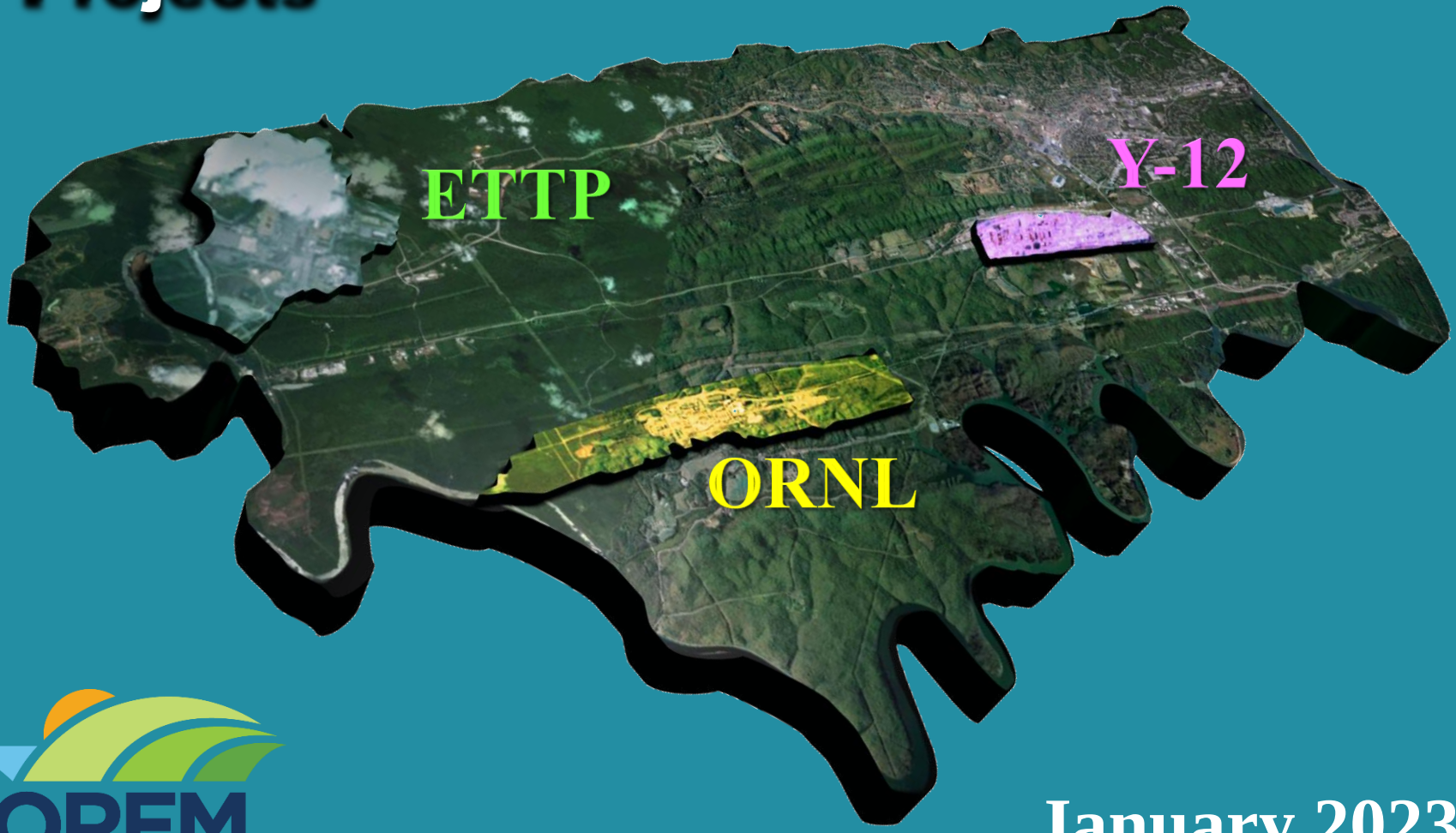
Tour of Department of Energy Oak Ridge Environmental Management Projects



OREM
Oak Ridge Office of Environmental Management

January 2023

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Acronyms

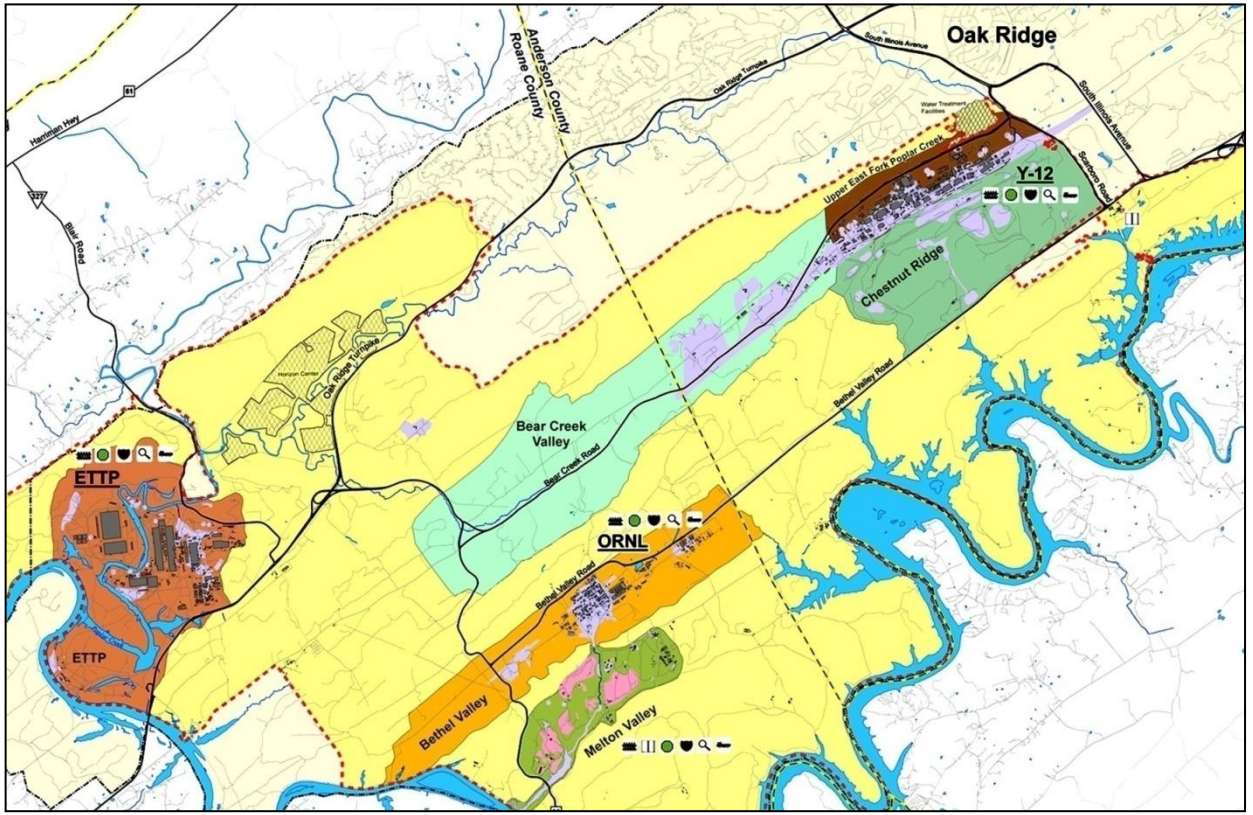
ARRA	American Recovery and Reinvestment Act
BSR	Bulk Shielding Reactor
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH	contact-handled
COC	contaminant of concern
COLEX	column exchange
CVOC	chlorinated volatile organic compound
D&D	deactivation and decommissioning
DOE	Department of Energy
EFPC	East Fork Poplar Creek
EM	Office of Environmental Management
EMDF	Environmental Management Disposal Facility
EMWMF	Environmental Management Waste Management Facility
EPA	U.S. Environmental Protection Agency
ETTP	East Tennessee Technology Park
EU	exposure unit
FFA	Federal Facilities Agreement
ft^2	square feet
FY	fiscal year
GAAT	Gunite and Associated Tanks
gpm	gallons per minute
GW	gaseous waste
LEFPC	Lower East Fork Poplar Creek
LGWO	Liquid/Gaseous Waste Operations
LLLW	liquid low-level waste
m3	cubic meters
MPNHP	Manhattan Project National Historical Park
MSRE	Molten Salt Reactor Experiment
MTF	Mercury Treatment Facility
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NPS	National Park Service
OF200	Outfall 200
OREM	Oak Ridge Office of Environmental Management
ORNL	Oak Ridge National Laboratory
PCB	polychlorinated biphenyl
pCi/g	average picocuries per gram
pH	potential of hydrogen
PW	process waste
RH	remote-handled
RI/FS	Remedial Investigation/Feasibility Study
RIWP	Remedial Investigation Work Plan
ROD	Record of Decision
SLTA	Sludge Test Area
SL-PFB	Sludge Project Facility Buildout
SWSA	Solid Waste Storage Area
TDEC	Tennessee Department of Environment and Conservation
TRU	transuranic
TSCAI	Toxic Substances Control Act Incinerator
TWPC	Transuranic Waste Processing Center
U-233	uranium-233
UEFPC	Upper East Fork Poplar Creek
UF_6	uranium hexafluoride
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant
y^3	cubic yards
Y-12	Y-12 National Security Complex

Introduction and Background (1 of 4)

In 1989, the Oak Ridge Reservation was placed on the National Priorities List to be cleaned up under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The reservation is an area of about 32,400 acres that straddles Anderson and Roane Counties and is within the city limits of Oak Ridge. As a result of decades of operations in nuclear research and weapons development, about 10,500 acres of land and related buildings may have been impacted by previous operations at the site.

The tour and this book will identify many individual projects associated with the cleanup objectives and will explain what has been finished to date, what is currently underway, and what is planned for the future.



NOTES:

Introduction and Background (2 of 4)

KEY DATES

1980	CERCLA enacted
1989	Oak Ridge Reservation placed on National Priorities List
1989	The Department of Energy (DOE) establishes the Office of Environmental Management (EM)
1992	Federal Facility Agreement implemented
1995	Oak Ridge Site Specific Advisory Board established
2003	First waste disposed at the EM Waste Management Facility (EMWMF)
2006	Melton Valley remediation completed
2008	First shipment of contact-handled (CH) transuranic (TRU) waste sent to the Waste Isolation Pilot Plant (WIPP) in New Mexico; demolition begins on the K-25 Building at the East Tennessee Technology Park (ETTP)
2009	First shipment of remote-handled (RH) TRU waste sent to WIPP in New Mexico
2011	First shipment of uranium-233 (U-233) material sent from Oak Ridge
2011	Completion of Alpha 5 and Beta 4 Legacy Material Disposition
2011	Y-12 National Security Complex (Y-12) Old Salvage Yard material removal action completed
2013	Demolition of K-25 Building completed
2015	Demolition of K-31 Building completed; Manhattan Project National Historical Park (MPNHP) established
2016	Completed Vision 2016 - demolition of all gaseous diffusion plants

NOTES:

Introduction and Background (3 of 4)

NOTES:

KEY DATES

2018	ETTP Poplar Creek buildings demolition completed
2018	Removal of West Column Exchange (COLEX) equipment completed
2018	Toxic Substances Control Act Incinerator (TSCAI) demolished
2018	Began reshipping CH TRU waste to WIPP after reopening
2019	Started construction of Outfall 200 (OF200) Mercury Treatment Facility (MTF)
2019	U-233 direct disposition campaign was completed
2019	Completed demolition of the K-1200 Centrifuge Complex, the final significant building, at ETTP
2020	Completed Vision 2020 - demolition of remaining ETTP buildings; K-1600, final ETTP facility, demolished
2020	K-25 history center opened to the public
2021	Y-12 Biology Complex (9207, 9210, 9767-2, and 9767-7) demolition to slab completed
2022	Operational responsibility for Y-12 Biology Complex property transferred back to National Nuclear Security Administration (NNSA)
2022	Oak Ridge National Laboratory (ORNL) Bulk Shielding Reactor (BSR) Complex (3009, 3010, 3010A, 3080, 3083, and 3107) demolition to slab completed
2022	Building 9213, the Oak Ridge Critical Experiments Facility at Y-12, was demolished

Introduction and Background (4 of 4)

MAJOR RECORDS OF DECISION (RODs)

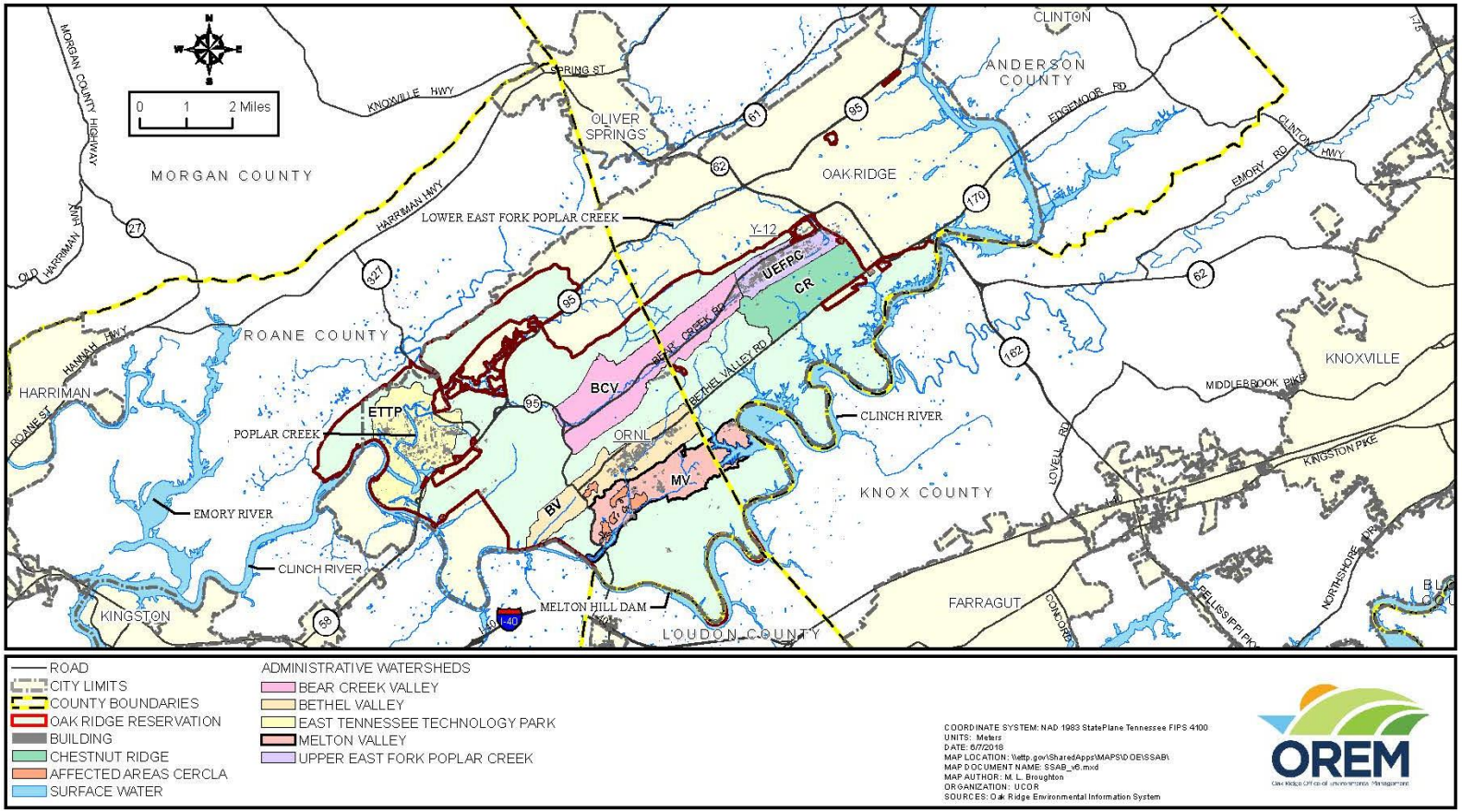
1995	Lower East Fork Poplar Creek (LEFPC), Watts Bar
1997	Gunite Tanks, Clinch River/Poplar Creek, Union Valley
1999	EMWMF
2000	Melton Valley, Bear Creek Valley
2002	Bethel Valley, Upper East Fork Poplar Creek (UEFPC) (Soils & Sediment)
2002	Bethel Valley (Soils & Sediment, Subsurface Structures, Deactivation and Decommissioning [D&D], and Surface Water)
2002	UEFPC Phase I Interim Source Control Actions
2003	ETTP - Zone 1 Soil
2005	ETTP - Zone 2 Soil
2005	UEFPC Phase 2 Interim Remedial Actions for Contaminated Soils and Scrapyard
2022	Environmental Management Disposal Facility (EMDF)
2022	Demolition of Building 3010 (BSR) completed
2022	Startup of U-233 Hot Cell downblending
2022	Transuranic Waste Processing Center (TWPC) transitioned to United Cleanup Oak Ridge, LLC

NOTES:

The Cleanup Challenge

The location and history of the Oak Ridge Reservation present some of the greatest challenges to cleanup activities at any DOE site in the country.

