



Cleanup Progress

Annual Report on Oak Ridge
Reservation Cleanup



2022



Message from the Acting Manager

DOE Oak Ridge Office of Environmental Management

To the Oak Ridge Regional Community:

2022 marked another year of visible and meaningful progress across the Oak Ridge Reservation. The U.S. Department of Energy's (DOE) Oak Ridge Office of Environmental Management (OREM) and our contractors continued transforming all three sites and investing in infrastructure that will be key for cleanup efforts in the years ahead.

Crews were busy deactivating and tearing down excess contaminated facilities at the Y-12 National Security Complex (Y-12) and Oak Ridge National Laboratory (ORNL) in 2022. The most noticeable landscape changes involved demolishing the Criticality Experiment Laboratory at Y-12 and the Bulk Shielding Reactor at ORNL. These projects eliminated old, high-risk buildings that had been shut down since the early 1990s. Specifically, removal of the Bulk Shielding Reactor marked the first-ever demolition of a former reactor in ORNL's central campus area.

In addition to these teardowns, workers prepared more buildings for near-term demolition. Notable facilities include the Low Intensity Reactor, Oak Ridge Research Reactor, and Isotope Row facilities at ORNL. Crews also advanced deactivation efforts at two large, former enrichment facilities at Y-12 – Alpha-2 and Beta-1. Employees also finished cleanup and transfer of the 18-acre former Biology Complex area back to the National Nuclear Security Administration (NNSA). That project provided land NNSA can reuse as the location of its future lithium processing facility.

OREM is also intently focused on reducing Oak Ridge's inventory of nuclear waste. We began processing uranium-233, a major priority in 2022, to convert it into a form that can be shipped and disposed. Eliminating



this inventory of material will save significant funds annually required to keep it safe and secure in the world's oldest operating nuclear facility. Part of this project also involves extracting medical isotopes that are being used to support next-generation cancer treatment research.

We pushed forward several pivotal infrastructure projects that lay the groundwork for future cleanup. Construction is ongoing on the Outfall 200 Mercury Treatment Facility. Teams advanced construction on the treatment plant and the shoring and excavation necessary to begin building the headworks facility. When operational, the Mercury Treatment Facility will open the door for demolition of Y-12's large, mercury-contaminated facilities and soil remediation by preventing potential mercury releases into the nearby creek.

Another key infrastructure project crossed a major milestone this year. We signed a final Record of Decision with the U.S. Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC) for the Environmental Management Disposal Facility. That document allows us to begin site preparation activities and develop a final design for a facility that will provide OREM the onsite waste disposal capacity needed to complete cleanup at Y-12 and ORNL. We also completed construction on the Sludge Processing Mock Test Facility, which will play a vital role in maturing technologies needed to begin processing Oak Ridge's inventory of transuranic sludge waste.

Finally, with all of the buildings demolished at the East Tennessee Technology Park (ETTP), crews are working to remove areas with contaminated soil. Completing these projects helps us achieve our ultimate vision to transform the site into a multi-use industrial center, national park, and conservation area. We are also working to transfer all cleaned parcels back to the community to be reused for economic development. Those efforts are attracting major industry to the site and bringing in hundreds of millions in new investments at ETTP.

We are incredibly grateful for the support and involvement we enjoy from the community, and we are committed to collaborating with these local partners and stakeholders and being responsible stewards of taxpayer dollars by completing our projects on time and on budget. Thank you for your role in helping advance cleanup in Oak Ridge, and we look forward to another productive year ahead.

Laura Wilkerson



Contents



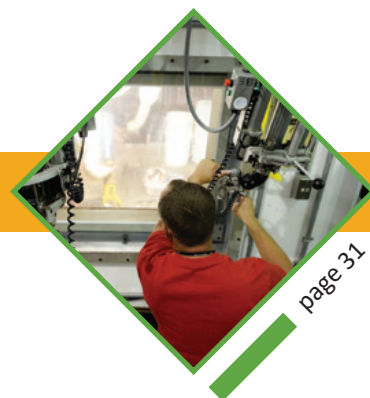
Introduction	4
Oak Ridge National Laboratory	5
Reactors being prepared for demolition	6
Workers deactivating Isotope Row facilities.....	9
Experimental Gas-Cooled Reactor being prepared for demolition	10
Final lab hot cell being prepared for removal	11
MSRE gets roofing, electrical system upgrades	12
Improvements continue at LGWO	12
Upgrades complete, U-233 processing begins	14
Y-12 National Security Complex	15
Criticality Experiment Laboratory demolished.....	16
Biology Complex slab removed	17
New technologies evaluated for mercury cleanup.....	18
Mercury Treatment Facility construction progressing.....	18
Uranium processing facilities being deactivated	20
East Tennessee Technology Park	21
Soil remediation eliminating hazards at ETTP	22
Remediation focuses on groundwater protection.....	25
Land transfer preparation and historic preservation are key focus areas for ETTP reindustrialization ..	27



page 16



page 24



page 31

Waste Management.....29

Onsite disposal facilities enable cleanup progress	30
Record of Decision signed for new disposal facility.....	31
TWPC has processed 98 percent of TRU inventory	31
Wastewater treatment helps facilitate cleanup	32
Sludge processing mock test facility completed.....	32
OREM monitoring effectiveness of controls.....	32

Public Involvement.....33

OREM kicks off Energycast	34
EMDF public meeting held	34
Advisory board provides public input on DOE cleanup activities	34

Websites for Additional Information.....36

Commonly Used Acronyms36

Commonly Used Terms.....37

Introduction

In Fiscal Year (FY) 2022, cleanup at Oak Ridge National Laboratory and the Y-12 National Security Complex took several steps forward as deactivation of several facilities was in full swing and demolition activities commenced at certain facilities. At East Tennessee Technology Park, soil remediation moved to the forefront as several excavation projects were underway to remove contaminated soil. The remedial actions work continued the site's transformation to a multi-use industrial park, national park, and recreational area.

