LA-UR-14-28025
Approved for public release; distribution is unlimited.

Title:	Long-Term Strategy for Environmental Stewardship and Sustainability 2014 Almanac
Author(s):	Lopez, Lorraine Bonds
Intended for:	Annual report Environmental Programs
Issued:	2014-12-19 (rev.2)

LONG-TERM STRATEGY FOR ENVIRONMENTAL STEWARDSHIP AND SUSTAINABILITY

2014 ALMANAC

Los Alamos
NATIONAL LABORATORY
EST. 1943

CLEAN THE PAST
CONTROL THE PRESENT
CREATE A SUSTAINABLE FUTURE

FULFILLING THE GRAND CHALLENGES

GRAND CHALLENGES

Collaborate with our stakeholders and tribal governments to ensure that the Laboratory's impact on the environment is as low as reasonably achievable.

Remove or stabilize pollutants from the Manhattan Project and Cold War eras.

Protect water resource quality and reduce water use.

Eliminate industrial emissions, discharges, and releases to the environment.

Protect human and environmental health by managing and restoring lands.

Produce zero radioactive, hazardous, liquid, or solid waste.

Use energy efficiently while creating sustainable energy sources.

Cavates on Laboratory land were occupied by ancestral cultures over 1000 years ago.

INTRODUCTION TO THE ALMANAC

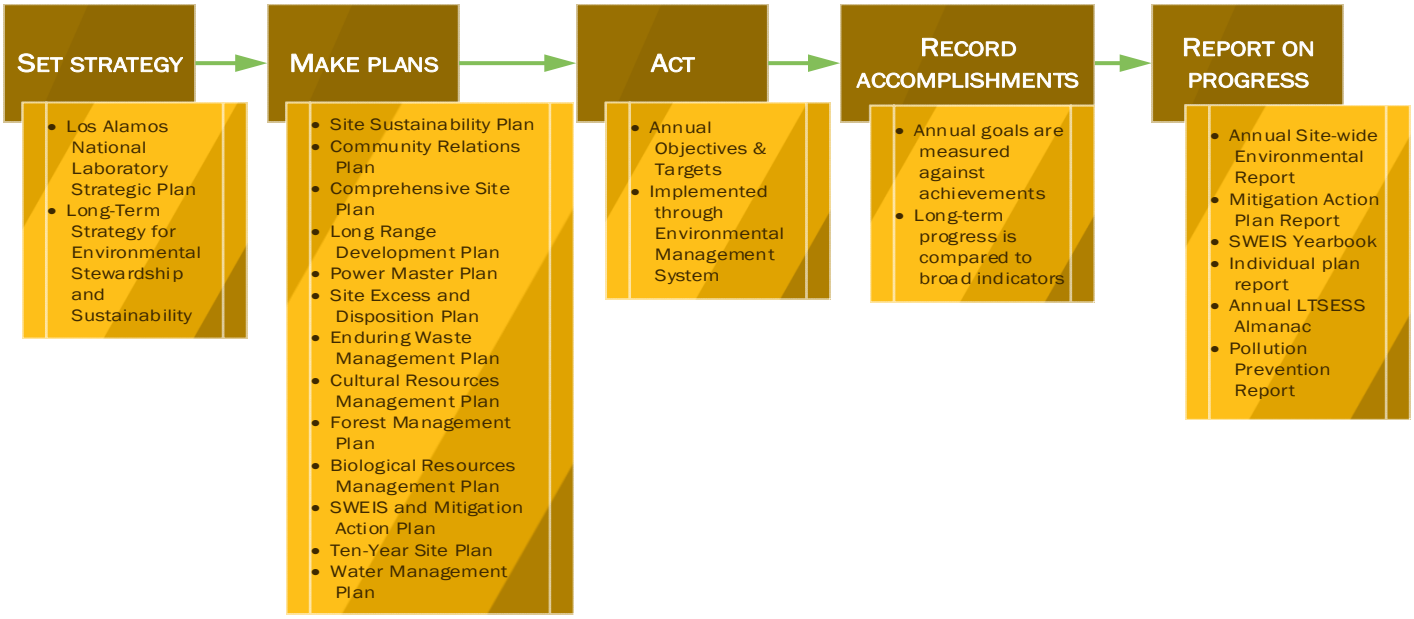
Los Alamos National Laboratory (the Laboratory) has a tiered process for setting and achieving environmental and sustainability goals that is rooted in the Laboratory Strategic Plan, which has four overarching goals:

1. Deliver national nuclear security and broader global security mission solutions
2. Foster excellence in science and engineering disciplines essential for national security missions
3. Attracting, inspiring, and developing world-class talent to ensure a vital future workforce
4. Enabling mission delivery through next-generation facilities, infrastructure, and operational excellence

These goals are underlain with the values of integrity, teamwork, service, excellence, stewardship, safety, and security. To fulfill the goals of the Strategic Plan, an interrelated set of strategy processes describe long-term approaches to operate, maintain, and improve various aspects of Laboratory activities.

- The Long-term Strategy for Environmental Stewardship and Sustainability (LTSESS) defines Grand Challenges that must be addressed year by year to minimize the impact of Laboratory operations on human health and the environment. These challenges address the overarching strategies to clean up the past, control the present, and create a sustainable future.
- The Long-Range Infrastructure Development Plan defines the long-term strategies necessary to create and maintain a flexible, efficient, and sustainable work infrastructure.
- The Ten-Year Site Plan provides an annual mechanism to report site infrastructure development plans to the U.S. Department of Energy (DOE) and the National Nuclear Security Administration (NNSA).
- The annual Site Sustainability Plan sets goals and reports on the Laboratory's progress in achieving the nine sustainability goals set by DOE.
- The Power Master Plan projects the Laboratory's current and future energy needs and a strategy to maximize efficient and sustainable delivery.
- The Site Excess and Disposition Plan outlines a strategy to consistently eliminate obsolete workspaces and reduce long-term maintenance costs.
- The Enduring Waste Management Plan sets the strategy and goals for providing long-term waste management solutions to support a flexible and sustainable mission.

FROM STRATEGY TO RESULT



Progress on such a long-term objective horizon requires a commitment to objectives and a well-honed implementation process. These interrelated processes are essential in the alignment of programs with overall Laboratory goals but do not, in themselves, ensure their achievement. To this end, the managers of these processes meet regularly to coordinate strategies, set objectives and targets for achieving those strategies, and measuring progress. The formal mechanism to set environmental and sustainability objectives and targets is the Laboratory's International Organization for Standardization (ISO) 14001–certified Environmental Management System (EMS).

Each of the following objectives has specific, measureable targets that support institutional strategies and that are measured regularly:

- Implement and maintain a site cleanout and workplace stewardship program
- Implement an enduring waste management program
- Implement and maintain a green infrastructure and maintenance program
- Design and implement an integrated site management plan
- Implement energy and water conservation

ENVIRONMENTAL ROAD MAP

The Environmental Protection Division provides leadership in environmental protection services and compliance support to anticipate and manage environmental risk in support of the mission. To best align our staff and resources with our partners in meeting the Grand Challenges, we are developing an environmental road map. The road map has specific, tangible milestones that provide feedback about progress toward the ultimate goal of a continuing, self-sustaining healthy ecosystem. We lead the Laboratory integrated Grand Challenges' efforts by planning our Environmental Protection Division work scope and yearly activities as stepwise, deliberate actions to reach our common goals.

Black bear wanders the Laboratory backcountry.

Trails collaboration on Main Hill Mesa.