NOTES:



Great Diversity of Contaminants
Fission Products – strontium, cesium, etc.
Transuranics – plutonium
Metals – mercury, uranium, beryllium
Organics – polychlorinated biphenyls (PCBs)
Others – nitrates, asbestos, etc.

Surface and Groundwater Flow
Abundant rainfall in the area (55 inches annually) enhances transport of contaminants.

Groundwater and surface water are interconnected, enhancing movement of contaminants.

Geology
Because underlying rocks are fractured, predicting groundwater flow is difficult. Some rock units contain caves and cavities that allow wide-ranging groundwater flow.

Population Centers
The entire Reservation is in the Oak Ridge city limits, and many people live near our cleanup sites.

Y-12 National Security Complex (Y-12)

NOTES:

The Y-12 Plant (now known as the Y-12 National Security Complex) began as a uranium enrichment facility during World War II. Wastes were buried in many areas around the plant, and thousands of pounds of mercury were released into the environment from 1950 to 1982 during the production of radioactive materials used in hydrogen bombs.

Today, the plant is used primarily for disassembly of nuclear weapons and the storage of uranium. It is also the site for a CERCLA Waste Management Facility (known as the Environmental Management Waste Management Facility), which is being used for disposal of much of DOE's environmental cleanup program wastes.

Y-12 comprises approximately 800 acres and is situated over a ridge, about 400 yards from the nearest Oak Ridge resident. The site is operated by Consolidated Nuclear Security.

High-priority risk-reduction actions at Y-12 include actions to mitigate mercury migration into surface water, as well as demolition of process buildings and other legacy Manhattan Project and Cold War facilities. Future actions include remediation of Chestnut Ridge, Bear Creek Valley (including Bear Creek Valley Burial Grounds), White Wing Scrap Yard, and remaining soils, slabs, and below-grade structures identified in the UEFPC Phase II ROD.

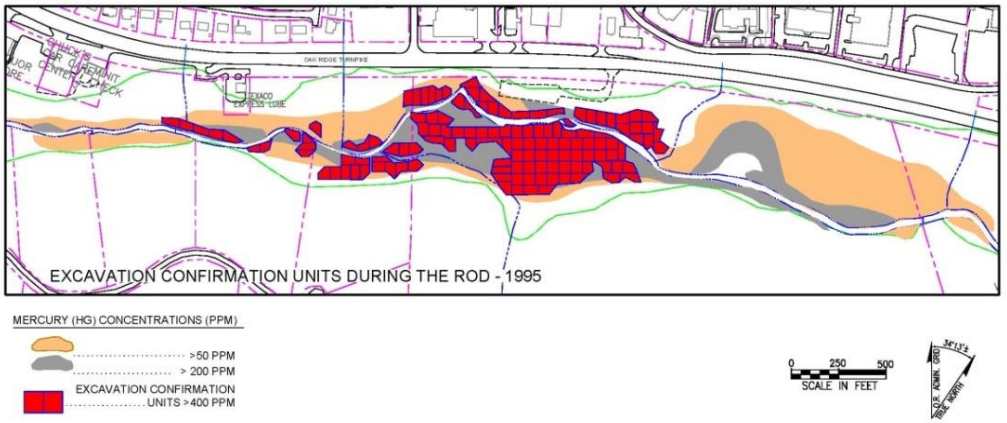
Lower East Fork Poplar Creek (LEFPC)

NOTES:

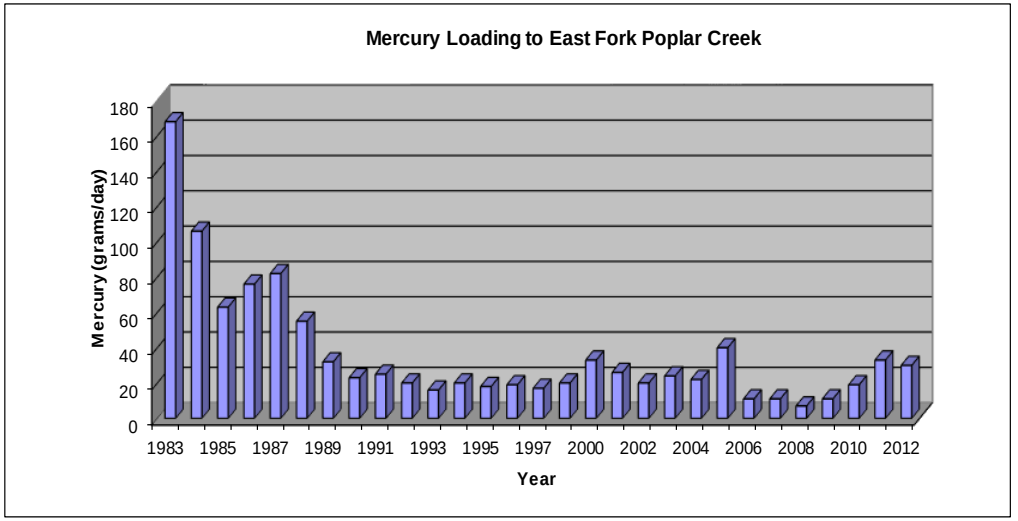
LEFPC flows through the residential and business portions of the City of Oak Ridge. The creek is downstream of Y-12 and the flood plains became contaminated with mercury and other contaminant releases that occurred from the 1950s to 1982.

The remedial investigation and proposed plan for the area identified two primary areas of the floodplain that required excavation. A third area currently covered by asphalt will be dealt with later.

An assessment process to define a 400 parts per million mercury cleanup level for the floodplain soils was proposed and supported by the public. The remedial action was accomplished in 1997. A final remediation alternative for the creek surface waters and creek bed sediments will be decided after the UEFPC soils remediation and mercury mitigation activities within the Y-12 site are completed.



Mercury Release to Lower East Fork Poplar Creek (grams/day)



Upper East Fork Poplar Creek (UEFPC)

NOTES:

An estimated 700,000 pounds of mercury were either lost into the environment or were otherwise unaccounted for at Y-12 during production of materials used in nuclear weapons from 1950 to 1982. Thousands of pounds of mercury found its way to UEFPC. Mercury levels in the creek have been reduced significantly, but still exceed Clean Water Act established levels. Mercury remaining in the soils, sediments, and surface water is still a concern, especially in contributing to the buildup of mercury in fish and aquatic life.

Sampling Fish for Mercury

In April 2006, the Federal Facilities Agreement (FFA) tri-parties (U.S. Environmental Protection Agency [EPA], Tennessee Department of Environment & Conservation [TDEC], and DOE) agreed to the UEFPC Phase II ROD for interim remedial actions to address accessible soil, buried waste, or subsurface structures that contribute significantly to contamination above acceptable risk levels in UEFPC.

Treatment alternatives are being evaluated and given consideration as to their ability to capture and treat the anticipated waste volume and meet regulatory goals. Construction of the OF200 MTF started in 2019 with a capacity to capture and treat up to 3,000 gallons of water per minute from UEFPC as part of the resolution. UEFPC Phase II remedial actions are planned to begin in Fiscal Year (FY) 2023 and will continue as DOE continues to demolish legacy facilities and reduce environmental liabilities across the Y-12 footprint.

Mercury Technology Development and the Aquatic Ecology Laboratory

NOTES:

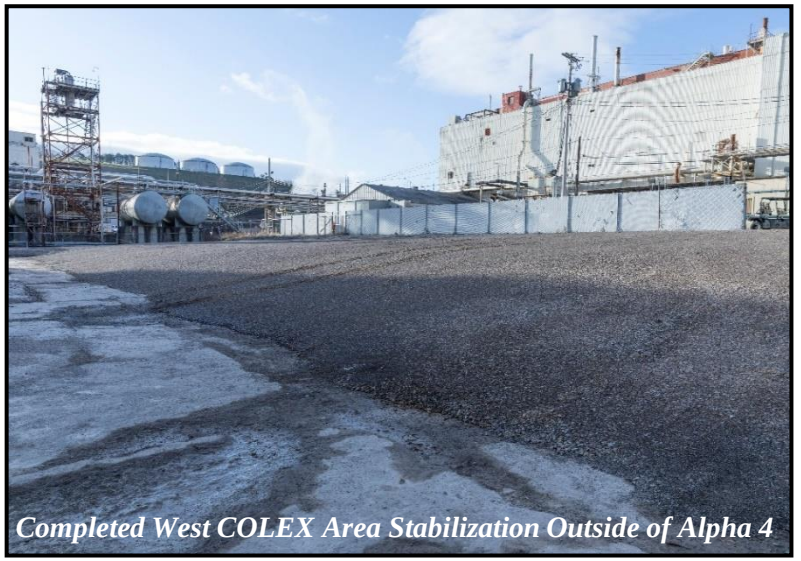
ORNL is home to the Aquatic Ecology Laboratory. This facility has been upgraded as part of the Y-12 Mercury Technology Development work to allow for extensive mercury testing of actual creek water in various situations – including those involving biological, ecological, and chemical aspects of mercury in the environment.

Research and technology development activities to date have focused on understanding mercury transport and fate in the East Fork Poplar Creek (EFPC) system. Monitoring sites from upstream to downstream in EFPC were established to measure flow, water chemistry, groundwater, and biota. Field studies have pointed to the importance of bank soil erosion as a source of mercury to the creek, especially in the upstream section. Instream factors, such as water chemistry and flow characteristics, also influence mercury concentration including the production of methylmercury. Research studies have highlighted the importance of methylmercury and its bioaccumulation in the food chain. Early efforts to understand the watershed have added significantly to our understanding of key mercury source areas and mercury transformations and processes. The watershed-scale mercury information is informing conceptual and dynamic models that can be used for future technology development and remedial decision making in EFPC.

Column Exchange (COLEX) Equipment Removal

Removal of the West COLEX equipment, which was connected to the side of Alpha 4, was completed in an 18-month project that ended in 2018. Nearly 6,500 pounds of mercury were recovered from the rusted and structurally degraded equipment. More than 10,000 feet of mercury-contaminated piping were removed and disposed. Tanks, condensers, heat exchangers, and a 1.6-million-pound mezzanine structure were also removed and disposed.

Deactivation of the COLEX equipment on the Eastern side of Alpha 4 was completed in 2022. Nearly 2.4 tons (4,786 lbs) of mercury were recovered amongst the piping, tanks, and pumps that were deactivated. Demolition of the East and South COLEX equipment will be performed at a later date. Interior preparation for demolition activities are in progress to support future facility demolition. Upon demolition completion, DOE will have removed approximately 68 tons of mercury and significantly reduced DOE's environmental liabilities.



Completed West COLEX Area Stabilization Outside of Alpha 4

NOTES:

Outfall 200 (OF200) Mercury Treatment Facility (MTF)

NOTES:

The Oak Ridge Office of Environmental Management (OREM) will construct the OF200 MTF to reduce mercury discharges from Y-12 into EFPC. Construction and operation of the OF200 MTF is a CERCLA Interim Action.

A ROD amendment establishing specific design parameters for the OF200 MTF was approved May 2016. These design parameters include a treatment capacity of 3,000 gallons per minute (gpm), a stormwater capture rate of 40,000 gpm, and 2 million gallons of stormwater storage capacity.

The final design was completed July 2017. The MTF design includes a headworks facility located immediately downstream of OF200 and a treatment plant located near the east end of Y-12.

The "Headworks" Component of the Outfall 200 Mercury Treatment Facility

The headworks will capture, store, and pump stormwater to the treatment plant via a pipeline. The treatment plant will remove mercury from the stormwater and discharge-treated water into EFPC. The treatment train includes grit removal at the headworks, flow equalization, pH adjustment, chlorine removal, chemical flocculation and precipitation, media filtration, sludge thickening, and sludge dewatering at the treatment plant.

Early site preparation began in December 2017 and was completed in January 2019. The balance of construction began in June 2019 and is planned to be complete by December 2026.

The "Treatment Plant" Component of the OF200 MTF

Biology Complex

NOTES:

A major step toward changing the Y-12 skyline and reducing worker risk was the demolition of six buildings that comprised a significant portion of the former Biology Complex. The project eliminated 135,812 square feet (ft^2) of deteriorated buildings in 2010.

The remaining Biology buildings, 9207 and 9210, underwent hazardous waste abatement, such as asbestos removal. Final demolition of these buildings began in 2020 and was completed in 2021, removing 343,761 ft^2 of deteriorated buildings. Remediation included removal of the remaining slabs and surrounding soil after characterization identified the disposal path.

Biology Building Demolition Complete

The Exposure Unit (EU) 5 technical memorandum recommended No Further Action for the exposure unit the Biology Complex was located in. The cleanup allowed return of operational responsibilities of the Biology Complex (EU-5) to NNSA in November 2022, allowing development for a proposed NNSA Lithium Production Facility.

Alpha 2, Beta 1, and Buildings 9401-1 and 9213

NOTES:

Alpha 2 and Beta 1 were built in the 1940s to aid in uranium enrichment and recovery operations, followed by lithium and mercury enrichment and research and development. Building 9401-1 was a former steam plant operated until 1954 and later used for maintenance and storage. Building 9213 was built in 1950 and used for criticality experiments followed later by limited U.S. Army field training operations.

Through funds received to cleanup and address D&D of Y-12 Excess Facilities, OREM continues addressing environmental contamination due to legacy operations and is making progress to reduce environmental liabilities at Y-12.

As of 2022, Building 9213 was demolished, which removed 28,898 ft^2 of dilapidated buildings from the Excess Facility Program. Preparations for demolition at the old Steam Plant (9401-1), Alpha 2, and Beta 1 complexes are in progress, as workforces collect characterization samples, and remove-universal/loose waste, machine oil, and asbestos from the structures and equipment. Demolition of 9401-1 will begin in FY 2024 followed by Alpha 2 and Beta 1 complexes.

Alpha 2 Building at Y-12

Building 9213, the Oak Ridge Critical Experiments Facility

Alpha 4 Project

Alpha 4 is a 600,000 ft^2 transite-covered, structural steel-and-concrete facility with three floors and a sub-basement, located in the protected area of the Y-12 site.

