

# East Tennessee Technology Park



## Background

The Oak Ridge Gaseous Diffusion Plant began operations during World War II as part of the Manhattan Project. Its original mission was to enrich uranium for use in atomic weapons. The plant also produced enriched uranium for the commercial nuclear power industry from 1945 to 1985 and was permanently shut down in 1987.

Work at the site now focuses on restoration of the environment, decontamination and demolition (D&D) of the site's facilities, and management of the legacy wastes. Reindustrialization of the site began in 1996, and the site was renamed East Tennessee Technology Park (ETTP) in 1997.

## Site Cleanup

Converting ETTP into a commercial industrial park is the U.S. Department of Energy's (DOE's) long-term goal. The site is undergoing environmental cleanup, which was conducted from 1998 until August 2011 by Bechtel Jacobs Company LLC and is now being performed by DOE's current Environmental Management contractor, URS | CH2M Oak Ridge LLC (UCOR). The reuse of key site facilities through title transfer is part of the closure plan for the site.

In an effort to accelerate cleanup, DOE established the Reindustrialization Program, which also helps to promote economic development by making DOE assets such as land, buildings, and infrastructure available to the private sector. The program accomplishes its goals via a unique partnership between DOE, community representatives, and the regulators.

## Completed Remediation Projects

### K-1070-C/D G Pit, Concrete Pad

Activities at ETTP generated many types of waste, including hazardous, radioactive, and classified wastes that were disposed of at the K-1070-C/D site from 1975 to 1989. G-Pit was originally designed as an organic solvent disposal pit. The G-Pit and the Concrete Pad area were grouped together for remedial action, which included a source removal at G-Pit (where the majority of the contaminant release is attributed) and putting a soil cover over the concrete pad at K-1071. The concrete pad was covered with a soil cover in April 1999, and the G-Pit removal was completed

in January 2000. Thermal treatment of the contaminated soil was completed in April 2001, and the treated waste was disposed of in the Environmental Management Waste Management Facility (EMWMF) in April 2002. Waste was also placed in the Oak Ridge Reservation Industrial Landfill at the Y-12 National Security Complex. Approximately 40 yd<sup>3</sup> of secondary construction waste was accepted for incineration at ETTP's Toxic Substances Control Act (TSCA) Incinerator in September 2003.

### K-1070-A Burial Ground

The K-1070-A Burial Ground was opened just west of ETTP in the 1950s to receive wastes from the gaseous diffusion plant. The one-acre site was used for underground burials of unclassified, contaminated materials, which consisted largely of uranium-contaminated materials. DOE, with public input, selected waste removal and disposal as the cleanup alternative. Remediation work began in June 2002 and was completed in March 2003 with 28,509 tons of waste excavated and disposed of at EMWMF. The site has been regraded to its original contour and restored.

### K-1085 Old Firehouse Drum Site

Six potential drum burial areas at the K-1085 Old Firehouse Drum Site, located outside the ETTP perimeter fence near State Highway 58, were excavated to remove contaminated material. This project was initiated after a state highway construction contractor accidentally uncovered drum fragments. The excavated material from two of the six areas was contaminated. A total of 55 m<sup>3</sup> of material was placed into waste containers and disposed of at EMWMF in December 2002.

### Blair Quarry Remediation

Blair Quarry, located just east of ETTP, was an operating rock quarry from 1942 to 1945. Material disposal and open burning of trash and debris within the

ETTP is located in the Roane County portion of Oak Ridge, Tennessee, approximately 13 miles west of downtown Oak Ridge.



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quarry began in 1945. Pits were dug into the floor of the quarry and subsequently filled with debris. Buried waste was primarily contaminated with polycyclic aromatic hydrocarbons and polychlorinated biphenyls (PCBs). The major component of the selected remedy was removal and disposal of the contaminated soil and debris. Remediation work began in November 2004 and was completed in January 2005 with 15,069 tons of waste excavated and disposed at EMWMF. The site has been re-contoured and revegetated.

## Depleted Uranium Hexafluoride

Approximately 7,200 cylinders at ETPP were shipped off-site, most of them going to DOE's Portsmouth Site. Most of the cylinders contained depleted uranium hexafluoride ( $UF_6$ ). Each steel cylinder could hold 10 to 14 tons of depleted  $UF_6$ . They were stored in yards in rows stacked two high. This project was completed in FY 2007.

Natural  $UF_6$  was used as feed material during the gaseous diffusion process to enrich uranium. The percentage of uranium-235 was increased from the original feed material in the process (i.e., enriched). The remaining material was depleted  $UF_6$ . It was stored as a white, crystalline solid that was slightly less radioactive than natural uranium.