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) National Priorities List, 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.





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.

Reactors being prepared for demolition

First-ever reactor demolition in ORNL's Central Campus achieved

More than a dozen research reactors were constructed at ORNL over multiple decades. Each contributed to ORNL's reputation as a world leader in cutting-edge nuclear research and development but no longer support current-day missions.

OREM cleanup contractor United Cleanup Oak Ridge (UCOR) demolished the Bulk Shielding Reactor, the first ever demolition of a reactor in ORNL's Central Campus area. It was a 1950s facility that included a 27-foot-deep reactor pool. Originally designed to support the Aircraft Nuclear Propulsion Program, its mission changed in 1963 to a general purpose research reactor and continued as such until permanent shutdown in 1991.

A key pre-demolition activity at the Bulk Shielding Reactor was removing irradiated and contaminated components from the reactor pool. Once those components were removed, workers removed all 130,000 gallons of water from the pool and sent it to an onsite treatment facility. The pool was then filled to the ground level with a concrete mixture.

In FY 2022, UCOR made significant progress at two other reactor facilities. At the Low Intensity Test Reactor, UCOR continued to prepare for demolition by manually removing reactor shielding wall blocks on the second floor of the three-level structure. In removing the wall, 10,600 pounds of debris were shipped for disposal. Demolition is expected in 2023.

Deactivation was also underway at the Oak Ridge Research Reactor, built from 1955 to 1958. In previous years, the reactor pool had been drained and capped but still contained irradiated material.

To safely remove this material, crews filled the pool with 116,500 gallons of demineralized water and removed 10 cement pedestal blocks weighing more than 1,800 pounds each. They also removed 12 cement shield caps, each weighing nearly 11,800 pounds. Repairs to the 20-ton overhead crane and additional safety railing facilitated this process.



A worker samples the pool wall in the Bulk Shielding Reactor (left). Above, the pool is being filled with a concrete mixture after components were removed and the pool drained.



Demolition of the Bulk
Shielding Reactor

The Oak Ridge Graphite Reactor was the world's first continuously operated nuclear reactor. It is now a non-operational historic landmark. Three facilities that once supported the reactor moved into the cold and dark stage in FY 2022, meaning that all power and utility sources to the structures were removed. These facilities are 3002 (Filter House), 3003 (Solid State Accelerator Facility), and 3018 (Exhaust Stack). Removing hazardous materials and sampling for contaminants have been the primary focus. Demolition of these facilities is expected in 2023.



Workers wrap pipes at the Low Intensity Test Reactor as part of deactivation activities.



Workers deactivating Isotope Row facilities

Characterization and deactivation continued throughout Isotope Row, a series of 12 buildings built in the 1950s and early 1960s to process radioisotopes. This work involved sampling various locations and systems inside and outside of the buildings. Crews removed asbestos, process piping, and equipment. As a risk reduction measure at Building 3038, a highly contaminated HEPA unit was removed from the roof and placed inside the facility bay for safe characterization and packaging for disposal. Isotope Row characterization and deactivation activities will continue in preparation for demolition, which should begin in late 2023.



Isotope Row facilities



A worker doffs personal protective equipment after performing deactivation activities in an Isotope Row facility

Experimental Gas-Cooled Reactor being prepared for demolition

To prepare for eventual demolition, various materials were removed from the Experimental Gas-Cooled Reactor (EGCR). Constructed in the early 1960s, the eight-level steel and concrete structure stands about 150 feet high with an additional 50 feet below grade. It was supposed to serve dual roles as an experimental and power reactor, but construction was halted in 1965, and the reactor was never fueled.

To streamline removal of hazardous materials from the various levels on EGCR, UCOR installed a transport platform cart system (TPCS) to access upper levels of the facility. Crews cut through the steel containment shell to make four access openings where the TPCS will stop and allow workers to remove hazardous waste, equipment, and materials from the building. The TPCS will also transport personnel in and out of the building, reducing the need to ascend and descend the building stairwell. Progress also continued in the below-grade portion of the facility where crews cut through steel bulkheads to gain access to each of the eight cells.



Installation of transport platform cart system





Workers remove sections of the hot cell roofing in order to access and characterize the structure.

Final lab hot cell being prepared for removal

In FY 2022, crews were deactivating the final hot cell in the former Radioisotope Development Laboratory.

The Radioisotope Development Laboratory was originally built in 1945 to support isotope separation and packaging, but it was later used to examine irradiated reactor fuel experiments and components. The outer structure and five of the facility's cells were previously demolished.