GRAND CHALLENGE 1: Collaborate with our stakeholders and tribal governments to ensure that the Laboratory's impact on the environment is as low as reasonably achievable.

2013–2014 Communications Plan

The Laboratory is committed to leading by example by minimizing our impacts to human and environmental health and by inviting and engaging our community to provide ideas, feedback, and examining our processes.

In 2014, our plan focused on informing stakeholders and collaborating with neighbors.

Accomplishments

Our programs thrive by providing the public with opportunities to see our work in person and to learn about the scope and decision-making that underlie our actions. In 2013 and 2014, we facilitated over 1000 environmental outreach events and fulfilled numerous requests, including 37 technical consultations, 203 meetings and presentations, 114 tours, 160 document requests, and 87 media interactions.

One important tool the public can use is the Intellus database. The web interface was upgraded, improving access to over 14 million environmental data records.

Next steps. In 2015, we will collaborate with stakeholders on shared goals.

160 documents, maps, posters, and fact sheets

203 meetings

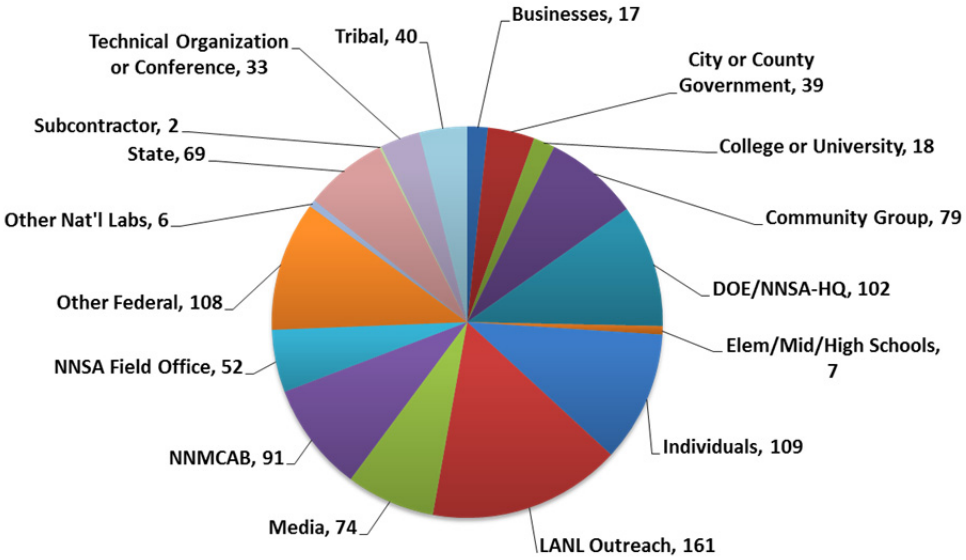
145 project updates and technical presentatations

114 site visits and tours

37 field, data analysis, and technical assistance activities

Showing the public how we interface with the land and explaining our work are important means to get feedback and demonstrate our stewardship of taxpayer dollars.

A Laboratory water expert assists students in learning how to sample water at the Rio Grande.



Community leaders tour the Sanitary Effluent Reclamation Facility (SERF) that recycles over 300 thousand gallons of sanitary wastewater a day to use in cooling super computers.

During a public tour of Sandia wetlands, a Laboratory subject matter expert demonstrates water outfall protections and explains chromium remediation efforts.

Sediment is removed from Los Alamos Canyon Weir and tested for contaminants.

GRAND CHALLENGE 2:
Remove or stabilize pollutants from the Manhattan Project and Cold War eras.

The Compliance Order on Consent between the Laboratory and the New Mexico Environment Department (NMED), in concert with the Individual Permit for Storm Water issued by the U.S. Environmental Protection Agency (EPA), governs the investigation and cleanup of legacy contamination from the Manhattan Project and the Cold War eras. The effort started with an inventory of 2123 potential sites that need to be investigated and possibly remediation. In the last 2 years, remediation programs at the Laboratory have focused on three projects to keep contaminants from affecting human or environmental health.

1. Ship 3706 cubic meters of transuranic waste from the Laboratory to remediate and close Material Disposal Area G. To date, the project has shipped 3323 cubic meters of transuranic waste to the Waste Isolation Pilot Plant.
2. Control storm water that could move across contaminated sites and disturb contaminants.
3. Protect groundwater.

As the remediation program works through the over 2000 original legacy-waste sites, approximately 700 sites, including many of the most complex sites, remain to be remediated. The goal is to complete cleanup of each site so that NMED can issue a finding of no further action or to implement sufficient controls to ensure the stability of contaminants. In 2013, NMED granted certificates of completion for 15 sites.

ACCOMPLISHMENTS

The National Pollution Discharge Elimination System (NPDES) Individual Permit for Storm Water Discharges (IP) issued by EPA covers 405 of the legacy-waste sites monitored at 250 locations (known as site monitoring areas [SMAs]). The Sites must be managed to prevent the transport of contaminants to surface waters via storm water runoff. The Storm Water Program completed the installation of enhanced control measures at 10 SMAS in 2013 and 11 SMAs in 2014.

The IP prescribes effluent limitations, coupled with a comprehensive inspection and monitoring program, for the 405 sites. In 2013, the program installed 93 additional control measures at 37 SMAs and collected baseline confirmation samples at 55 SMAs. Seven SMAs qualified for no further monitoring. Some target action levels (TALs) were exceeded, initiating corrective action at 48 SMAs. Additionally, 46 enhanced control measures were installed and implemented at 10 SMAs. Corrective action was completed at 10 SMAs.

To chronicle the progress of activities under the IP, the Laboratory updates the IP website for each milestone: http://www.lanl.gov/community-environment/environmental-stewardship/protection/compliance/individual-permit-stormwater/index.php. Milestones include

- IP Compliance Status Report
- Annual IP Site Discharge Pollution Prevention Plan (SDPPP)

- A total of 127 IP corrective action screens
- Certified completion of six no exposure sites
- One alternative compliance request to EPA
- IP renewal application
- Sandia wetland performance report
- Chapter 6, “Watershed Monitoring,” of the Environmental Report
- Los Alamos/Pueblo performance monitoring report
- Compliance with Buckman Direct Diversion memorandum of understanding by supporting operational goals
- Updates to Revision 1 of the five-volume Storm Water Discharge Pollution Prevention Plan

Additionally, the project conducts public and technical meetings with stakeholders. Three were held in 2014.

Storm Water Remediation Fieldwork

Field staff completed the 2013 flood mitigation scope by repairing over 200 IP Sites and implementing watershed controls, including excavating the Los Alamos Canyon weir, repairing the Pueblo Canyon grade-control structure, repairing the upper Los Alamos ponds, and planting over 10,000 willows in Pueblo Canyon.

Public interest group collaborates on storm water controls in Sandia Canyon.

Additionally, sediment samples were collected in all canyons and on San Ildefonso property and Cochiti Lake; 25 gage stations were repaired as were access roads in Sandia, Mortandad, and Los Alamos Canyons.

Compliance with the IP also included routine fieldwork:

- Certified installation of 11 IP enhanced controls
- Completed 700 control measure inspections
- Collected 84 storm water samples at canyon gage stations
- Collected 30 storm water samples at IP SMAs
- Collected 58 storm water run-on samples in support of background report

Storm water controls are a major part of the runoff management plan at Technical Area 03.

