U.S. DEPARTMENT OF ENERGY | Legacy Management

Program Update

October–December 2014

Welcome to the October–December 2014 issue of the U.S. Department of Energy Office of Legacy Management Quarterly Program Update. *This publication is designed to provide a status of activities within LM. Please direct all comments and inquiries to lm@hq.doe.gov.*

Goal 1

Enhanced Bioremediation—Pinellas County, Florida, Site

Operations to develop and manufacture components for the nation's nuclear weapons program at the former Pinellas Plant in Florida during the Cold War era, released solvents to subsurface soils beneath the plant's 11-acre Building 100. Release areas became sources of dissolved contamination, creating groundwater plumes that extended from the source areas beneath Building 100 to the south and east, and onto private property. After the Cold War ended the plant was closed and the site redeveloped for economic use; however, the contaminated groundwater plumes remained.

The U.S. Department of Energy site is known as the Young - Rainey Science, Technology, and Research (STAR) Center and is under the care of the Office of Legacy Management (LM).

LM began monitoring the plumes to determine if they were advancing, stable, or retreating, using the area-under-the-curve method of stability monitoring. This method uses information gathered from evaluating the entire width and centerline length of each plume to determine if contaminant concentrations are expanding to each side of the plume or along its length. Values for each sampling event are calculated, plotted, and analyzed. A level or decreasing trend indicates a stable plume. An increasing trend indicates an unstable plume. Monitoring conducted in 2013 and 2014 showed significant increasing trends at some of the cross sections, indicating that the contaminant plumes are not stable and that additional remediation should be considered.

A contractor uses a direct-push rig to inject emulsified vegetable oil (EVO) and Dehalococcoides mccartyi *into the soil. The transfer tanks containing the EVO are in the background.*

Bioremediation proved to be a successful approach to cleaning up two other areas of the STAR Center in the past, so enhanced bioremediation was chosen to treat the contaminant source areas beneath Building 100 and the plumes down gradient of the building. Treatment operations are conducted in phases. Phase 1 was conducted this fall (October 20 through November 18) and treated the down gradient, dissolved-phase contaminant plumes. Phase 2 is scheduled to take place in February 2015 and will entail treatment of the offsite properties dissolved-phase contaminant plumes. Areas of known contaminant sources beneath Building 100 will be treated in May 2015, during Phase 3.

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Inside this Update:

Goal 2

New Eligibility Guidelines Lead to Increase in LM's EEOICPA Requests for FY 2014

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) experienced a 19 percent increase in the total number of stakeholder requests from fiscal year (FY) 2013 to FY 2014, according to Dr. Edwin Parks, LM Program Analyst.

LM provides stakeholders with information in response to Freedom of Information Act (FOIA), Privacy Act, Energy Employee's Occupational Illness Compensation Program Act (EEOICPA) claims, and other routine requests.

Request volumes had been steady in previous fiscal years, but during FY 2014, LM processed nearly 1,860 requests. Dr. Parks attributes the rise to an increase in EEOICPA requests for the Rocky Flats site in Colorado between FY 2013 and FY 2014.

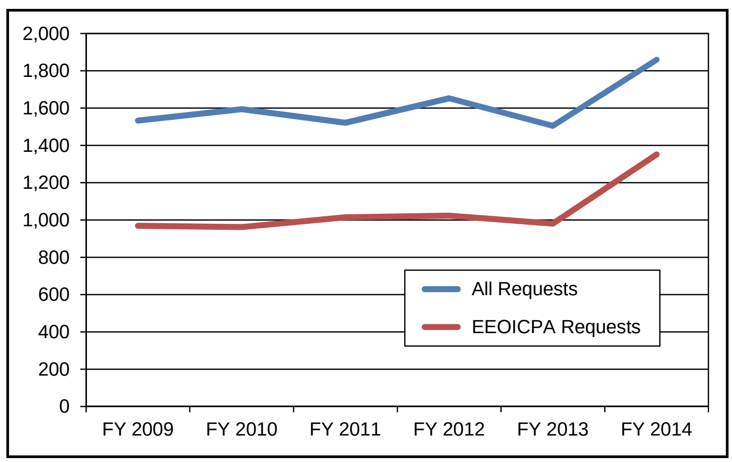
The increase of Rocky Flats requests follows changes to the Special Exposure Cohort (SEC) that eases the EEOICPA claims process for qualified former energy workers. Previously, two SEC classes that covered Rocky Flats workers from 1952 through 1966 were established. A new, third class extends coverage to qualifying workers from 1952 through 1983.

The new Rocky Flats SEC class has been followed by an increase of nearly 60 percent in new claims for EEOICPA compensation. This includes previously denied claims currently being submitted under the expanded eligibility.

Even with the influx of Rocky Flats EEOICPA requests, LM continued to complete all information requests in a timely manner, according to regulations and statutes. In addition to reexamining and improving the efficiency of its requests process, LM reprioritized resources, as necessary, to complete all requests on schedule.

According to Dr. Parks, LM ensures the timeliness of its responses to incoming requests by tracking them on a daily basis. The statistics are then compiled into reports that keep LM management informed of response progress. ❖

An LM contractor employee searches site records in response to a stakeholder request for information.



This chart shows a significant increase in requests from FY 2013 to FY 2014.

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Enhanced Bioremediation—Pinellas County, Florida, Site