One of the tools used to perform characterization in the Radioisotope Development Laboratory hot cell was a germanium gamma-ray imager. This camera system is used to detect, identify, and locate sources of gamma-emitting radioisotopes. Workers are able to identify

the potential location of radiation sources by using a camera to capture an image of the environment and then overlaying the radiation "image" onto the captured picture. Because of the heavy weight of the camera equipment, workers had to design and fabricate a hoisting system to lower the equipment into the cell.

To access the cell, workers safely lifted several heavy shield plugs from the roof of the structure and then removed and packaged hazardous materials for disposal. Deactivation has required the use of long reach tools and a sequenced approach in order to ensure worker safety. The cell is slated for demolition in 2023.

MSRE gets roofing, electrical system upgrades

Crews continued surveillance and maintenance work at the Molten Salt Reactor Experiment (MSRE), a test reactor that operated at ORNL from June 1965 until December 1969. Because it is an active nuclear facility, numerous upgrades are needed to keep critical systems safe until the facility is demolished. Upgrades and modifications have been implemented to minimize maintenance costs, reduce risks, and eventually eliminate the need for personnel to work there. Some of the upgrades involved workers installing a new roof over the high bay to protect key systems, such as reactor and containment ventilations. They also installed a new electrical distribution center to feed power to the facilities' critical system.

In addition to preparing the facility systems for deactivation and removal, personnel are conducting the MSRE Feasibility Study to collect vital characterization data for eventual agreement with site regulators on the final end state of the MSRE



footprint. The study is analyzing groundwater data collected from 14 new ground wells installed on the MSRE footprint and three flumes added to the local stream.

Additionally, the team is collecting nondestructive assay data from below-grade building cells and units to assist with the MSRE Removal Action Work Plans and waste disposition plans.

Improvements continue at LGWO

An extensive piping replacement effort was underway at the Liquid and Gaseous Waste Operations (LGWO) in FY 2022. Decades-old carbon steel piping is being replaced with new stainless steel piping. The project, which also includes replacement of corresponding valves, is anticipated to be completed in FY 2024. Crews have designed, fabricated, and installed 7 of 18 piping runs with four more fabricated and awaiting installation.

Another critical LGWO upgrade that was completed is replacement of the Distributed Control System (DCS), which controls LGWO instrumentation. With the old DCS system running on obsolete components, the upgrade project included the design, fabrication, and installation of new fiber optic cabling between the LGWO facilities. This extensive effort was completed ahead of schedule and under budget.



Workers install new roofing over the MSRE high bay to keep key systems protected.

Upgrades complete, U-233 processing begins

OREM and its contractor, Isotek, successfully completed all construction upgrades to Building 2026. They also completed an operational readiness review that will allow for the processing and disposal of the remaining high-dose uranium-233 (U-233) inventory stored at ORNL. Eliminating the inventory of U-233 is the DOE Oak Ridge Office of Environmental Management's highest priority at ORNL. U-233 is a manufactured isotope created as an alternative nuclear fuel source in the 1950s. The nation's inventory of U-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. However, the building where this would take place required significant upgrades before the work could begin. This work was completed in FY 2022.

With upgrades, installation of new equipment, and readiness reviews complete, Isotek began processing operations on the remaining inventory of U-233 stored at ORNL. Crews began the campaign by transferring a canister of U-233 oxide from Building 3019 into an adjacent, newly upgraded hot cell facility for downblending processing. The heavily shielded hot cells protect workers and allow them to handle the material using remote manipulators. This upcoming phase will enable Isotek to enhance productivity by processing larger amounts of U-233 and extracting more medical isotopes than the previous phase that involved processing material in glove boxes.



Oak Ridge contractor Isotek conducted numerous upgrades at Building 2026 to prepare the facility for U-233 processing operations. Workers are installing new equipment essential to the downblending process, which converts the U-233 material into a form safe for transportation and disposal.



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.

Criticality Experiment Laboratory demolished

Another excess facility at the Y-12 National Security Complex is gone. Crews successfully demolished the Criticality Experiment Laboratory. Seventy-three years after it was built, the lab (Building 9213) and all of its ancillary facilities have been leveled. Beginning in May, crews worked throughout the hot and rainy summer to demolish the 24,000-square-foot facility that has been home to a variety of missions since its construction in 1949.

During the first decade of the building's operation, more than 9,700 experiments were conducted. Later, it supported the ORNL High-Flux Isotope Reactor program. The building has been closed since 1992.

More than 4,500 cubic yards (525 truckloads) of waste was disposed. During the nearly two years of deactivation, crews prepped the building for demolition by safely removing, packaging, and

shipping 1,496 linear feet of asbestos-insulated piping, 323 linear feet of process piping, and 8,540 square feet of other asbestos-containing material.