Additionally, the program initiated a Boundary Protection Campaign to address public concerns about contaminant migration off DOE property and the effectiveness of various water and sediment control “defenses in depth.” To achieve the goal of zero migration of contaminants off-site, the program began fieldwork on sediment traps in Mortandad Canyon, planned sediment mitigations in lower Pueblo Canyon wetlands, and proposed seven projects to be completed over the next 2 years at or near boundary locations in the following canyons:

- Lower Sandia
- Portillo
- Water

- Upper Cañon de Valle
- Cañada del Buey
- Pajarito
- Ancho

Chromium

In the 1970s, the Laboratory used chromium to limit scaling in cooling towers for the Computing Center. Although environmentally neutral means were implemented in the 1980s, chromium contamination remains in the groundwater immediately below the Laboratory. Fiscal year (FY) 2013 and FY 2014 saw a shift in work related to the chromium contamination in groundwater, from detailed characterization of the contamination toward remediation. This shift involves tests of various remediation strategies that will be implemented in an integrated manner. Potential remediation strategies include pumping to remove contaminated groundwater from the aquifer, hydraulic containment of the plume, and in situ approaches that might include stimulation of naturally occurring microbes to convert the chromium to an immobile, nontoxic form. Reinjection of treated groundwater is also a likely component of the remediation strategy. Specific work activities included installing the first large-scale pumping well designed to pump up to 150 gallons per minute and initiating the drilling of six coreholes using sonic drilling technology to obtain undisturbed aquifer materials for testing.

Over 10,000 willows were planted to slow down surface water flow and retain sediments in Pueblo Canyon.

Post-September 2013 Flood Assessment and Response

The Laboratory conducted an extensive sediment sampling campaign to determine if deposits from the large and widespread flooding of September 2013 resulted in significant redistribution of contamination or increases in levels of contamination downgradient of the Laboratory. The results indicated that although detectable, concentrations of various contaminants are generally at or below levels present before the flooding and at concentrations well below action levels. The floods did, however, deposit over 6000 cubic yards of sediment in the retention basins in Los Alamos Canyon and eroded portions of an effluent-supported wetland in Pueblo Canyon. The Laboratory excavated the sediment in the Los Alamos Canyon retention basins to reestablish retention capacity and planted 10,000 willows in Pueblo Canyon that, once established, will restabilize the wetland.

Los Alamos Canyon weir performing as designed to retain as much sediment as possible during a major storm event.

Water sampling in canyon below the Sandia wetlands.

GRAND CHALLENGE 3:
Protect water resource quality and reduce water use.

Surface Water Protections

In addition to the IP, the NPDES Construction General Permit (CGP) Program regulates sediment and storm water discharges from construction activities that could disturb one or more acres. The CGP Program managed 32 Storm Water Pollution Prevention Plans (SWPPPs) in 2013 and 20 by end of July 2014.

Active outfalls are managed through the NPDES Industrial Point Source Outfall Permit Program that establishes specific chemical, physical, and biological criteria effluent must meet before water can be discharged. Eleven outfalls were listed on the Laboratory's permit in 2013 and 2014.

The NPDES Multi-Sector General Permit Program regulates storm water discharges from industrial activities and associated facilities. Thirteen facilities were managed under 11 SWPPPs in 2013 and 2014.

The Laboratory maintains a storm water gage station network that monitors flow and collects run-on and runoff samples from all the major canyons on DOE property. Sediment deposits resulting from each year's runoff events are sampled and compared with the results of previous years and used to guide necessary actions.

In 2014, a storm water management plan was developed for Technical Area 03 (TA-03) as well as a program for implementing the Energy Independence and Security Act Section 438.

Beginning a new practice of using Low Impact Development (LID) structures wherever feasible, the Laboratory installed its first engineered urban LID structure designed to process storm water from a parking lot west of the Otowi parking structure.

In outlying areas, crews completed construction of the Sandia Canyon grade-control structure, designed to prevent erosion and maintain saturated conditions in the Sandia Canyon wetland. Crews also constructed and maintained sediment traps in Mortandad Canyon, designed to reduce the probability of storm water runoff onto Pueblo de San Ildefonso land.

The Laboratory established an early notification system that provides information to operations at the Buckman Direct Diversion project, which diverts surface water from the Rio Grande for Santa Fe's drinking water. The system notifies operators of floods originating on DOE land that could enter the Rio Grande above the diversion.

Groundwater Protections

The Laboratory maintains a network of monitoring locations consisting of alluvial, intermediate, and regional groundwater well screens and springs and situated in monitoring groups across the Laboratory. Stations are sampled periodically to address specific project-area objectives.

The Laboratory began implementing interim-measures testing to evaluate the feasibility of pumping to remediate chromium contamination in groundwater and to collect data necessary to evaluate remedial alternatives.

The Laboratory completed construction of the Sandia Canyon grade-control structure, designed to prevent erosion and maintain saturated conditions in the Sandia Canyon wetland. Stability of the wetland is critical to the chromium remediation project because it supports stability of chromium still present in the wetland sediments.

The Laboratory also began implementing interim-measures testing to evaluate the feasibility of pumping to remediate RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) contamination in groundwater beneath TA-16 and to collect data necessary to evaluate remedial alternatives.

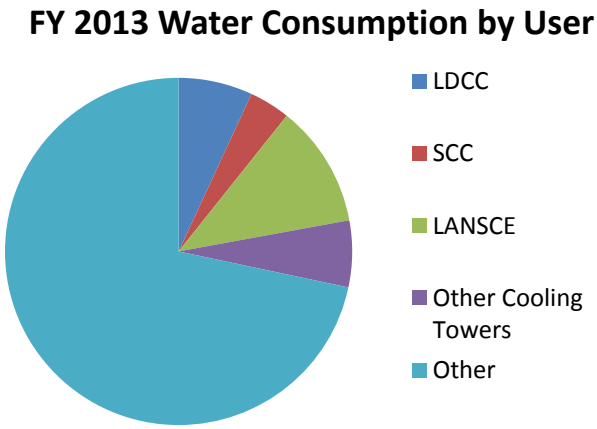
Agua es vida...the Rio Grande flows through White Rock Canyon.

The Laboratory continues to sample water-supply wells in the City of Santa Fe's Buckman well field and in Los Alamos County's water supply wells.

Finally, the Laboratory continues to sample groundwater from locations on the Pueblo de San Ildefonso.

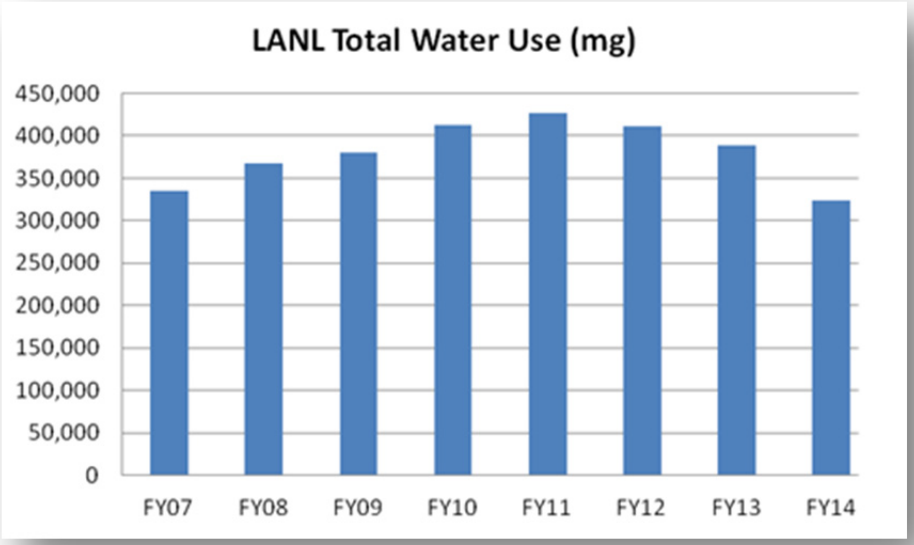
Institutional Water Use

In FY 2013, water use reduction was dependent on the operation of the Sanitary Effluent Reclamation Facility (SERF) and industrial water reuse at the Strategic Computing Center (SCC). SERF supplied 100% of SCC water demand from mid-April to September 2013. The Laboratory's total water use in FY 2013 was approximately 387 million gallons.



