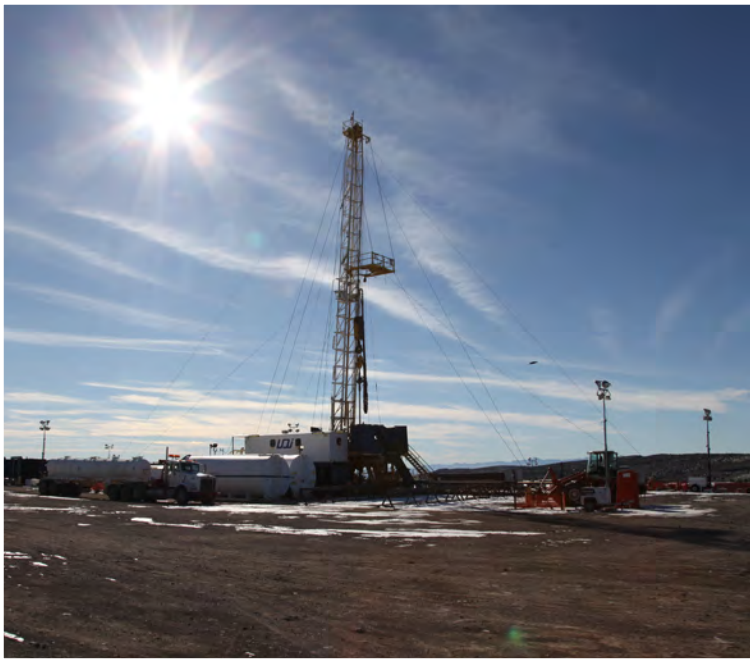
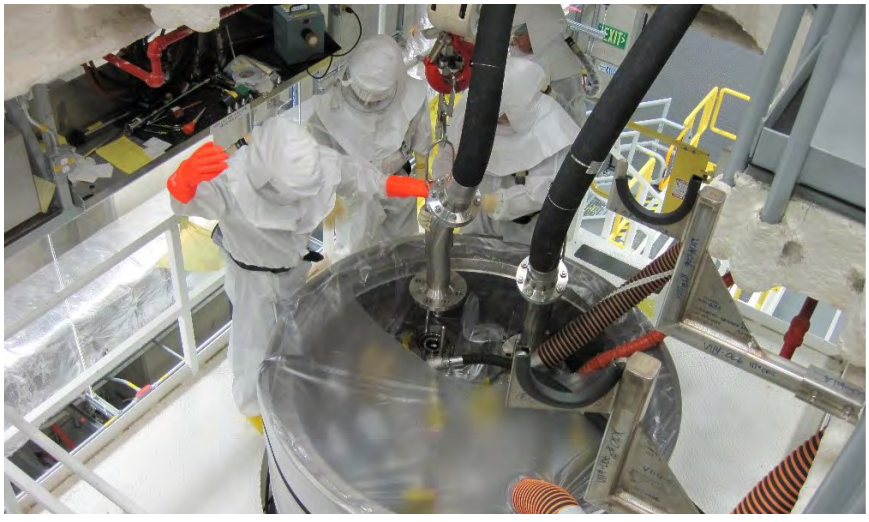
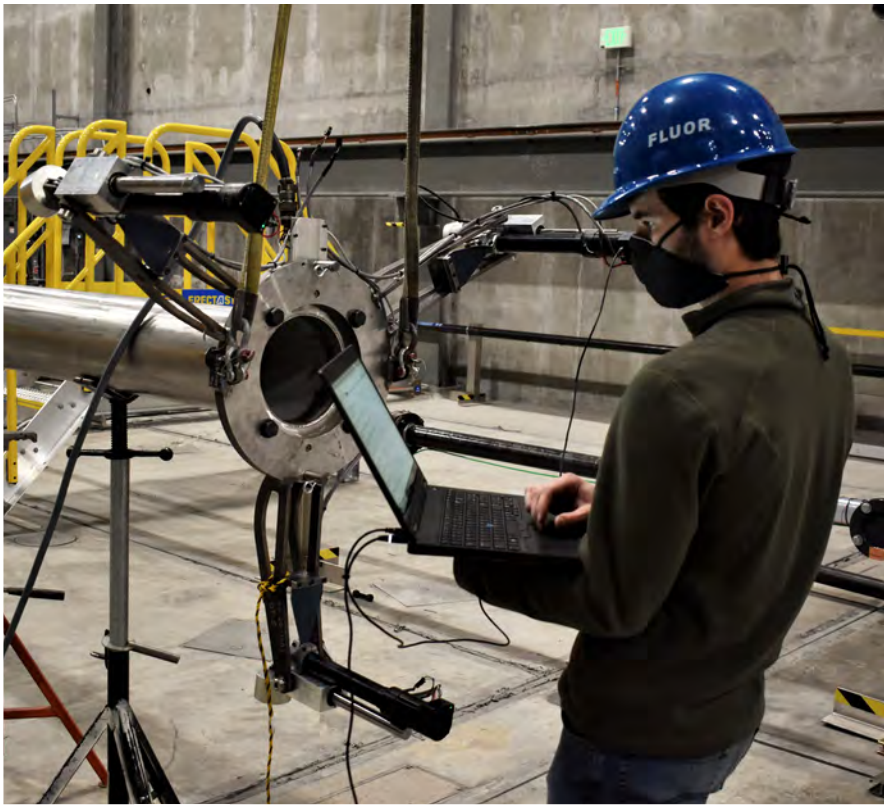
U.S. DEPARTMENT OF ENERGY | OFFICE OF ENVIRONMENTAL MANAGEMENT

EM Strategic Vision: 2021–2031



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Introductory Message from EM-1

The U.S. Department of Energy's (DOE) Office of Environmental Management (EM) is responsible for one of the largest environmental remediation efforts in the world. Decades of nuclear weapons development and government-sponsored nuclear energy research resulted in substantial environmental contamination at sites, often located in remote and rural areas, across the country. The men and women who carried out these activities, and the communities that supported and sacrificed for them, were vital to the United States' successes in World War II and the decades that followed. In service to those communities, EM continues to fulfill the moral and ecological responsibility of cleaning up that contamination.

Despite the COVID-19 pandemic, EM achieved a historic slate of accomplishments in 2020, marking an inflection point for the program. Collectively, these achievements have ushered in a new era for EM, setting the stage for accelerating cleanup momentum across the complex.

I am proud of all the EM team has achieved. From a leap forward in our capability to tackle tank waste, to shrinking the size of the cleanup footprint and forever changing skylines at several sites, to awarding new contracts that enable accelerated progress, we have turned years of preparation into an extraordinary slate of achievements. These cleanup milestones were met while simultaneously navigating the EM program through a global pandemic with the safety of the workforce as our top priority. These remarkable achievements are due in large part to the dedication and resilience of EM's greatest asset — the men and women who make up EM's workforce.

With many long-term projects now completed, EM has its sights set on the future. As we pull together the programs, people, and processes needed to take the cleanup program into the next decade, this updated Strategic Vision provides a clear and concise roadmap to guide our planning and priorities. We have much in store at our sites, including transformational progress in addressing tank waste challenges, demolishing contaminated buildings, remediating contaminated soil and groundwater, safely managing and disposing of waste, and completing work at some projects and sites.

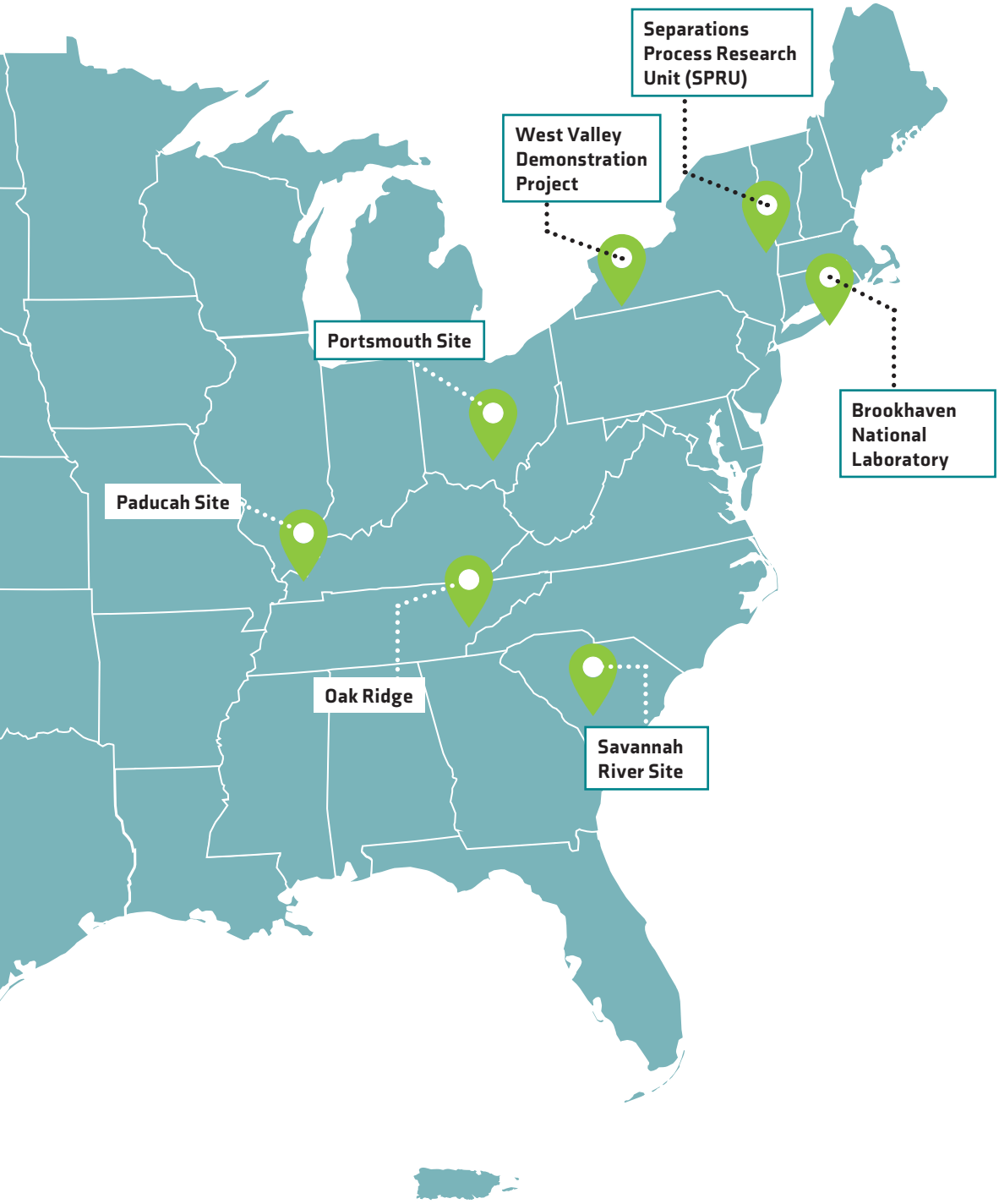
Through a variety of strategic initiatives, EM is further strengthening its ability to tackle the scope and magnitude of the remaining cleanup work. Efficient project management and effective contracting mechanisms will continue to improve cost and schedule performance. We are prioritizing the development of new and innovative approaches for environmental cleanup and risk reduction. We will leverage lessons learned from our response to the COVID-19 pandemic and incorporate them into our best practices. These organizational improvements will underpin continued successes across the EM complex — in the coming years and for the remainder of the EM mission.

To help provide insight into how we do our work, EM values and seeks the views and opinions of all of those who have a stake in its mission. We have sought input and, where appropriate, incorporated changes into this year's Strategic Vision update. I appreciate the feedback that regulators, tribal nations, local communities, and other EM partners contributed to this Strategic Vision. I look forward to continuing to work with Congress, state and local governments, tribal nations, and local communities to advance our shared goals of safe, effective cleanup and fiscal responsibility. I am excited for all we have planned in the next decade. As we work to see this Strategic Vision realized, we are writing the continued history of this important effort, benefiting communities across the nation, and paying tribute to our nation's past activities that contributed so much to national security and prosperity.

William "Ike" White
Acting Assistant Secretary of Energy for Environmental Management

EM Sites


Hanford
Idaho National Laboratory
Lawrence Livermore National Laboratory
Moab Uranium Mill Tailings Remedial Action Project
Nevada National Security Site
Los Alamos National Laboratory
Energy Technology Engineering Center
Sandia National Laboratories
Waste Isolation Pilot Plant


Separations Process Research Unit (SPRU)
West Valley Demonstration Project
Portsmouth Site
Brookhaven National Laboratory
Paducah Site
Oak Ridge
Savannah River Site

EM Strategic Vision: 2021–2031

Introduction

The U.S. Department of Energy (DOE) Office of Environmental Management (EM) has its roots in the Manhattan Project and the development of the first atomic weapon. EM's mission is to safely and efficiently address the substantial environmental liability resulting primarily from decades of nuclear weapons production and government-sponsored nuclear energy research that played a pivotal role in domestic security and prosperity.

At its inception in 1989, the EM program faced a daunting task. The production of more than 1,000 metric tons of weapons-grade uranium and more than 100 metric tons of plutonium resulted in environmental contamination at a total of 107 sites throughout the United States — covering an area equal to the combined size of Delaware and Rhode Island. This contamination included more than 90 million gallons of liquid radioactive waste resulting from the separation of plutonium from spent nuclear fuel (SNF) and more than 700,000 metric tons of depleted uranium produced as a byproduct of uranium enrichment activities. More than 5,000 contaminated facilities needed to be addressed. Millions of cubic meters of contaminated soil, and billions of gallons of contaminated groundwater, needed to be remediated.

Three Decades of Progress

Over the past three decades, the EM program has achieved significant and lasting progress in tackling this environmental legacy. EM has eliminated, or mitigated, at most sites the environmental, safety, and health risks from the most dangerous legacy wastes and contaminated facilities. In addition, contaminant pathways have been effectively controlled in groundwater and soils to mitigate potential future risks.

The program's combined active remediation footprint has been reduced by 90 percent, from approximately 3,300 square miles to less than 300 square miles. Significant legacy cleanup work remains at the following sites:

- Energy Technology Engineering Center (ETEC)
- Hanford
- Idaho National Laboratory (INL)
- Lawrence Livermore National Laboratory (LLNL)
- Los Alamos National Laboratory (LANL)
- Moab
- Nevada National Security Site (NNSS)
- Oak Ridge
- Paducah
- Portsmouth
- Sandia National Laboratories (SNL)
- Savannah River Site (SRS)
- Waste Isolation Pilot Plant (WIPP)
- West Valley Demonstration Project (WVDP)

Highlights of EM's significant accomplishments to date have included:

- Completing cleanup activities at major former weapons production sites such as Rocky Flats in Colorado and the Fernald and Mound sites in Ohio
- Opening the world's only deep geological repository for transuranic (TRU) waste resulting from atomic energy defense activities at WIPP in New Mexico
- Completing the bulk of cleanup activities along the 220-square-mile Columbia River corridor at Hanford in Washington State
- Placing six former plutonium-producing reactors at the Hanford Site into long-term stabilization
- Completing the removal of the former uranium enrichment complex at Oak Ridge in Tennessee, including Building K-25, at one time the largest building in the world under one roof
- Completing the construction of the tank waste treatment system at SRS in South Carolina, including almost 25 years of successful operations at the Defense Waste Processing Facility (DWPF), as well as the construction and startup of the Salt Waste Processing Facility (SWPF)
- Completing the Advanced Mixed Waste Treatment Project at INL, where 65,000 cubic meters of legacy TRU waste were processed for off-site disposal
- Completing construction and initiating operation of two depleted uranium hexafluoride (DUF6) conversion plants at the Paducah Site in Kentucky and Portsmouth Site in Ohio
- Completing waste vitrification activities and subsequent demolition of the Vitrification Facility at WVDP in New York — this was the first time EM has built, operated, and successfully decommissioned one of its major waste treatment facilities
- Transferring more than 25,000 acres of land to local communities for beneficial reuse
- Transferring 92 sites to the DOE Office of Legacy Management (LM) for long-term stewardship following successful remediation activities

EM's Prioritization Approach

EM pursues its cleanup objectives safely within a framework of regulatory compliance commitments and best business practices. Taking many variables into account, EM's priorities are as follows:

- Activities to maintain a safe, secure, and compliant posture
- Radioactive tank waste stabilization, treatment, and disposal
- Spent (used) nuclear fuel and nuclear materials management and disposition
- TRU and mixed low-level waste (MLLW) disposition
- Soil and groundwater remediation
- Excess facilities deactivation and decommissioning (D&D)

Intent of the Strategic Vision

The intent of the Strategic Vision is to provide a clear and concise high-level summary of the progress EM anticipates over the coming decade. The vision is based on current budget assumptions, as well as previous years' congressional appropriations. The Strategic Vision is not intended to be a comprehensive document of all planned cleanup projects at EM sites. Instead, it is one of a set of integrated planning activities and tools EM uses that also includes more detailed site-specific planning documents and periodic strategic alternatives analyses. To best inform this

iteration of the EM Strategic Vision, EM engaged in a concerted outreach effort with a number of stakeholder organizations that included a series of webinars with EM senior leadership. EM sites also routinely engage with stakeholders to solicit input and feedback on site-level cleanup plans.