The Criticality Experiment Laboratory during demolition (above) and as demolition was nearing completion (below)





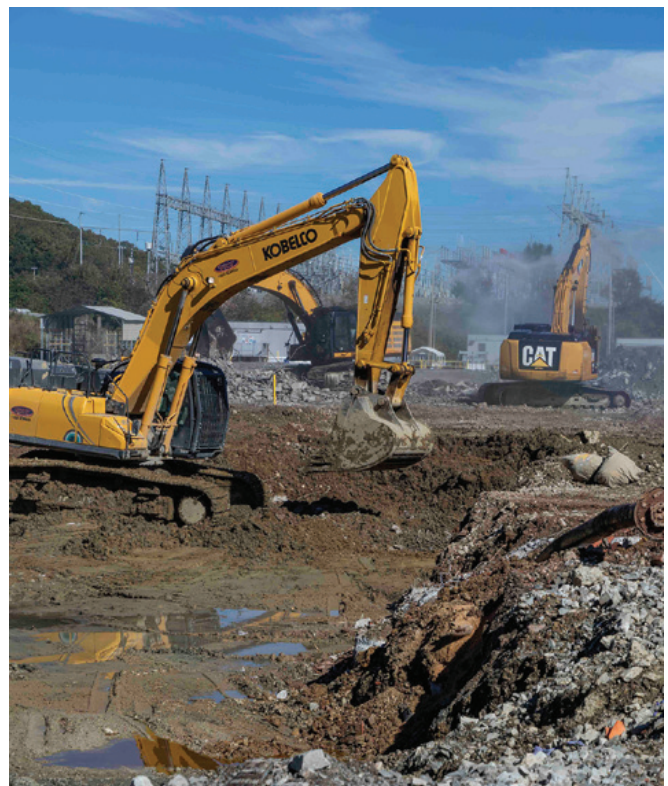
Removal of the final Biology Complex slab frees up the land for continuing Y-12 missions.

Biology Complex slab removed

Workers have finished removing the remaining slabs at the now demolished Biology Complex, readying the land for transfer to Y-12. The land is expected to be the site of a new lithium processing facility.

Dating back to the 1940s, the Biology Complex originally consisted of 11 buildings. It was constructed for recovering uranium from process streams and later used for research that led to strides in understanding genetics and the effects of radiation.

Crews completed backfilling and seeding the portion of the site where the last two buildings (9207 and 9210) once stood. In subsequent months, slabs remaining from previous demolition of buildings in the Complex were removed and their footprints backfilled and graveled. Between removal of those slabs and the slabs at 9207 and 9210, more than 6,141 cubic yards of waste and debris were removed.



New technologies evaluated for mercury cleanup

OREM is developing new remediation technologies to address releases of mercury into the environment from past operations. These technologies will support demolition of Y-12's mercury-contaminated facilities as well as soil remediation and reduction of mercury-related ecological risks.

At the Aquatic Ecology Laboratory, workers test the effectiveness of remediation technologies in a flow-through system using water from East Fork Poplar Creek.

Researchers have conducted studies 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 for reducing mercury in the water column. Scientists prepared a report titled "Mercury Remediation Technology Development for Lower East Fork Poplar Creek—FY 2022 Update" that provides findings from FY 2022 studies. Field characterization and research undertaken from 2015 to 2022 will support an evaluation of remediation alternatives for the creek in the mid-2020s.

In 2022, unmanned aerial vehicles equipped with sensors took various measurements to evaluate how organisms such as some algae, bacteria, fungi, and a

variety of invertebrates (periphyton) interact in stream environments. These periphyton have been recognized to play a major role in mercury methylation and accumulation in other living organisms.

A new support tool was developed that uses watershed models to simulate remediation scenarios. With a better understanding of mercury transport in the watershed system, specific technologies and strategies can be assessed and implemented.

There have also been increased efforts in identifying and demonstrating emerging technologies that will aid in addressing Y-12 mercury remediation challenges. A Mercury Review Committee consisting of members from DOE, its contractors, and subject matter experts serves as the primary resource to evaluate and select proposed new technologies. Contracting for the first technology demonstration began in 2022.

As part of the technology demonstration initiative, an evaluation of establishing a facility for demonstration of mercury-related technologies is ongoing. A conceptual report was prepared that outlines the modifications needed to be able to use an existing facility on the Oak Ridge Reservation as a location for technology demonstrations. The facility modification design is in progress.

Mercury Treatment Facility construction progressing

Progress continued on construction of the Outfall 200 Mercury Treatment Facility. Shoring and major excavations were completed at the headworks site. Crews continued placing concrete pads and walls of the treatment plant. Crews also began erecting structural steel and continued installing underground utilities.

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.

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. The facility is slated to be operational in 2025.



Mercury Treatment Facility construction



Certain past operations at Y-12 involved the use of a great deal of mercury. The element can be found in piping and equipment of various buildings that are slated for demolition. The Mercury Treatment Facility, under construction, is an essential piece of infrastructure that enables large-scale cleanup to begin in mercury-contaminated areas at Y-12.

Uranium processing facilities being deactivated

Three large former uranium processing facilities were undergoing deactivation in FY 2022. Those facilities—Alpha-2, Alpha-4, and Beta-1—were home to the historic calutron (mass spectrometer) racetracks used for separating isotopes of uranium.

Deactivation work in these large facilities is the heavy lift leading up to demolition and is focused on removing potential hazards and environmental risks. It can take months, sometimes years, to complete all of the aspects of deactivation.