Of that total, 28% was used by SCC, Laboratory Data Communication Center (LDCC), and Los Alamos Neutron Science Center (LANSCE) cooling towers. Although water intensity has increased by approximately 21.6% compared with the FY 2007 baseline, largely from cooling towers that support increases in supercomputing, it decreased by 12% since FY 2012.

The Laboratory water usage represents approximately one-third of the total water usage in the regional aquifer. The 2008 Site-wide Environmental Impact Statement measures potential environmental impacts by comparing projections of utility resource requirements against utility system capacities. The Laboratory's annual water use ceiling, the system capacity, is 542 million gallons. Any water use exceeding this ceiling can be considered an indicator of an environmental impact, and further analysis is warranted. Water use below this ceiling is not expected to have any additional impacts to the regional aquifer.



Trends in water levels in wells reflect a plateau-wide decline in regional aquifer water levels starting in 1977 in response to municipal water production. No unexplained changes in patterns have occurred since this time. The decline is gradual and does not exceed 1 to 2 feet per year for most production wells. In areas where pumping has been reduced, water levels show some recovery. When pumping stops, the static water level returns in about 6 to 12 months. Hence, the water-level trends indicate no adverse impacts on long-term water supply production from groundwater withdrawals.

The Laboratory is focusing on several projects to further reduce water consumption:

- Reclaimed water – SERF can produce up to 110,000 kilogallons per year of reclaimed industrial water and is forecasted to produce all water needed by SCC until 2018.
- Leak detection – Biennial leak detection surveys and replacement of portions of the over-60-year-old system can identify leaks.
- Water meters – Fifty water meters were installed to collect data for water conservation targets.

- Water-saving fixtures – Water-saving fixtures were installed in High-Performance Sustainable Buildings and aligns with current Laboratory recommissioning schedules.
- Upgrades in domestic plumbing – Modern water-conserving fixtures will be installed as existing less-efficient fixtures fail.
- Air-cooled chillers for cooling towers – As water-cooled cooling towers are replaced, system engineers will evaluate options for water-conserving air-cooled systems.
- Increase water reuse cycle – A pilot project to reduce the amount of water discharged from cooling towers to prevent silica scale demonstrated that the cycles of concentration could be increased from the current 2 to 3, thus reducing water consumption by approximately 35%.
- Leak rates – In 2013, the metered leak rate was relatively small (~5%) compared with industry averages. One main water meter will be installed in FY 2014, effecting three desired outcomes:
    1. an easy to access and use water model, including a "water balance" to help determine unknown uses, water losses, and possible system inefficiencies;
    2. testing protocols and analysis methods to identify further unknown uses; and
    3. further detailed analysis of existing operations, focused on large water-consuming activities (typically industrial) to update relevant and feasible opportunities from the last assessment.

Major upgrades to the SCC support warm water cooling technology for the first phase of liquid supercomputing. Using warmer water requires less energy, thereby saving both energy and water.

Given the low environmental impact from the Laboratory's current water-level usage, the Laboratory's overall sustainability efforts focus on a cost-effective life-cycle approach that emphasizes energy efficiency to reduce the Laboratory's regional impact on water use associated with energy generation.

Next Steps

The Laboratory is implementing a project to reduce potable water use in selected cooling processes and in steam-generation equipment. In addition, the Laboratory has collected water conservation measures from water assessments in over 80 facilities. If all the Laboratory facilities were upgraded, 8 million gallons of water per year could be saved, amounting to 2% of the average yearly water consumption over the last 10 years. The payback period is over 100 years. In light of this return on investment (ROI), the Laboratory has adopted an incremental approach to upgrade plumbing fixtures as they fail. The Laboratory is investing in water conservation measures that have a cost-effective life cycle and focus primarily on high ROI energy efficiency measures to reduce the Laboratory's impact on water use associated with energy generation and on the region.

ELIMINATE EMISSIONS

Frequent filter changed ensure accurate emissions calculations.

GRAND CHALLENGE 4: Eliminate industrial emissions, discharges, and releases to the environment.

No concerns. The Laboratory submitted its tenth Operating Permit Annual Compliance Certification report to NMED and EPA on January 29, 2014. The certification to EPA and NMED states the Laboratory met all permit conditions in 2013 related to air emissions. NMED has inspected the Laboratory every year for the last 10 years and has identified no issues or concerns.

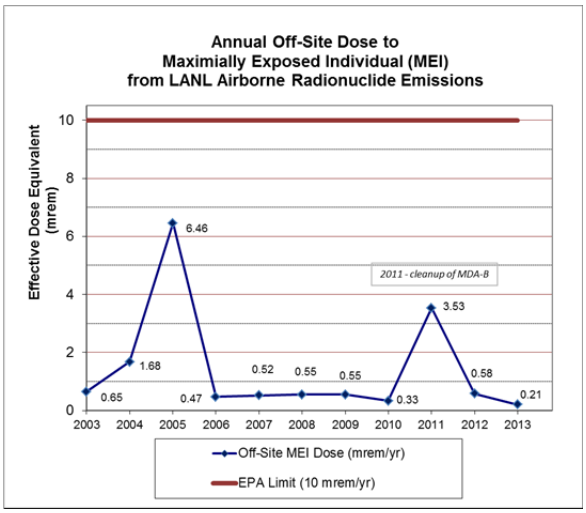
Well below permit limits. The Laboratory submitted the Title V Operating Permit Semi-Annual Emission Report for July–December 2013 on March 26, 2014; the Annual Emission Inventory report for calendar year 2013 to NMED on March 26, 2014; and the Semi-Annual Emission Report for January–June 2014 to EPA on August 28, 2014. These reports indicate Laboratory operations are well below permit limits.

One deviation. The Laboratory submitted the Operating Permit Semi-Annual Monitoring report for July–December 2013 on February 6, 2014, and for January–June 2014 on August 12, 2014. No deviations were reported for the first period, and one deviation was reported for the second period. The deviation occurred when the phone line for the asphalt plant continuous differential pressure–monitoring system was upgraded to fiber optics. The existing data logger system could not transmit information over the fiber optic network and went offline for several days. The data logger was rerouted to a backup phone line.

Below permitted levels. As documented in quarterly beryllium reports to NMED, beryllium stack monitoring at the Beryllium Technology Facility, demonstrated beryllium emissions were well below permitted levels.

Lowest radioactive air emissions in 20 years. For calendar year 2013, radioactive air emissions were the lowest in 20 years; the off-site dose was 0.21 millirem to the maximally exposed individual, contributing only 2% of the 10-millirem limit per year EPA imposes on DOE facilities.

Upgrades remain within limits. An analysis of Standard 1027 Dose Assessment Changes for Radiological Materials demonstrates that the planned new Radioactive Liquid Waste Treatment Facility stacks and the Radiological Utility Laboratory and Office Building can continue improvements and operations without significantly affecting off-site doses. Both the DOE Field Office and EPA Region 6 have accepted the analysis. The Laboratory continues to be a “minor emissions source” under EPA regulations.



