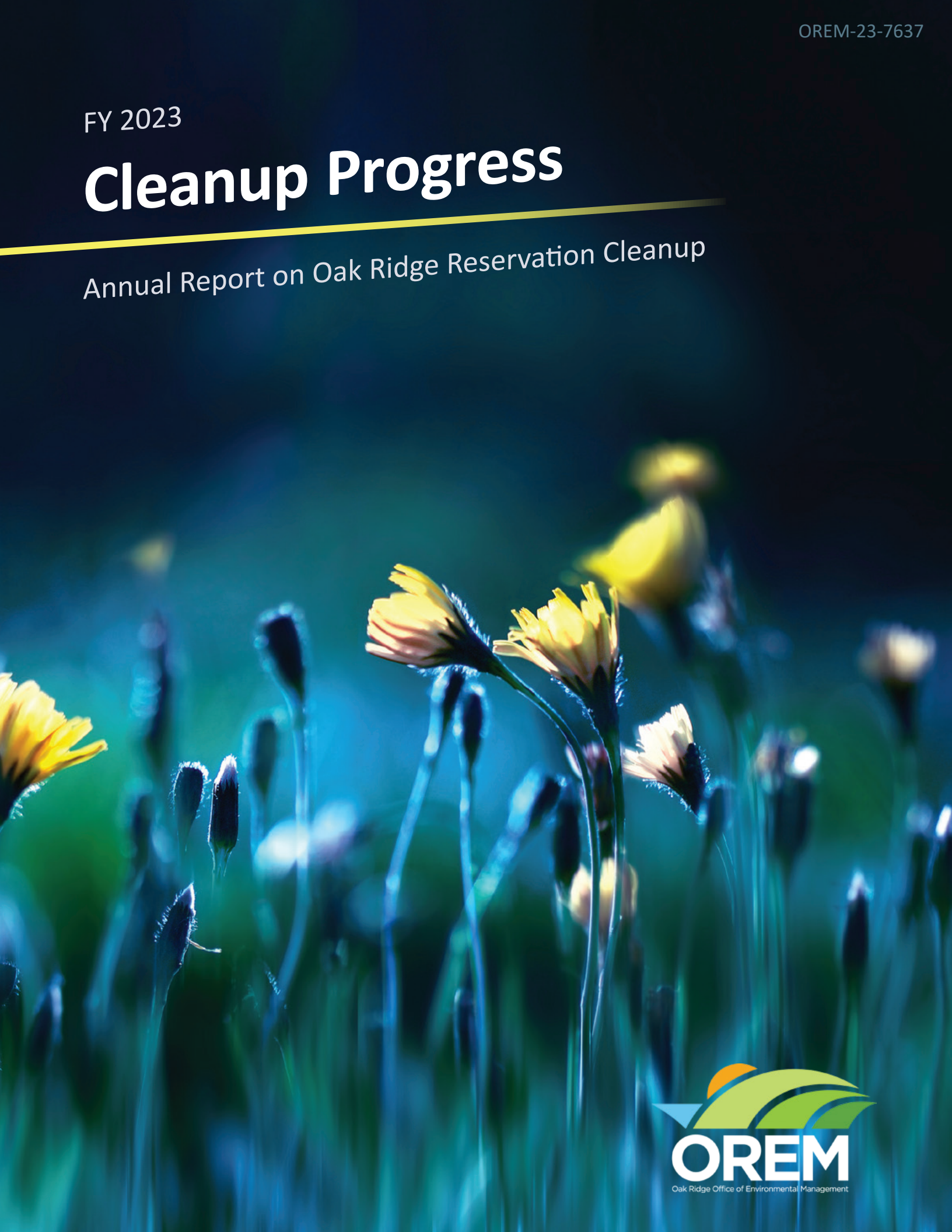


FY 2023

Cleanup Progress

Annual Report on Oak Ridge Reservation Cleanup



Message from the Manager

DOE Oak Ridge Office of Environmental Management



To the Oak Ridge Regional Community:

We're proud to report that 2023 marked another year of significant progress across the Oak Ridge Reservation. The U.S. Department of Energy's Oak Ridge Office of Environmental Management (OREM) and our contractors continued transformative work at all three sites, and we are strengthening partnerships that are key to our future success.

Crews were busy demolishing excess contaminated facilities at Oak Ridge National Laboratory (ORNL). They removed the Low Intensity Test Reactor at ORNL, achieving the second reactor teardown in the span of a year. Projects like this are clearing away high-risk buildings that have been shut down for decades, and they are also opening up land that can support future research missions.

Many more buildings are being prepared for near-term demolition. These projects will continue changing the landscape at ORNL and the Y-12 National Security Complex (Y-12). Teams have prepared Y-12's Alpha-2 facility for demolition next year. Its removal takes away an old, dilapidated Manhattan Project-era enrichment facility. Other teams are busy deactivating the Beta-1 and Alpha-4 facilities at Y-12 and the Oak Ridge Research Reactor, Isotope Row facilities, Building 3026 Hot Cell, and Graphite Reactor support facilities at ORNL.

OREM is also steadily eliminating Oak Ridge's inventory of nuclear waste. Every month, we are reducing Oak Ridge's inventory of transuranic waste with shipments to the Waste Isolation Pilot Plant in New Mexico.



Employees are also busy processing and disposing of the inventory of uranium-233 stored at ORNL. As part of an innovative public-private partnership, the U-233 disposition project is extracting medical isotopes that are supporting next-generation cancer treatment research.

We pushed forward two crucial infrastructure projects in 2023. OREM broke ground on the Environmental Management Disposal Facility this summer. With our current onsite disposal facility nearing full capacity, this project is essential to maintaining our momentum at ORNL and Y-12. Construction is also progressing on the Mercury Treatment Facility at Y-12. Teams are finishing the framework on the treatment plant, and they've finished the foundation and begun major installations on the headworks facility. When operational, this facility will allow us to begin addressing Y-12's large, mercury-contaminated facilities and sources of mercury in the soil by protecting against releases into the nearby creek.