Work is in progress eliminating classification concerns, characterizing the facility, and preparing for demolition through removal of hazardous materials, universal wastes, utility reroutes and deactivation, and removing equipment and stored legacy materials. To date, 6.5 tons of mercury have been removed from the facility. Demolition will occur in 2030.

NOTES:

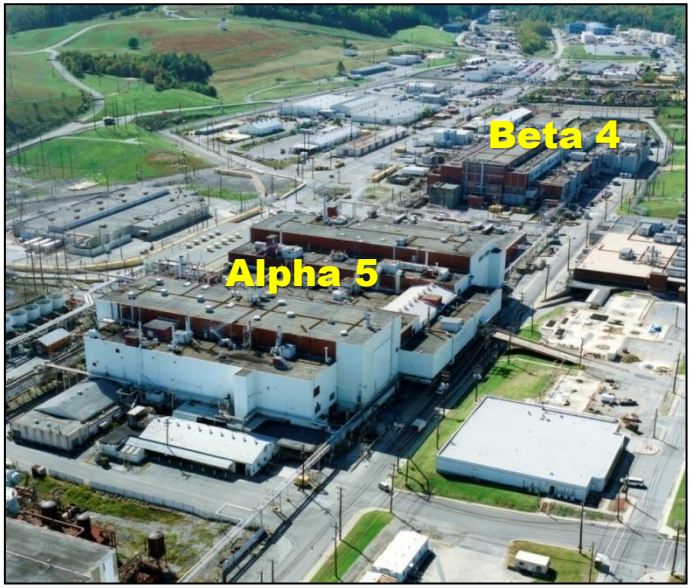
Alpha 5 and Beta 4 Legacy Material Disposition (completed)

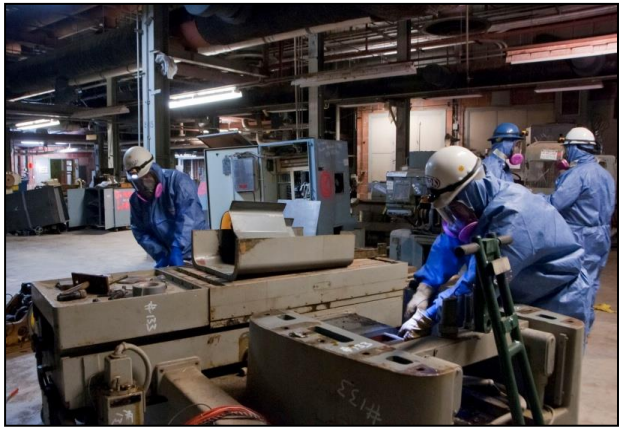
NOTES:

Alpha 5 and Beta 4 date to the 1940s and have been used recently for storing legacy material from past plant operations. Recovery Act funding was used to characterize and remove legacy materials from both buildings, including:

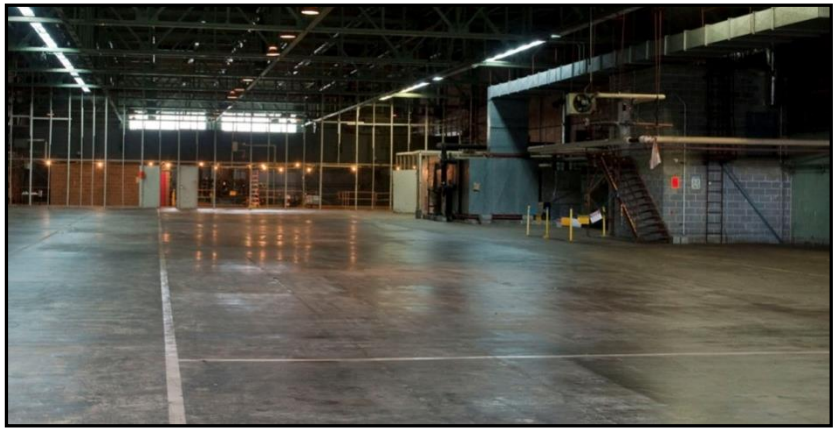
- 3,438 cubic meters (m^3) of material from Beta 4
- 613,000 ft^2 of floor space was cleared in Alpha 5

Preparation for demolition work is being planned, with initial activities beginning in Alpha 5 in late 2024. Much of this work is dependent upon reduction of the Y-12 security fence.





Cleaning Out the Interior of Alpha 5

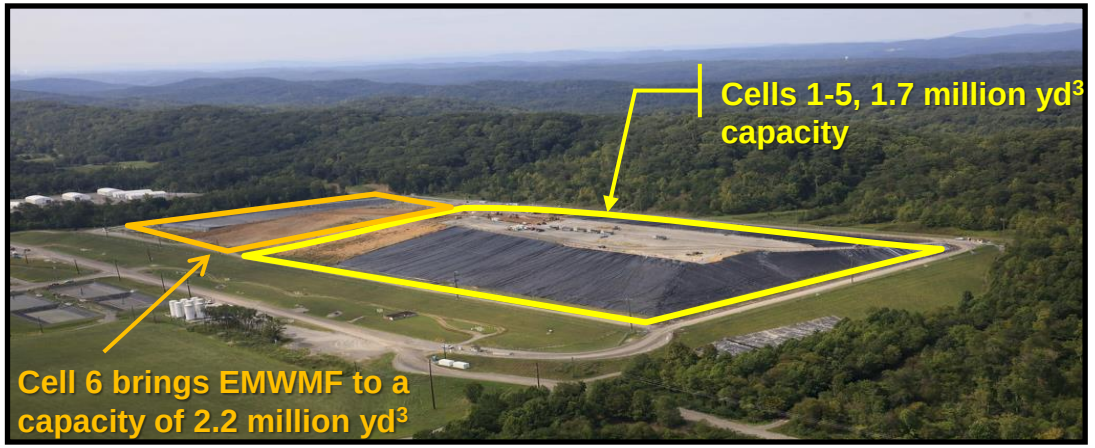


Interior of Alpha 5 After Cleanout

Existing CERCLA Waste Disposal Facility

aka Environmental Management Waste Management Facility (EMWMF)

EMWMF is an above-grade disposal facility with multiple layers of protective geotextiles and low-permeability clays above and below disposed waste to prevent contaminants from leaching into the groundwater.



EMWMF accepts low-level radioactive and hazardous wastes that meet specific waste acceptance criteria developed in accordance with EPA and state regulations. Waste types that qualify for disposal include soil, dried sludge and sediment, solidified wastes, stabilized waste, building debris, scrap equipment, and secondary waste such as personal protective equipment.

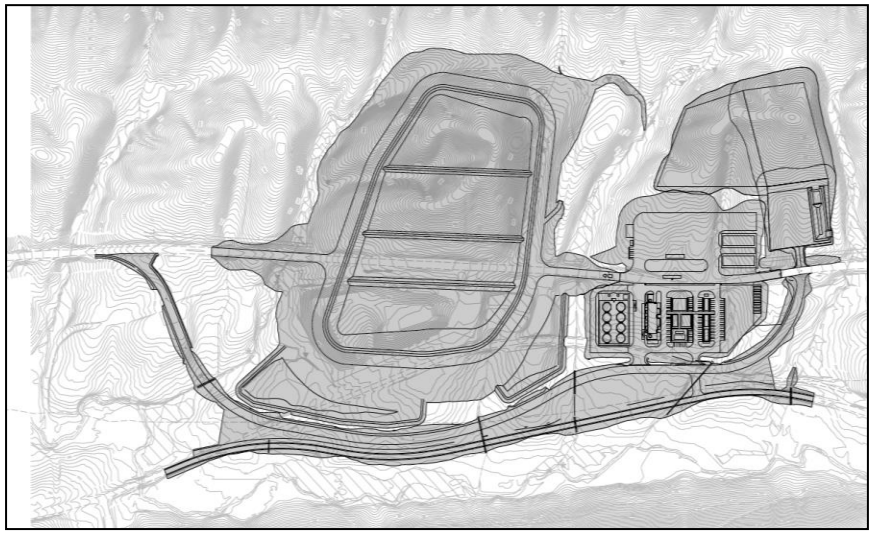
The facility consists of six disposal cells. The completion of the construction of Cell 6, funded by the American Recovery and Reinvestment Act (ARRA), brought the facility to a capacity of 2.2 million yd^3; additional cap redesign has added approximately 0.1 million yd^3 of capacity. That should be sufficient to handle waste disposition from work in Oak Ridge until the late-2020s. Plans are being made to construct the EMDF on-site disposal facility to handle waste generated by cleanup activities at Y-12 and ORNL.

NOTES:

Proposed CERCLA Waste Disposal Facility (EMDF)

NOTES:

EMDF is the second above-grade disposal facility designed with multiple layers of protective geotextiles and low-permeability clays above and below disposed waste to prevent contaminants from leaching into the groundwater. The facility is planned as a CERCLA remedy for disposal of future Y-12 and ORNL waste.



EMDF Site Characterization

EMDF will accept low-level radioactive and hazardous wastes that meet specific waste acceptance criteria developed in accordance with EPA and state regulations. Waste types that will be disposed include soil, dried sludge and sediment, solidified wastes, stabilized waste, building debris, scrap equipment, and secondary waste such as personal protective equipment.

The facility will consist of four disposal cells with a proposed final capacity of up to 2.2 million cubic yards (y^3). EMDF will provide disposal capacity through the end of the OREM Cleanup Program.

Haul Road from ETTP to EMWMF

In May 2005, construction began on a haul road to transport waste generated from cleanup activities at ETTP to EMWMF without using public roadways.

Construction was finished in January 2006, at a cost of about $20 million. DOE has significantly reduced risks by utilizing the Haul Road to prevent waste transportation on public roadways. As cleanup activities at ETTP wrap up, other alternatives for the Haul Road will be evaluated.

NOTES:

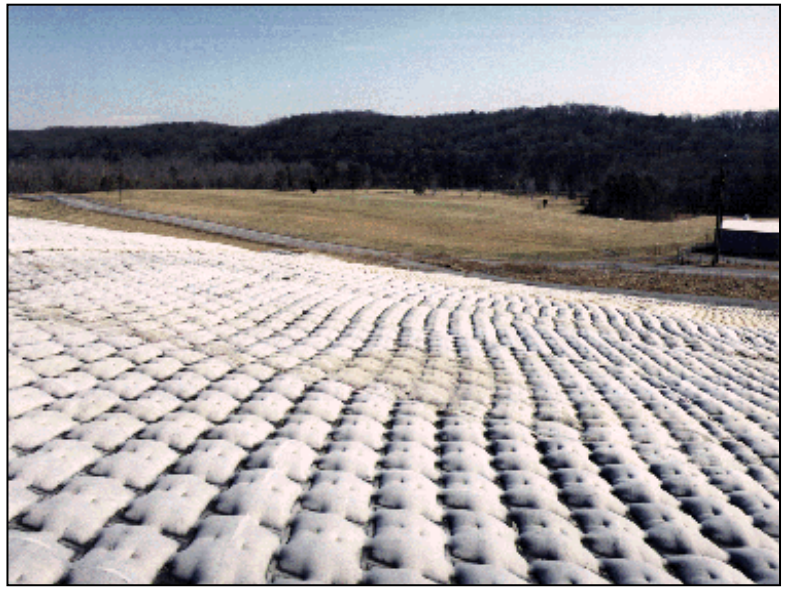
Bear Creek Valley Burial Grounds

NOTES:

The burial grounds are located approximately two miles west of Y-12 and were operated from about 1955 to 1993. Their primary use was for disposal of uranium turnings and industrial waste contaminated with uranium from nuclear weapons production.

The burial grounds include walk-in pits, uranium vaults, and several waste disposal units known as BCBG-A, -B, -C, -D, -E, and -J. Each disposal unit contains a series of trenches that are 14 to 25 feet deep. A concrete blanket covers the burial grounds to mitigate risk posed by buried shock-sensitive materials.

To begin addressing remediation concerns, DOE prepared a remedial investigation/feasibility study (RI/FS) in 1997 followed by a focused feasibility study and proposed plan in 2008, allowing the FFA tri-parties to evaluate remediation alternatives for addressing the burial grounds contamination. Approval of the proposed plan was paused in 2009 due to FFA tri-party disagreement and concerns. During the ensuing 14 years, DOE continued collecting data and evaluating options, including a recent non-time critical action to address and evaluate uranium contamination in North Tributary 8, which flows out the southwestern area of the burial grounds area. DOE will revaluate the RI/FS and begin working towards a final ROD in 2023 utilizing and evaluating more recent data and advancements in remediation technology.



Oak Ridge National Laboratory (ORNL)

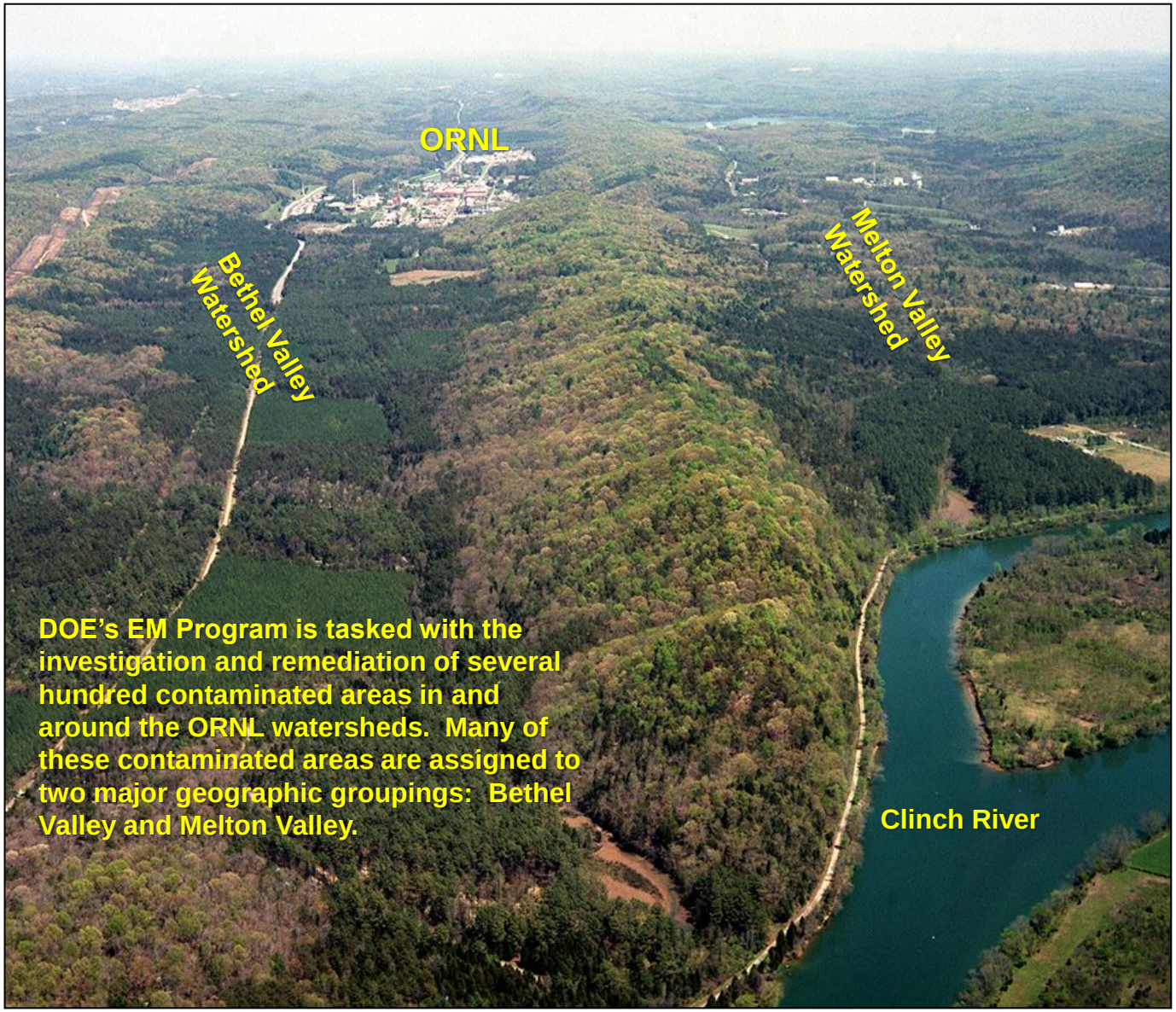
NOTES:

The lab was constructed as part of the Manhattan Project during World War II and was where the first gram quantities of plutonium were produced. The lab is now an internationally-renowned research facility with ongoing missions in areas such as energy and biological research for both government and civilian applications. The 2,900-acre site is located approximately 10 miles southwest of downtown Oak Ridge and is managed for DOE by UT-Battelle.

