



2021

YEAR IN REVIEW



U.S. DEPARTMENT OF
ENERGY

OFFICE OF
**ENVIRONMENTAL
MANAGEMENT**



“We are entering a new era for cleanup success, and we are already capitalizing on it. Despite the continuing challenges brought on by the pandemic, DOE achieved the vast majority of our environmental priorities for 2021. It’s about ensuring that the families most impacted by the Department’s environmental legacy can breathe clean air, drink clean water, and raise their children in safe homes. All of EM’s work enables the Department of Energy’s quest to push the boundaries of science and technology and realize a vision for a clean energy future.”

– *Jennifer M. Granholm, Secretary
U.S. Department of Energy*



“The EM mission is about keeping promises to the American people and ensuring a vibrant and sustainable future for all, including those who shouldered the burden of our safety and security during the Manhattan Project and the Cold War. In collaboration with a diverse set of partners, EM’s progress is protecting the environment, boosting other vital DOE missions in areas like climate change and national security, and opening new opportunities for energy jobs and conservation.”

– *David M. Turk, Deputy Secretary
U.S. Department of Energy*



“I am proud that this year EM again made significant strides in completing key projects, reducing the cleanup footprint, awarding major contracts that accelerate progress, and driving mission innovation and improved performance. We embarked on an ambitious slate of cleanup priorities this year, and thanks to the dedication of our workforce, we were able to achieve the vast majority of what we set out to do. These achievements were also the result of the strong ongoing support we received from state, tribal and local partners who share our commitment to cleanup progress.”

– *William “Ike” White, Senior Advisor
for Environmental Management
U.S. Department of Energy*

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Acronyms and Abbreviations

AMC	Advanced Manufacturing Collaborative	HFBR	High Flux Beam Reactor
AMWTP	Advanced Mixed Waste Treatment Project	ICP	Idaho Cleanup Project
AOC	Area of Concern	INL	Idaho National Laboratory
ARP	Accelerated Retrieval Project	IWTU	Integrated Waste Treatment Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	LANL	Los Alamos National Laboratory
CFM	Cubic Feet per Minute	LAW	Low-Activity Waste
DFLAW	Direct-Feed Low-Activity Waste	LLW	Low-Level Radioactive Waste
DOE	Department of Energy	LM	Legacy Management
DOE-SC	DOE Office of Science	M&O	Management and Operating
DUF6	Depleted Uranium Hexafluoride	MARS	Mirror Advanced Reactor System
DWPF	Defense Waste Processing Facility	MLLW	Mixed Low-Level Radioactive Waste
E-Beam	Electron Beam	MPPB	Main Plant Process Building
EBR-II	Experimental Breeder Reactor-II	NA-LA	National Nuclear Security Administration Los Alamos Field Office
EM	Office of Environmental Management	NDEP	Nevada Division of Environmental Protection
EMAD	Engine Maintenance, Assembly, and Disassembly	NMED	New Mexico Environment Department
EM-LA	Environmental Management - Los Alamos Field Office	NNLEMS	Network of National Laboratories for Environmental Management and Stewardship
EPA	U.S. Environmental Protection Agency	NNSA	National Nuclear Security Administration
ET	Evapotranspiration	NNSS	Nevada National Security Site
ETEC	Energy Technology Engineering Center	NPS	National Park Service
ETTP	East Tennessee Technology Park	OREM	Oak Ridge Office of Environmental Management
FY	Fiscal Year	ORNL	Oak Ridge National Laboratory
GPC	General Purpose Cell	OSWDF	On-Site Waste Disposal Facility
HBCUs	Historically Black Colleges and Universities		

Acronyms and Abbreviations *(continued)*

PPC-S	Product Purification Cell – South	STEM	Science, Technology, Engineering and Mathematics
R&D	Research and Development	SWPF	Salt Waste Processing Facility
RCRA	Resource Conservation and Recovery Act	TA	Technical Area
ROD	Record of Decision	TCC	Test Cell C
RSWF	Radioactive Scrap and Waste Facility	TCE	Trichloroethylene
SDU	Saltstone Disposal Unit	TRU	Transuranic
SFO	Sandia Field Office	TSCR	Tank-Side Cesium Removal
SPRU	Separations Process Research Unit	UAS	Unmanned Aircraft System
SRAT	Sludge Receipt and Adjustment Tank	UMTRA	Uranium Mill Tailings Remedial Action
SRNL	Savannah River National Laboratory	WIPP	Waste Isolation Pilot Plant
SRS	Savannah River Site	WTP	Waste Treatment and Immobilization Plant
SSCVS	Safety Significant Confinement Ventilation System	WVDP	West Valley Demonstration Project
		Y-12	Y-12 National Security Complex

OFFICE OF ENVIRONMENTAL MANAGEMENT

ENTERING A NEW ERA OF CLEANUP ACCOMPLISHMENT

The Office of Environmental Management (EM) is responsible for addressing the environmental legacy of decades of nuclear weapons production activities and government-sponsored nuclear energy research. One of the largest environmental remediation efforts in the world, the program is intended to help and protect the local communities across the country that played a vital role in helping the United States win World War II and the Cold War. EM's work provides environmental benefits and risk reduction to these communities.

In 2021, EM leveraged the results of years of successful work to launch a new era for the Department of Energy's (DOE) cleanup mission, all while continuing to navigate and manage the challenging conditions of the COVID-19 pandemic. To tackle one of the Department's largest environmental and financial responsibilities – radioactive tank waste – EM began ramping up treatment at the Savannah River Site (SRS) while continuing to make steady progress on preparing necessary facilities at the Hanford Site and the Idaho Cleanup Project (ICP) for eventual operation.

At Oak Ridge, workers transitioned from the historic accomplishment of bringing down the former uranium enrichment buildings at the East Tennessee Technology Park (ETTP) to focus on facility decommissioning and demolition work at the Y-12 National Security Complex (Y-12) and Oak Ridge National Laboratory (ORNL), successfully demolishing the former Biology Complex at Y-12. At the Portsmouth site, a new era of cleanup began when after of years of preparation, workers began tearing down the first of the three massive uranium enrichment process buildings there. And at the Energy Technology Engineering Center (ETEC), the

next phase of cleanup is ready to begin after EM safely demolished all DOE-owned buildings at the site.



Senior Advisor for EM Ike White (right) learns about the Waste Hoist during his visit to the Waste Isolation Pilot Plant (WIPP).

EM continued to institute its end-state contracting approach, featuring work grouped into specific task orders for greater clarity with shorter time frames and more accurate cost and schedules, across the complex with the award of new contracts at Idaho, Oak Ridge and Savannah River. EM also awarded a new deactivation and decommissioning services contract to help launch a new era of cleanup at sites managed by the National Nuclear Security Administration's (NNSA) Office of Naval Reactors.

EM's world-class laboratory, the Savannah River National Laboratory (SRNL), began a new era in its important mission to support EM and DOE when it completed the transition to a stand-alone management-and-operations contract. This transition will strengthen SRNL's ability to support cleanup not just at Savannah River, but across EM,

as well as to support wider Departmental goals and to position the laboratory for a vibrant future and expanded mission going forward.



DOE Secretary Jennifer Granholm (right) and others are briefed while overlooking the Bayview cleanup on an August visit to the Lawrence Berkeley National Laboratory.

As EM established this new era of cleanup, it took steps to ensure a diverse and inclusive workforce is ready and able to serve going forward. The Minority Serving Institutions Partnership Program, managed by SRNL, is expanding to a new EM STEM, Manufacturing and Cybersecurity Consortium. Through agreements with two Historically Black Colleges and Universities (HBCUs), Oak Ridge is providing students new education and professional opportunities. These partnerships with HBCUs and the new Consortium are helping to build a pipeline of qualified candidates for cleanup work.

Going forward, EM's relationships with all of those who have a stake in the Department's cleanup

activities, including Congress, state and local officials and regulators, Tribal nations and the communities most directly impacted, will remain vital. Even as the COVID-19 pandemic continued, EM maintained a robust outreach and engagement schedule this year to ensure that a diverse range of voices were heard, and that cleanup decisions and activities occurred in a collaborative manner. EM is committed to the approach that those most impacted by the mission continue to have a strong voice and a seat at the table as the cleanup program develops priorities outlined in the [Strategic Vision](#), moves toward more key completions, and tackles some of the biggest remaining challenges.

The [achievements of 2021](#) demonstrate the level of success possible when collaboration is prioritized and a commitment to safe, risk-informed, and results-focused cleanup is shared by the Department and its partners. EM's accomplishments this year put the cleanup program on a strong footing to advance into this new era to achieve lasting and substantial progress.



EM field managers discuss cleanup progress at their sites during a session of the 2021 National Cleanup Workshop.

BROOKHAVEN NATIONAL LABORATORY

“We remain committed to fully achieving Brookhaven’s goals associated with the High Flux Beam Reactor Stack Demolition Project despite early challenges associated with the COVID-19 pandemic and more extensive soils remediation than planned.”

– Paul Lucas, Federal Project Director, Brookhaven National Laboratory

HIGHLIGHTS

- Completed High Flux Beam Reactor (HFBR) stack demolition to grade.
- Remediated surrounding HFBR stack demolition contaminated soils, and concrete surface and subsurface structures.
- Completed independent verification of remaining potentially impacted surrounding soils and concrete post remediation.
- Completed backfill of HFBR stack area, excavated footprint and performed final grading/re-seeding of the disturbed project area.
- Completed equipment and demolition contractor demobilization from the site.

PROGRESSING TOWARD STACK DEMOLITION CLOSEOUT

The 320-foot-tall HFBR exhaust stack once used for multidisciplinary scientific research was demolished to grade without incident in eight weeks and was completed in February.

Although more impacted soils and concrete were encountered, the surrounding impacted soils were remediated, and the area was restored by the end of September.

Closeout activities to include the Final Project Closeout Report submittal to the U.S. Environmental Protection Agency (EPA) are expected to be completed in the first quarter of 2022, satisfying the established regulatory completion milestone.

When decommissioning and demolition is complete, the facility will be transferred back to the DOE Office of Science (DOE-SC) for long-term surveillance and maintenance. Stack demolition and closeout represent the final EM work scope for compliance with the 2009 Record of Decision (ROD).