Finally, we're nearing the end of our cleanup mission at the East Tennessee Technology Park (ETTP). With crews set to finish excavating contaminated soil from the site next year, the spotlight is turning to groundwater. Planning took a major step forward this year when the U.S. Environmental Protection Agency and Tennessee Department of Environment and Conservation approved our proposed plans for addressing groundwater at the site. Those plans help us chart our path to complete cleanup there and achieve our ultimate vision of transforming ETTP into a multi-use industrial center, national park, and conservation area for the community.

We are incredibly grateful for the support and involvement we enjoy from the Oak Ridge community, and we are committed to keeping our local partners and stakeholders informed about our work. Above all, we are focused on performing our mission safely and ensuring we conduct our projects in a manner that is responsible to taxpayers by completing them on time and on budget. Thank you for your role in helping advance cleanup, and we look forward to another productive year ahead.

Jay Mullis



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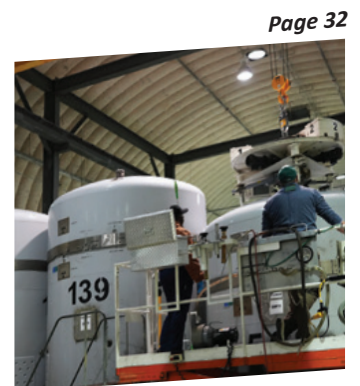
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Introduction

In Fiscal Year (FY) 2023, a great deal of cleanup progress took place across the Oak Ridge Reservation. Cleanup at the Oak Ridge National Laboratory advanced significantly with demolition of a second reactor at the site, continuing efforts to remove unneeded facilities and free up valuable space for continuing science missions. At the Y-12 National Security Complex, deactivation of several facilities was underway, preparing those facilities for eventual demolition. Soil remediation activities continued at East Tennessee Technology Park as that work is nearing completion. That work is moving forward the site's transformation to a multi-use industrial center, national park, and recreational area.

The Oak Ridge Reservation has played key roles in our nation's defense and energy research. However, past operations during the Manhattan Project and Cold War-era created legacies that require environmental cleanup and placed areas of the reservation on the U.S. Environmental Protection Agency's (EPA) National Priorities List, which includes sites nationwide 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, labor, Congress, and state and local officials, OREM is enhancing safety, removing barriers to economic development, and enabling vital missions in science, energy, and national security.



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, the site also houses numerous old, contaminated buildings and forms of waste from previous research and operations in past decades.



Demolition of second ORNL reactor completed

OREM cleanup contractor UCOR began demolishing the Low Intensity Test Reactor (LITR) (Building 3005) in February 2023. Demolition of this facility marked the second demolition of a reactor at ORNL after the Bulk Shielding Reactor was demolished the previous year.

The reactor site posed unique challenges, including working within a very small footprint and managing boundaries with facilities in close proximity. The demolition produced more than 1.1 million pounds of waste, which had to be sorted, tested, analyzed, and reduced before being disposed of at an onsite disposal facility, or segregated and packaged for offsite disposal.

When demolition of the outer structure was completed, the massive reactor structure (35,600 pounds and 30 feet long) was pulled from its housing and placed in a custom-made carbon metal container for eventual shipment.



Before demolition



The 30-foot long reactor structure being lifted out of its housing to be placed in a storage container

The carbon metal container used to transport the reactor weighed 20,000 pounds. It was designed and built to meet the reactor's oversized width and height. The container includes a removable top to accommodate the loading of the reactor.

Built in 1949, the LITR was one of the first research reactors used as a test facility for the Materials Testing Reactor. It was also used for mock-ups for criticality testing, which used highly enriched fuel with water as a coolant and moderator. It ceased operations in 1968.

The reactor site after demolition (right) and the reactor structure being loaded into a special container for storage and shipment (below)



Component removal a key focus for 3042 reactor

Preparing the Oak Ridge Research Reactor (Building 3042) for demolition was a key focus in FY 2023. Much of that preparation included removing components from the reactor pool. This work comes nearly a decade after employees first began work in the building following discovery of water seepage from the reactor pool. To address the issue, workers placed concrete shielding and containment panels over the pool, drained it, and injected a fixative to keep contamination in place.

A bright green color added to the fixative helped crews confirm that the fixative covered the entire pool's surface. However, when water was added in

the pool to begin deactivation efforts, the dye leached into the water and greatly reduced visibility in the pool.

Crews responded by developing an ultraviolet light and hydrogen peroxide treatment skid that eliminated the green dye and cleared the pool, providing visibility to conduct deactivation tasks.

At the end of the fiscal year, crews were advancing deactivation by removing irradiated items from the reactor pool and segmenting and packaging the items in waste containers for eventual disposal.



The top segment of the reactor structure was cut off, packaged, and removed from the building

Highly irradiated component removed from hot cell

Workers completed a big task involving a small item by safely removing a highly irradiated segment of wire roughly the size of a straightened-out paper clip from a cleanup project at ORNL.

The wire — only 3 to 4 inches in length — presented major challenges as crews cleaned out the East Cell Bank to get it ready for demolition next year. The hot cell structure is the last remaining component of the former Radioisotope Development Laboratory, also known as Building 3026.

The first challenge entailed locating and identifying the exact source of the elevated radioactive readings. Workers were operating through an opening atop the

hot cell structure, approximately 25 feet from the floor where debris was located.

With other debris scattered in the room, searching for the segment of wire was like trying to find a needle in a haystack. Once the wire was located, the next challenge was retrieving it.

The project team considered multiple options for safely packaging the radiological source to protect personnel during waste packaging, transportation, and disposal. Workers safely removed the component using a long-reach tool and placed it in a concrete-shielded, 85-gallon drum. The drum was filled with cement and placed in a specialized container to be shipped for disposal.



The roof of the hot cell was lifted to allow access into the structure

Graphite Reactor facilities being prepared for demo

Three support facilities associated with the Oak Ridge Graphite Reactor (OGR) are being prepared for demolition. These facilities include the filter house (Building 3002), the fan house (Building 3003), and the exhaust stack (Building 3018).

At the end of the fiscal year, the deactivation team had removed filters in two of the four filter cells and was over 50 percent complete in the third filter cell. In addition, the deactivation team was developing a process to remove the canal water and sludge in the filter house.



The filter house was built in 1948 to filter air from the air-cooled reactor prior to exhaust through the fan house and adjacent stack. This work will enable demolition to begin next year.