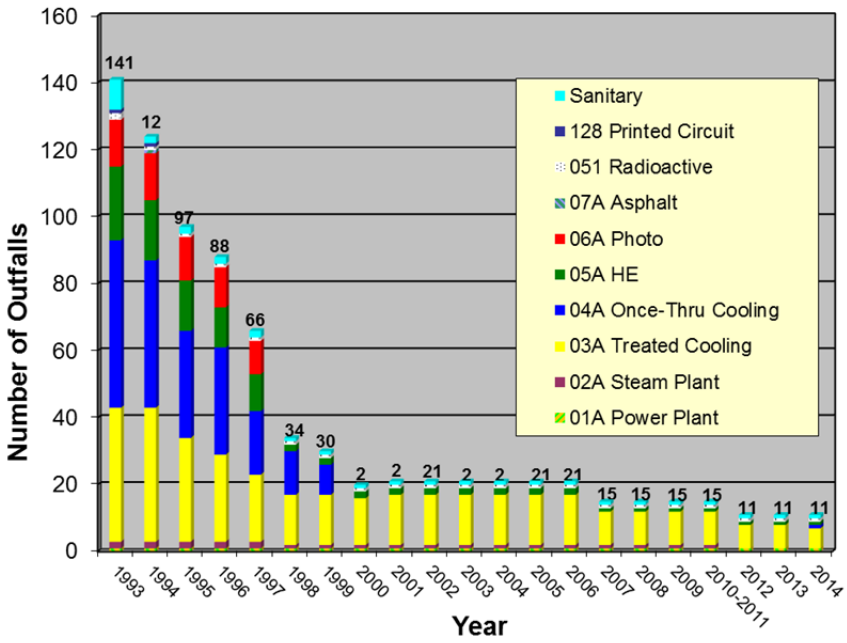
Leaks repaired. Over 240 refrigeration equipment service records were received during FY 2014; 22 chillers with greater than 50-pound charges were reported leaking. To minimize releases, Environmental Protection (ENV) worked with facility and equipment owners either to repair the leaks or to dispose of the equipment within the 30-day EPA deadline. Two refrigerant inventory assessments were conducted in FY 2014. Refrigerant accountability for both assessments was 100%, helping to ensure releases are minimized or prevented.

Minimize the big bang. Sodar, a new meteorological monitoring system, is fully operational, providing wind speed, direction, and temperature data up to 1000 meters above the ground surface. These data will be used to schedule high explosives test shots to minimize noise impacts to the public.

Toward a zero liquid discharge goal. The Laboratory is working with the EPA to renew the NPDES permit for 11 mission-critical industrial and sanitary outfalls. The new permit includes more monitoring requirements and more stringent effluent limits, some of the toughest in the country (see table below). To strengthen compliance, ENV worked with Laboratory maintenance personnel to establish a centralized cooling tower management and preventive maintenance plan. Several corrective actions have been completed, including replacing faulty equipment, establishing a rigorous inspection schedule for chemical feed pumps, and conducting real-time monitoring.

Contaminant of Concern	NPDES Permit Limit	Storm Water TALs	National Water Quality Criteria	Other New Mexico Permittees	Drinking Water MCL	Ground-water Standard	RCRA UTS
Total Copper	0.14 µg/L	4.3 ug/L (dissolved)	Determined using the Biotic Ligand Model (BLM)	24.5 µg/L	1300 µg/L	1000 µg/L	NA
Total Zinc	2.2 µg/L	42 ug/L (dissolved)	120 µg/L	200 ug/l	5000 ug/l	10,000 µg/L	2610 ug/L
Total PCBs	0.00064 ug/L	0.00064 ug/L	0.014 µg/L	Report	.5 µg/L	1 µg/L	100 ug/L

ENV initiated an outfall reduction program that succeeded in eliminating discharges to the environment. From 1993 to 2014, the Laboratory reduced the number of outfalls from 141 to 11 (see chart). At the same time, the Laboratory continues to pursue a zero liquid discharge (ZLD) goal to further reduce the quantity of water discharged to the environment. Of the remaining 11 outfalls, 2 are managed as ZLD, that is, they do not discharge to the environment.



The Laboratory constructed and placed the SERF into service to improve the quality of wastewater treatment and increase the number of cycles (of use) before water is discharged to the environment. After receiving treated effluent from the Laboratory's sanitary wastewater treatment plant, SERF further treats it before it is sent for use in cooling towers that previously required potable water.

The Laboratory participates in the national bluebird project to monitor reproductive rates.

GRAND CHALLENGE 5: Protect human and environmental health by managing and restoring lands.

DOE/NNSA Los Alamos Field Office manage the Laboratory in compliance with federal laws. Our environmental staff review and monitor the Laboratory's varied activities to protect the diverse natural environment and rich historical setting.

In consultation with the New Mexico State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation, DOE implemented a Cultural Resources Management Plan (CRMP), which establishes a set of procedures for effective compliance with historic preservation laws specific to the cultural heritage at the Laboratory. Our staff of cultural resources specialists meet the qualifications set forth in the Secretary of the Interior's requirements. As of September 2014, more than 90% of Laboratory property has been intensively surveyed for cultural resources. About 1600 archaeological sites, primarily Ancestral Pueblo in origin and dating from the 13th through 15th centuries, and 500 historic buildings, dating from the Manhattan Project and early Cold War years, have been identified.

In October 2013, the U.S. Fish and Wildlife Service (USFWS) listed the Jemez Mountains salamander as endangered. Laboratory wildlife biologists proactively worked with the DOE and USFWS to identify potential habitat areas to accomplish the mission of protecting the environment and to ensure compliance with regulations.

ACCOMPLISHMENTS

Outreach. A new exhibit that opened September 17, 2014, at the Bradbury Science Museum was designed, developed, and installed by staff from five Laboratory directorates, three of the Accord Pueblos, Highlands University, and the Americorps program. The exhibit focuses on cultural resources, wildlife studies, climate change and tree mortality, and land use and sustainability efforts.

A Laboratory biologist discovered an open pipes/bird mortality issue at the Laboratory. The team researched and solved the problem on Laboratory property and published a peer-reviewed journal article in *Western North American Naturalist*. Learning about this issue at the Laboratory and conducting further research showed that open pipes in fencing and many other uses posed a significant threat to birds on a very large scale. This discovery and its mitigation created a big win for avian conservation efforts.

Public Education. Cultural resources management staff routinely present information on compliance, awareness, historical properties, and historical preservation activities. Small-scale tours of historical properties are given to a variety of public, professional, and government groups. In FY 2014, members of the National Conference of SHPOs and the Federal Facilities Task Force toured cultural resource sites at the Laboratory. National news coverage included visits by outlets such as CBS News, Fox News, National Public Radio, and the television show Jeopardy. Additionally, cultural resources staff supported requests by local New Mexico television stations for newsworthy materials, including KRQE's piece that profiled a significant Cold War-era tunnel.

In 2014, cultural resources staff gave presentations and tours to local groups such as the Taos Archaeological Society and to high-profile visitors such as the Associated Press Board of Directors and Bill Gates. Wildlife biologists provided outreach and education on threatened and endangered species, migratory bird, and large-game studies to the public, universities, and Laboratory employees.

Site visit to Nake'muu Pueblo with tribal members.

Our cultural resources staff are active participants in Los Alamos community-wide dialogues regarding the proposed Manhattan Project National Historical Park, and they work closely with Los Alamos County historical preservation representatives and the Los Alamos Historical Society. The DOE/NNSA Los Alamos Field Office and Laboratory archaeologists routinely meet with their professional peers at Bandelier National Monument and the U.S. Forest Service several times a year as part of the East Jemez Research Council.