A patented concrete chimney demolition system called the MANTIS is being lifted by crews to the top of the exhaust stack.

ENERGY TECHNOLOGY ENGINEERING CENTER

“2021 has shown great progress toward environmental remediation at ETEC, but our team realizes the toughest work is yet to come. Now that building demolition is complete, we look forward to keeping the momentum of this cleanup as we switch our focus toward groundwater remediation. The Department plans to continue working with the State of California to clean up the site, including groundwater and soil remediation. I am extremely proud of how well our team performed this year, accomplishing the 2021 EM priority to complete building demolition with a spotless safety record.”

– Josh Mengers, Acting Manager, Energy Technology Engineering Center

HIGHLIGHTS

- Completed the demolition of all DOE-owned buildings – an EM 2021 priority.
- Safely transported 350 shipments (22,000 cubic yards) of demolition debris for disposal out of the state of California.
- Maintained an excellent health and safety culture, resulting in 32,000 person-hours worked during building demolition with no recordable incidents, loss time accidents or on-site COVID-19 transmission.
- Continued groundwater interim measures by capturing and removing approximately 9,000 gallons of solvent-impacted groundwater, keeping it away from the deeper bedrock groundwater.

BUILDING DEMOLITION AT ENERGY TECHNOLOGY ENGINEERING CENTER COMPLETE

Significant progress on cleanup at ETEC continued for a second straight year as the demolition of DOE-owned buildings was completed in 2021. This accomplishment is a direct result of multiple agreements between DOE and the state of California, as EM builds on good relationships that have enabled the current progress toward cleanup of Area IV of the Santa Susana Field Laboratory.



ETEC before final building demolition.

Shaped charges safely brought the final DOE buildings to the ground on October 1. All told, DOE safely demolished its final 18 buildings, covering approximately 75,000 square feet, in just over

15 months. With the buildings gone, workers sealed the vaults, basements and other remaining subgrade structures; those will be remediated in a future part of the project. DOE continues to work with state regulators on the formal closure of the Resource Conservation and Recovery Act (RCRA) permitted buildings that were removed. Over the final months of 2021 and into the first few months of 2022, DOE continues to ship the building debris to an agreed-upon disposal facility outside the state of California.

With a ROD for groundwater remediation published and a groundwater corrective measures study completed, 2021 saw DOE complete the design details for proposed groundwater remediation actions. These actions provide plans to remediate seven areas identified as having groundwater issues. Meanwhile, groundwater interim measures continued this year, removing a quantity of contaminants. DOE also made significant progress toward agreement on the groundwater



ETEC's final building for demolition – the Sodium Pump Test Facility – amid blasts from shaped charges.

implementation plan this year. Now that building demolition is complete, the DOE plans to ramp up groundwater remediation efforts to maintain momentum on site cleanup.

ENVIRONMENTAL MANAGEMENT CONSOLIDATED BUSINESS CENTER – NEW YORK PROJECT OFFICE

“Completing the field work in the F-Yard and awarding key initial task orders to disposition a portion of the SPRU TRU waste are significant milestones for the EMCBC-NY Project Office.”

– *Hugh Davis, Federal Project Director, Environmental Management Consolidated Business Center – New York Project Office*

HIGHLIGHTS

- Completed removal of F-Yard excess materials and restoration at the former Separations Process Research Unit (SPRU) site.
- Awarded contract to develop a path for commercial treatment of a portion of transuranic (TRU) waste stored at SPRU, followed by low-level radioactive waste (LLW) disposal.
- Continued safe storage of TRU waste from the project, pending final disposition.

RESTORING THE SITE FOR FUTURE USE

In 2021, DOE completed field work and site restoration at the F-Yard located at SPRU, the site of the former research facility that was used to develop chemical processes to separate plutonium from other radioactive materials during the Cold War. This completes the SPRU project with the exception of the TRU waste presently stored at the site. In 2021, DOE awarded a contract to develop



TRU waste storage area during inspection.



Removal of F-Yard excess materials.

an approach to process and dispose a portion of the TRU waste as LLW.

HANFORD SITE

“I am proud of the many important achievements that our Hanford team has safely delivered during challenging times. I am optimistic about our site’s future, given what we have accomplished over the last few years, and especially this last year as we have prepared to start treating waste from our large underground tanks in the Direct-Feed Low-Activity Waste program. That next chapter of Hanford cleanup begins in 2022, when we start up our Tank-Side Cesium Removal System to produce a supply of waste that will be fed directly to our vitrification facility starting in 2023. Beyond the DFLAW program, our team continued to deliver taxpayer value in 2021 by safely progressing projects and conducting operations that reduce risks to our workforce, our community, and the environment of the Pacific Northwest.”

– *Brian Vance, Manager, Hanford Site*

HIGHLIGHTS

- Completed construction and startup testing of all Waste Treatment and Immobilization Plant (WTP) facilities needed to start immobilizing tank waste in glass using vitrification.
- Continued commissioning major vitrification plant systems associated with the Low-Activity Waste (LAW) Facility, including a loss-of-power test, a critical step toward heatup of the plant’s melters.
- Connected Hanford tank farms and the LAW Facility with waste transfer piping.
- Completed building and testing the Tank-Side Cesium Removal (TSCR) system that will start treating tank waste in 2022 to build up a supply to feed directly to the vitrification facility in 2023 – an EM 2021 priority.
- Completed stabilizing three at-risk underground waste disposal structures – an EM 2021 priority.
- Treated more than 2 billion gallons of contaminated groundwater for the seventh consecutive year.
- Initiated work with Network of National Laboratories for Environmental Management and Stewardship (NNLEMS) to develop an EM Research and Development (R&D) Roadmap for accelerating the Hanford tank waste cleanup mission.

PREPARING FOR TRANSFORMATIONAL TANK WASTE TREATMENT ERA

In 2021, the Hanford Site made significant progress on preparing the entire site for 24/7 operations to treat radioactive and chemical waste from large underground tanks using vitrification, or immobilization in glass. The Direct-Feed Low-Activity Waste (DFLAW) program involves a set of interdependent projects and infrastructure improvements operating together to successfully treat and dispose of millions of gallons of low-activity tank waste.

The year began with the Department and its contractors making headlines throughout the U.S. that workers had finished constructing all WTP facilities needed for DFLAW. Over the summer, when the Department, state and contractor officials announced workers had made the 3,500-foot waste transfer line connection between Hanford tanks and the vitrification facility, regional editorial boards praised the accomplishment and other work, and recognized that Hanford took a huge step forward in its tank waste treatment mission.



Commissioning of the DFLAW Program facilities took a giant leap forward in November, when the WTP completed startup testing of all systems needed to transform low-activity tank waste into a safe form for disposal.

Plant startup and commissioning activities reached a peak in November when the power was shut off to test backup systems, a critical step toward heatup of the plant's two large vitrification melters.

The melters will be heated up in 2022 using a mixture of chemicals, called glass frit, that mimics Hanford tank waste.

Also in the fall, the DFLAW program took another giant stride forward when workers finished building and testing the TSCR system, completing one of EM's top priorities for 2021. In 2022, the system will start treating tank waste to remove radioactive cesium and solids to build up a supply of waste that is ready to be fed directly to the LAW Facility for vitrification beginning in 2023.



Following installation near the AP Tank Farm and rigorous testing, the TSCR is ready to start treating tank waste in 2022 to build up a large supply of liquids that can be fed directly to the nearby vitrification facility beginning in 2023.

PRIORITIZING RISK REDUCTION, SAFETY, AND SECURITY

Hanford teams also advanced several important risk-reduction projects in the past year. Workers finished stabilizing three underground waste disposal structures considered at risk, achieving another EM key priority for 2021. Workers began preparing the foundation for construction of a weather-resistant structure that will cover the K East Reactor until radioactive material in the core has decayed to levels safe for demolition. K East is the seventh of eight former plutonium production reactors that will be placed in interim safe storage, or "cocooned," with Hanford's ninth reactor preserved as part of the Manhattan Project National Park. In September, the site announced more than 2 billion gallons of groundwater had



For the seventh year in a row, the Department met its annual goal of treating more than 2 billion gallons of groundwater to remove contamination, in facilities like this one, in the 200 West Area of the Hanford Site.

been treated for the seventh year in a row. This brings the total to nearly 28 billion gallons treated since facilities began removing contamination

from groundwater in the mid-1990s as part of overarching efforts to safeguard the Columbia River.

ENSURING FUTURE SUCCESS

Infrastructure projects, facility upgrades, permitting and construction all continued to support safe and efficient operations and preparations for treating tank waste. In October, workers started building a new water treatment facility that will handle the increased demand when tank waste treatment gets underway in 2023. Further setting the course for future cleanup successes at Hanford, major transitions were completed for the Hanford Mission Essential Services, Central Plateau Cleanup and 222-S Laboratory contracts. The Plateau contract represents the first implementation of EM's end-state contracting model, which is designed to accelerate progress of cleanup activities.

IDAHO CLEANUP PROJECT

“The Idaho Cleanup Project continues to make strides toward completion of the environmental cleanup mission at the Idaho National Laboratory Site. Our crews continue to advance the completion of our remaining work scope, including spent nuclear fuel transfers from wet to dry storage, buried waste retrievals from the Subsurface Disposal Area, continued disposition of transuranic waste at WIPP, and the startup of the Integrated Waste Treatment Unit. I am very appreciative of my team and our contractor partners, and their continued focus toward our end state vision.”

– *Connie Flohr, Manager, Idaho Cleanup Project*

HIGHLIGHTS

- Drove to the finish line at the Accelerated Retrieval Project (ARP) IX facility, leaving just 0.12 acres of buried TRU waste left to remediate.
- Completed a total of 6,590 shipments of TRU waste to WIPP, representing more than half of all shipments to the repository.
- Idaho Cleanup Contract awarded – an EM 2021 priority.
- Removed waste, equipment and debris from a combined area of 179,000 square feet at the Advanced Mixed Waste Treatment Project’s (AMWTP) Transuranic Storage Area/Retrieval Enclosure in support of RCRA closure.
- Continued fabricating and testing specialized equipment designed to transfer a dry, high-level radioactive waste called calcine from one storage bin to another in support of a 2035 milestone with the state of Idaho.
- Completed more than 50 equipment modifications at the Integrated Waste Treatment Unit (IWTU) focused on contamination control and off-gas filters during a two-year outage.
- Completed all 58 Experimental Breeder Reactor-II (EBR-II) transfers to the Radioactive Scrap and Waste Facility (RSWF) and all 12 EBR-II transfers to the Fuel Conditioning Facility at the Materials and Fuels Complex.