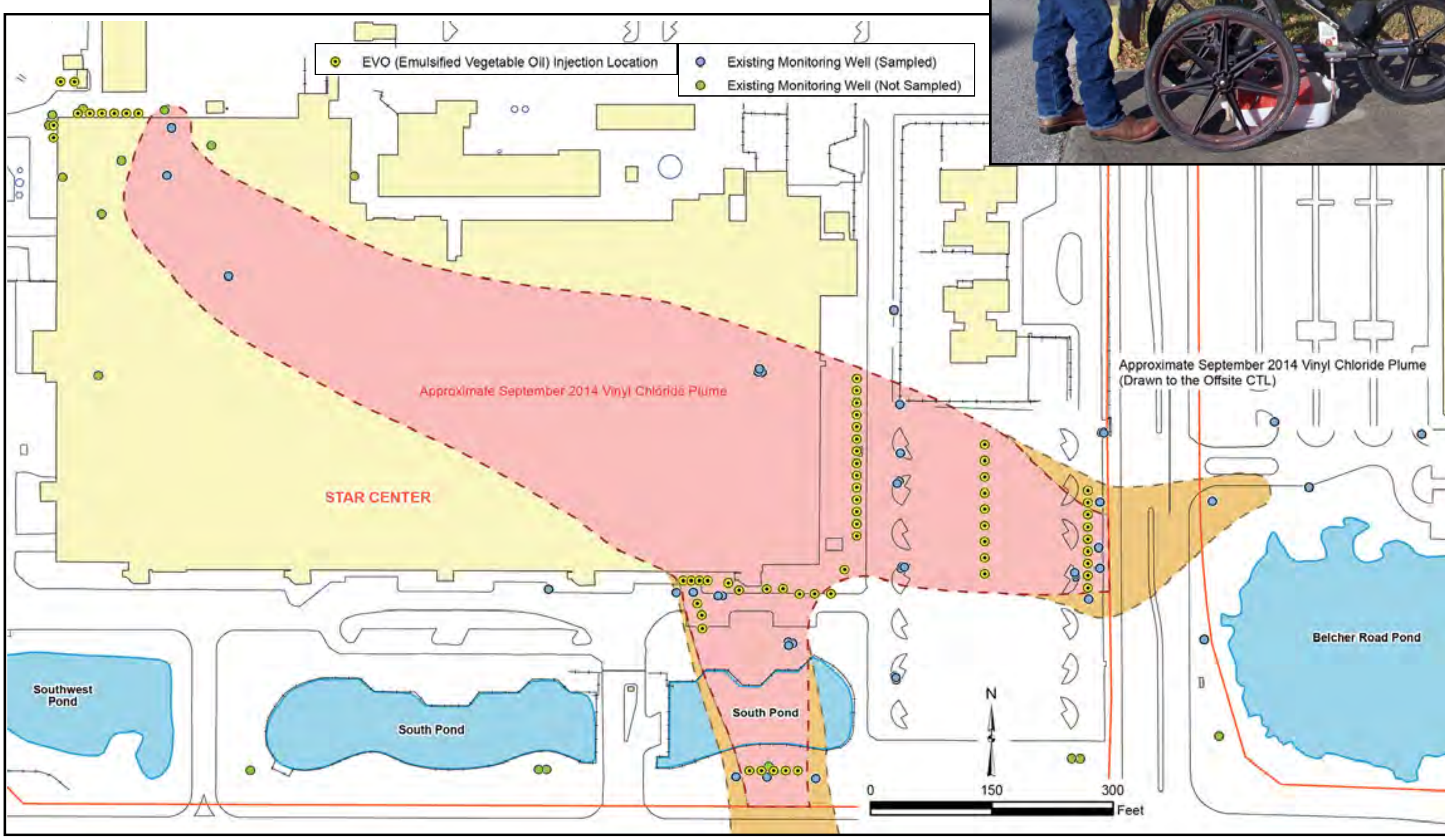
The chosen remediation method uses concentrated emulsified vegetable oil (EVO) that has been diluted with water prior to injection, for maximized distribution in the subsurface. Bacteria are also used during bioremediation. The microorganisms (*Dehalococcoides mccartyi* or DHC) live in an anaerobic (no oxygen) environment, so special measures were taken to ensure their survival. The first step was to remove residual chlorine and dissolved oxygen from the water used to dilute the EVO prior to injection, followed by constant purging of the mixture with nitrogen to maintain anaerobic conditions throughout the injection process.

Once introduced into the subsurface, the bioremediation mixture ferments and produces dissolved hydrogen, which the DHC uses to break the bonds on contaminant molecules, resulting in nontoxic end products.

During the first phase of cleanup, the bioremediation mixture was injected into 62 subsurface locations in the south and east plumes, immediately down-gradient from Building 100, at intermediate locations between Building 100 and the site property boundaries, at the property boundaries, and at the northwest corner of Building 100.

Approximately 500 gallons of the bioremediation mixture were introduced at each injection point. The total injected volume for the 62 locations was approximately 31,000 gallons. ❖

Ground-penetrating radar was used to locate underground utilities and clear injection locations near Building 100.



Injection locations of the first phase of treatment.

Goal 4

Thinking Outside the Box: Materials Reuse—Durango, Colorado, Site

When the permeable reactive barrier treatment system associated with the Durango disposal cell toe drain was removed in 2010, the perimeter fence was also removed and the materials were stockpiled outside of the evaporation pond fence line. Plans at the time were to eventually recycle the materials.

Activities associated with removal of a shed and excavation of the toe-drain valves this past September required a subcontractor that had use of a flatbed trailer. Having a trailer available at the site made it feasible to finally transport the surplus fencing materials for recycling. Several resources for taking care of the metal materials were identified; however, no local recycling centers would accept the treated-wood fence posts.

A solution to the recycling dilemma came with the opportunity to donate all of the materials for reuse through the Habitat for Humanity of La Plata County building supply reuse center in Durango. All building supplies donated to the reuse center are sold to the public at reduced retail prices. Proceeds from the sale of materials help support the mission of Habitat for Humanity.

Materials donated for reuse included approximately 150 linear feet of 8-foot-tall chainlink fencing and approximately 20, 6- to 8-inch diameter, 12-foot-long treated-wood fence posts. ❖

Goal 1

Evolution of a Groundwater Treatment System—Rocky Flats, Colorado, Site

A project to reconfigure the East Trenches Plume Treatment System (ETPTS) at the Rocky Flats site, to improve treatment effectiveness and meet the strict water quality standards in the area, is scheduled to be completed in January 2015. The ETPTS was installed in 1999. The system was designed to intercept and treat groundwater contaminated with chlorinated solvents, chemicals commonly used in dry cleaning and to clean tools. At Rocky Flats, the solvents were used primarily as degreasers and lathe and machining coolants. During the 1950s and 1960s, a common disposal practice around the world for these chemicals was to bury them in trenches dug into the ground. Rocky Flats followed this practice at that time, which led to the groundwater contamination at the site referred to as the East Trenches Plume.

The ETPTS includes a deep trench with a drainpipe along its floor, which intercepts the plume as contaminated groundwater flows toward nearby South Walnut Creek. The collected groundwater is routed to two treatment cells, which remove the contaminants from the water. The treated water is then released back into the subsurface.