Public education included installing outdoor informational panels, monuments, and kiosks at TA-70 and TA-71 in Rendija Canyon and installing the Omega West Reactor monument in Los Alamos Canyon.

Kiosk at a trail head in TA-70.

A new public education project developed a three-dimensional model of Nake'muu Pueblo, the only remaining standing wall pueblo on Laboratory property.

Rehabilitation/Restoration Projects. In FY 2014, several projects were completed to rehabilitate multiple historical properties damaged by wildland fires and subsequent floods, including the Las Conchas Fire Flooding Monitoring Project. Cultural resources staff supported fuel-mitigation projects to prevent future damage from fires. In consultation with the New Mexico SHPO and the DOE/NNSA Los Alamos Field Office, the Laboratory continues a major restoration project involving a significant Manhattan Project facility, the Gun Site. Phase 2 of the Gun Site restoration project included major repairs to the facility's damaged concrete exterior in addition to site work and exterior changes with the goal of returning the bunkered buildings to their World War II appearance. This facility will be part of the proposed Manhattan Period National Park, which will be included in the upcoming Defense Authorization Act Bill.

Gun Site where the "Little Boy" weapon was developed, after restoration.

A confinement vessel "bolas" is cleaned out to minimize radioactive waste.

GRAND CHALLENGE 6: Produce zero radioactive, hazardous, liquid, or solid waste.

2013–2014 Plan

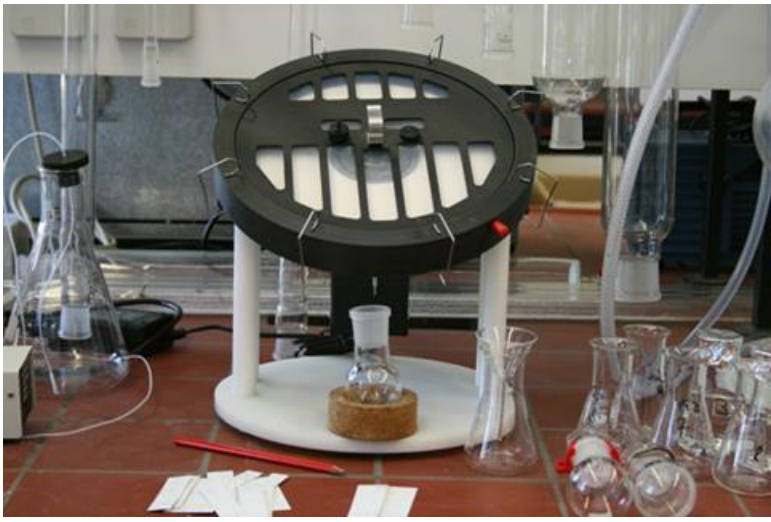
The Laboratory's commitment to the Zero Waste Grand Challenge underscores our understanding of environmental sustainability and its ties to current and future mission capabilities. Given the wide variety of waste types and sources, this challenge will spur ever-increasing efforts to identify process improvement opportunities across the site to reduce and eliminate potential waste before it is generated. The business imperative to reduce cost also provides ample incentive for process owners to take the necessary steps upfront to drive waste generation to zero.

Starting in 2013 and carrying through 2014, the Pollution Prevention program has identified specific focus areas, based on historical waste-generation data, that provide significant waste stream–reduction targets for both the institution and individual organizations. These focus areas are (1) greening infrastructure and maintenance; (2) enduring waste management; (3) environmental stewardship performance, zero waste, recycle, and reuse; and (4) energy, water, and resource conservation. The Pollution Prevention program uses these focus areas as criteria for project proposals and has been able to offer a small financial incentive for organizations to participate in the effort to prevent pollution at the Laboratory.

Accomplishments

In April 2014, the Pollution Prevention program gave out the annual Laboratory Pollution Prevention Awards, recognizing the efforts of projects to eliminate waste in 2013 and 2014. Nearly 260 employees on 28 teams received Pollution Prevention awards for protecting the environment and accumulating more than $10 million in cost savings and reducing the amount of waste generated. The achievement of zero waste includes:

- Decommissioning multiple satellite accumulation areas.
- Reducing purchases of solvents, paint, aerosols, silica gel, adsorption columns, sulfur hexafluoride, and liquid nitrogen.



New instrumentation and process improvement to reduce hazardous wastes.

- Recycling hundreds of batteries, 27,000 feet of copper cabling, hundreds of cubic meters of metal, over 11,000 wooden pallets, 350 gallons of ARAKLEEN solvent, and 10 cubic meters of circuit boards and capacitors.

- Avoiding generating 30 cubic meters of electronics mixed low-level waste and 65 kilograms of depleted uranium.
- Recovering over 2000 pounds of refrigerants for reuse by the U.S. Department of Defense.

Additionally, other project efforts contributed to zero waste:

- A total of 349 smoke detectors containing americium-241 was recycled rather than disposed of as low-level radioactive waste (volume = 3 cubic meters).

Progress. The Pollution Prevention program also made significant progress in several key areas that will set the stage for future efforts to reduce or eliminate waste.

- Conducted pilot project of a radiological survey protocol to enable decision making on metal items awaiting disposition. Commonly referred to as "moratorium or suspension metal," this extremely large volume (thousands of tons) can now be evaluated for release rather than disposal as low-level waste.
- Developed a plan to target the replacement of oil-containing equipment, specifically vacuum pumps and compressors, to systematically reduce this significant industrial waste stream.
- Working with procurement, updated food services contract clauses to ensure all sustainable acquisition requirements are addressed, thereby significantly reducing food services waste by upfront elimination and substitution of products.
- Completed pilot program for a "one-stream" recycling approach to greatly reduce the upfront effort of segregating recyclables by more than three times the number of eligible items/materials that can be recycled, thus greatly reducing the amount of material sent to the landfill.

Photovoltaic powered field samplers reduce greenhouse gas impacts.

- Met with Los Alamos County to investigate opportunities to partner on industrial composting, a critical component of driving towards zero waste. Additionally, explored partnering on a pilot project in 2015 to compost food waste, the final key obstacle in food service operations actually achieving full zero-waste status.
- Conducted the Laboratory's first-ever zero waste event in September 2014 at the opening of the Bradbury Museum Environmental exhibit.
- Adopted the 5S approach to cleaning and organizing work space: sort, straighten, shine, standardize, and sustain. Collaborated with the Workplace Stewardship program to provide organizations with the tools to radically change how work areas are managed and consequently drive operations towards zero waste.

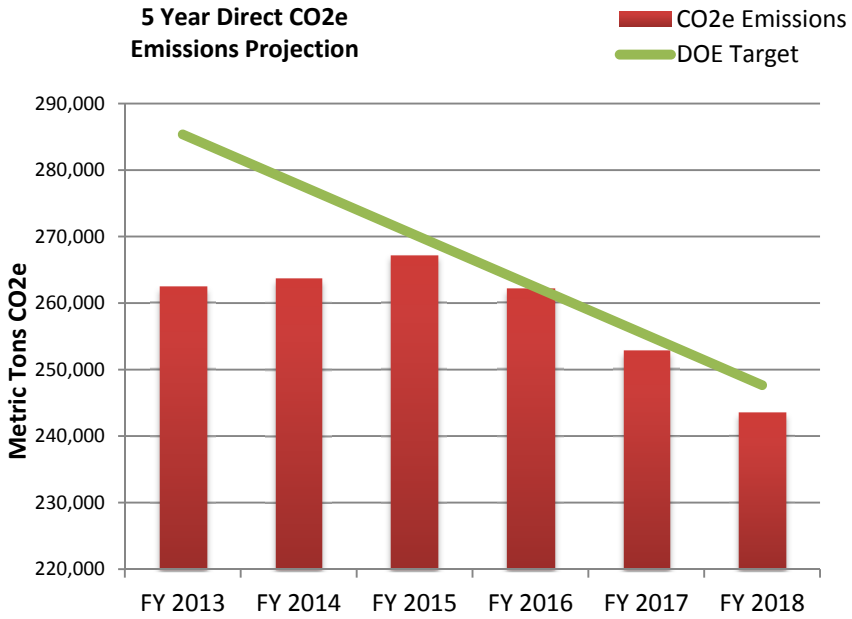
The first-ever zero waste event September 2014.

