



2019 Cleanup Progress

Annual Report to the
Oak Ridge Regional Community



Message from the Manager

DOE Oak Ridge Office of Environmental Management



To the Oak Ridge Regional Community:

The U.S. Department of Energy's (DOE) Oak Ridge Office of Environmental Management (OREM) completed another successful year of cleanup in Fiscal Year 2019. Our workforce is using the record-level of funding from Congress to achieve first-in-the-world accomplishments, eliminate risks, and transform the site.

Our employees remain intensely focused on achieving Vision 2020 at the East Tennessee Technology Park (ETTP)—a goal that will make Oak Ridge the first site in the world to complete major cleanup at an enrichment complex in 2020.

The latest tally shows our program has removed 12 million square feet of facilities at ETTP. This year, crews successfully removed the final buildings associated with the site's former gaseous diffusion uranium enrichment operations and demolished the site's largest remaining building. Employees also tore down numerous support structures, removed large concrete slabs, completed soil remediation projects, and initiated deactivation inside the former centrifuge enrichment complex.

As cleanup advances, we are realizing our ultimate vision for ETTP as a multi-use industrial park. DOE has transferred almost 1,300 acres from government ownership for economic development. The most recent company to locate on transferred land anticipates generating 200 high-paying jobs in 2025. We are also excited



to open the K-25 History Center. It will be a great educational attraction that gives the site's early workers the recognition and honor they deserve.

Congress's continued support has allowed us to reduce risks and make great strides preparing for the next chapter of cleanup at the Oak Ridge National Laboratory (ORNL) and Y-12 National Security Complex (Y-12).

Crews are inside the final five buildings of the Y-12 Biology Complex preparing them for demolition. They also cleaned out and removed old COLEX equipment at the Alpha-4 Building. That effort allowed workers to retrieve almost 10,000 pounds of mercury, preventing a potentially large environmental release. Our program is also actively testing new decontamination technologies that will enhance efficiency for future Y-12 projects.

In our last update, we announced teams had finished site preparations for the new Mercury Treatment Facility. Now, crews are hard at work building it. This project will fulfill a longtime commitment to reduce mercury levels leaving Y-12. It also will allow us to safely conduct large-scale demolition there.

We have numerous projects at ORNL that are modernizing waste treatment infrastructure, deactivating former research reactors, and eliminating contamination pathways to enable near-term demolition projects.

Additionally, in our partnership with researchers at ORNL, we are identifying effective and affordable approaches for mercury cleanup in soil, sediments, and creeks. This research has uncovered solutions that are less costly and less damaging to ecosystems. OREM is funding an expansion of the laboratory so researchers will have the capability to test mercury removal technologies using real-world stream settings. This addition will accelerate mercury technology development for OREM to deploy in the field in the coming years.

Our employees are key to maintaining our tremendous success. We are proud of the planning and efforts underway to ensure Oak Ridge continues to have a highly-trained, skilled, and experienced workforce. OREM and its contractors have numerous initiatives and partnerships with universities, community colleges, high schools, and labor apprenticeship training programs. This multi-faceted approach is equipping the next generation to safely and successfully take on and accomplish our complex and challenging mission.

Finally, we appreciate your interest in and support of our program. We recognize the importance and impact of our work on the community, and we keep you at the forefront of every decision. Our program will continue advancing cleanup to give Oak Ridge the future it deserves.

Jay Mullis



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This report was produced by UCOR, DOE’s Environmental Management contractor for the Oak Ridge Reservation.

Introduction

In Fiscal Year (FY) 2019, the DOE Oak Ridge Office of Environmental Management (OREM) made great progress toward achieving Vision 2020—the goal to complete major cleanup at the East Tennessee Technology Park (ETTP) in 2020. The cleanup work at the former gaseous diffusion plant is making parcels of land available for private sector development that can economically benefit the region. OREM also continued significant risk reduction activities at the Y-12 National Security Complex and Oak Ridge National Laboratory, including construction of a new Mercury Treatment Facility and stabilization of excess contaminated facilities awaiting eventual demolition.