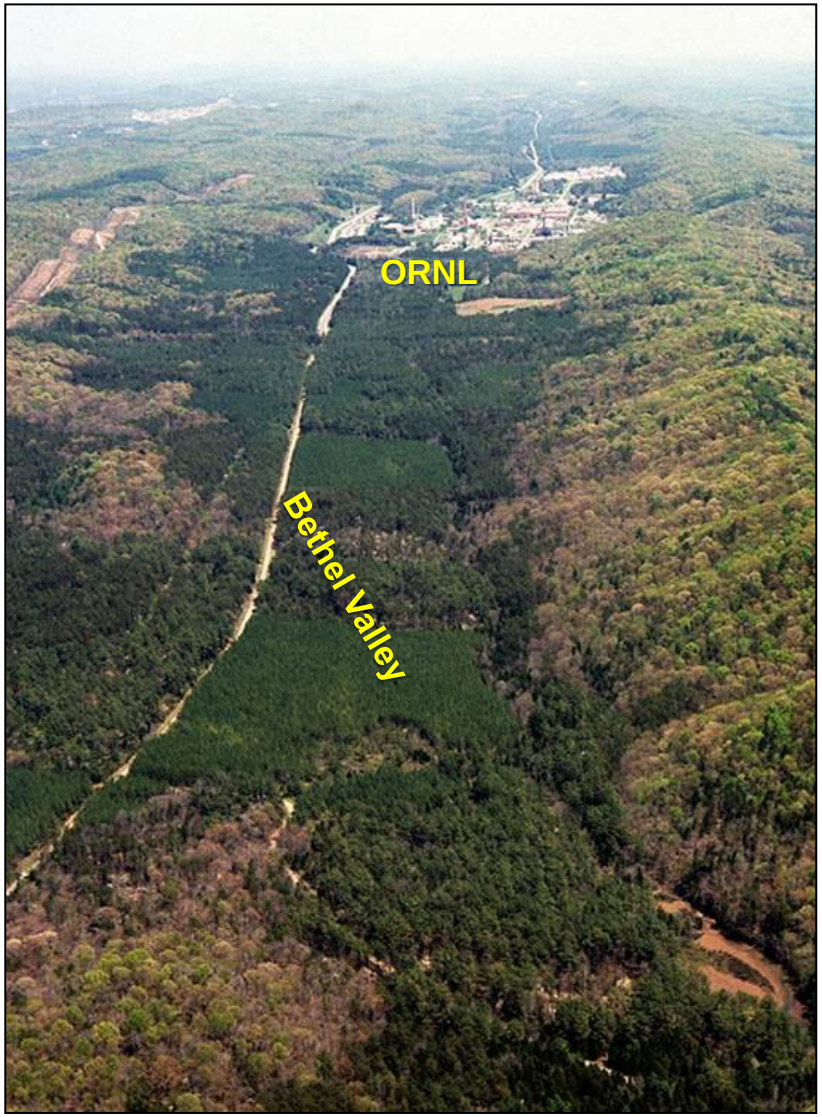
Remediation efforts at the lab focus on its two watershed divisions: Bethel Valley (which includes the main lab area) and Melton Valley (see photo next page). Some remediation in Melton Valley, which posed the highest environmental risk, was completed in 2006. Cleanup work in Bethel Valley includes a variety of challenges: contaminated soil and groundwater, buried inactive process tanks and transfer pipelines, inactive radiochemical processing facilities, and inactive nuclear reactors, totaling over 250 facilities. Many of these areas must be addressed in the middle of an active and operating laboratory site.

ORNL Watersheds

NOTES:



Bethel Valley Watershed



Bethel Valley encompasses about 1,700 acres of land, including the main area of ORNL. The watershed has approximately 150 sites and buildings that are included in the OREM Cleanup Program.

The types of remediation sites are diverse and include contaminated soil and groundwater, buried process tanks and transfer pipelines, inactive radiochemical processing facilities, and inactive nuclear reactors.

Because of this diversity, the valley has been divided into four regions, based on area hydrology, the level and type of environmental management activities, and the knowledge that the end use of the regions may vary.

The *Record of Decision for Interim Actions in Bethel Valley* was issued in May 2002 and presents the remedies for selected inactive units, accessible sources of contamination, and contaminated media.

High-priority actions have included facility demolition, soil and sediment remediation, burial ground capping, and groundwater. Current missions are focused on disposition of legacy materials and wastes, operation of on-site treatment facilities, management of excess facilities awaiting D&D, and deactivation activities in preparation of D&D.

NOTES:

Melton Valley Watershed

More than 50 years of operation, production, and research activities at ORNL left a legacy of release sites, contaminated facilities, and areas of secondary contamination on 160 acres of the watershed's 1,062 acres. In the 1950s, the area was also used as the Atomic Energy Commission's Southeastern Regional Burial Ground. During this time, largely uncharacterized radioactive wastes from more than 50 other facilities or federal programs were disposed here. The watershed has approximately 100 sites and buildings, which are included in the OREM Cleanup Program.

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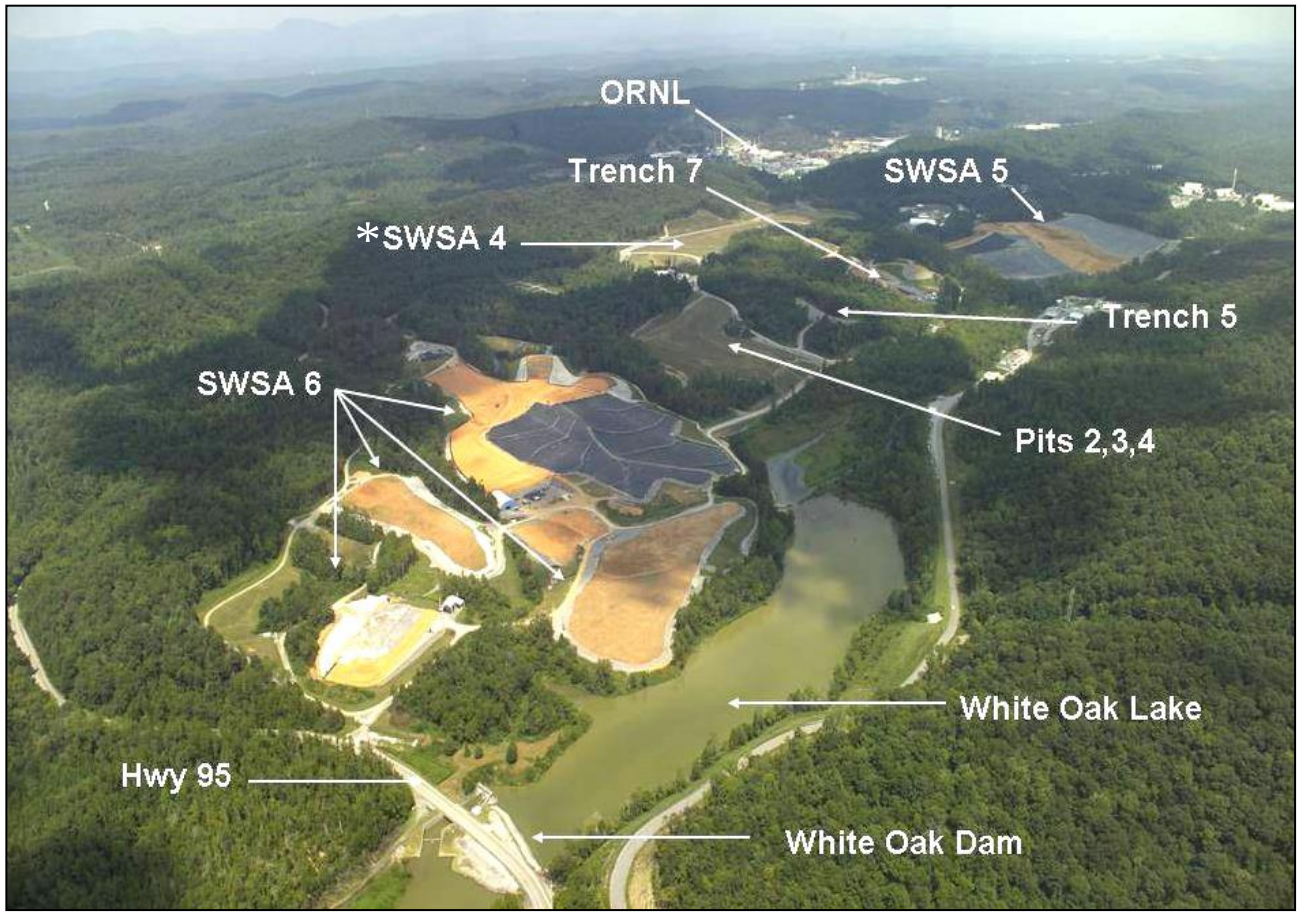


***SWSA = Solid Waste Storage Area**

Solid Waste Storage Area (SWSA) 4 Burial Grounds (completed)

NOTES:

SWSA 4 During Operation in the 1950s

SWSA 4 was used from 1951 to 1959 for disposal of various liquid and solid radioactive wastes in unlined trenches and auger holes. In Spring 2001, DOE released the *Remedial Design Report/Remedial Action Work Plan for the SWSA 4 Area and the Intermediate Holding Pond*, which outlined remediation of the area.

The SWSA 4 project included construction of a 32-acre, multi-layer cap over the area to minimize infiltration during precipitation, thereby protecting workers and wildlife. Approximately 2,400 linear feet of upgradient diversion trench and 1,200 linear feet of downgradient collection trench were installed. A groundwater treatment plant was constructed, and Lagoon Road was relocated as part of the project. Work was completed in September 2006.

Remediation activities in progress - 2005

SWSA 5 Burial Grounds (completed)

NOTES:

SWSA 5 was used to store or dispose of a variety of waste types, including low-level wastes, TRU wastes, and spent nuclear fuel. During the 1970s, TRU wastes were stored in trenches in retrievable containers. After the 1970s, newly-generated TRU wastes were stored in constructed facilities. The SWSA 5 trenches contained 204 concrete casks, 18 boxes, and 12 drums of TRU waste.

During remediation activities, all retrievable TRU waste containers from 22 trenches were removed and taken to TWPC, where they are being segregated and prepared for disposal at WIPP in New Mexico. The exception is the retrievable waste in Trench 13, where work was suspended because of a flame-up incident. The remediation of Trench 13 will be addressed at a later date.

Waste Disposal Practices at SWSA 5, 1950s Through 1970s

TRU Waste Retrieval Operations

Soil exceeding remediation levels (as designated in the Melton Valley ROD and debris waste associated with excavation were disposed at the EMWMF and other appropriate facilities. Spent nuclear fuel stored in SWSA 5 was retrieved, repackaged, and shipped to DOE's Idaho National Laboratory and Savannah River Site in 2004. Waste management facilities in SWSA 5 were demolished in 2005.

Multi-layer caps were installed in SWSA 5 to minimize water infiltration and protect workers and wildlife. Capping activities were completed in 2006.

SWSA 6 Burial Grounds (completed)

SWSA 6 was used for the disposal of solid low-level and mixed radioactive waste in trenches, auger holes, silos, and storage pads called tumuli. Only low-level waste was disposed in SWSA 6 after May 1986. Trenches and auger holes that received hazardous and/or mixed waste after November 8, 1980, were designated as "Resource Conservation and Recovery Act-Regulated Sites" that require a closure plan.

Remediation activities included demolition of surplus waste management facilities in 2005 and installation of multi-layer caps to minimize infiltration during precipitation, thereby protecting workers and wildlife. Spent nuclear fuel stored in SWSA 6 has been retrieved, repackaged, and shipped to off-site disposal facilities.

NOTES:

Melton Valley Burial Grounds

The Melton Valley Burial Grounds posed the highest risks to human health and the environment on the Oak Ridge Reservation, so this project provided an opportunity for early and significant risk reduction. Remediation was completed in 2006. Cleanup actions included hydrological isolation through installation of multilayer caps; retrievable TRU waste removal, treatment, and disposal; soil and sediment excavation and disposal; small facilities demolition; in-situ grouting; hydrofracture well plugging/abandonment; and legacy waste and spent nuclear fuel disposition.

NOTES:

Melton Valley Off-Site Monitoring Wells

There are concerns that contamination from the Melton Valley Burial Grounds could be migrating via groundwater off site, under the Clinch River and into groundwater under private property on the west side of the Clinch.

To determine if that is happening, a line of monitoring wells were placed on private property to detect any migration of contaminants.

Multiple rounds of sampling in wells installed by DOE and other private wells indicate minimal, if any, ongoing migration of contaminants from the Melton Valley Burial Grounds to off-site wells.

As a precautionary measure, property owners who have wells on the west side of the Clinch River have had their wells taken out of service; they have been connected to public water systems at no cost the them, while DOE continues to monitor groundwater for evidence of contamination.

In 2014, DOE completed a study of off-site, privately-owned wells to look for evidence of off-site migration. The study found no definite evidence of off-site migration; however, DOE will continue to monitor these wells.

Three additional wells were installed in 2021 to monitor the exit pathway from Bethel Valley and Melton Valley sources.

NOTES:

Transuranic Waste Processing Center (TWPC)

NOTES:

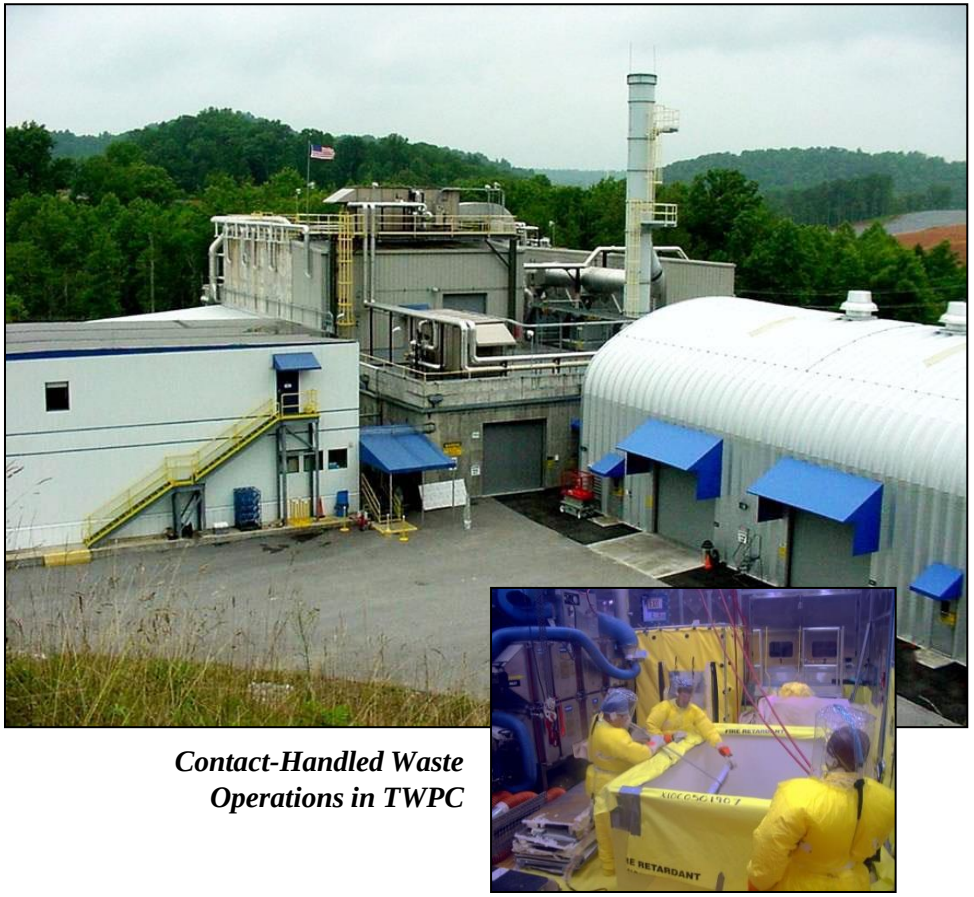
Two incidents in early 2014 caused the temporary shutdown of WIPP. WIPP reopened in December 2016, and TWPC began shipment of CH TRU waste to WIPP in August 2017.