More than 1,200 empty and near-empty cylinders containing residual uranium compounds other than depleted  $UF_6$  were disposed at the Nevada National Security Site, with that phase of the project completed in FY 2003.

## K-770 Area

The K-770 Scrap Metal Yard covers approximately 30 acres on the east bank of the Clinch River in the Powerhouse Area. During the 1940s and 1950s, the K-770 site was used as an oil tank farm

for fuel oil used in the boilers of the K-700 Powerhouse. Since the 1960s, the K-770 Scrap Metal Yard accepted radioactively contaminated or suspected contaminated metals and debris. The majority of scrap metal at the K-770 Scrap Metal Yard originated from upgrade/improvement programs or D&D of facilities at ETPP.

In addition to scrap material from ETPP, materials from the Y-12 National Security Complex, Savannah River Site, and the Oak Ridge National Laboratory also were received at the K-770 Scrap Metal Yard. Removal of scrap metal and debris from four additional areas (K-1064 Scrap Yard, K-1066-G Maintenance area, K-1131 Remnant Scrap Area, and K-1300 Area) was performed simultaneously for efficiency. The principal radionuclides of concern were those associated with uranium enrichment.

Removal of the scrap began in June 2004 and was completed April 2007. Approximately 48,100 tons of scrap metal were disposed at EMWMF.

Following removal of the scrap material, remediation of contaminated soils was initiated in 2009. Radiological walkover surveys and soil sampling were used to define excavation areas. Approximately 67,000  $yd^3$  of contaminated soil and debris were excavated and transported to EMWMF for disposal between May 2009 and October 2010, including more than 11,000  $yd^3$  of asbestos-contaminated soil and debris. Approximately 500  $yd^3$  of more highly contaminated soil and debris were shipped for disposal at the Nevada National Security Site and the Energy Solutions facility in Clive, Utah.



*$UF_6$  cylinder being loaded for transport at ETPP*



*One of ETPP's cylinder yards before and after cylinder removal*





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## K-710 Sludge Beds/Imhoff Tank

The K-710 Sludge Beds and Imhoff Tank were built in 1943 to handle sewage from the Powerhouse Area and operated until 1978. Other structures associated with the three sludge beds and Imhoff Tank included a lift station/pump house, a chlorinator unit, and the compressor house. No known waste releases occurred from the facility other than treated sewage. The primary contaminant of concern was PCBs at the K-710 facilities, with small quantities of radionuclides, semivolatile organic compounds, and metals detected. The structures and sludge beds were demolished, and approximately 260 yd<sup>3</sup> of waste was disposed at EMWMF. Remediation work began in August 2006 and was completed in September 2006.

## K-1401/K-1420 Sumps Project

During past operations, Building K-1401 served as a maintenance facility to clean equipment needed in the gaseous diffusion process, and Building K-1420 was used for equipment decontamination, uranium recovery, and metal finishing. Groundwater would seep into the basements, and sumps were installed during construction of these buildings to keep them dry. Since the groundwater in the area was contaminated as a result of equipment cleaning operations, a CERCLA removal action was implemented in August 1998 to pump the groundwater from the K-1401/K-1420 basement sumps and treat it at the ETPP Central Neutralization Facility. As part of the site-wide groundwater evaluation, DOE, EPA, and TDEC agreed to shut down the sump pumps. The K-1401 sump was backfilled with gravel and soil, and the sump in K-1420 was filled with grout and backfilled with soil.

## K-1085 Burnpit Soils

Drum removal activities completed at this site in 2002 identified an area with contamination associated with a former burn pit. Exploratory soil borings at the site in 2005 and 2006 confirmed the presence of contamination and provided data used to define the excavation limits for the remediation. Soil excavation activities began in June 2008 and were completed in July 2008. The excavated soil (225 yd<sup>3</sup>) was stockpiled on-site within a specially constructed, lined, and covered soil staging area pending completion of further characterization and evaluation to determine the status of the excavated soils. The excavated

soil was transported to the Clean Harbors, Inc. hazardous waste treatment facility in Deer Park, Texas, for treatment and disposal in 2009.

## K-1070-C/D and Mitchell Branch Plumes

ETTP has two areas—K-1070-C/D and Mitchell Branch—where previous DOE operations resulted in groundwater contamination. These defined areas of groundwater containing contamination, or “plumes,” have been investigated and identified. A groundwater collection system was installed at Mitchell Branch.

The Federal Facility Agreement parties evaluated the groundwater collection system remedy in 2005. The evaluation resulted in a decision to shut down the groundwater collection and treatment system because it was not reducing the contaminant flux into Mitchell Branch in a cost-effective manner.