The system was originally designed to operate without any electrical or other energy assistance. Gravity would carry the contaminated waterflow into the trench, then into and through the treatment cells. The two cells were filled with zero-valent iron (iron filings created from cast iron). When the solvent molecules came in contact with the iron filings, chemical reactions stripped the chlorine atoms off and gradually transformed the chemicals into harmless byproducts.

The system was not designed to remove all traces of the contaminants, but to reduce their concentrations and lessen the impact on South Walnut Creek. Even though the original level of treatment was protective of the environment, the post-closure regulatory agreement for Rocky Flats now requires that water issuing from the system meet much stricter quality standards, which couldn't be achieved using the old system.

One of four groundwater treatment systems at the Rocky Flats site, the ETPTS is similar to the nearby Mound Site Plume Treatment System (also located at Rocky Flats), and employs similar designs and objectives. Both systems treat chlorinated solvents using iron filings, and both include groundwater intercept trenches and treatment cells. The Mound system was also designed to reduce contamination, but like the ETPTS, it now must treat the water to meet very strict standards.

Several tractor-trailer loads of iron are used in each of the systems to treat the water. The media gradually becomes ineffective, and after a period of 3 to 5 years, it becomes a solid block of rust and other minerals. This solidified block

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Figure 1. The first tests at the Mound system (left) used a small garden fountain pump attached to landscaping mist nozzles, with an air monitor to detect whether the contaminants were moving from the water to the air. The test was performed in a plastic box. The next test (right) used a larger pump and spray nozzle. Both showed that air stripping removed contaminants from the groundwater, and led to a larger air stripper at the Mound system (not shown).

Goal 1

Applied Studies and Technology Stakeholder Outreach: Helping Native Students Heal the Land

On a late June afternoon on the high desert east of Tuba City, Arizona, members of a Navajo family scoot along the sand riding all-terrain vehicles, rounding up their horses under a ceramic-blue sky. Across a dune ridge, Quentin Benally wipes his brow, adjusts his camo sun hat, and for the umpteenth time, leans over a 25-meter tape measure stretched across the desert floor and calls out the scientific names of plants. His associate stands nearby with pen to paper.

What is Quentin up to and what drives him to spend his day roasting in the desert sun? Quentin wants to know if his Navajo homeland is healing. He's collecting data on the abundance of desert flora, evidence that will help him answer questions about the health of the land. His detective's bag for scientific inquiry also holds results of soil fertility and soil morphology sampling, and satellite images that tell him how much rainwater the desert plants sip from the ground.

To the north and west of where Quentin works extend two different tracts of land. Nearly 30 years ago, the U.S. Department of Energy (DOE) stripped the soil and plants from one large swath to remove radioactive particles that for years had blown in from an abandoned uranium mill. DOE then scattered native plant seeds to begin the long process of healing the land. The other swath, across a livestock fence from Quentin, remained clean of harmful dust and protected from livestock grazing for all those years. This large, unspoiled island serves as an ecological benchmark to gauge the health of both the stripped area and the historically overgrazed rangeland.

Quentin designed his study to answer land stewardship questions that are important to his tribe:

- Did DOE achieve their revegetation goals—has the stripped land healed?
- How well did short-term evaluations predict long-term revegetation success?
- Did revegetation limit the spread of harmful weeds?
- Is the rangeland recovering after decades of overgrazing?

University of Arizona graduate student measures percent cover of desert plants using a line intercept method on historically grazed rangeland near the Tuba City disposal site.

Quentin's land stewardship study near Tuba City is an example of the growing partnership between the DOE Office of Legacy Management (LM), Native American students, and tribal colleges. LM is currently working with Dr. Karletta Chief, Assistant Professor in the Department of Soil, Water and Environmental Sciences at the University of Arizona (UA) in Tucson. In addition to serving as Quentin's graduate faculty advisor, Dr. Chief works as an extension specialist bringing relevant science to Native American communities in a culturally sensitive manner.

Dr. Chief also advises Carrie Joseph, an active member of Hopi communities in northeastern Arizona. Carrie is evaluating the ability of uranium-mill-tailings disposal cells near native communities to adapt to climate change. (An article, "Weaving Community and Science: Former Summer Intern Is Investigating Plant Uptake of Contaminants on Disposal Cell Covers," about another of Carrie's projects was published in the July–September 2013 LM *Program Update*.) An LM scientist serves on graduate committees for Quentin and Carrie through an adjunct faculty appointment with UA.

LM is also partnering with the Environmental Sciences program at Diné College, the 2-year tribal college of the Navajo Nation. Diné College was chartered in 1968 as the first public institution of higher learning established by Native Americans for Native Americans. Diné College pioneered a teaching philosophy that weaves traditional and Western learning, to encourage youth to be contributing members of both their Navajo communities and the

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Goal 4

From Hydrogen Fuel Cells to High-Altitude-Pilot Protection Suits—Mound Science and Energy Museum Programs Cover a Wide Range of Topics

The Mound Science and Energy Museum (MSEM) is an active, volunteer-led organization located at the former U.S. Department of Energy (DOE) Mound site in Miamisburg, Ohio. MSEM keeps the 60-year history of scientific discoveries, inventions, and ingenuity of Mound site workers alive.

Monthly educational programs began to be offered at MSEM in 2006. A wide range of topics have been covered, from technologies developed at the former Mound Plant during the Cold War, to those of local and scientific interest. Program speakers are experts from universities, historical organizations, museums, government agencies, companies, and former Mound site employees.

In addition to the monthly educational programs, DOE Office of Legacy Management (LM) or contractor personnel present monthly updates on current LM activities at the site. These evening meetings are held on the fourth Wednesday of each month. They are announced in the local news media and by MSEM members and are generally well attended.

2014 Monthly Update Meeting Topics

- Storage of hydrogen for use in fuel-cell passenger vehicles
- Carillon Historical Park in Dayton, Ohio
- Ancient Native American Astronomy
- Pyroshock testing of radioisotope thermal generators as they related to the safe landing of the Curiosity Rover on Mars
- The History of High-Altitude-Pilot Protection
- Radon program at Mound and radon today
- Dayton Power & Light, O.H. Hutchings Station power plant history
- The Great Miami Buried Valley Aquifer
- Forensic Science

Jennifer Watson, forensic chemist from the Miami Valley Regional Crime Laboratory, spoke at the November 2014 MSEM program.

MSEM President Ray Seiler stated, “These monthly programs bring our members and the public together in a casual, friendly atmosphere. The meetings provide a forum to educate and exchange information about a variety of interesting topics.”

