



Program Update

July–September 2016

Welcome to the July–September 2016 issue of the U.S. Department of Energy (DOE) Office of Legacy Management (LM) 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

Unmanned Aircraft Systems Used to Improve Methods for Estimating Groundwater Discharge by Plants

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) uses mathematical models and monitoring-well data to understand and predict contaminated groundwater flow at former uranium processing sites. A more holistic understanding of groundwater systems may lead to more reliable models and better remediation strategies. Plants, for example, can influence the flow of groundwater. Plants with roots that tap groundwater to survive, called phreatophytes, can withdraw large volumes of water and alter groundwater flow. The combination of this pumping of water by plants (transpiration), and evaporation of water from a soil surface, is called evapotranspiration (ET).

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The LM Applied Studies and Technology (AS&T) program is collaborating with the DOE Office of Environmental Management (EM), the U.S. Geological Survey (USGS), and the University of Arizona (UA) to improve a method for estimating ET discharge of groundwater using imagery from unmanned aircraft systems (UAS). The collaboration will benefit DOE and USGS. LM's extensive network of groundwater monitoring wells record fluctuations in groundwater elevation and flow at uranium processing sites. LM will use the USGS's UAS technology to test hypotheses that these fluctuations can be attributed, in part, to changes in ET over time and space. USGS is studying ET by tamarisk, a

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Goal 2

What Are EEOICPA and RECA?

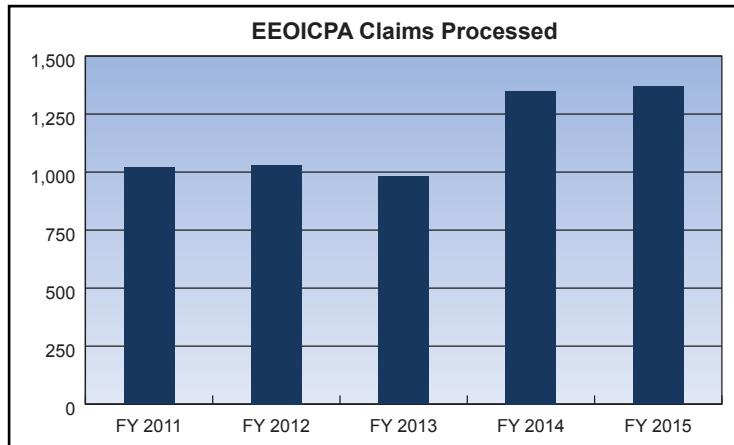
The Energy Employees Occupational Illness Compensation Program Act, or EEOICPA, was enacted in October 2000. EEOICPA covers employees—including contractors and subcontractors—of the U.S. Department of Energy (DOE) and predecessor agencies. It compensates workers involved in nuclear weapons production and testing programs who have developed occupational-related illnesses.

Compensation is provided through lump-sum payments and medical care to current or former DOE employees (or their survivors), contractor and subcontractor employees, and to certain vendors diagnosed with work-related illnesses at specified DOE facilities. (Visit <https://ehss.energy.gov/Search/Facility/findfacility.aspx> for a list of DOE-covered facilities.)

Implementation of EEOICPA is coordinated by four federal agencies, the Department of Labor (DOL), DOE, the National Institute for Occupational Safety and Health (NIOSH), and the Department of Justice (DOJ). DOL is responsible for administering EEOICPA, including claims adjudication for compensation and benefit payments. DOE provides records research. NIOSH performs occupational-radiation-dose reconstruction and is responsible for Special Exposure Cohorts (www.cdc.gov/niosh/ocas/ocassec.html). DOJ works closely with DOL to coordinate payments under Radiation Exposure Compensation Act (RECA) Section 5.



A miner drilling in a Colorado mine in 1955. Miners at former DOE facilities may meet eligibility requirements for EEOICPA and RECA compensation.



RECA pays individuals who developed cancer and other specified diseases from exposure to atmospheric nuclear testing conducted by the United States during the Cold War, or from exposure during uranium mining.

RECA Section 5 covers uranium miners, uranium-mill workers, and uranium-ore transporters. EEOICPA provides additional compensation to workers who receive RECA Section 5 compensation. Additional EEOICPA terms include monetary compensation and future medical benefits related to the condition for which they were approved under RECA Section 5.

DOE's role is to provide employee and site operational records to DOL and NIOSH for EEOICPA claim processing. EEOICPA claims account for approximately 70 percent of the record requests processed by the DOE Office of Legacy Management (LM) over the last 5 years.

The chart above illustrates a 35 percent increase in EEOICPA claims processed by LM in fiscal years 2014 and 2015. This increase is due to expanded Special Exposure Cohort eligibility and DOL's public outreach in areas near LM sites.

If you feel that you or a family member may qualify for EEOICPA benefits, please contact DOL. There are 11 resource centers located nationwide that provide assistance for individuals interested in filing EEOICPA claims. Resource center staff provide both in-person and telephone-based assistance. For a listing of each resource center, or to obtain additional information about how to file an EEOICPA claim, call DOL toll-free at (866) 888-3322, or visit <http://www.dol.gov/owcp/energy/>.

If you feel that you or a family member may qualify for RECA benefits, please contact DOJ toll-free at (800) 729-7327, or visit <http://www.justice.gov/civil/common/reca>. ♦



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Goal 2

LM Is a Repeat EPEAT Purchaser Award Recipient!

The Green Electronics Council (<http://greenelectronicscouncil.org/>) announced the winners of the 2016 Electronic Product Environmental Assessment Tool (EPEAT) Sustainable Purchasing Awards on May 24, 2016. The awards recognize excellence in sustainable electronics procurement. EPEAT purchasers earn a star for each product category for which they have a written policy in place requiring the purchase of EPEAT-registered electronics. The award winners represented a wide range of organizations, including national and provincial/state governments, leading academic institutions, and the healthcare sector.

For the second consecutive year, LM is a two-star EPEAT Purchaser Award winner for continuing excellence in sustainable procurement of electronic equipment.

Thirty-eight 2016 award winners were recognized for their procurement efforts in up to three categories:

- PCs/displays (desktops, notebooks, integrated desktop computers, workstation desktops, thin clients)
- Imaging equipment (copiers, digital duplicators, facsimile machines, mailing machines, multifunction devices, printers, scanners)
- Televisions

To qualify for the award, LM needed to demonstrate implemented policy for procuring environmentally preferable electronic equipment. The policy also included vendor contract specifications requiring that all PCs, laptops, monitors, and imaging equipment (printers) achieve bronze registration or better in the EPEAT system. Of the \$245,000 in EPEAT-rated electronic equipment purchased during fiscal year 2015, nearly 100 percent was registered at the EPEAT-gold level.

The combined impact of this year's 38 EPEAT Sustainable Purchasing Award winners resulted in more than \$16.8 million in energy savings, greenhouse gas reductions equivalent to removing 29,786 passenger cars from the road for a year, and a reduction of more than 702 metric tons of hazardous waste. ♦



Legacy Manager

U.S. DEA SW La

City/C

Tania Smith Taylor (right), Office of Site Operations Director, accepted the 2016 EPEAT Purchaser Award for LM.



