



New Mexico Environment Department DOE Oversight Bureau



2004 Annual Report

**Environmental Oversight and Monitoring
at Department of Energy Facilities**

Cover Photograph

ER Site 67 (aka Frustration Site) is an old mine adit which was used to house an experimental seismic station during the 1960s and 1970s. Interviews with SNL personnel who worked at the seismic station indicate that the unit was used for monitoring seismic events and the work conducted was not of a nature to generate hazardous wastes.



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INTRODUCTION

The mission of the New Mexico Environment Department (NMED) is to promote a safe, clean, and productive environment. The NMED, Department of Energy (DOE) Oversight Bureau mission is to help assure that activities at DOE facilities in New Mexico are protective of public health, safety, and the environment.

The DOE facilities are:

- Los Alamos National Laboratory (LANL)
- Sandia National Laboratories (SNL)
- Waste Isolation Pilot Plant (WIPP).

The DOE Oversight Bureau's activities are outlined in the *Agreement-in-Principle (AIP) between the State of New Mexico and the U.S. Department of Energy for Environmental Oversight and Monitoring*.

The NMED, DOE Oversight Bureau include a staff of nineteen at the following locations:

- Chief (1) - Santa Fe
- Administrative Staff (2) - Santa Fe
- Technical Support Staff (3) - Santa Fe
- LANL Oversight Office (6) - White Rock
- SNL Oversight Office (3) - Kirtland AFB
- WIPP Oversight Office (4) - Carlsbad

The DOE Oversight Bureau requested \$1,828,517.00 to support 2004 operations and received \$1,100,000.00 from DOE AIP funding sources. The WIPP Oversight Office funding for 2004 was \$600,000.00 from DOE sources and is exclusively for WIPP operations and separate from AIP funds.

The DOE Oversight Bureau re-opened its onsite office at WIPP by hiring four employees in November. The WIPP Oversight Office mission is to conduct technical oversight, and environmental monitoring to independently validate and verify compliance issues at the facility. DOE and the State of New Mexico have agreed to an initial 5-year term of operation for the DOE Oversight Bureau to conduct environmental monitoring programs in air, surface water, groundwater and facility effluent sampling. The WIPP Oversight Office's primary focus for its first year is preparing a program to perform air effluent sampling.

The Technical Support Office developed a Quality Assurance Management Plan (QMP) for the Bureau in November 2004. This QMP was developed according to EPA's QA/R-2 guidance and defines the quality assurance and quality control (QA/QC) procedures to be used by the Bureau. This QMP will serve as a means of documenting how the Bureau will plan, implement, and assess the effectiveness of its QA/QC operations as applied to its environmental programs.

This Annual Report highlights the activities of the DOE Oversight Bureau for calendar year 2004. It is also posted on the NMED website at:

http://www.nmenv.state.nm.us/DOE_Oversight/



PUBLIC OUTREACH AND INFORMATION TRANSFER

The DOE Oversight Bureau interacts extensively with the public, local Pueblos, citizen activist groups, the Citizen Advisory Boards at DOE facilities, other bureaus within NMED, and other government agencies (e.g., EPA, USF&W). The Bureau shares data and findings through poster presentations at public meetings, informal discussions, and posting data and reports on our web site:

http://www.nmenv.state.nm.us/DOE_Oversight/mondata.html

During 2004, the LANL Oversight Office provided maps and relevant information such as contaminant source terms for Drinking Water Bureau's Source Water Assessment and Protection Program, and assisted George Rice through data compilation and peer review of a Concerned Citizens for Nuclear Safety report, *New Mexico's Right to Know: The Potential for Groundwater Contaminants from Los Alamos National Laboratory (LANL) to Reach the Rio Grande*.

The SNL Oversight Office Manager was a panelist for a discussion on water at the 7th Annual Youth Conference on the Environment, *The Tap is Running Dry*. The Manager was one of the five panel members, including the Mayor of Albuquerque.

SNL Oversight Office staff served as judges at several school science fairs including the Grant Middle School Science Fair, Northwest New Mexico Regional Science

and Engineering Fair, and State Science Fair.

Citizen's Advisory Board Environmental Monitoring and Surveillance Committee

The DOE Oversight Bureau continued to provide support to the Northern New Mexico Citizen's Advisory Board Environmental Monitoring and Surveillance Committee. This committee works to ensure early and ongoing community access to LANL monitoring and surveillance information. In past years, the committee addressed ground water, air, and liquid discharge issues.

The LANL Oversight Office provided information to the Northern New Mexico Citizens Advisory Board concerning tritium and perchlorate contamination at the Four Series Springs in White Rock Canyon.

Environmental Data Integration with LANL

Environmental monitoring and surveillance data of air, water, soil, sediment and biota have been collected by LANL since 1949, and have been published historically in report format. At present, environmental databases are located within a myriad of groups at LANL, including:

- Meteorology and Air Quality (MAQ)
- Water Quality and Hydrology (WQH)
- Ecology & Environmental Characterization and Remediation (ECR).

Public concerns over environmental data collected at LANL over the years include fragmented locations, the inability to access, query, and compare data, problems associated with locations and naming conventions within each organization, territorial preferences each group has for their own database, and the excessive dollars spent to date developing these databases.

LANL invited the DOE Oversight Bureau to participate on their Commercial Off-The-Shelf Software (COTS) selection committee as a voting member - the only non-LANL participant on the team. Oversight staff spent many hours attending meetings, to provide insight into the desired functionality of the software, and evaluating vendor software products. It is anticipated that the chosen COTS software will allow LANL to improve their deliverables to the regulators as per the Compliance Order on Consent and Federal Facility Compliance Agreement. Moreover, a Centralized Environmental Data Information and Management system will provide easy Internet access of all environmental data collected at LANL for members of the public, activist groups, pueblos, tribal entities and other interested stakeholders. The DOE Oversight Bureau also expects to include environmental data on LANL's centralized database that was collected by its staff at LANL from 1992-present.