MSEM, located at 1075 Mound Road, Miamisburg, Ohio, is open Tuesdays from 1:00 to 3:00 p.m., and Saturdays from 9:00 a.m. to noon. For more information on MSEM or on monthly lectures, visit http://moundmuseum.com/ or email msem01@clearwire.net. ❖

The November 2014 MSEM program covered a variety of topics.

Goal 1

Improving Groundwater Cleanup—Monticello, Utah, Site

Completion of construction activities at the Monticello uranium mill tailings processing site in December 2014, fulfilled a commitment by the U.S. Department of Energy (DOE) Office of Legacy Management (LM) to improve the groundwater remedy that was in effect at the site. Construction activities started in May 2014. However, preliminary discussions, evaluation of improvement options, schedules, and project planning began much earlier. Wrap up of activities completed a project that spanned nearly 2 years.

"Discussions leading to this project began in the spring of 2013," said LM Site Manager Jason Nguyen, as activities were coming to a close. "We've been in close discussions with the U.S. Environmental Protection Agency and the State of Utah for many months now, and we're all excited to see the construction nearly complete and to start up the system. I'm looking forward to seeing the data once we flip the switch to start the system."

The new process expands groundwater treatment operations and modifies the treatment method. Uranium is the groundwater contaminant at the site of most concern. Previously, a chemical reaction treatment was used to remove uranium from groundwater that was pumped through one extraction well. The new system added eight extraction wells, which will be used to pump water from some of the most contaminated portions of the alluvial aquifer to an existing evaporation pond.

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Workers install new monitoring wells to track progress of the remedy optimization.

Workers excavate a trench to bury a sub-grade pipeline that allows the groundwater treatment system to operate year round.

Piping from eight extraction wells is pressure tested to ensure it meets specifications.

Goal 1

Digging Deeper—DOE Offices Collaborate on Research and Remedies

The U.S. Department of Energy (DOE) Office of Science (SC) is digging deeper into the basic science of subsurface uranium mobility at contaminated DOE Office of Legacy Management (LM) sites. Through this new work, SC hopes to develop a better understanding of biological and geochemical mechanisms underlying uranium-plume persistence.

As reported in this year's April–June LM *Program Update* article, "The Old Rifle Snowmaking Experience," SC activities to examine controls on uranium mobility at the LM Old Rifle, Colorado, uranium-processing site started a dozen years ago.

> *"One of the activities of greatest interest to LM is the development of a floodplain-scale understanding of hydrological and biogeochemical processes that govern contaminant mobility and plume persistence within the Rifle aquifer, and others like it throughout the intermountain west… A refined understanding of the chemically and biologically mediated mechanisms that affect the mobility of uranium and other metals in such systems is an important goal."*

Scientists at the SLAC National Accelerator Laboratory ("SLAC") in Stanford, California, under the direction of Dr. John Bargar, are working with LM to study uranium biogeochemistry at several former uranium-processing sites that are adjacent to floodplains. Included in the studies are the Grand Junction, Gunnison, Naturita, and Rifle sites in Colorado, and the Riverton, Wyoming, and Shiprock, New Mexico, sites.

SLAC efforts on this project are funded through the Subsurface Biogeochemistry Research activity of the DOE Office of Science Biological and Environmental Research, Climate and Environmental Sciences Division. The SLAC team has expertise in advanced synchrotron x-ray techniques that can probe the molecular-scale speciation of uranium in dilute natural sediments. Their expertise also encompasses molecular microbiology science and laboratory geochemical techniques such as chemical extractions.

LM is contributing field and laboratory equipment, coring activities, and site expertise. Under the direction of LM Site Managers (Rich Bush, Bill Dam, Jalena Dayvault, and Mark Kautsky), the collaboration involves all of the individuals in the SLAC Subsurface Biogeochemistry Research group and associates from Lawrence Berkeley National Laboratory (Berkeley Lab) in California.

Sediment core is examined at the Grand Junction site.

Uranium is a toxic and problematic contaminant at DOE nuclear-legacy sites, present in more contaminant plumes than any other radionuclide, except for tritium. It is the most important inorganic contaminant of concern at LM sites. Elevated concentrations of uranium in groundwater pose ongoing threats to the entire ecosystem, including human health, and make site cleanup and closure challenging.

Work performed at the Old Rifle site by SLAC, Berkeley Lab, and the Pacific Northwest National Laboratory in Washington State, has shown that relatively thin lenses of sediments—rich in silt, clay, and organics—in the subsurface strongly accumulate uranium, accounting for up to 95 percent of the uranium inventory at some locations. These sediments

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Goal 1

Environmental Justice Activities

Interagency Working Group on Environmental Justice Senior Leadership and Chiefs of Staff Meeting Held November 18, 2014

The Interagency Working Group on Environmental Justice (EJ IWG) Senior Leadership and Chiefs of Staff Meeting, hosted by the U.S. Environmental Protection Agency (EPA), on November 18, 2014, came 3 years after the signing of the Memorandum of Understanding (MOU). The Charter was adopted in August 2011.

The MOU directed that at least every 3 years EJ IWG was to “identify important areas for federal agencies to consider and address, as appropriate, in environmental justice (EJ) strategies, annual implementation progress reports and other efforts.” Fourteen federal agencies and three White House Offices attended the meeting. Deputy Under Secretary David Klaus was the Senior Leader Representative for the U.S. Department of Energy.

The meeting provided a venue for EJ IWG Senior Leadership and Chiefs of Staff to work together to strengthen coordination efforts on interagency EJ projects and activities throughout the respective departments and agencies. The meeting focused on how the federal family can ensure that resources reach communities and tribes disproportionately impacted by pollution, economic distress, and related challenges.

The meeting highlighted the Presidential Proclamation and 20th Anniversary of Executive Order 12898, which introduced a renewed focus to make a noticeable difference in overburdened communities. The EJ IWG is organized around the MOU and Charter that was signed in 2011, and is currently looking at priority areas for the next 3 years.

EPA, the lead agency for EJ, is looking for opportunities to synergize place-based efforts around the country with other federal agencies. EPA is now implementing its 30/50 Communities Plan. The goal is to pull resources together toward meeting the focus of Executive Order 12898. The EPA administrator will host a meeting in spring 2015 with cabinet-level members to discuss the action agenda and how to build on and leverage agencies investments in communities. ❖

Attendees at the Interagency Working Group on Environmental Justice Senior Leadership and Chiefs of Staff Meeting held at the U.S. Environmental Protection Agency on November 18, 2014.