Deactivation underway on Isotope Row

Deactivation activities continued in FY 2023 along ORNL Isotope Row, which consists of buildings and structures constructed in the 1950s through 1960s for processing radioisotopes.

Deactivation activities included removing contaminated materials and hazardous waste such as transite duct, laboratory hoods, glove boxes, ventilation exhaust pipes, process drains, and lead.

At the Radioisotope Production Lab-B (Building 3029), crews removed the last of the rooftop HEPA filters from the filter housing. When in operation, the filters provided final filtration for the local ventilation exhaust from the building. Workers sampled, characterized, and safely disposed of the filters.



HEPA filter hood removal in Building 3030, Isotope Row

Workers inspect structural integrity of 3039 stack

To ensure the structural integrity of the 250-foot-tall Gaseous Waste System's 3039 Stack, workers performed a physical inspection of the stack. Originally constructed in 1949, the stack is still actively used to provide facility off-gas and cell ventilation for ORNL.

In recent years, inspections were conducted by drones to avoid having employees climb the towering structure. Information from the aerial photos indicated a repair could be needed, and DOE

determined that a full physical stack inspection was necessary.

The inspection climb began in February 2023 using a permanently installed platform 50 feet above ground. Stack inspectors installed structural bands around the exterior of the stack along with ladder sections and a safety system for worker safety. As a result of the inspection, crews outlined repairs that are needed to ensure the stack continues to operate for at least 10 more years.

Piping replacement underway at Building 3608

An \$18 million project to replace piping and valves at Building 3608 made significant progress in FY 2023.

The project involves replacing existing old piping with new stainless steel piping and valves. It also includes removing out-of-service items such as old granular activated carbon tanks and backwash system pumps, and installing two tanker unloading stations.

When complete in 2024, the replaced piping will make the system more efficient and reliable and will help avoid the possibility of disrupting ongoing ORNL operations.



Pipe replacement at Building 3608

Purge system at MSRE nearing completion

The Molten Salt Reactor Experiment (MSRE), a test reactor, operated at ORNL from June 1965 until December 1969. Upgrade of the drain tank off-gassing system is required to keep this critical system safe until the facility is demolished. Accordingly, installation of the MSRE Continuous Purge System, which will allow continual off-gassing of the salt drain tanks, is nearing completion. Crews installed

various pieces of equipment and sections of piping. Additional components will be installed to enable the fabrication and installation of the interface and wall mount enclosures.

Project installation work is set to be completed in early FY 2024, followed by readiness assessments.

A worker performing inspection ascends the 3039 stack



The MSRE Feasibility Study (FS) is underway to develop remedial alternatives for the MSRE facility. This FS evaluates risk associated with potential future release of contaminants from groundwater to the nearby creek. In FY 2023, nondestructive assay (NDA) measurements were conducted for nuclide

identification and quantification in the MSRE High Bay and in cells below the MSRE facility (including cold trap cell, fuel processing cell, charcoal bed cell, and fuel drain tank cell). Additionally, groundwater geophysical data are being incorporated into an MSRE groundwater transport model from 14 groundwater wells installed around the MSRE footprint.

U-233 processing underway

After completing facility upgrades and in-depth safety planning in 2022, OREM and its contractor, Isotek, conducted significant processing operations on the remaining inventory of uranium-233 (U-233) stored at ORNL. OREM and Isotek are tasked with eliminating the U-233 inventory stored at ORNL because it presents risks and is costly to keep safe and secure. The effort to process and dispose of the remaining high-dose U-233 is OREM's highest priority at ORNL.

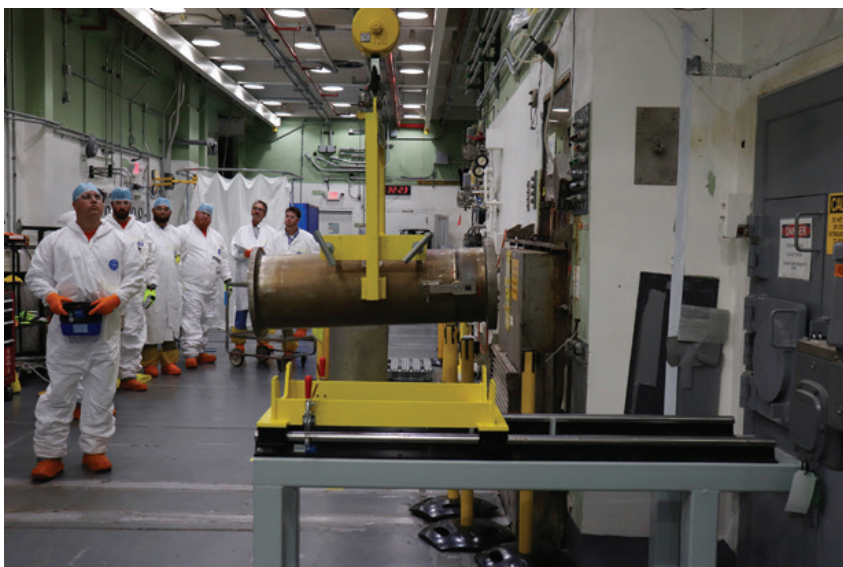
U-233 is a manufactured isotope created as an alternative nuclear fuel source in the 1950s, but it proved to be unviable. The nation's inventory of uranium-233 was later sent to ORNL for long-term storage.

OREM finished disposing of approximately half of the U-233 inventory in 2017, while the remaining material requires processing and downblending to convert it into a form for safe shipment and disposal. Conducting those operations involves the use of heavily shielded rooms, known as hot cells, to keep employees safe as they process the high-dose material. With the hot cell upgrades complete, employees have processed more than 50 canisters of U-233 since the campaign began.

The current phase of the project, using hot cells, has enabled Isotek to enhance productivity by processing larger amounts of U-233, and it also allows employees to extract more medical isotopes than the previous phase that used glove boxes.

A private nuclear innovation company, TerraPower, approached Isotek with a plan for the company's employees to extract rare medical isotopes from this material before it is prepared for disposal. That plan is now being carried out, and the medical isotopes are powering treatments called targeted alpha therapy in trials.