Alpha-2: The three-story facility (Building 9201-2) stands on a footprint of 107,619 square feet. Since bringing Alpha-2 to the cold and dark stage in the summer of 2021, workers have been steadily deactivating the facility. In addition to removing asbestos-contaminated materials and hazardous and universal waste, workers have drained tens of thousands of gallons of oil from large pieces of electrical equipment and, to date, have removed 184,569 pounds of lead blocks from shields that were used to support fusion experiments.

Alpha-4 and East COLEX: Standing on a footprint of more than 174,000 square feet, the four-story Alpha-4 building is one of Y-12's largest high-risk facilities with elemental mercury contaminating much of the structure.

During the fiscal year, workers completed deactivation of the adjacent East Column Exchange (COLEX) equipment, which involved retrieving 2.3 tons of mercury from the processing structure's pipes and tanks. That amount is in addition to the 4.19 tons that was recovered from the West COLEX equipment when it was demolished in 2018. A combined total of 6.49 tons was recovered from the

East and West COLEX equipment, which significantly reduces potential releases to the environment at Y-12.

As the fiscal year was ending, crews were beginning work to make Alpha-4 cold and dark. That work includes isolating mechanical and electrical power sources so that crews can safely remove hazardous waste and prep the facility for demolition.

Beta-1: Next door to Alpha-2 is the multi-level Beta-1 facility (Building 9204-1) with a footprint of 75,012 square feet. During the fiscal year, crews were busy removing asbestos-containing materials (floor and ceiling tile, ductwork, piping, etc.) as well as hazardous and legacy waste.

A challenge for deactivation crews in Beta-1 is to pump out tens of thousands of gallons of water from the basement in order to perform deactivation activities there. Crews performed an infiltration study in the spring to support design of a water treatment skid to treat and discharge approximately 3 million gallons of water starting in the late winter/early spring FY 2023.



Lead block removal in Alpha-2



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.

Soil remediation eliminating hazards at ETPP

Soil remediation at ETPP is helping to eliminate hazards at the site and pave the way for future industrial and recreational 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.

The Zone 2 Record of Decision—a document that details the decided remediation efforts for that area— includes land-use controls and requires OREM to remediate soil to protect groundwater and enable industrial reuse. It divides Zone 2 into 44 EUs ranging in size from 6 to 38 acres.

In FY 2022, OREM excavated and removed soil with radiological contaminants from several small areas in EU-13, an area near Poplar Creek that once housed many of the gaseous diffusion and uranium hexafluoride enrichment support facilities. Workers also removed the K-1131 ash pit and surrounding soils in that area.

Remediation was also underway within EU-21, an area that is located in the middle of the K-25 footprint, which is part of the Manhattan Project National Historical Park. Characterization sampling was performed as part of the overall cleanup of the ETPP site. Based on results of model calculations, workers are set to excavate 16,000 cubic yards of soil to eliminate risks to groundwater.



Workers load excavated soil for disposition in EU-13 in the Poplar Creek area.



Remediation at the K-25 Building site area (EU-21)

Excavations to remediate the potential risk to groundwater began in April 2021 and are ongoing. To support the treatment of water that could accumulate within the excavation areas, a treatment system was designed to remove contaminants from the water prior to discharge to the Clinch River.

Other remedial action accomplishments in FY 2022 include the following:

- Completed soil remedial action activities within the footprint of the former K-1303, Mercury Distillation Facility. Site restoration activities

included placing clean fill and hydroseeding the area to stabilize the site.

- Completed the concrete slab/associated plenum and soil remedial action surrounding the former K-1302, Fluorine Storage and Distribution Facility. Site restoration activities included placing soil fill with final site stabilization pending.
- Completed the concrete slab remedial action of the former K-1301, Fluorine Production Facility. Site restoration activities included placing and compacting gravel across the area's footprint.



A worker checks for radioactivity levels in soil excavated at EU-21.



Remediation at EU-25 involved removing building slabs and underlying soil.

Remediation focuses on groundwater protection

ETTP completed several soil remedial actions in FY 2022 that help protect groundwater. Workers on these projects removed approximately 20,000 cubic yards of soil and concrete.

The EU-25 remedial action centered on the slab, foundation, and underlying soil of the former K-1413 Building. Constructed in the 1950s, the building was operated until the early 1980s for a range of chemical waste processing activities. Included with the building were three neutralization pits ranging from 2,500 to 21,000 gallons. Extensive contamination in the concrete and soil was removed during the action. Over 13,000 cubic yards of concrete and soil were removed from the site.

The EU-35 remedial action was conducted on the site of the former K-1407-K Building. This facility contained six 500-gallon tanks and a system used for mixing chemical solutions. Four of the tanks were used to convert dry chemicals into solutions; two tanks were used to hold rinse water. Concrete and soil

in the footprint of the former building were found to contain methylene chloride and tetrachloroethene (PCE) that exceed site groundwater screening levels. Approximately 800 cubic yards of soil and concrete were removed from the area.

The EU-42 area is the site of the former K-1004-J Building, a laboratory that was part of the now-demolished Centrifuge Complex. Remediation was performed on the former slab and soils remaining after demolition. Research conducted in the former facility resulted in discharges to drain lines and neutralization pits that contaminated the concrete and soil in the area with radioactive isotopes. Remedial actions in this EU removed more than 6,200 cubic yards of concrete and soil.

