slightly over respond in typical low-intensity environmental radiation field. This is a property of the type of dosimeter we are currently using. This quality assurance test us helped quantify the amount of dosimeter over response, thus providing a "true" indication of gamma dose at each monitoring location. Our corrected data compared well to most of Sandia's data, was statistically equivalent to previously collected data, and was consistent with background radiation levels.

Groundwater Monitoring at the Lovelace Respiratory Research Institute

Analytical data from the last round of mandatory groundwater monitoring indicate that groundwater impacts associated with the wastewater disposal ponds used by the former Inhalation Toxicology Research Institute until 1992 continue to attenuate. The Bureau has split groundwater samples with the facility, now called the Lovelace Respiratory Research Institute, since 1993. In 2001, we sampled six of the eleven wells around the closed wastewater disposal ponds. These six wells included the three wells installed by the Environment Department on Isleta Pueblo land to monitor migration of contaminants toward pueblo property. Historically, nitrate, chloride, sulfate, fluoride, and total dissolved solids have been the focus of the sampling program.

Overall the apparent trend for historical contaminants of concern shows generally stable or decreasing

concentrations. In particular, all analyses for nitrate and chloride were less than the New Mexico Water Quality Control Commission's standard of 10 ppm and 250 ppm, respectively. Additionally, reported concentrations of fluoride, which in the past have equaled or exceeded WQCC standard of 1.6 ppm, show a trend of steady or decreasing concentrations. Although the facility no longer discharges, the currently approved Discharge Plan issued by the Environment Department will be in place until October 31, 2002. The Oversight Bureau anticipates continuing some level of annual groundwater monitoring of the facility in the future years.

Soil, Vegetation, and Water

Sandia National Laboratories assesses potential environmental impacts from its operations by annually taking samples of vegetation, soil, and water at about 60 fixed locations within the boundaries of Kirtland Air Force Base and in the surrounding community. The Bureau evaluates Sandia's sampling methodology and typically splits samples at about 10% of the locations to verify the accuracy of Sandia's results. During the year, we sampled only on-site locations due to scheduling issues and resource limitations. We analyzed our samples for gross alpha/beta, tritium, and gamma spectroscopy on relatively long-lived radionuclides. Our results, with one exception, compared favorably to Sandia's data and indicated no areas above the statistically derived background values from previous years. The exception was an elevated tritium value in one of our vegetation samples. We are not sure why the value was elevated, but it is likely to have been a laboratory error.

We also collected a pair of storm water samples in the Arroyo del Coyote drainage for gross alpha/beta, gamma spectroscopy, tritium, and total suspended solids analysis. The samplers were placed downstream of a group of Environmental Restoration sites that had undergone remediation. We were interested in determining if residual contamination was mobilized during storm events. All results were at background levels.

Discharges and Emissions

In addition to overseeing cleanup of legacy waste sites from past testing activities, the Bureau monitors current activities to ensure they are conducted appropriately and are protective of human health and the environment. A component of this activity is examination of the technical justifications for reducing the inventory of hazardous waste mixed with radioactive constituents. This included the evaluations of two innovative treatment technologies for removing the hazardous component of mixed waste. One, a molten aluminum bath technology, was to be demonstrated on mixed waste for the first time at Sandia. We reviewed the draft test plan for the demonstration, and provided comments. The other, a solidification technique, was effective in justifying the deletion of waste from the inventory.

We also continued regular radionuclide sampling of wastewater discharged from Technical Area 5 to the city sewer system. Sandia's burn test facilities at the Lurance Canyon Burn Site became more in demand following the events of September 11th, and our office had the opportunity to monitor operations and conditions of two burn tests.

Mixed Waste Accomplishments

Under a Compliance Order issued by the Environment Department in 1995, Sandia National Laboratories is obligated to store, manage, and treat mixed wastes (both radiological and hazardous components) according to schedules and milestones presented in the Mixed Waste Site Treatment Plan approved by the Environment Department. This plan includes all mixed wastes, regardless of the time of generation, that are newly discovered, identified, generated, or received from off-site. The Bureau facilitated the acceptance of an amendment to the Site Treatment Plan regarding how new waste that will be covered by the plan is defined. The amendment provides a more efficient administrative process for managing newly covered waste.