Isotek is extracting thorium-229 from the U-233 for TerraPower, which then uses the material to create the actinium-225 needed for targeted alpha therapy. TerraPower recently announced a collaboration agreement with Cardinal Health to produce and distribute actinium-225 to help extend the reach and impact of this effort. Through this public-private partnership, up to 100 times more doses of next-generation cancer treatments will be available annually than are currently available worldwide. That translates to half a million doses annually.



Workers process the first canister of U-233 after facility upgrades

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.

Biology Complex site transferred

EM's steady work removing old, contaminated structures is paving the way for new uses of land, including a site where the National Nuclear Security Administration (NNSA) recently hosted a groundbreaking ceremony for its new Lithium Processing Facility.

OREM and UCOR finished a project in November 2022 that opened the 18-acre area at Y-12 for the NNSA facility. Crews had cleared away the former Biology Complex comprised of 11 structures dating back to the 1940s.

This success story in reuse of land once used for the Manhattan Project and Cold War demonstrates that OREM and UCOR are achieving more than risk reduction through their cleanup. They're opening space to support important missions.

NNSA and Consolidated Nuclear Security held a groundbreaking that marked the beginning of site preparation for the construction project.

The new 245,000-square-foot facility will feature updated technology, increase processing capacity,



Lithium Processing Facility groundbreaking

and make the work environment safer for employees. Construction is forecasted to begin in mid-2025, with completion projected in the early 2030s.

Today, nearly 60% percent of NNSA's facilities are more than 40 years old, with many dating to the Manhattan Project. OREM and UCOR are changing that with numerous projects already underway to continue the transformation and enable modernization at Y-12.



A portion of the Biology Complex during demolition (above) and the cleared site (left), where the new Lithium Processing Facility will be located

Work continues on Mercury Treatment Facility

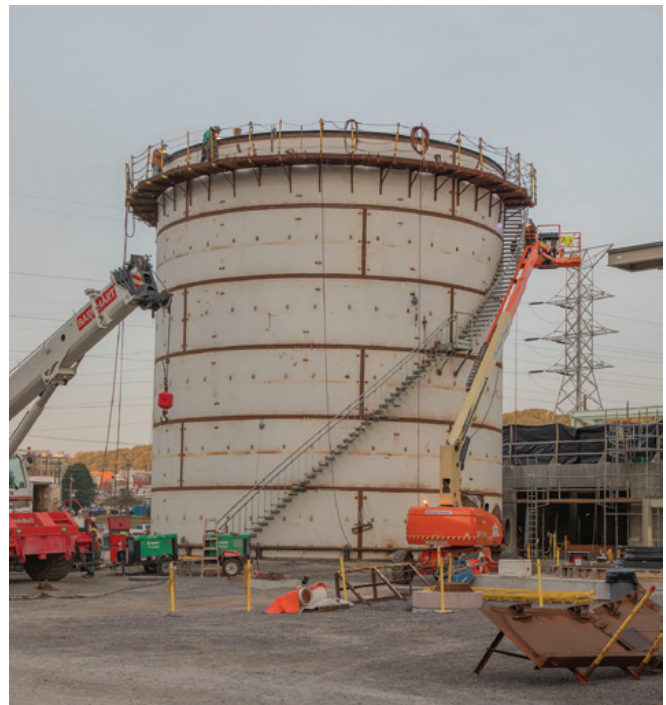
Progress continued on construction of the Outfall 200 Mercury Treatment Facility. The facility is the linchpin for OREM's cleanup strategy at Y-12. This vital piece of infrastructure will open the door for demolition of Y-12's large, deteriorated, mercury-contaminated facilities and subsequent soil remediation by providing a mechanism to limit potential mercury releases into the Upper East Fork Poplar Creek.

At the headworks site, the first lift concrete walls are complete on both major structures: the storm flow pump station and the grit flow chamber. The second lift walls were in progress at the end of the fiscal year with rebar and formwork being installed. Backfill of the excavation is also in process. A total of 1,800 yards of concrete have been placed with 200 tons of rebar installed.

At the treatment site, work continues with construction of a 500,000-gallon equalization tank.

All underground piping has been installed and tested. Chemical storage tanks are onsite and stored on location and the clarifier plates are installed. Painting of concrete surfaces and structural steel is progressing.

When operational, the facility will be able to treat 3,000 gallons of water per minute and help DOE meet regulatory limits in compliance with EPA and state of Tennessee requirements.



Mercury Treatment Facility construction



Deactivation continues on processing facilities



Workers perform sampling activities inside the Alpha-2 Building



Deactivation activities continued at three large former uranium processing facilities throughout FY 2023. Those facilities— Alpha-2, Alpha-4, and Beta-1—were home to the historic calutron (mass spectrometer) racetracks used for separating isotopes of uranium.

Alpha-2: The three-story Alpha-2 facility (Building 9201-2) is approximately 320,000 gross square feet. In FY 2023, crews conducted activities to remove a variety of contaminants. Approximately 4,500 gallons of water were drained from the facility’s demineralized water system, and 280,000 pounds of lead-shielding blocks were removed from the second floor of the facility. All deactivation activities were completed in the aboveground floors in 2023. In the basement, workers recovered 113 pounds of elemental mercury. The building is set for demolition starting in 2024.

Beta-1: Beta-1 (Building 9204-1) is a two-story building with approximately 210,500 gross square feet. Deactivation activities continued at Beta-1 in the above-ground floors similar to Alpha-2. Most of the deactivation in the upper

floors was completed in 2023, and the small amount remaining will be completed early in FY 2024. In the basement, crews have worked to remove, treat, and discharge more than 1 million gallons of water using a special water treatment skid system, which filters water through micron bag filters and carbon vessels inside the unit to successfully achieve water quality standards needed for discharge. Once the



Deactivation activities in the Beta-1 Building

water is removed, the basement can be accessed for deactivation in 2024.

Alpha-4: During 2023, workers began preparing Alpha-4 (Building 9201-4), a four-story facility with 600,000-square-feet, for deactivation. Alpha-4 is one of Y-12's larger high-risk facilities, with elemental mercury contaminating much of the structure. Like Alpha-2 and Beta-1, Alpha-4 was used to enrich

uranium. After the electromagnetic separation process was abandoned, Column Exchange processing structures were added to the outside of the facility to perform a new method of processing, which required substantial quantities of mercury. As part of preparing for building deactivation, workers have been sampling asbestos-containing material, performing utility isolations to bring the building to cold and dark status, and characterizing more than 400 legacy drums.