The Los Alamos Risk Analysis, Communication, Evaluation, and Reduction (RACER) Project

The DOE Oversight Bureau continued to support the RACER project headed by Risk Assessment Corporation under contract to Colorado State University. Two goals of the RACER team are:

- Provide a single source for accessing all environmental data related to LANL, and
- Provide a consistent process to compile, use, and update data to support the risk assessment and decision-making processes.

To facilitate this goal, the DOE Oversight Bureau provided the RACER team with periodic, updated copies of their environmental database for inclusion into the RACER Contaminant Database, which can be found at:

<http://www.racteam.com/LANLRisk/RACERDatabase.htm>

DOE Oversight Bureau staff delivered comments to the RACER team concerning the Bureau's data verification and validation process. The comments were incorporated into the *Risk Analysis, Communication, Evaluation, and Reduction at LANL: Data Verification and Validation Summary*, to be posted on the RACER website in 2005. Bureau staff also attended RACER Community Forums in May and October 2004, and assisted the RACER team in compiling and evaluating detailed polychlorinated biphenyl data sets.

Interactions with Local Pueblos

The LANL Oversight Office assisted San Ildefonso Pueblo to locate regional aquifer wells on their lands and conducted water-quality sampling at one deep well on Santa Clara Pueblo. Also, the DOE Oversight Bureau technical support staff in Santa Fe provided storm water sampling equipment and training to San Ildefonso Pueblo for their monitoring program in Pueblo Canyon and Los Alamos Canyon.

Technical Presentations

The LANL Oversight Office presented two posters at LANL's Quarterly Groundwater Protection Program titled, *Hydrochemical Profiles for Select White Rock Canyon Springs, Los Alamos, New Mexico*, and *Trace Perchlorate in Ground Waters of the Pajarito Plateau, Española Basin and the Rio Grande north of Taos, New Mexico*.

The DOE Oversight Bureau, Technical Support Office presented a poster at the LANL Groundwater Quarterly meeting titled, *Post Cerro Grande Fire Channel Morphology in Lower Pueblo Canyon, Reach P-4 West: and Storm Water Transport of Plutonium 239/240 in Suspended Sediments*.

The Technical Support Office conducted presentations on the erosion and offsite transport of contaminated sediments in Pueblo Canyon to the New Mexico Natural Resources Trustee, San Ildefonso Pueblo and DOE. DOE subsequently committed to developing and implementing strategies to reduce erosion and stabilize threatened contaminated packages in Pueblo Canyon.

Contaminated sediments, stored in eroding banks of the stream, are being planted with grass seed and covered with jute matting to stabilize them in place (Figure 1). Willow cuttings are being planted at the base of the banks to establish protective riparian vegetative communities which will physically slow and deflect floodwaters and help to hold the banks in place with their root systems.

The Technical Support Office and LANL presented findings of the PCB cooperative study to the Middle Rio Grande Water Quality Standards Working Group and the Bosque Hydrology Group Water Quality Summit.



Figure 1. Shaw Inc. staff plant clumps of coyote willows in recently seeded and jute-matted stream banks in Pueblo Canyon

SNL Oversight Bureau staff conducted presentations at several professional or technical organizations including: the New Mexico Chapter of Professional Engineers, State and Tribal Government Working Group, and WERC Summer Academy.

Data Releases and New Publications

The LANL Oversight Office provided all 2003 groundwater and surface water monitoring results and the SNL Oversight Office provided its 2004 environmental monitoring data to DOE.

The Bureau also shared its 2003 and 2004 environmental monitoring data with the following NMED Bureaus:

- Hazardous Waste Bureau
- Ground Water Quality Bureau
- Surface Water Quality Bureau.

Reports

The Technical Support Office completed two reports in 2004 regarding geomorphologic changes in Pueblo Canyon and plutonium transport from the canyon since the Cerro Grande Fire to 2002. The reports are: *Post Cerro Grande Fire Stream Channel Morphology In Lower Pueblo Canyon, Reach P-4 East*, and *Post Cerro Grande Fire Channel Morphology in Lower Pueblo Canyon Reach P-4 West: and Storm Water Transport of Plutonium 239/240 in Suspended Sediments*.

These reports summarized the dimensional changes in segments or reaches of lower Pueblo Canyon and plutonium transport in storm water from 2000 to 2002. The physical changes in the canyon and transport of plutonium are consequences of the increasing magnitudes and frequencies of storm water runoff that resulted from the Cerro Grande Fire and storage of Laboratory legacy waste in the canyon sediments.

The reports also provide benchmarks from which continued monitoring of the canyon will provide details of further channel adjustments and contaminant transport. We found that the channel in Pueblo Canyon has become destabilized and is alternatively aggrading and degrading during frequent storm water runoff events. These storm water events have transported over 87 mCi of plutonium in 22,000 tons of suspended sediments from the canyon since the Cerro Grande Fire to 2002.

The LANL Oversight Office published a summary report on their 2003 inspection and sampling of LANL's National Pollution Discharge Elimination System (NPDES) outfalls. Findings from the inspection resulted in substantial corrective changes to the treatment process at two facilities. Elevated perchlorate levels at the High Explosive Waste Treatment Facility

prompted the Laboratory to install a treatment unit to eliminate perchlorate from that discharge. Elevated levels of radionuclides from the Radioactive Waste Treatment Facility at TA-50 prompted an investigation that discovered contaminated influent water was leaking into the treated effluent discharge line and old, corroded, discharge piping was also leaching contaminants to the effluent. As a result of the investigations, LANL replaced the valve that was causing the cross contamination and also rerouted the discharge piping to a newer, less corroded, section of piping. To determine the effectiveness of these modifications, the Oversight Bureau has recommended that NPDES sampling be conducted at the end-of-pipe at the watercourse instead of the current sampling point that is located in the plant.

The SNL Oversight Office published a report titled, *Ambient Air Monitoring and Environmental Dosimetry at Sandia National Laboratory 1997 – 2000*. This report assesses DOE Oversight Bureau data that suggests SNL operations have not resulted in elevated environmental radionuclide concentrations over the four-year evaluation period. The calculated effective dose equivalent, using measured tritium data, was greater than the corresponding effective dose equivalent that SNL estimates using computer modeling based on various radionuclides. However, all effective dose equivalent values were well below the applicable regulatory criteria.