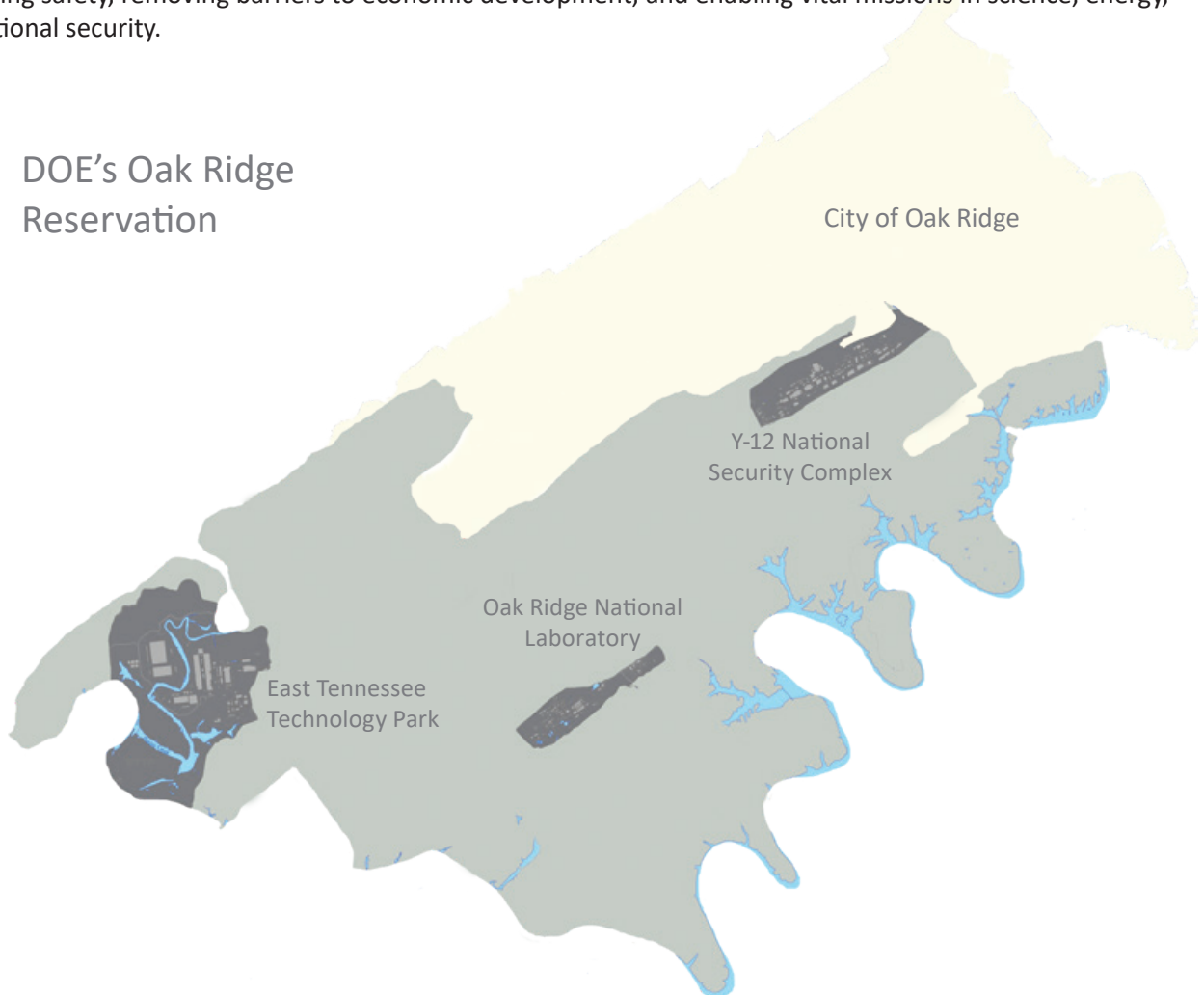
The Oak Ridge Reservation has played key roles in our nation’s defense and energy research. However, past waste disposal practices and unintentional releases have left portions of the land and facilities contaminated and in need of environmental cleanup.

The contaminated areas of the reservation are on the U.S. Environmental Protection Agency’s (EPA’s) National Priorities List (NPL), which includes sites across the nation that require cleanup under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). These areas on the Oak Ridge Reservation have been clearly defined, and OREM is working to clean and restore them under a partnership with the EPA and the Tennessee Department of Environment and Conservation (TDEC).



Together, through the support provided by contractors, unions, Congress, and elected officials, OREM is enhancing safety, removing barriers to economic development, and enabling vital missions in science, energy, and national security.

DOE’s Oak Ridge Reservation





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 multi-use industrial park. Major activities at the site include environmental restoration, facility deactivation and demolition, waste disposition, and land transfers.

Former barrier production facility demolished

Cleanup of ETPP took another major step forward as workers completed demolition of the K-1037 Building, which was the largest and one of the most challenging facilities still standing at the site.

Workers began tearing down the building in February 2019 and safely completed the project almost four months ahead of schedule. Most of the demolition debris was disposed of at onsite waste disposal facilities.

Built in 1945, the structure grew through the years with additions that brought its square footage to approximately 380,000 square feet. As one of the earliest structures at the site, K-1037 was originally a warehouse, but it was later used to produce barrier material used in the gaseous diffusion process until 1982.

DOE cleanup contractor UCOR, an AECOM-led partnership with Jacobs, spent almost two years before demolition preparing the facility to be safely torn down. The building posed a unique challenge because of the classified material that first had to be removed before the building itself could be declassified and demolition could begin.

Coordinating with DOE, UCOR successfully removed these classified components, as well as other equipment and waste. Other work performed to prepare the facility for demolition included asbestos abatement and utility disconnections.

Crews began removing transite paneling from the building before demolition began and continued simultaneously removing the panels from portions of the building while other sections were being demolished.





K-1037 before and after demolition



K-1037 site after demolition and slab removal

Demolition of Poplar Creek facilities completed

Some of the latest cleanup progress at ETPP has brought the end of an era at the site. The demolition of K-131 and K-631 marks the first time since 1943 that there are no buildings that conducted or supported gaseous diffusion uranium enrichment operations on the ETPP site.

At maximum operation, ETPP housed five massive uranium enrichment buildings and numerous support facilities. Eleven of those facilities, along with smaller supporting structures, were housed in a swath of land adjacent to Poplar Creek.

The final two process buildings in the Poplar Creek area that were demolished—K-131 and K-631—were

two of the oldest facilities remaining at ETPP and were physically connected to one another.

Originally, workers in Building K-131 provided purified uranium hexafluoride to the uranium enrichment cascade. Through the years, the building was used for a variety of other purposes until uranium enrichment operations ceased at the site in 1985.

Workers in the companion Building K-631 withdrew gaseous depleted uranium hexafluoride from the cascade, converted it to liquid, and transferred it into transport cylinders. The five-story K-131 and two-story K-631 had a combined floor space of more than 83,000 square feet.

The Poplar Creek area before and after the process buildings were demolished



The Poplar Creek facilities, many of which were radioactively contaminated, constituted some of the most contaminated facilities remaining at ETPP. Other notable demolitions in the area include a cooling tower, cooling water pump house, and a test loop facility that was used to evaluate gaseous diffusion equipment performance.

With demolition completed, the Poplar Creek area and the adjacent footprint of the previously demolished K-29 gaseous diffusion building will begin undergoing a regulatory approval process. That will continue ETPP's transformation and enable its next chapter as a privately-owned, multi-use industrial park.



Transportation personnel haul debris from K-131/K-631 demolition for disposal. Each truck is inspected and the load covered to ensure safe transport.



Workers demolish Chemical Recovery Facility

Demolition of the K-1232 Chemical Recovery Facility, another of the major Poplar Creek facilities, was completed in FY 2019.