Slab removal completed at demolished lab site

Workers have finished removing the slab at the former Criticality Experiment Laboratory at Y-12. OREM and UCOR demolished the structure in 2022.

The Criticality Experiment Laboratory was constructed in 1949 and was used to conduct experiments and collect reactor physics data while in operation from 1950 to 1987.

The facility was permanently shut down in 1992, with the exception of limited use for training exercises. The area is planned to be used as a storage/laydown area to support other Y-12 projects.



Criticality Experiment Laboratory before demolition (above) and the cleared site (below)



New cleanup technologies being evaluated

OREM and cleanup contractor UCOR are exploring technology development efforts to address both mercury and other types of cleanup on the Oak Ridge Reservation.

At ORNL's Aquatic Ecology Laboratory, significant progress was made in the following areas:

- Conducted experiments testing several manganese oxide compounds to reduce methylmercury production in sediments in anaerobic environments.
- Explored whether closely related species accumulate mercury and methylmercury at similar rates.
- Collected LiDAR—multispectral, thermal, sub-canopy true color imagery—and many instream field measurements for >1 km of Bear Creek and continued analysis of LiDAR data and field deployment of sorbents.
- Completed acute toxicity tests of mercury on *Daphnia magna* (a typical water flea) to aid experimental designs for follow-up sorbent toxicity and efficacy experiment in collaboration with soil and groundwater with higher concentrations of mercury and an additional sorbent.
- Submitted manuscript on bioaccumulation of mercury into *Corbicula* (clams) to *Environmental Science and Pollution Research*.

The planned remodeling of the Technology Demonstration Facility (formerly the Disposal Area Remedial Action, or DARA, facility) was underway in FY 2023 and expected to be completed by late 2024.

Mercury technology advancements that were explored in FY 2023 include the following:

- Working to gain an understanding of mercury waste management in accordance with the Environmental Management Disposal Facility Record of Decision to ensure that certain mercury mitigation technologies will yield material that meets the waste acceptance criteria.
- Exploring acid washing to remove mercury-contaminated scale, rust, and sludge from mercury-impacted systems.

- Investigating possible alternate methods for scanning and characterizing waste shipping packages with NDA-type technology.
- Working with Environmental Alternatives Inc. and UCOR to identify mercury sorbent material(s) for use in waste packaging to mitigate mercury vapor generation and prevent liquid mercury accumulation during shipment.

Robotic technology applications are also explored on the Oak Ridge Reservation. UCOR performed a mock test using a mechanical arm system that will support hot cell characterization in the Fission Product Development Lab (Building 3517) at ORNL. The mechanical arm will be lowered into the 3517 hot cells and used to record video footage, collect real time dose rates, and retrieve surface contamination data. Once lowered into the cell, the arm spins the tool slowly to retrieve data while keeping operators at a safe distance.

Collaborating with Savannah River National Laboratory and UCOR, OREM is exploring the use of exoskeletons at Oak Ridge for craft labor functions to reduce work-related injuries. OREM is also collaborating with Florida International University, Sandia National Laboratory, and UCOR to explore the use of autonomous field-deployable characterization and mapping systems to automate routine field characterization of mercury and beryllium contamination.



Testing the mechanical arm planned for use at Building 3517

East Tennessee Technology Park



The former Oak Ridge 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. All building demolition was completed in 2020 and remedial actions are now underway, facilitating the site's transformation into a multi-use industrial park.

What is an Exposure Unit, or EU?

To facilitate cleanup at ETPP, the site was divided into varying-sized parcels, called Exposure Units (EUs). Remediation activities are conducted per EU.

All remedial activities are focused on Zone 2, the 800-acre main plant portion of the site. Zone 1, which is completed, encompassed 1,400 acres surrounding the Main Plant Area.

First-of-a-kind remediation used on Poplar Creek mudflat

UCOR teamed with Severson Environmental Services (SES) to perform remediation of the EU-19 mudflat as part of a time-critical removal action.

The mudflat is located at the end of a ditch that empties into Poplar Creek and was contaminated during past site operations. Access to the mudflat was not possible from the land side of EU-19 without removing almost an acre of wooded creek bank and up to 8,000 cubic yards of soil.

Given the difficulty of accessing the site, UCOR engaged with SES to perform a first-of-its-kind for ETPP remediation from a floating work platform positioned in Poplar Creek. Excavation, soil packaging, and site restoration of the mudflat soils were completed. The containers of soil were removed from the work platform for characterization and disposal. An impermeable barrier was installed over the excavated area and the entire area was covered in riprap.



A crane is lifting a barge to be placed in the water and used to remediate the EU-19 mudflat

Rail shipment of hazardous EU-21 waste saves time, money

Approximately 3,100 cubic yards of the soil in EU-21, the area inside the U-shaped footprint of the former K-25 Building, contained hazardous waste from manufacturing and industrial operations and required offsite disposal.

Due to constraints in the U.S. supply chain affecting specialized containers to ship soil, this loading operation posed a significant challenge.

UCOR partnered with Perma-Fix Environmental Services, Inc., to ship the soil by rail instead. Overall, the effort reduced the schedule for packaging and disposal of the soil by six months and freed resources to perform additional remedial action scope at ETPP.



Workers prepare to load waste for rail shipment

Soil remediation at ETPP nearing completion

Soil remediation at ETPP is nearing completion. Regulatory agencies have identified and approved all required remedial actions necessary to address soil cleanup.

Several years of characterization, data analysis, delineation, and modeling have resulted in the identification of numerous contaminated areas at ETPP that are now in the final stages of cleanup. Remediation efforts are being performed to eliminate hazards at the site and pave the way for future industrial use.

A revised Final Record of Decision for Zone 1 Soils was submitted to the regulatory agencies, which recommended no further action.