The DOE Oversight Bureau published its 2003 Annual Report on environmental oversight and monitoring at DOE facilities in New Mexico. The reports can be found at:

http://www.nmenv.state.nm.us/DOE_Oversight/pubs.htm

*Regulatory Deliverables:
Review & Comment*

The LANL Oversight Office provided review and commentary on several of LANL's regulatory deliverables including: *Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan*, *Mortandad Canyon Groundwater Work Plan Revision 1*, and *Investigation Work Plan for Material Disposal Area B at Technical Area 21, Solid Waste Management Unit 21-015*.

*DOE Oversight Bureau Assistance in the
Development of the Federal Facility
Compliance Agreement (FFCA)*

An FFCA between EPA Region 6 and DOE requiring the development of a storm water management program at LANL will be published in the Federal Register in January 2005. The purpose of the program is to monitor erosion potential, stabilization measures effectiveness, and surface water quality. Both the LANL Oversight Office and the Technical Support Office contributed to the development of this Agreement.

An integral part of the FFCA requires DOE to develop a site-specific erosion control and monitoring plan as part of the LANL facility's storm water management program. The plan is required to outline a general approach to be used for identifying and prioritizing individual Solid Waste Management Unit (SWMU) sites where storm water runoff and contamination are most likely to have a potential impact to surface water(s) of the state. In addition, an erosion control and monitoring program is to be implemented and evaluated at each site. Erosion control must be implemented, as necessary, before, during, and after implementation of corrective measures.

Erosion controls shall include, but are not limited to, slope stabilization, surface water run on and runoff control, and sediment transport controls. The plan is required to be updated annually and must include proposed changes to the site-specific erosion control and monitoring program based on the results of the previous year's site-specific monitoring and include proposed sampling to be conducted the following year.

LANL used their Standard Operating Procedure (SOP) 2.01 to identify approximately 325 SWMUs and areas of concern with high to medium potential to impact surface water. Sites with high erosion potential and where contamination is present are scheduled for monitoring within the first two years (2004 – 2005). All 325 sites will be monitored within a 4-year period. DOE, LANL, and the Bureau's Technical Support Office developed water screening action levels (wSALs) that are protective of New Mexico's water quality standards. Sites where monitoring data show storm water quality exceeding wSALs will continue to be monitored yearly until site stabilization is verified and storm water quality is below wSALs.

Site-specific monitoring locations will be chosen so that they meet the representative sampling definition as defined by the Surface Water Assessment Data Quality Objective Team (2002). LANL Oversight Office and Technical Support Office staff participate as members of this team and helped develop the key components of the storm water monitoring process. LANL Oversight Office staff also provided in-the-field guidance to LANL in choosing "representative" monitoring stations for the 2004 sampling season.

Groundwater Technical Oversight/Technical Interactions with Facility Investigators and Regulatory Representatives

Throughout the year the LANL Oversight Office worked closely with facility and regulatory officials on activities relevant to the characterization, corrective action, and monitoring of ground water beneath the Laboratory. The DOE Oversight Bureau assisted with the continued implementation of the Laboratory's Hydrogeologic Work Plan, Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan, Mortandad Canyon Groundwater Work Plan, corrective measures studies at Technical Area 16, and the site-wide monitoring program. The Bureau provided document review and comment, data and information evaluation/interpretation relevant to decision making, field excursions to site well locations, well construction, sampling methodologies, and split sampling. The Bureau's involvement increases the efficiency (cost, time) and effectiveness of the Laboratory's environmental cleanup and site-wide monitoring programs.

The LANL Oversight Office assisted with the Laboratory's site-wide groundwater dating and contaminant pathway project, and assisted as a member of LANL's perchlorate source-term characterization project.

Assistance was provided from the LANL Oversight Office to USGS concerning the ground-water recharge project for the Española basin. The Office provided field support and used GIS to locate Water Canyon Gallery, Spring 4C and Pajarito Mountain Ski Area well number 2 for their project. Also, the Office assisted LANL to interpret, evaluate, and report historical and recently collected water-quality data with respect to impacts to the Pajarito Canyon 4 Series Springs.

Community Radiation Monitoring Group

The Technical Support Staff continued to facilitate monthly meetings of the Community Radiation Monitoring Group (CMRG), which focuses on issues related to the monitoring of radiation in the Los Alamos area, during 2004. Major issues during the year revolved around existing monitoring and emergency preparedness issues.

The monitoring tracked by the group included monthly summaries of NEWNET data that provide measures of real time ionizing gamma radiation. Discrepancies and anomalies in the data were discussed. Most of the identified issues were the result of weather events or lack of maintenance of the network due to greatly reduced funding.

The AIRNET station operated by the Dixon community was also frequently discussed. A full interpretation of the results was sought as well as continued and assured funding. LANL indicated it would like an independent entity to assume responsibility for community monitoring. However, community members would like LANL to continue both financial and technical support.

The Electret™ network in the Embudo Valley was also closely followed by the CRMG. Results were reported based on an estimated frequency for reading the ionizing gamma radiation devices of every 60 days. The LANL Oversight Office demonstrated how to determine the dose calculations based on readings from the Embudo Valley Electret™ network.

The LANL Oversight Office used GPS to determine the coordinates of the Embudo Valley air monitoring locations. Maps were developed for the Embudo Valley Environmental Monitoring Group (EVEMG) that showed the plume from the

Cerro Grande Fire and its spatial relation to the Embudo Valley sampling sites. These maps were used by EVEMG at a public meeting in Dixon attended by LANL, Concerned Citizens for Nuclear Safety (CCNS), and the DOE Oversight Bureau to demonstrate that the intensity of the plume in the Embudo Valley was higher than any other area monitored during the fire.

Community preparedness focused on potential LANL radiation emergencies. Questions asked by the CRMG required a more specific response from professional emergency managers in the area. In order to obtain answers for emergency preparedness and response questions from first response elements, an Emergency Preparedness Forum was held on November 13 at the Dixon Elementary School.

The event was coordinated by CRMG, CCNS, and EVEMG.