IWTU COMPLETES MODIFICATIONS, PREPARES FOR CONFIRMATORY RUN

The IWTU is a first-of-a-kind facility that will treat approximately 900,000 gallons of liquid radioactive and hazardous waste that has been stored in underground tanks. In addition to new ceramic filters, a wet and dry decontamination system, and robotic arms in the canister fill cells, the IWTU underwent several other modifications

during its recently completed two-year outage as it moved toward the start of radiological operations expected in 2022. The modifications are designed to prevent the spread of contamination, enhance operability, and improve reliability to support sustained operations. Some examples include heating, ventilation, and air conditioning, or HVAC, modifications, a personnel decontamination station, canister fill system enhancements, floor coatings and repairs, upgrades to emissions monitoring

systems, the addition of a permanent simulant storage/delivery system and plant compressed air modernization.

Crews are currently preparing for a 50-day confirmatory run at the IWTU to test the new equipment and to demonstrate that the facility and personnel are ready to begin radiological operations.

SPENT NUCLEAR FUEL TRANSFERS CONTINUE

EM continued transferring spent nuclear fuel from a water-filled basin at the Idaho Nuclear Technology and Engineering Center to dry-storage vaults at the RSWF of the Materials and Fuel Complex. Crews completed 58 spent nuclear fuel moves in support of the 1995 Idaho Settlement Agreement, which requires all EM fuel to be transferred to dry storage by 2023.



A mechanical engineer inspects calcine retrieval technology.

TRANSURANIC AND LOW-LEVEL RADIOACTIVE WASTE DISPOSITION

The Carlsbad Field Office approved the certification of three lots of TRU waste consisting of 2,238 drums stored at AMWTP. The amount of waste equates to six shipments a week to WIPP through February 2022.

AMWTP's Treatment Facility began treating and repackaging potentially reactive and pyrophoric

waste materials stored in approximately 500 drums from the former Rocky Flats Plant. Crews continue to treat sludge waste at the ARP VII facility. At the end of September, more than 550 containers of sludge remained to be treated. Treatment of the sludge waste in both the AMWTP Treatment Facility and ARP VII will continue into 2022. Following treatment and repackaging, this TRU waste will undergo final characterization and certification for disposal at WIPP.

The Waste Generator Services program instituted several COVID-19 safety protocols to allow it to continue to ship LLW/mixed low-level radioactive waste (MLLW) to three off-site repositories in support of the Idaho Settlement Agreement.



Workers prepare a TRUPACT-II container for shipment to WIPP.

ENVIRONMENTAL RESTORATION PROGRAM SUCCESSES

The Environmental Restoration Program completed a five-year review of Comprehensive Environmental Response, Compensation, and Liability Act's (CERCLA) ongoing and completed remedial actions which concluded that CERCLA remedies remain protective of human health and the environment.

Since 1996, three vapor vacuum treatment units at a former radioactive and hazardous waste landfill have used high-pressure vacuums to remove and destroy approximately 258,000 pounds of solvent vapors. Almost a year after shutting off the three vapor vacuum treatment units, evaluation of the analytical data indicates that cleanup objectives

have been achieved early, reducing potential threats to the underlying Snake River Plain aquifer.

A new in situ bioremediation treatment well went into service to help EM enhance groundwater treatment of a hazardous solvent from the underlying aquifer near Test Area North. This new well will advance the treatment in order to meet the CERCLA remedial action objectives.

The DOE ICP obtained initial approval and line-item funding for a new CERCLA disposal cell. The proposed new cell is needed to provide increased capacity for on-site disposal of wastes generated from CERCLA and deactivation and decommissioning activities on the Idaho National Laboratory (INL) Site. The Idaho CERCLA Disposal Facility provides a central containment of CERCLA-



Crews drill a new well near Test Area North at the INL Site.

generated waste for long-term protection of human health and the environment.

LAWRENCE BERKELEY NATIONAL LABORATORY

“EM has had a successful year at Lawrence Berkeley. The team was able to complete a demolition project in the Old Town area and complete cleanup in the Bayview Area in support of the Office of Science mission building construction.”

- Kevin Bazzell, Federal Project Director, Lawrence Berkeley National Laboratory

HIGHLIGHTS

- Completed demolition to slab of the two remaining Old Town area buildings: Building 7, Advanced Light Source Shipping and Receiving; and Building 7C, the Building 7 Admin Annex – an EM 2021 priority.
- Completed cleanup at Bayview Parcel 1 South and Parcel 1 North.
- Completed slab and soil characterization of Old Town area Building 4, Advanced Light Source Support Facility, and Building 14, Earth Science Laboratories. The laboratory awarded a contract for slab and soil removal.

COMPLETING OLD TOWN DEMOLITION

The purpose of the Old Town demolition projects is to demolish 1940s-era laboratory buildings that were declared seismically deficient and to clean up existing contamination. The remaining objective is to demolish the last two of the original seven Old Town buildings, remove the last two slabs from buildings previously demolished, remove contaminated soil and restore the area to a clean and stable site. Completion of the projects will make available approximately two acres of land for future DOE-SC missions.

In 2021, the Old Town team completed demolition of the remaining Old Town Project buildings. This



Looking south across the Old Town area in May 2014.



Looking south across the Old Town area in September.

involved tearing down the two-story, 10,700 square-foot Building 7, Advanced Light Source Shipping and Receiving, and the 480 square-foot Building 7C, the Building 7 Admin Annex. The remaining objective is to remove the slabs and associated contaminated soil from Building 4, Advanced Light Source Support Facility, and Building 14, Earth Science Laboratories, and restore the area to a clean and stable site.

BAYVIEW PARCEL 1 CLEANUP PROJECT

The Bayview Parcel 1 Cleanup Project includes demolition and removal of the former Bevatron utility tunnels and related concrete slab, grade beams, pilings and associated contaminated soil.

In 2021, the Bayview team completed both the Parcel 1 South and North cleanup projects to remove the utility tunnels and other demolition debris and soils to help prepare the area for future DOE-SC mission use.



Looking south across the Bayview area in September.

LAWRENCE LIVERMORE NATIONAL LABORATORY

“This has been an exciting year at Lawrence Livermore. We have been able to commence demolition activities at two of the high-risk facilities, with expectations of completion in early 2022, and are preparing to commence a third in late 2022.”

- Kevin Bazzell, Federal Project Director, Lawrence Livermore National Laboratory

HIGHLIGHTS

- Completed removal of the Building 280 Livermore Pool Type Reactor.
- Completed demolition to slab of Building 175, the Mirror Advanced Reactor System (MARS) electron beam (E-Beam) Facility – an EM 2021 priority.
- Commenced characterization of Building 251, the Heavy Element Facility, and awarded a task order for Building 251 demolition.

BUILDING 280 REACTOR REMOVAL

The U.S. Army Corps of Engineers completed removal of the Building 280 Livermore Pool Type Reactor. EM is preparing to commence demolition of Building 280 in 2022.

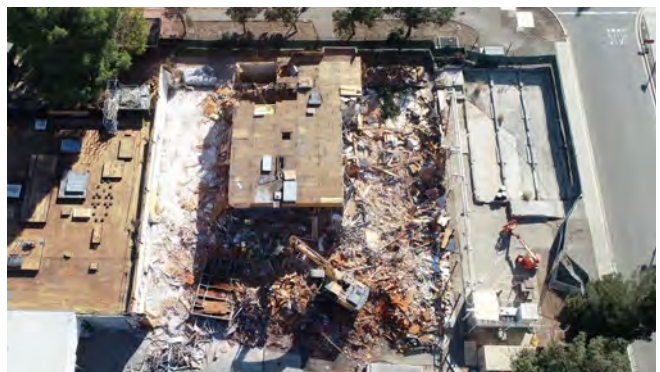
BUILDINGS 175 AND 251 DEMOLITION TO SLAB-ON-GRADE

Demolition crews took down Building 175, the MARS E-Beam Facility, and are preparing to commence removal of the slab and remaining structures in 2022.

Characterization commenced on Building 251, the Heavy Element Facility, in preparation for demolition in 2022. EM awarded a task order to APTIM Federal Services, LLC to perform demolition of Building 251 once characterization of the building is complete.



Building 280 reactor's west thermal column door during demolition.



An aerial view showing demolition of Building 175.

LOS ALAMOS NATIONAL LABORATORY

“In 2021, the EM Los Alamos Field Office continued to achieve progress in its mission of environmental remediation and legacy waste management to address the legacy cleanup at Los Alamos National Laboratory. In 2022, EM-LA will remain focused on removing legacy waste from Los Alamos, protecting groundwater with the Chromium Plume Interim Measure as we prepare a strategy for a final remedy, and completing the Middle DP Road cleanup. Public engagement is very important to EM-LA’s cleanup mission. As the EM-LA Manager, it is my priority to maintain regular engagement with our regulators, stakeholders, Pueblos, and the surrounding community.”

– Michael Mikolanis, Manager, Environmental Management Los Alamos Field Office

HIGHLIGHTS

- Certified and completed more than 30 legacy TRU waste shipments to WIPP – an EM 2021 priority.
- Completed all 14 proposed Consent Order milestones with the New Mexico Environment Department (NMED) for fiscal year (FY) 2021.
- Processed and repackaged approximately 130 cubic meters of TRU waste and approximately 190 cubic meters of LLW.
- Shipped 1,317 cubic meters (6,327 55-gallon drum equivalents) of legacy LLW to off-site disposal facilities.
- Treated more than 110 million gallons of hexavalent chromium contaminated groundwater while operating the Chromium Interim Measure.
- Completed the planned investigation and excavation of 124 unique locations along DP Road in the Los Alamos townsite.
- Conducted surface and storm water monitoring at 200 locations, constructed 33 storm water controls, and conducted more than 3,900 surface water infrastructure inspections.

