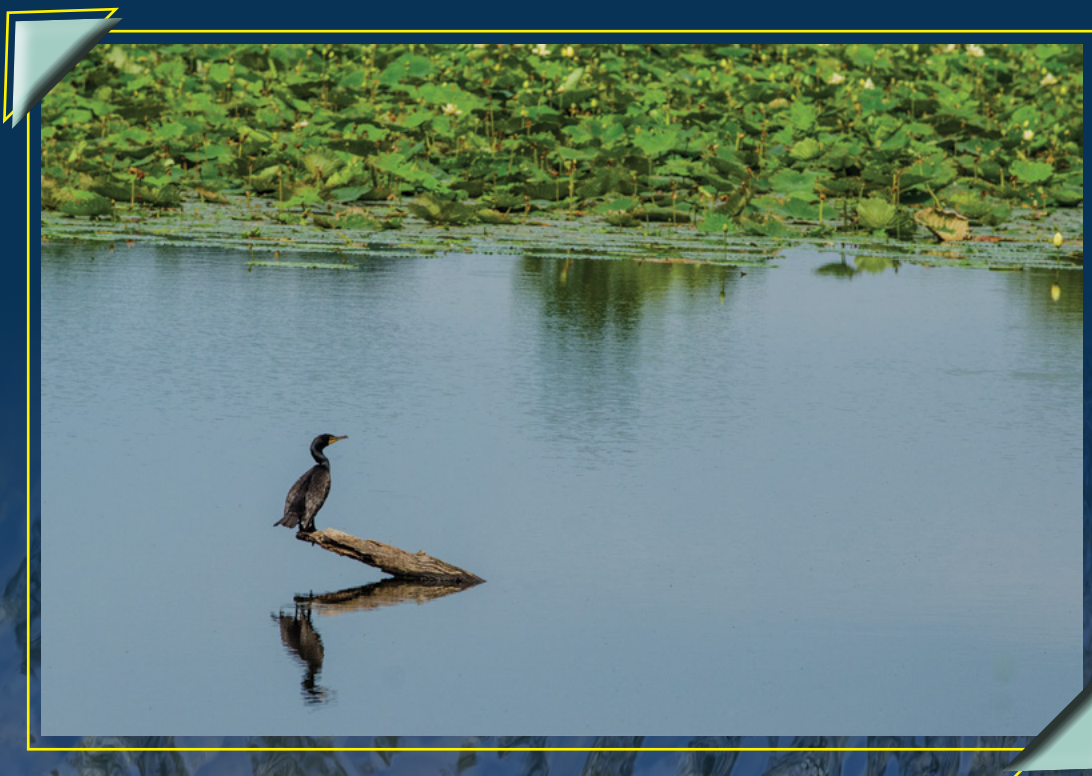


2016 Cleanup Progress

Annual Report
to the
Oak Ridge
Regional
Community





Cover photo taken by Alice Reed
at the ETP P1 Pond.

Message from the EM Manager

Department of Energy Oak Ridge Office

To the Oak Ridge Regional Community:

The Oak Ridge Office of Environmental Management had another banner year in 2016. The program achieved a feat never before realized anywhere in the world, maintained our cleanup momentum, and positioned the program for continued success in the years to come. Much of our success is attributable to the strong support we receive from our host city and counties and the engaged and involved citizens who call East Tennessee home. Each year this report is prepared with you in mind, and I am excited to share details about the tremendous progress we have made.

Our program's most notable accomplishment this year, and maybe in the history of our program, was achieving Vision 2016 at the East Tennessee Technology Park (ETTP). We successfully completed this decade-long effort that included the demolition of all former gaseous diffusion process buildings by the end of 2016. Throughout this process, our employees removed 4.5 million square feet of footprint, eliminated environmental hazards, and opened 300 acres of land that will be available for future development. This historic accomplishment brings us closer to completing ETTP's transformation into a private-sector industrial park by 2020.

While visible changes are happening at ETTP, we are also working diligently to ensure we can transition from our work at the former K-25 Site to large-scale cleanup at the Y-12 National Security Complex without interruption by the mid-2020s. Despite that seemingly distant date, planning is already underway on two necessary major capital asset projects that will allow for our seamless transition. The Outfall 200 Mercury Treatment Facility at Y-12 will allow us to control releases during demolition and subsurface remediation of the West End Mercury Area, and constructing additional onsite disposal capacity provides the safest and most cost-effective approach to demolition debris disposal. We are working closely with our federal and state regulators and the community on these two important projects and are encouraged by the progress we are making.

In addition, we have initiated an effort to address the risk and instability associated with the large number of excess contaminated facilities located at Y-12 and the Oak Ridge National Laboratory. While we will not be able to fully demolish these buildings for a number of years, allocating resources to make them safer is important, and that will be a focus of our program not only in the short term, but in the years to come.

On a more personal note, I want to thank you for your support of the Oak Ridge environmental cleanup program. I often say that Oak Ridge is the best community partner in the Department of Energy's Environmental Management complex, and time after time, you continue to reinforce that belief. Our partnerships with you, coupled with your incredible support and advocacy, are some of the biggest contributors that paved the way toward achieving our ambitious goals. Thank you for being part of the process and helping us to advance cleanup and push us toward a clean, modernized Oak Ridge with a bright future.



Sue Cange



EM Environmental Management

safety ❖ performance ❖ cleanup ❖ closure

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UCOR
URS | CH2M
Oak Ridge LLC

This report was produced by URS | CH2M Oak Ridge LLC, DOE's Environmental Management contractor for the Oak Ridge Reservation.

Introduction

The completion of Vision 2016—the demolition of all gaseous diffusion facilities at East Tennessee Technology Park (ETTP) by the end of 2016—highlighted another successful fiscal year of cleanup on the Oak Ridge Reservation. With the removal of Building K-27, Oak Ridge achieved a first in world history. This demolition marked the first-ever successful removal of a former uranium enrichment complex’s processing buildings. It also brings ETTP closer to becoming a private-sector industrial park, which is the U.S. Department of Energy’s (DOE’s) goal for the site by 2020.

This milestone reflects the impressive progress DOE’s Oak Ridge Office of Environmental Management (OREM) is making in cleaning up legacy contamination at the Oak Ridge Reservation’s three major facilities: ETTP, Oak Ridge National Laboratory (ORNL), and the Y-12 National Security Complex (Y-12).

The Oak Ridge Reservation has played key roles in our nation’s defense and energy research. However, past waste disposal practices and unintentional releases have left land and facilities contaminated with radioactive elements, mercury, asbestos, polychlorinated biphenyls (PCBs), and industrial wastes.

The contaminated portions of the Reservation are on the U.S. Environmental Protection Agency (EPA) National Priorities List (NPL), which includes hazardous waste sites across the nation that are to be cleaned up under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Areas that require cleanup or further action on the Oak Ridge Reservation have been clearly defined, and OREM is working to clean those areas under a Federal Facility Agreement with the EPA and the Tennessee Department of Environment and Conservation (TDEC).

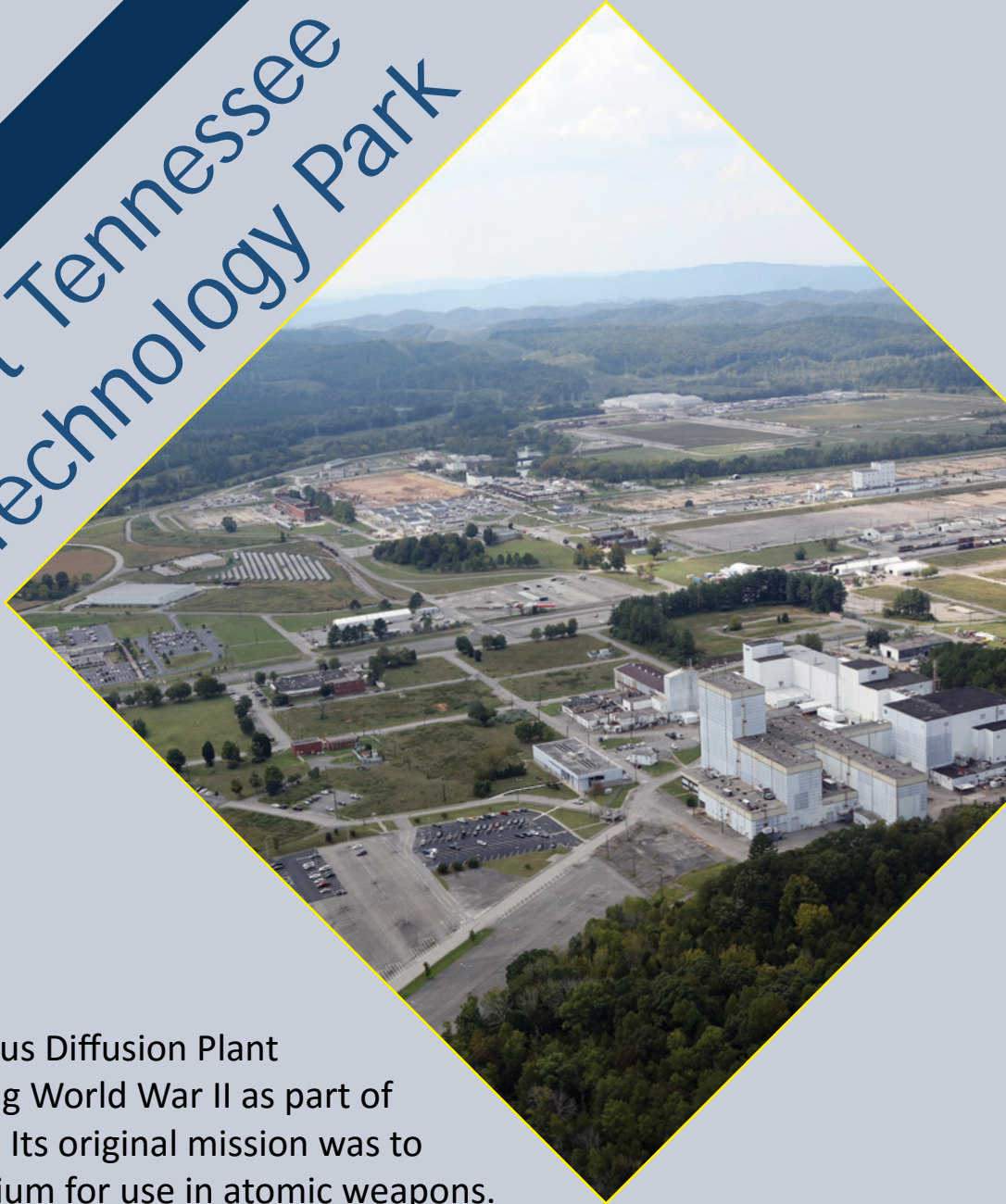
Through close partnerships with regulators, contractors, unions, elected officials, and the public, OREM is restoring environments, promoting economic development, and enabling vital missions in science, energy, and national security.