OREM is also working to develop Records of Decision (RODs) to address groundwater cleanup at the site. RODs document the cleanup approach that will be used. The RODs will be for the K-31/33 Area, Main Plant Area, and Zone 1.



Soils that cannot be disposed locally due to contaminant levels are placed in special containers and shipped offsite for disposal.



Land transfer preparation and historic preservation are key focus areas for ETPP reindustrialization

OREM continued to see significant momentum in the Reindustrialization program at ETPP. The former government-owned uranium enrichment complex is being turned into a multi-use industrial park that includes national historic preservation and conservation and greenspace areas. To date, OREM has successfully transferred almost 1,300 acres at ETPP for beneficial reuse and is working to complete transfer of the remaining acreage at the site.

During FY 2022, the Reindustrialization team advanced the regulatory review of seven land transfer packages. This includes areas such as the former Powerhouse area, the Centrifuge area, and the K-1037 and Toxic Substances Control Act Incinerator area. OREM and UCOR continued to partner with Community Reuse Organization of East Tennessee to identify remaining

available property, coordinate schedules, and support new businesses as they set up operations.

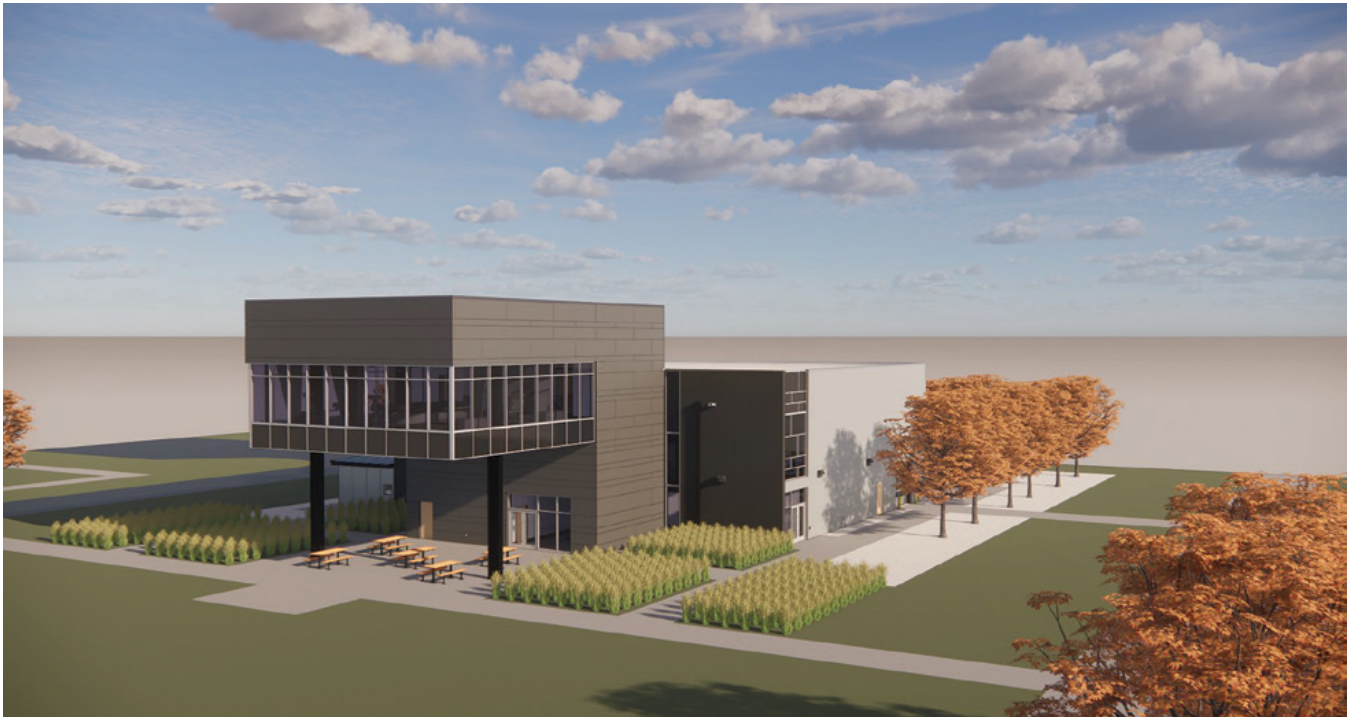
FY 2022 saw an increase in economic development with four new companies acquiring land. An estimated 1,500 jobs will be added in the coming years with an investment of nearly \$500 million. Their expertise ranges from an advanced nuclear demonstration project to nuclear fuel fabrication facilities and a glass fiber recycling facility. Oak Ridge is quickly becoming an area known for next generation nuclear and clean energy industries.

The national historical preservation activities continued with the completion of the building design for the K-25 Viewing Platform. This new facility will be adjacent to the K-25 History Center and is positioned to overlook the former K-25 building footprint.



Enhancing the area's natural assets and creating more public recreation opportunities continued to be a major focus at ETPP. The Tennessee Wildlife Resources Agency and OREM collaboration resulted in the signing of an agreement in principle to plan to transfer almost 3,500 acres for greenspace and mixed-use recreational areas.