The Emergency Managers from LANL, NM Department of Public Safety, NM Department of Health, NMED, Los Alamos County, and Rio Arriba County provided presentations on the integrated procedures and organizational activities that are in place to respond to a variety of emergency situations including a radiation incident. Each participant provided emergency preparedness and response information and the session was opened to questions from the audience. Over 50 members of the community were present at the Forum.



LOS ALAMOS NATIONAL LABORATORY

Environmental Monitoring

Federal Facility Compliance Storm Water Monitoring

During the 2004 sampling season, LANL evaluated 62 SWMUs by selecting 43 monitoring locations in 10 Canyons within the DOE-LANL facility boundary. LANL used three types of samplers: single stage, ISCO™ automatic water samplers, and watershed based automatic water samplers located at stream gages. The LANL Oversight Office used Environmental Liquid Samplers (ELS) to co-monitor 12 (23 SWMUs) of the 43 monitoring stations in 4 canyons. Two ELS were set side-by-side within the same drainage and in close proximity of the DOE-LANL sampler (Figure 2).

The LANL Oversight Office used one sampler for evaluation of suspended sediment concentration (SSC) and the other for analyses of metals and/or radionuclides. Sixty-one samples were collected during twelve rain events that occurred from June 30 through August 24, 2004. Forty-one samples were analyzed for SSC and radionuclides, thirty for chromium, three for cadmium, and seven for lead.

Data obtained from the LANL Oversight Office samplers will be compared to results obtained from the three different LANL samplers. LANL and the LANL Oversight Office will use the data to make a



determination as to which type of samplers to use during future sampling seasons.

Figure 2. ELS samplers in drainage below SWMU 48-007(f)

In addition, the LANL Oversight Office and LANL will use lessons learned during the 2004 sampling season to identify and prioritize contaminants at individual SWMU sites by comparing them to those that are most likely to have a potential impact on surface waters of the state.

Watershed Storm Water Monitoring

The LANL Oversight Office collected over 300 samples of snowmelt and storm water in Pueblo and Los Alamos Canyons. Samples were archived pending sufficient funding for analysis. DOE is to provide supplementary funding in 2005 but holding times for many of the planned analyses will have expired by that time. Despite this limitation, valuable data could still be extracted from many of the 2004-stormwater samples. Precipitation and flow data were available for 100 storm water samples collected in Pueblo and Los Alamos Canyons. We submitted those 100 samples for suspended sediment concentration and total plutonium in the suspended sediments. This will provide valuable baseline information for comparing 2005 data in order to determine if stabilization measures in Pueblo Canyon have been effective in reducing off-site plutonium transport. Data will be available in July 2005.

Polychlorinated Biphenyls in Storm Water Monitoring

During the 2003 sampling season, the LANL Oversight Office collected eight samples below SWMUs and four watershed samples for polychlorinated biphenyls (PCBs) using ELS and ISCO automatic samplers. Due to funding limitations, the Office was not able to submit the samples for analysis in 2003, but the NMED, Hazardous Waste Bureau provided funding in early 2004 to analyze the samples that were within maximum holding times. Several samples from Los Alamos Canyon SWMUs and watershed showed the highest levels of PCBs found in storm water to date in New Mexico. The highest levels were in samples from below a SWMU that had received a No-Further-Action determination from EPA and in Los Alamos Canyon downstream from this SWMU. In response,

LANL has initiated additional sampling of soils, storm water, and drain piping within the facility that discharge to this SWMU. The results are pending.

Direct Penetrating Radiation and Airborne Radionuclide Monitoring

During 2004, the LANL Oversight Office used Electret™ ion chambers for monitoring gamma radiation. The Electrets™ are co-located with LANL thermo luminescent dosimeters (TLDs) at eleven stations. The data from the Electrets™ compared favorably with the LANL TLD data.

The LANL Oversight Office submitted four quarters of airborne tritium samples from five on-site locations at LANL to the EPA National Air and Radiation Environmental Laboratory during 2004. The data results have not yet been received. The Office also submitted airborne radioactive particulate samples for isotopic analysis for uranium, plutonium, and americium. These values were received from the laboratory during late 2004. Results are well below the EPA concentration limits of 40CFR61 and as required by the Clean Air Act.

Funding was received in 2004 to restart the airborne radionuclide-monitoring program for collecting and analyzing air samples for plutonium, americium, uranium and tritium. The first of five stations is set to be in operation by April 2005 with the remaining stations all collecting data beginning on July 1, 2005.

Pueblo Canyon Geomorphic Investigations

The LANL Oversight Office has continued to monitor storm water and re-measure benchmark cross-sections established after the Cerro Grande Fire. These benchmarks and methods are described in reports completed in 2004. Based on LANL flow

measurements and the subsequent cross-section measurements, we have found that plutonium continues to be transported beyond the canyon and the channel in Pueblo Canyon remains destabilized.

The LANL Oversight Office estimates storm water has transported an additional 52 mCi of plutonium in 13,000 tons of suspended sediment beyond Pueblo Canyon during 2003 and 2004. These figures, in addition to our earlier estimates for storm water transport from 2000 to 2002, suggest that from 2000 through 2004, an approximate total of 139 mCi of plutonium in 35,000 tons of suspended sediment has been transported from Pueblo Canyon since the Cerro Grande Fire.

The dimensional changes we have recorded show that the canyon channel is alternatively aggrading and degrading. These changes are occurring in stages over time and distance and reflect the instability of the channel. The lowest reach in Pueblo Canyon, P-4 East, has demonstrated the greatest changes, while P-4 West has maintained relatively modest changes. The changes in P-4 East include an accelerated widening and deepening of the original channel form measured in the lower half of the reach.

Based partially on these conclusions, LANL, Los Alamos County, and the LANL Oversight Office are coordinating efforts to re-stabilize the channels in Pueblo Canyon. These efforts include grass-seeding, jute matting, and planting of willow trees along banks that are demonstrating the greatest degradation as well as having been identified as containing the largest concentrations of LANL legacy contaminants.