Remedial action accomplishments in FY 2023 include the following:

- EU-13: Completed soil and concrete remedial actions associated with a radiologically contaminated release from a tie line adjacent to the former K-631 Surge and Waste Facility. Site restoration activities included placing clean fill topped with gravel to stabilize the site.
- EU-16: Completed soil remedial actions at the former K-1064 Salvage Material Yard, the K-1064-H area, and a radiologically contaminated hot spot. Site restoration activities included placing soil fill and hydroseeding the area to stabilize the site. Crews also completed a remedial action to remove historical waste materials and contaminated soil at the former K-1064 North Trash Slope located along the bank of Poplar Creek. Site restoration activities included placing large stone (riprap) fill to stabilize the site.



Excavation activities at EU-13



Transite removal activity at EU-17 (above) and the completed site (right)

- EU-17: Completed a remedial action to remove exposed transite pieces (material made using asbestos) that were historically disposed and located along the banks of Poplar Creek. Site restoration activities included placing large stone fill to stabilize the site.
- EU-38: Completed a soil remedial action at the former K-1417-B Drum Storage Yard. Site restoration activities included placing clean fill topped with gravel to stabilize the site. Crews also started a remedial action to remove sediment from sumps at the K-1417-A Concrete Block Casting Facility.
- EU-39: Started a remedial action to remove contaminated soil from the footprint of the K-1420 Equipment Decontamination Facilities.

In addition to the ongoing soil remediation efforts, additional remaining media (surface water and sediment) across both Zones 1 and 2 are being



evaluated. Onsite ponds and streams associated with site activities are being characterized. Sites currently being evaluated include the K-1007-P ponds (along Highway 58), K-901 Pond, K-720 Slough, K-770 Embayment, Oxbow Lake, the K-720 Beaver Ponds, (near the Powerhouse Greenway Trail), and Mitchell Branch.

Focus shifting to groundwater at ETTP

OREM and UCOR have shifted to soil and groundwater remediation at ETTP in the homestretch of a cleanup that took down more than 500 aging, contaminated structures.

With crews set to finish excavating and removing contaminated soil from the site in 2024, the spotlight is turning to groundwater.

ETTP is divided into three sections for groundwater remediation planning. One section is the Main Plant Area, which encompasses most of the operations area at the former enrichment complex.

Another section is the area where the large K-31 and K-33 uranium enrichment buildings once stood. The third section is called Zone 1, which is the area immediately surrounding the Main Plant and K-31/K-33 area.

Planning took a major step forward recently when the U.S. Environmental Protection Agency and Tennessee Department of Environment and Conservation approved OREM’s proposed plans for addressing groundwater in the Main Plant and K-31 and K-33 areas.

OREM hosted two public meetings this year to discuss the preferred approach for groundwater remediation at ETTP. The meetings provided an opportunity to explain the planned work at the site and for attendees to share comments.

The preferred approach for groundwater remediation in the Main Plant Area is a process called enhanced in situ bioremediation. A widely used technology for treating contaminated waste, it involves injecting microorganisms and a carbon source, such as



Excavation in the main plant area

vegetable oil, into the ground. The microorganisms reduce or detoxify the contaminants.

For the K-31/K-33 area, OREM is proposing a process called monitored natural attenuation along with land use controls. Monitored natural attenuation relies on natural processes that reduce contaminant concentrations in groundwater. Using this process as

the remedial action involves monitoring groundwater conditions with land use controls, limiting potential exposures.

The proposed remedies for Zone 1 and associated public involvement opportunities will be announced later.

Groundbreaking held for K-25 Viewing Platform



A groundbreaking was held for a viewing platform that will provide an expansive view of the historic K-25 Building footprint. The facility is being constructed by the U.S. Army Corps of Engineers using contractor Geiger Brothers Inc. to manage construction.

The K-25 Building was once the largest in the world, covering more than 44 acres. The national historic preservation site design includes visual indicators at each corner of the former building to illustrate the original dimensions and height of the structure. The viewing platform, to be completed in 2025, will be located near the K-25 History Center and



Artist's rendering of viewing platform

will include 10-foot-tall wraparound glass windows and exhibits that provide quick facts and visuals related to the historic importance of the K-25 Building.

Reindustrialization spurring economic development

The Reindustrialization program maintained progress in 2023 by continuing partnerships and planning for the transfer of remediated land and remaining infrastructure at ETPP to public or private ownership and the economic benefit of the community. The former DOE K-25 uranium enrichment complex is currently in conversion to a multi-use industrial park that includes manufacturing, clean energy, national historic preservation, and conservation with public access to natural areas. Accounting for committed land transfers to date, only a few hundred acres of the approximately 2,200 original acres remain for final transfer. The vision for the park continues to be realized.

During FY 2023, the Reindustrialization team advanced the regulatory review of almost 500 acres of remediated land in transfer packages. This land includes the former K-1037 Steam Plant and Toxic Substances Control Act Incinerator package, the former Powerhouse Area, the former K-732 Switchyard, and multiple parcels intended for development of a new municipal airport. Upon regulatory approval, transfer packages are submitted for department and congressional approvals, which finalizes the process

to release the land for new businesses and economic growth opportunities.

The Oak Ridge community continues to develop a reputation as an area known for clean energy and next-generation nuclear power industries. In 2023, Tennessee Governor Bill Lee issued an Executive Order to Advance Nuclear Energy Innovation and Investment, thereby positioning Tennessee as a national leader, and created the Nuclear Energy Advisory Council to formalize an implementation strategy that could build upon recent progress in Oak Ridge and Knoxville. Members include prominent Oak Ridge scientists, policy makers, and business professionals working together to evaluate future possibilities. Clean energy and new nuclear businesses currently developing in the area include TRISO-X, Ultra Safe Nuclear Corporation, Kairos Power, and the Tennessee Valley Authority. The area is expected to attract additional companies needed to support these industries.

Oak Ridge continues to pave the way for successful reindustrialization of federal land, enabling new and exciting clean energy and nuclear innovations that will positively impact the community and the nation.



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 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 facilities handling most cleanup wastes

Most of the waste generated during FY 2023 cleanup activities in Oak Ridge went to disposal facilities on the Oak Ridge Reservation—namely, the Environmental Management Waste Management Facility (EMWMF) and the Oak Ridge Reservation Landfills (ORRL). These disposal facilities are owned by DOE and operated/maintained by UCOR. They have been vital to cleanup progress and success, enabling OREM to accomplish more cleanup by avoiding costly and unnecessary cross-country shipments.