OREM and UCOR continued to share progress and lessons learned with the community and stakeholders through several meetings, workshops, and a virtual public event held in February 2022. These activities helped describe the remaining scope of work and provided an update on how the site is being transformed into a valuable community asset.



**Artist's rendering of the
K-25 Viewing Platform**



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 disposal facilities enable cleanup progress

Most of the waste generated during FY 2022 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 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 2022, EMWMF received 7,172 waste shipments from cleanup projects at ETPP, ORNL, and Y-12, plus 643 clean fill shipments for the enhanced operational cover expansion and constructing access roads and dump ramps. The EMWMF landfill has a design capacity of 2.331 million cubic yards and is now over 82 percent filled.

EMWMF generated 17.28 million gallons of wastewater in FY 2022. Approximately 3.30 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 13.98 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 2022, these three active landfills received 11,146 waste shipments, totaling 155,034 cubic yards of waste.

ORRL also manages non-regulated leachate. In FY 2022, ORRL compliantly discharged 4.1 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 456,000 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 2022, 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 2022 noted excellent sediment and erosion controls with no areas of concern or violations. Workers removed approximately 60,000 cubic yards of soil and made major preparations for the Landfill V (Area 5) expansion.



EMWMF

Record of Decision signed for new disposal facility

EMWMF will reach capacity before OREM completes its cleanup at Y-12 and ORNL. Planning continued in FY 2022 for another disposal facility, the Environmental Management Disposal Facility (EMDF), to provide the capacity required to complete Oak Ridge's cleanup mission.

The EMDF Record of Decision was signed on September 30, 2022. This major milestone for the project allows OREM to begin site prep activities and finalize the facility's design. OREM continues to work with EPA and TDEC on follow-on regulatory documents related to the project. Planning for the groundwater field demonstration that will augment the existing site characterization is in progress, including finalizing

the demonstration design. Planning for early site preparation activities to reroute roads and provide utilities to the future EMDF site is in progress. The Focused Feasibility Study (FFS) for Water Management for the Disposal of CERCLA Waste was approved on September 6, 2022. This approval followed the dispute resolution for radiological discharge limits. The FFS provides an evaluation of landfill wastewater treatment alternatives, and its approval was a prerequisite for the EMDF ROD signature by the Federal Facility Agreement parties.

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.

TWPC has processed 98 percent of TRU inventory

The Transuranic (TRU) Waste Processing Center (TWPC) continued processing and shipping TRU, mixed low-level waste (MLLW), and low-level waste (LLW) in FY 2022. The facility has completed processing of 98% and shipment of 83% of its contact-handled TRU waste and 70% of its remote-handled TRU waste.

TWPC's operational focus in FY 2022 was on processing the legacy Nuclear Fuel Services waste (12.4 cubic meters) and TRU waste processing by-product wastes (46 cubic meters). TWPC completed limited

processing operations for 1.9 cubic meters of MLLW macro-encapsulation. TWPC continued critical actions associated with readiness preparation to commission new waste processing capabilities at TWPC for high activity oxide and wastes requiring new infrastructure, which encompasses over 75 percent of the remaining 39 cubic meters of the TRU legacy waste inventory on the Site Treatment Plan for Mixed Wastes on the DOE Oak Ridge Reservation. TWPC continued certification and shipment of 59.3 cubic meters of TRU waste to the Waste Isolation Pilot Plant (WIPP), 58.5 cubic meters MLLW to treatment and disposal, and 2.7 cubic meters of hazardous waste to treatment and disposal, eliminating 475 containers of the stored inventory.



Workers process TRU waste

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 45 million gallons of wastewater and groundwater during FY 2022.

At ORNL, the Liquid and Gaseous Waste Operations plant treated approximately 96 million gallons of wastewater in FY 2022. In addition, the liquid low-level waste system at ORNL received approximately 26,000 gallons for concentration.

The ORNL 3039 Stack Facility treated 0.84 billion cubic meters of gaseous waste. These waste treatment activities supported both OREM and DOE Office of Science mission activities.

Sludge processing mock test facility completed

Construction of the Sludge Processing Mock Test Facility was completed in June 2022. OREM has been working since 2003 to process, repackage, and ship Oak Ridge's inventory of transuranic debris waste for permanent disposal at WIPP. With that processing nearing completion, OREM is now working to address the site's 400,000-gallon inventory of TRU sludge waste.

OREM will test six critical technology elements to gather the data necessary to complete the final design and construction of the Sludge Processing Facility later this decade. Two of those technologies will be tested at the mock test facility.

This facility will be used to test pump technologies and instrumentation measurement technologies. Advanced pump technologies are needed to pull the sludge wastes out of their storage tanks for processing. The instrumentation measurement technologies will inform operators what material is moving through the pumps, including its contents and density, to assist with processing needs.

OREM monitoring effectiveness of controls

OREM continued to implement its groundwater strategy for the Oak Ridge Reservation in FY 2022 with the completion of the Phase 2 Offsite Detection Monitoring Remedial Site Evaluation (DOE/OR/01-2971&D2), a follow-on to the Phase 1 Offsite Groundwater Assessment. Detection monitoring for volatile organic compounds and select Oak Ridge Reservation signature radiological contaminants were performed over a three-year period with trend evaluations performed on detected results.