Contaminant Distribution in White Rock Canyon

From 1998 to 2001, the LANL Oversight Office collected sediments from terraces in White Rock Canyon and at the Santa Clara Pueblo to determine LANL contaminant distribution along the Rio Grande. We are currently completing a report that illustrates radiochemical influences to sediments along the canyon. Radiochemical impacts to sediments in White Rock Canyon could include contaminants from nuclear atmospheric fallout or fluvial transport of LANL legacy wastes. The report describes the multiple sediment samples that we collected from each of 5 sites and the radiochemical analysis of the samples obtained from commercial laboratories and LANL. The LANL Oversight Office evaluated the analytical results in multiple fashions to identify the potential LANL impact to sediments in White Rock Canyon.

The LANL Oversight Office collected samples from sediment deposits reflecting channels and floodplains that have aggraded since operations began at the LANL. They were collected from multiple depths at each site and represent sediment deposition during years LANL wastes were being dispersed within watersheds that flow to the Rio Grande. Commercial laboratories analyzed the sediments for radionuclides commonly associated with both nuclear weapons development and global fallout using standard analytical methods, including plutonium and uranium isotopes, strontium-90, cesium-137, americium-241, and neptunium-237. Thermal Ionization Mass Spectroscopy measurements were also used to identify the contribution of LANL derived plutonium relative to global fallout. LANL recently developed these methods to identify the origin of plutonium contaminants in the environment.

The LANL Oversight Office evaluated the analytical data by comparing individual measurements to background references, statistically comparing data cases that reflect up gradient and down gradient sample groups, and identifying the origin of plutonium using Thermal Ionization Mass Spectroscopy analytical methods. We have also demonstrated that although current analytical methods are adequate in identifying potential LANL contaminants at levels above health impacts, they are not capable of defining the degree of LANL environmental impacts or influences at low levels.

The Bureau's assessment shows that LANL contaminants are not uniformly dispersed in White Rock Canyon sediments. Contaminant concentrations nearest to Los Alamos Canyon were greatest and diminished as distance increased downstream, except at Frijoles Canyon. Lacustrine (lake-formed) deposits, containing greater concentrations of contaminants, were deposited from this approximate location downstream into Cochiti Reservoir during a period the lake was filled to its maximum level. Since 1985, the level in Cochiti Reservoir was reduced to levels similar to the current 2004 levels.

Cesium in Water and Aquatic Bryophytes (Mosses) at Springs below LANL

In November 2003, The Radioactivist Campaign (TRAC) published a report identifying detectable ^{137}Cs in water and bryophytes (aquatic mosses) from Spring 4A. Spring 4A is located downgradient of LANL near the Rio Grande in White Rock Canyon. The report states that the detected ^{137}Cs was of LANL origin and was the first confirmed detection of LANL radioactivity entering the Rio Grande from a ground-water pathway.

In 2004, the Oversight Bureau collected and analyzed samples of bryophytes and water from Springs 4A and 4C (a nearby spring), and two springs (Big Spring and Hemingway Spring) located 44 miles and 78 miles respectively upstream on the Rio Grande. Spring water samples were analyzed for ^{137}Cs , tritium, perchlorate, ^{90}Sr , ^{238}Pu , $^{239/240}\text{Pu}$, major anions, and dissolved and total metals. Bryophytes were dried for low-level perchlorate analysis, and reduced to ash for analysis for ^{137}Cs and other gamma-emitting radionuclides, ^{90}Sr , ^{238}Pu , $^{239/240}\text{Pu}$, and total metals. Approximately 100 liters of water from each spring were filtered through a 3M Empore™ Cesium Rad Disk. The Cesium Rad Disks were used to extract any cesium present in the dissolved and/or colloidal fraction. These methods reduced ^{137}Cs detection limits by two orders of magnitude for water and bryophytes.

^{137}Cs was not detected in any of the water through Cesium Rad Disks or ashed bryophyte samples from any of the four springs. Springs 4A and 4C show anthropogenic impact/influence such as elevated levels of tritium, chloride, nitrate, and perchlorate. While this indicates that some fraction of recharge to the springs is of a young age (<50 years) and possibly from past LANL discharges, we could not confirm the TRAC detections of ^{137}Cs in water or bryophytes at springs 4A or 4C using the best analytical technology available to NMED.

Groundwater Monitoring

The LANL Oversight Office conducts data verification and validation through split and independent sampling of ground water. Office staff split samples with LANL at 44 ground water monitoring stations, including seven springs sampled in September as part of LANL's Annual White Rock Canyon raft

trip. Office staff split samples with LANL at ten drinking water production wells, monitoring wells, and springs on Pueblo de San Ildefonso land.

The LANL Oversight Office collected independent samples at 50 stations on LANL property, at San Ildefonso Pueblo, Santa Clara Pueblo, and other off-site locations. Some of these independent samples supported the Office's *Background Perchlorate in Groundwater Investigation*. The LANL Oversight Office assisted the activist group Concerned Citizens for Nuclear Safety in their sampling of 14 White Rock Canyon springs during September. The Office also assisted the NMED, Hazardous Waste Bureau (HWB) by collecting samples from:

- 15 off-site and regional springs in March and May for tritium analysis,
- 14 White Rock Canyon springs during July as part of HWB's RDX degradation products study.

There were no unexpected results in the Office's split and independent sampling and where results were higher than background, the values closely tracked recent or historical LANL results.

Hydrochemical Profiling for White Rock Canyon Springs: Implications for Assessing Water-Quality-Impacts

The LANL Oversight Office analyzed hydrochemical results collected at the White Rock Canyon springs to develop regional/drinking-water aquifer hydrochemical profiles along the canyon reach from Otowi Bridge to Frijoles Canyon. Parameters and constituents include temperature, pH, total dissolved solids, major and minor ions such as nitrate and chloride and perchlorate, trace metals silicon and strontium, stable isotopes such as oxygen-18, and tritium.