EMWMF only receives low-level radioactive and hazardous waste meeting specific criteria. The waste is mostly soil and building debris. In FY 2023, EMWMF received 5,221 waste shipments from cleanup projects at ETP, ORNL, and Y-12, plus 84 clean fill shipments for maintenance of the enhanced operational cover and construction of access roads and dump ramps. The EMWMF landfill has a design capacity of 2.331 million cubic yards and is now 85 percent filled.

EMWMF generated 14.71 million gallons of landfill wastewater in FY 2023. Approximately 3.53 million gallons of leachate (water that enters the leachate collection system) was transported by tanker to the ORNL Liquid and Gaseous Waste Operations (LGWO) for treatment and release. Approximately 11.18 million gallons of contact water (water that contacts waste but does not enter the leachate collection system) was released to Bear Creek after laboratory analysis verified it met all regulatory limits and discharge standards.

ORRL accepts sanitary/industrial waste and construction/demolition debris. In FY 2023, these three active landfills received 6,629 waste shipments, totaling 92,991 cubic yards of waste.

ORRL also manages non-regulated leachate. In FY 2023, ORRL compliantly discharged 3.7 million gallons of leachate from the three active landfills to the Y-12 sanitary sewer system.

Work continued with regulatory agencies on seep mitigations for Sanitary Landfill II (a closed landfill) and active Landfill VII. Repairs at Landfill VII included developing and implementing a minor modification approved by the regulators that allowed landfill operations to remove approximately 1,164,000 gallons of leachate trapped inside of Landfill VII for an extended period of time. This water was transferred to the Landfill V leachate facility for discharge.

In FY 2023, ORRL continued improvements for all sediment and erosion controls. These measures included upgrading drainage features, which significantly reduces the amount of sediment released from these landfills. Tennessee Department of Environment and Conservation inspections in FY 2023 noted excellent sediment and erosion controls with no areas of concern or violations. CDL-V area 5 expansion was constructed to a 95 percent completion level during this fiscal year.

Wastewater treatment helps facilitate cleanup

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.

At Y-12, wastewater and groundwater generated from production and cleanup activities are treated. The site provided safe and compliant treatment of approximately 51 million gallons of wastewater and groundwater during FY 2023.

At ORNL, the Liquid and Gaseous Waste Operations plant treated approximately 114 million gallons of wastewater in FY 2023. In addition, the liquid low-level waste system at ORNL received approximately 117,000 gallons for treatment.

The ORNL 3039 Stack Facility treated 0.81 billion cubic meters of gaseous waste. These waste treatment activities supported both OREM and DOE Office of Science mission activities.

Ground broken for new disposal facility



A groundbreaking ceremony for the Environmental Management Disposal Facility (EMDF) was held on August 2, 2023. Attendees included U.S. Congressman Chuck Fleischmann, OREM Manager Jay Mullis, UCOR President and CEO Ken Rueter, contractor executives, other local elected officials, senior leadership from EPA and TDEC, and representatives from the U.S. laborers and operators unions.

Fieldwork for the early site preparation activities began after the groundbreaking. This work included rerouting portions of Bear Creek Road and the Haul Road, and development of other support areas.

EMDF is needed to handle waste generated from ORNL and Y-12 cleanup now that EMWMF is nearing capacity.

OREM continues to work with EPA and TDEC on regulatory documents for the EMDF landfill. The Early Site Preparation (ESP) Remedial Design Report/ Remedial Action Work Plan was approved in June 2023 and the Groundwater Field Demonstration Remedial Design Work Plan/Remedial Action Work Plan was

prepared and reviewed in 2023 with approval in October 2023.

OREM continued to monitor 31 groundwater wells at the selected site for the disposal facility, measuring and recording water levels and groundwater characteristic data for the entire year.



EMDF site

TWPC focusing on TRU legacy difficult waste

The Transuranic Waste Processing Center (TWPC) focused on the critical readiness actions for several categories of difficult wastes that present operational and safety challenges within the legacy transuranic (TRU) inventory. It also continued processing, certifying, and shipping the legacy TRU waste inventory in FY 2023. The facility has completed processing of 99 percent of the contact-handled (CH) TRU and 98 percent of the remote-handled (RH) TRU legacy wastes within the processing milestones of the Site Treatment Plan for Mixed Wastes on the DOE Oak Ridge Reservation. CH TRU certification and shipments continue, resulting in 91 percent of the CH TRU waste and 76 percent of the RH TRU waste shipped to offsite disposal.

TWPC completed critical actions associated with readiness preparation to commission new waste processing capabilities at TWPC for high activity oxide wastes and wastes requiring special treatment to meet Waste Isolation Pilot Plant (WIPP) acceptance criteria. TWPC continued processing the legacy Nuclear Fuel Services waste (1.9 cubic meters) and by-product wastes from TRU waste processing (12.8 cubic meters).

TWPC completed limited processing operations for 1 cubic meter of legacy CH TRU waste. TWPC completed certification and shipment of 159 cubic meters of TRU waste for disposal at WIPP, 72.5 cubic meters of LLW for disposal at Nevada National Security Site, and 1.8 cubic meters of hazardous/universal waste for treatment and disposal, eliminating 855 containers of the stored inventory.



Workers prepare waste for shipment

Continued monitoring measures protectiveness

OREM continued to implement its groundwater strategy for the Oak Ridge Reservation in FY 2023. The *Melton Valley/Bethel Valley Exit Pathway Phase 1 Remedial Investigation Completion Report for the U.S. Department of Energy Oak Ridge Site, Oak Ridge, Tennessee* (DOE/OR/01-2953&D1) was submitted for regulatory reviews in August 2023. The report describes the installation of three new deep exit pathway wells in west ORNL along the Clinch River and one year of quarterly groundwater and surface water monitoring to determine whether there are site-related contaminants in groundwater at the ORR property boundary at ORNL. All detected constituents were below screening levels; however, continued groundwater monitoring was recommended in synchronization with sampling the Melton Valley exit pathway and offsite monitoring wells as a best management practice.