Once WIPP's ventilation system is modified, RH TRU waste shipments are expected to begin (FY 2025).

TWPC is located next to the Melton Valley Storage Tanks, which contain liquid TRU wastes. Solid TRU wastes are stored in engineered bunkers and metal buildings at ORNL. Waste types include CH and RH TRU waste.

Storage tank supernate processing operations began in January 2004 and was completed in 10 months, disposing of more than 400,000 gallons of highly radioactive liquids containing approximately 30,000 curies.

CH TRU operations began in February 2006, and the first TRU waste shipment left Oak Ridge on September 28, 2008, for final disposal at WIPP in New Mexico. Of the 1,588 m^3 of CH waste, 98.5 percent has been processed and 77 percent has been shipped for disposal.



Contact-Handled Waste Operations in TWPC

Of the 691 m^3 of RH waste, approximately 98 percent has been processed and approximately 63 percent has shipped. A facility to be used for processing RH TRU sludge is under design, with construction planned in the late 2020s.

TWPC Sludge Test Area (SLTA)

NOTES:

SLTA nearing completion

SLTA process equipment at 7856F

Historical operations at ORNL resulted in the generation of liquid low-level waste (LLLW) that was transferred to the 7830 Tanks and the Building 7856 Melton Valley Storage Tanks Annex (six 100,000-gallon tanks) for long-term storage. Over time, solids settled in the 7830 Tanks and resulted in a TRU sludge layer with a LLLW supernate top layer. The Building 7856 Melton Valley Storage Tanks Annex (7856 Tanks) are assumed to contain only supernate. The purpose of the Sludge Project Facility Buildout (SL-PFB) Project is to construct the facilities and systems necessary to remove and mix the TRU sludge from the 7830 Tanks with the supernate from 7856 Tanks, as well as the facilities needed to process the mixture into a solid waste form. Engineering studies have determined that, once processed, the waste may be disposed as a low-level solid waste at the Nevada National Security Site (NNSS). Currently, the anticipated quantity of sludge and supernate to be processed for disposal at TWPC is approximately 2,000 m^3. The SL-PFB will be located at ORNL, adjacent to the TWPC.

The SLTA is being constructed as the mock-up test facility to ensure that the SL-PFB functions as designed and meets the requirements for sludge disposition.

U-233 Disposition Project

Building 3019 is one of the nation's few repositories for U-233. It is also the oldest operating Hazard Category 2 facility in the United States.

The U-233 Disposition Project was required by Congress to resolve safety and security issues associated with the continued storage of U-233. The objective of the project is to dispose of the U-233 inventory by identifying uses for it, completing disposition of containers that can be directly disposed, and treating the remaining inventory prior to disposal.

In August 2017, the direct disposition campaign was completed, with 126 items sent to the NNSS Device Assembly Facility for disposal, ten items transferred to ORNL for programmatic re-use, and 403 items directly disposed as waste. Current operations are focused on Oak Ridge oxide processing within Building 2026 glove boxes and preparation for the hot cell processing campaign in Building 2026, which involves dissolution, down-blending, solidification, and disposal of the remaining material.

NOTES:

Liquid/Gaseous Waste Operations (LGWO)

NOTES:

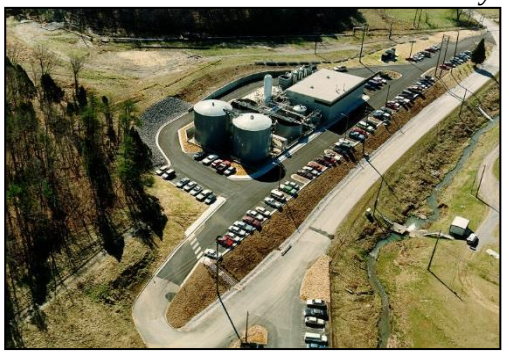
DOE operates three waste treatment systems on a 24/7 continuous operation: the LLLW System; the Process Waste (PW) System; and the Gaseous Waste (GW) System. These systems are comprised of 16 Category 2 Nuclear, eight Radiological, and 34 Industrial facilities, and over 20 miles of underground piping and ductwork at ORNL. Much of these systems are undergoing significant upgrades to replace aging systems and equipment.

LLLW Evaporator Facility

LLLW System Description

The LLLW System is comprised of 16 Category 2 Nuclear facilities. It consists of a series of dedicated tanks and underground piping used to collect LLLW from generating facilities at ORNL and transfer the waste to Building 2531, the LLLW Evaporator Facility, for volume reduction. The concentrated LLLW is then transferred to storage tanks in Bethel Valley and Melton Valley for long-term storage.

PW 3608 Facility



PW System Description

The PW System includes seven facilities categorized as Radiological facilities and 16 Industrial facilities. It collects wastewater from generators throughout Bethel Valley and Melton Valley using a series of single-contained hard-piped connections to pumping stations. Pumping stations transfer the wastewater to a tank farm in each valley, where wastewater is stored until transferred to the Process Waste Treatment Complex at Building 3608. The PW System also receives over 4.3 million gallons of leachate from the EMWMF each year by tanker for treatment.

GW 3039 Stack

GW System Description

The 3039 Stack Ventilation System includes five Industrial facilities that provides off-gas and cell ventilation services to generators throughout the main ORNL Complex in Bethel Valley.

Besides the three systems listed here, LGWO also has 14 support facilities, including a contaminated equipment maintenance facility, a change house, and a centralized monitoring facility.

Core Hole 8 Plume/Tank W1-A (completed)

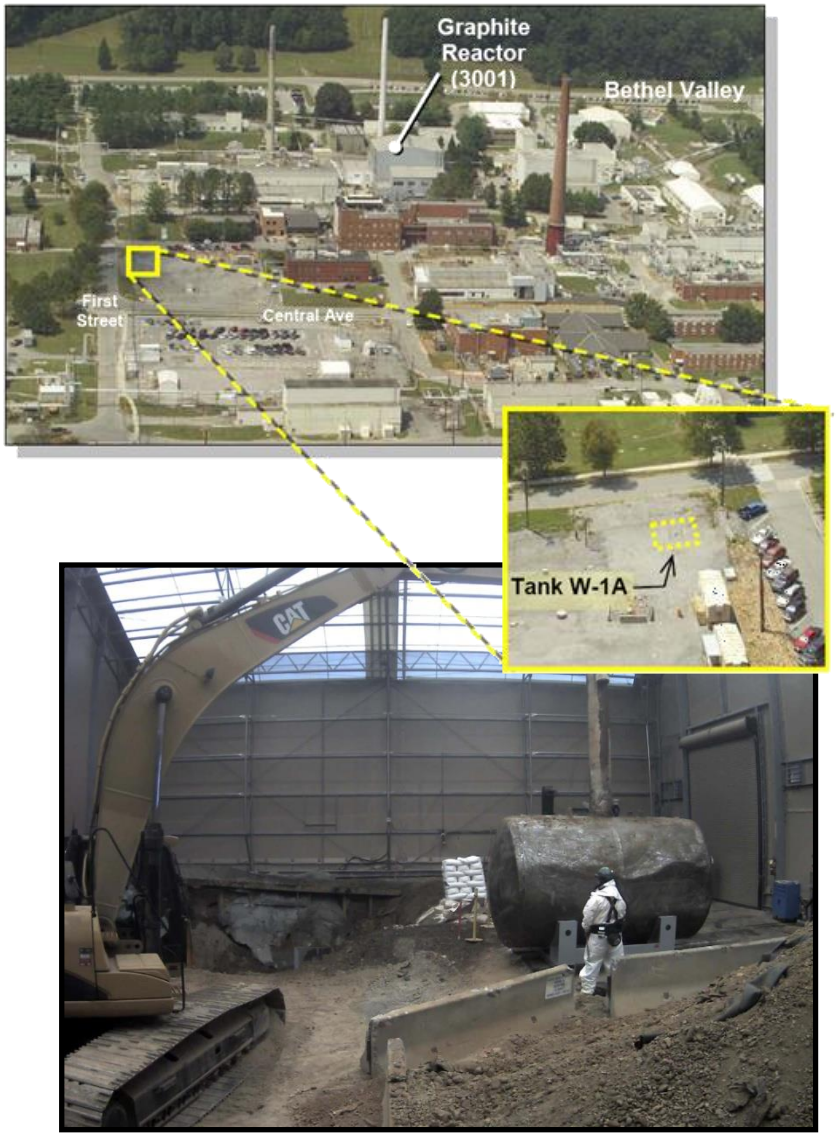
NOTES:

Core Hole 8 is an area of groundwater contamination located in the central portion of ORNL. The plume emanates from contaminated soil surrounding the old Tank W-1A in the North Tank Farm and migrates west to First Creek. The soil became contaminated through a leak at the inlet to Tank W-1A and other leaks from the pipe.

In FY 2011 and FY 2012, two bedrock wells were installed to extract contaminated groundwater and send it to the on-site wastewater treatment system. Older system components were replaced, and new wells and a refurbished pumping system began operation in March 2012.

Monitoring in First Creek shows the plume has been contained. Any remaining contamination will be addressed under the Bethel Valley Interim ROD as part of the soils and sediment actions addressing the EUs.

Excavation began in September 2011 to remove Tank W-1A. The tank was successfully removed in January 2012 and was sent to be cut up and disposed off site. Soil and secondary waste disposals were completed in May 2012.



Tank W-1A was Removed from the Core Hole 8 Area in January 2012

ORNL Reactor and Hot Cell D&D

NOTES:

Most of the facilities at ORNL in the current EM baseline slated for D&D are reactors, laboratory facilities with hot cells, and their associated support facilities. Many of these facilities have high levels of radiation and contain equipment that has been contaminated as well. They might also contain shock-sensitive, pyrophoric materials, and other biological and chemical hazards. Several facilities have confined spaces that are unsafe for human entry and are in close proximity to other operating facilities.

Additionally, there are many facilities at ORNL that are structurally unsound. Structural deterioration of abandoned facilities has occurred, some to the point that it is potentially unsafe for workers to access the facilities for surveillance and maintenance or demolition.

Deactivation activities have been initiated at the reactor facilities and the isotope facilities in the Central Campus of ORNL and are being planned for isotope facilities.

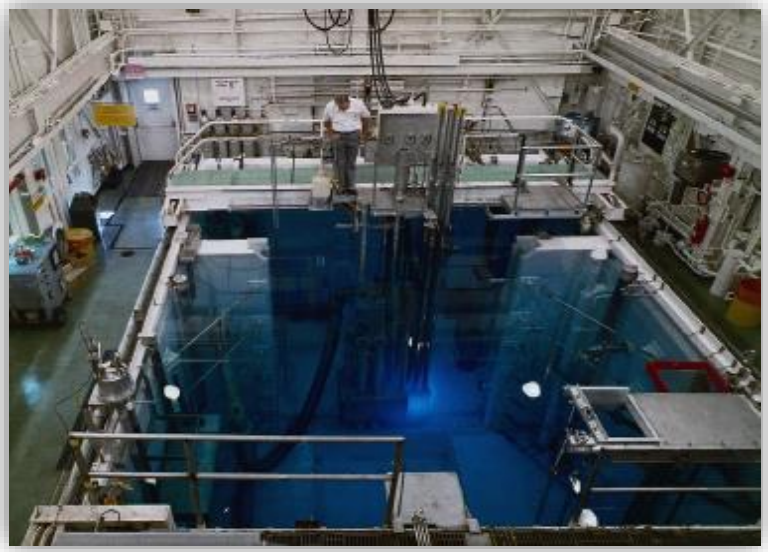
Significant safety hazards include facility instability, failure of upper floors and ceilings, falling debris, asbestos, PCBs, lead paint, high radiation activity, chemical hazards, and bats, fleas, roaches, molds, and other biological hazards from bird and rodent infestation.

Bulk Shielding Reactor (BSR) Complex D&D Project

NOTES:

The first-ever demolition of a reactor facility in Oak Ridge occurred in 2022 with the BSR Complex. The BSR Complex consisted of six facilities: 3009, 3010, 3010A, 3080, 3083, and 3107. Building 3010 housed the BSR.

The BSR was constructed in 1950 with the initial mission of advancing nuclear-powered aircraft. In the 1960s, the mission changed to a general-purpose research reactor for activities such as isotope production, material irradiation, and material effect experiments. Referred to as a "swimming pool" reactor, the BSR utilized a large below-ground pool to contain the water used for both shielding and cooling during experiments.



Building 3010 Reactor Pool

BSR Complex Demolition

The BSR operated up until 1987, was defueled in 1998, and was in a state of surveillance until D&D field activities started in 2018 with isolation of facility utilities. Removal of hazardous and radioactive materials began after utility isolations were completed in 2019. This included removal of submerged irradiated items in the BSR pool. The pool was then dewatered, decontaminated, and backfilled to support demolition.

Demolition of the facilities in this complex facilitates ORNL's ongoing science mission.

Building 3026 “C” and “D” Hot Cell D&D Project

NOTES:

Constructed in 1943-45, Building 3026 was one of the original Clinton Laboratory buildings built to support the war effort. It was later used for a variety of processing and research activities. The facility had been restricted from entry since 1998 and had fallen into severe disrepair.

The project objective was to remove any remaining legacy materials, abate hazardous materials, characterize hot cells and process equipment, decontaminate as needed, remove the hot cell concrete to slab or grade, and decontaminate the slab.

The building structure was demolished in early 2010 and the hot cells were encased in a heavy epoxy fixative.

Building 3026 "D" Hot Cells

Building 3026 "D" Hot Cells Demolition Enclosure

In April 2012, four cells were demolished and removed from the “C” side of the building. The remaining cells on the “D” side were found to be more contaminated than anticipated and were deferred until more data could be safely collected.

Planning for the "D” hot cells resumed in 2018 and in 2019, using a 175-ton crane, workers installed a protective tent to keep nearby research facilities protected while the final two hot cells (heavily shielded concrete rooms) were demolished. The West Cell Bank was demolished in the summer of 2021 and deactivation efforts are ongoing for the highly contaminated East Cell Bank.

The Graphite Reactor

The Graphite Reactor was built in 1943 to test the feasibility of producing plutonium for use in atomic weapons on a scale larger than laboratory experiments. It was the pilot for the larger Hanford B Reactor in Washington.