PRIORITIZED TRANSURANIC WASTE SHIPMENTS

Legacy waste operations at Technical Area (TA) 54 Area G remained a top priority for 2021. Through a collaboration with EM’s cleanup contractor, the NNSA Los Alamos Field Office (NA-LA), and Los Alamos National Laboratory’s (LANL) Management and Operating (M&O) contractor, the Environmental

Management-Los Alamos Field Office (EM-LA) increased efficiency in contact-handled TRU waste shipments. Combining legacy and new-generation radioactive waste together maximizes resources while safely shipping waste off site for disposal. During 2021, EM-LA completed 32 legacy TRU waste shipments to WIPP – a substantial increase over 2020.



Waste operations at TA-54 at LANL.

ADVANCED THE CHROMIUM INTERIM MEASURE

The operation of the interim measure to control migration of a hexavalent chromium groundwater plume beneath LANL marked a major 2021 achievement in EM-LA’s efforts to shrink the plume and protect area water quality until a final remedy is determined. The combination of extraction, treatment and injection has controlled downgradient migration, and resulted in a significant reduction in the extent of contamination along LANL’s boundary with the Pueblo de San Ildefonso. Two new wells have been installed to further characterize the plume.



A drilling contractor advances casing during construction of Well R-71.

REMEDIATED MANHATTAN PROJECT-ERA CONTAMINATION ON COUNTY LAND

At the Middle DP Road Site, EM-LA completed characterization and removal of soil and debris contaminated with low levels of radioactivity from historic LANL operations. The characterization and excavation work were performed concurrently to minimize disruption on Los Alamos County property. Confirmation sampling will determine if additional excavation is required to meet residential risk standards. EM-LA will coordinate with NMED, NA-LA, and Los Alamos County for project completion in 2022.



A crew worker screens debris mixed with soil for radiological activity.

THE JUSTICE40 INITIATIVE

EM is proud to have EM-LA selected as one of the five DOE pilot programs for the Justice40 Initiative. EM is committed to continuing to invest in communities that have been affected by decades of nuclear defense research at LANL. The Justice40 Initiative provides recommendations on how certain federal investments might be made toward a goal that 40 percent of the overall benefits flow to underserved communities. DOE has a history of engaging with underserved communities in the area surrounding LANL. EM-LA will continue to work with these communities and to invest in their future.

MOAB URANIUM MILL TAILINGS REMEDIAL ACTION PROJECT

“The year 2021 was another challenging one for Moab, requiring ingenuity and flexibility as we continued to adapt to changing conditions amidst the global pandemic. Our team safely and effectively sustained operations and met the 12 million tons milestone. I’m excited to be moving onto the home stretch of this cleanup mission.”

– Russell McCallister, Federal Cleanup Director, Moab Uranium Mill Tailings Remedial Action Project

HIGHLIGHTS

- Reached a cumulative total of more than 12 million tons of mill tailings shipped from Moab to disposal – an EM 2021 priority.
- Diverted a cumulative total of more than 970,000 pounds of ammonia and more than 5,400 pounds of uranium from the Colorado River.
- Performed size reduction, packaging and disposed of a portion of the mill building debris that was originally buried in the southern end of the tailings pile.
- Reached 60 percent design of the evapotranspiration (ET) cover at the Crescent Junction disposal cell.

MARKING THE 12 MILLION TONS MILESTONE

The Moab Uranium Mill Tailings Remedial Action (UMTRA) Project reached a milestone in October, commemorating 12 million tons of residual

radioactive material shipped from a former uranium ore processing facility in Moab, Utah, to the disposal cell near Crescent Junction, Utah. This represents 75 percent of the 16 million tons originally at the site.



Rail bench containers at the Moab Site.



A view from the rail bench at the Moab Site.

PROTECTING THE COLORADO RIVER

The Moab Site sits adjacent to the Colorado River. Efforts to protect the vital water source include extracting ammonia and uranium mass from groundwater underlying the site since 2003.

DELIVERING MORE EFFICIENT CLEANUP

In 2021, the Moab Project team continued to implement improvements and increase the quantity of residual radioactive material per shipment for disposal, despite challenges posed by the pandemic. On June 8, the project surpassed its own record, transporting the largest shipment of uranium mill tailings from Moab to Crescent Junction. After some minor rail improvements at Crescent Junction and fine-tuning operations at both sites, the project added a 39th railcar to the train, which enables it to ship on average an additional 540 tons each week. These incremental changes add up over time, making a significant impact to the project's life cycle.

REVEGETATION FOR RESTORING THE COLORADO RIVER CORRIDOR

The project partnered with the U.S. Geological Survey to develop experimental monitoring plots for soil restoration and revegetation of remediated areas, testing various soil treatments and seed mixes on site. The project also partnered with the National Park Service (NPS) to salvage native plants and soil for restoration of disturbed

ecosystems at the site, salvaging native plants and soils from NPS land slated for development. In addition, through collaboration with the Southeast Utah Riparian Partnership, the project is engaging in best practices for ecological restoration along the Colorado River corridor.

CRESCENT JUNCTION COVER

The Moab Project has made great progress by reaching a 60 percent design milestone for the ET cover at the Crescent Junction disposal cell. Unlike standard rock armor covers, ET covers feature



The Crescent Junction disposal cell, about 30 miles away from the Moab Site.

vegetation. Because plants remove water from the soil, allowing vegetation to grow on a cell cover limits precipitation from infiltrating the cell below. The ET cover is particularly well-suited for the arid climate of Crescent Junction, and it is also more cost-efficient as it requires less material.

NEVADA NATIONAL SECURITY SITE

“The past year was foundational for EM’s work in Nevada. As we stand at the precipice of initiating our last major demolition and closure projects at the NNSS, we can also see the completion of our groundwater work and the close-out of our overall environmental restoration mission on the horizon. As always, I thank the dedicated federal and contractor professionals who continue to safely, securely, and successfully move our program forward.”

– Rob Boehlecke, Manager, EM Nevada Program

HIGHLIGHTS

- Initiated characterization and hazard reduction activities to prepare for demolition and closure of two legacy facilities.
- Obtained regulatory approval of data completeness for the Pahute Mesa groundwater region – the last active groundwater corrective action area.
- Safely and securely disposed of approximately 550,000 cubic feet of classified LLW/ MLLW in support of DOE cleanup and activities at federal sites across the U.S. involved in nuclear research, development and testing, and ongoing national security and science missions.
- Completed the Area 5 Radioactive Waste Management Complex infrastructure expansion project to allow for future construction of LLW disposal cells.

PREPARING FOR LAST MAJOR DEMOLITION WORK

In 2021, the EM Nevada Program and its environmental program services contractor began characterizing contamination and abating known hazards to prepare for the upcoming demolition and closure of two large legacy nuclear facilities on the Nevada National Security Site (NNSS). The facilities are the Engine Maintenance, Assembly, and Disassembly (EMAD) and Test Cell C (TCC) complexes, which supported historical nuclear propulsion rocket development and testing programs. The characterization and hazard



Characterization is underway in preparation for demolition and closure of the EMAD facility.

reduction work being performed will help to ensure future demolition and closure activities at EMAD and TCC are conducted safely, securely, and successfully. Outlined in EM’s Strategic Vision for 2021-2031, the progress at EMAD and TCC represents the last major demolition and closure efforts currently identified in EM Nevada’s environmental remediation mission. The EM Nevada Program plans to mobilize for demolition at TCC and EMAD in 2022.

KEY REGULATORY APPROVAL FOR LAST ACTIVE GROUNDWATER AREA

In September, the EM Nevada Program earned approval of “data completeness” from the Nevada Division of Environmental Protection (NDEP), a key step necessary to advance environmental corrective action strategies at the Pahute Mesa groundwater area. Under the Federal Facility Agreement and Consent Order – a regulatory agreement governing EM cleanup strategies at the NNSS – an assessment of “data completeness” lies between the collection and analysis of field data and the start of advanced scientific modeling.



Nevada Site Specific Advisory Board members on a tour of Pahute Mesa in 2019.

This field data serves as a gateway for understanding the nature and movement of groundwater at the NNSS. The data collected by EM Nevada, analyzed by experts and reviewed by NDEP includes information related to groundwater

chemistry, pressure levels, subsurface temperature and geologic properties. With initial data collection and analysis complete, EM Nevada experts have begun developing sophisticated scientific models to forecast where and how contamination might move within the groundwater under Pahute Mesa.



Technicians collect samples from a groundwater well at the NNSS.

Groundwater contamination at the NNSS is the result of historical underground nuclear testing conducted from 1951 to 1992. To date, EM Nevada has succeeded in transitioning three of four main groundwater regions at the NNSS to long-term monitoring – only Pahute Mesa remains in the corrective action investigation stage. Decades of testing, analysis and modeling have resulted in an extensive understanding of the nature and movement of groundwater under the NNSS. As a result, current research shows that contaminated groundwater will not reach public water supplies.

EM Nevada projects that the Pahute Mesa groundwater corrective action region will transition to long-term monitoring by 2028. It is currently anticipated that regulatory closure of the Pahute Mesa groundwater area will complete EM’s currently identified environmental restoration mission in Nevada.

OAK RIDGE

“Our skilled, experienced workforce is advancing the new chapter of cleanup at the Y-12 National Security Complex and Oak Ridge National Laboratory in a big way. Our continued progress across the Oak Ridge Reservation is transforming the landscape and benefiting the community by enhancing safety, creating new economic opportunities, and clearing land for expanding research and national security missions.”