Early in FY 2022, the Federal Facility Agreement parties agreed that five-year reviews would be performed annually at related administrative watersheds rather than covering the entire Reservation every five years. The objective of the five-year review is to evaluate the success of completed CERCLA remedial actions in protecting human health and the environment. In July 2023, the *2023 CERCLA Five-Year Review for the East Tennessee Technology Park Administrative Watershed and the Clinch River/Poplar Creek and Lower Watts Bar Reservoir Operable Units on the U.S. Department of Energy Oak Ridge Site, Oak Ridge, Tennessee* (DOE/OR/01-2947&D1) was submitted for regulatory review. Also in FY 2023, OREM completed planning meetings for the upcoming 2024 CERCLA Five-Year Review for Upper East Fork Poplar Creek, Chestnut Ridge, Lower East Fork Poplar Creek, and South Campus Facility.

Public Involvement



The public is involved in 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.

Energycast wins national award of excellence

In the first year of producing its groundbreaking monthly news show, “Energycast Oak Ridge,” OREM took home a national award recognizing excellence in storytelling and public outreach.

“We’ve been really pleased with the interest and response to this newscast, and our team is actively working on some exciting ideas to continue strengthening the show as we kick off its second year,” said Ben Williams, OREM public affairs specialist.

OREM’s communications team won a 2023 Hometown Media Award in the government activities independent producer category. The awards were established to honor and promote community media, community radio, and local cable programs distributed on public, educational, and governmental access cable television channels.



Videographers Dylan Seiber and Cameron Jacobs record Energycast anchor Summer Dashe conducting an interview

“Energycast Oak Ridge” premiered on May 22, 2022, with the goal of showcasing the full scope and local impact of the cleanup mission in a new way—a news show. It airs on community television channels in 24 counties across eastern and middle Tennessee, including two of the state’s largest cities, Nashville and Knoxville.

Public meetings held on ETPP groundwater

Two public meetings were held in FY 2023 regarding groundwater remediation at ETPP.

OREM presented information on the proposed plans for remedial actions for the ETPP Main Plant Area and for the K-31/K-33 area.

For the main plant area, enhanced in situ bioremediation was identified as DOE’s preferred alternative to remediation of six specific areas of groundwater. This method involved using microorganisms to reduce contamination levels in these specific areas of groundwater.

For K-31/K-33, monitored natural attenuation and land use controls were identified as DOE’s preferred alternative for remediation of contaminated groundwater in the area. It was the method selected to address groundwater contaminated with metals, primarily chromium and nickel, detected



OREM Regulatory Affairs Specialist Roger Petrie discusses groundwater remediation plans

in concentrations above drinking water standards. Overall contaminant concentrations have been trending downward since the late 1980s. There are no current exposure pathways that affect human health or the environment.



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 OREM. ORSSAB meetings provide DOE and regulators at the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC) with a forum to communicate with and understand stakeholders' perspectives. Because all meetings are open to the public, it also serves as a venue for members of the community to express their views or ask questions.

In 2023, the board issued a recommendation on the site's budget request and a recommendation on groundwater remedies for ETPP. It discussed ongoing development of the planned new onsite waste disposal facility, EMDF. Since 1995, ORSSAB has provided nearly 300 recommendations to OREM on all 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 OREM 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. in Oak Ridge and virtually through



ORSSAB members

Zoom. The board also has two standing committees. All meetings are open to the public and feature comment periods. Meeting videos are also posted to the board's YouTube channel, www.youtube.com/user/ORSSAB. Staff members also maintain an active social media presence at www.facebook.com/ORSSAB and publish a weekly email newsletter and a quarterly print and electronic publication, the Advocate. More information about the board and its activities is available at www.energy.gov/orssab or email questions to staff at orssab@orem.doe.gov.

Board takes advantage of educational opportunities

Board members this year were active in attending a variety of events that enabled them to learn more about the EM cleanup program.

This year's twice-yearly Chairs meeting took place in Washington, DC, allowing board officers to meet with EM Headquarters leadership directly and share feedback on local projects as well as discuss the overall cleanup mission. EM leaders William "Ike" White and Jeff Avery met directly with the board.

Other members traveled to a variety of conferences dedicated to environmental management, cleanup, and long-term stewardship. These opportunities allow members to bring back knowledge to improve their service to OREM. This year, the board sent representatives to the Waste Management Symposia in Phoenix, Arizona; the Radwaste Summit in Las Vegas; the National Brownfields Conference; and the National Cleanup Workshop.

Locally, members participated in meetings and tours related to OREM's Five Year Review Process, which allows it and partner agencies to assess the effectiveness of current remedies in protecting human health and the environment. Being able to contribute to these discussions allows ORSSAB to see how OREM and regulators operate in the field and gain a better understanding of topics presented at board meetings.

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
<https://tdec.tn.gov/>

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

Commonly Used Acronyms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DOE	U.S. Department of Energy
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
FFA	Federal Facility Agreement
FY	Fiscal Year
LGWO	Liquid and Gaseous Waste Operations
LLW	Low-Level Waste
MSRE	Molten Salt Reactor Experiment
NNSA	National Nuclear Security Administration
OREM	Oak Ridge Office of Environmental Management
ORNL	Oak Ridge National Laboratory
ORRL	Oak Ridge Reservation Landfills
ORSSAB	Oak Ridge Site Specific Advisory Board
ROD	Record of Decision
TDEC	Tennessee Department of Environment and Conservation
TRU	Transuranic
TWPC	Transuranic Waste Processing Center
U-233	Uranium-233
WIPP	Waste Isolation Pilot Plant
Y-12	Y-12 National Security Complex

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

Commonly Used Terms

CERCLA

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.

FFA

Federal Facility Agreement: CERCLA requires an agreement between state and federal entities to guide cleanup work at CERCLA sites. For OREM, the parties of this agreement, called a Federal Facility Agreement, are 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.

RmA

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.

RA

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.

RI/FS

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.

ROD

Record of Decision: Under the CERCLA process, a Record of Decision (ROD) formally documents the selection of a preferred cleanup method after a series of steps, including an RI/FS. A preferred cleanup alternative is selected and presented to the public for comment in a Proposed Plan. EPA, the state, and the lead agency then select a remedy and document it in the ROD.

Fiscal Year: The 2023 fiscal year spans from Oct. 1, 2022, to Sept. 30, 2023.

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