2021: The Start of a New Era

In 2020, EM achieved a historic set of accomplishments, many of which were years in the making, that have shifted the trajectory for continued cleanup progress. These ranged from completing the removal of an entire uranium enrichment complex at Oak Ridge, to starting up the last major tank waste treatment facility at Savannah River, to demolishing what was once one of the highest risk buildings in the entire Hanford complex, the Plutonium Finishing Plant.

These accomplishments are even more notable for being completed as EM, and the entire federal government, faced the unprecedented challenge of responding to the COVID-19 pandemic. As the pandemic progressed, EM took action to protect the workforce at its sites by aligning activities in response to local health conditions, ramping down or increasing work, as necessary and appropriate. While EM continued to advance the DOE cleanup mission during this challenging time, some project impacts were unavoidable. EM is continuing to work with regulators across the complex on potential impacts to commitments.

Building on the substantial accomplishments achieved in 2020, calendar year (CY) 2021 launches a new era for sites across the EM program. EM will begin to significantly increase tank waste processing at Savannah River, building on the successful startup of the SWPF. In addition, the Hanford Site will draw nearer to the long-awaited goal of initiating tank waste treatment through continued progress on the capabilities necessary for the Direct Feed Low-Activity Waste (DFLAW) program. In 2021, EM anticipates completing construction of the Tank-Side Cesium Removal (TSCR) system to prepare waste for eventual DFLAW processing.

This year will see continued progress on infrastructure improvements at WIPP to enable an eventual increase in TRU waste shipments from across DOE and ensure the facility can continue to play its vital role for the entire DOE for years to come. At Oak Ridge, following the successful completion of the multi-year "Vision 2020" effort to remove the former uranium enrichment complex at the East Tennessee Technology Park (ETTP), cleanup will now increasingly focus on activities at the Y-12 National Security Complex (Y-12) and Oak Ridge National Laboratory (ORNL). In 2021, EM expects to complete demolition of the aging facilities at the former Biology Complex at Y-12.

At the Portsmouth Site, work is shifting from deactivation to demolition of the former uranium enrichment process buildings, with EM continuing to make progress on demolishing the former X-326 Process Building. At West Valley, EM will begin demolition of the last major facility remaining there — the Main Plant Process Building (MPPB). And, after resuming demolition activities at the ETEC Site last year after almost a decade, EM anticipates completing the demolition of the remaining DOE-owned buildings in 2021. EM is also on track to complete the demolition of a former reactor stack at the Brookhaven National Laboratory in New York, marking the end of legacy cleanup activities at that site.

The Decade to Come

Building on these anticipated successes, this Strategic Vision outlines the coming decade of progress in its cleanup activities across the EM program, including:

- **Initiating radioactive tank waste treatment at Hanford, as well as completing significant risk-reduction activities such as transferring cesium and strontium capsules to dry storage and placing the last of the former production reactors in interim safe storage**
- **Emptying and closing 22 of 51 underground waste tanks at SRS and completing disposal of remaining legacy TRU waste**
- **Completing the new Safety Significant Confinement Ventilation System (SSCVS), utility shaft, and other key infrastructure upgrades at WIPP**
- **Completing disposal of remaining legacy TRU waste and uranium-233 at Oak Ridge, along with completing construction of the site's new Mercury Treatment Facility**

- Completing the treatment of remaining liquid sodium-bearing waste at INL, along with completing targeted buried waste exhumation and shipments of remaining legacy TRU waste to WIPP for disposal
- Finalizing and implementing long-term treatment approaches for contaminated groundwater at LANL
- Demolishing two of three former uranium enrichment process buildings at Portsmouth
- Completing deactivation activities at the C-333 former uranium enrichment process building and demolishing the former C-400 Cleaning Building at Paducah
- Completing Phase 1 decommissioning activities at the WVDP
- Initiating soil remediation and final groundwater treatment approaches at ETEC
- Completing legacy cleanup activities at Moab
- Completing legacy cleanup activities at the NNSS
- Completing legacy cleanup activities at LLNL and SNL

Enabling Continued Success

EM is undertaking a variety of strategic initiatives to enable successes across the DOE complex in the coming decade, and for the remainder of its mission.

Safety and Security: Most importantly, EM will continue to perform its activities with a strong safety culture that integrates environmental, safety, health, and quality requirements and controls in all work activities. EM has a strong safety record and will continue to partner with EM contractor corporate leadership in strengthening corporate governance and oversight. EM will continue to incorporate graded approaches to nuclear safety and quality assurance requirements into end-state-based contracts, as well as to promote technically sound and cost-effective implementation of the requirements based on hazards and risks. The health and safety of EM workers, the public, and the environment is and will continue to be an overriding priority.

EM sites are home to a variety of special nuclear materials and facilities. EM will continue to address technology upgrades, infrastructure, and equipment; staffing and training; and streamlined processes to ensure safety, security, and emergency preparedness solutions provide effective protection of EM assets, operations, and essential functions, and provide resiliency during emergency events.

Cybersecurity threats present a significant challenge to DOE and EM. EM continues to enhance its cybersecurity capabilities to enable the program to anticipate and defend against growing threats and provide assurance that its information remains secure, communication is not compromised, and risks to data and system infiltrations are mitigated.

Program and Project Management: Given the scope and magnitude of the cleanup work to be tackled over the coming decade, it is essential that EM is best in class when it comes to program and project management. EM has performed several root cause analyses to better understand why some projects have experienced cost and schedule issues. Lessons learned from these analyses resulted in EM implementing a set of actions across the complex, including new project management capabilities and requirements, improved assessment and reporting capabilities, and increased guidance and training.

In recent years, EM has made significant strides in strengthening its program and project management capabilities. In 2020, EM issued new program and project management guidance: the Environmental Management Program Management Protocol and the Cleanup Project Management Protocol and Implementation Standard for Demolition Projects (Demolition Protocol). These protocols incorporate the principles of risk-informed decision-making and development of an integrated life cycle baseline, as well as follow the leading principles of program and project management.

The Program Management Protocol establishes the requirements and explains expectations for the planning, budgeting, execution, and evaluation of all work within the EM program. The Demolition Protocol establishes a standardized and streamlined approach for demolition projects to comply with DOE project management requirements, eliminating requirements typical of construction projects that are not applicable to demolition, and allowing regulatory cleanup process documentation to substitute for project management documentation when appropriate. This new approach will eliminate duplicative efforts and increase efficiency, saving both time and money.

EM is also working to further strengthen project management rigor and effectiveness. Improvements in

project management will focus on enhancing personnel capacity, use of project peer reviews, continued use of the Environmental Management Acquisition Advisory Board, and improved contractor performance evaluations. In the upcoming year, EM will develop implementation guides to further refine program and project management protocols.

Acquisition: Approximately 95 percent of EM's annual budget is utilized through contracting with an array of industry partners. EM will continue to be a demanding client, expecting that contractors will perform in a safe, efficient, and cost-effective manner and with the highest ethical standards. Over the coming decade, EM will continue to develop and improve acquisition tools, processes, and resources to increase consistency and efficiency in competing and awarding contracts. This includes new templates, approaches, and policies to greatly improve efficiency in executing competitive acquisitions. EM has also implemented an Acquisition Corps at the EM Consolidated Business Center to provide experienced technical experts who can serve as chairpersons, voting members, and advisors on source evaluation boards to increase the proficiency and efficiency of technical evaluations, as well as provide technical expertise to aid complex-wide problem-solving.

The next two to three years will see EM undertake new procurements for cleanup contracts at almost every site.

This contracting push will result in the wider use of EM's updated End State Contracting Model (ESCM), which encompasses a two-step indefinite delivery/indefinite quantity contracting process. The ESCM provides the ability to group work under a contract into specific task orders to allow better clarity and shorter time horizons, as well as provide more accurate cost and schedule targets.

As many as four new end-state contracts could be awarded in 2021. In 2021, EM will implement a new End-State Program Plan. This plan will define the ESCM vision, explain how priorities are established, and clarify roles and responsibilities of each entity within DOE, as well as provide the necessary strategic view to stakeholders.

Regulatory/Stakeholder Engagement: Cleanup decisions at EM sites are made through a complex and highly collaborative process, driven by considerations of human health and environmental risks, and the intended end use of lands and facilities. Across the country, EM is subject to more than 40 federal and state regulatory agreements, many of which have a significant number of milestones. EM works actively with its regulators in negotiating compliance agreement priorities and milestones for individual sites, and is endeavoring to better leverage more innovative, risk-based approaches at some sites. EM is focused on identifying methods for streamlining regulatory approaches and accelerating cleanup by pursuing strategies that are faster and more cost effective while still technically sound and protective of workers, the public, and the environment.

EM looks forward to maintaining and strengthening the constructive relationships it has with regulators across the country, and will continue meaningful discussion and ongoing engagement between federal and state decision-makers and local governments, tribal nations, community and civic groups, labor organizations, universities, national intergovernmental groups, industry, and other interested citizens. These constituencies offer diverse and unique vantage points and views that are important perspectives for consideration as EM moves forward. By having deliberate, open, and transparent collaboration, EM will continue to enhance public involvement in cleanup; promote mutual interests related to protecting natural, cultural, and historical resources; openly discuss challenges and potential impacts; and avoid misunderstandings and potential conflicts.

EM works directly with tribal nations on a government-to-government basis to enhance their involvement in cleanup decisions, while protecting relevant tribal rights and resources in accordance with DOE O 144.1, Department of Energy American Indian Tribal Government Interactions and Policy. Ensuring tribal voices are heard is an important aspect of EM engagement and outreach efforts, and EM supports government-to-government discussions between tribal and Departmental representatives at the staff, management, and leadership levels as well as through cooperative agreements with the tribes. This provides

an opportunity for tribal staff and scientific experts to inform tribal communities on cleanup progress, and provides opportunities for tribes to perform important activities that support the cleanup program, like air quality monitoring.

Infrastructure: EM faces a continued challenge of performing cleanup activities at sites with decades-old infrastructure that, in some instances, originated in the World War II era. EM is achieving success in infrastructure upgrades that will amplify the ability to perform cleanup in the future. For example, the successful startup of the SWPF at Savannah River, and the ongoing construction of the SSCVS at WIPP, provide infrastructure upgrades that will enable continued future success. EM is also working to modernize infrastructure at Hanford, and to "right-size" infrastructure needs at the Paducah and Portsmouth sites to support future cleanup operations. EM actively works with other DOE organizations to assess infrastructure needs across the Department, and will continue to pursue similar modernizing efforts throughout the complex to facilitate project completion.

EM also assists with performing deactivation and decommissioning activities on excess facilities for other organizations within DOE, such as the National Nuclear Security Administration (NNSA) and the Office of Science (SC), to assist with modernization efforts. EM will support deactivation and decommissioning activities at the Office of Naval Reactors' Knolls Atomic Power Laboratory and Kesselring sites beginning in fiscal year (FY) 2022. EM is addressing excess facilities and performing remediation activities at the Old Town and Bayview sections at Lawrence Berkeley National Laboratory, with this work anticipated to be completed over the coming decade. EM is also addressing excess facilities at the LLNL. Future work for other DOE organizations will be dependent on programmatic needs and other factors.

Next-Generation Workforce: EM currently has a workforce of approximately 33,000 federal and contractor employees. These employees are critical to EM's plans for the coming decade. However, with the EM program currently anticipated to last for decades to come, and a workforce that has a significant portion eligible, or soon to be eligible, for retirement, an infusion of new professionals, including those early in their careers, in a variety of fields will be needed.

EM is committed to promoting and supporting an inclusive environment that provides all employees the chance to work to their full potential. EM continues to use diversity, inclusion training, and education tools to enhance the value and practice of an inclusive working environment. EM is also expanding our recruitment strategies and leadership development programs to foster the workforce for the future.

EM and its contractors are working to continue building and sustaining a best-in-class workforce utilizing a diverse assortment of tools and hiring approaches. These tools include making use of the summer intern program by recruiting students with science, technology, engineering, and mathematics (STEM) areas of study to work on EM projects, and leveraging

students in the STEM disciplines for internship opportunities through programs such as the DOE Scholars Program, the Minority Serving Institutions Partnership Program, and the DOE Florida International University Fellows Program. EM also supports veterans, such as through the federal veterans' hiring preferences and contractors' participation in the Operation Warfighter Program, which is designed to provide recuperating service members meaningful activity outside of the hospital environment. In addition, EM is working to engage early career professionals through a variety of means, such as a relaunched Pathways internship program.

EM contractors utilize regional partnerships to ensure a consistent workforce pipeline. At Los Alamos, legacy cleanup contractor Newport News Nuclear BWXT Los Alamos, LLC (N3B) works with Northern New Mexico institutions to run a Nuclear Operators Apprenticeship Program, a Radiological Control Technician Boot Camp and a Waste Processing Operator Boot Camp. Pacific Northwest National Laboratory works closely with area colleges like Washington State University to facilitate research internships, including addressing Hanford-related cleanup challenges. Oak Ridge cleanup contractor URS-CH2M Oak Ridge, LLC (UCOR) invests in local schools for K-12 STEM activities and partnered with the University of Tennessee to form new curricula with nuclear engineering, nuclear decommissioning and environmental management.

The federal government's response to the COVID-19 pandemic has demonstrated the potential to perform work differently in the future. EM has observed an ability to incorporate increased flexibility in work locations, while maintaining readiness and focus on deliverable outcomes. By re-examining the nature and order of work performed and re-examining key project assumptions, EM has continued to make progress.

Innovative Approaches: Given the scale and scope of the remaining EM mission, it is critical to develop new and innovative approaches to performing cleanup activities so that EM can safely complete its work in a more efficient and more cost-effective manner. Such approaches should be science-based and focus on managing and disposing of waste in a safe manner, consistent with statutory and other legal requirements.

One such approach is the Department's interpretation of the statutory definition of "high-level waste," which makes clear that both source and risk are essential elements of the definition and also identifies science-based criteria for evaluating risk. EM has taken an initial step in the use of this interpretation for a waste stream at the SRS and is evaluating other potential uses.

EM is also seeking to enhance its technology research and development (R&D) efforts to better identify and demonstrate new and innovative approaches for tackling cleanup challenges that offer a significant return on investment, and to effectively adapt commercially available technologies to EM cleanup needs. EM's past R&D efforts have led to innovations such as solvent extraction and ion exchange technologies implemented with the commissioning of the SWPF. EM has also supported R&D tied to deployment of robotics and use of artificial intelligence for remote operation.

In partnership with the national laboratories, DOE is conducting a holistic EM technology review to evaluate technology development programs throughout the complex to ensure they have overall unity of effort, they are efficient, and that they provide maximum value. This assessment will be used to identify technology strengths, weaknesses, and gaps, and prioritize EM and DOE complex-wide issues, challenges, and risks for maximum potential value. Similarly, EM will adapt and implement existing technologies to address emerging contaminants and achieve meaningful progress towards environmental remediation and site closure.

Potential Opportunities for Acceleration: As a responsible steward of taxpayer resources, EM continually works to identify and assess opportunities to accelerate cleanup and completion of an entire site, or opportunities to accelerate key pieces of work scope. EM is developing a 2021 Program Plan that captures the results of alternatives analyses that include innovative risk-based approaches that could significantly reduce life cycle long-term risks, schedules, and costs.

As part of a robust and integrated strategic planning process, EM conducts regular analyses of alternatives that support innovation and reducing cleanup schedules. A number of opportunities and alternate

risk-based cleanup approaches continue to be identified and evaluated that could significantly shorten site cleanup and closure schedules, thereby reducing residual long-term environmental, safety, and health risks and ultimately saving billions in life cycle costs. These opportunities will be considered regularly, pursuant to the new Program Management Protocol, as part of ongoing budget and long-term planning activities.

For example, at Hanford, recognizing the characteristics of the tank waste, and consistent with practices at other sites, DOE is evaluating risk-reduction options to treat and close the tanks. A number of studies from organizations such as the Government Accountability Office and the National Academies of Science have recommended DOE consider the use of widely accepted grout technology as a tank waste treatment method for lower activity waste streams.

At Savannah River, EM is evaluating a proposal to "accelerate basin de-inventory" that would allow for accelerated processing of SNF and closure of several nuclear facilities decades ahead of schedule, potentially saving billions of dollars. At INL, closure of the Radioactive Waste Management Complex (RWMC) could be achieved by 2030. Modest investments at the Portsmouth Site could result in completing cleanup within this decade, years ahead of current schedules.

No decisions have been made at this time on these potential acceleration opportunities. EM will continue to assess these and other opportunities that may become apparent over the coming years, working with members of Congress, state and local governments, tribal nations, regulators, and other key partners.