The Compliance Order includes a schedule for achieving compliance with the storage and treatment requirements based on established compliance dates. During 2001, Sandia successfully achieved all required mixed waste compliance milestones.

Mixed wastes can be deleted from the requirements of the Compliance Order if they are sent off-site for treatment, treated onsite, or recharacterized as either non-radioactive or non-hazardous. We reviewed and assisted with the processing of 29 waste deletion requests for a variety of covered mixed wastes that are stored at the Radioactive and Mixed Waste Management Facility located at Technical Area 3.

Vacuum pumps sealed with oil are used at some DOE sites to provide a negative pressure on glove boxes. Frequently, the waste pump oil is contaminated with tritium and heavy metals. At DOE's Mound Plant in Ohio, an innovate

technology, using a product called Nochar®, was successfully used to treat contaminated oils. The treatment agent forms a solidified mass with the waste and a polymer adsorbent. During 2001, Sandia used the product to treat pump oils contaminated with tritium, cadmium, chromium, lead, and mercury. After treating the oil, Sandia investigators sampled and analyzed the solidified mass. We examined the sample results and concluded that the waste was no longer subject to RCRA Land Disposal Restrictions. The Environment Department subsequently approved the waste deletion request. As a result, Sandia will be able to remove this material from the requirements of the Compliance Order and dispose of it at the Nevada Test Site's low-level waste disposal facility.

Other mixed wastes processed and deleted at Sandia during 2001 included hydrides, metal oxides, corrosive liquids, and various forms of particulates and debris.

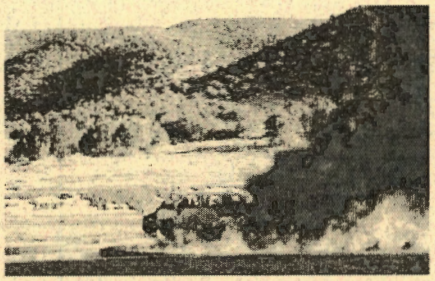
During 2001, Sandia reduced its low-level mixed waste volume by 43 cubic meters. At the beginning of the year, Sandia started with approximately 90 cubic meters of mixed waste and ended the year with approximately 47 cubic meters, a reduction of 48 percent.

Wastewater Sampling

New Mexico Radiation Protection Regulations regulate discharges of radioactive materials to a city sewer system. The City of Albuquerque permits Sandia's discharge to the sewer system according to those regulations. We split four wastewater samples with Sandia and the City during the year to check for radiological releases to the sewer system. We collected the samples at Station #11 north of Technical Area 5 and submitted them to an independent laboratory for gross alpha-beta and gamma spectroscopy analysis. Our results were comparable to Sandia's. The concentrations of radionuclides in each sample did not exceed the values set forth in the Radiation Protection Regulations for release to sewer and averaged around 200 times lower than the regulatory target concentrations.

Burn Facility Tests

We observed calibration testing at the Flame facility located at the Lurance Canyon Burn Site. The Flame facility is a contained burn structure with forced air ventilation and water-jacketed walls, which allows better control than open burn testing. The controlled environment is being used to collect data for the development of a burn simulation computer code to better understand fire conditions. The test burn utilized 35 gallons of jet fuel contained in a two-meter burn pan. Prior to the burn, instrumentation devices within the pan had been reconfigured in a successful attempt to create a more symmetrical flame. We saw lower emissions from the Flame facility stack than we have previously seen from larger open burns.