Program Update



Goal 1

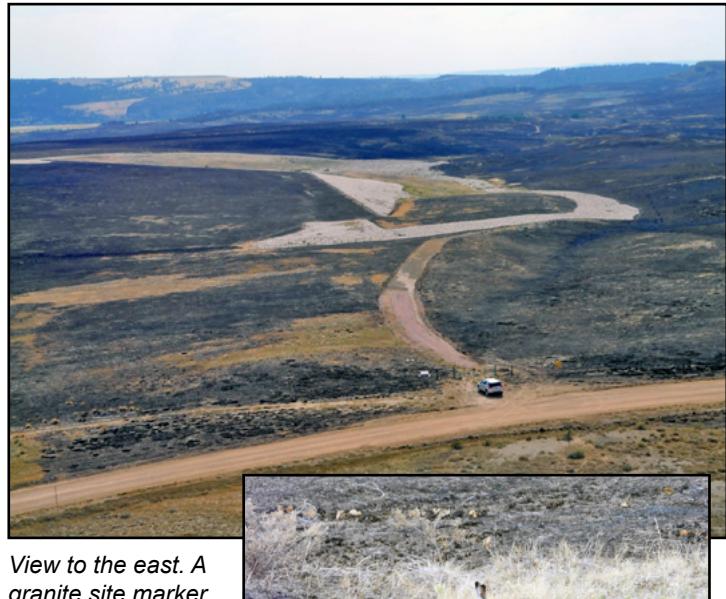
Summer Wildfire Engulfs Edgemont, South Dakota, Site

On July 17 and 18, 2016, a fast-moving, naturally caused wildfire burned over the 360-acre Edgemont, South Dakota, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II disposal site. The U.S. Department of Energy Office Legacy Management (LM) learned of the event early July 19, 2016, from a local rancher, whom LM permits to graze cattle on the site in return for fence maintenance and reporting local events that affect the site. Although the cell and the engineered erosion-control structures were unlikely to have been damaged by the wildfire, photos provided by the rancher and follow-up discussions indicated damage to the site's surface features (e.g. fences, signs, grass) was likely. On July 22, LM visited the site to verify the fire's impact, ensure the site was safe, and determine if any repairs were needed due to the fire or fire-fighting efforts.

The 100-acre disposal cell is located about 2 miles south of the city of Edgemont, in southwestern South Dakota. Between 1986 and 1989, approximately 4 million tons of uranium mill tailings, contaminated soils, building debris, and contaminated material from 251 vicinity properties were placed in the disposal cell during remediation of the Edgemont mill. The cell is designed to be protective for 200 to 1,000 years. The 9-foot-thick cell cover consists of a low-permeability radon barrier (first layer placed over compacted tailings) consisting of compacted clay; clean, compacted fill; and a layer of topsoil material. The top of the cell and surrounding disturbed areas were seeded with native grasses. The cell design includes ditches that divert runoff water away from the cell cover.

The annual site inspection, required under the U.S. Nuclear Regulatory Commission license for UMTRCA Title II sites, took place only 5 days before the wildfire, and determined that the site was in good condition. Approximately 100 head of cattle were counted on the site during the inspection. After the fire, when asked about the cattle, the rancher stated he did not know how they did it, but, "Not one cow was harmed!"

The post-fire inspection found minimal site damage. An entrance sign post had been bent by a bulldozer that had entered the site to clear a 150 foot section of vegetation to create a 20-foot-wide fire break. The rancher will reset the sign post. Bulldozer work stopped before reaching the tailings containment portion of the site. The barbed wire perimeter fence was in good condition—one small section



View to the east. A granite site marker is visible left of the vehicle and a new fire break begins half way between the vehicle and the white-rock runoff-diversion channel.



Numerous jackrabbits were observed after the fire, mostly near unburned vegetation within the riprap areas, but several were in deep burrows in the middle of burned areas.

had been damaged when the bulldozer entered the site, but was repaired by the rancher. The roots of the plant systems appeared to be in good condition and should continue to prevent soil erosion.

The fire appears to have been beneficial, as it consumed a large quantity of brush, thus preventing a more damaging fire in the future. Wildfires occur naturally on open prairies and are important to maintaining the ecosystem.

The wildfire at the Edgemont site may also benefit LM's pollinator initiative. The fire removed live and dead vegetation that competes with seedlings, creating an opportunity to seed pollinator species with a greater chance of success. A seed mix developed to support wild bee populations in the region could be broadcast over the site's burned areas. This would be a relatively low-cost project, as the seed could be spread onto the ground without soil preparation or amendments. This would support LM's

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Goals 1 and 6

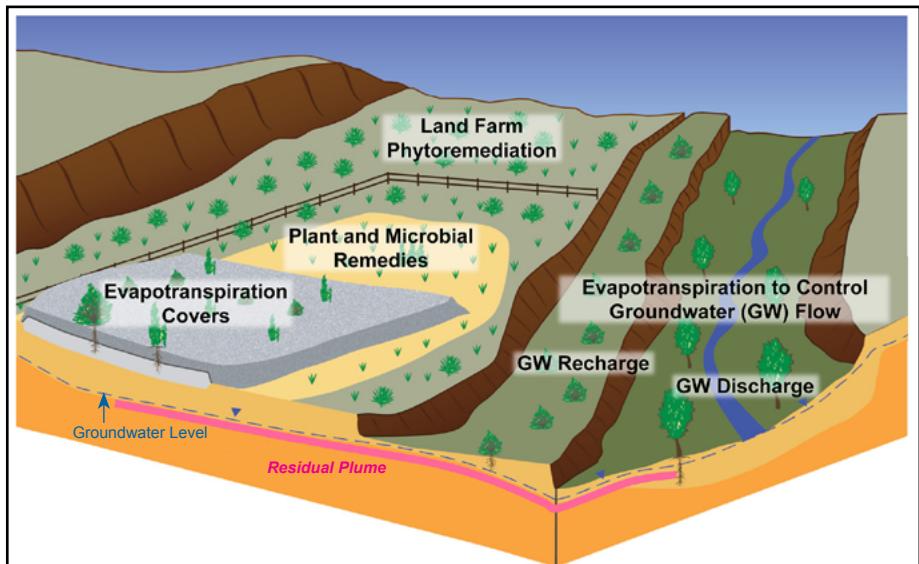
Ecological Engineering Remedies Presentation Given at International Atomic Energy Agency Conference

One goal of the U.S. Department of Energy Office of Legacy Management (LM) Applied Studies and Technology (AS&T) program is to share new knowledge. LM and the International Atomic Energy Agency (IAEA) often share advances in applied science. In May 2016, AS&T scientist Dr. Jody Waugh traveled to Madrid, Spain, to give a keynote presentation at the IAEA *International Conference on Advancing the Global Implementation of Decommissioning and Environmental Remediation Programmes*. The presentation was a synopsis of ecological engineering remedies that LM is evaluating at former uranium processing sites in the southwestern United States.

Ecological engineering remedies are based on the concept that natural ecological processes at legacy sites can be beneficially enhanced or manipulated. Dr. Waugh presented test cases for four ecological engineering remedies that may be candidates for international applications.

Hydraulic Control of Groundwater

LM is responsible for characterizing and remediating groundwater at several former uranium mill sites. Groundwater contamination at these sites is primarily due to large volumes of processing liquids seeping from tailings impoundments during milling operations. AS&T evaluated evapotranspiration (ET) by native plants to hydraulically control groundwater flow as an alternative to pump-and-treat remedies at three legacy sites in Arizona and New Mexico. Scientists characterized the sites' plant ecology, strategically transplanted native desert phreatophytes (deep-rooted desert plants that withdraw groundwater), and developed a mathematical model that combines satellite imagery and ground measurements of plants to estimate landscape-scale ET. Results suggest that by managing livestock grazing and planting native phreatophytes, ET from healthier vegetation can control upland recharge, enhance groundwater discharge, and thereby sustainably help control groundwater flow and contaminant transport.