Conclusion

In the past three decades, the EM program has demonstrated the ability to achieve significant and lasting progress, helping to fulfill the government's commitment to the people who live near, and work at, DOE sites. In 2021, EM is launching a new era that will continue to shift the overall trajectory of the Department's cleanup program. This Strategic Vision outlines the breadth and scope of the planned progress at each of the remaining EM sites where significant legacy cleanup remains, none of which would be possible without the talented and hardworking men and women who perform this important work every day, safely and efficiently.

Decade Timeline

2021
Complete demolition of DOE-owned buildings at ETEC

2021
Complete targeted buried waste exhumation at the INL Site

2021
Complete demolition of Y-12 Biology Complex at Oak Ridge

2023
Complete demolition of the former Main Plant Process Building at the WVDP

2023
Complete transfers of spent nuclear fuel from wet to dry storage at the INL Site

2023
Initiate radioactive tank waste treatment at Hanford

2025
Begin operation of Mercury Treatment Facility at Oak Ridge

2028

Complete the treatment of remaining liquid sodium-bearing waste at the INL Site

2031

Complete processing of salt waste inventory at SRS

2031

Complete demolition of 2 out of 3 former uranium enrichment process buildings at Portsmouth

2030

Complete disposal of legacy TRU waste from SRS

2027

Complete demolition of the C-400 Cleaning Building at Paducah

2028

Complete the legacy cleanup activities at the NNSS

2031

Complete cleanup activities at Moab

2031

Complete legacy cleanup activities at LLNL and SNL

2027

Complete disposition of uranium-233 at Oak Ridge

2031

Energy Technology Engineering Center

Overview

The ETEC Site is located at the Santa Susana Field Laboratory (SSFL) in Simi Valley, outside of Los Angeles, California. From the 1950s until 1988, DOE and its predecessor agencies conducted nuclear and liquid metals research at the 90-acre ETEC Site. While DOE does not own any land at the SSFL (today owned by The Boeing Company), the Department is responsible for demolition of the DOE-owned buildings and remediation of the 290 acres of the ETEC Site and the associated Northern Buffer Zone. At the beginning of 2021, there were six DOE-owned buildings remaining to be addressed, along with final soil and groundwater remediation activities.

The cleanup of ETEC is regulated by the State of California Department of Toxic Substance Control (DTSC) and other affiliated agencies.

Calendar Year 2020 Accomplishments

- **Met an EM priority to begin demolishing the remaining DOE-owned buildings at the site after reaching agreement with California regulators — EM completed the demolition of the 10 structures that made up the former Radioactive Materials Handling Facility (RMHF)**
- **Reached agreement with California to begin demolition of the remaining eight structures at the Hazardous Waste Materials Facility**
- **Issued a record of decision (ROD) that outlines planned methods for addressing contaminated groundwater**

Planned Cleanup Scope 2021–2031

In 2021, EM expects to complete the demolition of all remaining DOE-owned buildings at the site. Over the coming decade, EM plans to initiate final groundwater treatment approaches, complete a ROD for soils cleanup, and begin soil remediation.

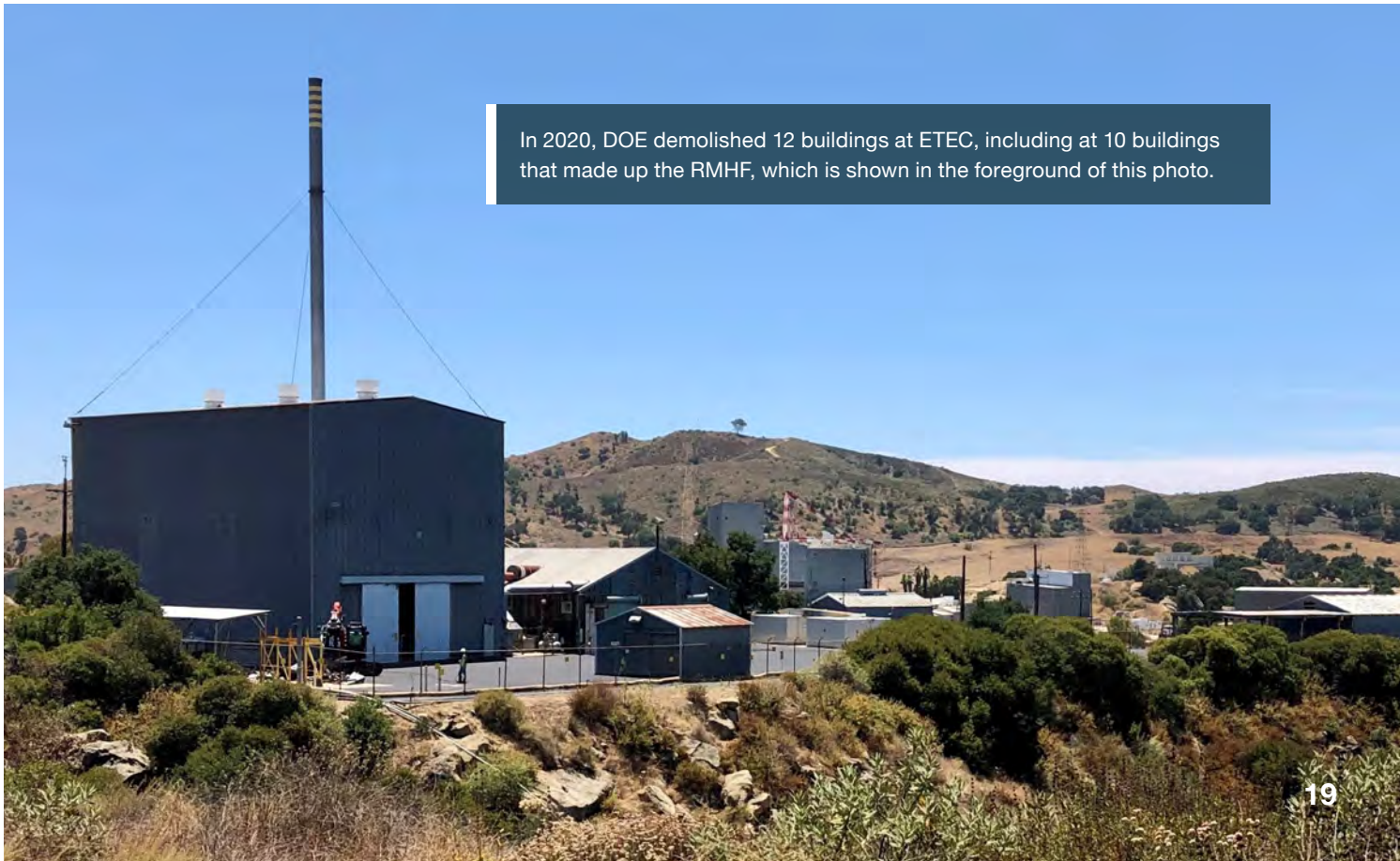
This photo shows four of the DOE-owned buildings remaining to be demolished at the Energy Technology Engineering Center.

Inside these containers, building debris is loaded onto a truck to be hauled off-site for disposal.

Key Regulatory Milestones 2021–2031

In 2010, DOE signed an Administrative Order on Consent with California regulators that required soil remediation activities to be completed by 2017. EM is actively working with California regulators on a path forward for soil remediation activities.

In May 2020, DOE and the DTSC reached a consent order for the demolition of 10 of the DOE-owned buildings at ETEC. In November 2020, the two parties amended the consent order to cover the demolition of the remaining eight DOE-owned buildings to proceed.



In 2020, DOE demolished 12 buildings at ETEC, including at 10 buildings that made up the RMHF, which is shown in the foreground of this photo.

Post-2031 Cleanup Scope

Remaining cleanup activities at ETEC post-2031 will be dependent, in large part, on decisions and progress made on soil and groundwater remediation during the next 10 years. In 2017, Boeing, the landowner, applied for and received a conservation easement, which ensures the preservation and protection of the unique and critical habitat, tribal cultural resources, and open space. The conservation easement is a legally enforceable property restriction that forever prohibits development or use of the land for residential or agricultural purposes. The land's future as open space habitat will preserve the land as a wildlife corridor, benefit local plants and animals (many of which are protected), and preserve its many cultural resources. The envisioned end state for the ETEC Site is an open space park for the surrounding community to enjoy and to provide habitat for the wildlife in the Santa Susana Mountains.

These asphalt and concrete slabs are what remains after the RMHF buildings were demolished, moving the ETEC project closer to its goal.

Hanford

Overview

The Hanford Site, a 580-square-mile section of semi-arid desert in southeast Washington, was established in 1943 as part of the Manhattan Project to produce plutonium for national defense. Construction began in October 1943 on the first industrial-scale nuclear reactor, B Reactor, which produced plutonium for the Trinity test and atomic bomb used to help end World War II. During a national security mission that lasted nearly five decades, nine nuclear reactors were built along the banks of the Columbia River to provide materials for five processing facilities that operated throughout the Cold War era. Hanford produced nearly two-thirds of the plutonium used in the U.S. nuclear weapons stockpile.

With the signing of the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement) in 1989 by the DOE, the Washington State Department of Ecology, and the Environmental Protection Agency (EPA), the primary mission of the Hanford Site shifted from national security to environmental cleanup. Hanford's current mission focuses on preparing to treat millions of gallons of waste in large underground tanks and reducing risks through remediation of contaminated areas, deactivation and decommissioning of facilities, groundwater treatment, and waste management (i.e., waste storage, treatment, and disposal).

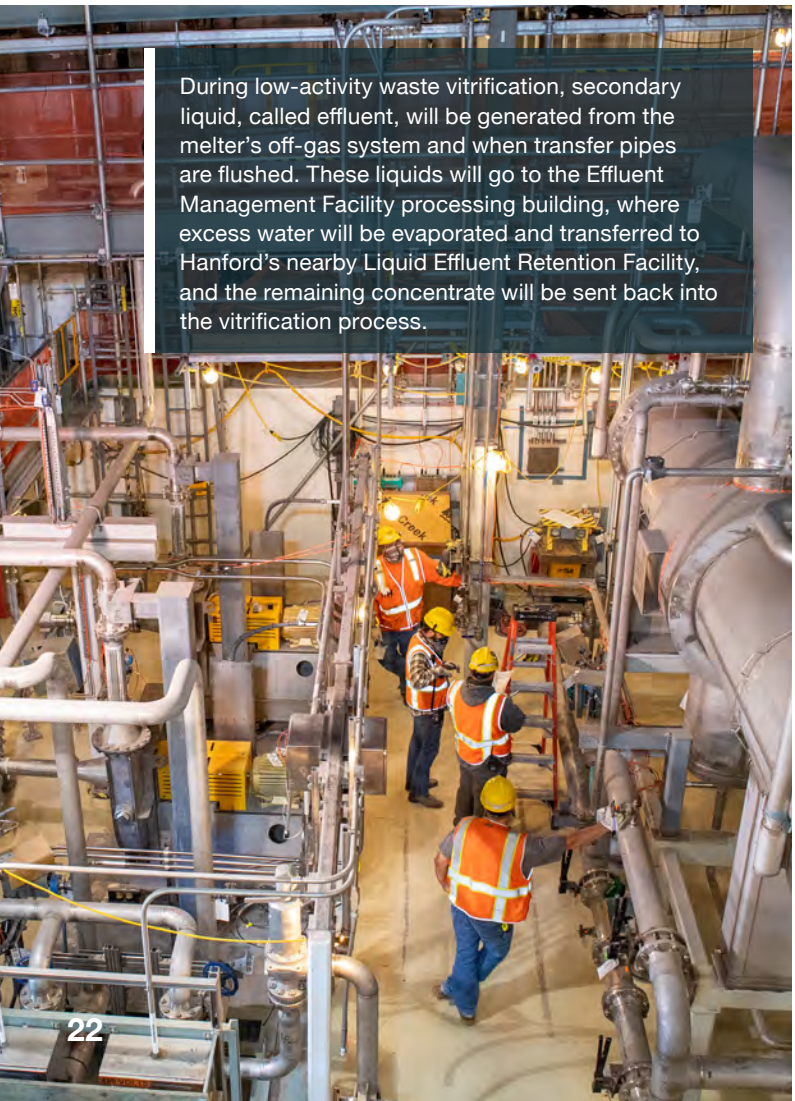
Cleanup of the Hanford Site is managed by two DOE offices, the Richland Operations Office (DOE-RL) and the Office of River Protection (DOE-ORP). DOE executes the cleanup and risk-reduction efforts at the site through several prime contractors and their subcontractors. DOE-RL serves as the Hanford Site property owner and oversees cleanup along the Columbia River and in Hanford's Central Plateau, including groundwater and waste site cleanup, facility cleanout and deactivation and decommissioning, management of solid waste and nuclear materials, and all site support services.

Congress established DOE-ORP in 1998 as a field office to manage the retrieval, treatment, and disposal of approximately 56 million gallons of radioactive tank waste stored in 177 underground tanks in the Central

A 175-ton crane operated by Hanford Mission Integration Solutions assisted a fellow contractor by lifting equipment onto a platform at Hanford's Cold Test Facility. The long reach of the crane could complete the job successfully, while team members provided additional safety enhancements, including fall protection and a work deck.

Plateau. The tank waste is material left over from nearly 50 years of plutonium production. In support of this mission, DOE-ORP is responsible for the safe operation of the tank farms and associated 200 Area facilities along with construction and operation of waste transfer systems and treatment facilities, including the Waste Treatment and Immobilization Plant (WTP) located in the Central Plateau.

EM leadership regularly engage a variety of stakeholders and tribal nations regarding the cleanup vision for the Hanford Site. These include regional elected officials, business leaders, and advisory board members representing more than 30 individual interests and the public at large. Through engagement during development of the Strategic Vision, stakeholders and tribal nations identified several areas in which the Strategic Vision for Hanford could be strengthened, including identifying established dates for noted milestones and completion dates for planned work, as well as goals that could allow quantifiable assessment of results.



During low-activity waste vitrification, secondary liquid, called effluent, will be generated from the melter's off-gas system and when transfer pipes are flushed. These liquids will go to the Effluent Management Facility processing building, where excess water will be evaporated and transferred to Hanford's nearby Liquid Effluent Retention Facility, and the remaining concentrate will be sent back into the vitrification process.

Calendar Year 2020 Accomplishments

- **Met an EM priority to complete construction of the Low-Activity Waste (LAW) Facility at the WTP**
- **Completed commissioning of the WTP Analytical Laboratory**
- **Began the installation of the TSCR system that will pretreat low-activity wastes**
- **Met an EM priority to complete demolition of the Plutonium Finishing Plant**
- **Initiated stabilization of aging underground structures to actively manage site risks**
- **Treated more than 2.4 billion gallons of contaminated groundwater**

Planned Cleanup Scope 2021–2031

The coming decade will see the successful launch of one of EM's largest and most significant cleanup activities — the start of tank waste treatment at Hanford through the DFLAW program. This is a goal EM has been pursuing for more than two decades at Hanford and will address one of the largest environmental challenges in the EM complex.

TANK WASTE TREATMENT

In 2021, commissioning of the DFLAW facilities will occur and DOE will work to complete startup of the WTP LAW Facility, Balance of Facilities, and Analytical Laboratory. Through the DFLAW program, EM anticipates the commencement of low-activity tank waste treatment by the end of 2023. Transitioning these facilities to operational status will commence the treatment of the most mobile form of tank waste, beginning an important new phase of the Hanford Site cleanup effort.

The DFLAW program requires a pretreatment system known as the TSCR system. This system will pretreat tank waste supernate in preparation for waste feed delivery when the WTP LAW Facility is operational. TSCR will be operational by the end of 2021. Waste feed will be staged in the AP Tank Farm until needed for operations. By the end of 2022, upgrades will also be completed at the Liquid Effluent Retention Facility (LERF) and Effluent Treatment Facility (ETF) to support the treatment of the anticipated secondary liquid effluent from DFLAW operations. Additionally, the Integrated

Disposal Facility, where the vitrified low-level tank waste will be disposed, will be completed and ready for operations. EM is preparing an analysis of alternatives for high-level waste (HLW) treatment to develop a realistic and achievable path forward for treating the high-level fraction of Hanford's tank waste.

RISK REDUCTION

Over the coming decade, the 324 Building will be demolished following the remote excavation of the contaminated soil underneath the facility. Additionally, the 105-K West Fuel Storage Basin will be deactivated and demolished, allowing the K-East and K-West reactors to be placed in interim safe storage. Active groundwater remediation systems will continue operating along the Columbia River and on the Hanford Central Plateau, reducing the risk that contaminated groundwater will leave the site.

DOE will complete the transfer of cesium and strontium capsules, currently at the Waste Encapsulation and Storage Facility, to safer and stable dry storage at a nearby Capsule Storage Area that is currently under construction. Stabilization activities at the Reduction-Oxidation Plant (REDOX), the Plutonium Uranium Extraction Plant (PUREX), and B Plant will place these facilities in a low-risk and low-cost surveillance and maintenance (S&M) configuration. Several high-risk facilities will be demolished, and waste site remediation efforts will continue throughout the Central Plateau with the waste disposed at the Environmental Restoration Disposal Facility. Finally, later in the decade, TRU waste shipments to WIPP are set to resume.

Key Regulatory Milestones 2021–2031*

Cleanup activities at Hanford are governed by the Tri-Party Agreement. Some cleanup activities are also governed by a 2010 Consent Decree between DOE and the State of Washington (as significantly amended by the court in 2016).

- **Complete construction of Effluent Management Facility — December 25, 2020**
- **Complete LERF and ETF upgrades to support DFLAW hot commissioning — April 15, 2023**
- **Complete LAW Facility hot commissioning and begin production-scale tank waste disposition — December 31, 2023**
- **Complete all response actions at 100-K, including placing the last two reactors in interim safe storage — September 30, 2024**
- **Transfer cesium/strontium capsules to dry storage — August 31, 2025**
- **Complete soil remediation and 324 Building demolition — September 30, 2025**
- **Complete single-shell tank retrievals in A/AX Farms — September 30, 2026**
- **Remove all mixed waste containers currently located at the Central Waste Storage Complex from outside Storage Areas A and B — September 30, 2026**

** Some scheduled milestones have been revised due to COVID restrictions, necessary protocols, and the resulting inefficiencies. DOE will continue to work with regulators to revise milestones, as needed.*

Post-2031 Cleanup Scope

Post-2031, cleanup activities at Hanford are expected to include continued tank waste retrieval and treatment, along with tank closure activities; construction of additional waste treatment facilities; and extensive facility demolition and waste site remediation activities. Most of the River Corridor and Outer Area remediation activities, including active groundwater treatment, will be nearly completed, allowing for a greater focus on the extensive waste sites and facilities surrounding the B Plant, PUREX, REDOX, U Plant, and T Plant processing canyons on the Central Plateau. The Hanford Site infrastructure will consistently be right-sized and reconfigured to support the focused efforts on the Central Plateau.

Idaho Cleanup Project

Overview

The INL Site, located on the ancestral lands of the Shoshone and Bannock Tribes in southeast Idaho, was established in 1949 as the National Reactor Testing Station. The original mission of the INL Site was to develop and test civilian and defense nuclear reactor technologies and manage SNF. Fifty-two reactors — most of them first of a kind — were built at the site, including the Navy's first prototype nuclear propulsion plant. Of the 52 reactors, four remain in operation.

In 1951, the INL Site achieved one of the most significant scientific accomplishments of the century — the first use of nuclear fission to produce a usable quantity of electricity at the Experimental Breeder Reactor No. 1 (EBR-I). The EBR-I is now a registered National Historic Landmark open to the public.

The Idaho Cleanup Project (ICP) at the INL Site is responsible for treating, storing, and dispositioning a variety of radioactive and hazardous wastes; removing and dispositioning targeted buried waste; removing or deactivating unneeded facilities; and managing — and ultimately removing — SNF and HLW from Idaho. Activities are primarily performed at the RWMC and the Idaho Nuclear Technology and Engineering Center (INTEC) facilities.

ICP conducts stakeholder briefings regularly with state, tribal, and local officials. ICP has a good working relationship and often provides updates about cleanup activities to the Shoshone-Bannock Tribes, the Idaho Department of Environmental Quality, the Idaho Cleanup Project Citizen's Advisory Board, and the Idaho congressional delegation's regional staff.

Crews transfer Experimental Breeder Reactor-II SNF to the Radioactive and Scrap Waste Facility at the Materials and Fuels Complex.

Calendar Year 2020 Accomplishments

- Continued Outage J facility modifications at the IWTU to prepare for start of operations in 2021
- Commenced contact-handled sludge treatment operations in the Advanced Mixed Waste Treatment Facility (in addition to ongoing sludge treatment operations in the Accelerated Retrieval Project VII enclosure)

Planned Cleanup Scope 2021–2031

Over the coming decade, cleanup activities at the INL Site will focus on completing treatment of remaining liquid sodium-bearing waste, buried waste exhumation, shipment of remaining TRU waste, and decommissioning and closure of facilities at the RWMC and INTEC.

At the RWMC facilities, buried waste exhumation and sludge processing operations are expected to be completed by the end of 2021. With the finish of waste processing operations, facility closures and demolitions will commence at the Subsurface Disposal Area (SDA). The SDA will be closed and permanently capped to meet a 2028 requirement. RWMC area closure is planned for 2028.

Activities at INTEC will increase for sodium-bearing waste, calcine, and SNF operations during the coming decade. Sodium-bearing waste processing at the IWTU is expected to finish by the end of 2028. The calcine retrieval and processing systems needed to make the waste road-ready are in their early stages of development. Mockups of the waste retrieval and bin set cleaning systems are being tested and readied for installation. The capabilities for calcine waste processing will be developed, installed, and placed into operations. For SNF, wet-to-dry storage transfers will be completed by the end of 2023. Additionally, fuel packaging capabilities will be developed, installed, and packaging operations commenced to make the fuel ready for shipment out of Idaho.

The Integrated Waste Treatment Unit.

Post-2031 Cleanup Scope

At INTEC, HLW processing and SNF packaging are expected to be completed in the 2030s. In support of the Office of Nuclear Energy, processing and shipping remote-handled TRU, MLLW, and low-level waste (LLW) will continue into the 2040s. After closure of the RWMC and INTEC facilities, the area will continue to be monitored and assessed for any further needed remediation as part of DOE's long-term stewardship.

Key Regulatory Milestones 2021–2031

The regulatory milestones are contained in the 1995 Idaho Settlement Agreement (ISA), 2019 Supplement Agreement (SA), the Agreement to Implement the ISA (AI), the Site Treatment Plan (STP), and the Federal Facility Agreement Compliance Order (FFACO). The milestones include:

- Idaho provides at least 55 percent of transuranic waste shipments to WIPP, based on an annual three-year average (SA)
- Commence sodium-bearing waste operations and fill one canister — June 30, 2021 (STP)
- Complete 100th canister of sodium-bearing waste — September 30, 2021 (STP)
- Complete targeted waste exhumation from SDA — December 31, 2023 (AI)
- Complete SNF wet-to-dry storage transfers — December 31, 2023 (ISA)
- Commence treatment of calcine waste — March 31, 2024 (STP)
- Complete certification of original volume TRU waste — September 30, 2024 (STP)
- Complete sodium-bearing waste operations — September 30, 2028 (STP)
- Complete SDA cap — December 31, 2028

Lawrence Livermore National Laboratory

Overview

Located in California, LLNL was established in 1952 as a multidisciplinary R&D center focusing on weapons development and stewardship and homeland security. The laboratory is operated by Lawrence Livermore National Security, LLC, for the NNSA. At the LLNL main site, EM has been tasked by Congress to demolish several excess facilities.

LLNL Site 300 is a remote experimental testing facility where the Department conducts research, development, and testing of high explosives and integrated non-nuclear weapons components. EM is responsible for addressing the remaining groundwater contamination issues at Buildings 812, 850 and 865 at Site 300.

LLNL Building 280 reactor to be removed.

Calendar Year 2020 Accomplishments

- **Met an EM priority to award a contract to remove the Pool Type Reactor from within Building 280**
- **Awarded a contract for demolition of Building 175 (MARS E-Beam Facility)**

Planned Cleanup Scope 2021–2031

Over the next decade, based on NNSA mission needs and funding availability, EM anticipates continuing to perform demolition work on remaining higher risk excess facilities. These facilities include Building 251 (Heavy Elements Facility), Building 292 (Rotating Target Neutron Source), Building 241 (Pluto Project Testing and Fabrication Facility), Building 343 (Explosives and High Pressure Testing Facility), LS212/Building 212 (Accelerator Facility), and other process contaminated facilities.

At Site 300, EM will move forward with selecting and implementing remedial actions for Building 812, Building 865, and Building 850 groundwater. An amended ROD documenting the selected treatment path forward is expected to be issued in 2026. Implementation of the selected path forward is anticipated to be initiated in 2029, and responsibility for the completed remedies is anticipated to be transferred to NNSA in 2031.

Key Regulatory Milestones 2021–2031

The key regulatory milestones listed below for soil and water remediation are required by the Lawrence Livermore National Laboratory Site 300 Federal Facility Agreement and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

- **Final remedial investigation/feasibility study (RI/FS) for Building 865 part 2 — September 26, 2022**
- **Final RI/FS for Building 812 — May 29, 2023**
- **Final proposed plan for Building 812, Building 865, Building 850 perchlorate in groundwater — February 18, 2025**
- **Final ROD amendment for Building 812, Building 865, and perchlorate in Building 850 groundwater — May 25, 2026**
- **Final remedial design for Building 812, Building 865, and perchlorate in Building 850 groundwater — August 16, 2027**

Post-2031 Cleanup Scope

None identified at this time, although there may be additional work if additional excess facilities are identified and transferred to EM for demolition.

Los Alamos National Laboratory

Overview

The EM Los Alamos Field Office (EM-LA) is dedicated to the cleanup of legacy contamination of radioactive and chemical materials and waste resulting from operations during the Manhattan Project and Cold War eras at LANL in New Mexico. EM-LA's cleanup scope includes legacy waste remediation and disposition, soil and groundwater remediation, and deactivation and decommissioning of excess buildings and facilities. Newly generated waste (waste post-1999) at LANL is the responsibility of NNSA.

Of the more than 2,100 contaminated areas originally identified for remediation at LANL, more than half (approximately 1,100) have been cleaned and closed, ranging from small spill sites with a few cubic feet of contaminated soil to large landfills encompassing several acres. There are two legacy groundwater contamination plumes that are being characterized and managed by EM-LA using subsurface control techniques. One plume contains hexavalent chromium and is being managed by a pump-and-treat system on an interim basis while a final remedy is under development. The second plume has chemical constituents related to early explosives work and is undergoing characterization to determine potential remediation alternatives.

Approximately 400,000 cubic meters of legacy hazardous and radioactive waste is located at LANL. Most of this waste is buried in 26 material disposal areas (MDAs) dispersed throughout LANL. Eight of these MDAs have been closed. There are approximately 3,500 cubic meters of legacy TRU waste stored at Technical Area 54, MDA G destined for disposal at WIPP. The waste is stored in a configuration that is protective of the environment, workers, and the public.

In the first half of 2020, small amounts of legacy material with very low levels of contamination were discovered in land that had been previously conveyed to Los Alamos County. Subsequent excavation of the area, known as the Middle DP Road Site, unearthed small amounts of legacy material that was subsequently removed with no impact on the environment or to the community. EM-LA will conduct additional screening on the site in 2021.

An environmental professional installs a compost sock to control migration of storm water from a historical LANL Site in Pajarito Canyon.

As part of its ongoing commitment to transparency and to maintaining a dialog with local communities and Pueblos on legacy cleanup, EM-LA frequently participates in public discussions on its mission at stakeholder-led events, such as Northern New Mexico Citizens' Advisory Board meetings, Los Alamos County Council meetings, and Regional Coalition of LANL Communities meetings. EM-LA also hosts monthly Technical Working Group meetings with stakeholders and quarterly Environmental Management Cleanup Forums, both of which focus on ongoing cleanup activities and future cleanup priorities.

Calendar Year 2020 Accomplishments

- **Remediated/repackaged 67 cubic meters of TRU waste for final disposal**
- **Completed the investigation, remediation, and restoration of soil under the Known Cleanup Sites Campaign to meet commitments to the State of New Mexico**
- **Disposed of 342 cubic meters of LLW and MLLW, exceeding the goal of 325 cubic meters**
- **Remediated 1,487 cubic meters of contaminated soil and debris**
- **Performed initial investigation and remediation of the Middle DP Road Site**

Planned Cleanup Scope 2021–2031

Over the coming decade, DOE will focus on addressing the groundwater contamination plumes, processing TRU waste stored aboveground, and retrieving below-ground TRU waste for off-site disposal. DOE will also work to complete disposition of LANL TRU waste currently in storage at the Waste Control Specialists (WCS) commercial disposal site in Texas. Depending on the disposition approach needed, DOE hopes to ship the TRU waste containers stored at WCS to WIPP in the near term. However, testing and analysis of the drum contents is ongoing and DOE's ability to ship is largely dependent upon the outcome of those analyses.

Characterization of the Middle DP Road Site will continue in 2021 with final remediation expected in 2022, depending on the results of the screening effort.

Legacy cleanup at LANL is organized into 18 campaigns. Work is ongoing in 11 campaigns, while three campaigns have been completed. Site investigations will continue and, where required, contaminated soil will be removed from the site and transported for off-site disposal with sampling to confirm compliant cleanup. In 2022, a final remedy for the hexavalent chromium plume is expected to be identified and proposed for regulatory approval, while the Chromium Plume Interim Measure will continue operation. In 2023, the final remedy for the Royal Demolition Explosives groundwater plume will similarly be proposed for regulatory approval.

Beginning in 2024, deactivation and decommissioning of Building 257, industrial waste lines, and DP West slabs in Technical Area 21 (TA-21) will be performed. This will be followed by the investigation and remediation of the TA-21 Solid Waste Management Units and Areas of Concern (AOC). Aggregate area campaigns, including the Southern External Boundary,

An EM TRU waste shipment from the Radioassay and Nondestructive Testing facility at LANL departs for WIPP.

Pajarito Watershed, and Upper Watershed, will be completed in succession, finishing in 2026, and will involve the removal of a variety of materials. The latter part of the decade will see considerable focus on completing the closure of disposal areas.

Over the coming decade, work at TA-54 will center on processing and disposition to off-site disposal facilities of aboveground waste inventories and retrieval, processing, and disposition of below-ground waste placed in long-term storage configurations. Inventory reduction is essential to allow demolition of structures within MDA G and will allow permanent closure of MDA L and MDA G. Waste treatment process lines, necessary to meet off-site disposal facility requirements, are currently active, but will be modified to address the range of materials requiring treatment. Retrieval processes will be developed for below-ground legacy waste, as necessary, to exhume waste containers of various sizes and content. Some waste items will require size reduction to facilitate packaging for transport.

Key Regulatory Milestones 2021–2031

The 2016 Consent Order between DOE and the New Mexico Environment Department (NMED) establishes an annual process by which both agencies jointly determine cleanup activities. Cleanup campaigns in the 2016 Consent Order are organized using a risk-based approach to grouping, prioritizing, and completing corrective action activities. Campaign activities may be subject to two types of deadlines: milestones within the current fiscal year, which are enforceable, and targets in the subsequent two fiscal years, which are not enforceable. DOE and NMED establish approximately 10 to 20 Consent Order milestones annually.

A stormwater sampling station in Pueblo Canyon is inspected by an environmental professional.

Post-2031 Cleanup Scope

Activities associated with the deactivation and decommissioning of TA-54 structures and subsequent closure of MDA G and MDA L are expected to extend beyond 2031. In addition, remote-handled TRU waste buried in 33 shafts at TA-54 MDA G is slated for exhumation and disposal at WIPP. This work will require additional facility infrastructure to ensure the waste is safely excavated and processed to enable shipment to WIPP.

Moab

Overview

The Moab Uranium Mill Tailings Remedial Action Project (Moab Site or Project) is located in southeastern Utah. Its 480-acre Moab Site includes a former uranium-ore processing facility that operated under private ownership from 1956 to 1984. The Project includes relocation of the estimated 16-million-ton pile of uranium mill tailings and other contaminated material near the Colorado River to an engineered disposal cell constructed 30 miles north near Crescent Junction, Utah. The scope also includes active remediation of contaminated groundwater at the Moab Site. After contaminated soil, tailings, debris, vicinity properties, and groundwater are remediated, the Moab Site will be transferred to LM for continued groundwater monitoring and potential reutilization of the site. The Crescent Junction Site will also be transferred to LM for monitoring and required stewardship of the disposal cell.

Calendar Year 2020 Accomplishments

- **Met an EM priority to dispose of a cumulative total of 11 million tons of uranium mill tailings out of the original total of 16 million tons**
- **Expanded a portion of the Crescent Junction disposal cell**
- **Removed a cumulative total of more than 950,000 pounds of ammonia and 5,300 pounds of uranium from groundwater, diverting those constituents from the Colorado River**

Planned Cleanup Scope 2021–2031

Over the next several years, DOE expects to ship nearly one million tons of uranium mill tailings annually to the Crescent Junction disposal site. As a result, DOE expects to complete the relocation and disposal of the pile by CY 2029. It will take an additional two years to complete the restoration of the Moab Site, dispose of potentially contaminated equipment and intermodal containers, and to install the cover on the disposal cell.

A gantry crane at the Moab Site is poised to lift a container loaded with mill tailings onto the train.

DOE also plans to continue transportation and disposal of oversize debris from the Moab Site, including 14 autoclaves decommissioned by the Atlas Minerals Corporation. They are assumed to weigh at least 40 tons each and could be filled with asbestos. Transportation of oversize debris will continue through CY 2028.

Key Regulatory Milestones 2021–2031

- None

Currently, the Moab Project is building an armored rock disposal cell cover at the Crescent Junction Site. DOE is evaluating an alternative cover to replace the one pictured here.

This pond at the Moab Site holds water that is pumped from the Colorado River. The water is used for groundwater injection activities. The pond is also utilized for dust suppression and revegetation efforts.

Post-2031 Cleanup Scope

The main cleanup activities at the Moab Site are scheduled to be completed in 2029, with site responsibility to be transferred to LM approximately two years later after the remaining site restoration work is completed. The Crescent Junction Site will be transferred to LM in this time frame also.

Every five years, a group of Grand County, Utah, volunteers revise a community vision for the Moab Site should the property be available for reuse after the Project is complete. Stakeholders involved in the update include representatives from the city of Moab; the Bureau of Land Management; Grand County; Utah Division of Forestry, Fire and State Lands; the National Park Service; and local citizens. The public's vision for reuse of the site includes: a park with an event center, multipurpose play areas, a lined lake or swimming pool facility, transportation facilities, a boat ramp, federal offices, a plaza with an "artist village" and performing arts center, trails, and an information center. The committee will revisit the community vision again in 2023.

Nevada National Security Site

Overview

The NNSS was used from 1951 to 1992 to conduct a total of 100 atmospheric and 828 underground nuclear weapons tests. As a result, some groundwater, surface soils, and industrial facilities were contaminated on the NNSS and the surrounding Nevada Test and Training Range. The DOE's EM Nevada Program is responsible for completing cleanup actions at these historic nuclear testing locations, as well as waste disposal for both on-site and off-site generators.

In accordance with the Federal Facility Agreement and Consent Order (FFACO), the EM Nevada Program is responsible for environmental corrective actions at 148 surface soil locations, 1,013 industrial locations, and groundwater contaminated by historical nuclear testing. Cleanup has been completed at all surface soil sites covered in the FFACO, an accomplishment reached six years ahead of schedule, with cost savings of approximately $67 million in federal funding. Cleanup has also been completed at 99 percent of all industrial sites, with only two legacy industrial facilities remaining to be addressed.

Concerning groundwater contamination, the EM Nevada Program is working to identify contaminant boundaries, restrict access to contaminated groundwater, and implement a long-term monitoring program. Because of the vast and complex geology of the NNSS, groundwater contamination is grouped into characterization areas based on location and similar geology. Three of the four groundwater characterization areas the EM Nevada Program manages have now transitioned into long-term monitoring. Notably, the Rainier Mesa/Shoshone Mountain groundwater area was closed in 2020, three years ahead of schedule, with savings of approximately $5 million in federal funding.

The EM Nevada Program welcomes stakeholder feedback through a variety of means, including regular meetings with intergovernmental stakeholders and the Nevada Site Specific Advisory Board (NSSAB). The NSSAB reviewed and provided input on EM Nevada's

Sunset view of a drill site for a groundwater characterization well on Pahute Mesa.

2021 Strategic Vision, in addition to incorporating items from the Program's planned cleanup scope and end state into the Board's self-identified Work Plan for FY 2021.

Calendar Year 2020 Accomplishments

- **Met an EM priority to complete the transfer of long-term stewardship responsibilities for 70 closed sites on and around the Tonopah Test Range to LM — ahead of schedule and under budget**
- **Closed the Rainier Mesa/Shoshone Mountain groundwater area three years ahead of schedule, with approximately $5 million in savings**
- **Closed the Yucca Flat/ Climax Mine groundwater area, bringing 75 percent of all NNSS groundwater areas to end-state completion**
- **Safely and securely disposed of approximately 500,000 cubic feet of classified and LLW/MLLW in support of DOE sites involved with nuclear research, development, and testing, and ongoing national security and science missions**

Planned Cleanup Scope 2021–2031

Over the coming decade, EM expects to complete its current scope of cleanup activities at the NNSS. EM Nevada will continue to closely collaborate with local stakeholders, including state and local officials, the NSSAB, Intergovernmental Liaisons group, Low-Level Waste Stakeholders Forum, and others, to complete its cleanup mission in a manner that prioritizes the protection of the public, communities, and the environment.

A desert tortoise at the NNSS.

GROUNDWATER/SOIL REMEDIATION

The EM Nevada Program is working to accelerate the closure of the remaining groundwater areas by approximately two years, which would result in approximately $80 million in anticipated savings.

At the Pahute Mesa groundwater characterization area, the corrective action investigation phase (including completion of the flow and transport model, external peer review, and regulatory approval of the corrective action plan) is anticipated to be completed by the end of 2023. By the end of 2027, EM anticipates completing the model evaluation phase for the Pahute Mesa, including the drilling of four model evaluation wells, data analysis, flow and transport model adjustments, and regulatory approval to move to the final phase. By the end of 2028, EM anticipates transitioning the Pahute Mesa area into the long-term monitoring phase. This action will complete groundwater corrective action activities and long-term monitoring will be transferred to the landlord of the NNSS, the NNSA.

Long-term monitoring of the soil corrective action sites on the NNSS will remain the responsibility of the EM Nevada Program until all FFACO-required environmental corrective actions on the NNSS are completed in or around 2028. At that time, any sites requiring future post-closure monitoring and use restrictions per the FFACO will be managed by NNSA.

INDUSTRIAL FACILITIES

The two remaining industrial facilities are the Engine Maintenance Assembly and Disassembly (EMAD) facility and Test Cell C (TCC) Ancillary Buildings and Structures, which consist of eight sites required to be addressed under the FFACO. By the end of 2022, the EM Nevada Program hopes to receive regulatory approval on the corrective action strategy for the EMAD and TCC sites. In 2023, the EM Nevada Program plans to demolish the TCC buildings to grade, dispose of the generated waste, and close in place any contamination located below grade. In 2025, the EM Nevada Program plans to complete similar demolition and waste disposal activities for the EMAD.

Long-term monitoring of NNSS industrial sites will remain the responsibility of the EM Nevada Program until all FFACO-required environmental corrective actions are completed in, or around, 2028. At that time,

Front loader places soil over LLW in an engineered disposal cell at the Area 5 Radioactive Waste Management Site.

any sites requiring future post-closure monitoring and use restrictions per the FFACO will be managed by NNSA.

WASTE DISPOSAL ACTIVITIES

The EM Nevada Program will continue to support cleanup activities across the DOE complex by providing disposal capacity and services for up to 1.2 million cubic feet annually of LLW, MLLW, and classified waste through 2030. In 2021, the EM Nevada Program will aid in the completion of the Area 5 Radioactive Waste Management Facility infrastructure improvements, including the addition of new power lines as well as a drainage berm and channel.

Key Regulatory Milestones 2021–2031

EM Nevada activities are primarily regulated by the FFACO. A supplemental Agreement in Principle between the Department and the state exists to provide a role for the Nevada Division of Environmental Protection in oversight of NNSS LLW disposal operations.

- **Submit the TCC closure report to the regulator — April 28, 2023**
- **Submit the EMAD facility closure report to the regulator — September 30, 2024**
- **Transition post-closure monitoring for most sites to NNSA — September 30, 2027**
- **Transition post-closure monitoring of Pahute Mesa to NNSA — September 30, 2028**

Post-2031 Cleanup Scope

The EM Nevada Program is scheduled to reach end state for its cleanup mission no later than 2030, which will ultimately involve the completion of all active remediation activities and the conveyance of remediated sites to NNSA for long-term stewardship. It is currently anticipated that there will be a need within the DOE complex for NNSS waste disposal beyond 2030.

Oak Ridge

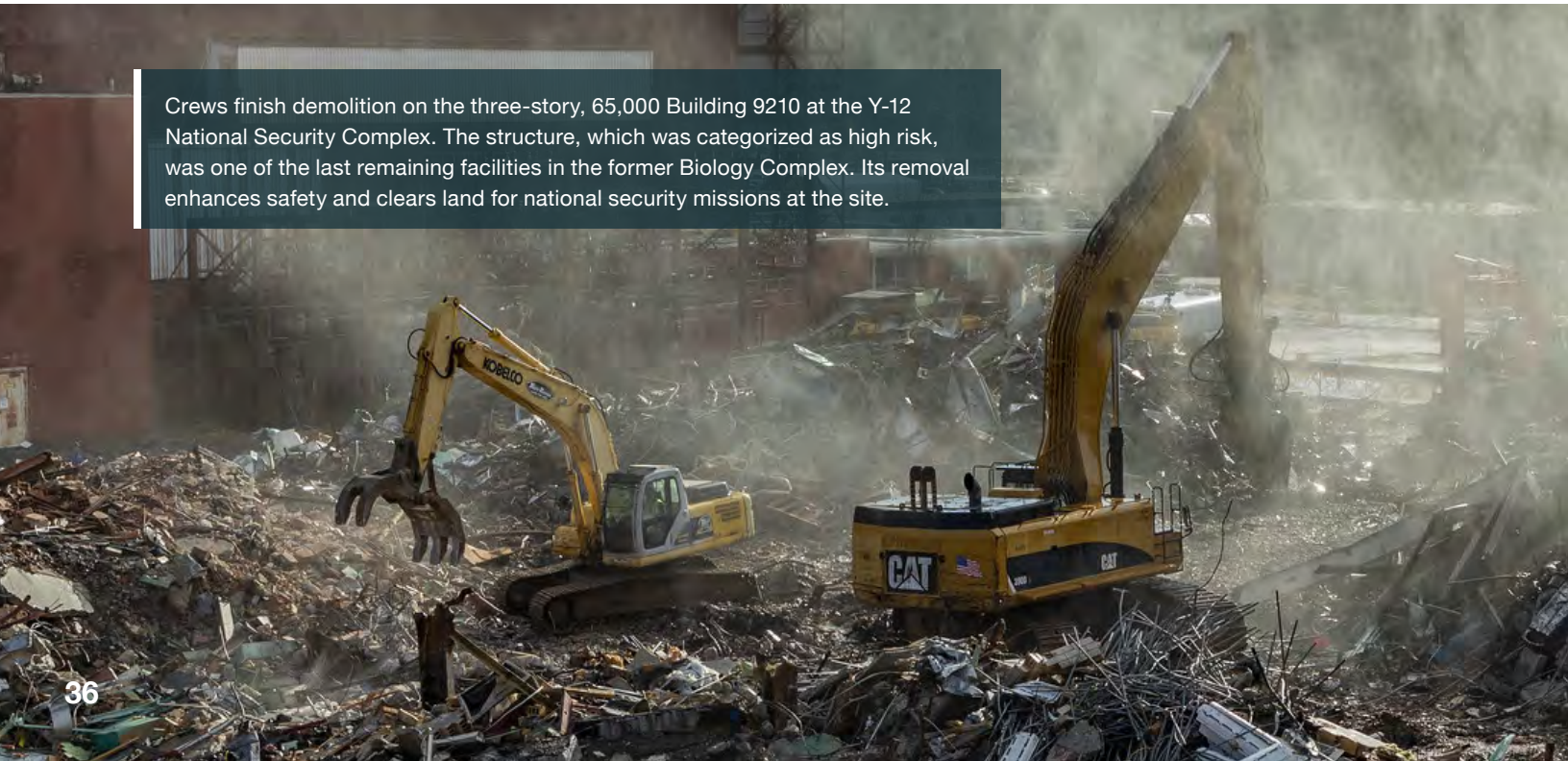
Overview

The Oak Ridge Site, located in eastern Tennessee, is one of the three original sites in the Manhattan Project. The U.S. Army Corps of Engineers began acquiring land in the area in October 1942. By March 1943, 56,000 acres were sealed behind fences and major industrial facilities were under construction. The K-25 and Y-12 plants were built to explore different methods to enrich uranium, while the X-10 Site was established as a pilot plant for the Graphite Reactor and to explore methods for the production of plutonium.

Throughout the following decades, the three sites — K-25 (present day ETTP), X-10 (present day ORNL), and Y-12 — purified isotopes, conducted advanced research, manufactured weapons components, and enriched uranium. These activities created environmental legacies that placed the Oak Ridge Reservation on EPA's National Priorities List in 1989.

The Oak Ridge Office of Environmental Management (OREM) is the landlord of ETTP, and it is responsible for the CERCLA cleanup at Y-12 and ORNL. OREM has achieved significant risk reduction across the Oak Ridge Reservation, including the removal of all facilities at ETTP in 2020 four years ahead of schedule, avoiding $500 million in costs to taxpayers. With demolition complete at ETTP, OREM has transitioned the skilled, experienced workforce from there to address the many high-risk facilities at ORNL and Y-12. OREM's cleanup of these sites will address DOE's largest inventory of high-risk, excess contaminated facilities (former research reactors, isotope production facilities, and former process buildings considered to be the worst of the worst); eliminate the site's remaining inventory of uranium-233; remediate areas with dense mercury contamination; and provide valuable real estate for NNSA and SC missions.

Throughout all this work, OREM works to keep the surrounding communities in Anderson and Roane counties and the city of Oak Ridge safe and informed. The program also fosters and maintains strong partnerships by involvement with organizations focused on economic opportunities including the East Tennessee Economic Council, Energy Technology and Environmental Business Association, Chamber of Commerce, and the Community Reuse Organization of East Tennessee. Additionally, OREM leadership provides updates and is available to answer the public's questions at monthly Oak Ridge Site Specific Advisory Board meetings. OREM representatives



Crews finish demolition on the three-story, 65,000 Building 9210 at the Y-12 National Security Complex. The structure, which was categorized as high risk, was one of the last remaining facilities in the former Biology Complex. Its removal enhances safety and clears land for national security missions at the site.

also correspond with the city's Environmental Quality Advisory Board and the Roane County Environmental Review Board.

Calendar Year 2020 Accomplishments

- **Met an EM priority to achieve Vision 2020 by completing demolition at ETTP — more than 500 structures totaling 13 million square feet were demolished; this achievement marked the first cleanup of a uranium enrichment complex in the world**
- **Finished construction and opened the K-25 History Center at ETTP**
- **Began demolition on the final structures in Y-12's Biology Complex**
- **Began construction on the Sludge Processing Mock Test Facility, which will mature technologies needed to process Oak Ridge's 500,000-gallon inventory of sludge TRU waste**

Planned Cleanup Scope 2021–2031

Over the next 10 years, OREM expects to make significant progress on cleanup activities at Y-12 and ORNL to help support the important missions of NNSA and SC, as well as eliminating one of the largest remaining security risks at ORNL.

While OREM successfully completed demolition at ETTP, soil and groundwater remediation and closure activities remain. OREM is slated to complete remaining soil remediation at ETTP by 2024. OREM has also reached agreement with Tennessee state regulators to complete necessary RODs for groundwater remedies at ETTP by 2026, and to completion by 2028. Much of land is expected to be transferred to the community for industrial redevelopment.

EM recently completed removing one of the two remaining structures at the former Radioisotope Development Lab (Building 3026) at the Oak Ridge National Laboratory (ORNL). The demolished structure was known as the West Bank Hot Cell. Characterization of the East Bank Hot Cell, the last remaining structure, has already started. Demolition and waste removal will follow characterization, and that project is scheduled for completion in 2022.

In 2021, the remaining buildings in Y-12's Biology Complex, which span more than 320,000 square feet, will be demolished. This project will eliminate five high-risk, excess contaminated facilities, and will open land for national security missions. OREM will also continue deactivation work at major high-risk excess contaminated facilities at Y-12 and ORNL. These projects will eliminate risks, enhance safety, enable modernization, and clear land for new research and national security missions to meet the needs of the nation. In 2022, OREM expects to award a new contract, employing EM's end-state contract model, for continued cleanup activities at Y-12 and ORNL.

In 2023, OREM is scheduled to complete mockup testing for sludge processing. This involves finishing construction on the Sludge Processing Mock Test Facility and operating that facility to assist in technology testing and maturation related to future processing of Oak Ridge's inventory of sludge TRU waste. In 2025, the Outfall 200 Mercury Treatment Facility is expected to be operational at Y-12. The facility will be able to treat 3,000 gallons of water per minute, and it will include a two-million-gallon storage tank to collect stormwater.

OREM is now expected to finish processing, downblending, and disposing the remaining inventory of uranium-233 stored at ORNL by 2027 based on the contractor's planned approach. This is EM's highest priority at ORNL because it constitutes a Category I quantity of highly enriched fissile material and drives the security posture of the site. The completion of this project will significantly reduce risks and security costs, and it will enable deactivation of a Manhattan Project-era facility located in the heart of ORNL. By 2028, as a result of revised shipping assumptions, all of the processing and shipments of Oak Ridge's inventory of legacy TRU debris waste will be completed. This inventory includes both contact-handled and remote-handled waste.

By the late 2020s, OREM expects to complete construction on the first phase of the new Environmental Management Disposal Facility. This crucial facility will provide the on-site waste disposal capacity for LLW generated by completing cleanup at ORNL and Y-12. The facility is anticipated to avoid more than $700 million in costs that would be required if all LLW were disposed at off-site facilities.