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Environmental Justice Activities

Eighth Annual National Conference on Health Disparities

Graduates and undergraduates attend a student research forum the first day of the conference.

The Eighth Annual National Conference on Health Disparities was held November 5 through 8, 2014, in Long Beach, California. Like past conferences, it focused on policies and programs to reduce health disparities. However, the 2014 session saw one panel address a new topic—the impact of health issues, including disparities, on our nation's military personnel and national security.

Day one of the conference featured an Undergraduate and Graduate Student Research Forum that was enthusiastically received by conference attendees. Opening remarks were presented by a group of distinguished public and private-sector leaders, including the Honorable James E. Clyburn, Assistant Democratic Leader, and U.S. House of Representatives of South Carolina.

Throughout the conference presenters emphasized the role of social factors, personal responsibility, and prevention in initiatives that reduce disparities. This is important to all Americans, and not just our nation's minority citizens, because over time, our nation's healthcare providers and policy makers have come to understand that the wellbeing of each citizen affects the wellbeing of all Americans. Truly healthy communities and their citizen leaders recognize the roles that human health, environmental quality, environmental justice, and economic development play in overall community development. Moreover, at a time when our nation's traditional "sick care" medical model appears to be unsustainable, a comprehensive "well care" approach, recognizing social determinants and emphasizing prevention and personal responsibility, may reduce disparities and restore much-needed balance to the national dialogue on healthcare.

Congressional session with Congressman G.K. Butterfield, Jr., North Carolina, and Congresswomen Grace Napolitano and Lucille Roybal-Allard of California.

From 2007 through 2013, the conferences have brought together diverse partners, presenters, and attendees to share their knowledge of health disparities. The programs have uncovered a much larger story that social factors like race, poverty, low educational attainment, public safety, environmental quality, and inadequate housing are major contributors to health disparities. Findings suggest potential benefits of rededicating a portion of America's healthcare resources to programs that emphasize education, prevention, and personal responsibility—each person's willingness and capacity to make informed decisions that reduce the likelihood of disease development.

The conference ended with a Congressional Roundtable Discussion. Elected officials and renowned health equity experts from community, local, state, and national levels created the perfect venue for leaders dedicated to health equity to share ideas and lessons learned about an issue that affects every American.

More than 360 people attended the conference. Conference Chair, Dr. David Rivers, Associate Professor at the Medical University of South Carolina, announced that the 2015 conference will be postponed and held jointly with the National Environmental Justice Conference and Training Program in Washington, DC, in 2016.

For more information go to: http://www.nationalhealthdisparities.com/2014/disparities_LONGBEACH_fnl.pdf. ❖

Goal 5

LM New Employees—Welcome Aboard!

Leslie Biagas joined the U.S. Department of Energy (DOE) Office of Legacy Management (LM) on October 19, 2014, as a financial analyst. She is located in our Washington, DC, office and is part of the Planning, Budget, and Acquisition Team.

Prior to joining LM, Leslie worked for the U.S. Immigration and Customs Enforcement Agency, as part of its Budget and Contracting Team for the National Firearms and Tactical Training Unit. Her work included program spending plans development, program funds tracking, and travel and training oversight.

Leslie is a graduate of the University of Maryland University College, where she received her bachelor's degree in business management. While in college, Leslie worked at the Pension Benefit Guaranty Corporation and interned at the U.S. Bureau of Labor Statistics. She is currently pursuing her master's degree in financial management ❖

John Chinkhota joined LM on October 19, 2014, as a financial analyst working out of our Washington, DC, office and is part of the Planning, Budget, and Acquisition Team. Prior to joining LM, John served as a financial management analyst in the Health Budgets and Financial Policy, and Programming Division; Resource Management Directorate for the Office of the U.S. Army Surgeon General (OTSG); and Headquarters, for the U.S. Army Medical Command (MEDCOM).

While working with the U.S. Army, John performed financial management analysis for diverse medical requirements to support fiscal programming actions for Defense Health Programs (DHP), Army Direct Reporting Unit, and Headquarters with OTSG.

John is a graduate of Hampton University, where he received his bachelor's degree in business management. John is a native of Washington, DC. ❖

Angelita Denny joined LM on October 5, 2014, as a physical scientist, working in our Grand Junction, Colorado, office and is part of the Environment Team 1.

Prior to working with LM, Angelita was part of the Navajo Nation's Surface Mining Program and worked as an assistant to the U.S. Office of Surface Mining inspectors. Her work with LM will include managing mill sites on Navajo Nation tribal lands and using her experience to expand LM's outreach programs to native communities.

Traditional Diné culture includes family history, based on clans, when making introductions. Angelita is Diné (Navajo) from Klagetoh, Arizona. She is a member of the Salt People Clan and is born of the Many Goats Clan. Angelita's maternal grandfather is from the Edge Water Clan and her paternal grandfather belongs to the Big Water Clan.

Angelita is a graduate of the University of Arizona in Tucson, where she received her bachelor's degree in mathematics and master's degree in environmental science. Her research for her thesis focused on atmospheric chemistry as influenced by emitted pollutants. ❖

Russel Edge became an LM staff member on November 2, 2014, as a business management specialist in the Westminster, Colorado, office. He reports directly to the DOE Office of Site Operations Director. Prior to joining LM, Russel was employed by the National Nuclear Security Administration Sandia field office in Albuquerque, New Mexico, as a program manager for the Laboratory Directed Research and Development (LDRD) program and point of contact for Nuclear Non-Proliferation program activities.

Russel is returning to DOE, where he previously spent 17 years helping manage remediation of several Uranium Mill Tailings Remedial Action project sites. He was also the program manager for the Pinellas, Florida, environmental restoration project for the Long-Term Surveillance and Maintenance program, which was a partial precursor to LM; and the groundwater program manager for Albuquerque, New Mexico, operations.