DOE Oversight Bureau findings suggest:

- Four-Series springs located near the confluence of Pajarito Canyon and the Rio Grande show elevated perchlorate, chloride, nitrate, and tritium, which indicate man-made impacts.
- Springs can be segregated into distinct geochemical types as determined by the sodium, calcium, bicarbonate, and sulfate content.
- Dissolved silicon increases to the south while dissolved strontium decreases.
- Stable isotope data support a recharge-source elevation range from about 6,000 to 8,000 feet, the central to western edge of the Pajarito Plateau.

Data and information derived from this work provide additional lines of evidence for assessing water-quality impacts, investigating contaminant flow paths, and natural attenuation.

Investigation of Background Perchlorate in Groundwater

The LANL Oversight Office collected 76 samples that completed the data acquisition portion of their background perchlorate in ground water investigation. The Office used aquifer type, pristine water-quality condition, and groundwater age to determine appropriate background sampling stations. We used the more sensitive analytical method Liquid Chromatography/Mass Spectrometry to obtain reliable detection limits below 1 ppb. The data were used to determine a provisional upper tolerance limit (UTL) of 0.44 ug/L (ppb). The UTL is equivalent to the mean of the data set plus two standard deviations. The UTL will be used by NMED, and potentially others (DOE, municipalities), to determine if perchlorate levels are from natural or anthropogenic sources. This 0.44 ug/L UTL is approximately ten times below EPA's 1999 low-end Interim Guidance of 4 ug/L.

The LANL Oversight Office also collected and analyzed seven precipitation samples using the LC/MS/MS method to rule out the presence of trace levels in precipitation as a direct source for the perchlorate in ground water. Perchlorate was not detected in these samples above the method detection limit (MDL) of 0.033 ppb. In late August of 2004, we collected and analyzed two additional rain samples using a method similar to LC/MS/MS but with an MDL of 0.0012 ppb or about 30 times lower than that of the LC/MS/MS method. Results, though preliminary and not yet validated, show that perchlorate may be present in these precipitation samples at 0.006 ppb and 0.017 ppb. These findings will aid in determining a site-specific background for perchlorate and may assist in determining a statewide drinking-water standard.

Watershed Initiative Grant

The LANL Oversight Office applied for EPA's 2004 Watershed Initiative Grant from the Office of Wetlands, Oceans, and Watersheds. The DOE Oversight Bureau also received a Letter of Nomination from New Mexico's Governor, Bill Richardson. Included in the package was a work plan and budget for *Measuring and Communicating Changes in the Los Alamos and Pueblo Canyon Watershed since the Cerro Grande Fire, Los Alamos County, New Mexico*. This watershed was highly impacted by the Cerro Grande Fire and is the major pathway for the transport of contaminated sediments from LANL. In all, 26 proposals were submitted and nine were funded. The DOE Oversight Bureau did not receive the grant for 2004, but was asked to resubmit a proposal in 2005.



SANDIA NATIONAL LABORATORIES

Legacy Waste Cleanup and Waste Management

Sandia National Laboratories (SNL) continued work to remediate contaminated or potentially contaminated sites. The facility proposed the removal of 18 Solid Waste Management Units (SWMUs) and 25 Areas of Concern (AOC) sites from its Resource Conservation and Recovery Act permit. SNL Oversight Office staff reviewed the No Further Action Rounds 1 through 4 for drains and septic system sites, which included 2 of the above SWMUs and 23 of the above AOCs. The environmental data reviewed showed that most sites from Rounds 1 thru 4 had widespread elevated volatile organic compound concentrations, particularly 2-butanone and toluene, but these values were below residential screening levels. This information was shared with the NMED, Hazardous Waste Bureau. The SNL Oversight Office was unable to conduct independent sampling of any drains and septic system wells due to budget constraints. The NMED, Hazardous Waste Bureau is reviewing the proposals, but at the end of 2004, had not approved permit modifications for any of the sites.

Chemical Waste Landfill

Monitoring wells CWL-MW7 and CWL-MW8 are regional groundwater wells that were drilled in 2003 and sampled for the first time by the SNL Oversight Office in 2004. No volatile organic compounds were found to be elevated above each

compound's respective detection limit. Several Target Analyte List (TAL) metals were elevated, although these concentrations appeared to be naturally occurring in the groundwater. The SNL Oversight Office values were consistent with the concentrations reported by SNL during their December 2003 sampling.

Groundwater at Technical Area V

The SNL Oversight Office and NMED management attended a tour of Technical Area V. The below ground storage facilities, some known as *Yard Holes* (Figure 3), were examined as part of the tour. The SNL Oversight Office reviewed the latest drafts of the SNL Technical Area V Site Conceptual Model and Work Plan. The work plan is currently in a draft stage and infers that a combination of monitored natural attenuation and monitoring is the potential preferred choice for the site remedy. SNL Oversight Office staff will continue to participate in the development and implementation of appropriate institutional controls.

Long Term Care Planning

One of the more important planning activities at SNL is related to long-term care or stewardship issues. The SNL Oversight Office helped DOE develop the assessment protocol for SNL's long-term care program. Much of the assessment will focus on management systems and general planning issues. The DOE assessment report will be completed by spring or summer 2005.



Figure 3. Technical Area V “Yard Holes”

The SNL Oversight Office participated in a number of meetings with DOE and SNL on planning for this transition. Public outreach and communication are key issues to the success of the long-term care program. Here are some methods that SNL will use to inform the public:

- SNL will have a display at the National Atomic Museum.
- A long-term poster will be part of SNL's traveling exhibit.
- Informational sessions will be presented to members of the public.
- SNL will provide on-line access to updates on stewardship activities.

The SNL Oversight Office is a member of the Long Term Environmental Stewardship (LTES) team. In August 2004, the LTES team evaluated the latest version of SNL's Information Management System model flow chart. The Geographical Information Systems (GIS) is considered to be the biggest identified gap in the SNL information system. A preliminary draft of the gap analysis was provided to Sandia managers in October 2004 and is continuing to be revised. The SNL Oversight Office staff will continue to attend meetings with SNL and DOE, make presentations at these meetings, and ensure information is made available to the public.

The SNL Oversight Office has been active on each of the LTES task groups:

- Administration and Management
- Monitoring and Maintenance
- Institutional Controls
- Information Management
- Outreach.

Environmental Monitoring

In 2004, the SNL Oversight Office investigators continued to operate four independent continuous air-monitoring stations - one at the Mixed Waste Landfill and three near the perimeter of Kirtland Air Force Base. We also monitored for gamma radiation, groundwater, surface water, vegetation, and soil.

Direct Penetrating Radiation

During 2004, the SNL Oversight Office discontinued using TLDs and has chosen the Electret™ passive ion chamber system to measure gamma radiation. The Electret™ consists of an electrically charged Teflon disk that when hit by gamma radiation, the disk discharges some of the voltage. The amount of voltage drop is directly proportional to how much radiation has hit the disk.

The Electrets™ provide real-time measurements and can be read in the field. TLDs have to be collected and then sent to an analytical laboratory for reading, which adds weeks to the time it takes to receive the results. By doing the measurements out in the field, uncertainty is lowered by reducing the introduction of other possible exposures (i.e. shipping), and by having immediate data, a faster response to a possible release can be reported.

The Electret™ passive ion chambers are co-located with SNL TLDs at all monitoring locations. The Electret™ values have trended well with the dosimeter values but on average are higher than the TLD values. The two-sigma error bars for all data overlapped at all locations. As a continuing assessment of the two measurement methods, the data collected by the Electrets™ will be compared to TLD data

collected by SNL and previous SNL Oversight Office data.

Airborne Radionuclide Monitoring

The SNL Oversight Office continued to conduct biweekly air particulate filter exchanges as well as quarterly tritium silica gel samples at four air monitoring stations at the perimeter of Kirtland Air Force Base and at the Mixed Waste Landfill throughout the year.

The tritium data, when trended with previous data, reveal cyclical tritium flux variations at the Mixed Waste Landfill. This flux is greatest during the warmer humid summer months and tapers off during the colder, dryer winter months.

Storm Water Monitoring

The SNL Oversight Office staff collected storm water samples at Solid Waste Management Units using single-stage environmental liquid samplers. SWMU 28-2 (the Mine Site) showed elevated gross alpha/beta, and radium-226, and radium 228 and appears to have a depleted uranium component. SWMU 28-2 has been submitted by SNL to NMED for No Further Action status. The sample collected from the north side of the Burn Site show elevated levels of total metals, including aluminum, arsenic, lead, and vanadium. The SNL Oversight Office recommended to SNL that best management practices should be installed to minimize contaminant transport from these SWMUs and additional monitoring be conducted to determine their effectiveness. The Office also recommended that dissolved metals be included in the Burn Site analytical suite for comparisons to the New Mexico Water Quality Standards.

As a continuation of 2004 sampling, the SNL Oversight Office will conduct more sampling during the 2005 storm season and include isotopic uranium analysis on samples collected in 2005. Isotopic uranium data is used to help determine whether radioactivity in the sample is from naturally occurring uranium, which is found in the granite in this area, or if it is man made (i.e. anthropogenic).

Site-wide Monitoring Wells

SNL is now required to analyze for perchlorate in water, based on the draft Consent Order issued in December 2003. The SNL Oversight Office began a study with thirty-four samples from on and offsite

monitoring wells. Many wells had detections but most were below 1 ppb or $\mu\text{g/L}$. A follow-up study had only 15 additional sampling events to the end of December 2004. The Oversight Office is using EPA method SW-846, 8321A (modified) to analyze for perchlorate. This method was chosen because the detection limit is below 1 $\mu\text{g/L}$ as compared with EPA method 314.0, used by Sandia on samples from wells identified in the Compliance Order of Consent, which has a detection limit of 4 $\mu\text{g/L}$. The LANL Oversight Office and LANL conducted an analytical method evaluation last year that showed EPA method SW-846, 8321A (modified) is more reliable below 4 $\mu\text{g/L}$.



WASTE ISOLATION PILOT PLANT

Environmental Monitoring

The Waste Isolation Pilot Plant (WIPP) is a geologic repository located near Carlsbad, New Mexico, owned by the DOE. WIPP became operational in March 1999 for the underground disposal of transuranic radioactive wastes generated by national defense programs.

This fiscal year, the NMED, DOE Oversight Bureau re-opened its onsite office. The WIPP Oversight Office will be conducting technical oversight, and environmental monitoring to independently validate and verify compliance issues. The DOE and State of New Mexico have agreed to an initial 5-year term of operation for NMED's WIPP Oversight Office to conduct four major elements of monitoring. The four major elements of the Oversight Office's monitoring program are air, surface water, groundwater, and facility effluent sampling. Effluent monitoring has been established to determine whether radionuclides are being released from WIPP operations into the environment.

An accidental release from the underground air effluent through the exhaust stack is the most likely pathway for accidental radioactivity releases from WIPP. These scenarios are postulated in the WIPP Safety Analysis Report (U.S. DOE, 1999). If an underground mine operations accident were to occur, air samples would be collected from Stations A and B, the final release points of the underground repository exhaust

ventilation. The WIPP Oversight Office's primary focus for its first year is to prepare a program for air effluent sampling by 2005.

The operations at the WIPP facility are regulated under provisions of 40CFR191 Subpart A which establishes 25 mrem/year as the maximum dose to the public from all sources, and 40CFR61 Subpart H which establishes 10 mrem/year as the maximum dose to the public resulting from air emissions.

The WIPP facility has three effluent emission compliance points that could release airborne radionuclides to the atmosphere. A monitoring station has been established for each emission point, designated Stations A, B, and C.

The air sampling station at the top of the exhaust shaft is referred to as Station A. Station A consists of three sampling systems or skids, each skid with a shrouded probe and three legs (Figure 4). Each leg leads to a filter designed to accumulate a sample of particulate material discharged through the exhaust shaft. To demonstrate compliance with these regulations, the management and operation contractor continuously samples the effluent air at Station A and analyzes the samples for transuranic radionuclides.

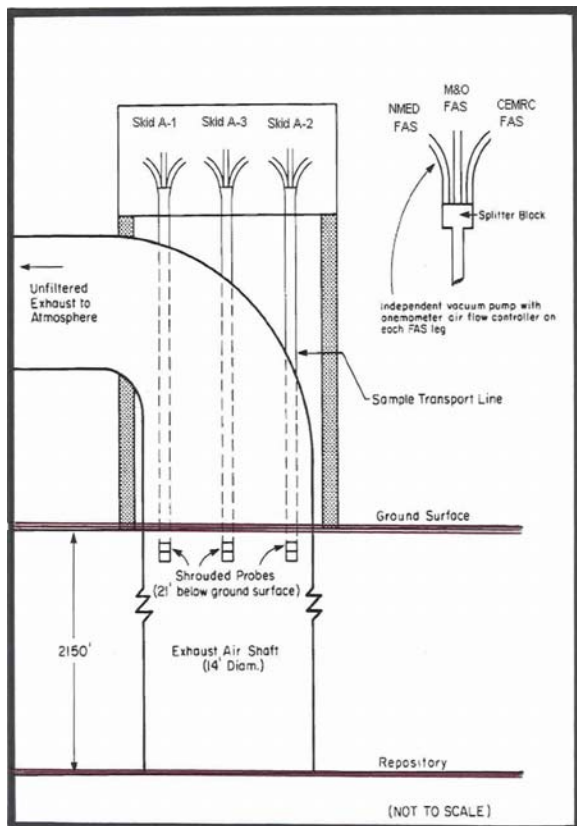


Figure 4: Station A Schematic Drawing of Sampling Probes

The WIPP Oversight Office will collect a sampling filter at Station A on one of the legs on the skid of record, which currently is skid A-3. A contracted laboratory approved by the State of New Mexico will independently analyze the particulates on the filters for the DOE, stakeholders, and the public.

The mission of the WIPP Oversight Office's Station A monitoring is to verify and validate WIPP's Management and Operating Contractor's results. This will insure that WIPP is in compliance with radiation dose limits from the National Emissions Standards for Hazardous Air Pollutants.



SUMMARY

Public Outreach and Information Transfer

The DOE Oversight Bureau provided the following activities during 2004.

RACER Project

The Risk Analysis, Communication, Evaluation, and Reduction (RACER) Project expects to achieve user-friendly, multi-media, environmental data access at LANL. This will benefit the public, regulatory agencies, and the Oversight Bureau's monitoring efforts primarily by allowing us to focus limited monitoring resources on priority canyons or contaminant sources.

Interaction with Pueblos

Interactions with Santa Clara San Ildefonso Pueblos, and Isleta Pueblos enhance their environmental monitoring programs. The Bureau's technical poster presentations and published reports provide additional information on regional perchlorate and PCB levels and the effects of the Cerro Grande Fire on offsite contaminant transport at LANL. The presentations on the erosion of contaminated sediment packages in Pueblo Canyon have resulted in commitments from LANL and DOE to develop and implement erosion stabilization actions there. Presentations on the chemistry of White Rock Canyon Springs, and age dating in ground waters of the Pajarito Plateau enhance the understanding of these waters.

Compliance Agreement

The Bureau's participation was instrumental in the development of the Federal Facility Compliance Agreement between EPA and LANL. It will result in the collection of much needed storm water quality data and improved stabilization of waste disposal sites. Assistance with the development of LANL's multiple groundwater work plans and groundwater-sampling efforts will increase the efficiency and effectiveness of LANL's environmental cleanup and site-wide monitoring program. Mapping of the Cerro Grande Fire plume intensity validated the Embudo Valley residents concern that air quality in the valley was not adequately monitored during the fire.

Environmental Stewardship

Involvement with SNL's Information Management programs has prompted the development and implementation of SNL's on-line information system. Public outreach efforts in the area of Long Term Environmental Stewardship (LTES) have increased the public's involvement with the understanding and support of SNL's LTES strategies. Published reports on ambient air monitoring at SNL provide documentation that the radiological effective dose equivalent values have been well below the applicable regulatory criteria.

Environmental Monitoring

The DOE Oversight Bureau provided the following activities during 2004.

Radiation Measurements

A more cost efficient and accurate method of measuring direct gamma radiation at all DOE facilities was evaluated and implemented. The Bureau's ambient air monitoring will continue to be used to validate LANL's ambient air monitoring program and SNL's air modeling used for calculating the effective dose equivalent values.

Perchlorate

Continued environmental monitoring of sites suggested by SNL for No Further Action (NFA) status provides increased reliability of the characterization of these sites. The Bureau's monitoring of groundwater wells has provided some indication of a perchlorate concern and if substantiated with continuing sampling, the discovery will allow SNL to address this issue proactively.

Storm Water Program

Effective methods for monitoring stormwater below solid waste management units at both SNL and LANL were used to determine if stabilization measures are adequately controlling contaminant transport at those sites or need to be reevaluated. The Bureau's storm water monitoring program is used to verify and validate all facility watershed and site-specific monitoring programs and to supplement them with alternate methods and monitoring locations. Also, models of storm water flow in Pueblo Canyon at LANL are created to estimate changes in contaminant transport off-site on an annual basis.

Cesium Studies

Studies of contaminant concentrations in water and aquatic bryophytes at springs below LANL show that while there is evidence of anthropogenic influence on the Four Series springs we could find no evidence that ¹³⁷Cs is present in spring waters or aquatic mosses.

Sampling Methods

Split and independent sampling of drinking water production wells, monitoring wells, and springs in and around LANL, including San Ildefonso Pueblo, helps to validate LANL's monitoring program and enhances all parties understanding of local and regional ground water quality.

Discharge Monitoring

The Bureau's point source National Pollution Discharge Elimination System monitoring results in voluntary improvements in radioactive and high explosive wastewater treatment systems by DOE. These include installing new treatment technologies, replacing old piping systems to prevent cross-contamination and leaching of contaminants back into discharges of treated waters, and relocating discharge sampling points to a location more representative of the actual discharge.

WIPP Oversight Office

The re-opening of the WIPP Oversight Office will allow NMED to conduct technical oversight and environmental monitoring to independently validate and verify compliance issues, technical monitoring, and sampling information. The primary focus for its first year is to prepare a program for air effluent sampling by 2005.