DOE works in partnership with regulatory officials, such as Dr. Shari Meghreblian, TDEC Deputy Commissioner, pictured right with OREM Manager Sue Cange and UCOR President and Project Manager Ken Rueter.



East Tennessee Technology Park



The former K-25 Gaseous Diffusion Plant began operations during World War II as part of the Manhattan Project. Its original mission was to produce enriched uranium for use in atomic weapons. The 2,200-acre plant was shut down permanently in 1987 and is undergoing cleanup for ultimate conversion to a private-sector industrial park. Major activities at the site include environmental restoration, facility deactivation and demolition, and waste disposition.





Vision 2016 achieved

K-27 demolition completed

The final of five gaseous diffusion buildings at ETPP was demolished in 2016, marking the first time in the world that all of a former uranium enrichment complex's processing buildings were successfully removed. It also fulfilled DOE's Vision 2016—the goal to demolish those five buildings by the end of 2016.

OREM completed demolition of the four other gaseous diffusion buildings from 2006 to 2015. Together, the projects removed 4.5 million square feet of deteriorating and contaminated facilities that posed significant risks at the site.

Completing the K-27 project brings OREM one step closer to its goal of finishing cleanup and converting the site into a private-sector industrial park by 2020. DOE cleanup contractor URS | CH2M Oak Ridge (UCOR) completed the demolition project nine months ahead of schedule and \$2.8 million under budget.

"The completion of Vision 2016 sets a standard for what is possible through a dedicated workforce and strong partnerships," said OREM Manager Sue Cange. "Its completion eliminates environmental hazards and makes 300 acres available for future development, creating opportunity for more innovation in a community already known for it."

Oak Ridge first made history in 1942 as the center of operations for the Manhattan Project. K-25, a gaseous diffusion facility on a 2,200-acre site, was built to produce weapons-grade enriched uranium, which would fuel one of two atomic bombs that would end World War II.

By 1955, the K-25 complex had grown to include gaseous diffusion buildings K-25, K-27, K-29, K-31, and K-33. The five facilities comprised a multibuilding production chain, and it was renamed the Oak Ridge Gaseous Diffusion Plant. In the following years, the plant produced highly enriched uranium for national defense and commercial energy production.

Following shutdown of gaseous diffusion equipment at Oak Ridge in 1985, DOE began a major environmental cleanup effort at the site in 1987. In 1996, the Oak Ridge Gaseous Diffusion Plant was renamed the East Tennessee Technology Park.

With the fulfillment of Vision 2016, OREM will continue its cleanup of ETPP and assist in transferring the land to the private sector.



Elected officials, union leaders, DOE officials, and other stakeholders celebrated the completion of Vision 2016 on August 30, 2016, when the final portion of K-27 was demolished. Pictured are Sen. Lamar Alexander and Rep. Chuck Fleischmann (top), and Assistant Secretary for Environmental Management Monica Regalbuto (bottom), who were among the dignitaries to witness completion of Vision 2016.



Employees who helped make Vision 2016 a reality were honored at a celebration luncheon.



K-27 before demolition

Electrical switch house coming down

UCOR began demolition on Building K-731 immediately after crews took down the final pieces of K-27. This marks the first post Vision 2016 demolition project, and it moves OREM closer to Vision 2020—the goal to complete cleanup of ETPP by the end of calendar year 2020. K-731 is a former switch house that provided essential electrical power levels to the uranium enrichment facilities for more than 40 years.

Demolition of the above-ground portion of the building was nearing completion at the end of fiscal year (FY) 2016. Additional work associated with removing pedestals and equipment in the basement area continued into FY 2017.

The K-731 Switch House was originally constructed in 1944 to provide electrical power to the K-27 Process Building. K-731 was extended in 1949 to provide electricity to the K-29 Process Building. K-731 consists of a two-story brick and concrete structure with three floors, including the below-grade basement.



Building K-1037 deactivation begins

UCOR began deactivation work in Building K-1037 in FY 2016. Deactivation is the initial step that prepares the facility for eventual demolition. The facility is one of the highest remaining cleanup priorities at the site. Currently, the facility contains the barrier material from the site's former enrichment operations. This material was a key component of the gaseous diffusion process when workers separated the uranium-235 and uranium-238 isotopes.

K-1037 was once a warehouse that was later converted into a facility that produced the porous barrier material used in the separation process.

Work during FY 2016 included asbestos abatement, universal hazardous waste disposal, chemical removal, and radiological surveys. Workers also achieved electrical and mechanical

“cold and dark” by removing all hazardous energy sources. Crews have also installed temporary power to facilitate deactivation activities, and OREM is scheduled to begin demolition in 2018.



K-1037



Poplar Creek deactivation underway

At the end of FY 2016, OREM had completed 40 percent of the deactivation required in the Poplar Creek area of ETP. The deactivation process involves disconnecting utilities to the facilities, removing certain components, and performing other steps necessary to prepare the buildings for demolition. The 27 Poplar Creek facilities supported operations at the site and included storage buildings that housed process equipment, water pump houses, and sandblasting/painting buildings.

Deactivation and demolition of the tie lines in the Poplar Creek area was 45 percent complete at the end of FY 2016. These tie lines connected the K-27 and K-31 gaseous diffusion buildings and carried enriched uranium from one building to another as the uranium moved through the enrichment process. Workers have been injecting foam into these lines to stabilize the contaminants so they will meet the criteria necessary for disposal in the onsite Environmental Management Waste Management Facility (EMWMF).



Last converters leave ETP

The final remaining converters at ETP were shipped to the Nevada National Security Site for disposition in 2016. The converters were part of the gaseous diffusion process used to enrich uranium at the site. The five gaseous diffusion buildings at the site once housed almost 5,000 converters.

ETTP soil remediation efforts preparing site for future commercial usage

UCOR's soil remediation efforts at ETTP are helping to prepare the site for future commercial industrial use. ETTP is divided into two cleanup regions: Zone 1, a 1,400-acre area outside the main plant, and Zone 2, the 800-acre area that comprises the main plant area. The areas in these zones are divided into exposure units (EUs) that range in size.

Zone 1

The interim Record of Decision (ROD), which documents the cleanup method for the site, required OREM to remove groundwater contamination and remediate soil to a depth suitable of protecting an industrial workforce (10 feet). As part of this interim ROD, in FY 2016, employees conducted an evaluation of all 10 acres in the K-1065 former waste storage area and determined that no cleanup was required. This outcome makes the area available for industrial use.

OREM prepared a Remedial Investigation/Feasibility Study (RI/FS) to evaluate the nature and extent of contamination affecting groundwater, surface water, and ecology. Based on the RI/FS, the Zone 1 Final

Soils Proposed Plan and Final Soil ROD were prepared to address ecological protection and land use controls, and OREM held a public meeting to solicit comments. Upcoming work includes addressing EPA and TDEC comments and finalizing the Final Soil ROD.

Zone 2

The Zone 2 ROD divided the zone into 7 geographic areas and 44 EUs that range in size from 6 to 38 acres.

In FY 2016, OREM completed remediation of EU Zone 2-28 and confirmation sampling. EPA and TDEC approved concurrence forms documenting the completion. The area is located in what is commonly referred to as the administrative section of ETTP, which generally housed offices and laboratories, and it was recommended for unrestricted industrial use.

OREM also evaluated the characterization data of the Building K-25 and K-31 footprints. They determined that remediation is required in the K-25 footprint but no action is required in the K-31 footprint. The 40-acre Building K-25 footprint is dedicated for historical commemoration and interpretation activities. The



*EPA officials
visit ETTP to
view EU 2-28*

characterization data are also being used to evaluate potential end states that can preserve the slab.

OREM continued its characterization of the remainder of Zone 2, and it remediated contaminated soil in EU Zone 2-28 and EU Zone 2-41. These two remedial actions resulted in the disposal of 5,850 cubic yards of soil and debris to EMWMF and the Nevada National Security Site. No further remedial actions are required for these two areas.

Sitewide ROD

OREM is performing a groundwater treatability study that will help determine the effectiveness of different treatment technologies that will assist in identifying and selecting ETTP's final groundwater remedy. Phase 1 of the study, which included the characterization of a groundwater contamination source in the K-1401 area, was completed in 2011. The study resumed in FY 2016 and involved characterization to support the design of a pilot scale *in situ* thermal treatment study in the K-1401 area.

The work plan was updated and approved by the regulators, and OREM initiated planning activities. Sitewide groundwater and surface water data are being evaluated in conjunction with the treatability study activities that support the preparation of CERCLA documentation leading to a final sitewide ROD. Upcoming work includes the design characterization field activities, data evaluation, and planning for the pilot scale thermal demonstration.

Tc-99 Groundwater Investigation

OREM completed the shallow groundwater investigation concerning the potential migration of technetium-99 (Tc-99) near the K-25 Building slab. This slow-decaying radioactive isotope was used in the gaseous diffusion process while the plant was operational. Through this investigation, OREM concluded that the migration of Tc-99 outside of sanitary sewer and storm drain pipes in subsurface utility corridors has been limited; however, 21 locations will be retained for future groundwater monitoring.



The former K-31 site is now a grassy field. No further remedial actions are required at the site.

Historic preservation efforts continue

National historic preservation initiatives at ETPP progressed during FY 2016 with the launch of the K-25 virtual museum website. The website shares oral histories from the site's former workers, and it recounts the history of the world's first gaseous diffusion plant and the hundreds of facilities and structures that followed.

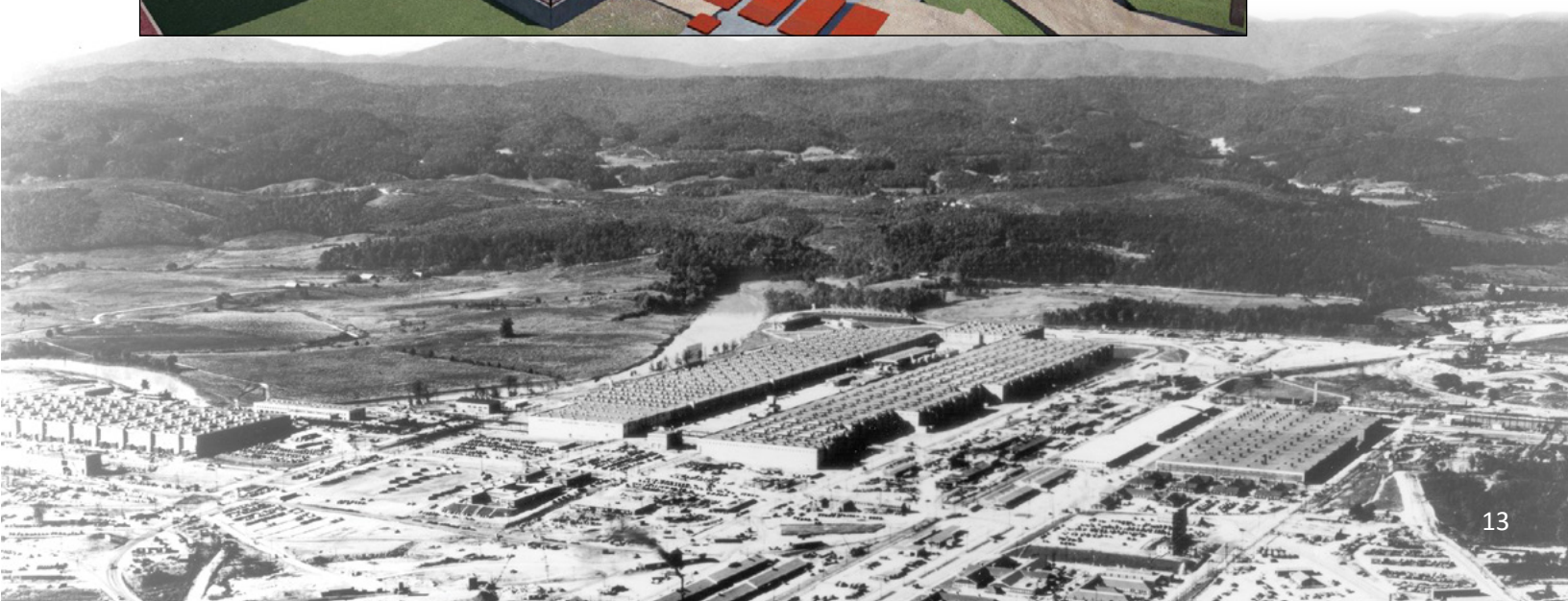
Congress appropriated approximately \$6 million in FY 2016 for K-25 historic preservation activities. This funding is helping OREM meet its commitment to plan and construct a History Center and Equipment Building for visitors. By the end of the fiscal year, design of the facilities was approaching 90 percent completion.

These facilities will allow visitors to explore the rich history of this Manhattan Project site. The K-25 History Center's exhibits and displays will feature building equipment replicas, period artifacts, and workers' oral histories. Additionally, a cross section of K-25's gaseous diffusion cascade will be recreated in the Equipment Building. Once inside, visitors will be able to experience the size and magnitude of the site's signature facility from the Viewing Tower. National Park Service-style exhibits will provide additional information about the site, its people, and its missions.

In November 2015, the footprint of the former K-25 Building and other historic facilities at Y-12 and ORNL became part of a larger preservation effort through the establishment of the Manhattan Project National Historical Park.



Artist's rendering of viewing tower



ETTP's future takes shape

Oak Ridge's Reindustrialization program commemorated its 20th anniversary in 2016 as the model DOE asset reuse program. Those 20 years have seen the development and expansion of an industrial business park where facilities once supported a gaseous diffusion plant.

As OREM moves toward the final phases of environmental cleanup at ETTP, the site is moving toward its future as an industrial business park, as well as a national park and conservation area. A formal plan began this year to address the necessary transfer and disposition path for all site assets. It includes transition planning for all of the remaining facilities, land, and utility infrastructure.

Additionally, a formal revitalization plan began that will reevaluate and modernize the master planning for the Heritage Center. This approach will account for recent cleanup accomplishments and new developments, such as the proposed regional general aviation airport. Several stakeholders are working to coordinate the Heritage Center's development to achieve a common goal.

During FY 2016, the Reindustrialization program moved forward with making larger parcels of land available for major manufacturing developments. Three major parcels are being made available for transfer: the 200-acre K-31/K-33 parcel, the 400-acre Powerhouse Area, and the 200-acre Duct Island parcel. These properties are the first available at ETTP that can accommodate large-scale manufacturing developments, which would contribute significantly to job growth in the area.

The proposed airport project reached a major milestone in FY 2016 with the completion of the Environmental Assessment for land use. The Metropolitan Knoxville Airport Authority (MCAA), working closely with DOE, is leading this project. MCAA is in the final stages of completing the master plan for the airport.



K-31/K-33 parcel

Oak Ridge National Laboratory



The Oak Ridge National Laboratory is DOE's largest multiprogram national laboratory that conducts cutting edge research in energy, materials and chemical sciences, nuclear science, and supercomputing. However, there are large contaminated areas from past operations and waste disposal practices among its world class facilities and vital research. OREM has divided ORNL into two major cleanup areas: Bethel Valley and Melton Valley. The Bethel Valley area includes reactors and former research facilities, and the Melton Valley area includes reactors and waste management areas, such as burial grounds.



Workers place a fiber membrane on the roof of the 3026-D hot cells to prevent intrusion of rain water into the cells.

Stabilization activities performed on contaminated excess facilities

In FY 2016, OREM initiated several projects at ORNL that were part of its Excess Facilities initiative. These projects focused on work that will reduce risks and stabilize facilities that are not scheduled for near-term demolition.

OREM began stabilization activities at Buildings 3026, 3038, and 7500 to reduce the potential for contaminant releases, risks to onsite workers, and the cost of surveillance and maintenance and future cleanup. Building 3026 was one of the site's original Manhattan Project facilities, and Building 3038 was used for packing, inspecting, and shipping activities for radioisotopes.

At Building 3026, crews conducted work that would minimize or prevent rainwater intrusion into the cells. Workers also poured new concrete caps over and around the two existing pedestals on the 3026C pad to stabilize the surface contamination. Water from the transfer tunnel was characterized, removed, and transferred for treatment.

At Building 3038, the planned activities were to characterize the glove boxes inside the Alpha Handling Facility Annex, apply fixative inside the glove boxes, and remove the high-efficiency particulate air filter enclosure on the roof. However, due to the discovery of additional radioactive inventory in the building, these activities have been placed on hold until the building's characterization is updated.

Additionally, workers removed the combustibles from Building 7500, also known as the Homogeneous Reactor Experiment.

MSRE waste items being dispositioned

During FY 2016, work continued to characterize and dispose of waste items from the Molten Salt Reactor Experiment (MSRE) facility, a graphite-moderated, liquid-fueled test reactor that operated at ORNL from June 1965 until December 1969. In FY 2016, seven items were disposed and another was characterized.

Since the reactor's shutdown, OREM has performed several studies and removal actions to stabilize the facility, including removing uranium deposits and defueling the reactor salts. Employees are characterizing the legacy fuel salt probes as part of the defueling campaign. This process requires relocating the probes throughout the MSRE complex to lower radiological background areas. OREM is continuing its routine surveillance and maintenance activities at the facility to manage the remaining hazards, including periodically removing reactive gas generated by the defueled salts.

In 2014, an addendum to the waste handling plan was approved to address the disposition of waste that remained from the earlier actions. The addendum includes a schedule for characterizing and dispositioning 74 waste items. Waste disposition will continue in FY 2017.

OREM successfully shipped all waste regulated by TDEC. Many of these waste types required special packaging and handling. One of the most notable successes was shipping and disposing offsite the "Turbo Pig," which was a shielded waste container that stored highly contaminated objects. Additionally, the Secondary Containment Systems were loaded into containers and shipped offsite for downsizing and subsequent disposal at the Nevada National Security Site. Lastly, the sodium fluoride traps were packed and loaded for direct disposal at the site.



An MSRE salt probe is being positioned for nondestructive assay.

U-233 processing prep continues

Oak Ridge has a significant inventory of uranium-233 (U-233) in Building 3019 at ORNL. Due to the strict safeguard and security needs for the special nuclear material, DOE initiated the U-233 Disposition Project to downgrade the security demands at ORNL, eliminate safety and nuclear criticality concerns, and safely dispose the material offsite.

In 2016, OREM continued direct disposition of the Consolidated Edison Uranium Solidification Project (CEUSP) material. CEUSP, which comprises a portion of Oak Ridge's U-233 inventory, originated from a research and development test in the 1960s of thorium and

uranium fuel at the Consolidated Edison's Indian Point 1 Nuclear Plant in New York.

This year, OREM also continued its preparations for the next phase of the U-233 Disposition Project, which involves processing the remaining portion of the U-233 inventory that cannot be directly disposed in its current form. OREM identified Building 2026, located directly across from Building 3019 at ORNL, as the location to conduct future processing work.

In September 2016, DOE approved the initial package allowing OREM to begin preparing and modifying Building 2026 for future processing activities.

Y-12 National Security Complex



The Y-12 National Security Complex is a premier manufacturing facility dedicated to making our nation and the world a safer place. The Y-12 Complex helps ensure a safe and reliable U.S. nuclear weapons deterrent. The site also retrieves and stores nuclear materials, fuels the nation's naval reactors, and performs highly skilled, specialized manufacturing work for other government and private-sector entities.

Design work moves forward for mercury treatment facility at the Y-12 Complex

OREM is working to plan, design, and construct the Outfall 200 Mercury Treatment Facility to reduce mercury concentrations in water exiting the Y-12 Complex. The facility opens the door for large-scale demolition to begin at Y-12 by providing a mechanism to limit and control potential mercury releases caused from disturbing the western portion of the site. It will also help the cleanup program make progress toward achieving compliance with regulatory criteria.

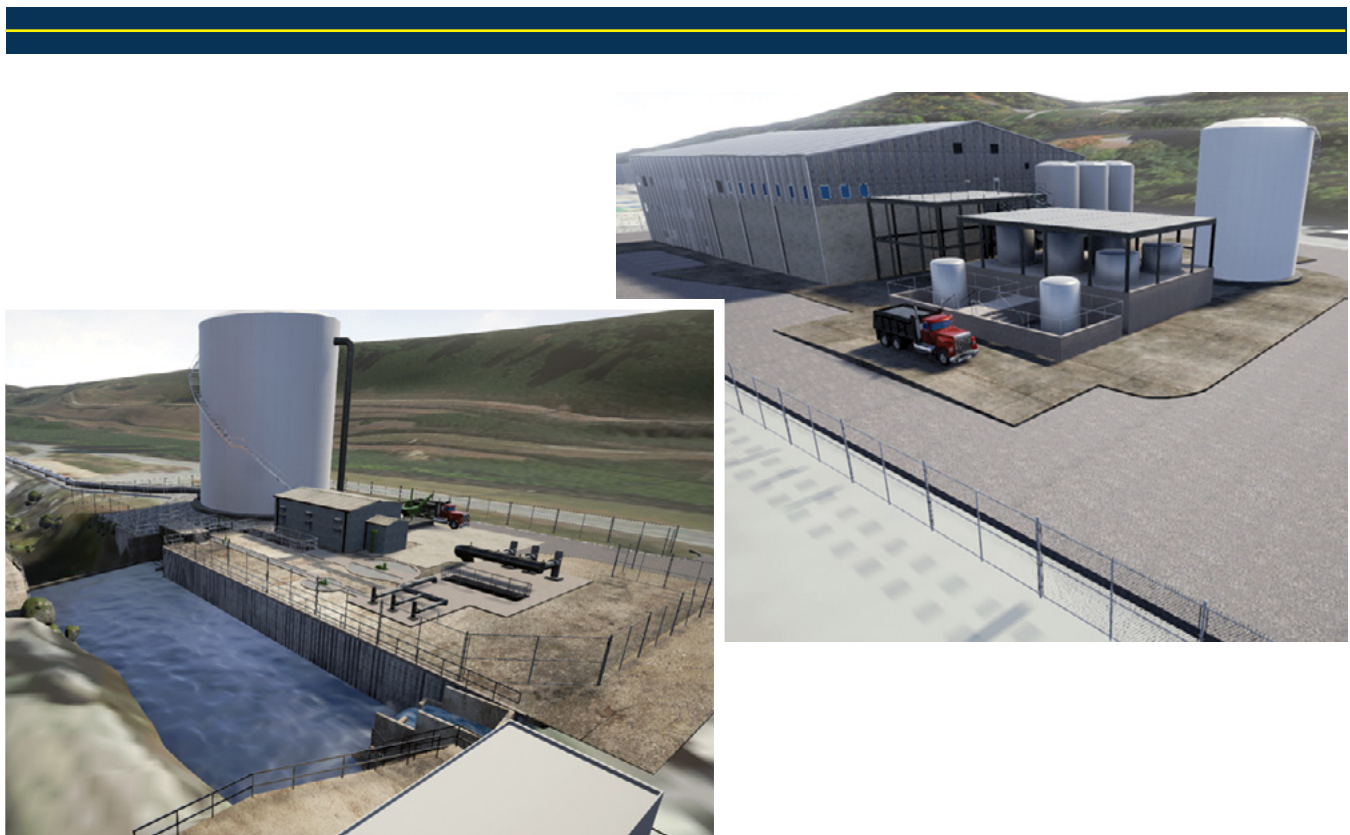
Outfall 200 is the point where the west end Y-12 storm drain system discharges to Upper East Fork Poplar Creek. Mercury from historical operations is present in the Outfall 200 storm water entering Upper East Fork Poplar Creek.

In FY 2016, OREM prepared the Preliminary Design Report and completed independent design, cost, and constructability reviews. OREM also completed a site

geotechnical investigation to support the final design of the facility. Final design efforts began in early 2016, with completion scheduled for FY 2017.

OREM is designing the mercury treatment facility with the capability to treat 3,000 gallons per minute, and the designs also include a 2-million-gallon storage tank to collect storm water during peak flow conditions. The facility will treat mercury using chemical precipitation, clarification, and media filtration. The treated water will then be discharged back into Upper East Fork Poplar Creek.

Employees working on the design are incorporating a modular design that enables future modifications as needed, such as adding additional storm water storage or unit operations to achieve greater mercury reductions based on performance monitoring data.



Artist's renderings of Outfall 200 Mercury Treatment Facility.

OREM researches mercury remediation technologies, conducts sampling

Mercury remediation is a high priority for OREM because of large historical losses of the element in buildings, soils, and surface waters at Y-12. Understanding how mercury moves in the East Fork Poplar Creek system is essential to the development of new technologies and ultimately to the development of remedial options and strategies for the creek.

Remediation of Y-12 and East Fork Poplar Creek (EFPC) is based on a phased, adaptive management approach. The approach to address surface water includes treatment actions in the short term and research and technology development to evaluate longer-term solutions in the downstream environment. As part of this effort, OREM has developed and is executing a Mercury Technology Development Plan.

In FY 2016, research and technology development activities continued to focus on the major factors influencing the accumulation of mercury in fish (fish are the major route of both human and wildlife exposure). Three lines of investigation for EFPC continue to be pursued to: (1) examine potential downstream sources, such as bank soil and sediment control, (2) investigate

the water chemistry and flow characteristics of the creek and its influence on mercury, and (3) study the ecology and how differences in food chain processes may influence the uptake of mercury in fish.

In FY 2016, the study identified and sampled a historical source of mercury entering EFPC. Researchers will continue to study the extent and impact of this source in FY 2017. Stream sediments were also obtained and analyzed for traces of mercury and how the mercury is bound to sediment particles. Additionally, the water chemistry and flow characteristic studies monitored the effects of chlorination on mercury mobilization and concentration in EFPC.

This year, the ecological investigations continued to sample EFPC fish, algae, and invertebrates. They also analyzed the exposure pathway the leads to elevated concentrations of mercury in fish.

ORNL scientists are preparing a report titled “Mercury Remediation Technology Development for Lower East Fork Poplar Creek—FY 2016 Progress Report.” This report will provide a detailed description of each of the study areas and findings from studies performed in FY 2016.



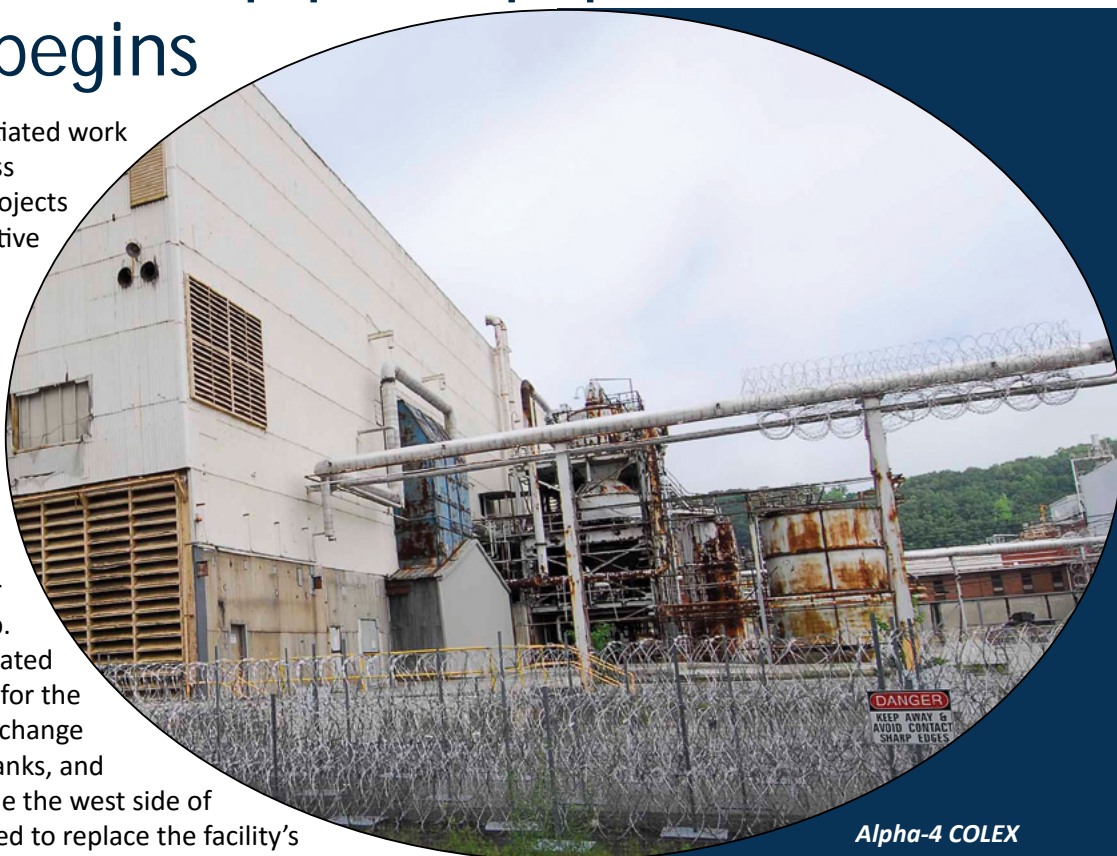
Fish are a major mercury route of human and wildlife exposure.

Alpha-4 process pipe, equipment removal begins

In FY 2016, OREM initiated work at Y-12 as part of its Excess Facilities initiative. The projects associated with this initiative focus on work that will reduce risks and stabilize facilities that are not scheduled for near-term demolition. These projects enhance safety for onsite employees, reduce opportunities for the release or spread of contamination, and lower the cost of future cleanup.

At Y-12, the work initiated in FY 2016 paves the way for the removal of the column exchange (COLEX) process piping, tanks, and equipment located outside the west side of Alpha-4. Crews also worked to replace the facility's roof. Alpha-4 is a 600,000-square-foot steel and concrete facility with three floors and a sub-basement. The building began operating in 1945 as a uranium enrichment facility until 1947. In 1953, workers installed the COLEX process, which used substantial quantities of mercury as a solvent agent to separate lithium, and the operations continued until 1962.

While workers drained the majority of process materials from the equipment when operations ceased, all of the systems and components were not cleaned. Recoverable amounts of mercury and lithium hydroxide are still in the equipment and lines. OREM is scheduled to remove the COLEX equipment on the west side of Alpha-4 in 2017, and equipment on the east and south sides will be removed in the future.



Alpha-4 COLEX

Biology Complex characterization begins



Biology Complex

The Biology Complex at Y-12 is part of the Excess Facilities initiative. OREM began characterizing the Biology Complex in FY 2016 to support future demolition and waste disposition activities on the structures.

The Biology Complex, which was once home to DOE's research in genetics, originally consisted of twelve buildings until OREM demolished four of them in 2010.

The Biology Complex has been vacant for decades, and it is starting to collapse due to its age and deteriorated condition. Crews can no longer enter at least one of the facilities due to a caving roof. In many cases, bricks are falling from the exterior facade. Asbestos, roofing and ceiling materials, and other materials are also falling due to roof leaks.

Waste Management



Wastes on the Oak Ridge Reservation are being disposed in a variety of ways. Most of the waste is being disposed onsite in the Environmental Management Waste Management Facility (EMWMF) or the Oak Ridge Reservation Landfills. Some wastes are shipped offsite for treatment and/or disposal. Wastewater is treated at the Chromium Water Treatment System at ETTP and the Process Waste Treatment Complex at ORNL.



Most cleanup wastes disposed onsite

Most of the waste generated during FY 2016 cleanup activities was disposed at facilities on the Oak Ridge Reservation.

This year, EMWMF received 10,668 waste shipments, accounting for 100,208 tons, from K-27's demolition and several smaller cleanup projects at ETPP, ORNL, and Y-12. This engineered landfill consists of six disposal cells that only accept low-level radioactive and hazardous CERCLA waste that meets specific waste acceptance criteria. Waste types that qualify for disposal include soil, dried sludge and sediment, solidified waste, stabilized waste, building debris, scrap equipment, personal protective equipment, and classified waste.

In FY 2016, EMWMF operations collected, analyzed, and dispositioned approximately 3.6 million gallons of leachate at the ORNL Liquid and Gaseous Waste Operations (LGWO) facility. No contact water (water that comes in contact with waste but does not enter the leachate collection system) required treatment at ORNL. However, 7.6 million gallons of contact water was collected, analyzed, and released to the storm water retention basin after laboratory analyses verified the water met all discharge standards. Operating

practices at the landfill also effectively controlled site erosion and sediment.

Additionally, OREM completed a draft focused feasibility study to evaluate alternatives for managing landfill wastewater generated from the on-site disposal of CERCLA waste. EMWMF is currently receiving waste, and the proposed Environmental Management Disposal Facility is expected to receive waste in the future. This study is under review by EPA and TDEC.

DOE also operates and maintains solid waste disposal facilities called the Oak Ridge Reservation Landfills, three of which are active. In FY 2016, approximately 33,632 cubic yards of waste were disposed in these landfills, which marks a 13 percent decrease from FY 2015 volumes. However, the clean spoils receipts increased 81% over FY 2015. Clean spoils have the potential for being reused and are segregated to avoid taking up valuable landfill airspace. Construction of the remaining phase of the classified landfill was also initiated.

Operation of the Oak Ridge Reservation Landfills generated approximately 2.1 million gallons of leachate that was collected, monitored, and discharged into the Y-12 Complex sanitary sewer system.

New disposal facility location sought

EMWMF, the existing on-site disposal facility for low-level, mixed, and classified waste, is expected to reach capacity before OREM completes its cleanup at Y-12 and ORNL. Planning for another landfill is essential so that cleanup work can continue without interruption. The new facility will be called the Environmental Management Disposal Facility (EMDF).

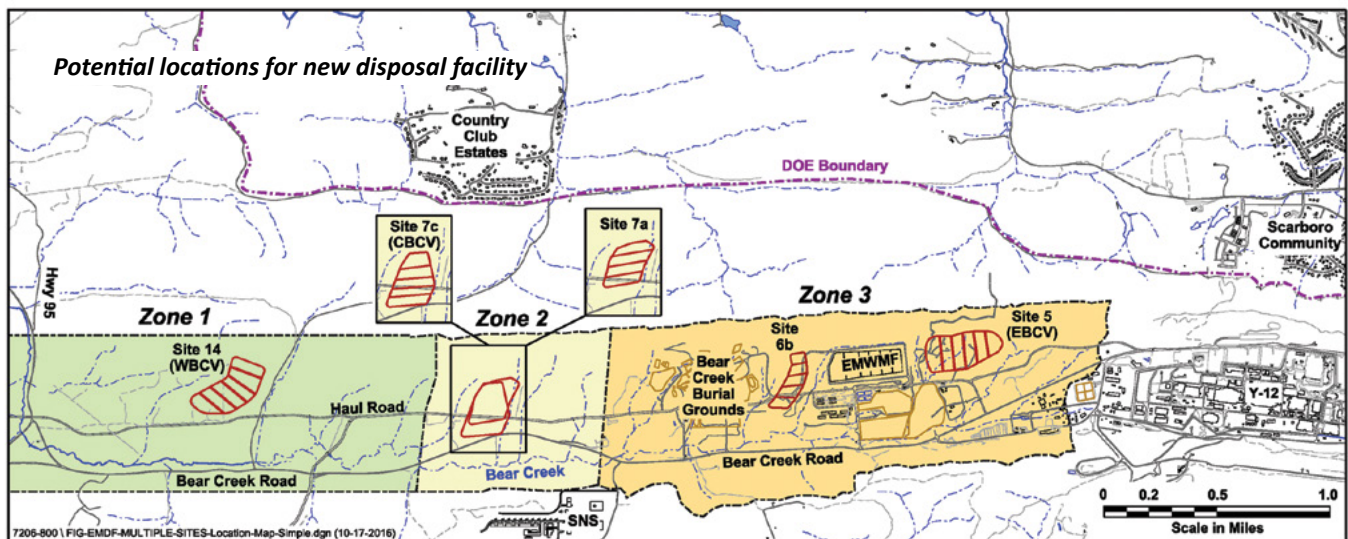
During 2016, OREM continued to work with regulators to submit a final version of the RI/FS for approval. The document lists options for onsite and offsite disposal. The on-site disposal alternative in the document lists four site options in Bear Creek Valley, including a Brownfield site to the east of EMWMF and three others that incorporate greenfield sites.

Under the offsite disposal alternative, future CERCLA waste would be transported off-site for disposal in approved disposal facilities in other states, primarily by rail. The hybrid disposal alternative considers a smaller on-site landfill in conjunction with sending a

larger percentage of waste off-site. For benchmark purposes, a no-action alternative is also listed as a means of comparison.

The document concludes that both on-site and off-site disposal alternatives would protect human health and the environment long-term. Short-term risks are higher for the off-site disposal alternative due to significant efforts to transport the waste. The off-site disposal alternative may isolate the wastes more effectively since the disposal sites are located in arid climates. Along with higher costs, off-site disposal would extend the cleanup schedule ten or more years.

The on-site disposal alternative would be located on DOE land within the Oak Ridge Reservation, but it would be much less costly, allow for more expedited waste disposal, avoid transportation risks, and provide a greater level of certainty that long-term disposal capacity remains available, thus offering the most condensed overall cleanup schedule.



Millions of gallons of wastewater treated

Each year, activities on the Oak Ridge Reservation generate millions of gallons of wastewater that must be treated to remove oil, chemicals, radiological constituents, and other contaminants.

The National Nuclear Security Administration at Y-12 treats wastewater generated from both production and environmental cleanup activities. Safe and compliant treatment of 112 million gallons of wastewater was provided at various facilities during

FY 2016. At ORNL, the Process Waste Treatment Complex treated approximately 88 million gallons of wastewater.

In addition, the liquid low-level waste evaporator at ORNL treated approximately 171,300 gallons. The ORNL 3039 Stack Facility treated 1.63 billion cubic meters of gaseous waste. These waste treatment activities supported both OREM and Office of Science mission activities in a safe and compliant manner.

Landfill space expanded



To support demolition of the K-1037 Building at ETPP, OREM needs additional landfill space for uncontaminated, classified waste debris. A smaller industrial, classified landfill located on Chestnut Ridge is being expanded to avoid placing this waste in EMWMF and filling valuable low-level, radioactive waste landfill space.

In the spring and summer of 2016, DOE requested a minor modification to the existing permit from TDEC after completing an expansion design. In addition, the expansion subcontractor was selected and mobilized

to the site. The expansion will more than double the existing capacity of the landfill. It includes removing excess soil, laying protective liners, extending a leachate collection system, and increasing the storage capacity of the existing leachate system.

An independent quality assurance subcontractor is performing the testing and documentation required to produce a certification report for TDEC approval prior to waste disposal in the new area. The expansion is anticipated to be completed before the end of calendar year 2016.

LGWO life cycle evaluation completed

The engineering evaluation and life cycle study of ORNL's Liquid and Gaseous Waste Operations (LGWO) was completed in FY 2016. The focus of the study was to evaluate the current conditions of the process water, gaseous waste, and liquid low-level waste systems; determine the future capacity needs to support OREM and the Office of Science missions at ORNL; research alternate technologies; and recommend and prioritize repairs and/or system upgrades for long-term operations.

The LGWO operating systems vary in age from 30-

to 60-years-old, and all of them are well beyond their designed life. The systems are experiencing frequent equipment breakdowns, and in many cases, spare parts are not available due to the age of the equipment that is in service. The engineering evaluation has confirmed and identified additional equipment repairs to be conducted in 2016.

Based on the completion of the LGWO Engineering Evaluation and Life Cycle Study, several upgrades and maintenance activities were identified and planned over the next five years.

TRU waste being processed, stored

The Transuranic (TRU) Waste Processing Center (TWPC) characterizes and packages TRU waste from the Oak Ridge Reservation for disposition at DOE's Waste Isolation Pilot Plant near Carlsbad, New Mexico. In October 2015, North Wind Solutions, LLC was selected as the managing contractor for TWPC.

TRU waste contains man-made elements heavier than uranium, such as plutonium, hence the name “trans” or “beyond” uranium. TRU waste is generally associated with the research involving fissionable material dating back to the Manhattan Project. It consists primarily of clothing, tools, rags, residues, soil, and debris.

Two waste streams—contact-handled (CH) and remote-handled (RH)—are processed at TWPC. CH TRU can be safely handled without remote equipment, although workers never actually touch the waste without protective barriers, such as special clothing or equipment. Higher energy radioactive TRU, or RH waste, is processed by remote control equipment in special rooms called “hot cells.” Workers who process RH waste are protected by barriers, such as thick concrete walls and leaded-glass viewing windows.

In FY 2016, the TWPC processed 23 cubic meters of CH waste, achieving an overall project lifecycle total of 1,507 cubic meters of processed CH waste. In addition, employees at the facility processed 69 cubic meters of RH waste for an overall project life cycle total of 553 cubic meters. These totals represent approximately 95 percent of the CH TRU waste and about 82 percent of the RH TRU waste based on the current inventory and generation forecasts.

Due to the prolonged shutdown of the Waste Isolation Pilot Plant, TWPC continues to implement a safe extended-storage plan allowing continued progress against regulatory milestones for TRU waste processing. TWPC continues to utilize available ORNL storage capacity for CH TRU waste and specially designed remote-handled over-packs to store RH TRU waste safely and compliantly until normal waste disposal operations resume at the Waste Isolation Pilot Plant.

During FY 2016, TWPC has actively participated in various reviews and audits necessary for approval to make future shipments to the New Mexico disposal facility.

Specifically designed protective containers are used to store RH waste until they can be shipped for disposal.





OREM awarded a contract to CH2M HILL Constructors, Inc., in March 2015 for the design of the Sludge Processing Facility Buildouts Project at TWPC.

Processing and dispositioning Oak Ridge's inventory of TRU sludge is an important element of the ongoing TRU waste disposition program. However, current facilities at TWPC are not designed for sludge processing. New facilities and processing systems will be designed and constructed adjacent to the TWPC in order to mobilize and transfer the sludge from the ORNL tanks to processing systems to solidify, package, and ship for offsite disposal.

The design of the new processing systems will involve full-scale, mock-up testing to achieve the technology maturation levels that are required for implementation. OREM will conduct mock-up testing through the design and construction of an onsite mock-up test facility (also referred to as the Sludge Test Area) and offsite testing at vendor facilities. Once the technologies are matured through mock-up testing, the design of the final processing facilities and systems can be completed and construction may begin.

The architect and engineering services contractor is currently focused on technology maturation activities for critical technology elements identified for the project. Changes to the Sludge Test Area's design, functions, and testing strategy are being

integrated into the project planning basis following OREM's approval of recommendations resulting from the contractor's technology assessment. Based on the recommendations, two critical technology elements will be matured at offsite vendor testing facilities while the Sludge Test Area undergoes procurement and construction.

Key progress for the project in 2016 includes:

- Completed development of an updated lifecycle planning schedule and transmitted to the regulators with proposed milestones/targets.
- Released Request for Information to potential vendors for the sludge mobilization system.
- Completed initial development of a design package for the Sludge Test Area, design of the density test element skid, and specification package for offsite vendor testing of the slurry mixing and characterization tanks and measurement system and issued for OREM review.
- Completed process chemistry modeling and issued Chemistry Modeling Report (calculation) to support update of the Integrated Systems Test Plan.
- Awarded task for environmental characterization of the Sludge Test Area site and sampling is scheduled to begin October 2016.
- Conducted second quarterly Safety Design Integration Team meeting.

Oak Ridge Reservation

The DOE Oak Ridge Reservation is home to ETP, ORNL, and the Y-12 Complex, as well as waste repositories and other facilities. It contains approximately 33,500 acres, which are mostly wooded. In addition to cleanup projects at the three facilities on the Reservation, OREM is taking measures to address Reservation-wide issues.

Recommendations implemented from Reservation groundwater strategy report

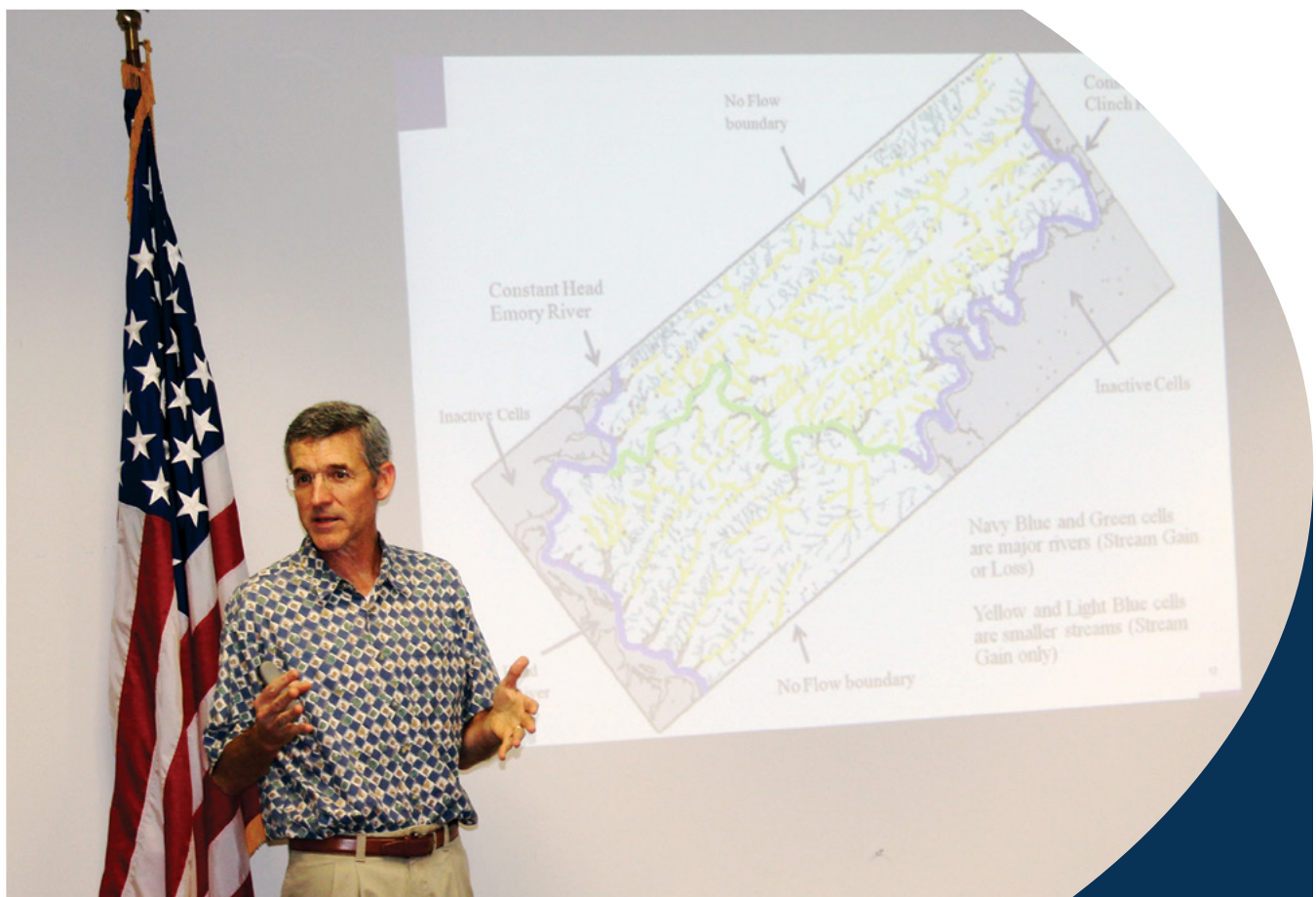
Work continued in 2016 to implement key recommendations from the Oak Ridge Reservation Groundwater Strategy Report that was approved in 2014.

Following two rounds of offsite groundwater sampling in 2015, OREM completed a third round in 2016.

The project is a cooperative effort among DOE, EPA, and TDEC. Samples have been collected at 34 wells and 15 springs located near the western boundary of the Oak Ridge Reservation to develop a deeper understanding about groundwater migration patterns in the area. A

report on the study was issued in November 2016.

A regional groundwater flow model was completed in 2016. The regional model will serve as an underlying framework to support future cleanup decisions and actions. A Technical Advisory Group composed of DOE, EPA, and TDEC members, as well as industry experts, has met several times annually since 2014. Members of this group review progress and make recommendations for development and future use of the model. One of the members, Dan Goode of the U.S. Geological Survey, has served as an interface with the Oak Ridge Site Specific Advisory Board.



Dan Goode briefs Oak Ridge Site Specific Advisory Board members about the regional flow model.

Review of remedial actions completed

The Five-Year Review, which assesses the effectiveness of completed CERCLA remedial actions, was completed in FY 2016.

This project included 29 individual reviews on sites where remedial actions are ongoing or have been completed and where contamination was left in place above unrestricted cleanup levels. In preparation for this effort, OREM completed additional monitoring and site visits to each location.

The Five-Year Review also evaluates the land-use

controls that are being utilized, which includes practices such as property record restrictions, property record notices, excavation/penetration permit programs, and access controls. A protectiveness determination was completed for each of the sites and is included in the review.

The annual Remediation Effectiveness Report was also completed in FY 2016 and submitted to EPA and TDEC. This report documents the progress of the remedial actions toward cleanup goals.



Public Information and Involvement



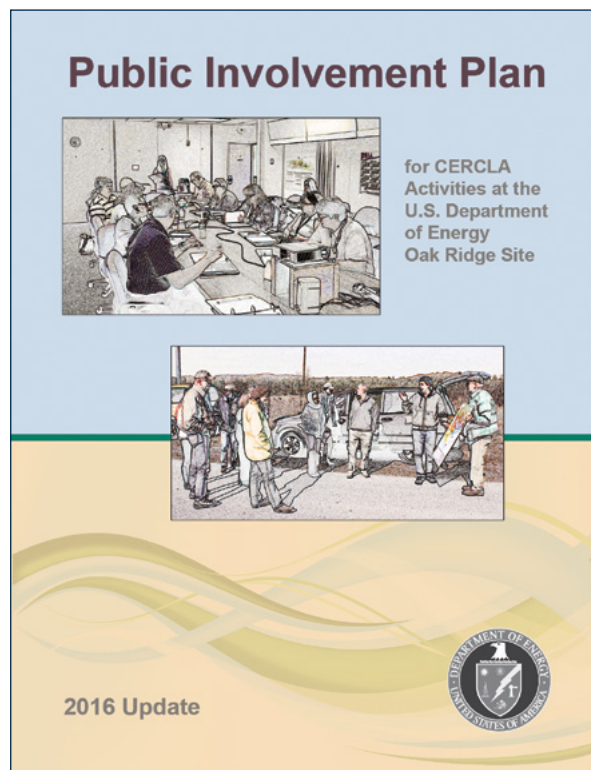
The public is involved in all cleanup decisions made by DOE. To keep the public informed, DOE provides information through a variety of outlets, including tours, meetings, fact sheets, public notices, websites, social media, and various publications.

Public Involvement Plan update released

DOE is updating the Public Involvement Plan for CERCLA Activities on the Oak Ridge Reservation. This document describes public involvement opportunities associated with OREM's activities performed under CERCLA.

The document is updated every three years to reflect the status of the cleanup decision-making process and to detail the continued avenues for public participation. It is forwarded to EPA and TDEC for review, and comments from these agencies are incorporated into the final document.

The public can participate in OREM's decision-making processes, and the cleanup program encourages such participation. Effective public involvement and good community relations rest on a foundation of positive relationships. OREM managers and staff work to build and nurture such relationships, and this plan details the opportunities and methods by which public input is incorporated into the decision-making.



Board focuses on outreach, advice on cleanup activities

The Oak Ridge Site Specific Advisory Board (ORSSAB) is a federally appointed citizens' panel that provides independent advice and recommendations to OREM.

The board is composed of up to 22 members, who are chosen to reflect the diverse occupations, perspectives, and interests of people living near the Oak Ridge Reservation. The board also includes two non-voting student representatives from area high schools.

Since 1995, ORSSAB has actively provided input to OREM on cleanup operations and stewardship of remediated areas and permanent waste disposal sites. The board continued that tradition in FY 2016. More information about ORSSAB is available online at www.energy.gov/orssab.

Following are some of the board's major recommendations, contributions, and activities for FY 2016.

Recommendations

ORSSAB's primary function is to provide advice and recommendations to DOE on its environmental cleanup of the Oak Ridge Reservation. Following are the board's recommendations for FY 2016. Complete text of all ORSSAB recommendations can be found on the board's website.

- Recommendation on the Preferred Alternative for the Proposed Plan for Water Treatment at Outfall 200 at the Y-12 National Security Complex
- Recommendation on the Final Proposed Plan for Soils in Zone 1 at East Tennessee Technology Park

- Recommendations on the FY 2018 DOE Oak Ridge EM Budget Request
- Recommendation to EM on the Waste Isolation Pilot Plant (a joint recommendation from the eight SSABs to DOE Headquarters)

Spring SSAB Chairs Meeting

On April 19–21, 2016, ORSSAB hosted the spring SSAB chairs meeting in Oak Ridge. Approximately 60 representatives from DOE Headquarters and from the eight local SSABs around the nation attended. The three-day event included a site tour of the Oak Ridge Reservation on April 19, a full day meeting on April 20, and a half day meeting on April 21.

Public Outreach

The board completed a number of public outreach goals this year in its continuing mission to inform and involve the public in the EM decision-making process. The board issued five news releases, four Advocate newsletters, and its FY 2015 annual report. Members staffed a booth at the Oak Ridge Earth Day event. Board meetings were video recorded and broadcast on local cable stations. Regular postings were made about board meetings, events, and videos on Facebook and YouTube, and a Flickr photo stream was launched.

On May 26, 2016, ORSSAB Secretary Dave Hemelright presented the board's recommendations on the FY 2018 Oak Ridge EM budget request at the annual Oak Ridge EM Community Workshop. The event was held to discuss FY 2018 budget formulation and priorities for Oak Ridge cleanup. The workshop was attended by approximately 100 people.

Special Events and Site Tours

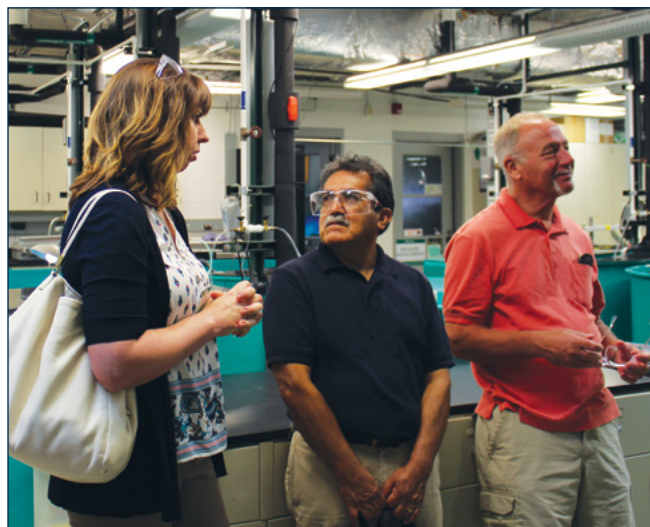
ORSSAB has been restructuring its work plan in an effort to get members more engaged in work plan topics by having meetings at different locations, taking field trips, and ensuring that meeting presentations are focused only on EM issues where decisions are to be made and ORSSAB input is requested by DOE, and spending less time on project updates. Those efforts were successful and were continued in FY 2016. During



Board members with representatives from DOE, EPA, and TDEC at the ORSSAB 2016 annual meeting.

the year, board members participated in a variety of special events and site tours:

- East Tennessee Technology Park tour
- Y-12 National Security Complex landfill tour
- K-27 demolition celebration
- Groundwater modeling demonstrations at Leidos offices
- Oak Ridge National Laboratory Aquatic Ecology Laboratory tour



ORSSAB members (from left) Elizabeth Ross, Ed Trujillo, and Greg Paulus tour ORNL's Aquatic Ecology Laboratory in June.

DOE Information Center in Oak Ridge

The DOE Information Center is a one-stop information facility that maintains a collection of more than 47,000 documents involving environmental activities in Oak Ridge.

The Center hosts various meetings, including some of the ORSSAB meetings, relevant to cleanup activities in Oak Ridge. Staff are available Monday through Friday, 8 a.m. to 5 p.m., to assist with information needs. Users can consult the below website for information available from the Center.

FY 2016 Stats

Average number of visitors per month	70
Number of public meetings held	62
Total citizen inquiries	688
Total number of documents at the center	47,884
Total number of documents on-line	16,066



DOE Information Center staff, from left, are Trilla Hutchins, Eva Butler, and Wanda Joyce.

Visit the DOE Information Center on the Web at <http://doeic.science.energy.gov/>

Phone: (865) 241-4780

The DOE Information Center is located at the Office of Scientific and Technical Information, Building 1916 – T1, 1 Science.gov Way, Oak Ridge, Tennessee 37831

Information Resources

DOE Information Center
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Building 1916 – T1, 1 Science.gov Way
Oak Ridge, Tennessee 37831
Phone: (865) 241-4780
Fax: (865) 574-3521
E-mail: doeic@science.doe.gov
Hours 8 a.m. to 5 p.m., Monday – Friday

DOE OREM Public Information
(865) 576-0742

DOE-ORO Public Information Line
1-800-382-6938

Oak Ridge Site Specific Advisory Board
(865) 241-4583, (865) 241-4584
1-800-382-6938

Tennessee Department of Environment
and Conservation - DOE Oversight Office
(865) 481-0995

U.S. Environmental Protection Agency
Region 4
1-800-241-1754

Internet Sites

OREM Program	www.energy.gov/orem
OREM Facebook	https://www.facebook.com/Department-of-Energy-Oak-Ridge-Office-486186205206/
OREM Twitter	https://twitter.com/OakRidgeOffice
DOE Main Website	www.energy.gov
Oak Ridge Site Specific Advisory Board	www.energy.gov/orssab
Tennessee Department of Environment and Conservation	www.state.tn.us/environment/
U.S. Environmental Protection Agency	www.epa.gov/region4/

Commonly Used Acronyms and Initialisms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CEUSP	Consolidated Edison Uranium Solidification Project
CH	Contact-handled
DOE	U.S. Department of Energy
EFPC	East Fork Poplar Creek
EM	Environmental Management
EMDF	Environmental Management Disposal Facility
EMWMF	Environmental Management Waste Management Facility
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
EU	Exposure Unit
FY	Fiscal year
MSRE	Molten Salt Reactor Experiment
NPL	National Priorities List
ORNL	Oak Ridge National Laboratory
ORSSAB	Oak Ridge Site Specific Advisory Board
RH	Remote-handled
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
TRU	Transuranic
TWPC	Transuranic Waste Processing Center

Commonly Used Terms

CERCLA: The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for hazardous waste releases at these sites, and established a trust fund to provide cleanup when no responsible party could be identified. The law, which governs cleanup operations on the Oak Ridge Reservation, authorizes two kinds of response actions: short-term removal actions, where actions may be taken to address releases or threatened releases requiring prompt response, and long-term remedial actions, which permanently and significantly reduce the dangers associated with releases or threats of releases. Long-term actions can be conducted at sites on the U.S. Environmental Protection Agency's National Priorities List, a listing of the nation's most hazardous waste sites. The Oak Ridge Reservation was added to that list in 1989.

Federal Facility Agreement: CERCLA requires an agreement between state and federal entities to guide cleanup work at CERCLA sites. For the DOE Oak Ridge Office, the parties of this agreement, called a Federal Facility Agreement, is DOE, the U.S. Environmental Protection Agency, and the Tennessee Department of Environment and Conservation. The Federal Facility Agreement for Oak Ridge was initiated in January 1992.

Removal Actions: Some cleanup activities on the Oak Ridge Reservation are conducted as Removal Actions under CERCLA. These actions provide an important method for moving sites more quickly through the CERCLA process. When a site presents a relatively time-sensitive, non-complex problem that can and should be addressed, a Removal Action would be warranted.

Remedial Actions: Remedial actions are long-term response actions that seek to permanently and significantly reduce the risks associated with the release or threat of release of hazardous substances.

Remedial Investigation/Feasibility Study: The purpose of the remedial investigation/feasibility study (RI/FS) is to assess site conditions and evaluate alternatives to the extent necessary to select a remedy. Developing and conducting an RI/FS generally includes the following activities: project scoping, data collection, risk assessment, treatability studies, and analysis of alternatives. The scope and timing of these activities should be tailored to the nature and complexity of the problem and the response alternatives being considered.

Record of Decision: Under the CERCLA process, a Record of Decision formally documents the selection of a preferred cleanup method after a series of steps, including a Remedial Investigation/Feasibility Study. A preferred cleanup alternative is selected and presented to the public for comment in a Proposed Plan. The U.S. Environmental Protection Agency, the state, and the lead agency then select a remedy and document it in the Record of Decision.

Fiscal Year: The 2016 fiscal year spans from Oct. 1, 2015, to Sept. 30, 2016.

For more information, please contact the DOE Public Affairs Office
at (865) 576-0885 or 1-800-382-6938.