Los Alamos County and the Laboratory collaborated to build a photovoltaic field on the old landfill site.

GRAND CHALLENGE 7: Use energy efficiently while creating sustainable energy sources.

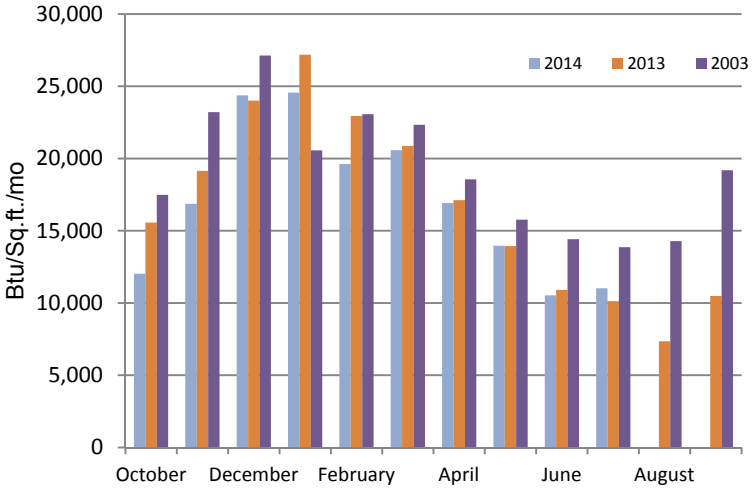
2013–2014 Plan

DOE is committed to reducing energy intensity by 30% by FY 2015 compared with the FY 2003 baseline year. The Laboratory is working to reach this goal. However, should the Laboratory increase its supercomputing capacity, energy consumption and greenhouse gas (GHG) emissions may also increase. Between FY 2003 and FY 2014, the Laboratory reduced its cumulative energy intensity by over 12%. In FY 2003, the Laboratory used 227,880 BTUs per square foot, and 200,128 BTUs per square foot in FY 2013. The Laboratory also reduced energy intensity by over 18% in FY 2014. Through planned investments the Laboratory estimates it will reduce its energy intensity by 3% per year.



The Laboratory has invested in a number of energy-reduction initiatives, including replacing conventional bulbs with light-emitting diode (LED) lighting in four facilities and two parking lots; repairing and upgrading building automation systems including implementing night setback schedules; and retrocommissioning in high-performance sustainable buildings, thus reducing energy use in some facilities by up to 50%.

The Laboratory also completed an Energy Savings Performance Contract in 2012 and upgraded existing heating, ventilating, and air conditioning (HVAC) systems and lighting at several facilities, resulting in an estimated energy reduction in goal-target facilities by about 65,000 MMBTU per year.



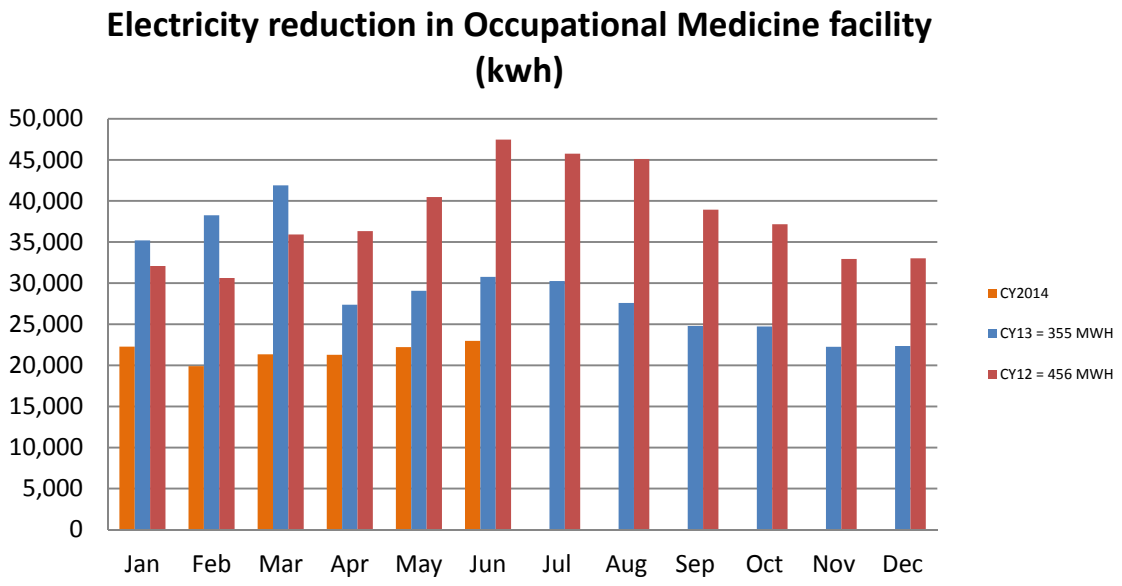
Monthy Energy Intensity Comparison with 2003 Baseline.

The Laboratory has achieved an 18.8% reduction in Scope 1 and 2 GHG emissions compared with the FY 2008 baseline largely through Renewable Energy Credit (REC) procurements to offset electricity purchases. In FY 2013, the Laboratory purchased 11,698 MWh RECs. The Laboratory's energy use is expected to steadily increase over the next 10 years because computing requires additional electricity, and expanded programmatic activities at LANSCE consume greater quantities of power. The Laboratory reduced energy use from 1,471,400 MBTU in FY 2012 to 1,443,459 MTBUin FY 2013. The funded energy reduction projects mainly contribute to Scope 2 GHG emissions reductions.

The Laboratory will continue its current practice of purchasing RECs to meet its renewable energy goals and satisfy DOE's FY 2020 28% Scope 1 and 2 GHG reduction goal. The Laboratory plans to purchase up to 1,013,897 MWh RECs, equivalent to a 76.5% reduction for the projected FY 2020 GHG emissions.

The Laboratory is interested in exploring a number of initiatives to meet the 28% GHG emissions-reduction goal. Based on the major contributors to GHG, the Laboratory plans to reduce GHG from facility heating by improving the efficiency of the on-site central heating and distribution system. The plan includes improving overall efficiency by adding a second cycle on the combustion turbine and using cogeneration to produce heat for the TA-03 complex.

The Laboratory has begun the planning process to upgrade a nominal 23-MW combustion turbine it currently uses as a backup generator resource. The upgrade would modify the turbine into a high-efficiency, dual-cycle unit with a steam turbine as the second cycle. Steam will also be extracted from the turbine when needed to power a refurbished campus heating system in a cogeneration mode. The new unit will be operated as a base-



load machine and will provide 31 MW on average. The new unit is slated to come online in 2018, and its net effect will be to meet the growing demand of the Laboratory's high-performance computing program with a lower carbon resource than currently available in the New Mexico region. The revitalized central heating system is tied to upgrades at several older facilities as part of the long-range development plan that will improve the energy efficiency of the HVAC systems. The Laboratory is exploring the financing mechanisms to support this project, including an Energy Savings Performance Contract.