Most recently, Russel served as a waste safety specialist for the International Atomic Energy Agency (IAEA) in Vienna, Austria. His specialty was remediation and long-term care of former uranium production facilities. ❖

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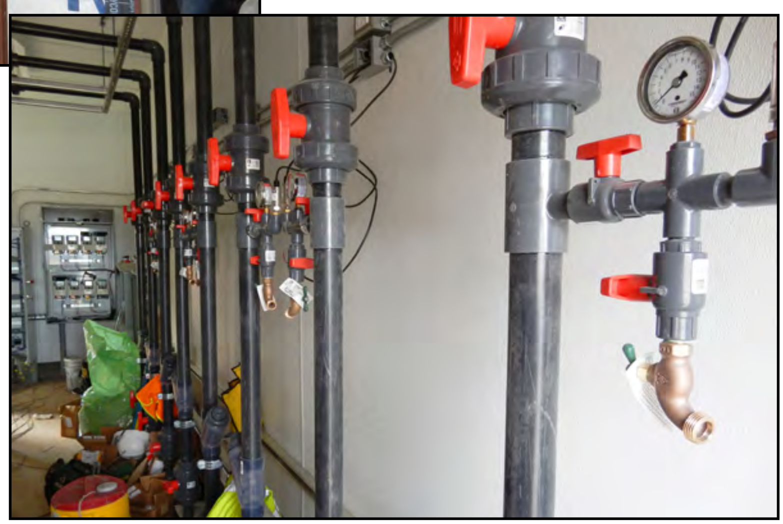
Improving Groundwater Cleanup—Monticello, Utah, Site

"Modifying our approach allowed us to be much more aggressive with our groundwater treatment at the site. Adding new extraction wells lets us target different areas of the contaminant plume, as well as increase our overall treatment capacity," said Nguyen.

Startup testing was scheduled to begin soon after construction activities wrapped up in December. LM expects the system to be fully operational in spring 2015. ❖

Conduit was installed to house electrical control and well field components.

A groundwater transfer building holds an aboveground batch tank that collects extracted groundwater. A strong pump on the tank sends the water to the evaporation pond on LM property.



Piping from the eight extraction wells in the field pump water to the transfer building batch tank.

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Evolution of a Groundwater Treatment System—Rocky Flats, Colorado, Site

then needs to be chipped out of the treatment cells (which are made of plastic, so they're more fragile than concrete tanks) and hauled away for disposal. Due to the past nuclear weapons-related mission of Rocky Flats, the spent media often needs to be disposed of as low-level radioactive waste at a facility in Clive, Utah. This entire process makes using iron to treat Rocky Flats groundwater costly, even though the treatment process itself may be passive.

Working to improve treatment effectiveness and meet the strict water quality standards set by the U.S. Environmental Protection Agency (EPA), a different approach to water treatment was tested. The new method is called air stripping, and it is appropriate for chlorinated solvents.

Air stripping works by moving volatile contaminants from the groundwater into the air either by spraying the contaminated water through air or by blowing air through the water. Once in the air, the contaminants are quickly dispersed and degraded, and are at such low concentrations that air permits are not required. Tests at the Mound system used nozzles to spray water that had already been treated by the iron media (see Figure 1 on page 5). This approach proved to be effective at removing residual contaminants from the water.

After successful, longer-term testing at the Mound system, air stripping at the ETPTS was tested. However, in this case the air stripping process was used to treat groundwater that had not yet been treated by the iron filings (Figure 2 below). This was intended to evaluate whether air stripping might completely replace the iron-based treatment. Even though the extremely hard groundwater at Rocky Flats caused great accumulation of scale, air stripping still proved to be effective.

Air stripping is not a new technology. However, unlike allowing gravity to push water through a tank filled with iron filings, air stripping does require a substantial amount of energy to power the pumps, blowers, and other components. Since Rocky Flats has no electrical utilities, only small solar facilities, the air stripping approach required much more careful consideration than would be necessary if the air stripper could just be plugged into a nearby electrical source.

Two main factors helped to suggest air stripping might be feasible as a stand-alone, complete treatment method, despite the lack of utilities at the site. The cost of solar energy components has decreased sharply over the past several years, and the amount of water intercepted and treated by the treatment system is so small that the facility could be operated on a part-time basis. A solar power facility had been installed to support the initial air stripper installed at the East Trenches system, and with very little additional

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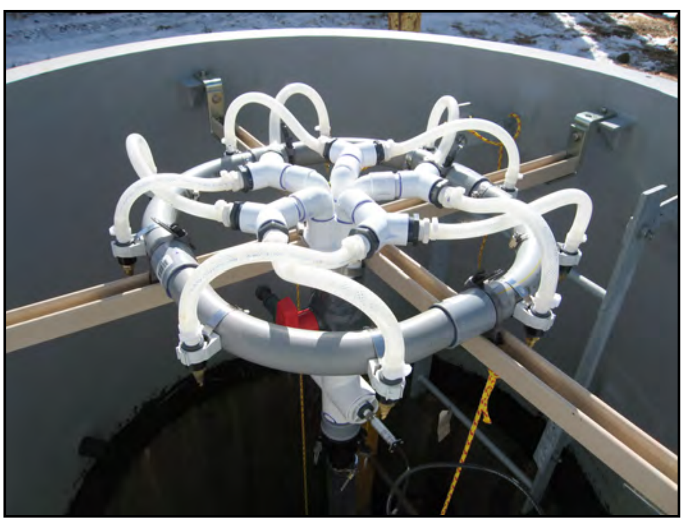

Figure 2. Air stripping at the East Trenches Plume Treatment System focused on water that was not yet treated using iron filings. The spray nozzles (above left) are located in the gray manhole next to the solar array shown in the photo on the right. The solar panels charge batteries located inside the conex, which power the pump.

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Applied Studies and Technology Stakeholder Outreach: Helping Native Students Heal the Land

greater global community. Instruction and community outreach within the Environmental Sciences program focus on air and water quality, remediation of land impacted by mining, and sustainable land management. An LM scientist recently taught the scientific method to students in an introductory class using, as an example, ongoing LM studies of groundwater phytoremediation—the science of using plants to naturally transform or prevent migration of contaminants in soil and water—at a former uranium-processing site near Shiprock, New Mexico. Faculty and students view phytoremediation as a culturally acceptable and potentially sustainable remedy. The Diné College teaching philosophy helps guide the studies, and the students help collect and analyze field data.

This winter Quentin is back in Tucson, analyzing his evidence and piecing together answers to his land stewardship questions. Quentin wrote, “This project is important to me as a member of the Navajo Nation—I am a stakeholder in this project. My family has been directly affected by the uranium that was mined and milled on the Navajo Nation. My overall goal working on this project is to protect my people from further exposure to these harmful elements, and through scientific research, prevent further damage to my people and our lands.”