Uranium mill tailings ecological engineering remedies.

In Situ Plant and Microbial Remedies for Soil and Groundwater

Uranium processing fluids leaching from tailings left residual contamination in soil and groundwater at many legacy sites. AS&T combined phytoremediation and microbial cycles to reduce nitrate and ammonium levels at one former uranium mill site in Arizona. Contaminants were leaching into groundwater from a bare soil area where a tailings pile had been removed. Scientists planted and lightly irrigated this source area with two species of native shrubs, and then discontinued irrigation. ET decreased leaching, and total soil nitrogen levels dropped more than 80 percent over 15 years. Nitrogen isotope analyses indicated that the drop resulted from coupled microbial nitrification and denitrification processes. Scientists also greatly enhanced rates of microbial denitrification in groundwater by injecting ethanol, which also reduced sulfate and uranium levels and led to a current AS&T investigation of ethanol injection to enhance microbial isolation of uranium in groundwater.

Land Farm Phytoremediation of Groundwater

AS&T evaluated land-farm phytoremediation as a pump-and-treat approach for nitrate, ammonia, and sulfate

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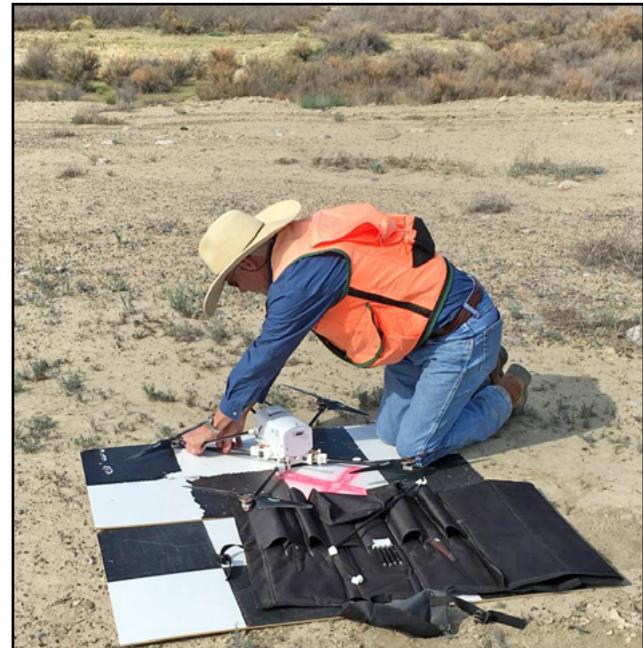
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Unmanned Aircraft Systems Used to Improve Methods for Estimating Groundwater Discharge by Plants

non-native tree that competes for water with native cottonwoods and willows along river corridors of the southwestern United States. USGS is particularly interested in tamarisk defoliation by introduced beetles and subsequent effects to tamarisk health and ET on water resources. Tamarisk beetles co-evolved in Asia with tamarisk trees. The U.S. Department of Agriculture released tamarisk beetles for biocontrol after years of studies verified that they feed only on plants of the tamarisk family. USGS and UA will use LM's groundwater monitoring data as an independent check of their UAS methods for estimating tamarisk ET.

The research team currently estimates ET using a computer algorithm that Dr. Pamela Nagler, USGS, and Dr. Edward Glenn, UA, derived from statistical relationships between ground-based measurements of plant health and ET, climate data, and multispectral satellite imagery. Satellite images are used to scale ET ground measurements to larger landscapes. The algorithm using satellite imagery works well for rangeland vegetation that may extend many miles. However, the satellite imagery lacks the resolution needed to estimate ET for smaller land areas within river corridors. The research team plans to use high-resolution UAS imagery to detect subtle changes in the patchy distribution of tamarisk and other phreatophytes growing at uranium processing sites adjacent to rivers in the southwestern United States. The higher UAS imagery resolution is due to the UAS flying at a lower altitude. Scientists will use UAS images to correlate satellite and UAS imagery to improve the algorithm for scaling up from ground measurements of plant health and ET to satellite images of larger landscapes. LM groundwater modeling could benefit from the improved algorithm's greater vegetation detail where ET may be much higher along river corridors.

In August 2016, LM, EM, and USGS scientists teamed with faculty from Diné College, a 4-year, tribally controlled community college serving the Navajo Nation, to obtain UAS imagery and ground data needed to estimate ET by tamarisks and other phreatophytes. The research team acquired imagery and measured plant growth indices for phreatophytic trees growing on floodplains at uranium mill tailings sites adjacent to the San Juan River near LM's Shiprock, New Mexico, Disposal Site and the Colorado River near EM's Moab, Utah, site. USGS pilots flew a quadcopter equipped with a high-resolution multispectral camera. Flights were timed to coincide with satellite overpasses. AS&T and Diné College scientists measured the leaf area index (LAI) of phreatophytes growing on the floodplains. LAI is the green leaf area within a plant canopy per unit of ground surface area. Scientists measured



John Vogel, USGS, preparing to launch a quadcopter equipped with a multispectral camera to fly a section of the San Juan River floodplain near the Shiprock, New Mexico, site.



Neilroy Singer, Diné Environmental Institute, Diné College, preparing rabbitbrush samples for leaf-area measurement using an electronic planimeter (background).

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Summer Wildfire Engulfs Edgemont, South Dakota, Site

goals to increase the diversity of desirable native plants in disturbed areas of the site and to provide habitat for pollinators.

LM confirmed that the fire did not harm any of the disposal cell's engineered features and will continue to monitor the site to ensure that the cell remains protective of human health and the environment. The site will be inspected for any effects from the fire, specifically possible erosion caused by plant loss. Any ecological benefits resulting from the fire will be documented. Areas damaged by the new firebreak will be reseeded and the berms created will be graded to prevent channeling runoff. A September 2016 site visit was planned by LM ecologists as part of a noxious-weed control program, but the focus was shifted to the ecological effects of the fire. ♦



Site condition 5 days after the fire. This interior fence is used for grazing and is not part of the perimeter fence system. It will be repaired by the grazing permittee.



The granite marker providing information about the site is designed to outlast all other signs and institutional controls.



Vegetation is recovering 7 weeks after the wildfire.

View toward the south from the northwest corner of the site. Signs were unharmed by the wildfire.



Goal 1

Florida Department of Environmental Protection Issues Completion Orders for Two Pinellas Sites

In July 2016, the U.S. Department of Energy (DOE) Office of Legacy Management (LM) achieved two key cleanup milestones at the Pinellas County, Florida, Site in Largo by completing work at two of the site's four active remediation areas where DOE has been performing corrective actions under a Hazardous and Solid Waste Amendments permit since 1990.

The Pinellas site is a former nuclear weapons component production facility 10 miles northwest of St. Petersburg that operated from 1957 to 1997. DOE has been remediating contaminated locations across the site for more than 25 years.