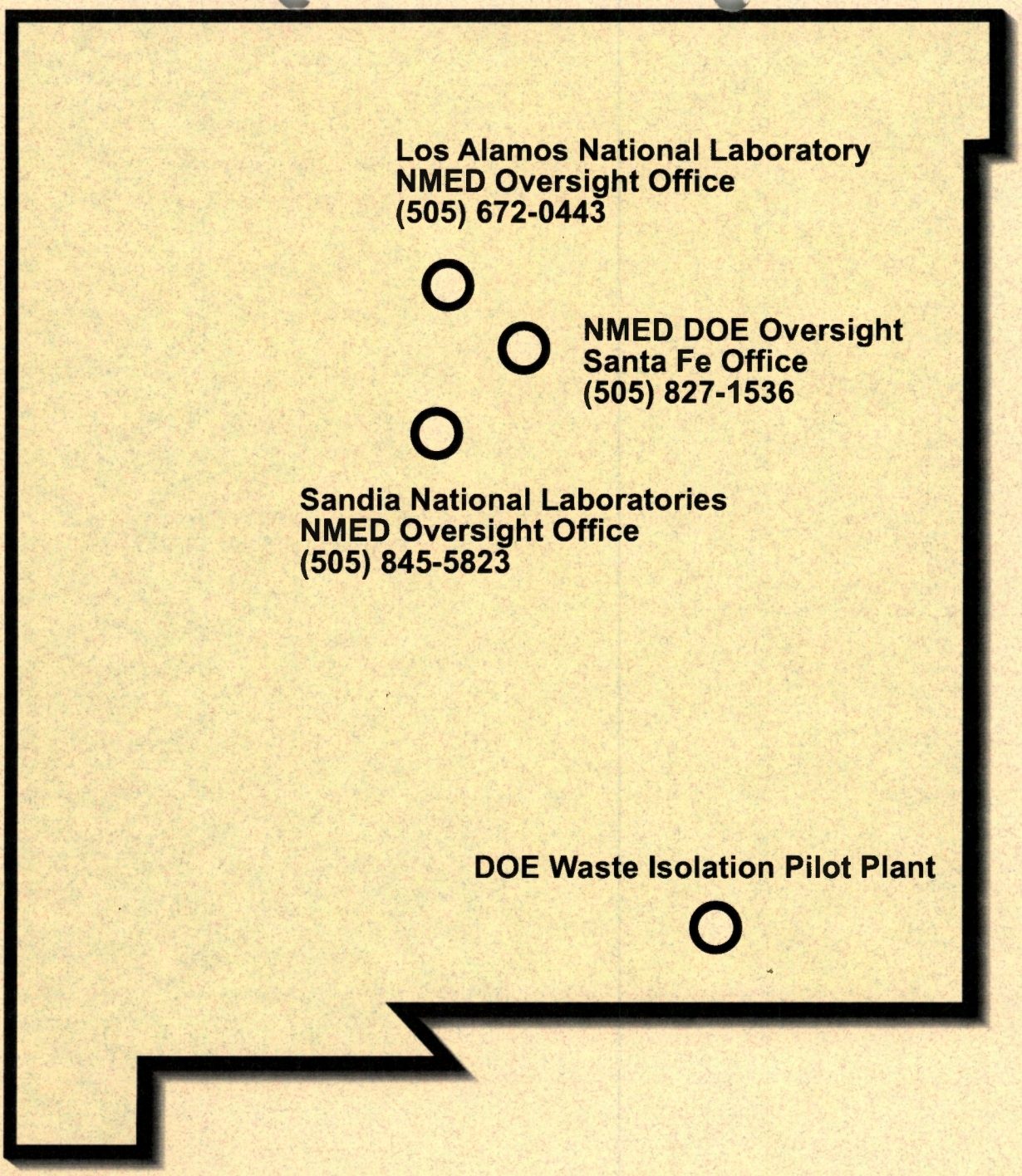


A minivan burning at the Lurance Canyon Burn Site

We also observed an open burn test. This test involved the burning of a minivan to evaluate survivability of the vehicle in addition to the function of the reconfigured open burn pool facility. As described in the Legacy Waste Section, we monitored the characterization and remediation of contaminated soils discovered by Sandia during removal of underground piping and electrical conduit at the site. Potential for future spills or leaks is minimized through the installation of new double-walled piping, most of which is above ground to allow for visual detection of leaks.

Waste Isolation Pilot Plant

We maintained our gamma radiation monitors around the perimeter of the Waste Isolation Plant or WIPP. For test purposes, we deployed gamma monitors from a different supplier at some locations. Because of funding and subsequent staff reductions, we made plans to discontinue monitoring at WIPP in 2002.



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