Quentin, Carrie, and students like them are the next generation of leaders in their communities. They will advance the science, preserve the traditions, inform and protect the people, and help heal the land. ❖

Dr. Karletta Chief, Assistant Professor and Extension Specialist, Department of Soil, Water, and Environmental Science, University of Arizona.

LM is continually seeking opportunities to protect natural resources and the future. One simple step we can take toward improving environmental consciousness is to distribute the *Program Update* newsletter by email instead of sending a printed copy.

Please send your email address and your first and last names to lm@hq.doe.gov so that we can update our database.

Thank you for your assistance.

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Digging Deeper—DOE Offices Collaborate on Research and Remedies

contain carbon and oxidation states of uranium, iron, and sulfur that are rich in electrons (i.e., uranium^{4+}, iron^{2+}, and sulfur^{2-}). Electron-rich molecules are referred to as being "reduced." Consequently, these organic-rich sediments are referred to as "naturally reduced zones" (NRZs). NRZs are biogeochemical hotspots that host intense biological activity, which affects the behavior of metals such as iron and uranium. NRZs accumulate uranium from the groundwater. Even though the mill tailing sites are remediated, LM suspects that NRZs are providing a slow-release source of uranium to groundwater.

As shown on Figure 1, green balls illustrate uranium atoms, red balls indicate oxygen atoms, and grey balls indicate either carbon or phosphorous atoms. Sediments in the upper half of the figure are oxidized. Uranium is present in these sediments as U(VI) (i.e., uranium^{6+} oxidation state), which is soluble and mobile in groundwater. Sediments in the bottom half of the figure are stained dark by electron-rich iron sulfide minerals, which indicate reducing conditions. This dark coloration is characteristic of NRZs. Uranium in this portion of the sediments is present as U(IV) (uranium^{4+}). As illustrated in Figure 1, the molecular-scale structures of U(IV) and U(VI) are different. Synchrotron-based techniques at SLAC can distinguish between these different forms of uranium at concentrations naturally present in NRZs.

Processes controlling uranium mobility at the Old Rifle site are likely to be common throughout the upper Colorado River Basin, which hosts a large fraction of LM processing sites. In order to test this hypothesis, it is necessary to examine sediments from different sites within and peripheral to the upper basin. Consequently, the central goal of the new field effort is to examine uranium-organic matter interactions at this basin-wide scale.

Recent work suggests that seasonal precipitation of evaporites may also contribute to uranium-plume persistence. Samples taken from a river bank at the Riverton site were found to contain uranium-bearing evaporite minerals. The samples were collected by researchers from the Savannah River National Laboratory in South Carolina, and are also being tested at SLAC.

A Collaborative Fieldwork Program

While the SLAC team brings expertise in molecular-scale science, it does not have the logistical and geotechnical resources for a region-wide study. DOE has developed extensive knowledge and expertise in these areas

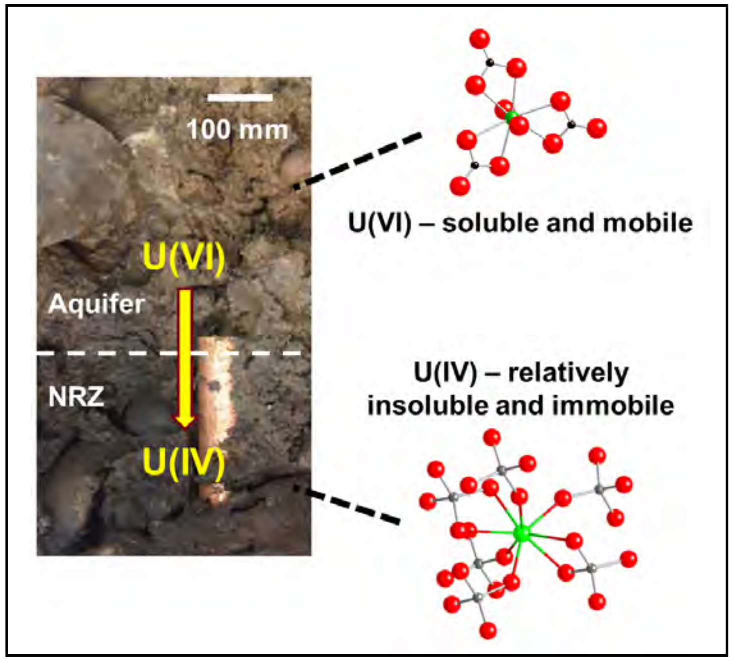

Figure 1. Diagram depicts a cross-section of core from the Old Rifle site and displays different molecular structures of uranium, which control mobility between water and sediments.

over two decades of stewardship work with uranium-mill-tailings sites. This is one of the areas where the capabilities of SLAC and those of LM are complementary.

The SLAC and LM collaboration involves collecting sediment, groundwater, and pore water samples by hand auger, Geoprobe®, and rotosonic coring methods. Samples are collected along entire cores at high spatial resolution (down to 2-inch intervals). Sediments are then shipped to SLAC for analysis of the molecular speciation of uranium, iron, sulfur, and natural organic matter, to identify microbial genes in the sediments, and to analyze uranium isotope signatures. By combining these measurements, it will be possible to develop a comprehensive picture of biological and non-biological processes that control the ability of organic-rich sediments to hold and release uranium.

Persistent uranium mobility in floodplains is a long-standing and extremely difficult problem for LM. By performing molecular-scale studies at sites across the upper Colorado River Basin, SLAC and LM will have the opportunity to develop new and more accurate models to rationalize, predict, and manage uranium behavior. This work demonstrates effective cross-organizational and interdisciplinary efforts. The ultimate goal for LM is to use national laboratory basic research to evaluate and improve compliance strategies, including natural flushing and alternatives. ❖

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Evolution of a Groundwater Treatment System—Rocky Flats, Colorado, Site

power to help provide a safety margin, we could confidently power an air stripper if it could be limited to operating a few hours every day.

Air stripper manufacturers were contacted to evaluate how feasible this approach might be. Water quality data, including basic information like temperature and pH, as well as details including concentrations of the contaminants and hardness levels, were provided. Additional information included water flow rates, treatment requirements (the standards to which the discharged water would be held), location of the unit, and specifications of the existing solar power facility. One firm responded favorably, confirming that existing power would be adequate to drive a commercial air stripper for several hours of daily treatment of intercepted water, and meet EPA water quality standards. In addition, the air stripper would not need to be heated (a concern in Colorado winters), and managing the hard-water scale should not require more than normal effort.