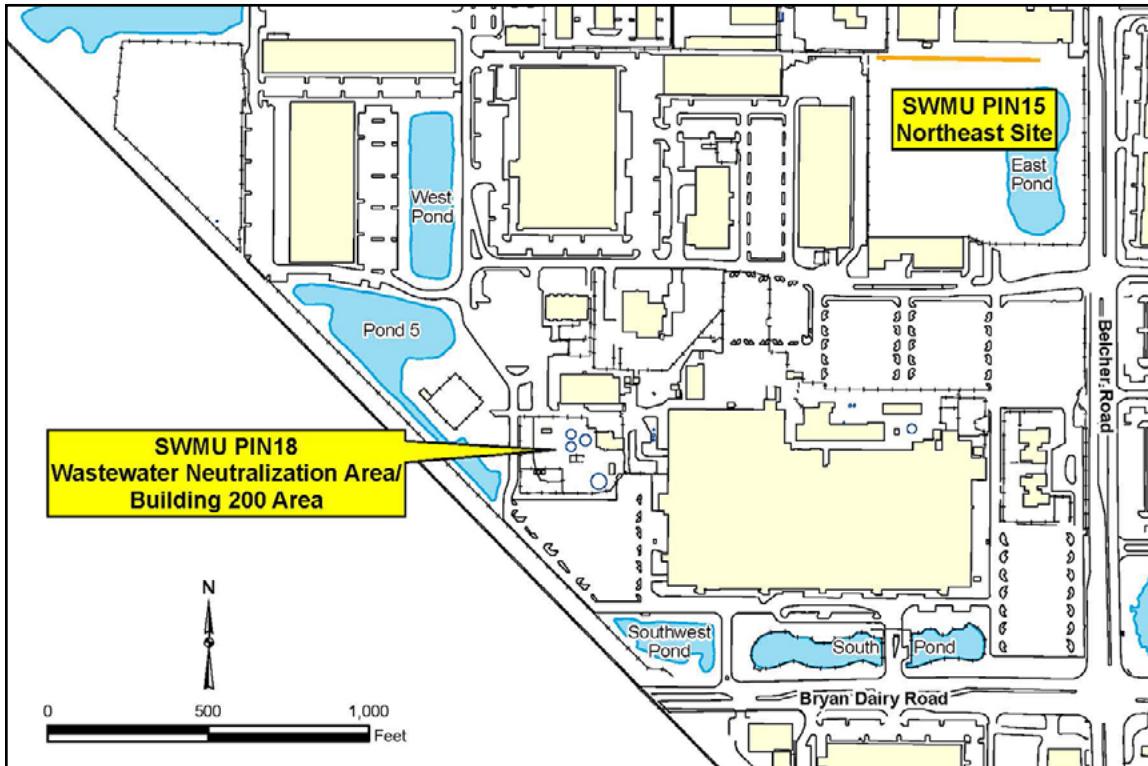
Contamination at the Northeast Site consisted of nonaqueous phase liquids, including trichloroethene, dichloroethene, methylene chloride, toluene, and oils. Cleanup involved using a large-diameter auger to remove contaminant source soils, and thermal treatment techniques including electrical resistive heating and steam-enhanced

extraction to remove contaminant liquids and vapors that were treated in an above-ground treatment system. Following the excavation and extraction processes, enhanced bioremediation amendments were injected into the subsurface to treat the dissolved chlorinated solvents remaining in the groundwater. These actions resulted in removing more than 20,000 pounds of solvents and reduced contaminant concentrations to near drinking-water standards.

Groundwater in the Wastewater Neutralization Area (WWNA) was contaminated with arsenic. DOE extracted the contaminated groundwater and conducted extensive soil sampling to identify the areas with the highest arsenic-contamination levels. These soils were excavated to remove the arsenic contamination source.

On July 27, the Florida Department of Environmental Protection (FDEP) issued conditional Site Rehabilitation Completion Orders for the Northeast Site and the WWNA.

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Unmanned Aircraft Systems Used to Improve Methods for Estimating Groundwater Discharge by Plants

LAI indirectly for tree species and directly for smaller shrubs. The indirect method used an instrument with a fish-eye optical sensor that detects light penetrating a tree canopy at different angles, and a mathematical model of light interception and transfer in tree canopies. For the direct method, scientists harvested leaves overlying a standard ground surface area, and measured leaf area using an electronic planimeter.

What's next? USGS scientists will process and analyze the UAS imagery then the research team will use that imagery and LAI data from Shiprock and Moab to refine the algorithm for estimating landscape-scale ET. LM and USGS will use the new algorithm to estimate spatial, seasonal, and annual variation in ET and groundwater discharge for tamarisk and other phreatophytes growing along river corridors at the Shiprock and Moab sites. ♦

Dr. Jody Waugh, LM support contractor AS&T scientist, uses an optical instrument to estimate leaf area index beneath a cottonwood tree growing on the San Juan River floodplain near the Shiprock, New Mexico, site.



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Florida Department of Environmental Protection Issues Completion Orders for Two Pinellas Sites

This milestone resulted from years of aggressive DOE efforts, using the most up-to-date technologies, to meet state groundwater cleanup target levels (drinking-water standards) and negotiate institutional controls with the landowners. The completion orders significantly reduce DOE's long-term liabilities at the Pinellas site and document the state's concurrence that remediation is complete and protective of human health. DOE has no additional remediation responsibilities at the two completed areas, no additional groundwater monitoring is required, and LM will assist the land owners in enforcing the minor groundwater use restrictions that make up the institutional controls.



The electrical resistive heating and steam-enhanced extraction treatment system at the Northeast Site (above), and source soils excavation removed more than 20,000 pounds of solvents from groundwater and reduced contaminant concentrations to near drinking-water standards.

DOE continues to conduct corrective actions at the two remaining active sites, the 4.5 Acre Site and the Building 100 Area, with the goal of achieving closures in the near future.

For more information about the Pinellas County, Florida, Site, please visit <http://www.lm.doe.gov/pinellas/Sites.aspx>. ♦



Goal 1

Using LiDAR Technology to Monitor Disposal Cell Changes

The U.S. Department of Energy Office of Legacy Management (LM) is using evolving technology to create high-resolution topographic maps of radioactive-waste disposal cells. The technology, known as Light Detection and Ranging, or LiDAR, uses laser light to map the location and elevation of surface features. Initial uses are to determine if changes are occurring to the physical configurations of cells and provide stewards with a baseline to document as-built conditions and determine if slow-acting changes are occurring.

LM is responsible for 44 radioactive-waste disposal cells across the United States. The cells are designed to remain stable for hundreds of years. Each cell is monitored to ensure it is performing as designed. Monitoring consists first of a visual inspection to look for changes, such as cover materials moving down the cell's side or forming depressions, plant growth, or rock degradation. If a potential change is found, more information is needed and a topographic survey may be required.

Historically, topographic surveys were conducted using transit and rod survey equipment or, more recently, global positioning system equipment. Elevation data was limited by the number of recorded locations. Results varied because the rod could be placed on top of a large rock for one survey and between rocks for another. It might take several days to conduct a conventional topographic survey of a disposal cell that covers hundreds of acres, due to the number of data points needed to obtain a sufficient database and because the survey resolution might miss small changes in elevation due to the uneven surfaces of the rocks. LiDAR methods collect more data and small, progressive changes can be detected. With LiDAR technology the survey can be performed in less than an hour, with a minimum of 20 elevation data points collected per square meter.