The 140-ft by 60-ft, two-story facility was built in the early 1970s to recover chemicals resulting from site operations. Recovery operations were shut down in 1982, and the facility was then used to treat wastewater from the Y-12 National Security Complex during the 1980s and early 1990s.



K-1232 Chemical Recovery Facility during and after demolition



Workers sample the K-1232 slab after demolition



ETTP FY 2019 progress by the numbers

540,000
square feet
demolished

29
facilities
demolished

716,668
safe miles
traveled hauling waste

Toll Enrichment Facility demolished

Workers finished demolition and debris removal of the 30,817-square-foot K-1423 Toll Enrichment Facility. It was used to transfer liquefied uranium hexafluoride, which was used in the former gaseous diffusion plant's uranium enrichment process, into cylinders.

It operated for that purpose from 1969 until 1986. The building was later used for a variety of purposes, including addressing radiologically contaminated drums, washing chemically contaminated drums, and storing waste.



K-1423
Building as demolition begins and after it is completed



ETTP garage demolished

ETTP's longest operating facility, the K-1414 Garage, was demolished in FY 2019.

The structure was built in 1949 and operated until early 2018—long after the site's uranium enrichment operations ceased in the mid-1980s. The building covered more than 12,000 square feet and served as the maintenance hub and fueling station for vehicles used to support the site's enrichment and, later, cleanup missions.



K-1414 Garage demolition

Slab left from K-29 Building demolition removed

The slab of the former K-29 uranium enrichment facility was removed in FY 2019.

The K-29 Building was the first of the five massive gaseous diffusion facilities that was demolished at ETTP. The facilities were used to enrich uranium for defense and commercial purposes until the plant shut down in the mid-1980s. The other four buildings have since come down in a historic, first-ever cleanup of a gaseous diffusion complex. The 291,000-square-

foot K-29 Building was demolished in 2006, and the slab left behind was paved over with asphalt. Trailers were placed on the asphalt pad to house cleanup personnel. Cleanup contractor UCOR removed the trailers, asphalt, and slab.

Completion of this project, combined with the adjacent Poplar Creek area, furthers the mission of making property area available for economic development.



The slab removal at the K-29 site opens up more land for industrial development

Soil remediation preparing site for future use

Soil remediation efforts at ETPP are helping to eliminate hazards at the site and pave the way for its future industrial use. ETPP is divided into two cleanup regions: Zone 1, a 1,400-acre area outside the main plant, and Zone 2, an 800-acre area that comprises the main plant area. The areas in these zones are divided into varying-sized exposure units (EUs) for the purpose of remediation.

Zone 1

The Interim Record of Decision (ROD), which documents the cleanup method for Zone 1, requires OREM to remediate soil for the protection of groundwater and a future industrial workforce and includes land use controls. The ROD divides Zone 1 into 80 EUs that range in size from 4 to 66 acres.

In FY 2019, OREM and UCOR initiated characterization to identify areas that require remediation to eliminate ecological risk to wildlife, particularly in the K-901

Drainage Ditch. Additionally, planning started for the remediation of two subsurface vaults associated with the abandoned underground utility system in the Powerhouse Area.

Zone 2

The Zone 2 ROD requires OREM to remediate soil for the protection of groundwater and a future industrial workforce and includes land use controls. It divides Zone 2 into 44 EUs that range in size from 6 to 38 acres.

In FY 2019, OREM and UCOR completed characterization and remediation of EUs Z2-11, -14, -15, and -37. The slabs for Buildings K-27 and K-29 were removed in EU Z2-14. As part of a major remediation action, crews continued to excavate and remove soil contaminated with concentrations of technetium-99 (Tc-99) to meet regulatory standards.



Excavation of Tc-99 contaminated soil

ETTP transforming into multi-use industrial park

Oak Ridge's Reindustrialization Program entered its 23rd year as the model DOE asset reuse program. During that time, OREM has been transforming ETTP from a former government-owned uranium enrichment complex into a multi-use industrial business park. OREM has successfully transferred almost 1,300 acres at ETTP for beneficial reuse and is working to complete transfer of the remaining acreage at the site.

As OREM completes the final phases of environmental cleanup at ETTP, the site continues toward its future as a multi-use industrial park, national historical park, and conservation area. A closure plan was developed in 2017 and updated in 2019 to address the necessary transfers for all of the site assets, including facilities, land, and utility infrastructure.

Additionally, UCOR and the Community Reuse Organization of East Tennessee re-evaluated and

modernized the existing revitalization plan for ETTP. The approach accounted for recent cleanup accomplishments and new developments, such as a proposed regional general aviation airport.

A proposed plan to build an airport on the ETTP site reached a major milestone in FY 2019 with the Federal Aviation Administration's (FAA) conditional approval of the airport layout plan. The Metropolitan Knoxville Airport Authority is now proceeding with final design work.

Another interesting development at ETTP in FY 2019 was a new focus on the beneficial reuse of greenspace. In areas where redevelopment is more challenging due to terrain or wetlands, UCOR is facilitating opportunities to enrich the community through potential conservation and greenspace initiatives that will be integrated into the industrial park and the national historical park.

Construction begins on commemorative facilities

After an extensive renovation project, the K-25 History Center is nearly complete for the community. This commemorative facility was commissioned through a Memorandum of Agreement to enable OREM to complete decontamination, decommissioning, and demolition of historic structures at ETTP. As construction nears completion, exhibits are arriving on site and being moved into the building. The K-25 History Center will feature exhibits, artifacts, and audio-visual displays to interpret the significant role of the K-25 site in the Manhattan Project and Cold War, and to commemorate the people who worked there.



Workers are preparing walkways for the History Center

Future phases of the project include constructing an Equipment Building and Viewing Tower. The Equipment Building will be a showcase for representative gaseous diffusion technology contained in the K-25 Building. An enclosed observation deck at the top of the Viewing Tower, standing 70-ft tall, will overlook the K-25 Building footprint and provide a 360-degree view of the site.