## Ponds Remediation

Remediation of the ETPP 1007-P1 and 901-A Ponds and 720 Slough was completed using ecological enhancement. Ecological enhancement is an innovative approach to remediation that includes fish community restructuring, revegetation, and wildlife management. The goal is to establish a new condition within the ponds that reduces risk from polychlorinated biphenyls (PCBs) by enhancing components of the ecology that minimize PCB uptake. Actions completed were removing fish that bioaccumulate PCBs, restocking with fish (bluegill) that do not bioaccumulate PCBs, planting aquatic vegetation to limit



*One of the contaminated ponds at ETPP being drained*

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sediment resuspension, and monitoring the progress to evaluate effectiveness and identify adjustments. All of the work has been completed, and operational monitoring is being performed.

## K-1035 Soil Remediation

Demolition of Building K-1035 was completed in 2009. The associated remediation consisted of removing the building slab, removing three pits and surrounding soil, and removing the pits' inlet piping and surrounding soil.

## K-1070-B Burial Ground

Contaminated debris and soil have been removed from trenches within a 60-year-old landfill adjacent to the K-25 cleanup project and a protective cover has been installed. The materials were removed to minimize the potential for future contamination of surface water and groundwater.

The 6.5-acre landfill, called K-1070-B, was used from the early 1950s to the mid 1970s to dispose of items such as equipment, materials, parts, and drums.

The landfill consisted of six trenches, each excavated to about 15 feet deep, and approximately 20 feet of debris landfilled over the top of these trenches.

Personnel cleaning up the burial ground worked 205,800 accident-free hours while excavating 100,200 cubic yards of soil and debris. A total of 7,790 dump truck loads of waste shipped to EMWMF.



*K-1070-B during remediation*

## Ongoing Remediation Projects

### Hexavalent Chromium Releases

Operation of the Chromium Water Treatment System began in FY 2012. This system provides a long-term solution for hexavalent chromium being released into Mitchell Branch. The source of this contamination has not been identified.

These releases affected the ambient water quality in Mitchell Branch, potentially affecting the water quality in Poplar Creek. In response to this concern, DOE completed a time-critical Removal Action to extract the contaminated groundwater and a non-time-critical Removal Action to install the Chromium Water Treatment System. Since completion of these Removal Actions, the concentration of chromium in Mitchell Branch has been reduced to compliant levels.

## Groundwater Strategy

As a consequence of past missions, the groundwater beneath several areas of ETTP has become contaminated. While the final decision for the protection of groundwater has not been determined, the Department of Energy and UCOR have implemented extensive measures to isolate remaining contaminant sources.

Multiple complex sources/plumes have been identified on the ETTP. As demolition and soil restoration projects are completed, environmental specialists will gather and evaluate critical data to determine protective cleanup actions for affected groundwater.

The current groundwater strategy for ETTP includes

- Accelerate groundwater approach for three large cleanup parcels to enable transfer of land for redevelopment and reuse
- Obtain a groundwater Record of Decision for specified plumes in Zone 1, the 1,400-acres bordering the ETTP industrial area
- Develop approach for the remaining plumes in Zone 2, the 800-acre central ETTP site

## Completed D&D Projects

### Group 1 Buildings, Auxiliary Facilities

DOE completed the demolition of five buildings known collectively as the Group 1 Buildings.

The Group 1 Buildings included the K-725 Beryllium Building and the K-724 Storage Building, the K-1131 Feed and Tails Building, the K-1410 Plating Facility, and the K-1031 Warehouse. Demolition of these facilities was completed in June 1999.

### Group 2 Buildings, Auxiliary Facilities

DOE completed the demolition of the Group 2 buildings, phases 1 and 2. Phase 1 included 10 facilities, known collectively as the Main Plant D&D project. The facilities include the K-1045-A Waste Oil Burning Pit, K-1408 Tire and Battery Shop, K-1300 Stack, K-1301 Fluorine Production Facility, K-1302 Fluorine Storage Building, K-1303 Fluorine Facility, K-1404 Acid Storage, K-1405 High Temperature Laboratory, K-1407 Laboratory and



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*K-33 and K-31 area after demolition*



Storage Facility, and K-1413 Engineering Laboratory. Demolition was completed in January 2003.

Phase 2 also included the demolition of 18 facilities located on and around the K-1064 Peninsula and the cleanup of the K-1064 Scrapyard. The facilities consisted of pump houses, a cooling tower (K-801-H), old storage facilities (K-1025 A-E), and miscellaneous maintenance areas. Demolition of the last facility was completed in June 2006 and the Scrapyard cleanup was completed in September 2006.