Built in just 11 months, the reactor went critical at 5 a.m. on November 4, 1943. It produced the first few grams of plutonium about four months later.

After World War II, the Graphite Reactor was the first facility to produce radioactive isotopes for peacetime use. The first isotope intended for medical use was produced in August 1946. Subsequent shipments of radioisotopes were intended for scientific, industrial, and agricultural uses.

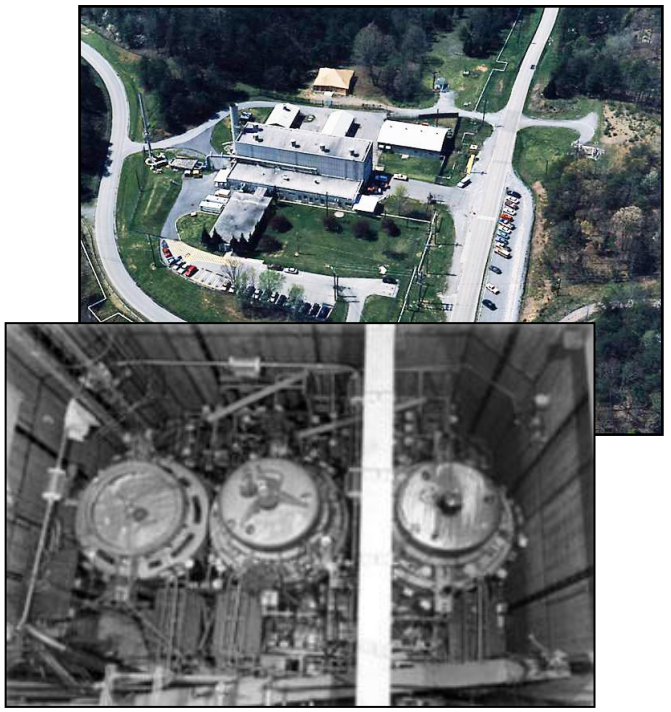
The Graphite Reactor was shut down in 1963, after twenty years of use. It was designated a national historic landmark in 1966 and is now a part of the MPNHP, established November 10, 2015.

Current plans include additional decontamination and structural maintenance by the National Park Service (NPS) to support public visits.

NOTES:

Molten Salt Reactor Experiment (MSRE)

NOTES:



MSRE Tanks

MSRE operated from 1965 to 1969. Unlike most reactors that use fuel rods, MSRE was fueled by molten salt that flowed through the reactor chamber. When MSRE was shut down, the salt was drained into two storage tanks, where it solidified. A flush salt was circulated through the reactor, drained into a third tank, and solidified. All three storage tanks are located in an underground, concrete-shielded cell.

From 1987 to 1994, surveillance activities detected a migration of radioactivity from the tanks to other process lines. A 2- to 3-kilogram uranium deposit in the charcoal bed that filtered the off-gas from the tanks was also detected. Because of concerns about a release of contamination or nuclear criticality, all staff at the facility were relocated and a remediation project was begun in 1994.

Removal of the uranium, as uranium hexafluoride (UF_6) gas, was essentially completed in 1997, although small amounts of UF_6 are still being generated in the tanks and require periodic removal. In 2001, a majority of the uranium sufficient to preclude criticality was removed from the charcoal bed.

Processing of the initial flush salt tank was initiated in December 2004 and completed in June 2005. The last of the U-233 was removed from the drain tanks in March 2008. The uranium was separated from the salts and then transferred to sodium fluoride traps, which were sent to Building 3019 at ORNL for interim storage. A final disposition path for the uranium is to be determined.

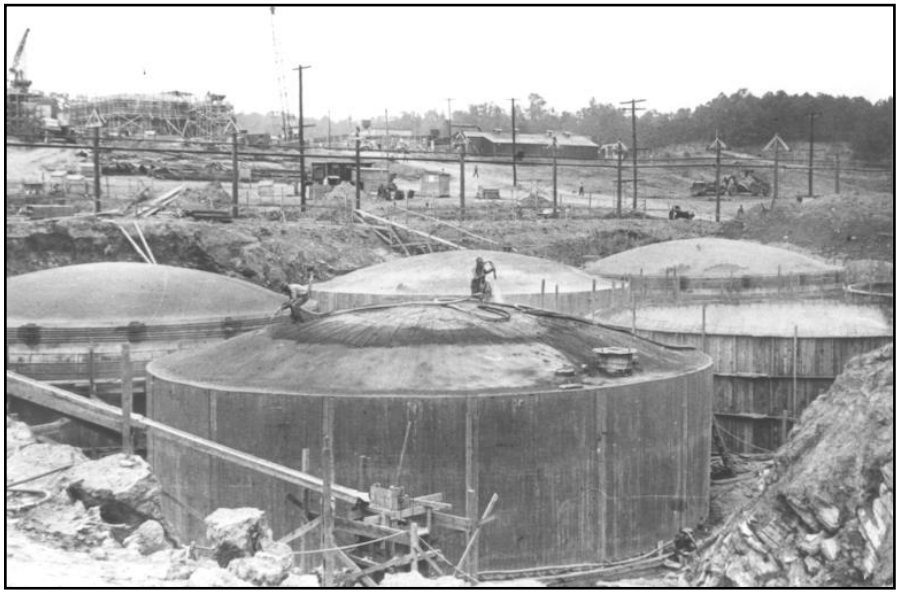
An engineering evaluation was completed to determine actions that can be taken to reduce risks at MSRE until D&D can occur. As a result of the recommendations from that evaluation, DOE is pursuing projects to provide continuous ventilation of the fuel salt drain and flush tanks and charcoal bed, as well as actions to upgrade the facility electrical systems for critical equipment. The facility will then be placed in warm standby until future D&D.

Gunite and Associated Tanks (GAAT) (completed)

NOTES:

The GAAT project, completed in August 2001, was charged with remediation of eight underground storage tanks (W-3 through W-10) constructed during the Manhattan Project in 1943. These tanks stored radioactive liquid waste until the early 1970s, when they were taken out of service. The original design life of the tanks was five years.

The GAAT project was the first of its kind completed in the United States. Integrated, remotely-operated robotic equipment was used to clean the tanks.



GAAT Construction, 1943

Parking Area at Former GAAT Site

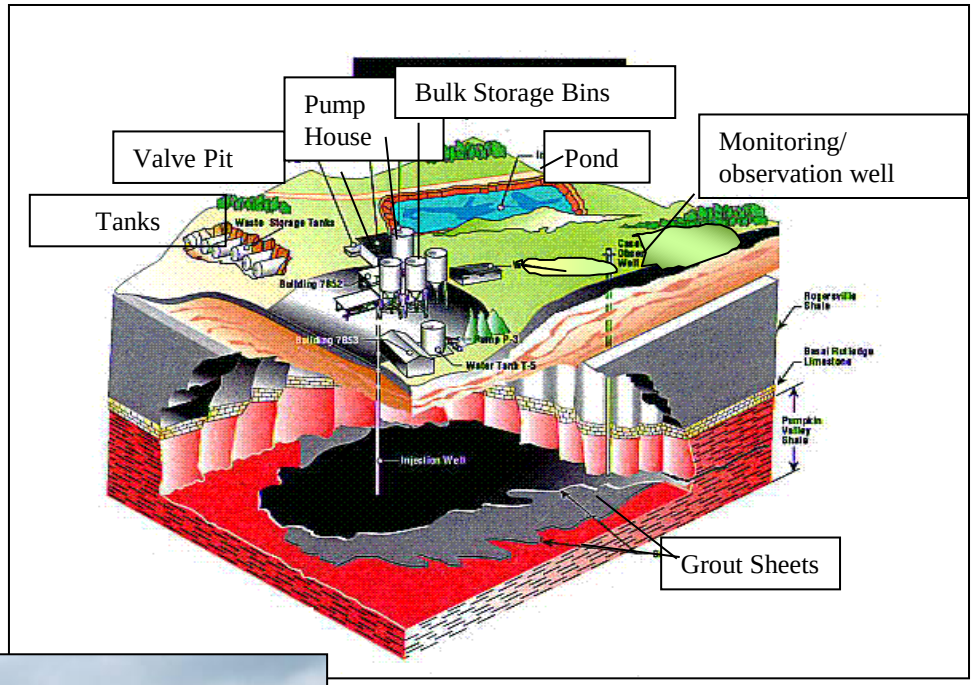
Twenty-eight technologies were used to perform tank characterization, plus waste characterization, removal, mixing, and transfer activities. Retrieved supernate and sludge were transferred to the Melton Valley Storage Tanks for final waste treatment and disposal. The empty tanks were filled with grout and left in place. The removal action report was issued in January 2002.

Hydrofracture Facilities and Wells (completed)

NOTES:

The technique of waste disposal by hydrofracture was pilot tested at ORNL to meet the need for permanent disposal of low-level radioactive waste. From 1959 to 1984, 42 injections were made into two wells at the Old Hydrofracture and New Hydrofracture Facilities. More than 5 million gallons of waste grout were injected into the wells.

Research has shown that a contaminated filtrate plume surrounds the grout, and that observation wells are contaminated and provide a potential pathway for contaminant migration.



Remediation Activities at the New Hydrofracture Facility

108 monitoring wells and four injection wells have been plugged to prevent migration of contaminated fluids to more shallow groundwater zones. The hydrofracture facilities were demolished in 2003 and the waste removed, with the exception of three hot cells. Site restoration was completed in 2006. Groundwater contamination associated with the hydrofracture facilities continues to be monitored in five on-site wells near the former injection wells and in a multi-zone well array near Clinch River comprising 40 individual groundwater sampling zones.

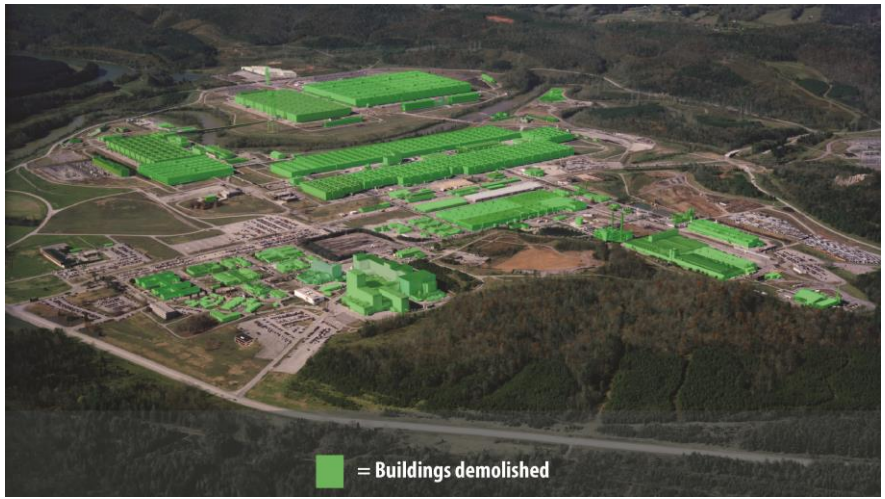
East Tennessee Technology Park (ETTP)

NOTES:

The K-25 gaseous diffusion plant, now known as ETTP, was constructed in 1943 to produce enriched uranium for defense purposes and later for nuclear power reactors. Operations were permanently shut down in 1987. Located 13 miles west of downtown Oak Ridge, the site originally contained nearly 500 facilities with only commercial industrial and office buildings remaining for future reindustrialization.

ETTP Prior to Major Demolition Work

Primary remediation concerns include uranium and volatile organic compound (VOC)-contaminated groundwater plumes and surface water, solid radioactive-contaminated low-level waste (uranium) burial grounds, and D&D of buildings. Cleanup actions include demolition of all facilities not transferred to private entities by 2020 (completed), removal of depleted UF_6 cylinders (completed), disposal of legacy waste (completed), excavation of most burial grounds and contaminated soils (in progress to complete by 2024), and reaching agreement on contaminated groundwater, surface water, and sediment for future remedial action decisions.



ETTP August 2020

ETTP Zone 1 Soils ROD

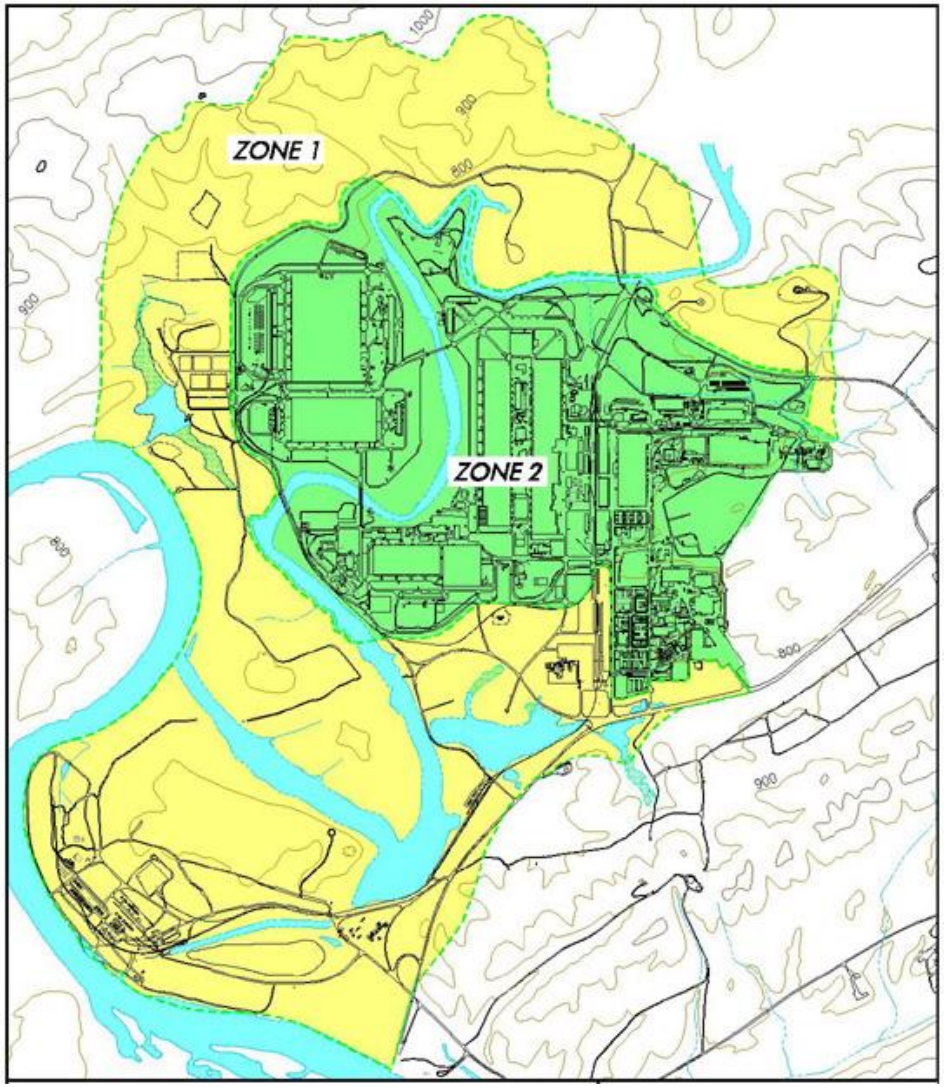
NOTES:

Zone 1 encompasses approximately 1,400 acres wrapping around the site's northern, western, and southwestern boundaries.

In September 2000, DOE, EPA, and TDEC agreed to a path forward for the cleanup of ETTP. This agreement includes an interim decision on soil remediation in Zone 1. DOE, EPA, and TDEC signed the ROD for Interim Actions in Zone 1 in November 2002.