Oak Ridge National Laboratory

The Oak Ridge National Laboratory is DOE's largest multi-program 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.

Excess contaminated facilities stabilized

In FY 2019, work started on the characterization and deactivation of Buildings 3009, 3010, 3010-A, 3080, 3083, 3107, and 3026-D. The Building 3010 Reactor Pool was characterized for waste disposal, and asbestos and universal waste were removed.

Building 3026-D was a hot cell facility constructed in 1946 that housed the East Cell Bank, the West Cell Bank, and an underground concrete transfer tunnel where a rail-mounted transfer cart was used to transfer material between cell banks. The transfer

tunnel was grouted in place in 2019 to prevent any potential pathway for contaminant migration and provide structural stability. The 47-foot-long tunnel was used to load radioactive material into the hot cell for research and analysis. It is contaminated and will be removed at a future date as a remedial action.

Deactivating these facilities paves the way for future demolition, which will remove a significant risk from the heart of ORNL and open land for future research and science missions.



Workers grout the transfer tunnel at the 3026-D hot cell

Uranium-233 processing begins ahead of schedule

Oak Ridge has a significant inventory of uranium-233 (U-233) in Building 3019 at ORNL. DOE has declared the inventory excess to its needs and in 2006, was directed by Congress to disposition the inventory. OREM responded by initiating the U-233 Disposition Project to safely disposition the material, eliminate safety and nuclear criticality concerns, and downgrade the security demands at ORNL.

The U-233 Disposition Project involved two phases—the Direct Disposition Campaign and the Processing Campaign. The Direct Disposition Campaign transferred U-233 material suitable for beneficial reuse to other programs and directly disposed materials that did not require further processing.

OREM successfully completed that campaign in FY 2017. The Processing Campaign will convert the remaining U-233 inventory into a form that is ready for disposal. In FY 2019, OREM approved final design to upgrade Building 2026 hot cells so employees can process and solidify the remaining U-233 material for disposal.

Processing operations were originally scheduled to begin in October 2020 when crews are set to finish upgrading hot cells in an ORNL facility. The upgraded cells will be designed to handle larger amounts of U-233, providing more shielding for workers equipped with mechanical arm manipulators.



Fissionable material handlers working in a glove box in Building 2026

However, rather than wait for the hot cells to be completed for larger-scale processing, Isotek arranged for workers to begin processing the portions of the uranium-233 inventory with lower levels of radioactivity in glove boxes in Fall 2019. Glove boxes are structures with ports containing gloves that allow waste handlers to safely work with radioactive material.

This modified approach allowed OREM to begin a year ahead of schedule, and it will enable employees to process approximately 11 percent of the Oak Ridge Oxide as other crews finish upgrading the hot cells. Processing operations are expected to continue through 2024.

MSRE waste items characterized, dispositioned

Waste characterization and disposal were completed for waste items from the Molten Salt Reactor Experiment (MSRE) facility—a test reactor that operated at ORNL from June 1965 until December 1969. 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 and disposing of legacy defueling equipment, such as the fuel salt probes and fuel salt probe glove box. OREM is continuing its routine surveillance and maintenance activities to manage the remaining hazards, including periodically removing reactive gas generated by the defueled salts.

Project enhancing safety and reducing costs at MSRE

OREM began a \$4.7 million project in FY 2019 that will reduce maintenance and operations costs at ORNL's Molten Salt Reactor Experiment (MSRE).

The project, expected to result in cost savings of nearly \$25 million, will enhance the facility's electrical distribution, sump pump, fire suppression, and monitoring systems.

Although it was shut down 50 years ago, certain systems within the reactor building have continued to operate to keep the facility safe and stable until it can be demolished. OREM defueled the reactor in 2007, and it is working to identify the best approach to address remaining fuel salts in the building. Crews are replacing existing electrical systems with a new

conduit-based one to power essential systems. This change will minimize maintenance costs, reduce risk of injury to workers, and provide reliable electrical service.

The new sump pump system, which removes groundwater from the building's basement and foundation, will provide more reliable operations, improve safety, and reduce risks during maintenance activities.

Workers are also designing and installing the new dry fire suppression system, which will eliminate costs associated with purchasing and providing steam from the laboratory.

Zeolite treatment process at LGWO being moved

At the Liquid and Gaseous Waste Operations (LGWO), which processes wastes from ORNL and other sources, the Zeolite treatment process is planned to be moved out of Building 3544 (the radiological wastewater treatment facility), which has exceeded its design life and is scheduled for demolition. The new treatment system will be housed at Building 3608 (formerly, the non-radiological wastewater treatment facility). Workers are demolishing existing equipment at 3608 to make room for the new equipment. These infrastructure upgrade projects are vital for a system that helps one of the nation's most important research sites, ORNL, remain operational.



Workers are demolishing equipment at 3608 to make room for new equipment



Y-12 National Security Complex

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

More than 4.6 tons of mercury removed at COLEX

At the Alpha-4 Building, workers removed more than a ton of mercury from the building's east Column Exchange (COLEX) equipment. Combined with the mercury previously removed from the West COLEX equipment, more than 4.6 tons of mercury have been removed.

The four-story, 500,000-square-foot Alpha-4 facility was used for uranium separation from 1944 to 1945. Workers finished installing the COLEX equipment in 1955 for lithium separation, a process that required

large amounts of mercury. A significant amount of the element was lost into the equipment, buildings, and surrounding soils, and its cleanup is one of OREM's top priorities.

Workers have completed the East COLEX risk reduction project, including activities to tap and drain the East COLEX piping and inspect, clean, and characterize 22 tanks. The COLEX mercury removal project is part of a broader initiative to address large quantities of mercury resulting from decades of Y-12 operations.

The West COLEX equipment before and after demolition. Below a worker is tapping and draining a pipe.