A LiDAR system is mounted on a piloted aircraft or an unmanned aerial system (UAS). The LiDAR device emits pulses of laser light. Some pulses reflect off the ground and back to a detector in the aircraft or UAS. The position of the detector is accurately recorded and the distance to an object is measured by the time it takes the pulse to reflect off the object and back to the detector. The system can define elevation changes as small as 3 inches.

Laser light is extremely focused. A pulse can be reflected off anything on the surface—the top of a plant, a tree branch,



Surveyors install a ground control station for the Bluewater, New Mexico, Disposal Site LiDAR survey.

or the bare earth. Reflections off vegetation arrive sooner than reflections off the land surface. Each pulse is recorded with reflection time and location information. The data points form a three-dimensional “point cloud.”

After data are collected, they are processed to remove vegetation and other effects then analyzed to create a digital elevation model of the disposal cell surface. Data can be presented as topographic maps, three-dimensional visualizations, or other products. Data from different surveys can be compared to identify changes in elevation, which might indicate slow, modifying processes at work on disposal structures.

Following are two examples of LiDAR use for the LM long-term surveillance and maintenance program.

**Bluewater, New Mexico, Disposal Site
LiDAR Survey**

The main disposal cell at the Bluewater site was designed to allow storm water to flow off the top and down the sides. However, depressions started to form shortly after the cell was built and storm water and snow melt began ponding on the cell surface. Water that does not evaporate can seep through the radioactive waste and into the underlying formation.

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Goal 6

Fernald Preserve— A Visit to Remember

Memorial Day weekend 2016, Sally Nelson of Albuquerque, New Mexico, and her sister Diane Nelson of Huntington, West Virginia, visited the Fernald Preserve, Ohio, Visitors Center. Their father McDonald (Don) S. Nelson had been assistant plant manager for National Lead of Ohio, the contract operator for the Fernald Feed Materials Production Center during the late 1950s and 1960s, at the peak of the 40-year Cold War uranium metals production.

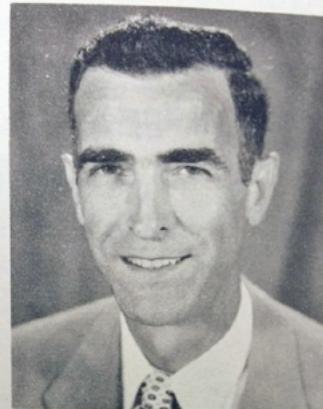
The sisters looked through historic volumes of the employee news publication, *The Atomizer*, and were able to locate numerous pictures of their father. They also found pictures and references to other family members, including one of Diane, at the age of 18, in an article about a New Zealand exchange student who resided for a year in the Nelson's

Harrison, Ohio, home. The exchange between Visitors Center staff and the sisters was mutually beneficial as past and present stories were shared.

Stories preserved in family oral tradition, along with written material, digital archives, and artifacts at the Fernald Visitors Center bring past decades to life and are important to U.S. Department of Energy Office of Legacy Management's work to impart historical lessons into programs for today's youth. The Nelson sisters were pleased to see the site's evolution and learn about its current mission to engage the public with the history, stories, meanings, and nature of the land, expressing that they wished their parents could see it now, knowing that it would make them smile. ♦



Sisters Diane Nelson Feagans and Sally Nelson look through materials at the Fernald Preserve Visitors Center, delighted to find articles and photos of their father.



McDONALD S. NELSON
Assistant Plant Manager

Mr. Nelson has been an employee of the National Lead Company for 16 years. He started with the Company as Assistant Plant Manager at the wartime operation, Magnesium Reduction Company at Luckey, Ohio, and later as Assistant Superintendent at the Company's St. Louis Lead and Oil Works. From 1946 to 1951 he was Plant Superintendent of the Hoyt Plant at Granite City, Illinois. His positions at Fernald include Superintendent of Plants 5 and 9, Superintendent of Production Engineering, and General Superintendent.

Newspaper clipping announcing the promotion of Mr. McDonald Nelson, discovered by his daughters during their visit to the Fernald Preserve Visitors Center.



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Ecological Engineering Remedies Presentation Given at IAEA Conference

contamination in groundwater at a former mill site in Arizona. Scientists irrigated a planting of native shrubs with nitrogen-contaminated groundwater pumped from an alluvial aquifer. Plant uptake and microbial denitrification and nitrification cycles kept nitrogen levels from building up in the land-farm soil, plant growth and transpiration limited nitrate and ammonia recharge and leaching back into the aquifer, sulfate pumped from the plume remained in the soil profile as calcium sulfate, and the land farm produced a native seed crop that residents could use for rangeland revegetation and mine-land reclamation.

Evapotranspiration Covers for Tailings Disposal Cells

Finally, AS&T is evaluating ET covers as an alternative to conventional covers for tailings disposal cells. ET covers consist of thick, fine-textured soil layers that retain precipitation, which is seasonally removed by plants. Capillary barriers composed of coarse-textured sand and

gravel placed below this soil "sponge" can enhance soil water storage capacity and limit unsaturated flow. The sustainability of ET covers depends, in part, on the establishment and resilience of a diverse plant community. Scientists used a series of increasingly larger test cells to design an ET cover for a uranium mill tailings disposal cell in Utah. The design used sandy clay loam soil from the site and native shrub-steppe vegetation. The test cells were designed to continuously measure percolation at a field scale and to provide comprehensive soil water balance monitoring. Results were used to design the final cover for the disposal cell. Subsequent monitoring over 16 years demonstrated exceptional hydraulic performance of the ET cover.

LM and IAEA plan to continue sharing knowledge about remediation science applications. IAEA invited Dr. Waugh to return and share more information on ecological engineering remedies with member states. LM has hosted IAEA tours of AS&T field studies at legacy sites in Colorado, Utah, and Arizona in the past, and will continue to do so in the future. ♦



Save the Date!

WEAPONS TO WETLANDS

A Decade of Difference

Saturday, October 29, 2016
10:00 a.m. to 2:00 p.m.


Fernald Preserve



The U.S. Department of Energy Office of Legacy Management invites you to remember the work that took the Fernald Feed Materials Production Center, to the Fernald Closure Project, to the Fernald Preserve. At the time, the project was one of the largest environmental cleanup operations in the history of the United States. See how the site has come full circle with the restoration of extensive natural habitats including wetland, prairies, and forest.

Enjoy walks, demonstrations, special guests, and refreshments as we contemplate the dramatic changes that have been brought about on the landscape. You will have the opportunity to learn about the ongoing aquifer remediation, monitoring programs, and the community asset features, including walking trails, wildlife viewing, history exhibits, and meeting spaces.

The site's mission changed from broad-scale environmental remediation to groundwater remedy, ecological restoration, monitoring, and public access during October of 2006. See the land now—10 years later.

For more information about Fernald Preserve activities, contact:

**Fernald Preserve Visitors Center
7400 Willey Road, Hamilton, OH 45013
(513) 648-3330**

**fernald@lm.doe.gov
www.lm.doe.gov/fernald**



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Using LiDAR Technology to Monitor Disposal Cell Changes

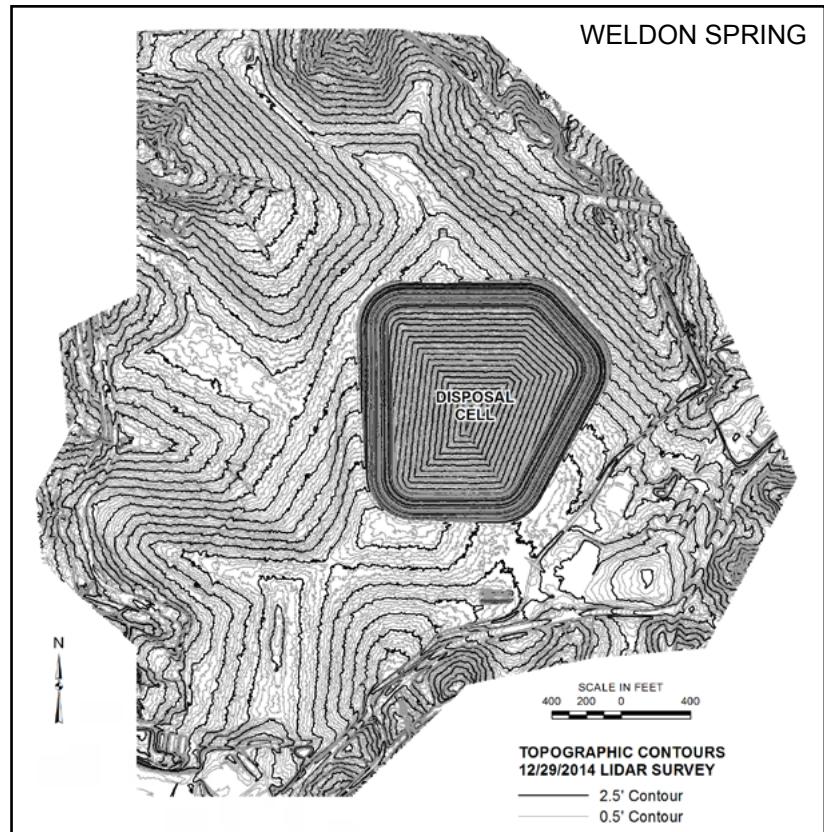
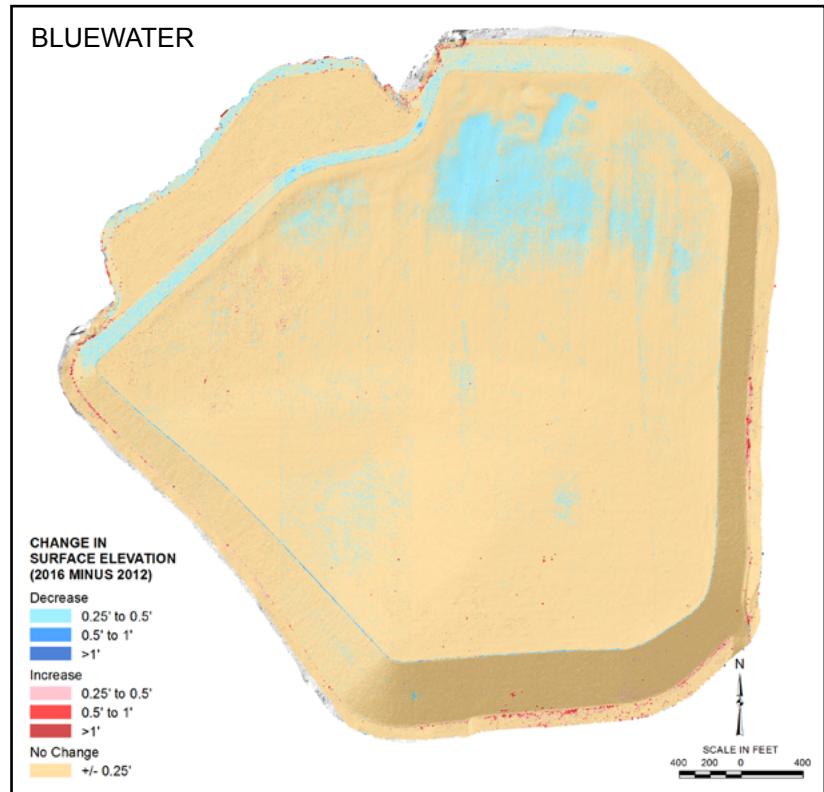
LM conducted a LiDAR survey of the disposal cell in 2012 and another survey in 2016. The two surveys were compared and a map was created showing elevation changes, which indicated the depressions were getting deeper. LM will use this information to decide whether to fill in low spots or install a drainage system.

Weldon Spring, Missouri, Disposal Site LiDAR Survey

LM is required to conduct a topographic survey of the Weldon Spring disposal cell every 5 years. LM collects elevation data on the entire site, including the prairie area where erosion occurs. LM previously used aerial photographic methods to determine topography, but used LiDAR techniques in 2014. Although LiDAR and photographic methods are similar in accuracy, LiDAR has the advantage of allowing determination of bare-ground elevations in vegetated areas, making it a useful tool for monitoring erosion.

Future Use of LiDAR for LM Sites

Inspectors have found features on several cell covers that might be the result of slow-acting processes. LM does not have high-resolution topographic information on most disposal cells, so it is unclear if the features are artifacts of original cell construction or changes that have occurred since construction. A program to collect baseline topographic information for its sites is being investigated. This information would be available for future reference, to decide if changes are occurring and whether any changes can proceed, unchecked, without risk, or if intervention is needed. ♦



Top right: This comparison of 2012 and 2016 LiDAR survey results for the main tailings cell at the Bluewater site shows that depressions at the north end of the disposal cell continue to subside.

Bottom right: Contour map of the Weldon Spring site generated from the digital terrain model created from the LiDAR point cloud.



Goal 2

LM Introduces the DOE Web Council to Environmental Systems Research Institute Story Maps

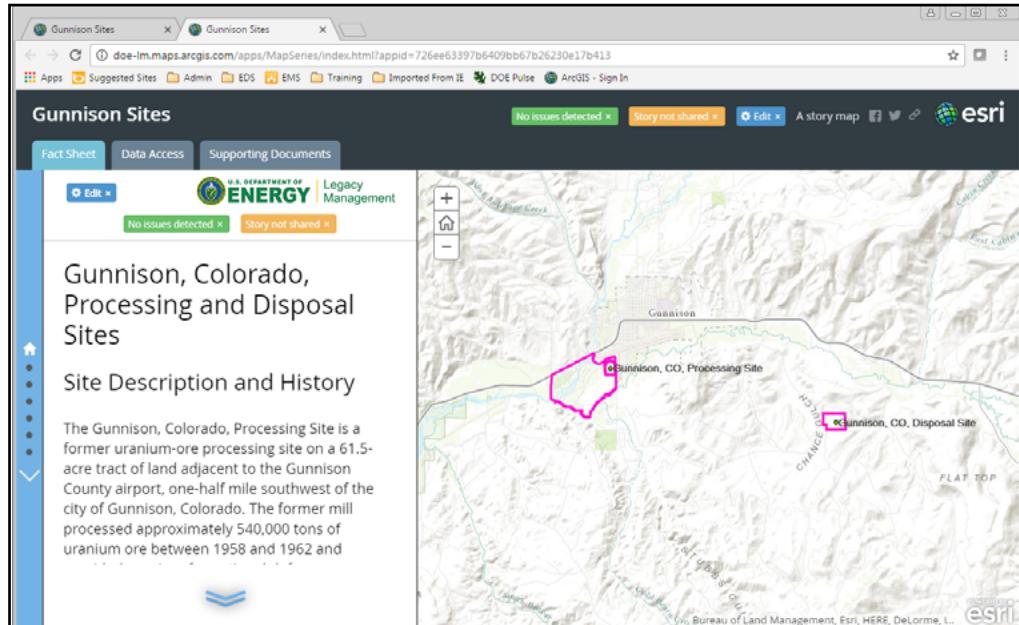
The U.S. Department of Energy (DOE) Office of Legacy Management (LM) evaluates web-based tools to enhance stakeholder engagement. Tools that are new or unique to DOE and result in positive evaluations are presented to the DOE Web Managers Council (Web Council). Such a tool was found in Environmental Systems Research Institute (ESRI) Story Maps and examples of their use were presented this past September. The examples included story maps designed to effectively and succinctly communicate site history and data associated with LM long-term surveillance and maintenance, the National Energy Technology Laboratory's research into understanding seismicity in Oklahoma (<http://netl-doe.maps.arcgis.com/apps/MapSeries/index.html?appid=a04fcf36e6d74c769241bc0b30471b>), and the DOE Office of Energy Efficiency and Renewable Energy's research into the effects of sea-level rise and storm surges on energy assets for select major metropolitan areas (<http://energy-oe.maps.arcgis.com/apps/MapSeries/index.html?appid=244e96e24b5a47d28414b3c960198625>). These story maps show complex information in user-friendly, interactive, and intuitive ways.

Sharing complex information can be simplified by using the ESRI tools. Computer programming skills or special software are not required. Anyone who sets up a user account can

create a story map using the free, online tools and tutorials. ESRI has numerous templates that allow designers to pair text with illustrations showing changes in time and magnitude of data, photos, videos, or links to other webpages.

LM's story map brings together various site information sources. Currently, site history and general information are available from the LM Sites webpage (<http://energy.gov/lm/sites/lm-sites>). Maps and environmental data are viewable at the Geospatial and Environmental Mapping System webpage (<http://gems.lm.doe.gov/>). In addition to bringing data from both webpages together, the story map included new animations comparing changes in land use and uranium concentrations. The resulting story map provides an engaging platform to share information with stakeholders while being simple to develop and maintain. LM's story map release to the public is pending.

Coupling stories with maps in an online format is an exciting avenue for LM to explore. With 91 LM sites and more to be transferred in the future, story maps will help current and future stakeholder interactions. Whether the stories are complex, like those presented to the DOE Web Council or simple like those presented here, story mapping may prove to be a valuable tool. ♦





Goal 6

World Thinking Day Celebration Held at the Fernald Preserve

Around the world, Girl Scouts and Girl Guides celebrated World Thinking Day 2016 on February 22. The theme for the event was "Connect," and a group of more than 100 Girl Scouts from southwest Ohio celebrated at the Fernald Preserve Visitors Center by connecting with their friends and families, to share their special projects that highlighted many cultures from around the world.

Fernald Preserve visitor services include natural and cultural history programs, public walking trails, and a Visitors Center. We strive to create connections and engage the public through programs, projects, and site activities. It was an honor to host a local, nonprofit organization's event with a theme of creating connections with one's self, with friends, and around the world.

As a result of its ongoing efforts to collaborate and provide targeted services to the Girl Scouts of Western Ohio, the Fernald Preserve was identified this past May as a Premier Program Partner and recognized with a thank-you and a certificate of appreciation. ♦



Girl Scout participants attend the southwest Ohio regional World Thinking Day 2016 hosted at the Fernald Preserve Visitors Center dressed in their best uniforms.



Ongoing collaboration with the Girl Scouts of Western Ohio enhances community outreach at the Fernald Preserve.



Girl Scouts celebrate World Thinking Day by setting up colorful multi-cultural displays they have created.



Program Update



Goal 5

LM Announces New Employees

Jeffrey Murl joined the U.S. Department of Energy, Office of Legacy Management (LM) as an Environmental Team 2 site manager in July 2016, through the prestigious Presidential Management Fellowship program.

Prior to LM, Jeff worked for Arcadis, in Honolulu, Hawaii, as an environmental specialist (engineer/geologist). His responsibilities included soil and groundwater remediation, hazardous waste, water and wastewater environmental permitting and compliance, solid waste/geotechnical, air services, environmental and human-health risk assessment, sediment and waterfront remediation, and construction services. He was also selected as a National Aeronautics and Space Administration research fellow and completed projects on geologic mapping of the Earth's Moon and simulating the effects of space weathering on the surface of the Moon and Mercury.

Jeff also served over 9 years in the U.S. Navy Submarine Force as a nuclear propulsion plant supervisor (machinist's mate). He was responsible for coordination and supervision of 14 nuclear operators and for the routine and complex maintenance and operations of the nuclear engine room systems of fast attack submarines.

Jeff's educational background include a bachelor of science degree in nuclear engineering from Thomas Edison State College in Trenton, New Jersey, and a bachelor of science degree in geology and geophysics and a master of geoscience degree from University of Hawaii at Manoa in Honolulu. ♦

Michael Garrett joined the LM Archives and Information Management Team as a program analyst (records management program) in August 2016.

Prior to coming on board, he served as the director of records and e-Discovery at NorthWestern Energy, a publicly traded gas and electric utility, in Butte, Montana. Mike has also served as the records manager for the U.S. Naval Special Warfare Command in Coronado, Colorado, as an electronic records management policy advisor with the U.S. Department of Education, the records manager for the Joint IED Defeat Organization, and began his records management career with the U.S. Department of the Navy in Washington, DC.

Mike is originally from Helen, Georgia, and served with the U.S. Army in Korea and with the 82nd Airborne Division at Fort Bragg, North Carolina. He attended college at Hampden-Sydney College in Virginia. ♦

Joyce Chavez joined the LM Asset Management Team as a reuse asset manager in September 2016.

Prior to joining LM, Joyce managed environmental programs for the U.S. Department of Defense. Joyce served as the water program manager at Joint Base Lewis-McChord in Washington (formerly Fort Lewis Army Installation), to develop and implement policy and guidance for water quality while partnering with the regulatory community. She led several initiatives to promote sustainable practices and improve infrastructure. This involved working with community members on area planning, regulatory compliance, emergency operations, and beneficial reuse.

Her professional career also includes serving as a National Environmental Policy Act (NEPA) program manager at Eglin Air Force Base in Florida, an environmental program manager for the U.S. Army Corps of Engineers in Germany, and as a chemist in the private sector.

Joyce holds a bachelor degree in biochemistry from the University of Colorado at Boulder. ♦



Goal 6

Environmental Justice Activities

Interagency Working Group on Environmental Justice – Passing the Administration’s Leadership Baton

On August 29, 2016, U.S. Environmental Protection Agency (EPA) Administrator Gina McCarthy, and the White House Council on Environmental Quality (CEQ) Director, Christy Goldfuss, invited cabinet and senior-level staff from 17 federal agencies of the Interagency Working Group on Environmental Justice (IWG EJ) to a meeting that focused on transition planning and strengthening the EJ infrastructure in our agencies and departments.

For over 20 years, advancing EJ principals has been a priority for EPA. Nearing the end of this administration, we’re presented with an opportunity to highlight our collaboration successes and examine the sustainability of our EJ efforts for 2016 and beyond.

The meeting began with a roundtable discussion, “Lessons Learned Through EJ Strategy Implementation and Collaboration.” Three federal agencies, the General Services Administration, the U.S. Department of Justice, and the U.S. Department of Energy (DOE) were invited to discuss the following:

- Building a Strong EJ Program
- Collaborating for a Strong EJ Program
- Sustaining a Strong EJ Program

Representatives from DOE included Savannah River Site Deputy Associate Manager, Thomas Johnson; Deputy General Counsel for Environment, Kedric Payne; and EJ Program Manager, Melinda Downing. Following the roundtable, the agencies began discussing efforts to advance EJ principles throughout the federal government, particularly as we approach the final months of the Obama administration. This event allowed participants to reflect on lessons learned and to identify what big challenges and opportunities remain.

Agency Highlights

- U.S. Department of Justice is releasing a new website, which will include descriptions of duties for all 94 attorneys. Funding will be set aside for American Indians to offset pollution resulting from 600 vehicles. Release of emerging management guidance.
- U.S. Department of Interior is creating an EJ policy for each bureau.
- White House CEQ announced a Spanish-translation website publication of its *Promising Practices for EJ Methodologies in NEPA* (National Environmental Policy Act) Reviews report. CEQ is transforming the NEPA.gov website to include, “How climate justice and environmental equity relate.”

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IWG EJ passing the administration’s leadership baton at the Eisenhower Executive Office Building, Washington, DC.



Program Update

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Environmental Justice Activities

IWG EJ – Passing the Administration’s Leadership Baton

- A letter of recommendation was sent to the White House to 1) establish an Office of EJ at the White House, 2) appoint a special advisor to the White House on EJ, and 3) enforce Title VI of the *Civil Rights Act of 1964*.

The meeting also included special acknowledgments for the College/Underserved Community Partnership Program (CUPP) and the signing of the Memorandum of Understanding on CUPP by EPA and the U.S. Department of Agriculture. Also, awards were granted to Arthur “Butch” Blazer, former deputy undersecretary of agriculture, who

received the EJ Champion Award, and the U.S. Department of Human Health and Services, which received the Environmental Justice Pioneer Award and Federal Agency Award on behalf of Mazel M. Johns.

Administrator McCarthy and White House CEQ Erin Shew closed the meeting discussing the steps that are to follow and with a message about looking forward to strengthening a cohesive and comprehensive federal approach to improve the health and sustainability of communities that need the most assistance. In addition, the administrator requested that IWG EJ develop transition language on EJ. ♦

Teaching Radiation, Energy, and Technology Workshop Held in Aiken, South Carolina

U.S. Department of Energy Environmental Justice Program representatives participated in a Teaching Radiation, Energy, and Technology (TREAT) workshop at the University of South Carolina, in Aiken, South Carolina, July 13 through 15, 2016. The event was sponsored by Savannah State University and the Savannah River Site (SRS). The goal of the TREAT Workshop is to educate kindergarten through 12th grade mathematics and science teachers and community leaders who reside near the SRS facility. The workshop is designed to educate teachers so they can take the radiation education message to their students, and ultimately, to the community.

Subject matter included radiation, sources of radiation, radioactive-waste management, the effects of radiation

on environmental health, and the negative effects of environmental-radiation exposure to humans.

Sessions included: community education outreach programs; overview of nuclear technology, regionally and globally; a U.S. Environmental Protection Agency (EPA) overview; a South Carolina Department of Health and Environmental Control overview; monitoring operations; and fundamentals of grantsmanship.

Attendees represented EPA, South Carolina Department of Health and Environmental Control, and the Community Reuse Organization. Local attendees included the mayor and city councilwoman of the City of Aiken; as well as, students, teachers, and community members. ♦



Participants at the TREAT Workshop held July 13 through 15, 2016, in Aiken, South Carolina.

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Environmental Justice Activities

Community Leaders' Institute, Climate Change: A Global Reality, Myrtle Beach, South Carolina

On August 27, 2016, a made-for-television dialogue entitled Climate Change: A Global Reality was held at Ripley's Aquarium in Myrtle Beach, South Carolina. The presentation was sponsored by the Medical University of South Carolina, Ripley's Aquarium of Myrtle Beach, Allen University, the U.S. Department of Energy, South Carolina Educational Television (ETV), and South Carolina Aquarium. It is the third in a series of four climate change dialogues held in coastal communities to introduce climate change issues to local audiences.

The program included representations from the director of the School of Coastal and Marine Systems Science and an infectious disease consultant and epidemiologist, each of whom shared climate change knowledge from a scientific perspective as well as information on environmental health impacts. In addition, a group of local experts discussed their issues and concerns on climate change.

While climate change is a global phenomenon, its localized impacts require community-level action. Many of the most

effective climate change initiatives are conceived and enacted at the local level. Action occurs when those with authority assume an informed and active leadership role. The purpose of the Community Leaders' Institute (CLI) and the made-for-television dialogue is to help community leaders know how to access and obtain the information necessary for making good decisions and communicating that information to the citizenry. The focus of this CLI was on the unique relationship between environmental protection, human health, environmental justice, and economic development change, and encouraged a broad-based discussion that included audience members.

CLI sessions and individual interviews were recorded by ETV, which will package them as part of a larger, made-for-television program to be broadcast statewide in South Carolina and neighboring cities in Georgia and North Carolina in March 2017. The fourth and final made-for-television dialogue will be held in Savannah, Georgia, on October 15, 2016. ♦



2016 CLI panel members.

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Program Update

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Environmental Justice Activities

46th Congressional Black Caucus Annual Legislative Conference, Environmental Justice Braintrust

The Congressional Black Caucus (CBC) held its 46th Annual Legislative Conference in Washington, DC, September 14 through 17, 2016. Assistant Democratic Leader, Representative James E. Clyburn (D-SC), served as chair of the CBC Environmental Justice (EJ) Braintrust during the conference. This year's Braintrust focused on education.

The EJ Braintrust highlighted the unique relationship between environmental protection, EJ, economic development, and human health. When viewing the social determinants that play a role in communities with disproportionate health problems, education is a major factor. This year's Braintrust brought together experts to discuss the role education plays and how to improve access to education in all communities. The panel discussed enhancing existing opportunities to build on various university and federal agency partnerships to reach out to communities nationwide.

Panelists were Dr. Glenda Baskin Glover, President, Tennessee State University, Nashville, Tennessee; Dr. Britt Rios-Ellis, Founding Dean, College of Health Sciences and Human Services, California State University, Monterey Bay, Seaside, California; Mr. Milton Bluehouse, Jr., Esquire, Founder, Tribal Consultation Resources, LLC, Albuquerque, New Mexico; Ms. Karen Dale, Market President, AmeriHealth Caritas District of Columbia,



Assistant Democratic Leader, Representative James E. Clyburn (D-SC)

Washington, DC; and Dr. Marvella E. Ford, Professor, Department of Public Health Sciences, Associate Director, Cancer Disparities, Hollings Cancer Center, Medical University of South Carolina, Charleston, South Carolina.

More than 100 attendees were present at this year's Braintrust, which concluded with an interactive question and answer session. ♦

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.





Anticipated LM Sites Through Fiscal Year (FY) 2025





LM Goals



1 Protect Human Health and the Environment



2 Preserve, Protect, and Share Records and Information



3 Safeguard Former Contractor Workers Retirement Benefits



4 Sustainably Manage and Optimize the Use of Land and Assets



5 Sustain Management Excellence



6 Engage the Public, Governments, and Interested Parties



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Office of Legacy Management**

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