Key Regulatory Milestones 2021–2031

Cleanup of the Oak Ridge Reservation is governed by a Federal Facility Agreement between DOE, EPA, and the Tennessee Department of Environment and Conservation. This agreement establishes the guidelines and milestones for cleanup in Oak Ridge in accordance with CERCLA and other laws.

- Complete demolition on the remaining Biology Complex buildings at Y-12 — January 2022
- Complete the final ETTP Main Plant Area groundwater ROD — January 2022
- Complete soil remediation at the EU-5 area of Y-12 — April 2022
- Complete the Zone 1 soil ROD for ETTP — May 2022
- Complete demolition of Building 3026-D — September 2022
- Complete pre-demolition of ORNL Central Campus Research Reactor Complex — September 2023
- Complete demolition of Building 3005 and Building 3010 — September 2023

A rendering of the $10 million Sludge Processing Mock Test Facility, which will play a vital role in maturing technologies needed to begin processing Oak Ridge's 500,000-gallon inventory of TRU sludge waste. Construction is already underway.

Post-2031 Cleanup Scope

At Oak Ridge, the remaining work will focus on completing cleanup at ORNL and Y-12. This will include deactivating and demolishing the remaining excess contaminated facilities, remediating soil and groundwater, and addressing source contamination. OREM will also work to complete the processing of 530,000 gallons of TRU sludge and operate the program's waste treatment and disposal facilities.

Paducah

Overview

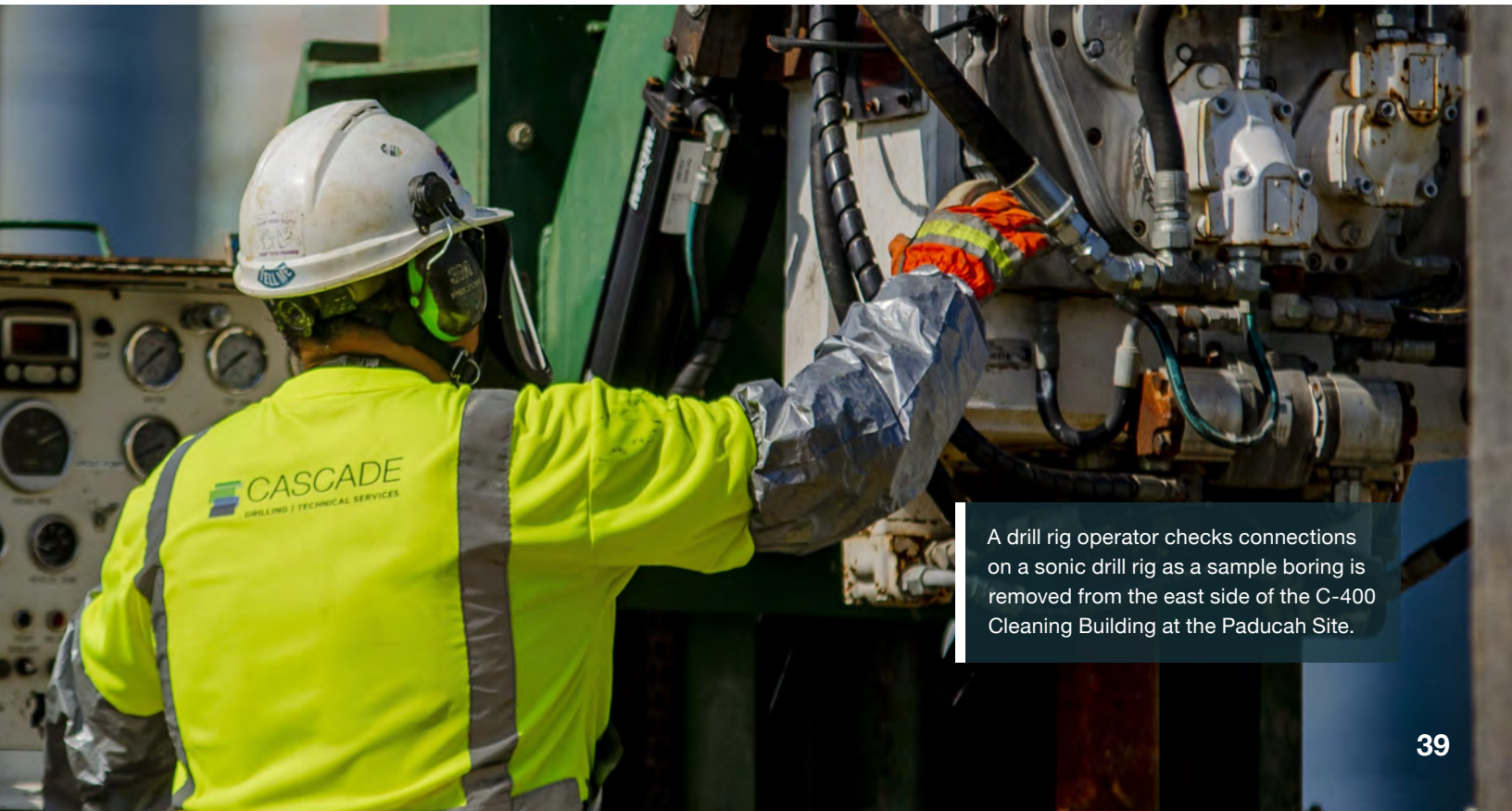
In 1950, the Atomic Energy Commission (AEC), a predecessor agency to DOE, selected a 3,556-acre tract of government-owned land near Paducah, Kentucky, in McCracken County, as the location to construct a second gaseous diffusion uranium enrichment plant (GDP) to support U.S. national security needs. The Paducah GDP enriched uranium from 1952 to 2013 and was the last government-owned uranium enrichment facility operating in the United States. The Paducah GDP produced low-enriched uranium originally as feedstock for nuclear weapons materials and later for commercial nuclear power plants.

Environmental cleanup of the Paducah GDP began in 1988 when groundwater contamination resulting from plant operations was discovered outside of the DOE property. Environmental cleanup includes remediation of groundwater, surface water, soil, lagoons, and burial grounds. All of the more than 500 facilities and buildings will be evaluated for removal and/or remediation, including four process buildings measuring more than 74 acres under roof.

The Paducah Site is also home to one of two DOE DUF6 conversion plants. DUF6 was a byproduct from the uranium enrichment operations at the three enrichment plants in Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. DOE has a total inventory of approximately 67,000 steel cylinders at the Portsmouth and Paducah sites. At Paducah, the DUF6 conversion facility began operation in 2011.

Calendar Year 2020 Accomplishments

- **Completed pre-demolition scope and deactivation activities for the C-400 Building**
- **Removed approximately 750,000 pounds of hazardous refrigerant from the site**
- **Disposed of 22 cold traps that removed 42 percent of the enriched uranium stored at the site**
- **Processed 1,187 metric tons of inventory at the DUF6 conversion plant**
- **Completed the first shipment of DUF6 oxide for disposal**



A drill rig operator checks connections on a sonic drill rig as a sample boring is removed from the east side of the C-400 Cleaning Building at the Paducah Site.

In 2020, the DUF6 Conversion Project completed the first of two pilot shipments of uranium oxide from the Paducah Site in Kentucky — six cylinders via specially modified railcar — off-site to a licensed disposal facility. In 2021, the project aims to complete the second pilot shipment, an alternate conveyance method with up to 12 cylinders per railcar. Routine shipments from the Portsmouth/Paducah Project Office sites in Kentucky and Ohio are part of EM's Strategic Vision.

Planned Cleanup Scope 2021–2031

At Paducah, work over the next decade will continue to focus on remediating a trichloroethylene (TCE) groundwater contamination plume, along with activities to prepare the site's former uranium enrichment process buildings for demolition.

In 2021, the Paducah Site will complete a major milestone in right-sizing utilities to meet future cleanup needs. DOE is expected to complete construction of a new Tennessee Valley Authority substation and tie-line connecting to the plant, allowing the site to significantly reduce electrical usage. Additionally, this action will kick off the deactivation of the C-531 switchyard for potential reuse. DOE will continue deactivation activities in the C-333 building by removing and dispositioning process gas equipment components and other activities to facilitate hazard removal; and in the C-710 technical services building by characterizing, removing, and dispositioning fissile material and equipment from the building. In addition, the site will continue to remove hazardous refrigerant stored in rail cars to improve the overall safety posture of the site.

For the upcoming years, DOE will perform fieldwork associated with the characterization and remediation of the C-400 Complex Operable Unit, the highest environmental priority at the site. The C-400 Complex includes the C-400 Cleaning Building, which utilized TCE for cleaning equipment. The complex is the primary source of the TCE groundwater contamination that was discovered off the DOE property in 1988. DOE will work with federal and state environmental regulators to perform remedial investigation activities, developing and reaching consensus on final remedial actions, and preparing and implementing the remedial action work plans. In 2024, DOE anticipates a ROD to identify the final remedial action for the C-400 Complex. The demolition of the C-400 Cleaning Building in 2027 will facilitate this action.

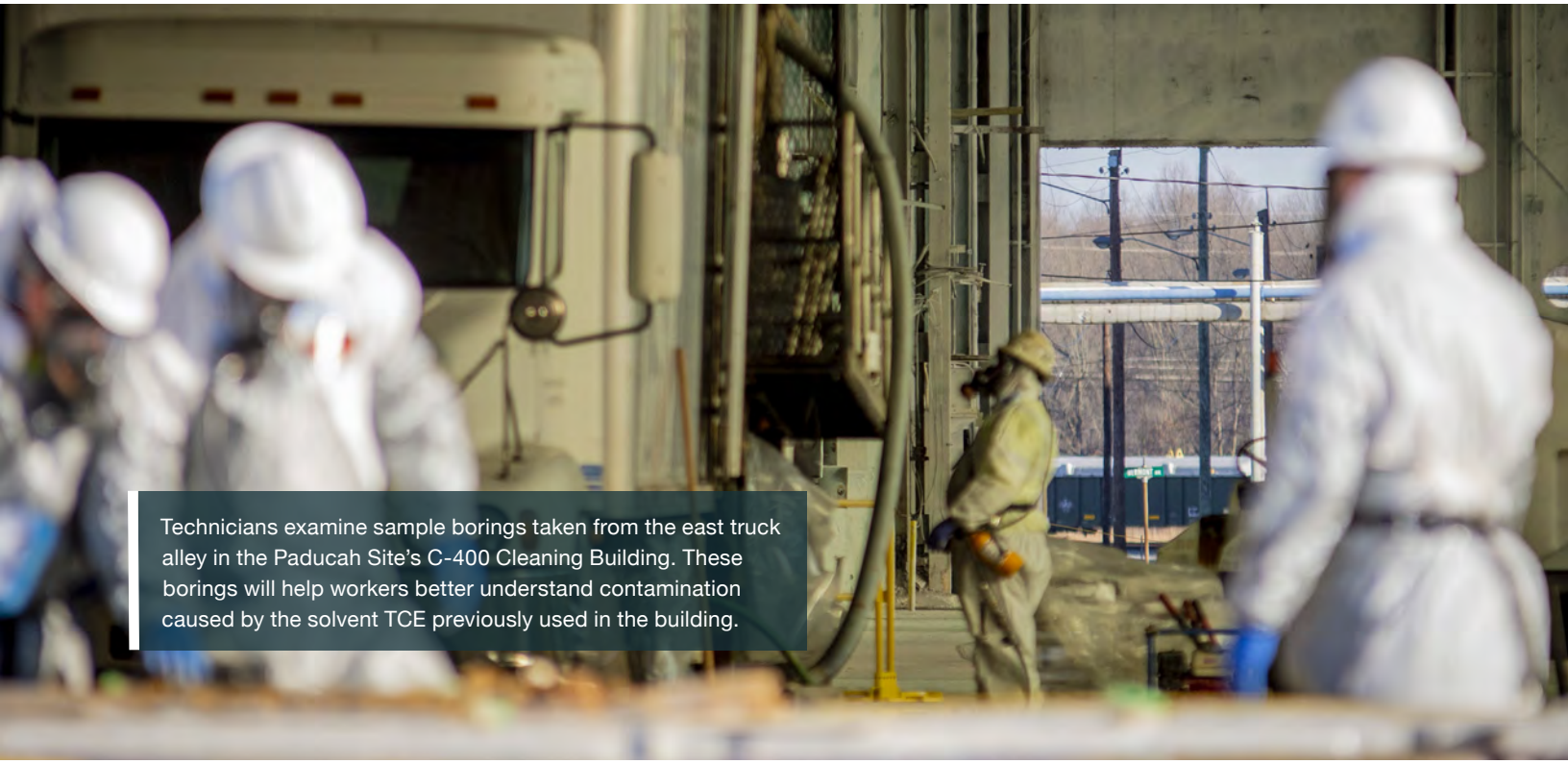
Over the coming decade, DOE plans to complete deactivation work at the C-333 Process Building, one of the four large process buildings at the site. These activities include hazard removal (including refrigerant, chemicals, fire hazards, etc.), characterization of the components within the facility, and other actions to prepare the C-333 Process Building for demolition. Paducah is also expected to begin the regulatory documentation process to determine the waste disposal options associated with demolition of the process buildings and balance of plant cleanup activities.

In 2021, 2,500 metric tons of inventory at the DUF6 conversion plant will be processed. Over the next 10 years, the plant expects approximately 73,500 metric tons of DUF6 material will be converted, and approximately 21 million gallons of hydrogen fluoride will be shipped off-site for commercial use.

Key Regulatory Milestones 2021–2031

Cleanup activities at Paducah are covered by Federal Facilities Agreement between DOE, the Commonwealth of Kentucky, and the EPA.

- Complete RI/FS for C-400 final remedial action — October 2022
- Complete proposed plan for C-400 final remedial action — April 2023



Technicians examine sample borings taken from the east truck alley in the Paducah Site's C-400 Cleaning Building. These borings will help workers better understand contamination caused by the solvent TCE previously used in the building.

Post-2031 Cleanup Scope

Beyond 2031, site activities will include implementation of the selected remedy for waste disposal and continued demolition of the more than 500 site facilities. The remaining environmental cleanup activities related to groundwater, surface water, soils, lagoons, and burial grounds are expected to also be completed. DOE expects to complete disposition of the entire inventory of DUF6 located at Paducah by 2057. DOE currently projects completing cleanup activities at Paducah in 2065.

As future cleanup progresses, the planned Paducah end state is intended to allow the site to be used for light/heavy industrial purposes. This end state was developed in 2011 through a process conducted by the University of Kentucky that captured stakeholder input through a series of community meetings and integration of input from public, stakeholder, regulatory, and local community leaders. DOE continues to solicit and obtain stakeholder input through monthly meetings with the Paducah Citizens Advisory Board. In 2020, DOE completed a land transfer process model to raise awareness of DOE's plans for future land transfer. In addition, ongoing meetings with community leaders will continue to support future development of the site.

Portsmouth

Overview

In August 1952, the AEC selected a tract of land in the Ohio Valley along the Scioto River in Pike County, Ohio, for the site of the Portsmouth Gaseous Diffusion Plant, the third of three GDPs in the United States. In 1956, construction of the plant was completed, and the plant began enriching uranium for nuclear weapons. In the 1960s, Portsmouth's mission changed to focus on producing fuel for commercial nuclear power plants and other national security applications.

An extensive environmental cleanup program began at the 3,777-acre site in 1989, with deactivation and decommissioning activities initiated in 2011. The DOE near-term focus is the deactivation and decommissioning of 415 facilities, including the three former uranium enrichment process buildings (X-326, X-333, and X-330), each measuring over 50 acres of floor area. The site also continues to maintain utility operations, monitor air and water emissions, and operate several groundwater treatment facilities to address legacy groundwater contamination caused by former plant operations.

The Portsmouth Site is also home to one of DOE's two DUF6 conversion plants. DUF6 was a byproduct from the uranium enrichment operations at the three enrichment plants in Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. DOE has a total inventory of approximately 67,000 steel cylinders at the Portsmouth and Paducah sites. At Portsmouth, the DUF6 conversion facility began operation in 2010.

Calendar Year 2020 Accomplishments

- **Advanced construction of key support systems in preparation for demolition of the X-326 Process Building**
- **Completed construction of DOE and Ohio Environmental Protection Agency co-located air monitors to provide parallel sampling data during building demolition**

Portsmouth Site workers survey a transite panel from the X-326 uranium enrichment process building. This is one of the many steps taken to ensure a safe demolition. EM's CY 2021 Mission and Priorities calls for transitioning from deactivation to demolition at Building X-326.

- Installed power utilities to support operation of the On-Site Waste Disposal Facility (OSWDF)
- Processed 1,623 metric tons of DUF6 at the conversion plant

Planned Cleanup Scope 2021–2031

Over the next decade, DOE plans to make significant progress in addressing the three former uranium enrichment process buildings at the site, with demolition of two to be completed in that time frame.

Preparations are underway to start demolition of the X-326 Building, the first of three process buildings. In 2021, DOE will demolish four of 10 sections of the building. By 2031, DOE will complete demolition of the X-326 and X-333 Process Buildings, and complete deactivation of the X-330 Process Building.

Next year, DOE expects to begin utilizing the OSWDF for demolition debris from the X-326 Process Building. In 2021, the haul road and the modular leachate treatment system will be completed to support operation of the OSWDF. Additionally, excavation of one of the groundwater plumes will provide fill for a portion of the X-326 demolition debris. Construction of the first three cells of the OSWDF are scheduled for completion by 2022 and will be used for all of the demolition debris from the X-326 Process Building.

Construction of the next three cells of the OSWDF, as well as the remaining infrastructure, is scheduled to begin in the 2025 time frame. This will support demolition of the X-333 Process Building. Based on capacity needs to support the demolition of X-330 and other remaining site facilities, four to six additional OSWDF cells will be constructed. Additionally, over the next decade, three landfills and an additional plume will be excavated and disposed at the OSWDF.

At the Portsmouth DUF6 conversion facility, DOE will convert 2,000 metric tons of DUF6 and complete planned plant safety upgrades. By 2031, approximately 56,000 metric tons of DUF6 will be converted and approximately 8.5 million gallons of hydrogen fluoride will be shipped off-site for commercial use.

Key Regulatory Milestones 2021–2031

- None

Post-2031 Cleanup Scope

Beyond 2031, the last three OSWDF cells are expected to be constructed to support demolition of the X-330 Process Building and remaining balance of plant facilities. In addition, a Resource Conservation and Recovery Act (RCRA) decision will be made regarding final soil remediation. Cleanup activities are anticipated to be completed in 2038, including the disposition of the entire inventory of DUF6 located at Portsmouth.

As cleanup reaches its end state at Portsmouth, DOE will continue to transfer land for economic development. Through a grant with Ohio University, a multi-faceted community outreach program was completed to understand the community's future use vision for the Portsmouth, which led to community interest in an industrial style future use of the site. With the assistance of the PORTS Future Project and interaction with the Southern Ohio Diversification Initiative, the Portsmouth Site Specific Advisory Board, elected officials, economic development professionals, and others, the community has expressed a consensus vision to reindustrialize appropriate portions of the Portsmouth Site property.

Sandia National Laboratories

Overview

EM's cleanup activities at SNL take place at the SNL section located on Kirtland Air Force Base, adjacent to Albuquerque, New Mexico. The Sandia National Laboratories-New Mexico Environmental Restoration (ER) Operations Project scope includes the remediation of inactive waste disposal and release sites, along with the characterization and remediation of three plumes of contaminated groundwater.

The regulatory driver for completing this work is the Compliance Order on Consent signed in 2004 by DOE, the Sandia Corporation, and the NMED. DOE's approach is to work closely with NMED to complete RCRA corrective actions at the last three ER sites using cost-effective approaches that meet regulatory requirements.

The remaining cleanup scope includes three areas with contaminated groundwater in various stages of characterization and remedy selection — the Tijeras Arroyo Groundwater Investigation AOC, the Burn Site Groundwater Investigation AOC, and the Technical Area-V Groundwater AOC. All soil sites in SNL's baseline have received Corrective Action Complete status from NMED and have been transferred to the laboratory's landlord, the NNSA.

Burn Site Groundwater well installation.

Calendar Year 2020 Accomplishments

- **Continued characterization and monitoring activities at three groundwater contamination sites**

Planned Cleanup Scope 2021–2031

Beginning in 2021, DOE expects to complete the second year of planned characterization studies of the nature and extent of nitrate contamination at the Burn Site Groundwater AOC section of the laboratory, before resuming the corrective action process and proposing alternatives for a remedy. Four of the eight characterization/monitoring wells were installed in 2019, and up to four contingency wells are scoped to ensure installation of a clean down-gradient well. DOE plans to transition this section of the laboratory to long-term stewardship by 2030.

In 2023, the Tijeras Arroyo Groundwater AOC is planned to transition to long-term stewardship. An NMED decision on a final remedy end state is still pending. For Technical Area-V, EM hopes to finish installation of injection wells 2 and 3 and start full-scale injection in well 2 to meet corrective action activities that may continue through 2030.

Key Regulatory Milestones 2021–2031

- None

Post-2031 Cleanup Scope

EM work is expected to be completed by this time frame. Long-term monitoring requirements are expected to transition to NNSA by 2031.

Savannah River Site

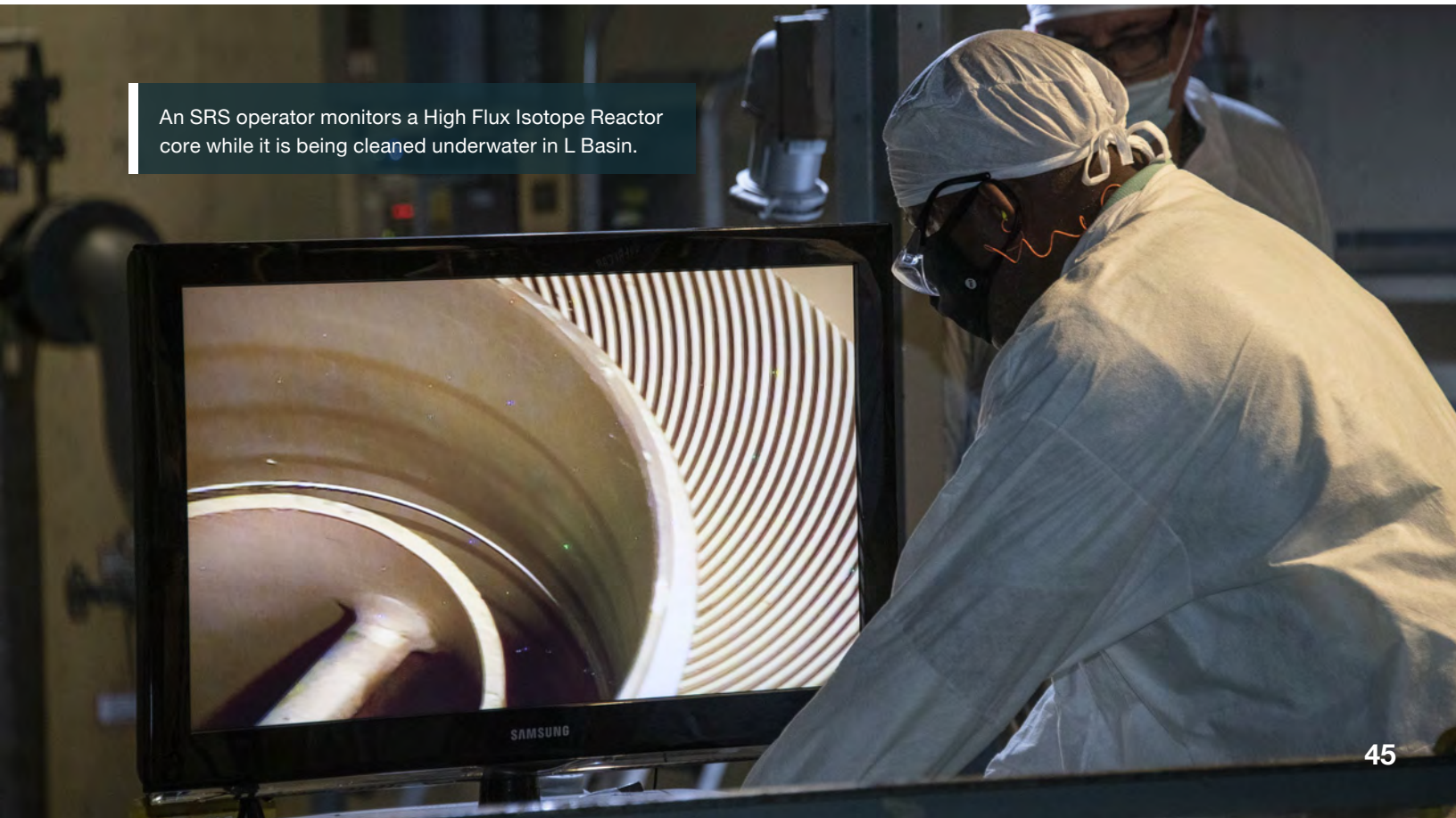
Overview

The SRS, a 310-square-mile-site in Aiken, South Carolina, focused on the production of plutonium and tritium for use in the manufacture of nuclear weapons from its inception in the early 1950s until the end of the Cold War. In 1992, the focus at SRS turned to environmental cleanup, nuclear materials management, and R&D activities.

Today, SRS is a complex site run by EM and host to NNSA and the U.S. Forest Service. The DOE Savannah River Operations Office (DOE-SR) works in partnership with multiple contractors in technically sophisticated nuclear and non-nuclear facilities. Cleanup activities at SRS include addressing 35 million gallons of radioactive liquid waste stored in 43 underground tanks; surplus plutonium downblending with eventual disposition as TRU waste to WIPP; disposition of highly enriched uranium and receipt/storage/processing of foreign and domestic research reactor SNF; facility deactivation and decommissioning; and soil and groundwater remediation.

To date, 300 of 1,127 facilities have undergone deactivation and decommissioning; 411 of 515 waste units across multiple industrial areas have been remediated; and 39 remediation systems are in operation addressing 14 groundwater contamination areas. Notably, collaboration among SRS stakeholders and state and federal regulators resulted in the in-situ decommissioning of P- and R-Area Reactors in 2011 — the first in the DOE complex. Finally, the operational footprint of SRS has been reduced by 85 percent.

SRS processes and stores nuclear materials in support of national defense and U.S. nuclear nonproliferation efforts. DOE-SR is also responsible for oversight of the Savannah River National Laboratory (SRNL), EM's only national laboratory. SRNL assists EM in achieving the nation's legacy nuclear waste cleanup objectives and plays an equally important role supporting NNSA through its work in tritium R&D, operations support,



An SRS operator monitors a High Flux Isotope Reactor core while it is being cleaned underwater in L Basin.

At the height of the Cold War, the Ford Building was used to test components used in five nuclear reactors at SRS. An excavator is shown here removing a section of the facility's metal roof.

stockpile stewardship, nuclear nonproliferation, and other critical national security programs.

SRS leadership is dedicated to meaningful engagement with stakeholders and the citizens of the Central Savannah River Area. DOE-SR and contractor managers meet regularly with federal and state regulators, business and community leaders, and citizen groups to provide updates on SRS operations and to solicit input regarding the missions and budget priorities. SRS enjoys a positive working relationship with stakeholders and the vision for the coming decade has their support. SRS stakeholders include EPA, South Carolina Department of Health and Environmental Control (SCDHEC), the Savannah River Site Community Reuse Organization, the SRS Citizens Advisory Board, and a host of state and local elected officials.

Calendar Year 2020 Accomplishments

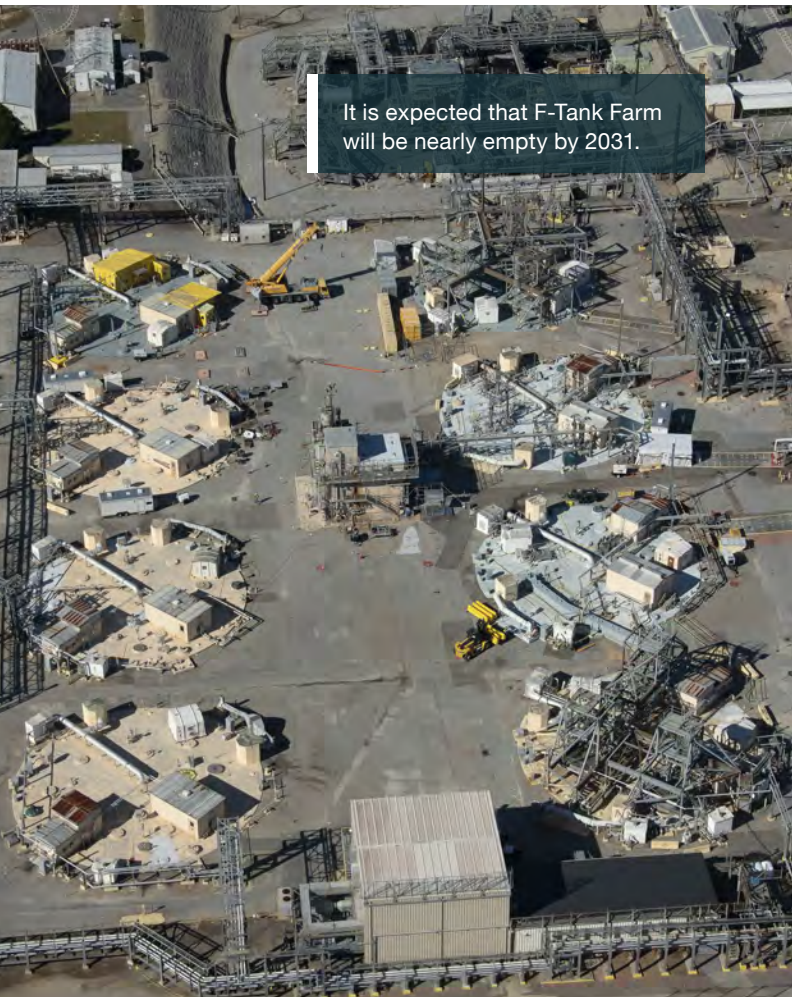
- **Met an EM priority to begin radioactive operations at the SWPF, a key component in the Liquid Waste program**
- **Initiated optimized downblending operations for Surplus Plutonium Disposition**
- **Processed a total of six batches of High Flux Isotope Reactor cores and Material Test Reactor bundled fuel in H-Canyon**
- **Completed material-at-risk removal activities from Building 235-F, a former plutonium fabrication facility**
- **Met an EM priority to award a new standalone management and operating (M&O) contract for SRNL**

Planned Cleanup Scope 2021–2031

Over the coming decade, DOE expects to significantly enhance its ability to tackle the largest remaining environmental risk at SRS — radioactive tank waste — with the ramp up of new waste treatment facilities. DOE will also make continued progress in addressing nuclear materials stored at SRS, and complete disposition of remaining TRU waste.

LIQUID WASTE PROGRAM

The Liquid Waste program will achieve significant risk reduction through continued stabilization and immobilization of the high-activity fraction of the waste in a glass waste form and immobilization of the low-level fraction of the waste as a saltstone waste form. The SWPF began hot operations in January 2021 and expects to process up to 9 million gallons of waste per year by FY 2024 following the implementation of the Next-Generation Solvent. In 2021, EM expects to operate the SWPF at a rate of 6 million gallons per year. By 2031, it is expected that nearly all of the salt waste



It is expected that F-Tank Farm will be nearly empty by 2031.

inventory will be processed, and F-Tank Farm will be nearly empty.

DOE will continue to perform environmental analyses in an effort toward the use of the Department's interpretation of HLW for waste streams at SRS. The interpretation was successfully demonstrated in 2020 when a small amount of DWPF recycle wastewater was treated and disposed.

With the startup and operation of SWPF and its integration with the Liquid Waste System, substantial progress toward tank closure will continue with up to 22 of the 51 underground tanks being closed in the next decade. By 2031, the DWPF will have produced more than 6,800 canisters of vitrified radioactive waste (more than 85 percent of the anticipated total). The Liquid Waste program will continue to support receipt of waste from H-Canyon operations.

NUCLEAR MATERIALS DISPOSITION PROGRAM

The near-term Nuclear Materials Disposition program strategic objectives are to continue disposition of legacy material stored in L- and K-Areas, as well as continued S&M of excess, non-operating nuclear facilities awaiting decommissioning. Over the next 10 years, the K-Area facilities will continue to downblend and disposition both EM and NNSA surplus plutonium to produce TRU waste for eventual disposal at WIPP. Shipment of waste to WIPP is expected to begin in 2022. The K-Area facilities will continue to provide long-term storage of special nuclear material owned by both EM and NNSA.

The L-Area facilities will continue to provide wet storage of SNF received as part of the domestic and foreign research reactor fuel receipt programs. EM is considering implementing over the next decade an Accelerated Basin De-inventory, which would change H-Canyon operations from recovery of uranium during processing to no recovery of uranium, along with discontinuance of support for H-Canyon capabilities for which there are no designated missions. This approach could allow all the SNF in L-Basin to be processed through the H-Canyon chemical separations facility, thereby eliminating the need for a new dry SNF storage capability and generating life cycle cost savings of more than $4 billion. The Receiving Basin for Off-Site Fuels, 235-F, and F/H Analytical Laboratories will complete deactivation activities, enabling transfer to the Decommissioning program.

SOLID WASTE PROGRAM

The Solid Waste program will continue to characterize, store, and disposition site-generated wastes in compliance with applicable regulations and requirements. All remaining SRS legacy TRU waste (approximately 500 cubic meters) will be disposed of at WIPP.

ENVIRONMENTAL REMEDIATION, DEACTIVATION, AND DECOMMISSIONING

The SRS Environmental Remediation program employs an approach to address remediation of waste units and facility deactivation and decommissioning per the various site areas. The program will continue to clean up contaminated soils, groundwater, streams and

associated wetlands, and legacy waste units, which include ash basins and coal yards. EM is committed to reducing risk and protecting groundwater aquifers and surface waters from the spread of contamination by addressing sources of contamination and employing innovative technologies such as the in-ground reactive barrier wall in P-Area to treat solvent-contaminated groundwater.

In addition, an integral part of the cleanup mission is the deactivation and decommissioning of legacy facilities constructed in support of industrial operations, common infrastructure systems, and past nuclear materials production, such as the 235-F Plutonium Processing Facility, C/K/L Reactors, and F-Area Tank Farm. SRS will continue to operate and maintain soil and groundwater remedial systems; and conduct post-closure and post-ROD care, surveillance, and maintenance of 73 closed areas (approximately 1,000 acres).

SAVANNAH RIVER NATIONAL LABORATORY

In 2021, EM will work to transition to the new standalone M&O contract for SRNL. This new contract positions the laboratory for long-term growth and continued success in support of the DOE strategic goals in the cleanup of the nuclear legacy, science and energy, and nuclear security. It will also enable SRNL to focus on its strategic plans for expanding the R&D portfolio supporting DOE missions and other federal agencies, while allowing the SRS M&O to focus on its program priorities in managing and operating the SRS.

DOE is also moving forward with design and build of the Advanced Manufacturing Collaborative (AMC). Construction of the AMC facility will allow the Department to focus on developing and adapting safer and more cost-effective technology, facilities, and expertise for nuclear chemical and materials manufacturing to tackle the remaining challenges in the cleanup of radioactive and chemical waste resulting from Cold War activities and nuclear research. Construction of the AMC facility is expected to be completed in 2024.

Key Regulatory Milestones 2021–2031

Cleanup work at Savannah River is governed by a Federal Facility Agreement between the DOE, SCDHEC, and the EPA. In addition, the Dispute Resolution Agreement with SCDHEC governs salt waste processing quantities for the Liquid Waste program.

- **Start remedial action for Lower Three Runs Stream System — April 24, 2023**
- **Start coal ash remediation in A-Area — January 2026**
- **Start remedial action for ancillary facilities in F-Area — March 2027**
- **Start remedial action for C-Area groundwater — July 2028**
- **Start coal ash remediation in K-Area — December 2028**
- **Start remedial action for D-Area groundwater — June 2029**
- **Start coal ash remediation in L-Area — November 2029**

Construction continues of SDUs 7–9 at SRS.

Post-2031 Cleanup Scope

The Liquid Waste program will start shutting down its operations after DWPF completes treatment operations for the remaining sludge and salt waste and operational closure of the tank farms is completed, achieving F-Tank Farm operational closure by 2038. The Liquid Waste program cleanup mission is planned for completion by 2040, and the S&M of the vitrification canisters in storage will be transferred to the Solid Waste program before eventual disposition at a federal repository yet to be determined.

The remaining non-operational nuclear material facilities (e.g., F-Canyon/FB-Line, H-Canyon/HB-Line) will complete deactivation and be turned over for decommissioning. Operations in K-Area will continue to support the disposition of surplus plutonium with a significant downblending mission, with the facility deactivated after the special nuclear material is dispositioned.

Newly generated wastes resulting from the EM cleanup program will continue to be disposed of in accordance with the EM mission as the waste is generated. As the Nuclear Materials and Liquid Waste programs complete their missions, the Environmental Remediation and deactivation and decommissioning programs will ramp up to provide for remediation of approximately 100 legacy waste units and deactivation and decommissioning of over 800 industrial, nuclear, and radioactive facilities.

Waste Isolation Pilot Plant

Overview

WIPP is the nation's only repository for the disposal of TRU waste generated by atomic energy defense activities. WIPP is located 33 miles southeast of Carlsbad, New Mexico, in the Chihuahuan Desert, far from major population centers. Waste is disposed of in a set of panels located nearly one-half mile below the surface (2,150 feet) in a deep geologic salt bed formed 250 million years ago. Construction of WIPP started in the early 1980s. The facility began operation in 1999 and celebrated 20 years of operations in 2019. To date, WIPP has received approximately 13,000 shipments that were safely transported more than 15 million cumulative miles.

The WIPP Land Withdrawal Act (LWA), Public Law 102-579 as amended by Public Law 104-201, limits the amount of TRU waste that can be disposed of in the repository to 6.2 million cubic feet (about 176,000 cubic meters). Approximately 2.44 million cubic feet (69,000 cubic meters) of TRU waste, or about 39 percent of the LWA TRU volume limit, has been placed in the underground repository to date. WIPP is currently anticipated to operate beyond 2050.

A number of diverse stakeholder groups closely monitor all aspects of WIPP and the National TRU Program. WIPP has pursued significant engagement with local area stakeholders in the city of Carlsbad and Eddy and Lea counties with an interest in WIPP events, progress, and the role WIPP has in the overall cleanup of the DOE complex. WIPP engages routinely with state and federal regulators, and advocacy groups that tend to serve a watchdog role in their interest in WIPP. DOE provides technical, training, logistical, and funding support to six tribal nations and state regional groups and their 25 member states that focus on the safe transport of TRU waste through their jurisdictions. The Carlsbad Field Office will continue to work with its stakeholders and foster the ongoing collaborative relationships developed since the inception of WIPP.

A radiological worker surveys the inside of a Transuranic Package Transporter Model 2 (TRUPACT-II) containment lid during waste handling operations at the WIPP Site.

The ground immediately surrounding the 700C fan is covered in tarps as WIPP prepares to perform a bump test of the fan.

Calendar Year 2020 Accomplishments

- **Met an EM priority to begin work on the new utility shaft; when finished, this 26-foot-diameter shaft will be the fifth shaft that leads to the WIPP underground and will help improve ventilation throughout the mine**
- **Maintained a shipping rate from EM sites of five shipments per week; this included resuming waste shipments from LLNL for the first time in a decade**
- **Completed the WIPP North Access Road Bypass allowing the diversion of traffic away from the WIPP Site, improving traffic safety for site employees and workers at the Utility Shaft Project**

Planned Cleanup Scope 2021–2031

It is anticipated that over the next 10 years, approximately 883,000 cubic feet (25,000 cubic meters) of TRU waste from EM, NNSA and SC sites will be emplaced at WIPP. To support planned waste emplacement activities, EM expects to complete mining activities in Panel 8 in 2022.

Much of the work to be performed at WIPP over the next decade will focus on necessary infrastructure improvements to ensure the facility can continue to play its important role in the EM complex for the long term. By the end of 2024, a set of key infrastructure projects will be completed, improving WIPP capabilities in mining and waste emplacement. These include the new SSCVS, which will provide 540,000 cubic feet per minute of ventilation to the underground, allowing concurrent mining, waste emplacement, and ground control operations throughout the life of the facility. In addition, the new utility shaft will serve as an air intake entry point to support the SSCVS, and house a new, larger capacity hoisting capability to transport materials from the repository to the surface.

Additional site infrastructure improvements to be completed over the next decade include:

- **Recapitalization of key safety systems**
- **Replacement/refurbishment of shaft and hoist systems**

- Upgrades to monitoring and site network systems
- Replacement of electrical substations
- Installation of additional backup generators
- Modernizing underground equipment to zero-emission, battery-electric vehicles, or very low emission Tier IV Final diesel-powered equipment
- Replacement of underground Electrical System Switch Stations
- Modernization of WIPP's Central Monitoring Control Room
- Installation of a new digitally based geotechnical monitoring system in the WIPP underground

Key Regulatory Milestones 2021–2031

- None

Crews lift portions of the plenum, a large pipe that will provide air to the new utility shaft at the WIPP Site.

Post-2031 Cleanup Scope

WIPP will continue mining and waste emplacement operations to dispose of a total of 6.2 million cubic feet of TRU waste, supporting key NNSA and SC missions, along with the remaining EM cleanup mission. Initially, it was assumed that WIPP would complete its mission and cease operation in 2030. However, based on revised TRU waste estimates, it has been determined that additional time will be required for WIPP to fully complete its mission. The expected life of the project is limited by the volume of waste allowed under the LWA, which does not specify an operating period for WIPP. Before taking any actions outside the scope of DOE's existing NEPA analysis and decisions, DOE will determine the need for and conduct, as appropriate, further NEPA analysis.

West Valley Demonstration Project

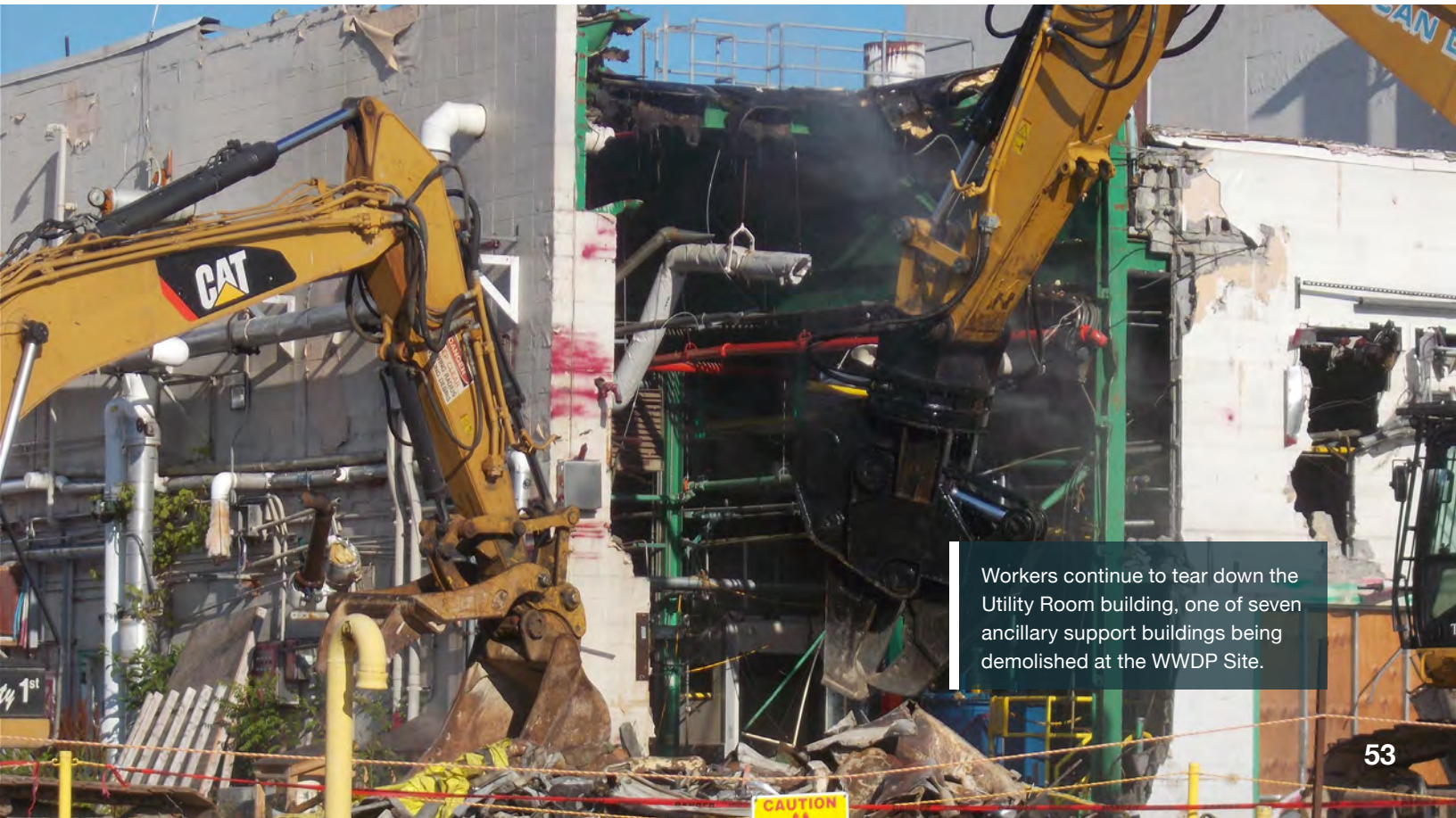
Overview

The WVDP is an approximate 150-acre area located within the Western New York Nuclear Service Center (WNYNSC), which is a 3,338-acre site 30 miles south of Buffalo, New York. The site is owned by the New York State Energy Research and Development Authority (NYSERDA) and is home to the only commercial SNF reprocessing facility to operate in the United States. In 1962, Nuclear Fuel Services, Inc., entered into agreements with the Atomic Energy Commission (AEC) and New York State to construct, license, and operate the commercial reprocessing plant. The fuel reprocessing plant, along with two associated waste burial grounds and an underground set of four tanks for reprocessing waste, operated from 1963 to 1972, processing 640 metric tons of SNF and generating over 600,000 gallons of liquid HLW.

In 1980, Congress passed the WVDP Act, which required DOE to conduct a HLW management demonstration project at the WNYNSC and transport it to a federal repository for disposal. The WVDP Act directed DOE to:

- **Solidify the HLW in a suitable form for transportation and disposal**
- **Develop containers suitable for the HLW's disposal**
- **Transport the solidified waste to a federal repository for disposal as soon as feasible**
- **Dispose of LLW and TRU waste produced by the HLW solidification process***

** Because WVDP TRU waste was derived from commercial nuclear fuel reprocessing, it is considered commercial TRU waste. DOE refers to this waste stream as Greater than Class C (GTCC)-like waste.*



Workers continue to tear down the Utility Room building, one of seven ancillary support buildings being demolished at the WWDP Site.

Workers perform waste loadout while demolition activities continue on the Main Plant Office Building.

- **Decontaminate and decommission the tanks and other facilities used at the WNYNSC in which the HLW was solidified, the facilities used in the waste's solidification, and any material and hardware used in connection with the WVDP**

DOE completed vitrifying the HLW in 2002. The resulting 278 canisters of vitrified HLW are currently stored on-site, pending availability of a federal repository. Since 1998, DOE has been disposing of LLW; processing and packaging both contact-handled and remote-handled GTCC-like waste; and deactivating, decontaminating, and removing unneeded facilities.

In 2010, DOE and NYSERDA published, in compliance with the National Environmental Policy Act, a joint final environmental impact statement that addressed both DOE's completion of the WVDP and NYSERDA's decommissioning and/or long-term stewardship of the WNYNSC. The same year, DOE and NYSERDA issued a ROD to proceed with a phased decision-making approach for remaining cleanup activities. Phase 1 covers soil remediation and disposition of the remaining

facilities. Phase 2 will address the four underground waste tanks and the two on-site disposal areas, and the non-source area of the groundwater plume. DOE intends to complete the remaining decision-making with its Phase 2 decision in a supplemental environmental impact statement.

DOE has a strong public outreach program at WVDP including conducting Quarterly Public Meetings (QPMs) and participating in monthly meetings with the West Valley Citizen Task Force (CTF). During the planning of the Phase 1 decommissioning decision, DOE discussed the approach at both the QPMs and CTF meetings. DOE provides updates of the status of ongoing Phase 1 decommissioning activities at both the QPM and CTF meetings. DOE also provides a status of site progress at the monthly Ashford Town Board meetings.

Calendar Year 2020 Accomplishments

- **Completed removal of all removable asbestos-containing material from the MPPB Fuel Receiving and Storage Facility**
- **Initiated deactivation of below-grade cells in the MPPB**
- **Completed removal of two additional of MPPB ancillary support buildings (the Main Plant Office Building and the Utility Room), bringing the total number of ancillary support buildings removed to six of seven**
- **Completed removal of one additional balance of site facility, bringing the number removed to 44 out of 46**

Planned Cleanup Scope 2021–2031

Over the next decade, DOE will complete Phase 1 soil remediation and facility decommissioning activities, though completion could be impacted by a lack of disposal options for GTCC-like waste. In 2021, DOE will continue deactivation activities and begin demolition of the MPPB, the last major remaining facility at the site. By September 2023, DOE expects to complete demolition the MPPB. In addition, demolition activities will be completed at the remaining ancillary support building, and two remaining balance of site facilities.

By the end of 2028, DOE will complete decommissioning of the below-grade portions of the MPPB and the Vitrification Facility, where aboveground demolition was completed in 2019. DOE will also complete the decommissioning of the site's radioactive water treatment system, including four active lagoons and one closed lagoon. By the end of 2030, DOE will complete soil remediation efforts in Waste Management Area-1 and Waste Management Area-2.

By 2023, DOE and NYSERDA intend to make an integrated decision on the path forward for the Phase 2 decommissioning activities and/or long-term stewardship of the WNYNSC. Phase 2 decommissioning decisions will address the Waste Tank Farm, the waste disposal areas, and the non-source area of the groundwater plume.

Key Regulatory Milestones 2021–2031

- **None**

Post-2031 Cleanup Scope

Remaining work at West Valley post-2031 will focus on disposal of orphan waste and completion of Phase 2 decommissioning activities. If a disposal option for GTCC-like waste is available, DOE could, by the end of 2033, complete the processing, packaging, shipment, and disposal of GTCC-like waste and removal of remaining waste processing facilities, such as the Remote-Handled Waste Facility, once GTCC-like waste shipping and disposal is complete.

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