The project to reconfigure the ETPTS for operating by air stripping rather than iron-based treatment began in late 2013. Designs were finalized in early 2014 and fieldwork began this past summer. The two plastic tanks that previously held iron filings will be repurposed. One will be used to accumulate untreated water (air stripper influent), and the other will accumulate and slowly discharge water that has been treated by the air stripper (effluent). The air stripper will operate for several hours each day (longer when flows are higher and more groundwater has accumulated in the influent tank, and shorter when conditions are drier). It will be housed in a small, insulated shed installed into the ground to benefit from geothermal heat; it will also have a small solar-thermal array on its roof to lessen the effects of winter temperatures. The system will incorporate automation to reduce the potential for undesirable events, such as overflows, dead batteries, frozen components, etc.

The reconfigured ETPTS is scheduled to be completed in January 2015. ❖

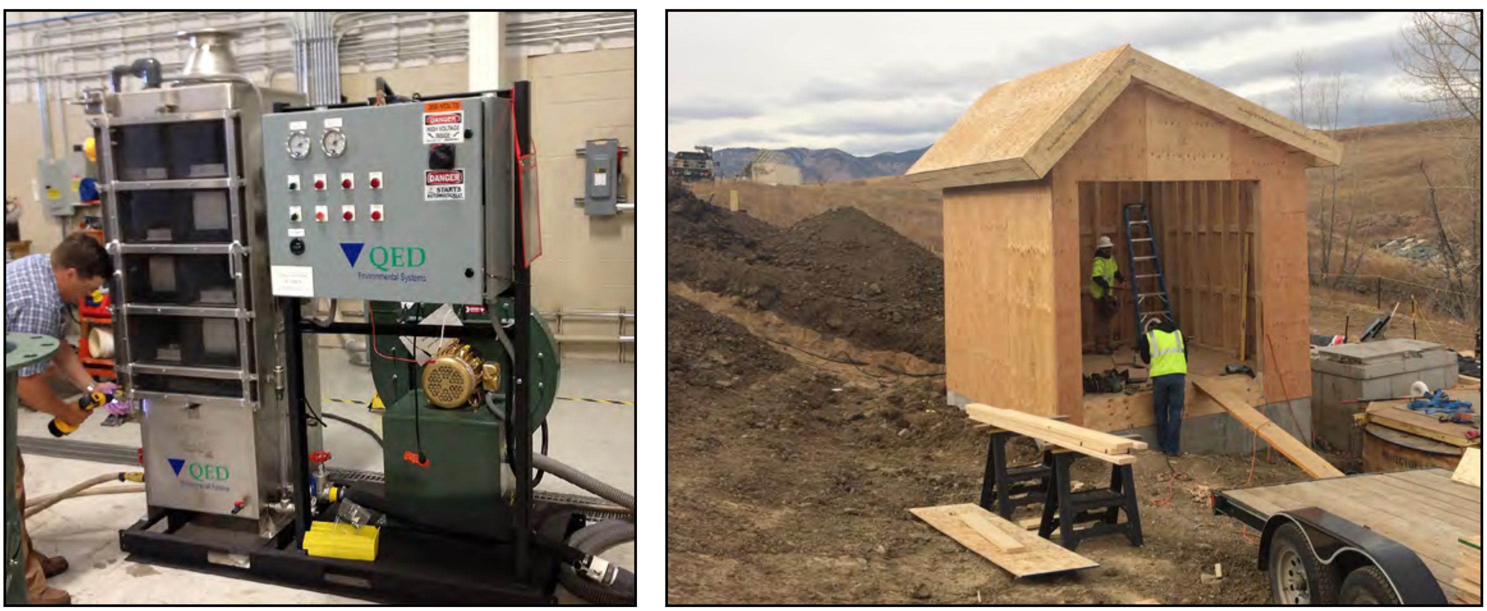

Figure 3. The new, commercial air stripper is shown in the left photo above, and will be housed in the shed shown in the photo on the right. The roof of the shed is angled to provide better solar-thermal exposure. The solar/battery conex from Figure 2 (see page 14) is visible in the background to the left of the shed.

Anticipated Legacy Management Sites Through Fiscal Year (FY) 2020

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LM New Employees—Welcome Aboard!

Luis A. Rivera started working as a financial analyst in the Washington, DC, LM office on October 19, 2014, and is part of the Planning, Budget, and Acquisition Team. Before joining LM, Luis worked for the Federal Emergency Management Agency (FEMA). While in the Office of the Chief Financial Officer, Luis managed budget formulation and budget execution functions for five of the ten FEMA Regions and three FEMA programs. He also participated in drafting policies and providing recommendations relating to travel policy; the quarterly resource review process, providing final decision documents to all programs; and participating in the President's Budget Review process.

Luis is a graduate of St. Mary's University in San Antonio, Texas. At St. Mary's, he received his bachelor's degree in corporate financial management and risk management. Luis earned his master's degree at the University of Texas at San Antonio. ❖

Legacy Management Goals and Objectives

Goal 1. Protect human health and the environment

Objectives

1. Comply with environmental laws and regulations.
2. Reduce health risks and long-term surveillance and maintenance (LTS&M) costs.
3. Partner with other Federal programs to make environmental remedies better and last longer.
4. Oversee DOE implementation of Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*.

Goal 2. Preserve, protect, and share records and information

Objectives

1. Meet public expectations for outreach activities.
2. Protect records and make them accessible.
3. Protect and ensure access to information.

Goal 3. Meet commitments to the contractor work force

Objectives

1. Safeguard contractor pension plans.
2. Fund contractor health and life insurance.

Goal 4. Optimize the use of land and assets

Objectives

1. Optimize public use of Federal lands and properties.
2. Transfer excess government property.
3. Improve domestic uranium mining and milling operations.

Goal 5. Sustain management excellence

Objectives

1. Renew LM's designation as a high performing organization (HPO).
2. Implement LM's *Human Capital Management Plan*.
3. Operate in a sustainable manner and reduce LM's carbon footprint.

U.S. DEPARTMENT OF ENERGY | Legacy Management

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U.S. Department of Energy
Office of Legacy Management

Program Update

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LM Public Information Update

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