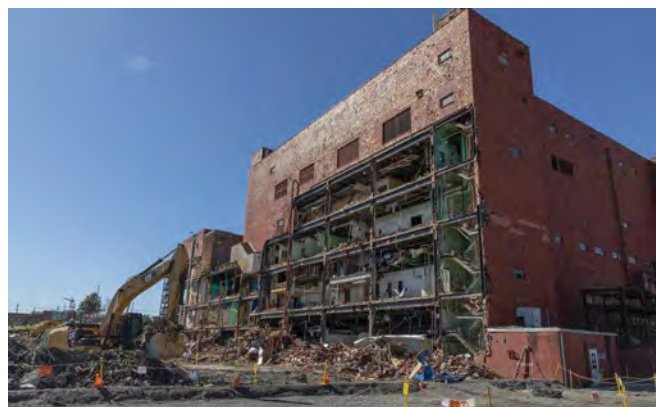
– *Laura Wilkerson, Acting Manager, Oak Ridge Office of Environmental Management*

HIGHLIGHTS

- Completed demolition on the Biology Complex – an EM 2021 priority.
- Demolished the Radiological Development Lab’s West Cell Bank.
- Demolished the Tritium Target Preparation Facility.
- Oak Ridge Reservation cleanup contract awarded – an EM 2021 priority.
- Transferred ETPP real property to other DOE programs/community organizations.
- Conducted deactivation activities at 23 buildings to address DOE’s largest inventory of high-risk facilities.
- Processed and disposed the low-dose portion of Oak Ridge’s uranium-233 inventory and provided medical isotopes for next-generation cancer research.
- Advanced construction on the Mercury Treatment Facility.
- Restored the former Centrifuge Complex and Powerhouse areas for transfer and future use.
- Completed 100th shipment of TRU waste to WIPP since waste disposal resumed in 2017.

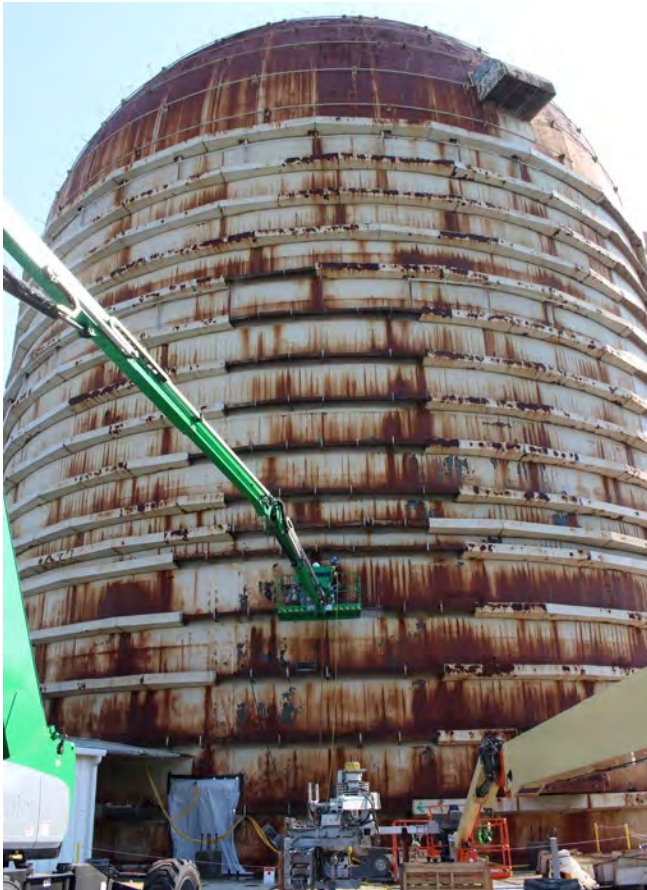
CLEARING AWAY THE OLD AND MAKING WAY FOR THE NEW

With all demolition complete at the ETPP, the Oak Ridge Office of Environmental Management (OREM) transitioned its skilled, experienced workforce responsible for that historic accomplishment to begin a new chapter of cleanup at ORNL and Y-12. Those crews are now in various stages of deactivation and demolition preparation inside 23 facilities at those sites, including former research reactors, uranium processing facilities, isotope and fission development laboratories, and support buildings. ORNL and Y-12 house hundreds of excess contaminated facilities that comprise the largest inventory of high-risk buildings in the DOE complex. Collectively, these efforts are reducing risks, stabilizing facilities, and paving the way for large-scale demolition that will enhance safety, advance



Crews take down the six-story Building 9207 at the former Biology Complex at Y-12. The 1940s-era building spanned 255,000 square feet and was listed as a high-risk facility.

cleanup and provide land for research and national security missions.



Crews prepare the Experimental Gas-Cooled Reactor for deactivation. The eight-story facility at ORNL stands 216 feet tall.

OREM completed a 2021 EM priority by finishing demolition of the former Biology Complex, located at Y-12. This involved tearing down the massive six-story, 255,000 square-foot Building 9207 and the three-story, 65,000-square-foot Building 9210. These were the final two structures remaining from the original 11-building complex that dated back to the 1940s. The project shortened the list of high-risk facilities in Oak Ridge, and it cleared an 18-acre area that is the planned location for the future Lithium Processing Facility that will support national security missions at the site.

Crews also demolished the former Radiological Development Lab's West Cell Bank at ORNL. Crews eliminated this high-risk contaminated structure and opened space in the heart of ORNL for future research missions.



Crews remove the former Radiological Development Lab's West Cell Bank at ORNL. Crews built a protective cover over the structure to ensure a safe teardown of the high-risk contaminated structure.

REMOVING OAK RIDGE'S INVENTORY OF NUCLEAR WASTE

This year, workers completed processing the remaining low-dose inventory of uranium-233 stored at ORNL and shipped the material for safe, permanent disposal off site. Part of this process involved extracting medical isotopes being used for next-generation cancer treatment research. Employees also finished upgrades in Building 2026 for processing to begin on the high-dose portion of the remaining uranium-233 inventory.



Employees finished processing the remaining low-dose inventory of uranium-233 stored at ORNL. Part of this process involved extracting medical isotopes being used for next-generation cancer treatment research.

Oak Ridge also hit a milestone related to disposing its inventory of TRU waste in 2021. Since shipments resumed to WIPP in 2017, more than 100 shipments have been completed from Oak Ridge. This accounts for more than 3,300 drums of legacy contact-handled TRU waste, representing

a 50 percent reduction in the Transuranic Waste Processing Center’s inventory.

INVESTING IN INFRASTRUCTURE TO MAINTAIN PROGRESS

The Outfall 200 Mercury Treatment Facility is the linchpin for EM’s cleanup strategy at Y-12. This vital piece of infrastructure will open the door for large-scale demolition at Y-12 by providing a mechanism to safeguard against potential mercury releases into the Upper East Fork Poplar Creek. Teams advanced construction on the treatment plant and headworks facilities. When operational in 2025, the facility will treat up to 3,000 gallons of water per minute, helping meet regulatory limits in compliance with EPA and State of Tennessee requirements.



View of construction progressing at the Mercury Treatment Facility. When operational in 2025, it will be able to treat up to 3,000 gallons per minute.

OREM is also investing \$27 million to upgrade and extend the life of an aging waste treatment system that is critical to ongoing missions at ORNL. The Liquid and Gaseous Waste Operations system is comprised of more than 60 facilities and 27 miles of piping that treats waste streams from cleanup operations, R&D labs, radiochemical pilot plants and nuclear reactors. As part of that investment, OREM completed construction of a new treatment

system that consolidates multiple capabilities into a single facility, and workers are replacing more than a mile of deteriorated piping to ensure the system’s reliability.

ADVANCING SOIL CLEANUP AT THE EAST TENNESSEE TECHNOLOGY PARK

With all the buildings demolished at ETPP, crews were actively removing slabs and remaining contaminated soil areas this year to achieve OREM’s ultimate vision for the site as a multi-use industrial center, national park and conservation area. Workers completed several major projects, including removing the largest slab at the site from the former Centrifuge Complex. The five-acre footprint was excavated and backfilled with nearly 5,500 truckloads of soil to support the area’s transfer and reuse.

Crews also transformed the former Powerhouse Area – once home to a massive power plant and oil tanks – into a clean, grassy field primed for future recreational use. OREM backfilled and contoured a 21-acre section of the area previously used as a scrapyard. The project directs stormwater to wetlands and the nearby Clinch River. Transforming and recontouring the site, which is proposed for recreational development, required more than 6,000 truckloads of backfill and 2,000 truckloads of topsoil.



Heavy equipment tears up the largest remaining slab at ETPP, which was where the former Centrifuge Complex once stood.

PORTSMOUTH/PADUCAH PROJECT OFFICE

“The collective endeavor of PPPO’s workforce to safely and successfully implement site-altering projects at Portsmouth and Paducah is having a dramatic impact on the cleanup mission.”

– Joel Bradburne, Manager, Portsmouth/Paducah Project Office

HIGHLIGHTS

- Initiated demolition activities on the X-326 process building at Portsmouth and demolished 40 percent of the first of three massive structures – an EM 2021 priority.
- Portsmouth Infrastructure Support Services contract awarded – an EM 2021 priority.
- Opened the Portsmouth On-Site Waste Disposal Facility (OSWDF) and moved the first demolition debris generated from deactivation and decommissioning at the site into the facility.
- Completed excavation of the X-740 groundwater plume at Portsmouth to use its soil as engineered fill for the OSWDF.
- Completed the next steps of a multi-year project by removing an additional 1.5 million pounds of refrigerant currently stored at the Paducah site – an EM 2021 priority.
- Completed deactivation of the C-530 switchyard, the last of four switchyards at Paducah that supported electrical needs during legacy uranium enrichment operations.
- Completed the installation of a bulk hydrogen system at the Depleted Uranium Hexafluoride (DUF6) Conversion Project facilities in Paducah and Portsmouth, providing an alternate source of hydrogen needed for the conversion process.

PORTSMOUTH

Cleanup at the Portsmouth site entered a new era in 2021 with the onset of demolition of the X-326 process building, the operational start of the OSWDF and excavation of the previously closed X-740 groundwater plume to provide fill for the OSWDF. The successful alignment of these three projects paved the way for final cleanup of the site.

PROCESS BUILDING DEMOLITION

In May, following more than nine years of safe and systematic deactivation, workers began the structural demolition of the 2.6 million square-foot X-326 process building, one of the three large former uranium enrichment facilities at the site. By the end of December, 40 percent of the building’s structure had been demolished, with the expectation that the remaining structural demolition will be completed in 2022.



Demolition of the X-326 process building began in May.

While demolition occurs at one process building, deactivation continues at the second of the three process buildings. Workers are fully engaged in activities to complete deactivation of the X-333 building, readying it for demolition to begin in 2023.