The first year of monitoring at three deep, multi-zone groundwater wells in west Bethel Valley along the ORR boundary at the Clinch River was performed during FY 2022. The monitoring was in accordance with the Phase 1 Melton Valley/Bethel Valley Exit Pathway Remedial Investigation Work Plan (DOE/OR/01-2756&D2). Exit pathways are areas where contaminants have the potential to exit the

Reservation to offsite areas. A characterization report scheduled for completion in FY 2023 will include monitoring results and evaluations and well drilling, construction, and geophysical information.

Also in FY 2022, OREM completed planning meetings and site interviews/site visits for the upcoming 2023 CERCLA Five-Year Review for East Tennessee Technology Park and Lower Watts Reservoir and Clinch River/Poplar Creek. Early in FY 2022, the FFA 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. The document identifies potential issues related to the status of the implemented actions and recommends follow-up actions to ensure protectiveness.



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.



OREM kicks off Energycast

In FY 2022, OREM launched its first on-air newscast designed to showcase the full scope of OREM's mission in a new and more comprehensive way. Episodes appear in East Tennessee on Sundays, Tuesdays and Fridays in Middle Tennessee, and they are posted to OREM's YouTube channel.

This show is OREM's latest effort to expand outreach aimed at educating employees, stakeholders, and area residents about the work happening across the site.

EMDF public meeting held

In May 2022, DOE OREM and cleanup contractor UCOR hosted more than 100 people for a public meeting on the proposed onsite Environmental Management Disposal Facility (EMDF).

The meeting was part of a public outreach effort OREM launched for the proposed EMDF that included a 30-day comment period and website to inform area residents about the project.

OREM hosted the meeting with representatives from the U.S. Environmental Protection Agency and Tennessee Department of Environment and Conservation. The meeting focused on three key areas related to the project: site groundwater characterization, waste acceptance criteria, and ensuring the protection of Bear Creek's water quality. The proposed EMDF is essential to adequately dispose of waste from OREM's environmental cleanup at the Y-12 and ORNL.



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 and the Tennessee Department of Environment and Conservation 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.

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 developed under OREM has

had heavy SSAB involvement, and none of the final Records of Decision have been at odds with majority SSAB opinions.

In 2022, the board issued a recommendation on the site's budget request; discussed ongoing development of the planned new onsite waste disposal facility, EMDF; and provided input on future groundwater remedies at ETP.

The board encourages individuals to apply for membership to receive additional insights. Members tour the site directly, have continuing education, and are offered opportunities to travel to other sites and relevant conferences. The board conducts an annual recruitment event each winter but welcomes applicants to submit their information at any time through its website. ORSSAB may have up to 22

members. Individuals apply for membership and are selected annually by DOE to reflect a diversity of interests, gender, race, and other criteria of persons in the multi-county area that surrounds the Oak Ridge Reservation. Technical expertise is not a requirement for membership, although some members may have those skills. DOE strives to have a good mix of educational backgrounds and experiences among members.

ORSSAB meets the second Wednesday of most months at 6 p.m. in Oak Ridge and virtually through Zoom. The board also has two standing committees, which are also open to the public. Additional learning opportunities are available through news releases, advertisements in local media, and meeting videos 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 welcomes return to in-person activities

This year marked the first in-person activities ORSSAB members have participated in since early 2020 limits on travel and social distancing precautions. Locally, the board participated in several meetings and tours related to OREM's Five Year Review process, which allows it and other agencies to assess the effectiveness of current remedies in protecting human health and the environment.

Members participated in the twice-yearly chairs meetings where board officers from several DOE sites share best practices and meet with federal leadership for updates on DOE Office of Environmental Management (EM) projects across the complex and other DOE endeavors relevant to their communities. Notable this year was an increased emphasis on the importance of community outreach and engagement at all levels. Members were once again able to tour the site at the chairs meetings in Paducah, Kentucky, and Santa Fe, New Mexico. They heard about results of ongoing improvements to the SSAB membership process to increase the boards' commitment to a variety of perspectives, which has become a model for other federal boards, and learned of several new outreach programs.



DOE EM Senior Advisor Ike White (third from left) met with ORSSAB officers during a visit to Oak Ridge. Attendees included Acting OREM Manager Laura Wilkerson, Board Chair Leon Shields, and Board Vice Chair Amy Jones.

ORSSAB got to experience this commitment firsthand when William "Ike" White, the leader of DOE EM in Washington, D.C., visited Oak Ridge and invited the board's chair and vice chair to share their experiences and feedback as members. The group discussed ongoing historical preservation efforts at East Tennessee Technology Park and future changes to come with the Manhattan Project National Historical Park, among other issues.

Other members attended nationwide conferences dedicated to environmental management. The board sent representatives to the National Cleanup Workshop in Washington, D.C. and the Waste Management Symposium in Phoenix, Arizona.

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

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
COLEX	Column Exchange
DOE	U.S. Department of Energy
EGCR	Experimental Gas-Cooled Reactor
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
FFS	Focused Feasibility Study
FY	Fiscal Year
LGWO	Liquid and Gaseous Waste Operations
MSRE	Molten Salt Reactor Experiment
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

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 2022 fiscal year spans from Oct. 1, 2021, to Sept. 30, 2022.