All required soil remediation projects in Zone 1 have been completed and no further action decisions have been reached. The exception is the K-720 Fly Ash Pile, which has been moved to the Zone 1 Groundwater Plumes project so that an integrated approach can be taken.

A Final Zone 1 Soils ROD declaring no further action is currently being prepared.

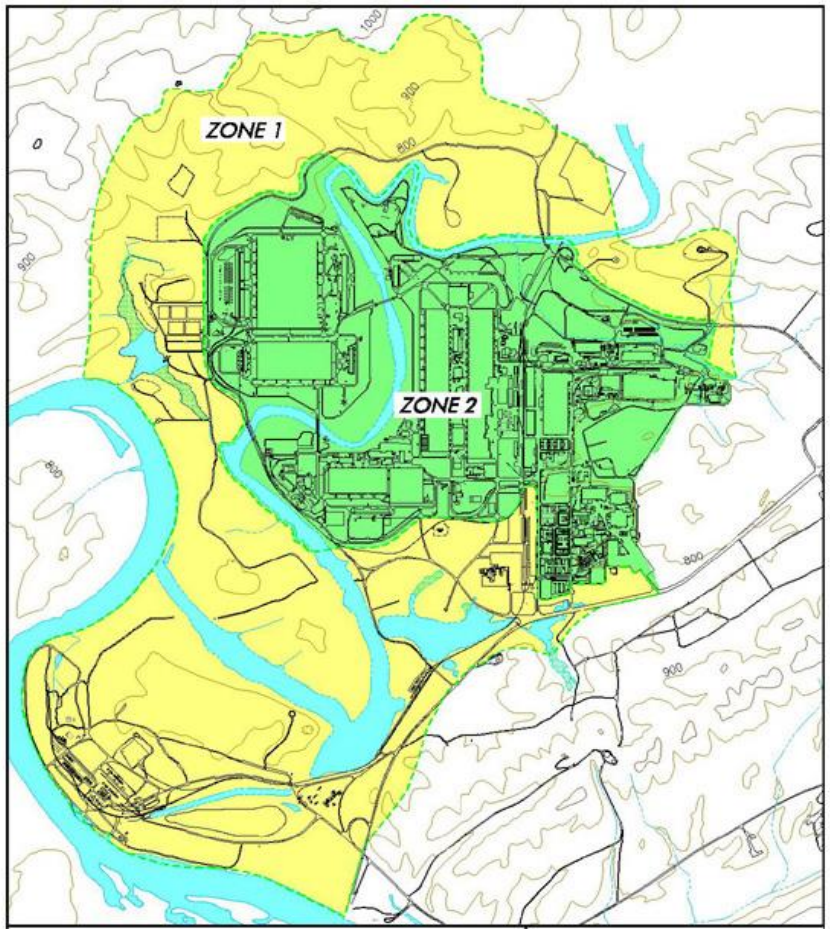


ETTP Zone 2 Soils ROD

Zone 2 encompasses approximately 800 acres within the former main industrial area of ETTP. Soil is contaminated primarily with metals Chlorinated Volatile Organics and radionuclides throughout Zone 2 that could pose a risk to future industrial workers or could be a source of continuing groundwater contamination.

The *Record of Decision for Soil, Buried Waste, and Subsurface Structures in Zone 2 at the DOE East Tennessee Technology Par*k was signed in April 2005.

The selected alternative identified in the ROD calls for removal of contaminated soil to a depth of 10 feet, buried waste removal from the K-1070-B Pond area, regardless of depth, and partial removal of the K-1070-C/D classified burial ground. Soil removal was extended to include removal of soil with contaminant concentrations exceeding levels that could cause further degradation of groundwater to depths greater than 10 feet, or to groundwater (whichever is shallower). Soil remedial actions have been completed in 34 of 44 exposure units, resulting in No Further Action determinations. All remaining soil remedial actions covered by the Zone 2 Soils ROD will be completed by 2024.



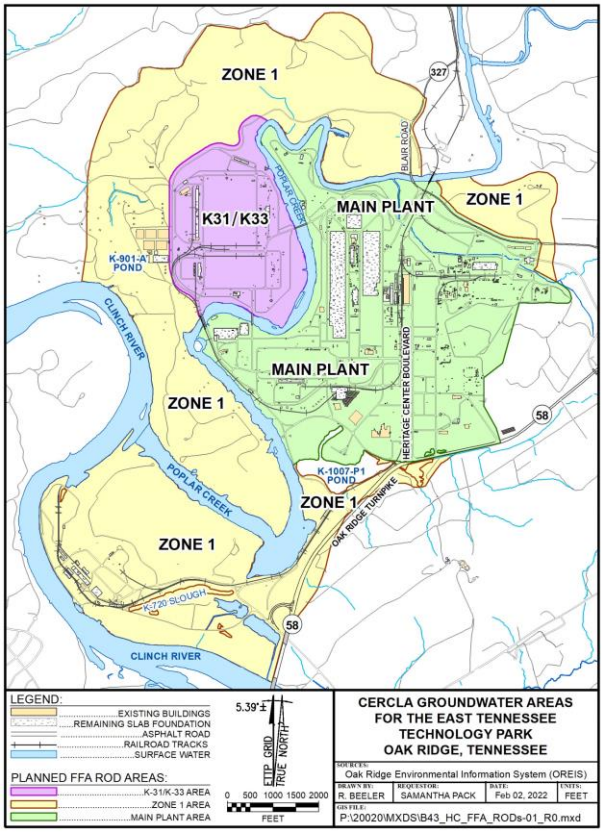
NOTES:

Future ETTP Groundwater RODs

NOTES:

Groundwater at ETTP is contaminated due to historical activities and practices across the site footprint. It has been investigated since the 1990s and monitoring is ongoing. The three primary groundwater areas of concern include:

- K-31/K-33 Area: Main contaminants of concern (COCs) include chromium and nickel. A RI/FS evaluating remedial action alternatives was approved in 2022, and a Proposed Plan is in development.
- Main Plant Area: Primary COCs include various metals, chlorinated volatile organic compounds (CVOCs) and radionuclides. A RI/FS was prepared followed by a focused feasibility study evaluating multiple areas of concern. A Proposed Plan is in development focusing on six CVOC plumes representing some of the highest contaminant concentrations with a preferred enhanced in-situ bioremediation treatment alternative. An Interim ROD is expected in August 2023 and future activities will continue evaluating data gaps
- Zone 1 Groundwater Plumes: Investigations are in process following the Remedial Investigation Work Plan (RIWP), which was approved in 2022.

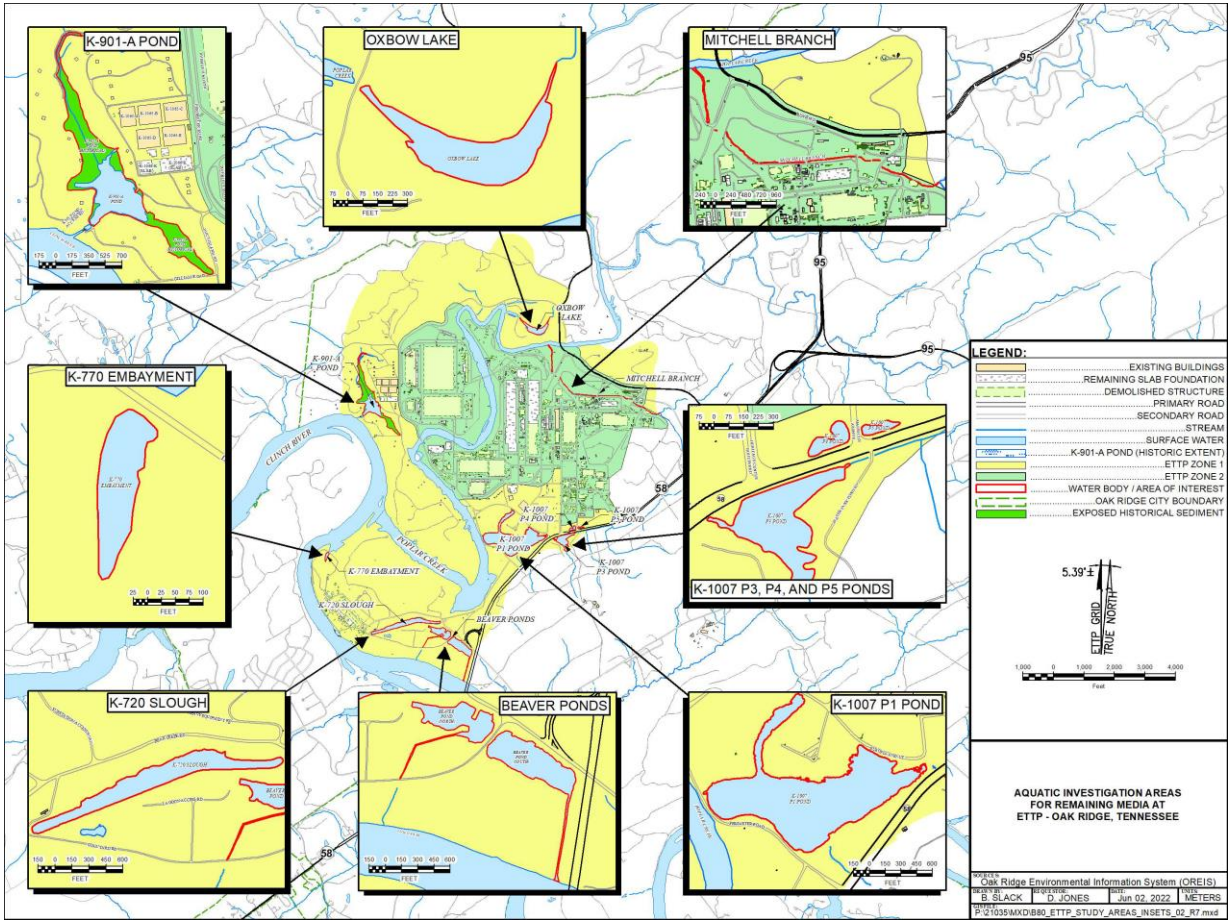


An addendum addressing the inclusion of the K-720 Fly Ash Pile is in development. This work will support CERCLA decision documents for groundwater at ETTP, which will become a priority once soil remediation is complete.

Future ETTP Remaining Ecology/Surface Water/Sediment (Remaining Media) ROD

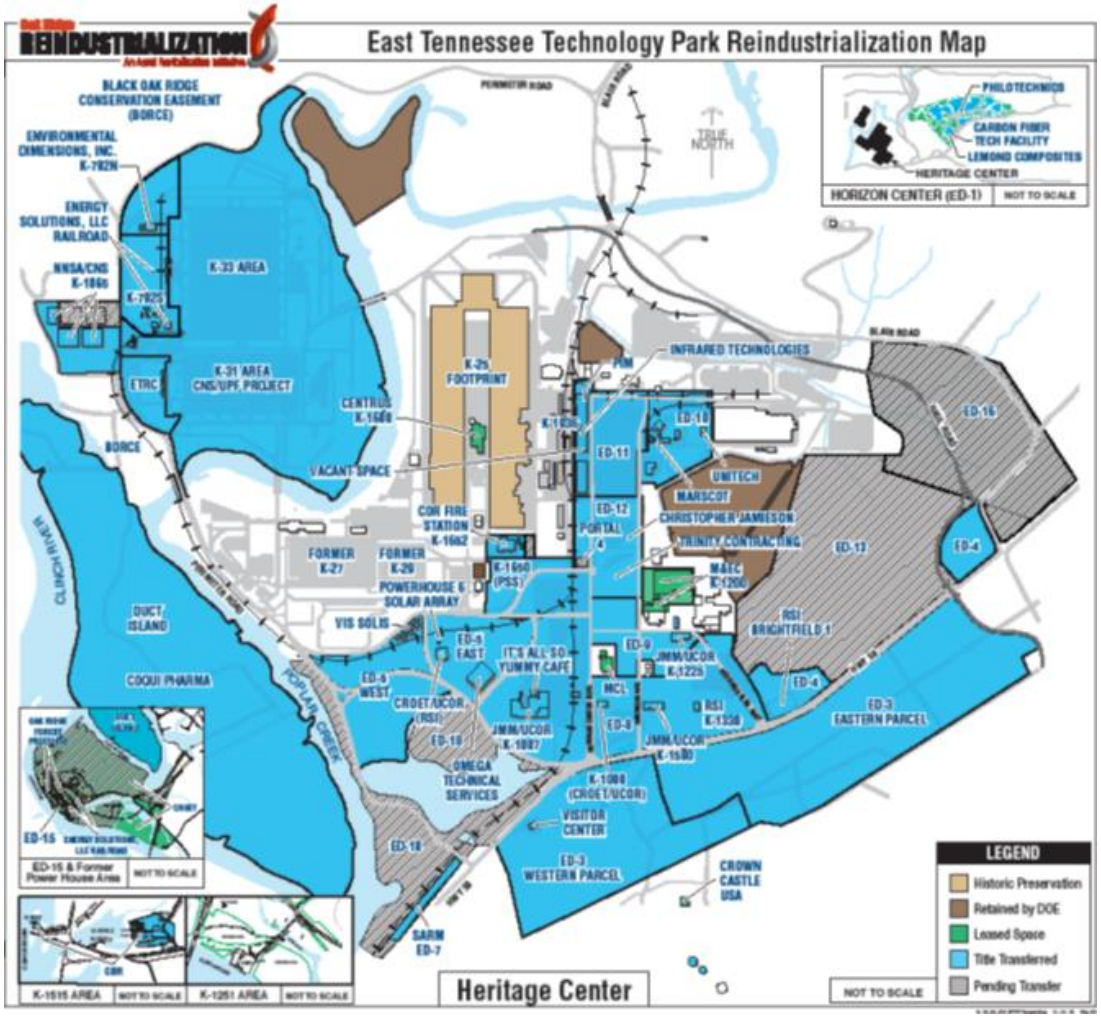
NOTES:

Sediment and surface water at ETTP are potentially contaminated due to discharges from previous on-site operations. Field investigations are in progress, following a RIWP that was approved in 2022. A RI/FS will follow that will support a final ETTP CERCLA decision for surface water, sediment, and protection of ecological and recreational receptors that might use any of the eight surface water bodies seen in the figure.



Reindustrialization

NOTES:



DOE established the Reindustrialization Program, which helps promote economic development by making DOE assets such as land, buildings, and infrastructure available to the private sector. The map shows areas at ETTP that are transferred, leased, and currently available for transfer.

DOE has also turned over portions of water, sewer, and electrical lines to the City of Oak Ridge and plans to transfer additional interior roadways and utility infrastructure.

Environmental Contamination Addressed at ETTP

NOTES:

Releases to Mitchell Branch

Operation of the chromium Water Treatment System began in FY 2012 to capture hexavalent chromium that would otherwise enter Mitchell Branch. This improves the water quality in Mitchell Branch and Poplar Creek.

Chromium Water Treatment System at ETTP

K-1070-B Burial Ground

K-1070-B Burial Ground

Excavation of six trenches and two hot spots was completed at the 6.5-acre landfill near the K-25 Building site.

Debris and soil were excavated down to 10 feet for protection of groundwater. More than 100,000 y^3 of soil and debris were disposed.

After excavation, the site was graded and contoured, covered with topsoil, and re-seeded.