OSWDF PROVIDES A PATH FOR SAFE DISPOSAL OF DEMOLITION DEBRIS

The OSWDF began operations in 2021 as the landfill specifically engineered to safely accept debris from demolition at the Portsmouth Gaseous Diffusion Plant. The OSWDF received its first waste placement from the X-326 process building demolition in May. In total, the OSWDF expects to receive up to 5 million cubic yards of demolition debris and soils from the Portsmouth cleanup project.



At the OSWDF, placement operations continue as a landfill compactor compresses debris from the X-326 demolition project.

Operations at the OSWDF will be enhanced by a regulatory agreement that allows previously closed landfills and plumes within the site's perimeter to be excavated and used as engineered fill at the OSWDF. The unique approach eliminates the need for off-site soils and will free up close to 1,000 acres of contiguous land to the community for beneficial reuse. In 2021, excavation of the X-740 groundwater plume was completed and provided approximately 37,000 cubic yards of soil as engineered fill for the OSWDF.



A northeast aerial view of the X-740 Groundwater Plume Excavation Project shows continuing progress on the site's west side.

PADUCAH

At Paducah, projects continued to move the site toward demolition. Efforts to remove hazards, right-size utilities for cleanup operations, and investigate the primary source of trichloroethylene (TCE) at the site will continue to position it for an efficient and effective cleanup approach.

REFORMING INFRASTRUCTURE, TARGETING SOURCE ELIMINATION

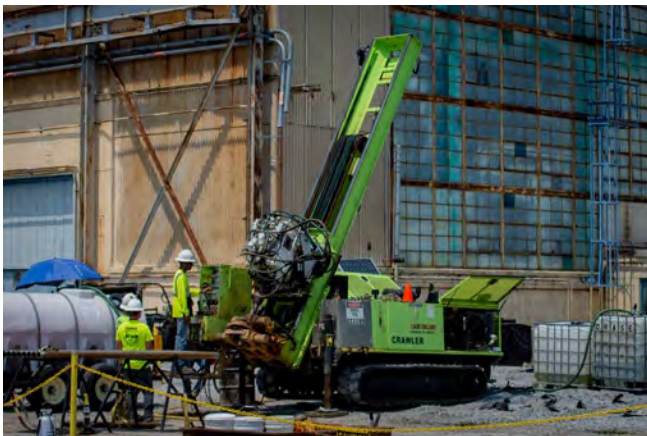
In 2021, activation of a new Tennessee Valley Authority substation at the site continued efforts to align the site's infrastructure with future cleanup needs. Coupled with the deactivation of the C-531 switchyard, the new substation completes the elimination of four on-site switchyards left from legacy operations and downsizes the site from enough energy to power a city as large as Nashville, Tennessee, to a modernized, efficient, and independent electrical source.

The project team also continued the multi-year project removal of R-114 refrigerant from the Paducah site. Used to cool equipment in the uranium enrichment process during production years, the site was left with eight million pounds of the product in storage. In 2021, the site removed and shipped 1.5 million pounds for treatment and disposal.



Workers prepare R-114 for removal from the Paducah site.

In addition to deactivation efforts, workers completed base sampling at the C-400 maintenance building to support the C-400 Remedial Investigation/Feasibility Study. The study is the first document in a decision process that will develop a path for eliminating the primary source of TCE groundwater contamination that was discovered off DOE property in 1988.



Workers use a drill rig to access and collect samples at the C-400 maintenance building.

BULK HYDROGEN SYSTEM INCREASED DUF6 PLANT PROFICIENCY

Although DUF6 conversion operations were paused in 2021, the project moved forward with several major upgrades to the plants at Portsmouth and Paducah that will enhance their reliability and safety. This included the installation of the bulk hydrogen system at the plants. The bulk hydrogen systems will give the plants an alternate source of hydrogen, which is required for DUF6 conversion, thereby decreasing downtime during unplanned shutdowns.



Aerial view of the bulk hydrogen system at the Portsmouth DUF6 facility.

SANDIA NATIONAL LABORATORY

“The Sandia New Mexico Environmental Restoration Project continues to execute the groundwater mission at three remaining sites. COVID-19 challenges over the last year did not affect planned progress in moving these sites closer to final remedy recommendations and solutions for long-term stewardship. I appreciate all the progress made by our Sandia project partners, including the data collection and evaluation conducted and shared with our state regulator, the New Mexico Environment Department.”

– *Bill Wilborn, Federal Project Director, Sandia National Laboratory-New Mexico Environmental Restoration Operations Project*

HIGHLIGHT

- Continued characterization, monitoring and data evaluation activities for three groundwater plumes: Tijeras Arroyo Groundwater Investigation Area of Concern (AOC), TA-V Groundwater Investigation and Bioremediation Study AOC and the Burn Site Groundwater Investigation AOC.

BURN SITE GROUNDWATER

The four sampling events required by NMED for new wells were completed and the data shared with NMED. Four additional wells were initially planned for this site, however the Sandia Field Office (SFO) petitioned NMED that additional wells may not be necessary. NMED agreed that no additional wells are needed to delineate plumes at this site.



Installation of a groundwater monitoring well at the Burn Site Groundwater AOC.

TIJERAS ARROYO GROUNDWATER

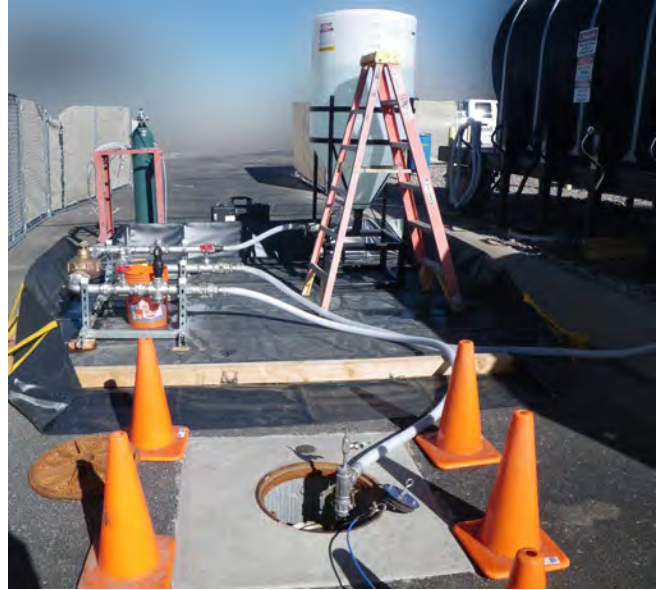
Monitoring at the site continues. A revised current conceptual model and corrective measures evaluation report has been submitted to NMED, and NMED is reviewing.



Geophysical logging at groundwater monitoring well TA2-W-19 on the Tijeras Arroyo floodplain.

TECHNICAL AREA-V

The SFO continues to monitor the well network and plans to begin drafting the corrective measures report for this AOC.



Injection of bioremediation agents into the groundwater for potential cleanup of contaminants during the TA-V Treatability Study.

SAVANNAH RIVER NATIONAL LABORATORY

“Despite numerous challenges, 2021 has been a year marked by successful transition for SRNL, becoming a truly independent national lab. In the year ahead, I am excited to lead SRNL as operated by Battelle Savannah River Alliance and firmly establish it as a best-in-class federally funded research and development center for the Department of Energy.”

– Dr. Vahid Majidi, Director, Savannah River National Laboratory

HIGHLIGHTS

- Opened the Critical Infrastructure, Industrial Control System Cybersecurity Laboratory at the Georgia Cyber Center in downtown Augusta, Georgia, establishing SRNL’s physical presence in Georgia.
- Received the DOE Unmanned Aircraft System (UAS) Unit Award, an award given by the Office of Aviation Management, for the SRNL UAS team.
- Authorized to conduct unmanned aircraft flights at SRS Beyond Visual Line of Sight, the first issued by the Federal Aviation Administration in the eastern sector (Mississippi to Maine) at altitudes up to 1,200 feet above mean sea-level. This will allow for expanded UAS operations in support of national security objectives.
- As part of the NNLEMS, initiated development of an EM R&D Roadmap for accelerating Hanford tank waste cleanup.
- Nominated to be a member of the International Atomic Energy Agency’s Network of Analytical Laboratories for particle reference materials to support international nuclear safeguards programs.
- Completed technical baseline testing to allow the disposition of higher quantities of fissile material to the Defense Waste Processing Facility (DWPF) glass to enable disposition of excess nuclear material at SRS.

TRANSITION TO NEW MANAGEMENT

After a four-month period, SRNL transitioned to a new M&O contractor in June. Being an independent national laboratory under new management offers an exciting, compelling vision for the future of SRNL and provides DOE a leadership team and strategy to deliver excellence in science and technology, operations, and continued community engagement.

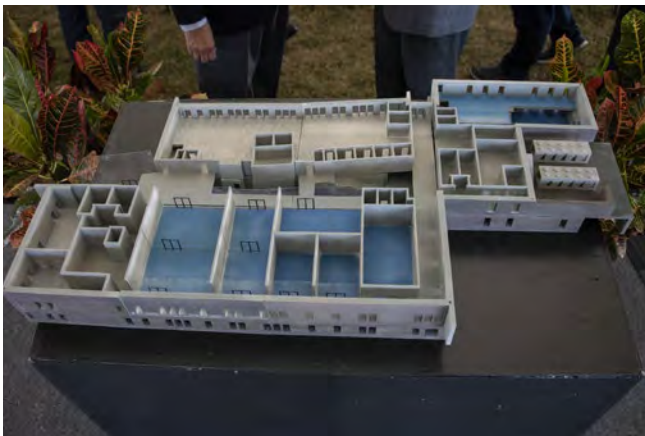
The new contractor includes an alliance of five regional universities – Clemson University, Georgia Institute of Technology, South Carolina State University, University of Georgia and University of South Carolina – as well as small business partners. Extensive effort was put into standing up independent business systems, developing interface agreements, and preparing for the transfer of employees.



The SRNL Modifications Team reached a milestone of shuttering F/H Laboratory on January 31 and transitioning activities and staff into new facilities.

ADVANCED MANUFACTURING COLLABORATIVE

In April, DOE awarded a contract for the design and construction of the Advanced Manufacturing Collaborative (AMC) facility on the campus of the University of South Carolina Aiken. Once constructed, the AMC will provide SRNL with an accessible, modern facility for R&D that brings government, industry, and academia together to develop and share advanced manufacturing technology. It will also support STEM education to train the next generation of advanced manufacturing workers to support both DOE missions and U.S. industry that will increase manufacturing competitiveness across the state, region and nation.



A 3-D model of the proposed Advanced Manufacturing Collaborative facility to be built at the University of South Carolina-Aiken.

LABORATORY CONSOLIDATION

Consolidation of the F/H Analytical Laboratory was successfully completed, providing operational cost savings of more than \$20 million. The F/H Analytical Laboratory has been providing vital and quality analytical results to support SRS in almost every critical mission over the last 60 years. In an effort to close F Area legacy facilities, Savannah River's M&O contractor and SRNL began a phased approach in 2015 to close the laboratory and relocate the lab's capabilities, programs, and personnel to SRNL's main campus. The final phase was completed successfully two years ahead of schedule, despite COVID-19 and other competing SRNL priorities.

NUCLEAR MATERIALS INFRASTRUCTURE AND HANDLING INITIATIVE

The Nuclear Materials Infrastructure and Handling Initiative was created to establish a comprehensive assessment of the nuclear materials processing and handling infrastructure capabilities and needs across the DOE complex. The initiative worked to provide an integrated, complex-wide understanding of current, emerging and future nuclear materials mission needs, schedule drivers and required processing capabilities, including associated infrastructure. SRNL played a key role in each of the four pillars of the initiative – Infrastructure, Mission Needs, Inventory and Integration. The most significant role was in the development of the Inventory pillar, including the identification of the significant groups of nuclear materials with no defined disposition path and potential alternatives to address them. DOE awarded a special achievement award to the SRNL team for their efforts across all the pillars of the initiative.

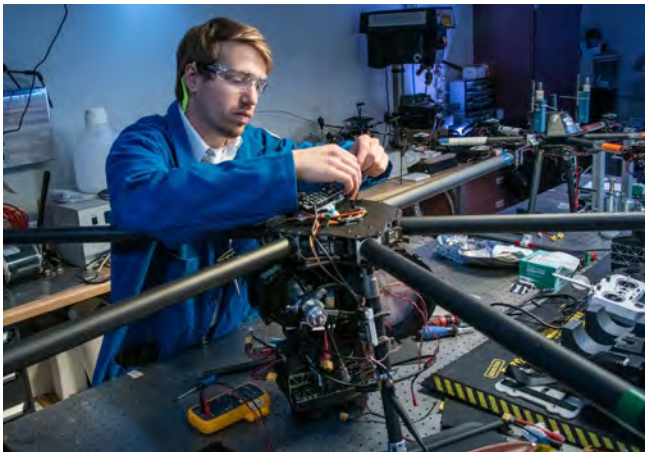
DOE-EM/ADVANCED LONG-TERM MONITORING SYSTEMS

SRNL is the lead of a multi-laboratory and multi-institution project sponsored by the EM Technology Development office to support better design of long-term monitoring strategies for complex

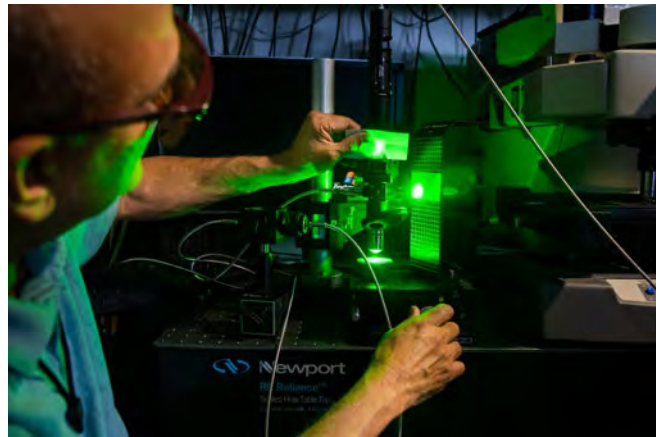
groundwater sites and offers a potential to reduce monitoring costs by 90 percent over the next five decades through real-time monitoring systems. This program will aid in developing various machine learning tools for improving soil and groundwater data and estimations using real-time sensor data.

NETWORK OF NATIONAL LABORATORIES FOR ENVIRONMENTAL MANAGEMENT AND STEWARDSHIP

SRNL leads the NNLEMS facilitating technical evaluations and consulting by 11 National Laboratories for EM and the DOE Office of Legacy Management (LM). This year, the NNLEMS has



A mechanical engineer at SRNL prepares a large Hex Copter to be used to demonstrate extended flight time using hydrogen fuel metal hydrides.



An SRNL Laboratory Fellow demonstrates SRNL's capabilities using laser technology.

been chartered to perform a review of Technology Development efforts across the EM complex to assess alignment with the needs and priorities of the site and EM; perform a National Defense Authorization Act study of supplemental low-activity waste treatment for the Hanford Site in parallel with the National Academies of Sciences, Engineering, and Medicine's review; develop an R&D Roadmap to identify technologies for accelerating the Hanford tank waste cleanup mission; perform an analysis of DOE-LM sites to identify and quantify potential risks; and review the groundwater remediation strategies for plumes of hexavalent chromium and explosives at the Los Alamos site. These teams have been supplemented by experts from academia and industry to ensure relevant technologies are considered.

SAVANNAH RIVER SITE

“Our SRS team rose to the challenges 2021 presented and exceeded expectations. We advanced our cleanup goals and entered a new era in processing radioactive material with the start of the Salt Waste Processing Facility operations. We continued effectively managing the site’s response to the COVID-19 pandemic.”

– Mike Budney, Manager, Savannah River Operations Office

HIGHLIGHTS

- Integrated Mission Completion Contract awarded – an EM 2021 priority.
- Processed more than two million gallons of waste at the Salt Waste Processing Facility (SWPF) in its first year of operations.
- Received approval to start construction for the remaining three Saltstone Disposal Units (SDU).
- Repackaged 69 plutonium containers (3013s) into Nuclear Regulatory Commission-certified shippable containers in preparation for future shipment to WIPP.
- Completed construction eight months ahead of schedule and \$32 million under budget for SDU 7, the second mega-sized SDU to permanently dispose of decontaminated saltstone – an EM 2021 priority.
- Deactivated and decommissioned five buildings in D Area.
- Completed the D Area Coal Yard cleanup project.
- Treated and disposed more than 3 million gallons of decontaminated salt solution at the Saltstone Production Facility – a record for any fiscal year in the history of the high-level radioactive waste program at SRS.
- Initiated WIPP characterization activities in newly constructed Criticality Control Overpack Characterization and Storage pad in K-Area.

IMPROVING LIQUID WASTE SYSTEMS CAPABILITIES

With the startup of the SWPF in October 2020, EM’s liquid waste mission began a new era of processing radioactive waste material at SRS. The SWPF will significantly increase the rate at which waste is processed and tanks are emptied. Despite challenges that prevented reaching a goal of 6 million gallons, more than 2.4 million gallons of salt

waste have been processed at SWPF since the start of hot operations in October 2020.

This year, SRS improved key equipment and processes to support SWPF operations. In the tank farms, modifications were made to three waste storage tanks to convert them into blend tanks to prepare salt batches for SWPF. SRS significantly improved the process and shortened the time frame to expedite material for processing, from six months to only seven weeks. Four salt batches have been transferred and processed at SWPF.

SRS also made significant improvements in the DWPF canister production by re-evaluating a calculation to allow more strip effluent into a Sludge Receipt and Adjustment Tank (SRAT) batch, creating the first “super” SRAT batch. More strip effluent added to fewer canisters means the facility is stabilizing more cesium per canister, improving the overall efficiency of the vitrification process.



SRS continues to meet mission needs by constructing mega-sized SDUs to permanently dispose of decontaminated saltstone.

SRS continues to meet mission needs by constructing mega-sized SDUs. The larger-sized SDUs support the increased output from SWPF. Construction continues simultaneously on SDUs 8 and 9. Constructing the SDUs concurrently optimizes crews and resources used on the adjacent structures, ultimately cutting costs for the program. All major concrete placements for SDU 8 are complete. The floor of SDU 9 is complete – five (of 25) walls, and 48 (of 208) columns are in place as of early December. The remaining three SDUs needed to complete the tank closure mission at SRS – SDUs 10, 11 and 12 – all received approval to start construction.



SRS completed modifications to convert Tank 42 into the third blend tank for the SWPF feed. Pictured is the site of Tank 42.

INNOVATING CLEANUP WITH ADVANCED MATERIALS MANAGEMENT TECHNIQUES

SRS continued to make strides in effectively and safely managing nuclear materials through H Canyon. The facility began operations in the early 1950s and is the only operating, production-scale, radiologically shielded chemical separations facility in the United States. Additionally, progress was made toward the new Fast Critical Assembly project in H Canyon, which allows for dissolution of non-aluminum clad spent nuclear fuel and requires the installation of a new electrolytic dissolver and increases H Canyon dissolution capabilities.



SRS completed the D Area Coal Yard cleanup project to excavate and blend soil with fine-grade limestone to lower pH levels.

In the K Area Complex, plutonium downblending continued and glovebox operations moved to four shifts to help accelerate the removal of plutonium from South Carolina. With the Criticality Control Overpack Characterization and Storage pad built by the NNSA, EM can store and ship TRU waste directly from K Area to WIPP, increasing efficiency and security.

Progress was made in the deactivation of the F/H Analytical Laboratories and Building 235-F, and consolidation of the H Canyon and HB Line control rooms after placing HB Line in reversible layup last year.

WASTE ISOLATION PILOT PLANT

“We are making great progress on many fronts at WIPP, with safety being the cornerstone of everything we do. We continued to improve WIPP’s infrastructure in 2021. Projects like the permanent ventilation system help ensure we can carry out WIPP’s critical national defense mission for years to come. WIPP employees also performed at a very high level despite the many challenges related to the COVID-19 pandemic.”

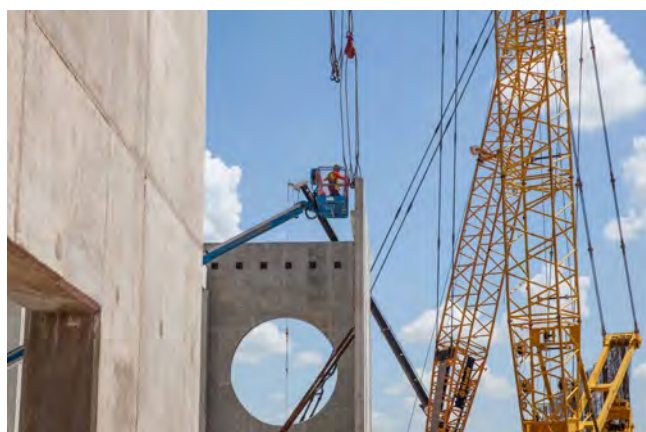
– Reinhard Knerr, Manager, Carlsbad Field Office

HIGHLIGHTS

- Completed Panel 8 mining to create additional TRU waste disposal space.
- Completed construction of the Salt Reduction Building, a key component of the Safety Significant Containment Ventilation System (SSCVS) to improve air quality in the underground portion of the site – an EM 2021 priority.
- Safely received up to 12 TRU waste shipments weekly, for an average of five shipments per week, despite COVID-19 restrictions.
- Continued multiple infrastructure upgrades including a fire water system.
- Began mining of the West Access Drifts – an EM 2021 priority.
- Completed the initial testing of the 700-C ventilation fan in preparation of its restart.
- Completed 97 projects during a two-month-long maintenance outage.
- Transported waste shipments safely over more than 222,000 cumulative miles; more than 15 million safe miles over the life of the project.
- Received more than 200 TRU waste shipments; more than 13,000 all-time shipments received.

PROJECTS SPIN UP IN YEAR OF RESURGENCE

Multiple projects slowed by the pandemic spun back up to speed in 2021 and showed visible progress, led by the SSCVS. The SSCVS is the largest containment fan system in the DOE complex and will significantly increase airflow underground. Work on the system’s three major facilities showed major advancements. The foundation for the New Filter Building, where 1,000-horsepower fans will pull air through HEPA filtration, was completed three weeks early, kick-starting construction of the building’s walls. The Salt Reduction Building went vertical with the installation of precast concrete walls in advance of roof work. The utility shaft, the massive air intake for the system, has reached 124 feet of its projected 2,275-foot depth.



Workers attach a precast wall at WIPP’s Salt Reduction Building, part of the SSCVS.

The new shaft saw the installation of a plenum and ductwork that forces air into the underground. It is WIPP's largest shaft at 26 feet in finished diameter.



Workers attach guiding tag lines to ductwork before lowering it into a channel adjacent to the utility shaft at WIPP.

RESTARTING THE LEGACY 700-C FAN

Bridging the gap between the current ventilation system and when the SSCVS is scheduled to start in 2025, WIPP is on the verge of restarting one of its legacy fans, the 700-C. The WIPP ventilation system currently pulls 170,000 cubic feet per minute (CFM) of filtered air throughout the underground. The 700-C fan provides 240,000 CFM of unfiltered air for non-emplacements activities such as mining and rock bolting. When the SSCVS comes online, it will provide up to 540,000 CFM in either filtered or unfiltered modes. More air allows more machinery to work in the underground and makes for a safer and more comfortable working condition.

PREPARING FOR FUTURE WASTE EMPLACEMENT

As Panel 7 nears capacity, mining crews excavated the last of more than 120,000 tons of salt to create Panel 8. After outfitting with power, communications and air monitors, Panel 8 is preparing to accept waste starting in 2022. When Panel 7 is full, which is anticipated in April 2022, Panel 7 will be sealed. WIPP's first six panels have

already been filled and sealed. Mining at WIPP is timed so that a disposal panel is only ready when it is needed. This is because the natural movement of salt causes mined openings to close at a rate of two to four inches yearly. Panels are mined slightly larger than the desired size to account for this closure. This closure is attributed to salt rock movement which eventually permanently encapsulates the waste.



A continuous miner machine in WIPP's underground chews through a final section of salt to finish the preliminary rough cut of Panel 8.

OVERHAULING AGING INFRASTRUCTURE

WIPP's aging infrastructure is getting a massive overhaul. A new fire protection system is close to completion, including new 200,000-gallon water tanks, a pump house, and mains. Updated electrical substations above and below ground replace aging equipment. The new equipment provides compressed air for underground airlocks. A new Central Monitoring Room and fiber-optic network allows for close monitoring of all WIPP operations. The site's upgraded lightning protection system safeguards critical infrastructure such as the hoists and water supply.

MAINTENANCE OUTAGE COMPLETES 97 PROJECTS

WIPP personnel prioritize maintenance in the form of daily through yearly preventive maintenance checks, and once a year, the most complex projects receive attention over an extended period of time. A

two-month maintenance outage proved productive at the WIPP site as crews completed 97 projects. The largest effort included removing tracks at the waste station 2,150 feet underground. This included digging out six feet of rock and releveling the area with gravel and salt. The tracks serve a dual purpose of moving remote-handled waste and materials when they reach the WIPP underground. A double bulkhead that supplies airflow to the station was also replaced, including new ventilation fans.



Workers in the WIPP underground install a bulkhead as part of a two-month maintenance outage.

WEST VALLEY DEMONSTRATION PROJECT

“The West Valley Demonstration Project team continues to deliver results in a manner that is safe and protective of employees, the local community, and environment. Employees continue to reduce legacy risks at the site in an environmentally sound manner, which is a testament to their dedication and commitment. The removal and area restoration of 46 site structures that are no longer needed changed the landscape of the site and the community. The safe and deliberate deactivation of several fuel reprocessing cells, along with the removal of the west wall of the Main Plant Process Building, signals that demolition of this last and largest remaining structure is in the very near future. I am truly proud to be a part of this team, and I look forward to continuing our work together.”

– *Bryan Bower, Director, West Valley Demonstration Project*

HIGHLIGHTS

- Restored rail shipment capabilities for the site.
- Continued preparation for the Main Plant Process Building (MPPB) demolition by:
 - Installing a new water collection and treatment system; and
 - Repurposing an administrative trailer complex into a multipurpose building to support MPPB demolition activities.
- Placed several cells used during spent fuel reprocessing operations in a readiness state for future demolition.
- Removed the west wall of the MPPB to continue deactivation activities inside the Acid Recovery Cell.
- Continued aggressive decontamination in the Product Purification Cell-South (PPC-S).
- Completed the removal and restoration of 46 balance of site facilities that are no longer needed for current or future cleanup efforts.

RESUMED RAIL SHIPMENTS

Rail shipments at the site resumed in June as part of ongoing cleanup efforts at the West Valley Demonstration Project (WVDP). The rail line was last used in 2007 and will now support waste shipments for the MPPB demolition project. The

rail line will help accelerate decommissioning and remediation activities in the very near future.

The upgraded rail line is being used to ship materials from the soil and structure removal project used in building the permeable treatment wall that is aiding in addressing a contamination plume in the site groundwater. The wall, which



Rail shipments resumed to transport materials from a soil and structure removal project.

will remain in place, was designed and installed to effectively remove and contain the expansion of the plume that resulted from previous nuclear fuel reprocessing operations. This project will provide lessons learned and hone logistics when using the rail line for the future demolition of MPPB.

CONTINUED PREPARATION FOR MAIN PLANT PROCESS BUILDING DEMOLITION

Crews completed the physical installation of the new water collection and treatment system for capturing and treating dust suppression water and storm water from the MPPB demolition. This one-of-a-kind system was designed to handle severe weather events and is capable of performing multiple water treatment processes that may be required to support the demolition.

In addition, WVDP crews repurposed a former office trailer complex into a multi-purpose facility to support MPPB demolition work. The building



Crews install a robust water management system in preparation for MPPB demolition.

now includes locker rooms, showers, a respirator issuance area and a radiological monitoring control room.

CONTINUED MAIN PLANT PROCESS BUILDING DEACTIVATION ACTIVITIES

Crews completed the final stabilization of the General Purpose Cell (GPC), GPC Crane Room, GPC Operating Aisle and GPC Crane Room Extension by placing 2,000 cubic yards of grout, which provides structural stability for equipment tracking over below-grade rooms and shielding while still being readily removable.

All final deactivation activities in the Equipment Decontamination Room have been completed, which included a fixative application, draining fluids from the crane and manlift, and electrical waste removal.

The fixative application in the Chemical Process Cell shield door's lower and upper penthouse have been completed. Work in this cell also included the draining of fluids from the shield door's motors and hoists.

REMOVAL OF WEST WALL FOR CONTINUED DEACTIVATION ACTIVITIES INSIDE THE MPPB

Crews used a heavy-duty excavator with a shear attachment to safely remove a large portion of the



A large excavator is used to remove the west wall for continued deactivation work inside the Acid Recovery Cell.

west wall on the MPPB to allow for deactivation activities inside the ARC that will include precutting the floor to prepare its removal during MPPB demolition. This work will be done under ventilation controls using an excavator with a quarry saw attachment to cut the floor into blocks, so they can be removed later with minimal disturbance during MPPB demolition.

CUTTING-EDGE TECHNOLOGY IN PRODUCT PURIFICATION CELL-SOUTH

The PPC-S contains very high levels of contamination from previous nuclear fuel reprocessing operations. Operations resumed in September, after COVID-19 restrictions were lifted on close-contact work activities. The state-of-the-science technology WVDP uses employs liquid nitrogen at up to 60,000 pound-force per square inch to provide an aggressive, yet safe, cleaning application. Decontamination is accomplished by



A worker gets trained on how to get suited up for PPC-S decontamination work.

removing one-eighth of an inch from the surface of the wall and safely collecting the material in a vacuum system for disposal.

DEMOLITION OF THE LAST BALANCE OF SITE FACILITY

A septic system and well associated with a former schoolhouse at WVDP were safely removed, which completed the removal and demolition of 46 balance of site facilities.



Workers remove the steel well casing from a former schoolhouse site and restored the area.

The School House septic system and all associated piping were removed using an excavator; and the 37-foot deep well and six-inch casing were removed in five-foot sections. The School House area was restored after being graded and reseeded. The former School House was used as a training center for WVDP employees during the early days of the project.



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