In addition to efficiencies, the Laboratory plans to reduce GHG from electrical energy either by purchasing RECs to replace fossil fuel–dependent energy or focusing on a power purchase agreement for lower or no-carbon-producing energy to change its generation mix to reduce the carbon footprint of electricity supplies. The Laboratory's projections show these initiatives will bring its carbon emissions to approximately 70% of the FY 2008 baseline, although in the same period electrical consumption will grow by 135%. One option under consideration is contracting for renewable power as the source of supply after those times when the generation owned by the Los Alamos Power Pool cannot meet the demand. Power generated in the New Mexico to Arizona region is 60% coal-fired, and it is anticipated this resource would displace open-market purchases largely generated in regional coal-fired plants.

Accomplishments

The Laboratory recently reduced its energy usage and therefore reduced Scope 1 and 2 GHG emissions by approximately 20% compared with the FY 2008 baseline year.

Students tour the low-flow turbine at Abiquiu Dam, a joint venture between the Laboratory and Los Alamos County.

TOOLS

EMS Environmental Action Plans

The 16 Directorates at the Laboratory and the Director's Office create environmental action plans annually following the processes of our EMS. The Laboratory's EMS has been certified by ISO since 2004. In addition, the EMS Steering Committee uses the Long-Term Strategy for Environmental Stewardship and Sustainability to inform annual goals setting and the selection of environmental protection objectives by each Director to indicate progress toward the Grand Challenges.

Integrated Review Tool

Determining how to fulfill the over 50 environmental requirements can be daunting for a project manager attempting to start or modify a technical project, scientific study, or infrastructure project. The Laboratory uses the Integrated Review Tool to help project managers determine environmental requirements. By answering a systematic sequence of questions, the project managers can determine which requirements are pertinent to the project and obtain a list of subject matter experts to help in planning a compliant execution of their project.

Environmental Sampling Board progress

The Sampling Board developed an Environmental Sampling Plan (ESP) in FY 2013. The ESP provided fundamental data quality objectives (DQOs) for the Laboratory groups that oversee environmental sampling. The DQOs cover the entire data cycle that includes (1) defining the question, (2) determining what type and quality of data is needed to answer the question, (3) using robust sampling procedures, (4) defining measurement quality needs, (5) outlining statistical data analysis techniques, and (6) communicating the results in clear and meaningful ways. The goal in FY 2014 was to begin integration of the ESP into the environmental sampling programs.

Intellus: Environmental Data

The Laboratory is the first federal facility in the DOE complex to make identical environmental data records available to the public, scientists, remediation teams, and regulators within hours of receipt at the click of a mouse.

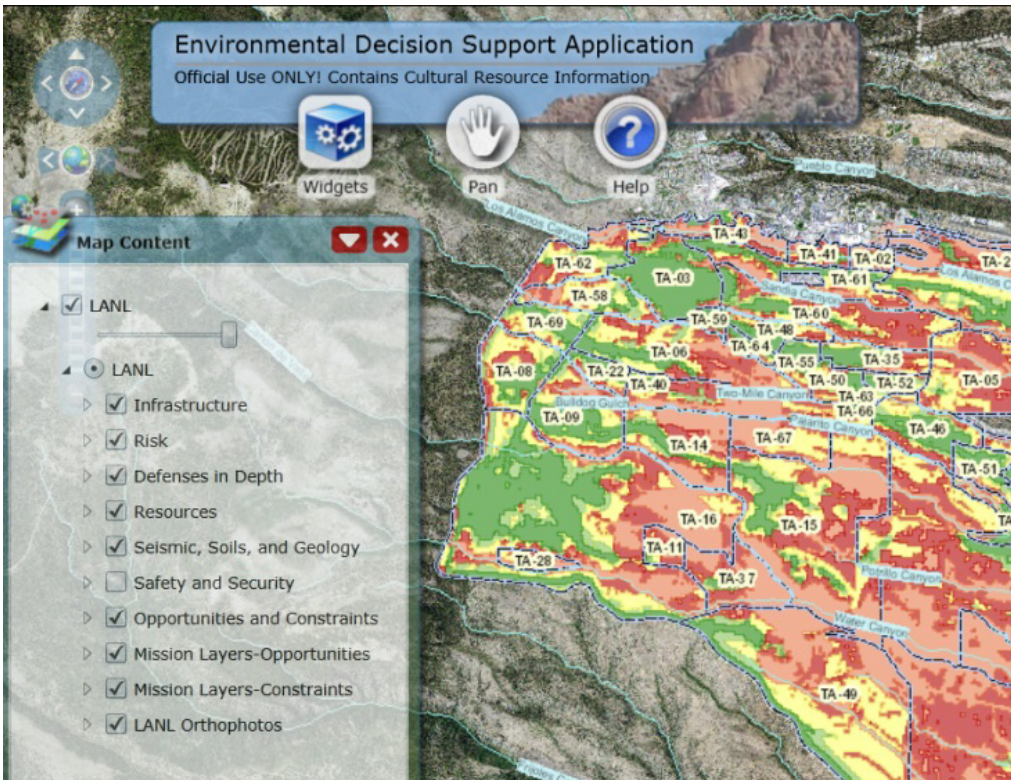
The environmental data span a wide range of media, including air, soil, sediment, biota, and water, various analytes, and numerous time periods. The system is cloud-based and houses over 14 million records, including over 28,000 locations and approximately 300,000 samples.

The website, www.intellusnm.com, also hosts data from NMED and other third-party providers, such as local or tribal entities. Intellus can be expanded to include data from environmental programs in other neighboring cities, state agencies, or tribal facilities.

A partial listing of features includes

- Free-form querying,
- Ability to design new reports,
- Accommodation of new third-party data providers, and
- Interactive mapping with live data with drill-down capability.

Decision Support Application



Many decisions that could impact environmental stewardship hinge on understanding spatial relationships, migration patterns, and habitat needs. Capitalizing on the Laboratory's extensive geographic information system, the Decision Support Application provides project and program managers access to an integrated environmental spatial database linked with analytical information to support decision-making. With over 160 layers, the integrated database includes spatial data on a wide range of environmental themes, including a high-resolution digital elevation model, orthophotography, hydrology, sensitive habitat, cultural resources, solid waste management units and areas of concern, monitoring and sampling locations, flood-control features, infrastructure, facilities, utilities, and a host of other derived spatial environmental information. The Decision Support Application is used in site planning to evaluate multiple environmental and operational opportunities and constraints to promote cost-effective mission development, minimize environmental impacts, and identify land potentially suitable for conveyance to others for economic development under 10 Code of Federal Regulations 770.

A set of planning principles guides the evaluation process for determining lands that are suitable for siting new work processes include the following:

- As a priority, preserve land for mission capability and opportunities
- Support safety and security
- Promote "smart growth" development that reflects the Recommendations on Sustainable Siting for Federal Facilities publication
- Practice environmental stewardship
- Pursue land conveyance opportunities to promote economic growth and prosperity of Los Alamos County and other surrounding communities

In 2014, decision makers showed extensive creativity in using these tools. Over 30 new uses of the tool were imagined and employed, including such disparate application as endangered species habitat overlaps with programmatic needs and calculations for dredge and fill, excavations, and flow patterns.

LA-UR-14-28025

Approved for public release;
distribution is unlimited

Issued October 2014

Parts of the Laboratory are closed each year during breeding season to protect the endangered Mexican Spotted Owl

Los Alamos
NATIONAL LABORATORY
EST.1943

LA-UR-14-28025