Workers perform characterization and asbestos abatement inside the Biology Complex to prepare the structures for demolition in 2020

Biology Complex deactivation underway

OREM is preparing to remove five high-risk excess contaminated facilities, known as the Biology Complex, at Y-12. The 350,000-square-foot area poses asbestos hazards as well as structural deterioration risks. Demolition of these facilities is part of an effort to eliminate excess contaminated facilities throughout

the DOE complex. Asbestos abatement and material removal were initiated in FY 2019.

Originally constructed in the 1940s to recover uranium from process streams, the complex later housed DOE's research on the genetic effects of radiation. The facilities once housed more individuals with doctorates than anywhere in the world.



Biology Complex

The complex originally consisted of 11 buildings until OREM demolished four of them in 2010 as part of the American Recovery and Reinvestment Act of 2009. Buildings 9743-2 and 9770-2 were demolished in FY 2018, and mobilization started for the demolition of the remaining buildings. The completion of this project will clear land for important future national security missions.



Excavation underway at the headworks facility area

Construction begins on Mercury Treatment Facility

Construction is underway on the Outfall 200 Mercury Treatment Facility. It will reduce mercury in water exiting the site through the East Fork Poplar Creek. Outfall 200 is the point where the west end of the Y-12 storm drain system creates the headwaters of the Upper East Fork Poplar Creek.

The mercury treatment facility will help OREM achieve compliance with regulatory criteria for the East Fork Poplar Creek. It also facilitates large-scale facility demolition to begin at Y-12 by helping to control potential mercury releases that could occur when disturbing the mercury-contaminated buildings and soil.

In FY 2019, OREM completed early site preparation activities ahead of the treatment facility construction. Early site preparation activities began in 2018 and included construction of utilities necessary for the

treatment facility, installation of secant pile walls near East Fork Poplar Creek, and relocation and demolition of existing infrastructure and structures to prepare the site for construction of the mercury treatment facility.



Excavation underway at the treatment facility area

Major soil disposition project completed

Workers disposed of 4,071 cubic yards of soil that had been in storage since 1989, resulting from the closure of oil retention ponds. The ponds were constructed decades earlier to collect oils, preventing them from seeping from below-ground waste sites to nearby surface streams.

The project was completed for \$1.2 million—nearly \$75 million under its original estimated budget.

During the closure project in 1989, the soil from the oil retention ponds was labeled as containing solvents based on the contents of the below-ground waste sites near the soil retrieval location. The presence of solvents would require treatment and disposal offsite, a significant cost reflected in the original budget.

Years later, reviews of the original sampling data revealed the need for new samples and analysis to determine the appropriate path to address the soil. The DOE Oak Ridge Office of Environmental

Management (OREM) contracted with small business Alliant Corporation to conduct that work. Results of the sampling revealed that the soil, spanning a facility the size of an Olympic-sized swimming pool, did not contain solvents.

The U.S. Environmental Protection Agency and the Tennessee Department of Environment and Conservation agreed with OREM's technical basis for eliminating the previous requirements to treat the soil, and allowed OREM to safely dispose of most of it onsite. With the change, OREM awarded a contract to small business Cherokee National Environmental Solutions to complete the soil disposal project.

The removal of soil paves the way for OREM to reuse the building where the soil was stored. Workers conducted sampling to confirm the facility is safe for future projects. OREM expects to use the facility for research on waste treatment and cleanup at the Y-12 National Security Complex.



Workers dispose soil resulting from the closure of oil retention ponds

Mercury treatment technologies explored

Mercury remediation is OREM’s highest priority at the Y-12 National Security Complex due to the large historical losses of the element in buildings, soils, and surface waters. Mercury contamination in the environment poses significant technical and regulatory challenges and can benefit from development of new tools and approaches that might be more effective, reduce costs, and accelerate cleanup schedules.

The importance of technology development was highlighted by Secretary of Energy Rick Perry and Undersecretary Paul Dabbar during a visit to ORNL’s Aquatic Ecology Lab on May 6, 2019. OREM is making significant investments into the development of new remediation technologies to help address the complex mercury challenge in Oak Ridge. In the near-term, mercury technology development activities will support the successful completion of the demolition of Y-12’s mercury-contaminated facilities and soils remediation, waste disposition, and reduction of mercury-related ecological risks in East Fork Poplar Creek.

In the downstream environment, field characterization and research during the 2015-2020 time period will support an evaluation of potential remediation

alternatives for the creek in the mid-2020s. Activities to modernize ORNL’s Aquatic Ecology Lab will allow for mesocosm testing of various remediation technologies, more closely simulating creek conditions in the laboratory. With a better understanding of mercury transport processes in the watershed system, specific technologies and strategies can be assessed and implemented to aid future cleanup. Quantitative modeling was initiated in FY 2018-2019 to simulate various remediation and technology development scenarios and better inform future remedial decision-making.

Studies have been conducted to evaluate alternative treatment chemicals on mercury flux, the effect of sorbents on mercury and methylmercury concentrations in the presence of dissolved organic matter, and the use of mussels as a tool for reducing particle-associated mercury in the water column. ORNL scientists have prepared a report titled “Mercury Remediation Technology Development for Lower East Fork Poplar Creek—FY 2019 Update.” This report provides a detailed description of each of the study areas and findings from studies performed in FY 2019.



Workers construct housing for large tanks at the ORNL Aquatic Ecology Lab



Waste Management

Wastes generated from cleanup activities on the Oak Ridge Reservation are addressed in a variety of ways. Most of the volume is disposed onsite in the Environmental Management Waste Management Facility (EMWMF) or the Oak Ridge Reservation Landfills. However, the highly contaminated material is shipped offsite. Wastewater is treated at various facilities on the Oak Ridge Reservation.

Onsite disposal aids site's cleanup

Most of the waste generated during FY 2019 cleanup activities in Oak Ridge went to disposal facilities on the Oak Ridge Reservation.

EMWMF received 10,555 waste shipments, totaling 75,074 cubic yards, from cleanup projects at ETTP, ORNL, and Y-12. This engineered landfill consists of six disposal cells that only accept low-level radioactive and hazardous waste meeting specific criteria. These wastes include soil, dried sludge and sediment, building debris, and personal protective equipment.

This disposal facility, which accepts the larger volume of waste that does not contain highly hazardous materials, has been vital to Oak Ridge's cleanup progress and success. It has enabled OREM to accomplish more cleanup by being able to focus its resources on projects that eliminate risks across with site.

EMWMF operations shipped approximately 4.5 million gallons of leachate for disposal at the ORNL Liquid and Gaseous Waste Operations facility. Contact water, which comes in contact with waste but does not enter the leachate collection system, did not require treatment in FY 2019. That water is only released after laboratory analysis verifies it meets all regulatory limits and discharge standards.

DOE also operates and maintains solid waste disposal facilities, the Oak Ridge Reservation Landfills. In FY 2019, these three active landfills received 11,100



Receipt of oversized item at EMWMF



Erosion controls put in place at the Oak Ridge Reservation Landfills

waste shipments, totaling 123,376 cubic yards of waste.

In FY 2019, OREM also completed improvements to the sediment control ponds and erosion controls at the Oak Ridge Reservation Landfills. These actions significantly reduce the amount of sediment released from these landfills.

Data gathered for proposed waste disposal facility

EMWWMF will reach capacity in the near term before OREM completes its cleanup at Y-12 and ORNL. Planning continued in FY 2019 for another disposal facility that will provide the capacity required to complete Oak Ridge's cleanup. The new facility will be called the Environmental Management Disposal Facility (EMDF).

OREM monitored a total of 31 wells (measuring and recording water levels and groundwater characteristic data) for the entire year. The results of the year-long monitoring were documented in a technical memorandum and provided to the Federal Facility Agreement regulators for comment. Test pits and borings were also installed on two potential borrow

areas to evaluate the potential quality and quantity of borrow soil for berms and liner construction.

Preliminary design of the facility, as well as a detailed evaluation of its long-term performance, continued using site-specific characterization results to ensure that the disposal facility can be protective in the long-term.

OREM concluded a four-month public comment period for the proposed new facility in January 2019, and the cleanup program is working with Environmental Protection Agency and Tennessee Department of Environment and Conservation to move forward on planning documents related to the project.



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 Y-12 National Security Complex treats wastewater and groundwater generated from production and environmental cleanup activities. The site provided safe and compliant treatment of 128 million gallons of wastewater and groundwater during FY 2019.

At ORNL, the Process Waste Treatment Complex treated approximately 85 million gallons of wastewater in FY 2019.

In addition, the liquid low-level waste system at ORNL received approximately 77,000 gallons for treatment. The ORNL 3039 Stack Facility treated 1.63 billion cubic meters of gaseous waste. These waste treatment activities supported both OREM and DOE Office of Science mission activities safely and compliantly.

TWPC continues waste processing, shipments

North Wind Solutions, LLC, operator of the Transuranic Waste Processing Center (TWPC), continued processing waste in FY 2019. TWPC is responsible for processing and packaging transuranic (TRU) waste from the Oak Ridge Reservation for shipment to DOE's Waste Isolation Pilot Plant (WIPP), near Carlsbad, New Mexico. This form of waste consists of materials and debris that are contaminated with elements that have a higher atomic mass and are listed after uranium on the periodic table. The majority of Oak Ridge's inventory originated from previous research and isotope production missions at ORNL.

Two TRU waste streams are processed at the facility—contact-handled (CH) and remote-handled (RH) waste. CH waste 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 waste is processed by remote control equipment in special protective rooms called "hot cells." Workers who process this form of waste are protected by barriers, such as thick concrete walls and leaded-glass viewing windows. TWPC has processed approximately 98 percent of the CH TRU waste and 98 percent of the RH TRU and completed key regulatory Site Treatment Plan milestones on schedule.

In FY 2019, North Wind Solutions completed 85 CH TRU waste shipments containing 2,739 drums to WIPP. As a result, OREM has been able to disposition approximately 76 percent of the CH TRU waste and 56 percent of the RH TRU waste.

Progress continues on sludge buildout facility

Once TRU debris processing is completed, OREM must process and dispose of the large inventory of remaining TRU sludge waste. TWPC is not designed for sludge processing, so new facilities must be constructed to mobilize and transfer the sludge from the ORNL tanks to processing systems that will enable the solidification, packaging, and disposing of the waste offsite.

OREM will conduct initial testing through the design and construction of a mock test facility and offsite testing at vendor facilities. Once the technologies are matured, the design of the final processing facilities and systems can be completed and construction can begin. In FY 2019, workers continued to make progress on the Sludge Mobilization System, Slurry Mixing and Characterization Tank, and Mobilization Measurement Instrumentation, as well as design documents for the Sludge Test Area to support technology maturation and compliance with a Site Treatment Plan milestone.



TWPC operators using manipulators to process highly radioactive transuranic waste inside the hot cell



Oak Ridge Reservation

The DOE Oak Ridge Reservation is home to ETTP, ORNL, and Y-12. It contains approximately 32,400 acres that are predominantly undeveloped, forested areas. In addition to cleanup projects at the three sites on the reservation, OREM is taking measures to address reservation-wide issues.



The Oak Ridge Reservation has an extensive network of monitoring wells that provide valuable groundwater data

Groundwater strategy projects implemented

In FY 2019, OREM continued to implement projects under the Oak Ridge Reservation Groundwater Strategy. The Melton Valley/Bethel Valley Exit Pathway Remedial Investigation Work Plan was approved by the regulators, and OREM initiated plans to install three new onsite wells west of ORNL near the Clinch River. Exit pathways are areas where contaminants have the potential to exit the Oak Ridge Reservation to offsite areas.

Monitoring of the new wells will supplement current exit pathway monitoring in Bethel Valley near the Oak Ridge Reservation boundary. A groundwater flow model was also completed using a computer modeling program. The groundwater flow model will be further refined with the results from the new wells that

will be used to help simulate and better understand groundwater movement.

Also in FY 2019, work continued on the Bethel Valley Final Record of Decision Remedial Investigation Work Plan. A meeting with the regulators was completed that addressed the objectives and focus areas of the work plan. This plan will outline an investigation strategy to support a future, final groundwater decision for Bethel Valley.

Offsite detection monitoring was completed in FY 2019. The study provides additional confirmation that there were no offsite health risks related to groundwater.



Public 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, briefings, conferences, media outreach, fact sheets, public notices, websites, social media, and various publications.

Tribal working group visits Oak Ridge

DOE hosted the State and Tribal Government Working Group (STGWG) on a visit and tour of the Oak Ridge Reservation during its spring meeting in Knoxville, Tenn., on May 14-16, 2019. STGWG states and tribes were joined by officials from the DOE headquarters and field offices.



Dave Adler conducts an STGWG tour at the ORNL Graphite Reactor

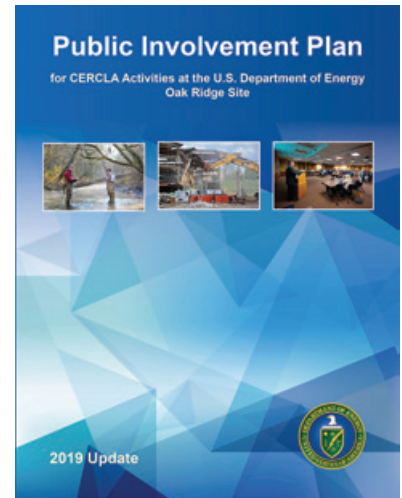
Grand opening held for AMSE

Local elected officials, including Rep. Chuck Fleischmann, below, joined DOE and others at the grand opening of the new American Museum of Science and Energy (AMSE). AMSE showcases Oak Ridge’s leadership in environmental cleanup, scientific and technical innovation, and national security since the Secret City’s start in the Manhattan Project.



PIP issued

OREM issued the 2019 update of the Public Involvement Plan (PIP) for Oak Ridge. The document, which describes public involvement activities for Oak Ridge cleanup, is updated and reissued every three years.



OREM emphasizes STEM education in local schools

In FY 2019, OREM employees visited numerous local schools to highlight the career opportunities in science, technology, engineering and math (STEM). They also shared the ins and outs of the local cleanup program and how it is helping transform the region.

Employees visited Linden Elementary, Coalfield Middle, Robertsville Middle, Jefferson Middle, Hardin Valley Academy, and Oak Ridge High School in their efforts to share the importance and value of STEM. One such event at Jefferson Middle School attracted more than 800 students and their family members.

The event provided the students and families the opportunity to learn and have fun. Organizers designed activities to share ideas, resources, and opportunities in the STEM fields. Those fields are central to the technical work occurring in Oak Ridge.

Many local organizations partnered with the school for the STEM night to enable the students to explore different aspects of STEM, including 3-D printing, laser scanning, radiation detection, virtual reality, drones, and CO₂-powered race cars.

OREM employees gave students an entertaining hands-on lesson on building lava lamps using vegetable oil, water, food coloring, and effervescent antacid.

Others participated in the DOE Career Café, where students shared interests, learned about careers, and asked questions of OREM’s scientists, engineers, and technicians.

“Community involvement is incredibly important to us as an organization, and we are continuously looking for opportunities for our employees to interact with students in local schools,” OREM Manager Jay Mullis said. “This event provided an excellent environment for students to have some fun and learn how diverse and exciting STEM careers can be.”

Alex Goldberg, the school’s STEM coach, emphasized the importance of having major STEM employers engage young people in the community.

“We are proud to represent Oak Ridge and bring the community together to further the STEM possibilities for our students, and the Department of Energy plays a vital role in this endeavor,” Goldberg said.

Oak Ridge was the second school district in the U.S. to



DOE’s Elizabeth Phillips promoting STEM at a local school

have each of its elementary, middle, and high schools fully STEM-accredited and certified.

Mullis appreciated the opportunity to engage with the students at this stage of their education at the STEM event.

“We work to introduce them to new, exciting ideas and make them aware of the options available to them,” he said. “It is an investment in our future. One day, some of these kids may be responsible for leading our program and achieving Oak Ridge’s cleanup mission.”



Advisory board provides public input on DOE cleanup activities

The Oak Ridge Site Specific Advisory Board (ORSSAB) is a federally chartered volunteer citizens panel that provides independent advice and recommendations to the DOE Oak Ridge Office of Environmental Management (OREM). ORSSAB provides DOE and regulators at EPA and TDEC with a forum for understanding stakeholder perspectives. It also serves as a venue for members of the community to express their views or ask questions.

Since 1995, ORSSAB has provided 245 recommendations to OREM on important aspects of the cleanup program, such as land use and reindustrialization; stewardship; cleanup standards, activities, and budgets; and waste management. Every

major record of decision (ROD) developed under Environmental Management (EM) has had heavy SSAB involvement, and none of the final RODs have been at odds with majority SSAB opinions.

ORSSAB meets the second Wednesday of most months at 6 p.m. at the DOE Information Center located at 1 Science.gov Way in Oak Ridge. The board held eight regular meetings in FY 2019 and participated in five tours of OREM projects. It also has two standing committees that meet separately. Meetings are always open to the public and include time for public comment. More information about ORSSAB is available at www.energy.gov/orssab.

Following are some of the board's major contributions and activities for FY 2019.

FY 2019 recommendations support increased communication and investment in new technologies

In FY 2019, the board passed four recommendations. Three of those recommendations were in partnership with the Environmental Management Site-Specific Advisory Board (EM SSAB), which consists of officers from other SSAB groups around the country. The EM SSAB meets twice annually to discuss topics with impact across all EM sites. The fourth gave input on OREM's FY 2021 budget request.

- Recommendation 242—EM SSAB Recommendation Regarding Site-Specific Advisory Board Involvement in Enhancing Stakeholder and Public Engagement: The leadership of the boards encouraged DOE to consider additional forms of community, public, and stakeholder engagement. They noted that individual site-specific advisory boards are in the perfect position to help develop and recommend implementation strategies.
- Recommendation 243—EM SSAB Recommendation on EM's Review of Cleanup Milestones: This recommendation was made in response to a recent report from the U.S. Government Accountability Office concerning improving oversight of cleanup milestones. Tracking milestones is one of the ways local boards become informed about cleanup actions at their sites. Milestone achievements, delays or changes in information should be shared regularly. SSAB members also recommended that EM create a complex-wide data dictionary for milestone terminology to reduce confusion.
- Recommendation 244—EM SSAB Recommendation on Improving EM's Science and Technology Program: The EM SSAB Chairs wrote this recommendation in response to the National Academies of Sciences' report, "Independent Assessment of Science and Technology for the Department of Energy's Defense Environmental Cleanup Program." The chairs agreed with the report's focus on a formal, open, transparent, quantifiable, and integrated science and technology program that is accessible to everyone – scientists, regulators and the public. They also supported the need for an aggressive program to verify the success of selected remediation pathways and risk-informed cleanup decisions.



In September, OREM Manager Jay Mullis briefed the board on OREM's FY 2021 budget request and asked for its input on projects and priorities. Like all ORSSAB meetings, it was open to the public and included time for public comments.

ORSSAB increases community awareness of ongoing cleanup

ORSSAB offers additional opportunities outside of its meetings for the public to learn about and express views on OREM's cleanup mission. The board regularly issues news releases, advertises in local media in print and online, broadcasts a portion of its monthly meetings on local cable stations, and archives the video to its YouTube channel, www.youtube.com/user/ORSSAB. Staff maintain an active social media presence at www.facebook.com/ORSSAB and offer several mailing lists to distribute news and meeting materials (users can sign up by emailing orssab@orem.doe.gov). Board members and staff are also available on request to educate community groups and organizations about the board's function.

The board completed a number of activities this year in its continuing mission to inform and involve the public in the EM decision-making process.

ORSSAB continued its long-standing tradition of appointing two student representatives to the board as part of its interest in long-term stewardship of the Oak Ridge Reservation. Educating and engaging students about OREM's work ensures the next generation of stewards are prepared for their role in making sure cleanup is completed and stewardship of the site continues.

Members pursue continuing education as part of advisory role

Since board members are not required to be experts, DOE supports ongoing education for members, including regular site tours and travel to select cleanup-related conferences such as the National Cleanup Workshop, the Waste Management Symposium, and the National Environmental Justice Conference.

Member reports and materials from offsite events are included in board meeting packets and archived at the DOE Information Center. In FY 2019, board members participated in the following local activities:

- Mercury remediation: Members toured ORNL's Aquatic Ecology Laboratory and learned about EM-funded research and upcoming expansion of the facility. Previous board recommendations had encouraged and supported additional funding for the Aquatics Lab's research and technology development. Construction of the expansion is underway and will be operational in 2020.
- Efforts for waste disposal: Members toured the Environmental Management Waste Management Facility, viewed the proposed site for the Environmental Management Disposal Facility, and attended public meetings about the project.
- Groundwater remediation: Members toured



Bill McMillan and UCOR's Chuck Curtis led members on a tour of ORNL's Liquid and Gaseous Waste Operations. The facility has been undergoing repairs and upgrades to extend its useful lifespan.

sites where groundwater decisions are needed or underway. A major component of current and upcoming recommendation topics involve areas at ETPP, where OREM is working to complete cleanup.

- Excess contaminated facilities: Several recommendations have focused on Oak Ridge's old, contaminated structures that are no longer supporting DOE missions and related issues that need to be addressed prior to large-scale demolition.

DOE Information Center in Oak Ridge

The DOE Information Center is a one-stop information facility that maintains a collection of more than 48,000 documents regarding environmental activities in Oak Ridge.

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

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
E-mail: doeic@science.doe.gov
Hours: 8 a.m. to 5 p.m., Monday – Friday
<http://doeic.science.energy.gov>
Phone: (865) 241-4780

FY 2019 Stats

Number of public meetings held	45
Total citizen inquiries	629
Total number of documents at the center	48,948
Total number of documents online	17,738

Websites for Additional Information

DOE OREM Public Information
(865) 574-4912
www.energy.gov/orem

Oak Ridge Site Specific Advisory Board
(865) 241-4583, (865) 241-4584
1-800-382-6938
www.energy.gov/orssab

Tennessee Department of Environment
and Conservation–DOE Oversight Office
(865) 481-0995
www.state.tn.us/environment/

U.S. Environmental Protection Agency
Region 4
1-800-241-1754
www.epa.gov/aboutepa/about-epa-region-4-southeast

Commonly Used Acronyms

AMSE	American Museum of Science and Energy
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COLEX	Column Exchange
CROET	Community Reuse Organization of East Tennessee
DOE	U.S. Department of Energy
DOEIC	DOE Information Center
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
LGWO	Liquid and Gaseous Waste Operations
MSRE	Molten Salt Reactor Experiment
NPL	National Priorities List
OREM	Oak Ridge Office of Environmental Management
ORNL	Oak Ridge National Laboratory
ORRL	Oak Ridge Reservation Landfills
ORSSAB	Oak Ridge Site Specific Advisory Board
PIP	Public Involvement Plan
ROD	Record of Decision
STEM	Science, Technology, Engineering and Mathematics
STGWG	State and Tribal Government Working Group
TDEC	Tennessee Department of Environment and Conservation

TRU	Transuranic
TWPC	Transuranic Waste Processing Center
WIPP	Waste Isolation Pilot Plant

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 assessments, 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 2019 fiscal year spans from Oct. 1, 2018, to Sept. 30, 2019.

For more information, please contact
the DOE Oak Ridge Public Affairs Office at (865) 574-4912.