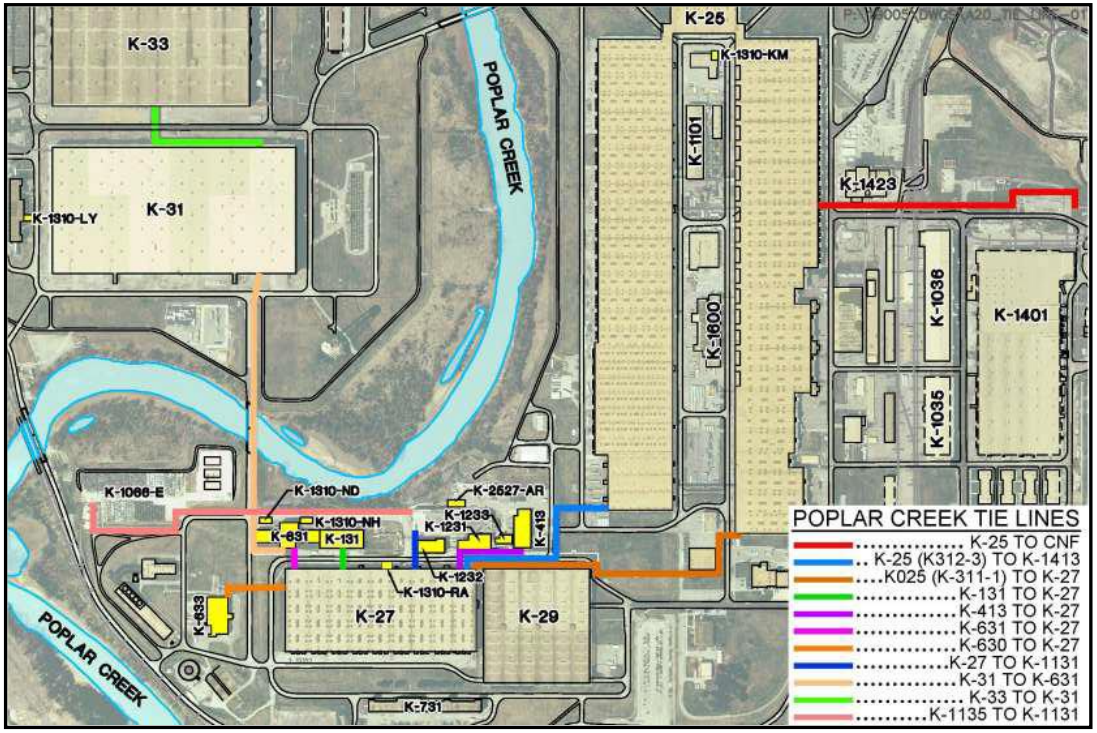
ETTP Buildings D&D

NOTES:

As part of cleanup efforts at ETTP, buildings have been razed at the site at a steady pace and work has been finished on many that were selected for demolition for a variety of reasons: contamination, poor physical condition, proximity to surface water, and surveillance and maintenance costs. These facilities include buildings, tanks, sheds, and other structures. Demolition of ETTP buildings was completed in 2020 and final ETTP soil remediation activities are planned for completion in 2024.

Poplar Creek Building D&D

NOTES:



Poplar Creek facilities were located north and west of Building K-27 and primarily supported operations in Buildings K-27 and K-29. The demolition project also included removal of approximately 12,000 linear feet of process gas and utility tie lines associated with the gaseous diffusion plant facilities.

The project began in July 2008 and was completed in September 2019. Soil remediation activities under the Zone 2 Soil ROD are scheduled to be completed by 2024.

Major Poplar Creek facilities include:

Building K-131: 83,000 ft^2 Feed Vaporization and Field Maintenance Facility - demolished in 2019
Building K-413: 15,300 ft^2 Product Withdrawal Facility - demolished in 2009
Building K-631: 19,000 ft^2 Process Tails Facility - demolished in 2019
Building K-633: 19,000 ft^2 Test Loop Facility - demolished in 2018
Building K-1231: 21,000 ft^2 Process Building - demolished in 2009
Building K-1232: Chemical Recovery Facility - demolished in 2018
Building K-1233: 6,000 ft^2 Collection Facility - demolished in 2009

Toxic Substances Control Act Incinerator (TSCAI) (completed)

NOTES:

For many years, TSCAI was the only U.S. facility permitted to incinerate certain radioactive or hazardous wastes.

TSCAI began operations in 1991 and it burned more than 35 million pounds of solid and liquid waste. It was shut down permanently on the morning of December 2, 2009.

Actions were taken to encapsulate remaining PCB and radioactive contamination. This helped fix potential contaminants and reduce the cost of ongoing surveillance and maintenance, until the facility was demolished.

Demolition was completed in 2018.

Building K-1037

NOTES:

Building K-1037 is a rectangular building that contains approximately 380,000 ft^2 of floor space and is composed of a series of additions and extensions that are now covered under one roof. The K-1037 Facility was originally a warehouse that was later used for production of barrier material for the gaseous diffusion plant operations at the site. The building was most recently used for office space and document storage. Building K-1037 had a large amount of legacy material and process equipment to be disposed.

North Aerial View of K-1037

The facility underwent extensive deactivation before it was demolished. During deactivation, classified equipment and materials were removed along with hazardous and universal waste. Demolition began in January 2019 and was completed three months ahead of schedule in June 2019.

The building slab was removed, and the area was graded to ensure a safe, stable site.

Final Stages of Building K-1037 Demolition

K-1200 Centrifuge Complex (1 of 2)

NOTES:

The K-1200 Complex, located in the southeast portion of ETTP, including the three primary facilities (K-1200, K-1210, and K-1220) as well as laboratory facilities and support structures. These buildings were constructed in the mid-1970s as part of the Gas Centrifuge Project. The centrifuge preparation and testing program ended in 1985, and additional isotopic research was continued until 1990.

Building K-1200 was the Component Preparation Laboratory; it was primarily used to manufacture, test, and store centrifuge units. K-1200 was a steel frame and concrete block structure with approximately 71,500 ft^2 of floor space.

K-1210 began operation as a centrifuge test facility in 1975 to test the reliability of gas centrifuges. Building K-1210 was a steel frame structure with a basement and a total of approximately 34,000 ft^2 of floor space.

Building K-1220 operated between 1982 and 1985 as a centrifuge test facility. It housed all of the facilities necessary to demonstrate and test a centrifuge unit cascade. The building had approximately 75,000 ft^2 of floor space.

K-1200 Centrifuge Complex (2 of 2)

NOTES:

Centrifuge Facility Before Demolition

Building K-1200 Demolition

The Centrifuge Complex Demolition, the final significant building demolition project at ETTP, was completed in July 2020.

Deactivation activities, including removing classified equipment, universal and hazardous waste, were required to support demolition. Deactivation activities within the building began in June 2018 and was complete in March 2020. Demolition of the Laboratory facilities began in September 2019, while deactivation continued in other facilities prior to the building demolition.

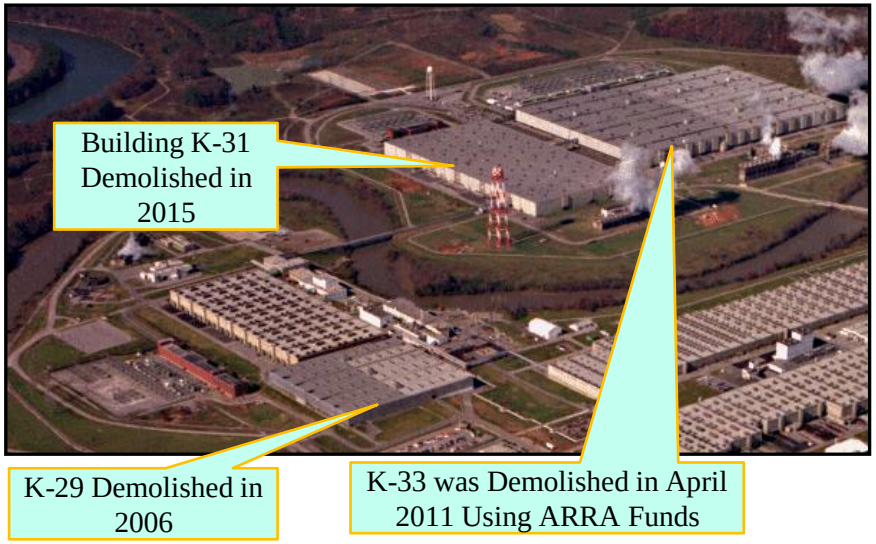
Centrifuge Facility After Demolition

Gaseous Diffusion Plants K-29, K-31, and K-33 D&D (completed)

NOTES:

Buildings K-29, K-31, and K-33 contamination removal was substantially completed in September 2005. These cavernous gaseous diffusion plants comprised almost 5 million ft^2 of floor space. More than 159,000 tons of material were dismantled, removed, and dispositioned from the buildings during the D&D project performed by BNG America.

The original plan was to clean up all three and convert them into usable facilities for private industrial tenants. However, DOE later decided that the three buildings were not structurally sound or suitable for reindustrialization.



In July 2005, the K-29 building was transferred to Bechtel Jacobs, Co. for demolition, which was completed in 2006.

Buildings K-31 and K-33 were transferred to Bechtel Jacobs for surveillance and maintenance in anticipation of finding private companies to lease them. However, a decision was made to use ARRA funds to demolish the K-33 Building at an estimated cost of $51 million. Demolition was completed in April 2011.

K-31 demolition was completed in June 2015.

K-33 Demolition

Gaseous Diffusion Plants K-25/K-27 D&D (completed) (1 of 2)

The K-25 and K-27 buildings were constructed for enriching uranium for defense purposes and later nuclear power reactors. Operations were permanently shut down in 1987. In August 2001, DOE issued the "Engineering Evaluation/Cost Analysis for the D&D of the K-25 and K-27 Buildings at ETTP", which addressed the non-time-critical removal of the buildings and their contents. The scope of the project included actions to abate hazardous materials, remove process and support equipment and piping, demolish the two building structures, and dispose of all wastes. The buildings had a combined footprint of approximately 2 million ft^2 and contained more than 3,500 converters, 6,700 compressor motors, and 400 miles of process pipe.

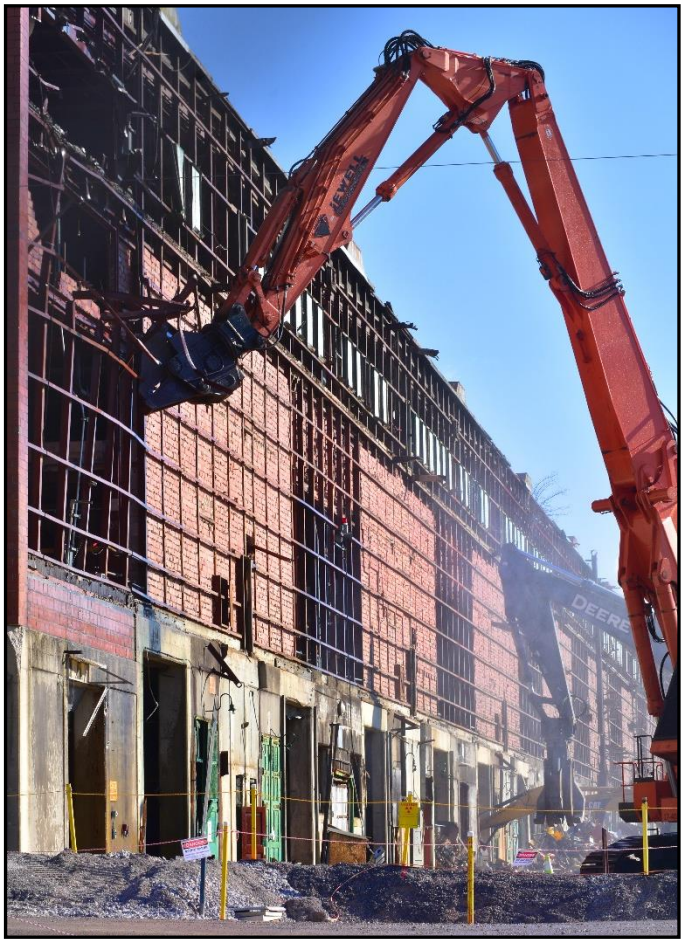
The first demolition activity on K-25 was completed in 2008 with removal of the northwest bridge that connected the west wing to the base of the U-shaped structure. A major milestone was reached in December 2008 when demolition began on the south end of the west 'leg' of K-25.

The final portion of the west wing demolition was completed on January 20, 2010. Demolition of the east wing began in 2011. The south end units of the east wing were contaminated with technetium, and those sections were isolated from the rest of the east wing. Demolition of the northern run of the east wing and north tower that connected the two wings was completed in January 2013. Final demolition of the east wing was completed in December 2013.

Demolition of Building K-27, the last remaining gaseous diffusion plant at ETTP, began in February 2016 and was complete six months later in August 2016.

NOTES:

K-25/K-27 D&D (completed) (2 of 2)



In FY 2012, DOE and cleanup contractor URS | CH2M Oak Ridge LLC developed a plan to accelerate demolition of K-27. The building had deteriorated rapidly, requiring timely attention to ensure safe and efficient demolition.

Pre-demolition work included non-destructive assay of process piping, vent/purge/drain activities, installation of safety controls, and removal of high-hazard sodium fluoride traps.

After completing deactivation and demolition activities, building demolition began in February 2016 and was complete in August 2016. The building slab was removed and remedial actions will be completed as necessary to reduce potential hazards associated with contaminated soil.

NOTES:

UF_6 Cylinder Program (completed)

NOTES:

During gaseous diffusion activities at ETTP, UF_6 was stored in cylinders located in six outdoor storage yards. Continued deterioration of the cylinders posed a potential threat of release of radioactive and toxic contaminants to the environment and a risk to on-site workers and off-site public. In addition, surveillance and maintenance (inspections, radiological surveys, breach repair, etc.) contributed to ETTP's high overhead costs. Of the approximately 7,000 cylinders, about 4,700 were full of depleted UF_6. The rest contained non-depleted UF_6, were partially full, contained heel amounts of UF_6, or were empty. Shipments began in FY 2004 and by December 2006 all cylinders had been shipped off site.

K-1006-K Yard Before Removal was Completed

K-1006-K Yard in December 2006

Technetium-99 (Tc-99) Contaminated Soils at K-25

NOTES:

Following demolition of K-25, a large area of soil contaminated with Technetium-99 (Tc-99) was discovered beneath a portion of the Building K-25 slab near the south-east corner of the building. A significant remedial action was designed to mitigate risk associated with the contaminated soil. Soil with contamination in excess of 60 pCi/g was excavated and disposed in either the on-site EMWMF or in an off-site facility, depending on the level of contamination. An on-site water treatment system was installed to treat contaminated water pumped from the excavation area.

The project began in December 2017 and the soil remediation was complete in March 2020. Almost 90,000 y^3 of contaminated soil were excavated to depths of over 30 feet. Concentration of Tc-99 in the most contaminated area was as great as 28,000 pCi/g and a total of almost 786,000 gallons of water was treated during the remedial action.

K-25 Historic Preservation

K-25 played such an important role in the Manhattan Project that efforts have been underway for many years to commemorate its place in history.

Construction is expected to begin in 2023 on a Viewing Platform that will enable visitors to see across the entire footprint of the former K-25 Building, including portions of the original building slab, and so gain a sense of the size of the former building. The K-25 building was a signature facility of the Manhattan Project which ushered in the nuclear age with the development of the world's first atomic bombs. The footprint of the former building is part of the MPNHP.

NOTES:

Certified for Construction Design for the Viewing Platform

The historic preservation plan includes a number of wayside markers around the K-25 site and a virtual museum.

In 2015, the NPS established a MPNHP in three states, and the K-25 site is one of those locations.

The second floor of the ETTP fire station was converted to a history center, housing a theater and museum, to display Manhattan Project and K-25 artifacts and exhibits of life in the early years of Oak Ridge. The history center was opened to the public on February 27, 2020.

K-25 History Center

K-25 History Center

NOTES: