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

EM VISION 2020-2030:

A Time of Transition and Transformation







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The U.S. Department of Energy's (DOE) Office of Environmental Management (EM) has been entrusted with one of the largest environmental efforts in the world – addressing the substantial environmental liability resulting primarily from decades of nuclear weapons production and government-sponsored nuclear energy research that contributed so much to national security and prosperity. For 30 years, EM has tackled this legacy, and as a result of a track record of success, EM has shrunk the overall program footprint by 90 percent, completing work at 91 of the original 107 sites, some of which date back to the Manhattan Project and the birth of the Atomic Age.

As EM proceeds toward completion of the remaining 10 percent, 2020 will come to be seen as an inflection point for sites across the complex. We will see skyline changes at a variety of sites where successful demolition efforts will result in risk reduction after years of preparatory work. We will continue to shrink the remaining EM footprint, and we will compete and award new contracts that will enable continued, and accelerated, progress across the EM program. After years of effort, we will bring online new capabilities to tackle our largest remaining environmental risk – radioactive waste stored in underground tanks.

This *Strategic Vision* not only lays out EM's planned slate of accomplishments for this year, but also outlines a decade of anticipated progress across the breadth of the program. This progress will be based on a foundation of strategic initiatives EM is pursuing to ensure we are best positioned for the years to come, including strengthening project management, continued use of new contracting mechanisms to reduce taxpayer risks and encourage innovation, utilizing a science-driven and risk-informed approach to cleanup and ensuring a strong pipeline of talent throughout the program for the future.

Secretary of Energy Dan Brouillette, Under Secretary for Science Paul Dabbar and senior DOE leadership are personally committed to, and invested in, the success of the EM mission. I am honored to lead the program at this point in its history. I have had the opportunity to visit many EM sites, and meet with the men and women – both federal and contractor employees – who are EM's greatest asset. They are the reason for our successes to date, and the accomplishments we plan to achieve.

I am excited for the future of EM – over the course of this year, the decade to come and the long-term – and look forward to seeing this *Strategic Vision* realized. We will continue engaging with Congress, state and local governments, Tribal nations and the communities near our sites on this vision for the future so that we can demonstrate the government's ability to keep its commitments to all of those who have played such an important role in this country's history.

William "Ike" White

Senior Advisor for Environmental Management
to the Under Secretary for Science

EM Sites


Hanford
Idaho National Laboratory
Lawrence Livermore National Laboratory
Moab UMTRA Project
Nevada National Security Site
Energy Technology Engineering Center (ETEC)
Los Alamos National Laboratory
Sandia National Laboratories
Waste Isolation Pilot Plant (WIPP)
Separations Process Research Unit (SPRU)
West Valley Demonstration Project
Portsmouth Site
Brookhaven National Laboratory
Paducah Site
Oak Ridge
Savannah River Site

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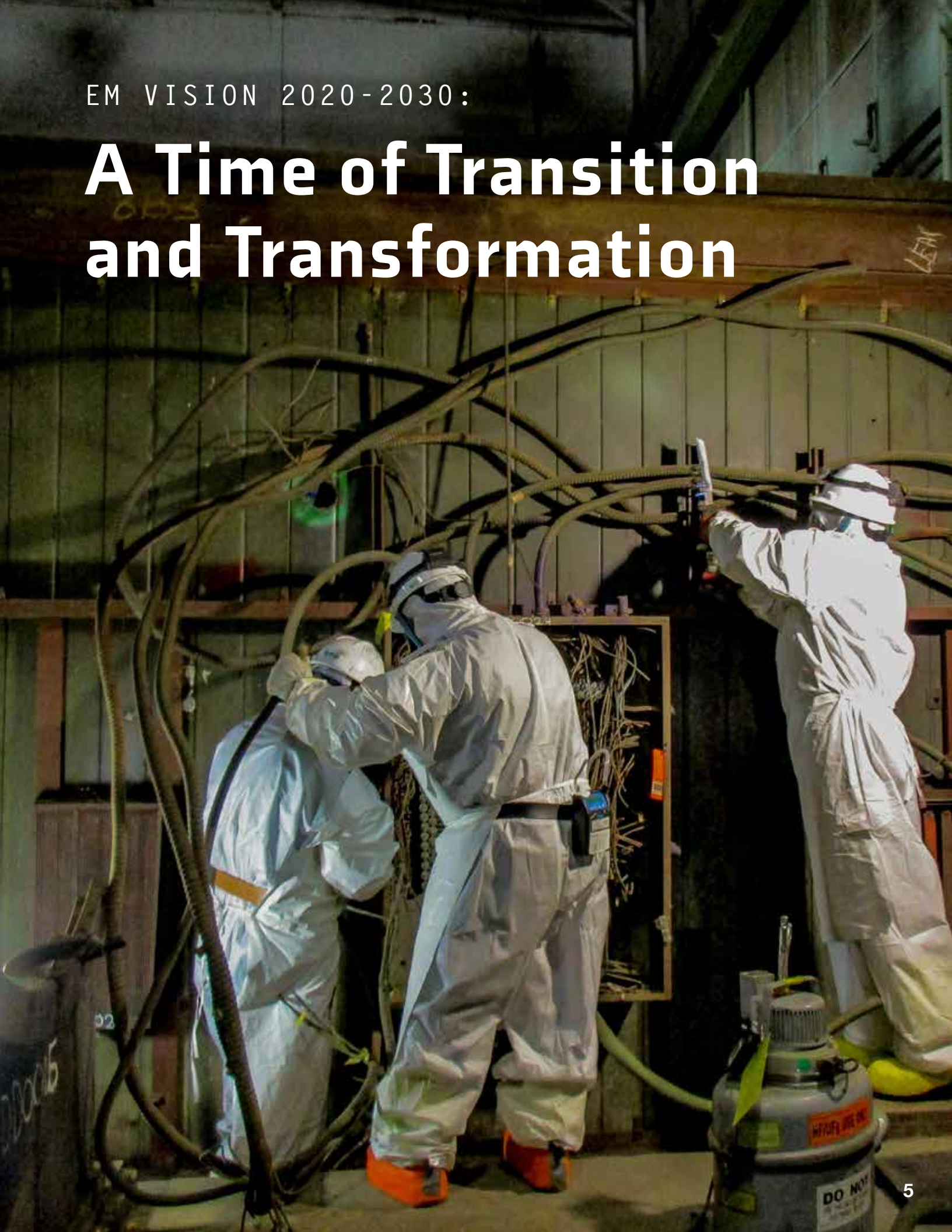


EM VISION 2020-2030:

A Time of Transition and Transformation

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 such 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, now stored in underground tanks; 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.

30 Years of Progress

Over the past 30 years, the EM program has achieved significant and lasting progress in tackling this environmental legacy. The overall footprint has been reduced by 90 percent, from approximately 3,300 square miles to less than 300 square miles. Work remains at 16 of the original 107 sites, including:

- Brookhaven National Laboratory
- Energy Technology Engineering Center (ETEC)
- Hanford
- Idaho National Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Moab
- Nevada National Security Site
- Oak Ridge
- Paducah
- Portsmouth
- Sandia National Laboratory
- Savannah River Site
- Separations Process Research Unit
- Waste Isolation Pilot Plant
- West Valley Demonstration Project

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 first underground deep geological repository for transuranic (TRU) waste resulting from atomic energy defense activities at the Waste Isolation Pilot Plant (WIPP) in New Mexico.
- Completing the bulk of cleanup activities along the 220-square mile Columbia River Corridor at Hanford in Washington State.
- Completing almost 25 years of successful operations at the Defense Waste Processing Facility at the Savannah River Site (SRS) in South Carolina, vitrifying more than 4 million gallons of radioactive waste.
- Completing the decommissioning and demolition of five former gaseous diffusion uranium enrichment plants at Oak Ridge in Tennessee, including Building K-25, at one time the largest building in the world under one roof.
- Completing the Advanced Mixed Waste Treatment Project at the Idaho National Laboratory (INL) site 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 the disposal of approximately two-thirds of the 16-million-ton uranium mill tailings pile at the Moab site in Utah.
- Completing waste vitrification activities and subsequent demolition of the Vitrification Facility at the West Valley Demonstration Project (WVDP) in New York State. This marked the first time EM has built, operated and successfully decommissioned one of its major waste treatment facilities.

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 storage, receipt, and disposition.
- Nuclear material consolidation, stabilization, and disposition.
- TRU and mixed low-level waste (MLLW) disposition.
- Soil and groundwater remediation.
- Excess facilities deactivation and decommissioning (D&D).

2020– An Inflection Point for EM

At the start of this decade, EM is at an inflection point at sites across the complex that will position the program for even greater success in the years to come. After years of effort, EM plans to begin operation of two major radioactive waste treatment facilities – the Salt Waste Processing Facility (SWPF) at SRS and the Integrated Waste Treatment Unit (IWTU) at the INL site. In addition, progress will continue toward beginning tank waste treatment at Hanford through the Direct Feed Low Activity Waste (DFLAW) approach.

Individually, these capabilities will significantly enhance EM's ability to tackle the largest environmental risks at SRS, the INL site and Hanford. Together, they represent an evolution of the EM mission as it transitions from years of design and construction of these massive, first-of-a-kind nuclear facilities, to focusing on tank waste treatment operations.

EM is also taking major steps to further reduce its footprint and remove legacy facilities. At the Oak Ridge site, this year will mark the successful completion of a multi-year effort to demolish facilities at the East Tennessee Technology Park (ETTP), one of the original Manhattan Project sites. The successful completion of ETTP will provide significant risk reduction and environmental benefits.

At Hanford, the former Plutonium Finishing Plant – a key facility in U.S. nuclear weapons production and once one of the most dangerous buildings in the DOE complex – will be demolished to slab-on-grade, representing a major risk reduction achievement. At the Portsmouth site, the skyline will change as demolition begins at one of the three former massive gaseous diffusion enrichment process buildings. And at West Valley, EM will gear up to demolish the last remaining major facility there – the former Main Plant Process Building.

EM's accomplishments over the coming year will not be limited to its larger sites. Legacy cleanup activities at the Brookhaven National Laboratory will be completed. In addition, responsibility for the successfully remediated sites at the Tonopah Test Range, near the Nevada National Security Site (NNSS), will be transferred to the DOE Office of Legacy Management (LM) for long-term monitoring.

The Decade to Come

Building upon these anticipated successes, this *Strategic Vision* outlines the coming decade of progress and risk reduction across the EM program, including:

- **Initiating radioactive tank waste treatment at Hanford (Page 18).**
- **Completing demolition activities along the Columbia River at Hanford and placing the last two reactors into an interim safe storage configuration (Page 18).**
- **Emptying and closing 22 of 51 underground waste tanks at SRS (Page 52).**
- **Completing disposal of legacy TRU waste from SRS (Page 52).**
- **Completing construction of the Mercury Treatment Facility at Oak Ridge (Page 38).**
- **Completing disposal of remaining legacy TRU waste and uranium-233 at Oak Ridge (Page 38).**
- **Completing the treatment of remaining liquid sodium-bearing waste at the INL site (Page 22).**
- **Completing targeted buried waste exhumation at the INL site (Page 22).**
- **Completing shipments of legacy TRU waste from the INL site to WIPP for disposal (Page 22).**
- **Completing building demolition at TA-21 at the Los Alamos National Laboratory (LANL) (Page 28).**
- **Addressing chromium groundwater contamination at LANL (Page 28).**
- **Completing the new Safety-Significant Confinement Ventilation System and other key infrastructure upgrades at WIPP (Page 58).**
- **Demolishing two of three former uranium enrichment process buildings at Portsmouth (Page 46).**
- **Completing deactivation activities at the C-333 former uranium enrichment process building at Paducah (Page 42).**
- **Completing demolition of the former Main Plant Process Building at the WVDP (Page 62).**
- **Demolishing the remaining buildings, and initiating soil remediation, at the ETEC site in California (Page 16).**
- **Completing legacy cleanup activities at the NNSS (Page 34).**

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: Most importantly, EM will continue to perform its activities in a "Safety First" culture that integrates environmental, safety and health requirements and controls in all work activities. EM has a safety record well ahead of other comparable industries. We 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 the new end-state based contracts, 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 our highest priority.

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 project management. In recent years, EM has made significant strides in strengthening its project management capabilities. Going forward, EM is in the process of developing a new Cleanup Project Management Policy and revising its Cleanup Program Management Policy.

The Project Management policy will initially apply to the demolition projects in the EM portfolio, but may be expanded to other EM cleanup projects. The Cleanup Program Management Policy will incorporate the principles of risk-based decision making, development of an integrated lifecycle baseline and follow the leading principles of program management.

End-State Contracting: Approximately 90 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. 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 wide-spread application of EM's end-state contracting model, which encompasses a two-step Indefinite Delivery/Indefinite Quantity (IDIQ) contracting process.

In the end-state model, EM will negotiate scope, cost, and schedule on specific elements of work through task orders in an IDIQ type of contract, instead of putting in place cost-based contracts that span 10-plus years with general scopes of work. This initiative provides the ability to group the work under the contract into specific task orders to allow better clarity and shorter time horizons, as well as provide more accurate cost and schedule targets. The initiative will also provide for an improved accountability structure to motivate contractors

toward improved cost and schedule performance.

Innovative Approaches: Given the scale and scope of the remaining EM mission, the development of new and innovative approaches to performing cleanup activities is critical so that EM can safely complete its work in a more efficient and more cost-effective manner. Last year, DOE took the significant step of issuing a notice of its interpretation of the statutory term "high-level radioactive waste," which may allow some lower activity reprocessing waste to be disposed of based on its radiological characteristics, rather than solely upon its origin. This could provide additional options to dispose of certain reprocessing wastes in a timely and technologically sound fashion. EM has taken an initial step toward the use of this interpretation for a single waste stream at SRS. This process is part of the DOE science-based approach to managing radioactive waste that is fully protective of human health and the environment.

EM is also seeking to enhance its technology research-and-development efforts to better identify and demonstrate new and innovative approaches for tackling cleanup challenges that offer a significant return on investment, recognizing the need to balance between basic and applied research, and to effectively adapt commercially available technologies to EM cleanup needs.

Over the coming years, EM will construct the Advanced Manufacturing Collaborative (AMC) facility for the Savannah River National Laboratory (SRNL). The AMC 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.

Potential Opportunities for Acceleration: As a strong steward of taxpayer resources, EM constantly works to identify and assess opportunities to accelerate cleanup and completion of an entire site, or opportunities to accelerate key pieces of workscope. The coming decade offers several potential opportunities for acceleration that EM will continue to assess and develop. For example,

modest investments at the Portsmouth and Moab sites could result in completing cleanup within this decade, years ahead of current schedules.

At the INL site, closure of the Radioactive Waste Management Complex could be achieved by 2030. At Los Alamos, additional resources could allow waste processing activities at Area G to operate at full capacity, and lead to completing shipments of transuranic waste from Area G by 2029. No decisions have been made at this time on these potential acceleration opportunities. EM will continue to assess these, as well as other opportunities that may become apparent over the coming years, working with Members of Congress, state governments and other key regulators and stakeholders.

Next-Generation Workforce: EM currently has a workforce of approximately 25,000 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 at least another 50 years, 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 plans to execute a federal recruitment strategy utilizing a diverse assortment of federal tools and hiring authorities that allow for maximum management flexibility and discretion as we build and sustain a best-in-class workforce. These tools include making use of the summer intern program by recruiting students with science, technology, engineering and math (STEM) areas of study to work on EM projects; and leveraging students with STEM disciplines for internship opportunities through programs such as the DOE Scholars Program and the Minority Serving Institutions Partnership Program (MSIPP).

EM also supports veterans, such as through the Operation Warfighter Program, which is designed to provide recuperating service members meaningful activity outside of the hospital environment. This program offers a formal means of transition from the military to the civilian workforce. In addition, EM is working to engage early career professionals through a variety of means, such as knowledge transfer meetings and detail opportunities, as well as a relaunched Pathways internship program.

Infrastructure: EM faces a continued challenge of performing cleanup activities at sites with decades-old general purpose and mission-specific infrastructure, in some instances originating in the World War II era. EM will work to align infrastructure needs with cleanup activities. EM continues to monitor the status of infrastructure investments and the Department's evolving infrastructure condition. EM actively works with other DOE organizations to assess infrastructure needs across the Department.

Regulatory/Stakeholder Engagement: Across the country, EM is subject to more than 40 various federal and state regulatory agreements, many of which have hundreds of milestones. EM looks forward to maintaining and strengthening the positive relationship it has with regulators across the country, and will continue meaningful discussion between federal decision-makers and local governments, civic groups, labor organizations, universities, industry and other interested citizens, to promote mutual interests, share perspectives and openly discuss potential impacts.

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 will continue to leverage international opportunities for technical information exchange that mutually benefits the U.S. and foreign governments.

Security/Cybersecurity: 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 to protect EM assets, operations, mission essential

functions, and provide resiliency during emergency events.

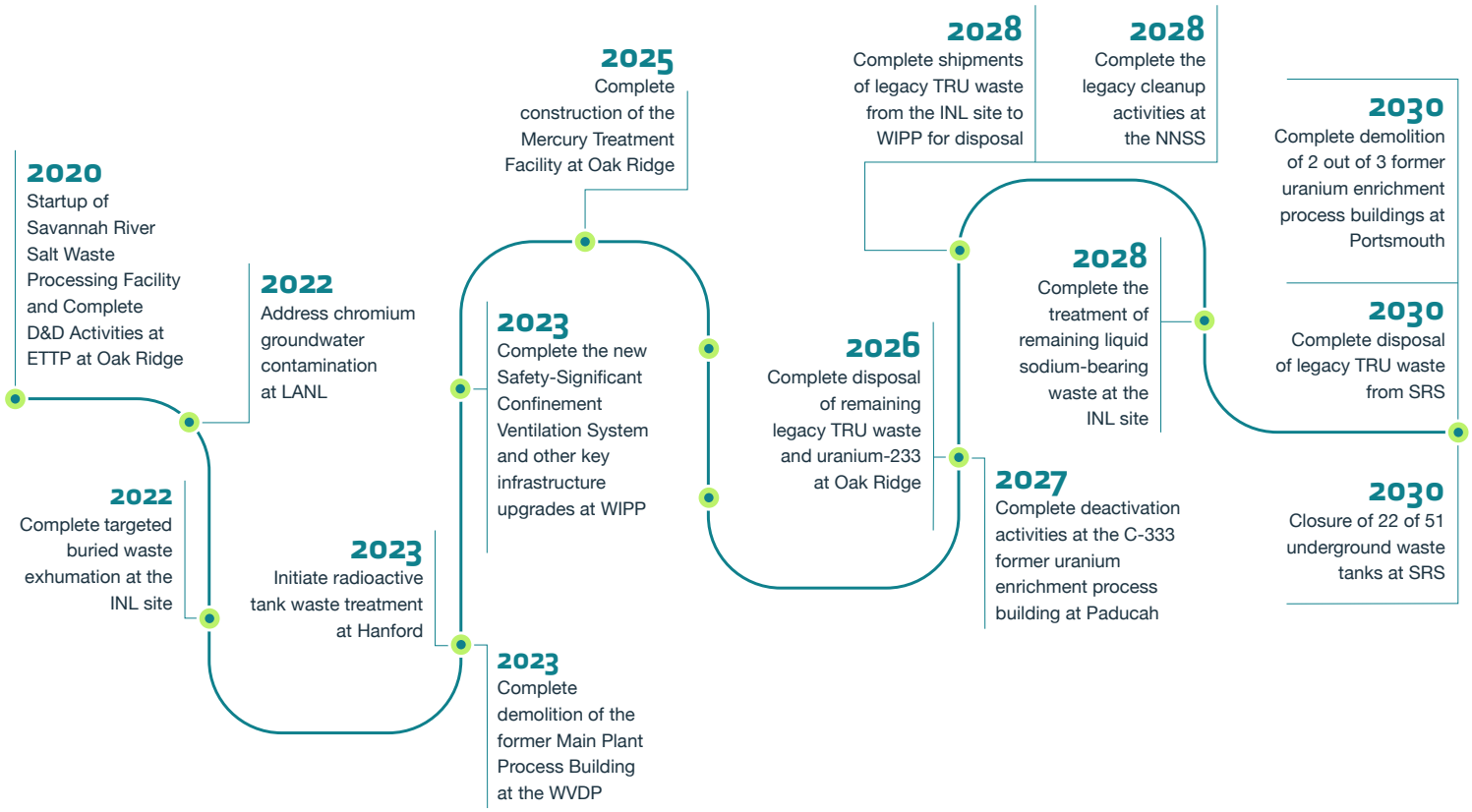
Cybersecurity threats are growing and present significant challenge to DOE and EM. To keep pace with this continually changing environment, EM will develop comprehensive, risk-based approaches based on the Department's recently updated DOE Order 205.1C. Implementing an agile, effective, and cost-efficient approach to cybersecurity requires EM to develop improved and systematic processes, and to leverage technologies that streamline the implementation of security controls. The enhancement of EM cybersecurity capabilities will enable the program to anticipate and defend against the growing threat landscape and provide assurance that its information remains secure, communication is not compromised, and risks to data and system infiltrations are mitigated.

Conclusion

Over the past 30 years, the EM program has demonstrated the capability to achieve significant and lasting progress, helping to fulfill the government's commitment to the people who live near, and work at, DOE sites. The year 2020 sets the stage for a fourth decade of success across the program that has the potential to fundamentally shift the overall trajectory of EM. This *Strategic Vision* outlines the breadth and scope of the planned progress at each of the remaining EM sites.

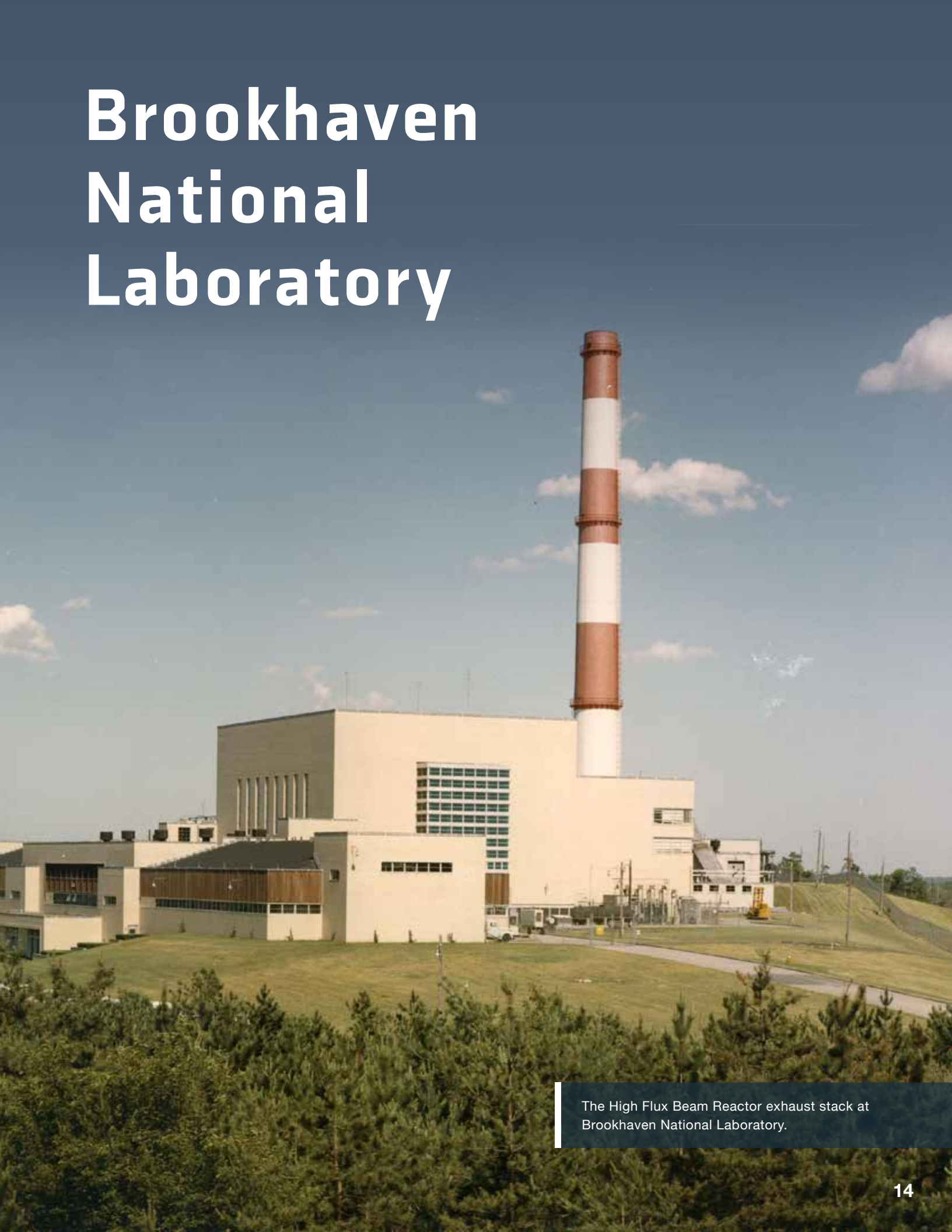
None of this would be possible, though, without the talented and hardworking men and women who perform this important work every day safely and efficiently.

Decade Timeline



2020 2030

Brookhaven National Laboratory



The High Flux Beam Reactor exhaust stack at Brookhaven National Laboratory.

Brookhaven National Laboratory

Overview

The High Flux Beam Reactor (HFBR) at the Brookhaven National Laboratory (BNL) in Upton, New York, was a research reactor that operated from 1965 to 1996. The mission of the HFBR was to provide a source of neutrons for multidisciplinary scientific research in materials science, chemistry, biology, and physics. In April 2000, the Office of Environmental Management developed a Memorandum of Agreement with the Offices of Science (SC) and Nuclear Energy (NE) to transfer management and ownership of the reactor to EM.

In February 2009, EM and the U.S. Environmental Protection Agency, Region 2, signed the Final Record of Decision (ROD) for the reactor. EM conducted cleanup and demolition activities at BNL from the 1990s until 2013. While two of the reactors and associated facilities were decommissioned, left behind was the 100-meter exhaust stack (Building 705). The scope of this ROD included remedial activities required to be completed by the end of 2020. All of these actions, except for the removal of the HFBR Exhaust Stack, have been completed. Upon completion of D&D, the facility will be transferred back to SC for long-term surveillance and maintenance.

Cleanup accomplishments include:

- **Completed D&D of the Brookhaven Graphite Research Reactor (BGRR).**
- **Completed soil and groundwater remediation activities.**

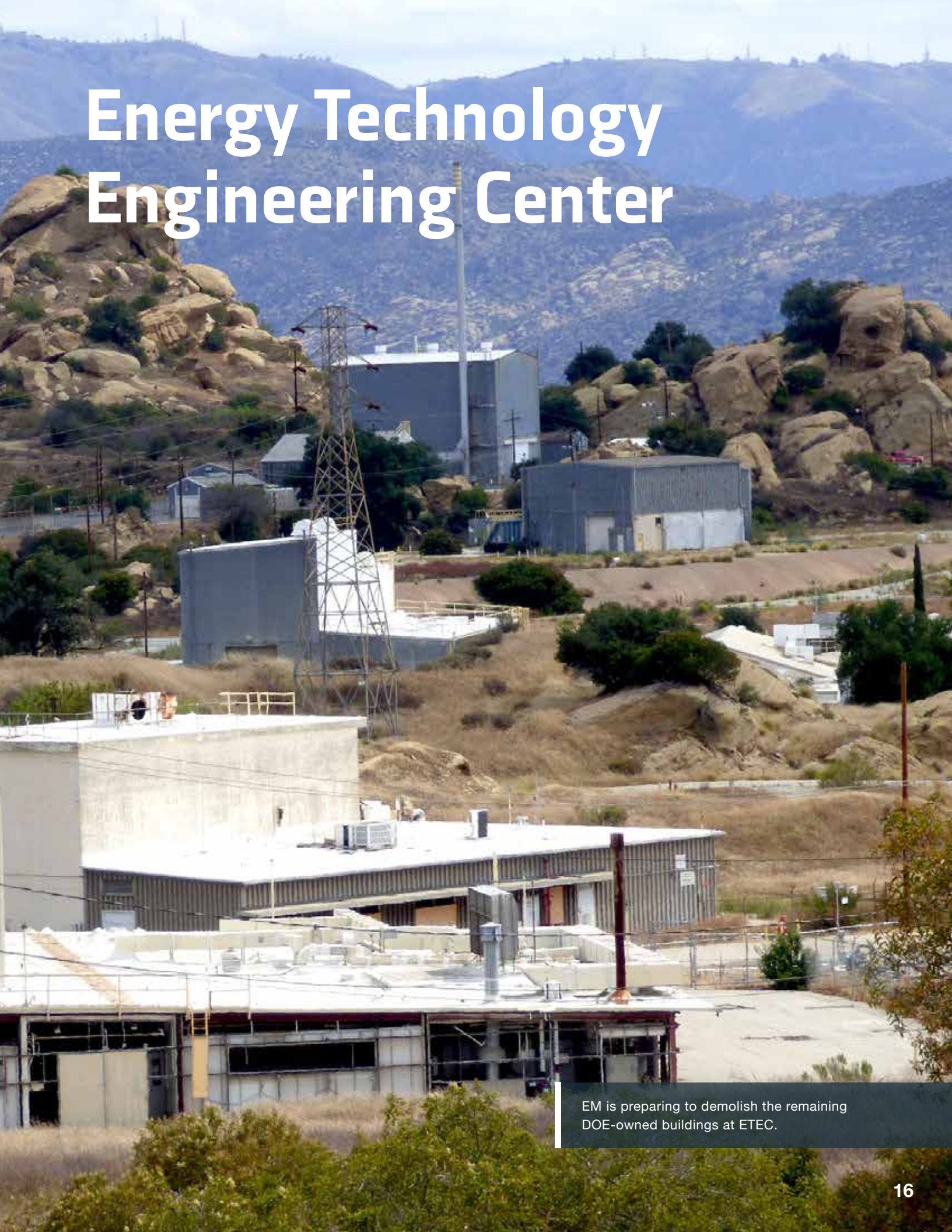
Planned Cleanup Scope 2020-2030

DOE will complete its remaining workscope at Brookhaven in 2020. By the end of 2020, work will be completed to remove Building 705, the HFBR Exhaust Stack. This 100-meter tall stack, initially constructed to provide an elevated exhaust of the BGRR primary and secondary cooling air, is now almost 70 years old, and is no longer needed. Demolition activities include isolation of utilities (e.g., electrical service), demolition and removal of the stack to the pedestal, final status survey, independent verification survey, packaging, transportation, and disposal of the waste, and restoration of the affected site.

Remaining Cleanup Scope Post-2030

There are no post-2030 plans associated with Brookhaven.

Energy Technology Engineering Center



EM is preparing to demolish the remaining DOE-owned buildings at ETEC.

Energy Technology Engineering Center (ETEC)

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 directly own any land at the SSFL (today owned by Boeing), the Department is responsible for demolition of the DOE-owned buildings and cleanup in the 290 acres of the ETEC site and the associated Northern Buffer Zone. Today, there are 18 DOE-owned buildings that remain to be addressed, along with final soil and groundwater cleanup activities.

Cleanup accomplishments include:

- **Demolished more than 250 buildings.**
- **Published a final EIS for soil and groundwater remediation.**
- **Issued a Record of Decision for demolition of the remaining 18 DOE-owned buildings.**

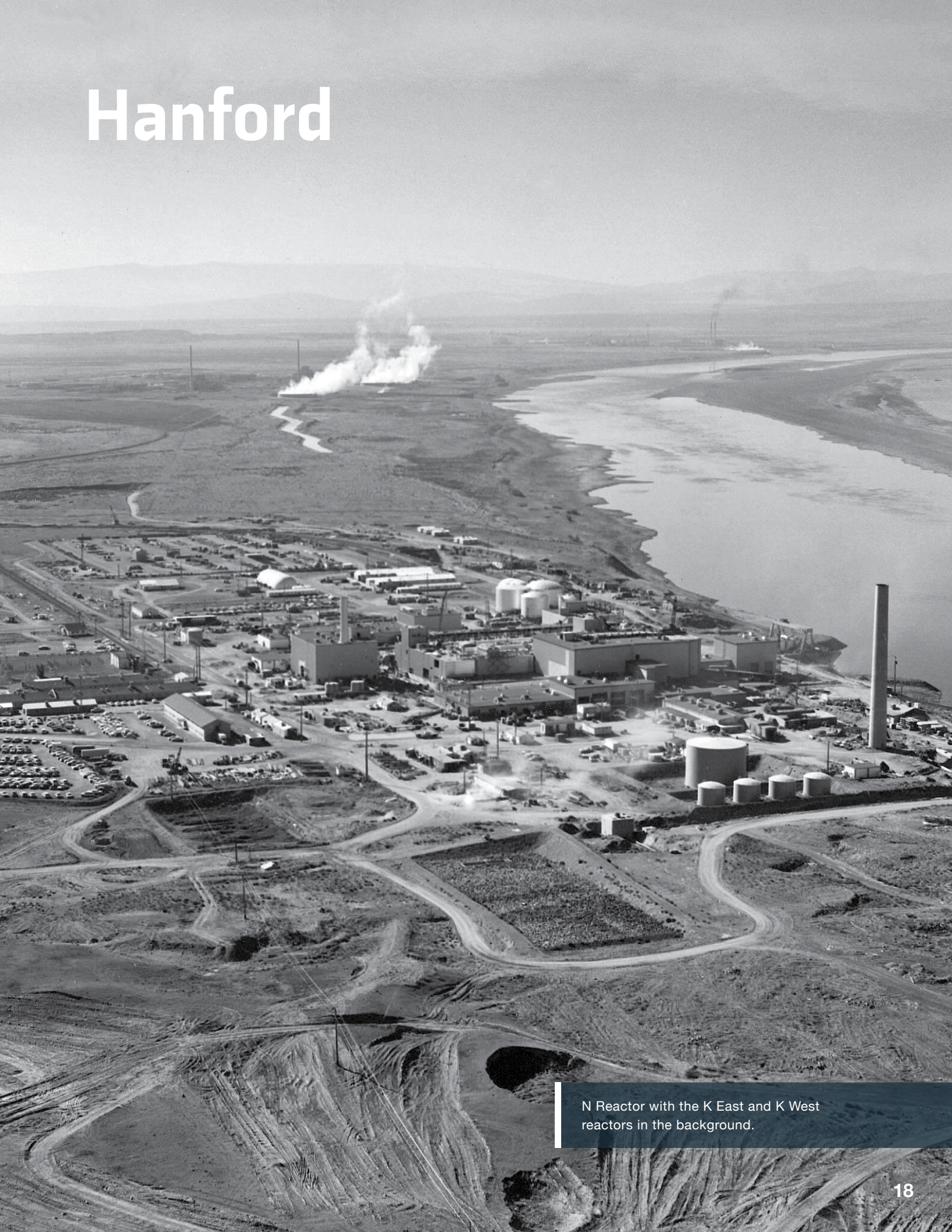
Planned Cleanup Projects 2020-2030

In the next 10 years, DOE will focus on demolishing the remaining DOE-owned buildings at the ETEC site, along with initiating soil and groundwater clean-up.

Remaining Cleanup Scope Post-2030

Remaining cleanup activities at ETEC post-2030 will be dependent, in large part, on progress made on soil and groundwater clean-up through 2030.

Hanford



N Reactor with the K East and K West reactors in the background.

Hanford

Overview

The Hanford Site, a 580-square-mile section of semi-arid desert in central 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 the atomic bomb used to help end World War II. In total, nine nuclear reactors were built along the banks of the Columbia River to provide product for five primary processing facilities that operated throughout the Cold War era. In total, Hanford produced 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 [TPA]) in 1989 by the Washington State Department of Ecology (Ecology), EPA, and DOE, the primary mission of the Hanford Site shifted from production to cleanup. The Hanford Site's current mission focuses on environmental restoration, which includes remediation of contaminated areas, decontamination and decommissioning of facilities, waste management (i.e., waste storage, treatment, and disposal), and related scientific and environmental research and development of waste management technologies.

Cleanup of the Hanford Site is overseen by DOE's Richland Operations Office (DOE-RL) and Office of River Protection (DOE-ORP). The DOE-RL and the DOE-ORP manage the site through several contractors and their subcontractors. The 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; management of solid waste, spent nuclear fuel, and sludge; facility cleanout, deactivation, and demolition; environmental restoration; plutonium management; and all site support services.

DOE-ORP was established by Congress in 1998 as a field office to manage the retrieval, treatment, and disposal of approximately 56 million gallons of radioactive tank waste currently stored in 177 underground tanks in the central part of the site. The tank waste is material left over from years of World War II and post-war production of nuclear weapons fuel. In support of this mission, DOE-ORP is responsible for the safe operation of the tank farms and associated 200 Area facilities and construction and operation of the Hanford Tank Waste Treatment Plant and Immobilization Plant (WTP) located in the Central Plateau.

Cleanup accomplishments include:

- **Remediated more than 1,300 waste sites.**
- **Demolished over 880 facilities.**
- **Completed interim safe storage six reactors out of nine.**
- **Preserved the B Reactor as a National Historic Landmark.**
- **Transferred all spent nuclear fuel to dry storage.**
- **Transferred highly radioactive sludge from K Basins near the Columbia River to longer-term storage on the Hanford Central Plateau.**
- **Treated more than 22 billion gallons of contaminated groundwater.**
- **Completed interim stabilization**

efforts transferring 3 million gallons of pumpable liquids from single-shell tanks (SSTs) to newer double-shell tanks (DSTs).

- Completed waste retrieval activities from 17 SSTs and 1 DST.
- Installed interim surface barriers at SST farms with historical soil contamination.

Cleanup Highlights 2020-2030

At Hanford, the coming decade will see the successful launch of one of EM's largest and most significant efforts – the start of tank waste treatment. The WTP is EM's largest and most complex project and one of the largest civilian nuclear construction projects in the world.

TANK WASTE TREATMENT

By the end 2023, DOE-ORP will complete the Low-Activity Waste (LAW) Facility, Balance of Facilities (BOF), and Analytical Laboratory (LAB) (collectively known as LBL, including direct-feed low-activity waste [DFLAW] and LBL facility services) to begin treating LAW. Starting these facilities in the near term allows for treatment to begin on the most mobile form of tank waste prior to all treatment facilities being completed.

The DFLAW approach will rely on a LAW pretreatment system known as the Tank Side Cesium Removal (TSCR) pretreatment system that will allow tank waste supernatant to be treated and stored in AP Farm for subsequent delivery to the WTP LAW Facility. Upgrades will also be completed at the Liquid Effluent Retention Facility and Effluent Treatment Facility to allow receipt and treatment of the anticipated secondary liquid effluent from DFLAW operations. DOE-ORP is also completing an Analysis of Alternatives (AoA) for high-level waste treatment to identify and evaluate a broad set of alternatives that meets the established mission need and to analyze the life-cycle cost, schedule, and risks associated with each alternative. In addition, DOE-ORP will continue tank waste retrieval activities in the SSTs. Work is currently underway in the A and AX tank farms.

ADDITIONAL RISK REDUCTION

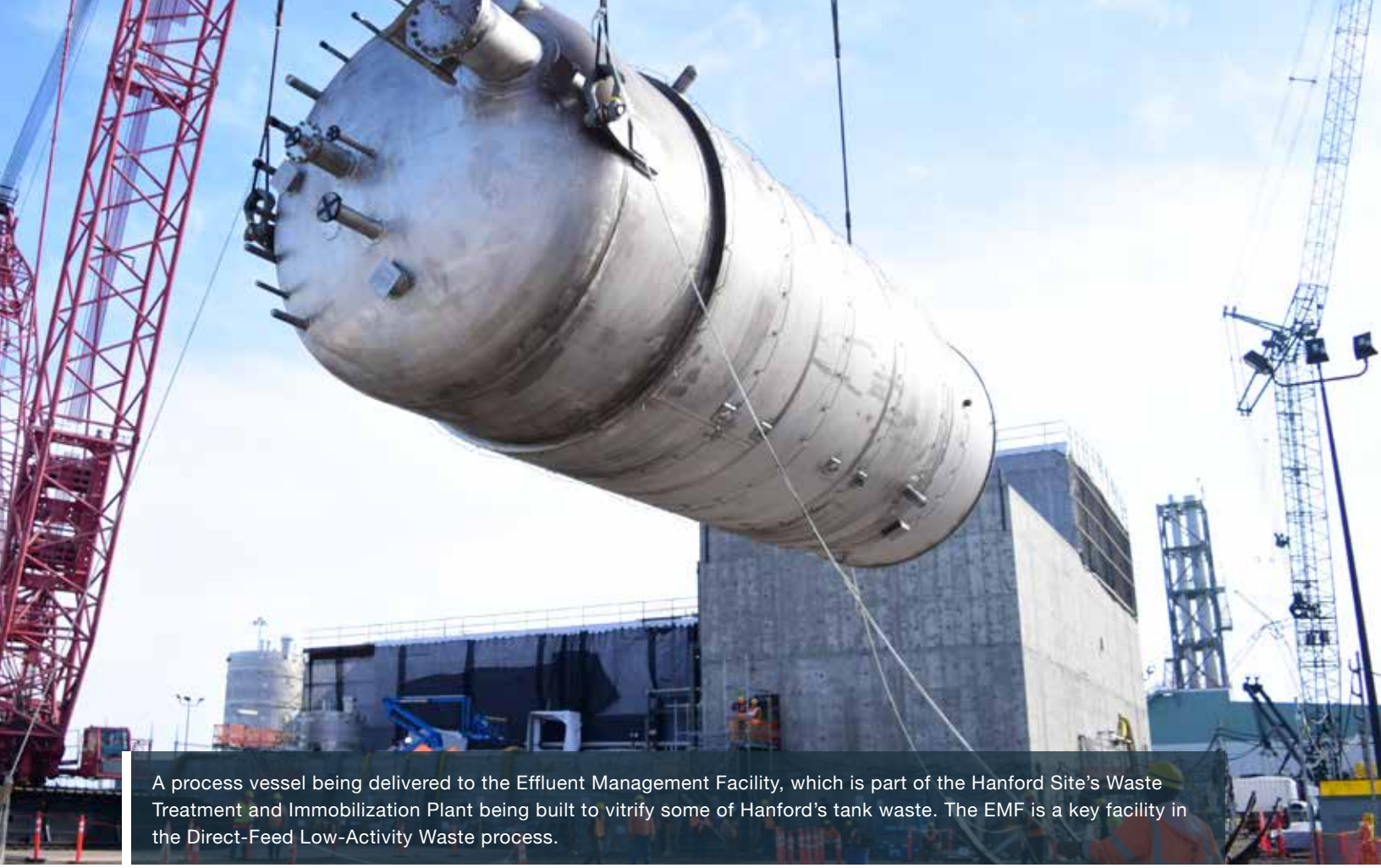
In 2020, DOE will complete the demolition of the Plutonium Finishing Plant, leaving it in slab-on-grade condition. Furthermore, several below grade structures will be stabilized with grout to prevent potential surface subsidence.

Over the coming decade, the 324 Building will be placed in a minimum surveillance and maintenance configuration until remediation can be resumed at the underlying 300-296 waste site and the building can be demolished. EM will continue to evaluate the transfer of cesium and strontium capsules currently stored in wet storage at the Waste Encapsulation and Storage Facility to safer dry storage. Stabilization activities at REDOX and PUREX will place these facilities in a low-cost surveillance and maintenance configuration.

Active groundwater remediation systems will continue operating along the River Corridor, treating about 1 billion gallons of contaminated groundwater annually. Additionally, DOE-RL will complete critical infrastructure projects to support the Hanford mission.

Remaining Cleanup Scope Post-2030

While there is a great deal of uncertainty about what may transpire between now and the distant post-2030 clean-up work, the Hanford clean-up mission, currently outlined in the TPA and other legal documents includes waste retrieval and tank closure activities, construction of additional waste treatment facilities, and extensive waste site demolition and remediation activities, including at the B Plant, PUREX, REDOX, and T Plant processing canyons.



A process vessel being delivered to the Effluent Management Facility, which is part of the Hanford Site's Waste Treatment and Immobilization Plant being built to vitrify some of Hanford's tank waste. The EMF is a key facility in the Direct-Feed Low-Activity Waste process.

Commissioning technicians review procedures in the Low-Activity Waste Facility control room, which is part of the Hanford Site's Waste Treatment and Immobilization Plant (WTP) being built to vitrify some of Hanford's tank waste. Multiple facilities in the WTP are controlled from one location, increasing safety and efficiency.

Idaho

An aerial view of the Radioactive Waste Management Complex, which DOE is working to close by the end of this decade.

Idaho

Overview

The INL site, located 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, 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-1). The EBR-1 is now a Registered National Historic Landmark open to the public.

The Idaho Cleanup Project 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.

Cleanup accomplishments include:

- **Completed the processing of contact-handled (CH) transuranic debris waste tied to the Idaho Settlement Agreement at the Advanced Mixed Waste Treatment Project (AMWTP) for eventual off-site disposition.**
- **Completed the retrieval of transuranic waste containers placed in retrievable storage at the Transuranic Storage Area Retrieval Enclosure.**
- **Completed exhumation of targeted, buried TRU waste in 5 acres of a planned 5.69 acres at the Subsurface Disposal Area.**
- **Completed the transfers of all EM-owned SNF at the Idaho Nuclear Technology and Engineering Center (INTEC) from wet to dry storage facilities.**
- **Completed treatment of all Idaho Settlement Agreement remote-handled (RH) transuranic waste.**
- **Completed decontamination, decommissioning, and demolition (D&D) of 225 nuclear, radiological, and industrial facilities.**

Long-term work will include emptying and closing the INTEC liquid waste tank farm; the safe storage of any remaining legacy SNF not acceptable for the Office of Nuclear Energy's missions; dispositioning calcine waste; decontaminating and decommissioning remaining excess facilities; and completing the Comprehensive Environmental Response, Compensation and Liability Act cleanup requirements, including Test Area North groundwater remediation and the capping of the SDA. Long term work also includes operating and maintaining the facilities and infrastructure necessary to safely complete the EM mission.

Cleanup Highlights 2020-2030

Over the coming decade, cleanup activities at Idaho will largely focus on completing treatment of remaining liquid sodium-bearing waste, buried waste exhumation, shipment of remaining transuranic waste and decommissioning and closure of facilities at the Radioactive Waste Management Complex (RWMC).

RADIOACTIVE WASTE MANAGEMENT COMPLEX FACILITY OPERATIONS/RWMC CLOSURE

By the end of 2022, DOE will complete several actions at the SDA, including targeted buried waste exhumation, closure of RH LLW disposal vaults and D&D activities. By the end of 2028, DOE is targeting completing the off-site shipments of legacy CH and RH TRU waste. TRU waste shipments are dependent on operations and the availability of WIPP.

IDAHO NUCLEAR TECHNOLOGY AND ENGINEERING CENTER FACILITY OPERATIONS

At INTEC, DOE will complete several actions related to stored SNF. By the end of 2023, DOE will retrieve and move the Peach Bottom Fuel from the older Generation I storage vaults to the more robust Generation II storage vaults at the INTEC Outdoor Fuel Storage Facility (CPP-749). By the end of 2023, DOE will complete the transfer of the balance of non-EM-owned SNF from wet to dry storage and will maintain the fuel in a safe configuration.

Over the next decade, DOE will complete the treatment of the remaining liquid sodium-bearing waste stored at the INTEC Tank Farm. DOE expects to begin radioactive waste treatment operations at IWTU by the end of 2020 and is targeting completion of treatment by the end of 2028. To continue moving the Calcine Disposition Project forward, DOE will continue to develop and test retrieval methods and equipment at the full-scale mockup of the calcine retrieval system.

The Integrated Waste Treatment Unit will turn about 900,000 gallons of liquid radioactive waste into a granular solid.

Remaining Cleanup Scope Post-2030

At the RWMC, remaining work would focus on completing the construction of a planned cap over the SDA (Subsurface Disposal Area) and Resource Conservation and Recovery Act (RCRA) closure and D&D (Decontamination and Decommissioning) of any AMWTP-related facilities along with long-term surveillance-and-maintenance (S&M). S&M activities would continue at least through 2035 for the U.S. Nuclear Regulatory Commission-licensed SNF storage sites (at Ft. St. Vrain in Colorado and the Three Mile Island-2 storage facility at INTEC). Treatment activities would continue for remote-handled mixed low-level and low-level waste. Long-term S&M activities would also continue at INTEC.

Idaho Cleanup Project workers celebrate the last shipment of spent naval fuel from underwater to dry storage.

Transuranic waste leaving Idaho for the Waste Isolation Pilot Plant.

Lawrence Livermore National Laboratory (LLNL)

An aerial view of Lawrence Livermore National Laboratory.

Lawrence Livermore National Laboratory (LLNL)

Overview

Lawrence Livermore National Laboratory, located in California, was established in 1952 and is a multi-disciplinary R&D center focusing on weapons development and stewardship and homeland security. The laboratory is operated by Lawrence Livermore National Security, LLC for the National Nuclear Security Administration (NNSA). In addition to the main site, there is a remote location called Site 300 on 7,000 acres in rural foothills approximately 15 miles southeast of Livermore. Site 300 was established in 1955 as a non-nuclear explosives test facility to support the laboratory's national security mission.

The EM-managed LLNL Excess Facilities decommissioning and demolition effort commenced in 2018. Congress directed DOE to decommission and demolish the B280 Pool Type Reactor and other excess facilities at LLNL.

Cleanup accomplishments at these sites include:

- **Removed Building 280 ancillary facilities.**
- **Completed the Interagency Agreement with the U.S. Army Corps of Engineers to accomplish the Building 280 (Pool Type Reactor) reactor dismantlement and removal.**
- **Completed the Memorandum of Understanding and Work Authorizations with NNSA's M&O contractor or the lab to decommission and demolish Building 175 (MARS-E Beam Facility).**
- **Constructed 21 groundwater and soil vapor extraction and treatment facilities at Site 300 that are now operational.**

Cleanup Highlights 2020-2030

By the end of 2022, DOE will complete demolition of Building 175 to slab on grade at LLNL. Then, by the end of 2023, DOE will complete removal of the Building 280 reactor at LLNL. In addition to currently ongoing work on the Building 280 reactor and Building 175, additional NNSA facilities (e.g., Buildings 212, 241, 251, 280, 292, 343) at LLNL are ready for decommissioning and demolition as additional funding becomes available. The majority of activities scheduled for FY 2021 and beyond for the 300 site are in support of the development of remedial solutions for groundwater contamination at Building 812, Building 850, and Building 865.

Remaining Cleanup Scope Post-2030

There are no post-2030 plans associated with LLNL.

Los Alamos National Laboratory

Building 257, the last building at Technical Area 21, is being prepped for demolition in FY 2020.

Los Alamos National Laboratory

Overview

The EM Los Alamos Field Office (EM-LA) is dedicated to cleanup of legacy contamination of radioactive and chemical materials and waste resulting from operations during the Manhattan Project and Cold War-era at LANL in New Mexico. EM-LA's cleanup scope includes legacy waste remediation and disposition, soil and groundwater remediation, and demolition, deactivation, and disposition 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 sites at LANL originally identified for remediation, more than half (approximately 1,100) have been cleaned up 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 contamination plumes that are being characterized and managed by EM-LA using subsurface control techniques. One plume has chromium contamination and is being actively managed by a pump-and-treat system with reinjection, while 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 (m3) of legacy radioactive waste is located at LANL. The majority of this waste was buried at 26 different Material Disposal Areas (MDAs) dispersed throughout the lab. Eight of these MDAs have been excavated and closed. There is approximately 3,500 m^3 of legacy TRU waste stored at Technical Area (TA)-54's Area G destined for disposal at WIPP. The waste is stored in a configuration that is protective of the environment, workers and the public.

Cleanup accomplishments include:

- **Completed 31 sites located in or adjacent to the Los Alamos town-site.**
- **Implemented an interim pump-and-treat approach to address chromium groundwater contamination.**
- **Completed 16 TRU waste shipments to WIPP in 2019.**
- **Completed shipment of 300 m^3 of LLW and MLLW for offsite disposal.**

Cleanup Highlights 2020-2030

Over the coming decade, DOE intends to focus on addressing the groundwater contamination plumes, processing above-ground-stored TRU waste and retrieval of below-ground-stored TRU waste for off-site disposal. DOE will also work to complete the disposition of the remaining TRU waste from Los Alamos currently in storage at the Waste Control Specialists (WCS) commercial disposal site in Texas. Depending on the disposition approach chosen, the TRU containers at WCS could be shipped to WIPP in the 2020-2025 timeframe.

By the end of 2020, DOE will complete the Historical Properties Campaign, and finish demolition of the last building at TA-21. By 2022, the final remedy for the Royal Demolition Explosives plume will be determined and implemented and the remaining building slabs, basements, utility tunnels and vaults, and other below-grade structures will be removed at TA-21. Contaminated soil will be removed from

the site and transported for offsite disposal with sampling conducted to confirm compliant cleanup. In 2022, a final remedy for the chromium plume will be implemented and will likely operate for several years.

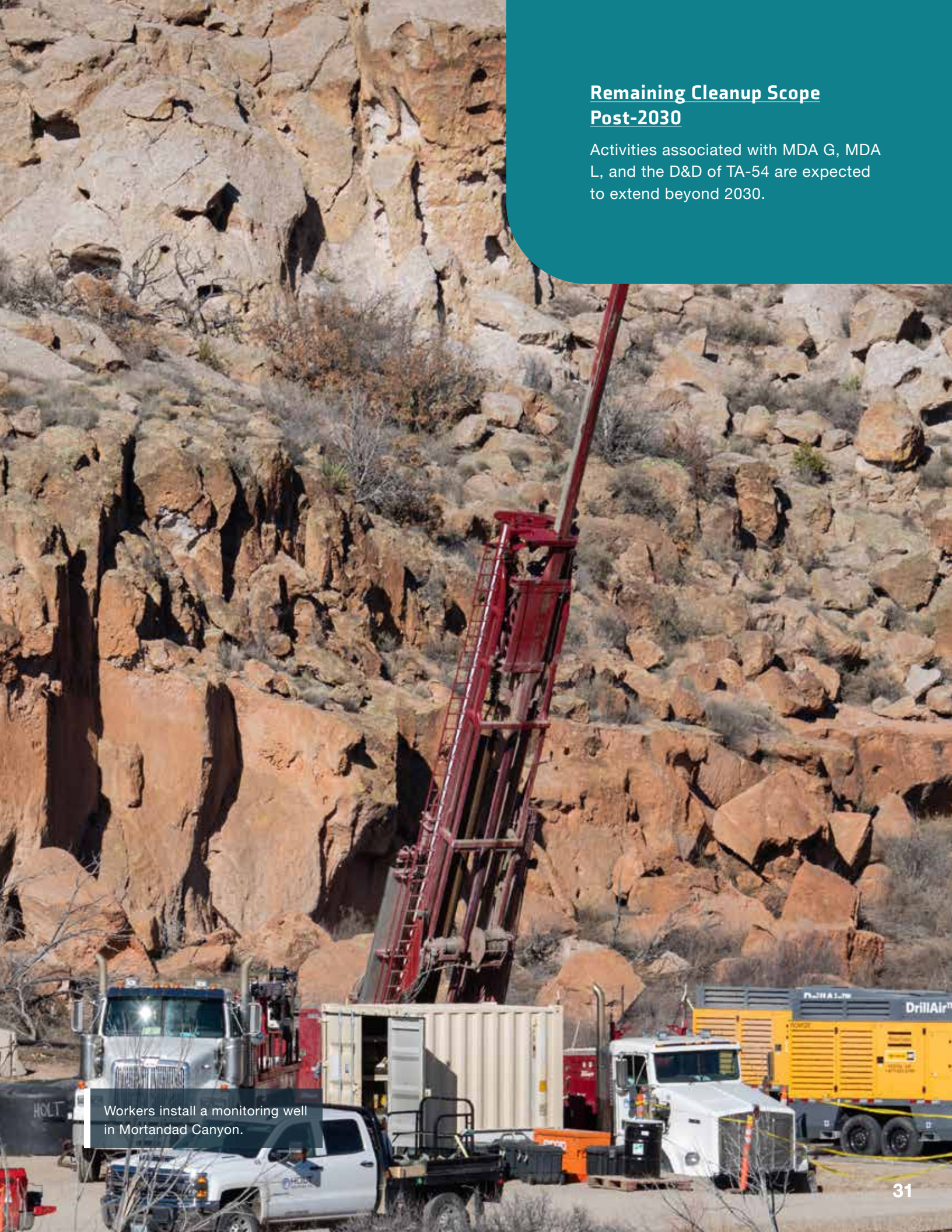
Aggregate Area campaigns, including the Southern External Boundary, Pajarito Watershed, and Upper Watershed, will be completed in succession, beginning in 2023 and finishing in 2026, and will involve the removal of a variety of materials. The latter part of the decade will see considerable focus on completing the cleanup of MDAs H, C, AB, A and T.

Over the next decade, work at TA-54 will center on processing of above-ground waste inventories, retrieval of waste placed in below ground configuration for long term storage for processing, and disposition of inventory to offsite disposal facilities. Inventory reduction is essential to allow demolition of structures within MDA G, and will allow permanent demolition and closure of the disposal area. Process lines to treat the waste to meet offsite disposal facility requirements are active, but will be modified to address the range of materials requiring treatment. Retrieval of legacy waste from subsurface storage will also evolve over the decade to exhume waste containers of various sizes and content. In some cases, waste items will require size reduction so they can be packaged for transport.

Several TRU shipments were made from Area G at LANL to WIPP.

Remaining Cleanup Scope Post-2030

Activities associated with MDA G, MDA L, and the D&D of TA-54 are expected to extend beyond 2030.



Workers install a monitoring well in Mortandad Canyon.

Moab

An aerial photo of the Moab Uranium Mill Tailings Remedial Action (UMTRA) Project's Moab, Utah site.

Moab

Overview

The Moab Uranium Mill Tailings Remedial Action Project is located in southeastern Utah. The 480-acre Moab site is 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 near the Colorado River and other contaminated material 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 surface and groundwater are remediated, the 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 of the disposal cell.

Cleanup accomplishments include:

- **Increased weekly shipments beginning in February 2019 of uranium mill tailings from two shipments per week (450,000 tons annually) to four shipments per week (900,000 tons annually).**
- **Disposed of a total of 10 million tons of residual radioactive material out of the original total of 16 million tons.**

Cleanup Highlights 2020-2030

Over the coming decade, DOE will continue to steadily reduce the remaining size of the uranium mill tailings pile. DOE expects to ship approximately 450,000 tons of uranium mill tailings annually to the Crescent Junction disposal site. DOE also plans to continue transportation and disposal of oversize debris from the Moab site.

Remaining Cleanup Scope Post-2030

The project will continue excavating, shipping, and placing uranium mill tailings and other contaminated material in the disposal cell. Demobilization, demolition, and disposal of site infrastructure and equipment, placement of the final cover on the disposal cell, and site closure will take place. Turn-over of the Moab site for reuse, or continued control under DOE, and turn-over of the Crescent Junction site for maintenance and long-term surveillance by DOE LM will occur.

Nevada National Security Site

Drill rig for construction of groundwater characterization well ER-20-4 located on Pahute Mesa at the NNSS.

Nevada National Security Site

Overview

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 (NTTR).

In accordance with the Federal Facility Agreement and Consent Order (FFACO), EM is responsible for environmental corrective actions at 148 surface and near-surface soil locations, 1,013 industrial locations, and groundwater contaminated by historical nuclear testing. Environmental corrective actions have been completed at all the surface soils locations, and there are two industrial facilities remaining to be addressed.

Concerning groundwater contamination, the FFACO strategy agreed upon with the State of Nevada requires the identification of contaminant boundaries, restricted access to contaminated groundwater, and the implementation of 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. One of the groundwater characterization areas has already been transitioned into the final "closure" phase of the FFACO groundwater strategy, long-term monitoring; another two will transition to long-term monitoring in 2020; and investigations are ongoing in the last area to fully understand the nature and extent of contamination.

Cleanup accomplishments include:

- **Completed cleanup actions at the last soils site.**
- **Disposed of approximately 1 million ft³ of classified and LLW and MLLW.**
- **Maximized the capacity of a permitted cell which allowed for an extra 125,000 ft³ of MLLW to be disposed of before permanent closure.**

Cleanup Highlights 2020-2030

Over the coming decade, EM will complete its current scope of cleanup activities at the NNSS.

GROUNDWATER/SOIL REMEDIATION

In 2020, the Office of Legacy Management will take responsibility for long-term monitoring of FFACO sites located on the Tonopah Test Range (TTR) where environmental corrective actions were completed.

Also in 2020, long-term monitoring activities are expected to begin for the Rainier Mesa/Shoshone Mountain; and Yucca Flat/Climax Mine groundwater characterization areas.

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) will be completed by the end of 2023. By the end of 2027, the Model Evaluation Phase will be completed for Pahute Mesa to include drilling five model evaluation wells, data analysis, flow and transport model adjustments, and

regulatory approval for the final phase. By the end of 2028, the Pahute Mesa area will transition into long-term monitoring.

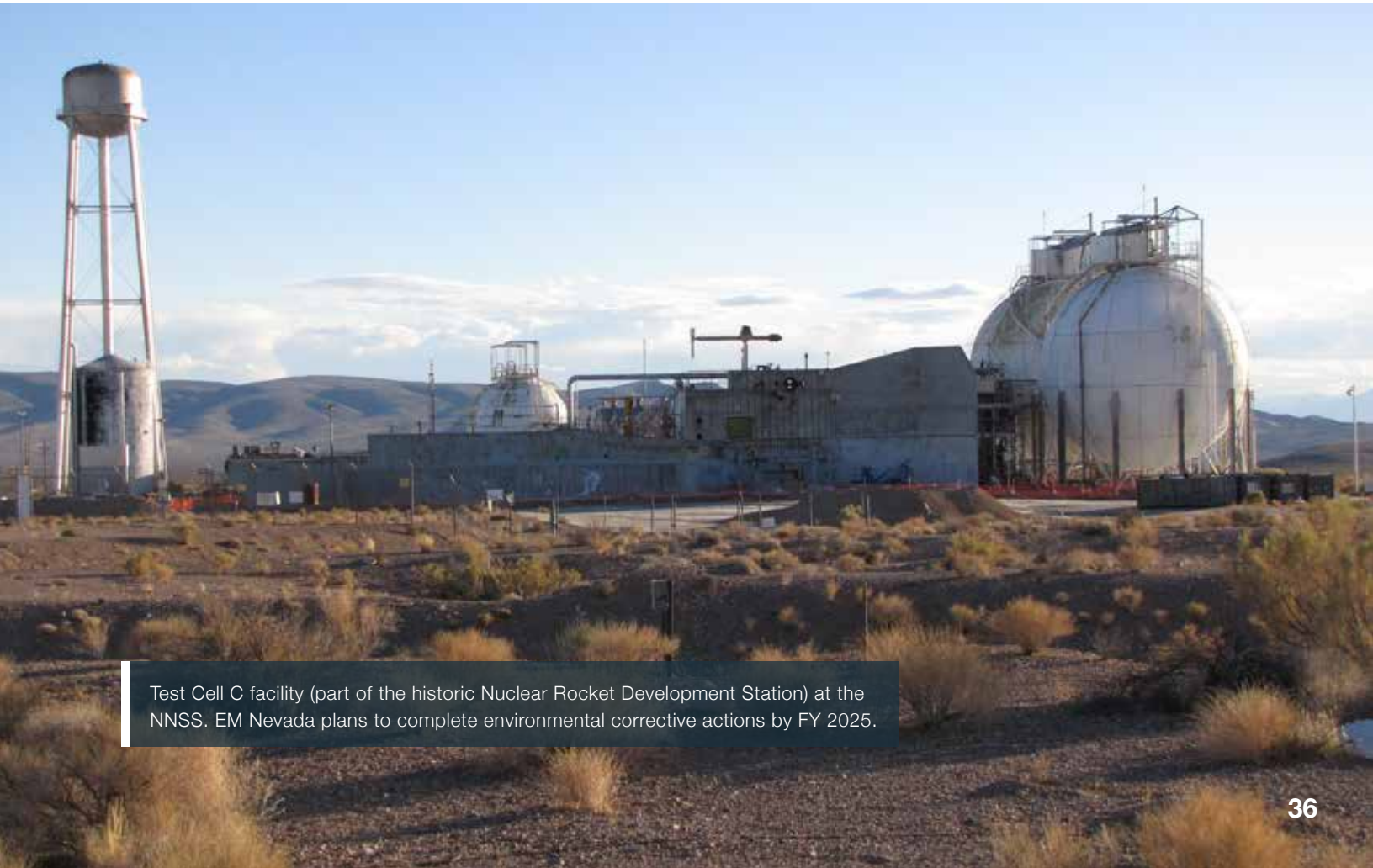
INDUSTRIAL FACILITIES

The two remaining industrial facilities are the Engine Maintenance Assembly and Disassembly (EMAD) facility and Test Cell C Ancillary Buildings and Structures, which consist of eight sites requiring cleanup. By the end of 2022, EM plans to receive regulatory approval on the corrective action strategy for the EMAD and Test Cell C sites. In 2025, EM will have addressed the required regulatory actions to close Test Cell C sites. The current plan is to demolish the buildings to grade with appropriate disposal of the debris, and to close in place any contamination located below grade. In 2027, EM will complete similar regulatory actions to close EMAD. The completion of environmental correction actions at EMAD and Test Cell C sites will result in the demolition and cleanup of all industrial facilities that are included in the FFACO.

Long-term monitoring of the FFACO 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 2028. At that time, any sites requiring future post-closure monitoring and use restrictions per the FFACO will be managed by the NNSA.

WASTE DISPOSAL ACTIVITIES

The NNSS 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.



Test Cell C facility (part of the historic Nuclear Rocket Development Station) at the NNSS. EM Nevada plans to complete environmental corrective actions by FY 2025.

Remaining Cleanup Scope Post-2030

EM currently anticipates a need for the ability to dispose of waste at the NNSS beyond 2030.

Low-level radioactive waste disposal activities at the NNSS Area 5 Radioactive Waste Management Complex.

Oak Ridge

EM completed demolition of the Poplar Creek facilities at the East Tennessee Technology Park in 2019.

Oak Ridge

Overview

The Oak Ridge site, located in eastern Tennessee, was 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 how to produce plutonium.

Throughout the following decades the three sites – K-25 (present day ETTP), X-10 (present day Oak Ridge National Laboratory (ORNL)), and Y-12 (present day Y-12 National Security Complex (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 the U.S. Environmental Protection Agency's National Priorities list in 1989.

The Oak Ridge Office of Environmental Management (OREM) is the landlord of ETTP, and it is responsible for environmental cleanup at Y-12 and ORNL. OREM has achieved significant risk reduction across the Oak Ridge Reservation and is nearing the completion of environmental cleanup at ETTP. This accomplishment will save millions of dollars in annual landlord, maintenance, and oversight costs that could be redirected to accelerate future cleanup.

With completion in sight at ETTP, OREM is currently laying the foundation for ramping up major cleanup operations at ORNL and Y-12. These projects will address DOE's largest inventory of high-risk excess contaminated facilities (former research reactors, isotope production facilities, and former process buildings), eliminate the site's inventory of uranium-233, remediate areas with dense mercury-contamination, and provide valuable real estate to SC and NNSA missions.

Cleanup accomplishments include:

- **Demolished all Poplar Creek Facilities. These were the most contaminated buildings remaining at ETTP and were the last support facilities associated with the former gaseous diffusion process.**
- **Demolished Building K-1037; at 380,000 square feet it was the largest remaining building at ETTP.**
- **Prepared the remaining uranium-233 inventory stored at ORNL for disposal.**
- **Commenced construction of the Outfall 200 Mercury Treatment Facility. This vital capability will open the door for the demolition of Y-12's large, deteriorated, mercury-contaminated facilities and subsequent soil remediation by providing a mechanism to limit potential mercury releases into the Upper East Fork Poplar Creek.**
- **Retrieved nearly 10,000 pounds of mercury from old equipment at Y-12, preventing a potential environmental release.**

Cleanup Highlights 2020-2030

DOE is on the cusp of completing all remaining demolition work at the ETTP. Over the next 10 years, DOE will also continue to make significant progress on cleanup activities at Y-12 and ORNL to help support the important missions of the NNSA and SC, as well as eliminating one of the largest

remaining security risks at ORNL.

By the end of 2020, all major demolition projects will be completed at ETTP. This will account for the removal of nearly 13 million square feet of buildings, and it will mark the first time in the world an entire enrichment complex has been removed. DOE is slated to complete any remaining soil and groundwater remediation at ETTP in 2024. The majority of land will be transferred to the community for industrial redevelopment, while the smaller stewardship areas will be transferred to LM.

In 2021, demolition will be completed on the remaining buildings in Y-12's Biology Complex, which span more than 320,000 square feet. This project will eliminate five high-risk excess contaminated facilities from the DOE national listing, and will open land for national security missions. In 2022, DOE is scheduled to complete mockup testing for sludge processing. This involves constructing a Sludge Processing Mockup Test Facility that will assist in technology testing and maturation related to future processing of Oak Ridge's inventory of sludge TRU waste.

By 2024, OREM will resume deactivation of major facilities at ORNL and Y-12. These projects will eliminate risks and clear land for science and national security missions to meet the needs of the nation. Currently, those two sites have approximately 220 excess, contaminated facilities.

In 2025, construction of the Outfall 200 Mercury Treatment Facility will be completed. When operational, 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. Also in 2025, OREM will finish processing, downblending, and disposing the remaining inventory of uranium-233 stored at ORNL. Finishing this removal 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.

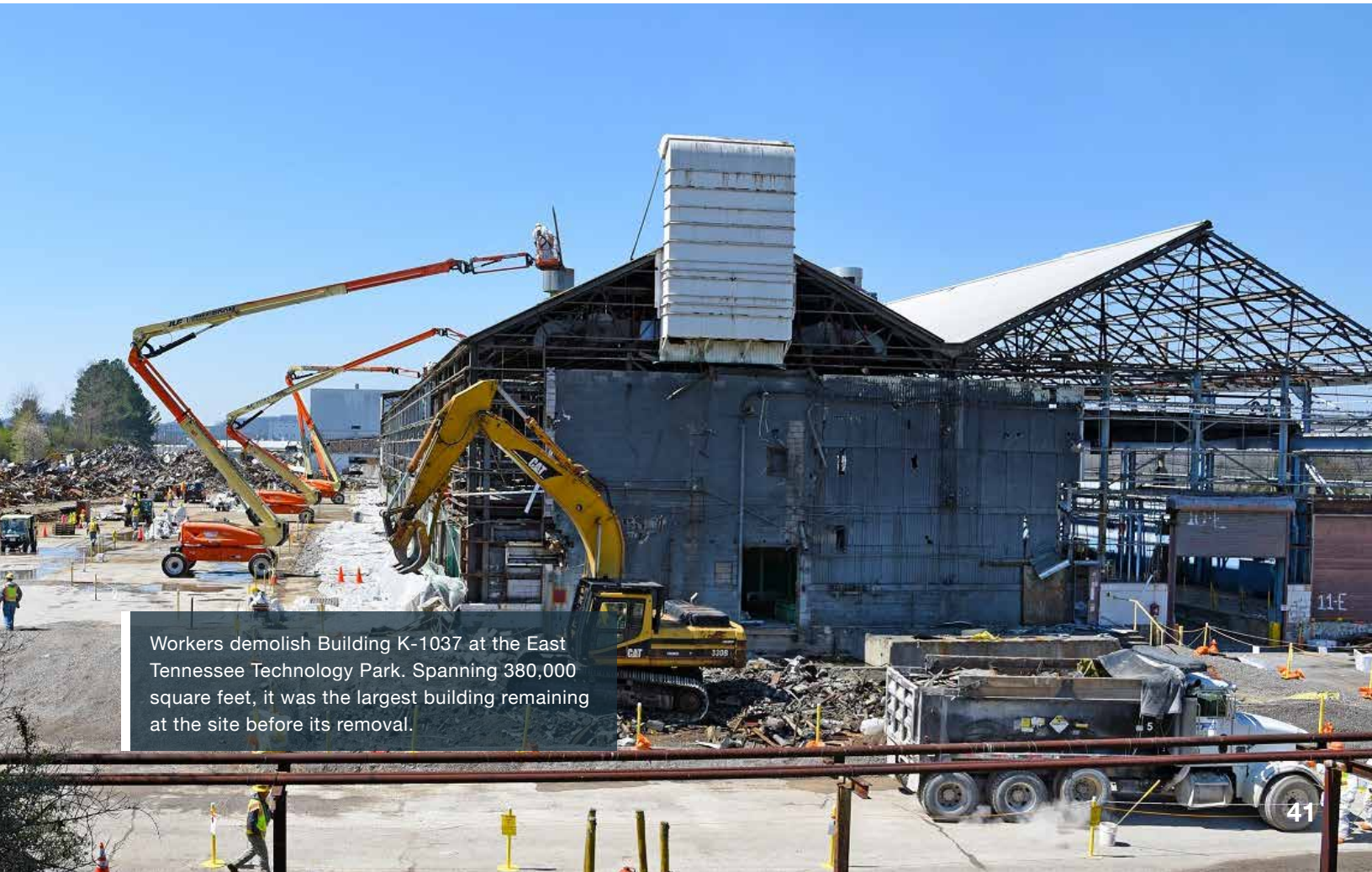
By 2026, all of the processing and shipments of Oak Ridge's inventory of legacy TRU debris waste to the WIPP will be completed. This inventory includes both CH and RH waste.

Currently, DOE is scheduled to complete construction on the first phase of the Environmental Management Disposal Facility in the mid-2020s. This crucial capability will provide the onsite waste disposal capacity for lower activity level waste and is needed to complete cleanup in Oak Ridge. It will accept the LLW generated from cleanup at ORNL and Y-12, and it is anticipated to avoid more than $700 million in costs that would be required if all of the waste is disposed of off-site.

Remaining Cleanup Scope Post-2030

At Oak Ridge, the remaining work will focus on completing cleanup at ORNL and Y-12. That includes deactivating and demolishing all of 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.

Fissionable material handlers open a canister containing uranium-233 to begin the extracting medical isotopes that will be used for cancer research.



Workers demolish Building K-1037 at the East Tennessee Technology Park. Spanning 380,000 square feet, it was the largest building remaining at the site before its removal.

Paducah

An aerial view of Paducah.

Paducah

Overview

In 1950, the Atomic Energy Commission, a precursor 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 U.S. The Paducah GDP produced low-enriched uranium originally as feedstock for nuclear weapons and later for commercial nuclear power plants.

Environmental cleanup of the Paducah GDP began in 1988 when groundwater contamination was discovered off the DOE property. Environmental cleanup includes remediation of groundwater, surface water, soil, lagoons and burial grounds. All of the facilities and buildings (over 500), along with their associated slabs, will be removed and/or remediated.

The Paducah site is also home to one of two DOE DUF6 conversion plants. DUF6 was a by-product 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.

Cleanup accomplishments include:

- **Initiated deactivation activities at Building C-333, one of the large process buildings, including the removal and disposition of asbestos cell housing panels, disposition of process gas components, removal of hazardous materials and reduction in the fire loading and characterization of all loose process gas equipment on the ground floor.**
- **Processed 3,889 cylinders at the DUF6 conversion facility through November 2019.**

Cleanup Highlights 2020-2030

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

Over the next decade, DOE will perform fieldwork associated with the characterization and remediation of the C-400 Complex Operable Unit (OU), the highest environmental priority at the site. The C-400 Complex (city block) includes the C-400 Cleaning Building, which utilized trichloroethylene (TCE) for cleaning equipment. The Complex is the primary source of the TCE groundwater contamination that was discovered off the DOE property in 1988. The Remedial Investigation/Feasibility Work Plan has been approved by the U.S. Environmental Protection Agency, and the remedial investigation of the entire C-400 city block for all media and contaminants has begun.

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. By the end of 2021, remedial investigation fieldwork activities will be completed at the C-400 Complex. The C-400 Complex OU Record of Decision, which details the remedial actions, is scheduled for issuance in 2024.

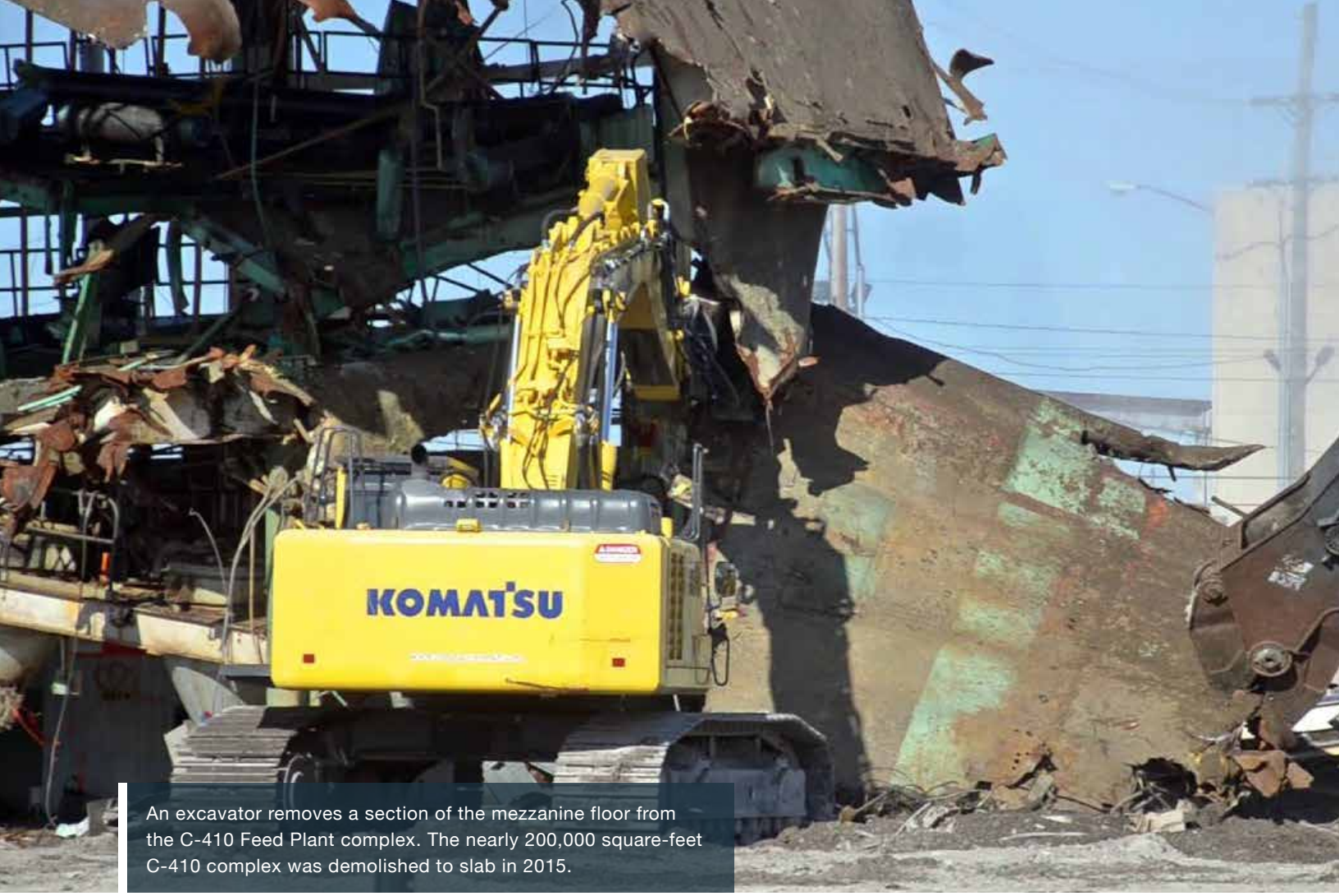
By the end of 2027, DOE also plans to complete deactivation work at the C-333 Process Building.

These activities include hazard removal (including freon, chemicals, fire hazards, etc.), characterization of the components within the facility, characterization and disposition of converters and select uranium deposits, utility isolation, conversion of wet sprinkler system to a dry hybrid system and other actions to prepare the C-333 Process Building for demolition.

At the Paducah DUF6 conversion facility, approximately 11,500 cylinders will be converted, and approximately 22 million gallons of hydrogen fluoride will be shipped off-site for commercial use by 2030.

Remaining Cleanup Scope Post-2030

Beyond 2030, site activities will include the design and construction of an On-Site Waste Disposal Facility (OSWDF), if selected as the waste disposal alternative, and continued deactivation and demolition of the more than 500 GDP facilities. Completion of design for the final cleanup of C-400 is anticipated to occur in the 2031 timeframe. Additionally, the remaining environmental cleanup activities related to groundwater, surface water, soils lagoons, and burial grounds will still need to 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.



An excavator removes a section of the mezzanine floor from the C-410 Feed Plant complex. The nearly 200,000 square-feet C-410 complex was demolished to slab in 2015.

Rail cars from the Depleted Uranium Hexafluoride conversion plant are staged to be shipped offsite.

Portsmouth

An aerial view of the Portsmouth Gaseous Diffusion Plant.

Portsmouth

Overview

In August 1952, the Atomic Energy Commission (AEC), a precursor agency to DOE, 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 gaseous diffusion enrichment plants 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 D&D activities initiated in 2011. The DOE near-term focus is the D&D of 415 facilities including the three former uranium enrichment process buildings (X-326, X-333, and X-330) each measuring approximately 33 acres. 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 by-product 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.

Cleanup accomplishments include:

- **Initiated preliminary demolition activities at the X-326 Building, one of the three former uranium enrichment process buildings.**
- **Began deactivation activities at the X-333 Building, the second of the three former uranium enrichment process buildings.**
- **Initiated construction for the first three cells and associated infrastructure for the OSWDF.**
- **Processed 2,487 cylinders at the DUF6 conversion plant through November 2019.**

Cleanup Highlights 2020-2030

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

Preparations are underway for the start of demolition of the X-326 Building, the first of three process buildings, including removal of obstructions around the building perimeter, Limited Area reconfiguration, and expansion of the site water treatment capability. Over the next decade, DOE will complete demolition of the X-326 process building and the X-333 process building, and complete deactivation of the X-330 process building.

In early 2021, DOE expects to begin utilizing the OSWDF for demolition debris

from the X-326 Process Building. To support this effort, excavation of one of the groundwater plumes will be completed to 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 utilized 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 will also be initiated and utilized for disposition of debris from X-333 Process Building demolition scheduled to begin in the 2025 timeframe.

Based on cell capacity need for X-330 process building demolition and Balance of Plant facilities, four to six additional OSWDF cell liners will be constructed (10-12 total) with the seventh scheduled to be completed in 2029. Additionally, over the next decade, three landfills will be relocated, and an additional plume will be excavated to provide fill materials for the demolition debris from the remainder of the X-326 and all of the debris from X-333 demolition.

At the Portsmouth DUF6 conversion facility, approximately 9,500 cylinders will be converted and approximately 18 million gallons of hydrogen fluoride (HF) will be shipped off-site for commercial use by 2030.

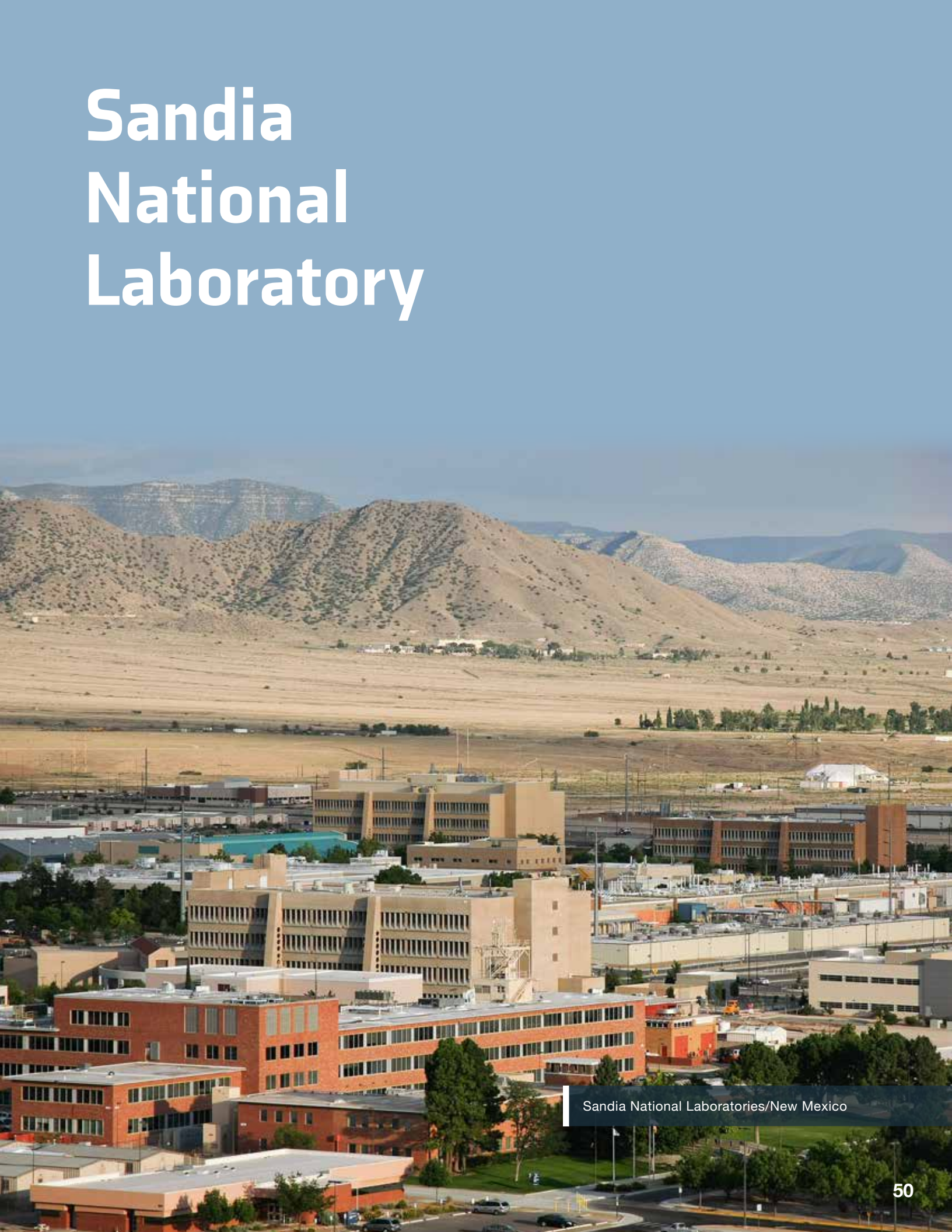
Remaining Cleanup Scope Post-2030

Beyond 2030, the last three liners of the OSWDF will be constructed to support demolition of the X-330 Process Building and remaining approximately 400 balance of plant facilities. Final soil restoration will be completed with the excavation of the remaining two plumes and two landfills. Cleanup activities at Portsmouth are anticipated to be completed in 2038. Additionally, DOE expects to complete disposition of the entire inventory of DUF6 located at Portsmouth by 2038.

The On Site Waste Disposal Facility (OSWDF) is currently under construction. The OSWDF is specifically engineered and built to safely accept contaminated debris from the gaseous diffusion buildings at Portsmouth.

As part of demolition preparations at Portsmouth, crews are constructing a waste water treatment facility to handle runoff from rain as well as dust suppression activities associated with tearing down the massive uranium enrichment process buildings and smaller support facilities. When operational, it can treat up to 400 gallons a minute, removing contaminants and releasing water safely into the local streams and tributaries.

Sandia National Laboratory



Sandia National Laboratories/New Mexico

Sandia National Laboratory

Overview

EM's cleanup activities at the Sandia National Laboratories takes 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 New Mexico Environment Department (NMED). DOE's approach is to work closely with NMED to complete Resource Conservation and Recovery Act (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. All soil sites in Sandia's ER Baseline have received Corrective Action Complete status from NMED and have been transferred to the laboratory's landlord, the NNSA.

Cleanup accomplishments include:

- **Completed work at 312 out of a total of 315 sites identified as needing soil and groundwater remediation.**

Planned Cleanup Scope 2020-2030

Beginning in 2020, DOE will conduct two years of characterization activities and install up to eight groundwater monitoring wells in the Burn Site Groundwater (BSG) Areas of Concern (AOC) section of the laboratory. Four of the eight wells are required, and up to four contingency wells are scoped to ensure installation of a clean downgradient well. DOE plans to transition this section of the laboratory to long-term stewardship by 2030.

In 2023, EM plans to transition the Tijeras Arroyo Groundwater (TAG) Areas of Concern (AOC) to long-term stewardship. DOE will also work over the next decade to perform corrective action activities at the Technical Area V Groundwater AOC.

Remaining Cleanup Scope Post-2030

In 2031, DOE will complete all the corrective action activities at the Technical Area-V Groundwater AOC and transition the section to long-term stewardship.

Savannah River Site

The Salt Waste Processing Facility will significantly enhance DOE's ability to treat tank waste at the site.

Savannah River Site

Overview

The Savannah River Site (SRS), an approximately 310-square-mile-site located in 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 research and development (R&D) activities.

Today, SRS is a complex site run by EM and host to NNSA. DOE 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 processing waste stored in 43 underground tanks; surplus plutonium downblending and disposition as TRU waste to WIPP; disposition of highly enriched uranium and processing of foreign and domestic research reactor receipts; facility decommissioning and demolition and soil and groundwater remediation.

To date, 293 facilities out of 1,127 have been deactivated and decommissioned, and 410 out of 515 areas have been remediated. Notably, collaboration among SRS entities 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.

For NNSA, SRS processes and stores nuclear materials in support of national defense and U.S. nuclear nonproliferation efforts. EM is also responsible for the SRNL, located at the site. 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, stockpile stewardship, nuclear non-proliferation, and other critical national security programs.

Cleanup accomplishments include:

- **Emptied and closed eight underground waste tanks.**
- **Produced more than 4,200 canisters of radioactive vitrified waste.**
- **Completed construction and cold commissioning of the Salt Waste Processing Facility, a key component in the site liquid waste program.**
- **Completed Saltstone Disposal Unit 6 ahead of schedule and under budget.**
- **Removed one metric ton of plutonium.**
- **Processed Canadian liquid Highly Enriched Uranium target material shipments, High Flux Isotope Reactor cores and four batches of Material Test Reactor Fuel.**
- **Completed material-at-risk removal activities from Building 235-F, a former plutonium fabrication facility.**
- **Completed D-Area Ash Project ahead of schedule and under budget, which resulted in the removal and consolidation of ash into an on-site landfill, remediating 60 acres.**
- **Completed the removal and disposition of coal ash at Dunbarton Bay Coal Ash Basin Phase 1, resulting in 29,600 tons of ash dispositioned.**

Cleanup Highlights 2020-2030

Over the coming decade, DOE will significantly enhance its ability to tackle the largest remaining environmental risk at SRS – radioactive tank waste – with the startup 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 will begin hot commissioning in 2020 and will process up to 9 million gallons of waste per year after the initial year of operation, enhanced through implementation of the Next Generation Solvent. By 2030, it is expected that nearly all of the salt waste inventory will be processed.

DOE will continue to perform environmental analyses in an effort toward the use of the Department's interpretation of the term "high-level waste" for a waste stream at SRS. This waste stream, recycle wastewater from the Defense Waste Processing Facility (DWPF), is undergoing analyses to determine if it could be solidified and disposed of at an off-site commercial disposal facility.

Substantial progress toward tank closure will continue with 22 of the 51 underground tanks being closed. By 2030, the DWPF will have produced more than 7,100 canisters of vitrified radioactive waste (more 85 percent of the anticipated total). The Liquid Waste Program will continue to support receipt of waste from H-Canyon.

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-Area, as well as continued surveillance and maintenance (S&M) of excess, non-operating nuclear facilities awaiting D&D. Over the next 10 years, the K-Area facilities will continue to down-blend and disposition both EM and NNSA surplus plutonium through capital upgrades and eventual shipment to WIPP. Shipment of down-blended material to WIPP is expected to begin in 2021.

The L-Area facilities will continue to provide wet storage of spent nuclear fuel received as part of the domestic and foreign research reactor fuel receipt programs. The H-Canyon chemical separations facility will continue to process nuclear materials and spent nuclear fuel (including Test Reactor Material and High Flux Isotope Reactor fuel) to support disposition of these materials. The K-Area facilities will continue to provide long-term storage of special nuclear material owned by both EM and NNSA.

SOLID WASTE PROGRAM

The Solid Waste Program will continue to safely 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

Environmental Remediation will continue to clean up contaminated soils, groundwater, streams (and associated wetlands) and legacy waste sites. EM is committed to reducing risk and protecting groundwater aquifers and surface waters from the spread of contamination by addressing sources of contamination using an area completion approach. Examples include installation of a Reactive Barrier Wall in P Area to treat solvent-contaminated groundwater; and the remediation of a former Oil Seepage Basin in G Area.

In addition, an integral part of the cleanup mission is the D&D of legacy facilities constructed in support of past nuclear materials production, such as the Process Heat Exchanger Repair Facility (also known as the Ford Building) and the Cask Car Repair Facility. SRS will continue to operate and maintain soil and groundwater remedial systems; and conduct post-closure and post-Record of Decision (ROD) care, surveillance, and maintenance of 73 closed areas (approximately 1,000 acres).

SRNL

Construction of the Advanced Manufacturing Collaborative (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. The DOE Laboratory Operations Board review of SRNL infrastructure concluded that two-thirds of the SRNL facilities are substandard or inadequate for modern technology development. The AMC facility strengthens current efforts to consolidate and modernize Laboratory facilities to address these inadequacies.

The AMC facility will provide accessible, modern, commercially viable and flexible laboratory space for SRNL to collaborate with industry and academia to translate a range of proven and potential advanced manufacturing technologies from the commercial chemical and manufacturing sectors into DOE processes, plans and missions to significantly improve risk management, enhance worker and public safety, reduce costs and shave years off the legacy waste cleanup schedule.

Remaining Cleanup Scope Post-2030

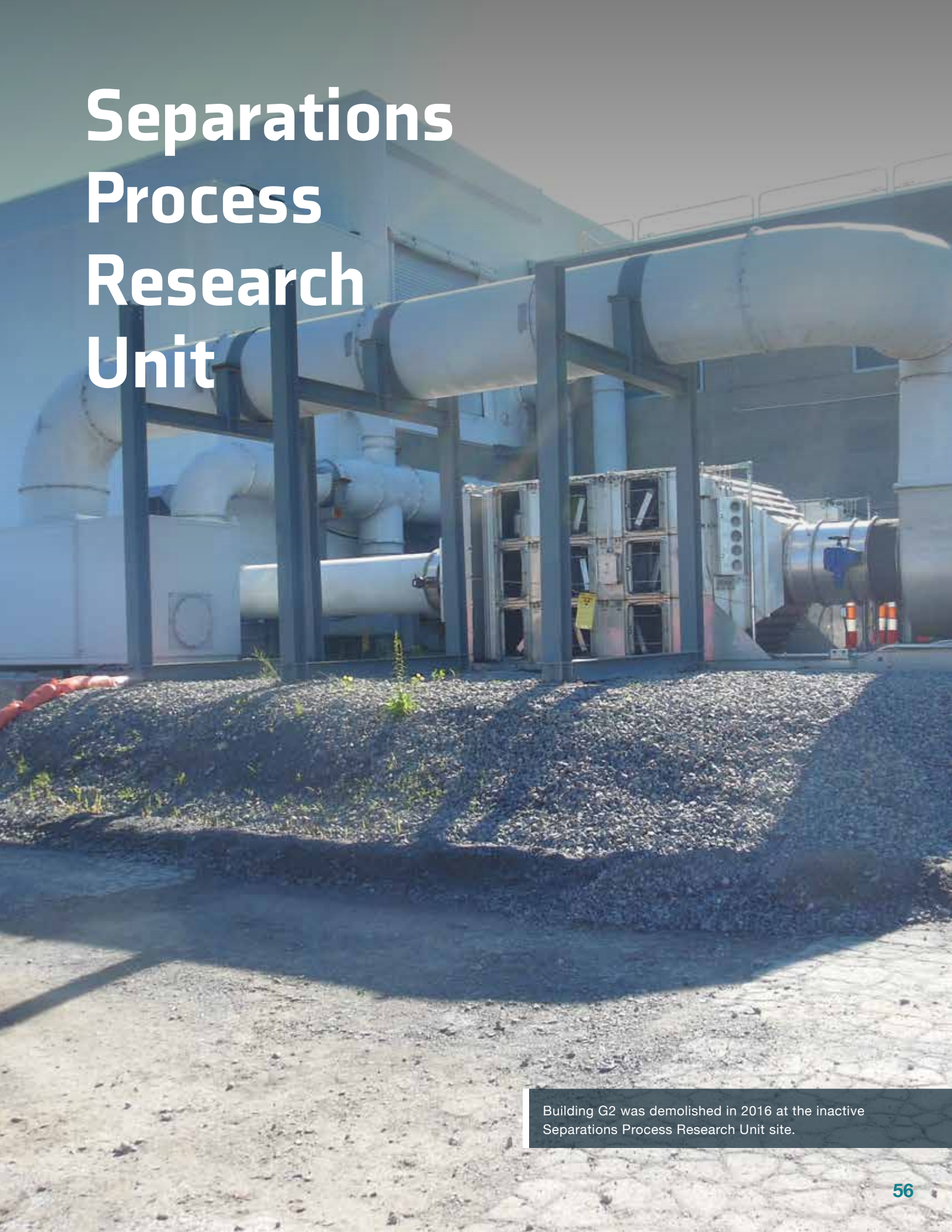
The Liquid Waste program will start closing its operations after SWPF completes treatment operations for the remaining salt waste and operational closure of the tank farms is completed. The Liquid Waste Program cleanup mission is planned for completion in 2037, and the S&M of the vitrification canisters in storage will be transferred to the Solid Waste Program.

The remaining Nuclear Material clean-up scope will be to complete deactivation and turn over for decommissioning all facilities other than K-Area facilities. Operations in K-Area will continue, particularly with the surplus plutonium disposition mission and all facilities will be deactivated at the conclusion of the disposition of special nuclear material.

Newly generated wastes resulting from the EM cleanup program will continue to be disposed as the waste is generated through the EM mission. As the Nuclear Materials and Liquid Waste Programs complete their missions, the Environmental Remediation, D&D Program will ramp up its program to provide for remediation of approximately 100 legacy waste units and D&D of over 800 industrial, nuclear and radioactive facilities.

Operators move fuel along in L Area Disassembly Basin after completing spent nuclear fuel travel modifications. The modifications allow movement of spent nuclear fuel vertically, instead of horizontally, and will realize a 25 percent efficiency gain for cask processing.

Separations Process Research Unit



Building G2 was demolished in 2016 at the inactive Separations Process Research Unit site.

Separations Process Research Unit (SPRU)

Overview

The Separations Process Research Unit (SPRU) site is located at the Knolls Atomic Power Laboratory in New York State. SPRU is an inactive pilot plant that was used to research and develop chemical processes to separate plutonium from other radioactive material. As a result of operations, contamination occurred at two buildings and interconnecting pipe tunnels, as well as approximately 30 acres of land where waste containers were managed.

Cleanup activities at SPRU to date have resulted in removal of the nuclear facilities (including the sub-grade building foundations and tank vaults), remediation of land areas, shipment of the resulting waste to the appropriate off-site disposal facilities, and transfer of the areas back to the Office of Naval Reactors. All site physical work finished in summer 2019. A storage facility containing 24 containers of TRU waste remains at the site. This waste was generated from removal of sediments in building sumps and some of the SPRU processing equipment.

Cleanup accomplishments at these sites include:

- **Demolished and removed Buildings G2 and H2.**

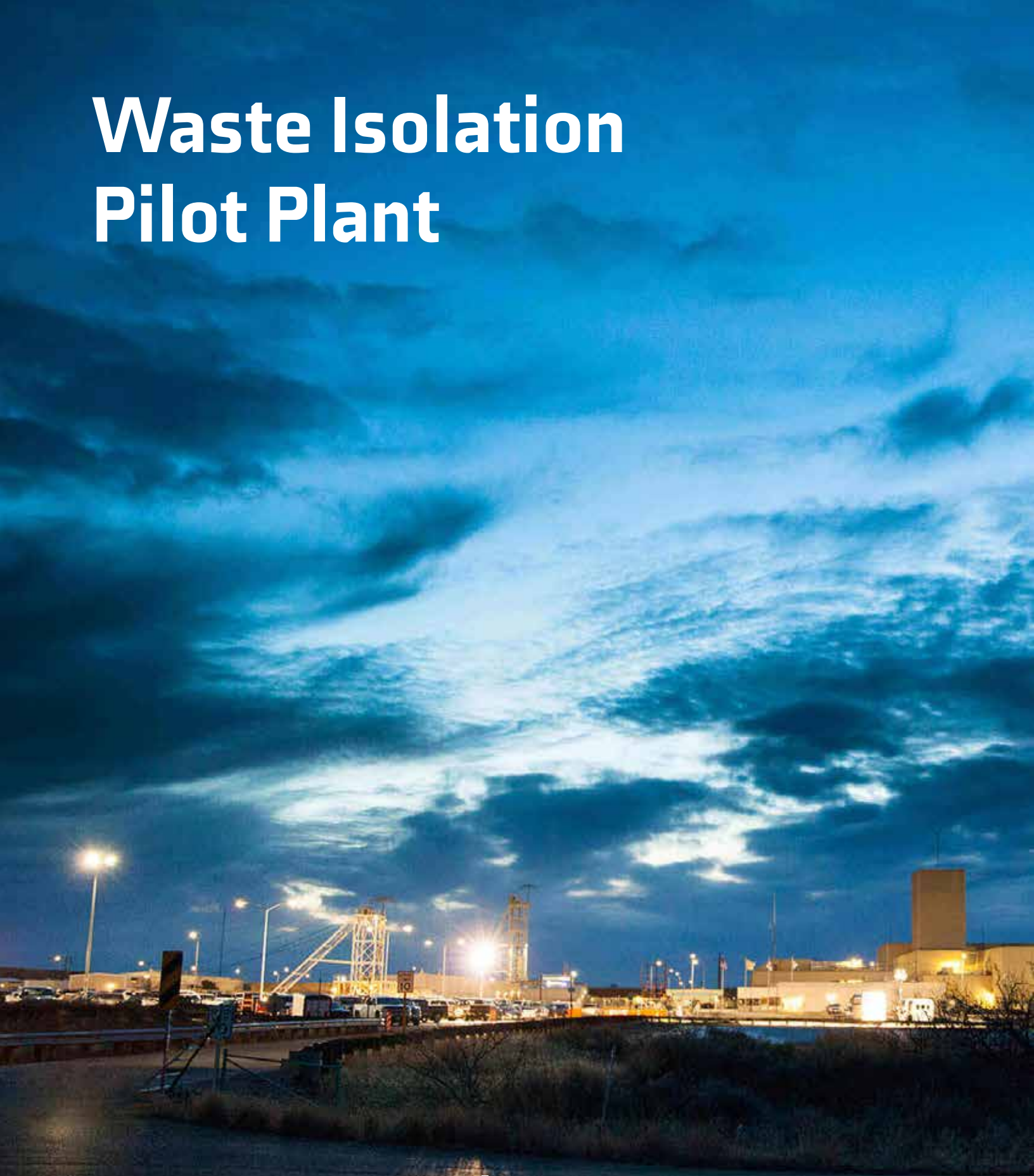
Cleanup Highlights 2020-2030

EM will complete the removal of the F-Yard Equipment and characterization of the Mohawk River contamination.

Remaining Cleanup Scope Post-2030

There are no post-2030 plans associated with SPRU.

Waste Isolation Pilot Plant



WIPP continues to be the cornerstone of EM's transuranic waste cleanup efforts.

Waste Isolation Pilot Plant

Overview

WIPP is the nation's only repository for the disposal of TRU waste generated as a result of atomic energy defense activities. WIPP is located 33 miles southeast of Carlsbad, New Mexico, in the Chihuahuan Desert, far from major population centers. The waste disposal rooms are 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.

The WIPP Land Withdrawal Act (LWA), Pub. L. 102-579 as amended by Pub. L. 104-201, limits the amount of TRU waste that can be disposed of in the repository to 6.2 million cubic feet. Approximately 69,000 cubic meters (m3) of TRU waste, or about 39% of the LWA TRU volume limit has been emplaced in the underground repository to date. WIPP is currently anticipated to operate beyond 2050.

Cleanup accomplishments include:

- **Removed TRU waste from 22 of 30 sites.**
- **Conducted more than 13,500 shipments safely to date.**

Cleanup Highlights 2020-2030

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.

SITE INFRASTRUCTURE IMPROVEMENTS

By the end of 2023, a set of key infrastructure projects will be completed, improving WIPP capabilities in mining and waste emplacement. These include the new Safety Significant Confinement Ventilation System (SSCVS), which will provide 540,000 cubic feet per minute of HEPA-filtered 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 provide a new air intake shaft to support the SSCVS and facilitate mining additional panels. The new Utility Shaft will also provide a shaft to house a new, larger capacity hoisting capability to transport salt and 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.**
- **Electrical substation replacements.**
- **Additional backup generators.**

WASTE EMPLACEMENT

EM expects to complete mining activities in Panel 8 by early 2022.

It is anticipated that over the next 10 years approximately 25,000 cubic meters of TRU waste might be emplaced at WIPP.

Construction of a new, permanent ventilation system is one of several capital improvement projects that are ongoing at WIPP.

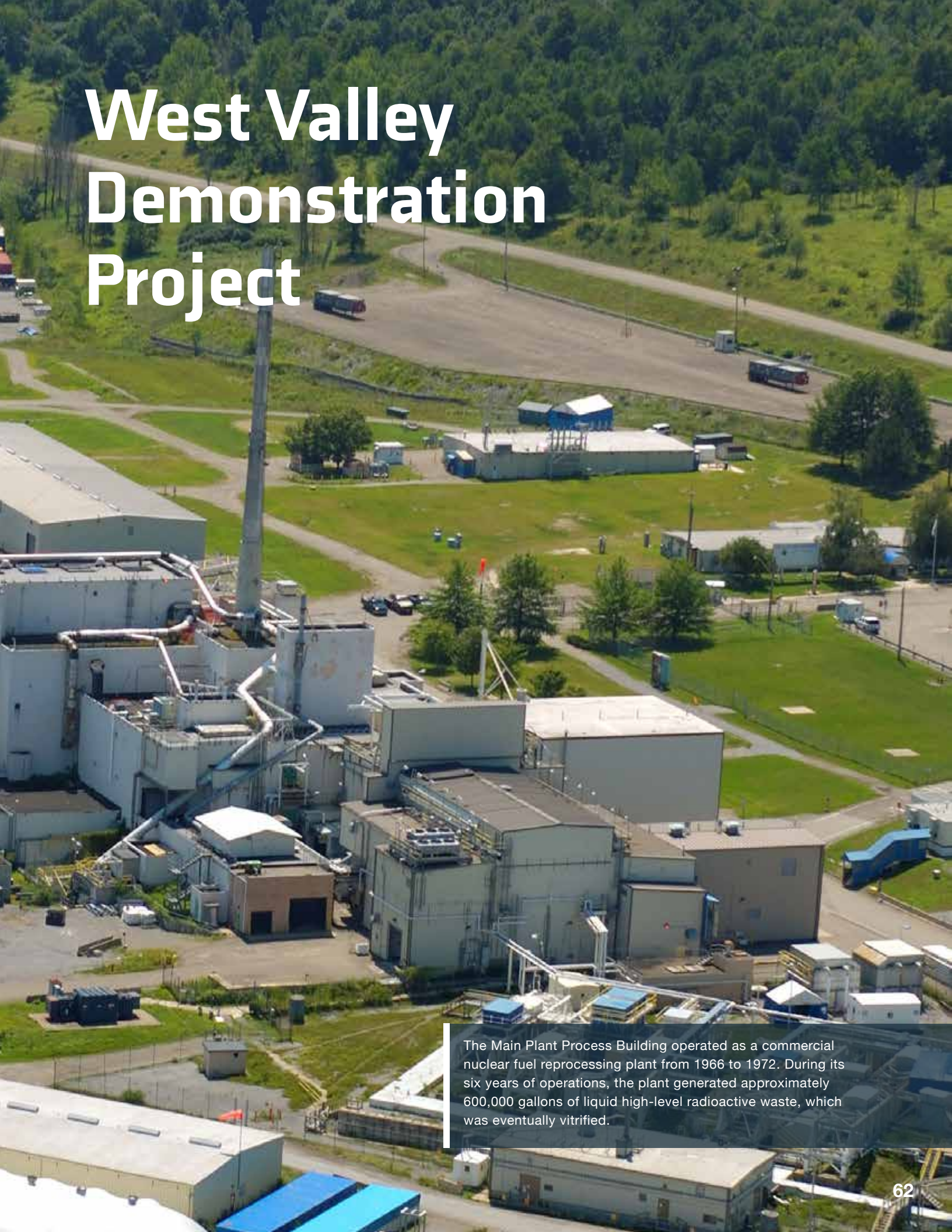
Usage of the TRUPACT-III packaging resumed in 2019, allowing EM facilities like the Savannah River Site to safely transport large-sized defense transuranic waste in a single shipping cask.

Work continued in late 2019 on a bypass road that will allow non-WIPP traffic to be re-routed around the transuranic waste repository, making it safer for employees traveling to the facility.

Remaining Scope Post-2030

WIPP will continue mining and waste emplacement operations to dispose of a total of 6.2 million cubic feet of TRU waste generated as a result of atomic energy defense activities.

West Valley Demonstration Project



The Main Plant Process Building operated as a commercial nuclear fuel reprocessing plant from 1966 to 1972. During its six years of operations, the plant generated approximately 600,000 gallons of liquid high-level radioactive waste, which was eventually vitrified.

West Valley Demonstration Project

Overview

The West Valley Demonstration Project (WVDP) is located at the Western New York Nuclear Service Center (WNYNSC), 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 spent nuclear fuel reprocessing facility to operate in the United States. In 1962, Nuclear Fuel Services, Inc. (NFS) entered into agreements with the Atomic Energy Commission (AEC) and New York State to construct, license, and operate the commercial spent nuclear fuel reprocessing plant. NFS built and operated the plant and two waste burial grounds from 1963 to 1972. NFS processed 640 metric tons of spent nuclear fuel and generated over 600,000 gallons of liquid high-level waste (HLW). In 1976, NFS exercised its contractual right to yield the WNYNSC's responsibility back to New York State and currently NYSERDA holds title and manages it.

In 1980, Congress passed the WVDP Act. The WVDP Act requires the U.S. Department of Energy (DOE) to conduct a HLW management demonstration project at the WNYNSC for purposes of demonstrating solidification techniques which may be used for preparing HLW for disposal. The WVDP Act directed DOE to:

- Solidify the HLW in a suitable form for transportation and disposal.
- Develop containers suitable for the disposal of the HLW.
- Transport, as soon as feasible, the solidified waste to a federal repository for disposal.
- Dispose of low-level radioactive waste (LLW) and transuranic (TRU) waste produced by the HLW's solidification processes.
- Decontaminate and decommission the tanks and other facilities used at the WNYNSC in which the HLW was solidified, the facilities used in the waste solidification effort, and any material and hardware used in connection with the WVDP.

The WVDP Act prohibits DOE from taking title to the waste, real property, or facilities at the WNYNSC.

DOE completed solidifying the HLW into canisters in 2002. The resulting 278 canisters of vitrified HLW are currently stored onsite, pending availability of a federal repository. Since 1998, DOE has been disposing of LLW; processing and packaging both CH and RH Greater-than-Class-C (GTCC)-like waste; and deactivating, decontaminating, and removing facilities used in the process of solidification of the HLW.

In 2010, DOE and NYSERDA issued a joint Final Environmental Impact Statement (FEIS) that analyzed the potential environmental impacts of reasonable alternatives to complete the WVDP cleanup pursuant to the WVDP Act and the decommissioning and/or long-term stewardship of the WNYNSC. In that same year, DOE issued a Record of Decision in which DOE decided to implement a phased decision-making approach for decommissioning the site. The first phase covers decommissioning and removal

of certain facilities and areas, which includes soil remediation activities.

The second phase, for which DOE has not yet made a decision, would involve decommissioning remaining facilities and areas pursuant to the WVDP Act, including the four underground waste tanks and decommissioning of the NRC-licensed Disposal Area.

Cleanup accomplishments include the following:

- **Relocated 278 vitrified waste canisters to a new on-site dry cask storage area.**
- **Dispositioned all legacy LLW.**
- **Demolished the Vitrification facility and 25 other support buildings.**
- **Deactivated 98% of the Main Plant Process Building in preparation for demolition in 2020.**

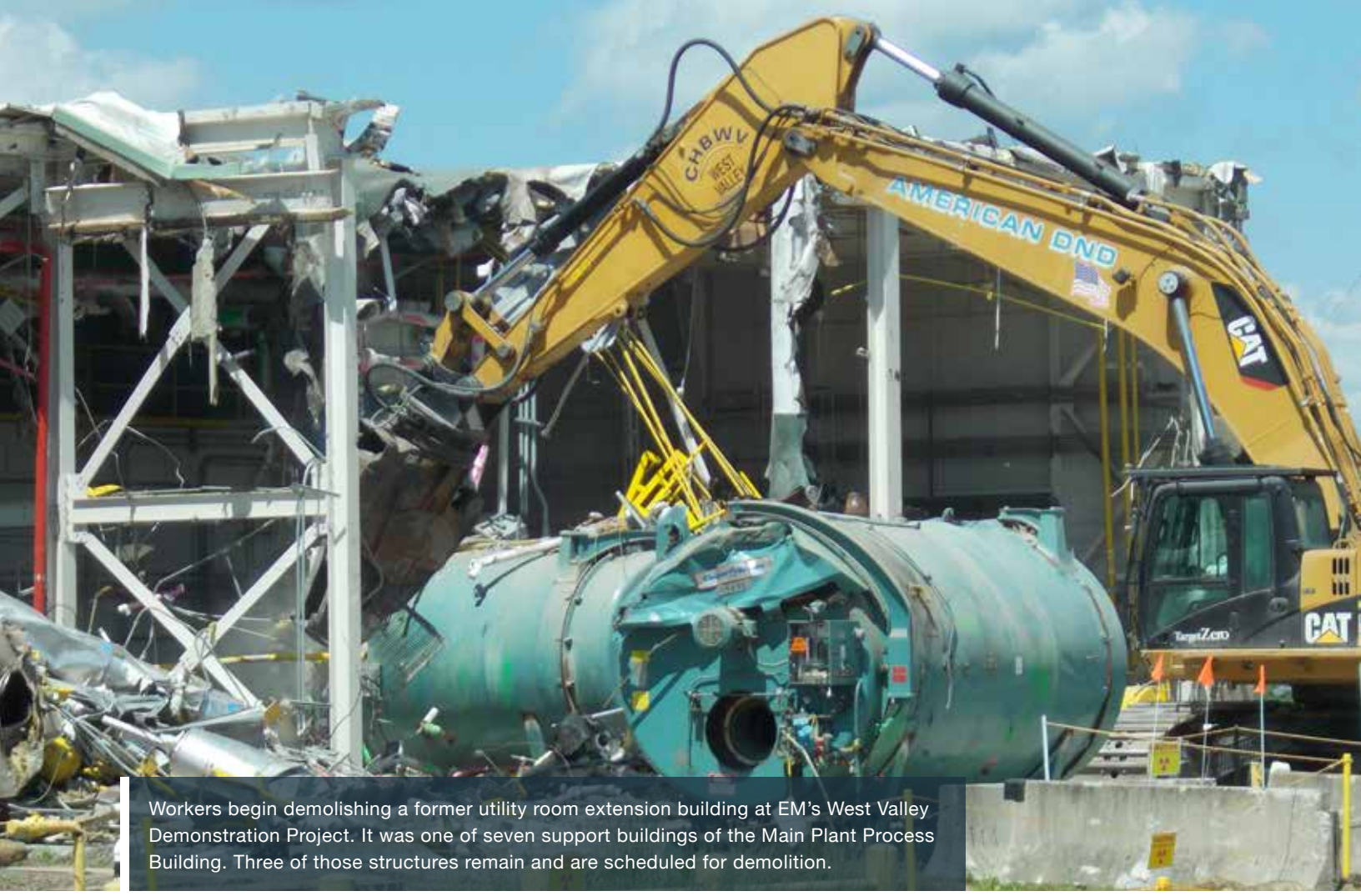
Cleanup Highlights 2020-2030

Work at West Valley over the coming decade will focus on completing remaining facility decommissioning activities, including demolition of the last remaining major building – the former Main Plant Process Building – as well as reaching agreement with state regulators on paths forward for remaining cleanup activities.

Over the next decade, DOE will complete soil remediation and facility decommissioning activities, though completion could be impacted by a lack of disposal options for GTCC-like waste. By September 2023, DOE expects to complete demolition of the Main Plant Process Building. In addition, demolition activities will be completed at the remaining two ancillary support buildings, and three remaining excess facilities.

Between 2024 and 2030, DOE will complete the decommissioning of the below-grade portions of the Main Plant Process Building and Vitrification Facility, as well as the radioactive water treatment system, including four active lagoons and one closed lagoon. EM will need an identified GTCC-like waste disposal option by 2025 to allow the demolition of all GTCC-like waste storage and processing facilities, such as the Remote Handled Waste Facility, and related support facilities, by 2030.

The West Valley Demonstration Project is a radioactive waste management and decommissioning project at the site of the only commercial nuclear fuel reprocessing plant to have operated in the United States.



Workers begin demolishing a former utility room extension building at EM's West Valley Demonstration Project. It was one of seven support buildings of the Main Plant Process Building. Three of those structures remain and are scheduled for demolition.

A view of debris following completion of demolition of the former utility room extension building.

Remaining Cleanup Scope Post-2030

Work at West Valley post-2030 will focus on DOE and NYSERDA intended integrated decisions for a path forward on the disposal of waste and completing the cleanup of the waste tank farm two waste burial grounds, and long-term site stewardship. DOE and NYSERDA intend to make an integrated decision on the path forward for these activities by 2023. In addition, some facility demolition activities may remain to be completed if a GTCC-like waste disposal option is not identified by 2025. DOE will also work to identify a disposal pathway for the stored canisters of vitrified HLW.

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