## **Buildings K-29, K-31, and K-33**

Buildings K-29, K-31, and K-33 were previously used for uranium enrichment processes. Contaminated structures and equipment remained. BNFL Inc. was awarded a fixed-price contract in 1997 to decontaminate and decommission the facilities.

The company dismantled, removed, and dispositioned more than 159,000 tons of materials and equipment from the three buildings, which comprise more than 4.8 million ft<sup>2</sup> of floor space.

Bechtel Jacobs Company LLC completed demolition of K-29 in August 2006. In 2010, DOE contracted with LATA/Sharp to demolish the K-33 Building. The building demolition was completed, and the last waste was disposed in September 2011.

DOE's current cleanup contractor, UCOR, completed K-31 demolition in June 2015.



*K-33 (foreground) and K-31 before demolition*

## **K-1206-F Fire Water Tower**

One of the most iconic structures at ETP, the checkerboard water tower that dominated the sites's skyline for 55 years, was demolished in August 2013. Officially called the K-1206-F Fire Water Tower, the 400,000- gallon structure was designed and built by the Chicago Bridge & Iron Company in 1958 to service the site's fire protection system. It operated until June 2013, when the valves were turned off. It was drained, disconnected, and permanently taken out of service on July 15, 2013.

## **K-25 Demolition**

Demolition activities have been completed at the K-25 Building, a massive U-shaped structure that originally contained 1.64 million ft<sup>2</sup> of floor space and occupied about 40 acres near the center of ETP. The former gaseous diffusion building



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contained radioactive contamination and hazardous materials. The demolition process leaves the basement slabs in place. The Zone 2 ROD addresses the slab, underground soil, and utilities.

Demolition of the west wing was completed in January 2010, and demolition of the east wing, with the exception of a few units contaminated with technetium-99, was completed in September 2012. Workers completed bringing down the north end, the smallest of the three-sectioned building, in January 2013. The north end formed the base of the building's unique U shape. The technetium-99-contaminated portion of the east wing was completed in December 2013, completing building demolition activities. Wastes have been removed from the site.

DOE and local historic preservation agencies have agreed upon commemorative measures to preserve the historic contributions of Oak Ridge's K-25 site to the Manhattan Project.

While preservation of the K-25 Building's north end was once under consideration, the building's deteriorated condition made that option too costly. Instead, DOE will commemorate the site by implementing the following measures:

- Approximately 40 acres located inside the road that currently surrounds the original K-25 Building will be dedicated for commemoration and interpretation activities. The agreement calls for the construction of a three-story equipment building at the property's southern end that

will recreate a scale representation of the gaseous diffusion technology and contain authentic equipment used in the K-25 Building. The building will also house other equipment that was developed and/or used at the site. The project will include a viewing tower erected on the south end of the building's footprint (near the Oak Ridge Fire Station) and 12 wayside exhibits that will tell portions of the K-25 story.

- A K-25 History Center will be located nearby on the second level of the Fire Station, owned by the City of Oak Ridge. The History Center will provide space to exhibit equipment, artifacts, oral histories, photographs, and video.
- DOE provided a grant of \$500,000 to the East Tennessee Preservation Association to help preserve the Alexander Inn, a historic structure in Oak Ridge where visiting scientists and dignitaries stayed. The grant was used to purchase the



*The final section of the K-25 Building was demolished in December 2013.*

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property and stabilize the structure until the Inn could be transferred to a private developer, which took place in 2013.

## K-27 Building

Demolition of the K-27 Building, the last standing gaseous diffusion facility at ETTP, has been completed. The building occupied a 383,000 ft<sup>2</sup> footprint with more than 1.1 million ft<sup>2</sup> of total floor area. It is similar in structure to the K-25 Building.

Demolition of the building was completed in August 2016, and complete site cleanup was finished in 2017. Removing this building marked the first-ever complete demolition of a gaseous diffusion complex and allowed DOE to achieve Vision 2016—the demolition of all ETTP gaseous diffusion facilities by the end of 2016.

## Ongoing D&D Projects

### Poplar Creek Facilities

Demolition has begun on the ETTP Poplar Creek facilities, a series of 11 buildings and several other ancillary facilities and tie lines built in the 1940s and 1950s to support the site's nuclear operations.

These structures are ETTP's most contaminated remaining facilities. Two of the larger facilities were demolished in FY 2017—the K-832-H Cooling Tower and the K-832 Cooling Water Pumphouse. The 5,500-square-foot cooling tower, which was used in the site's uranium enrichment process, was constructed in 1985 to replace the original 14-cell tower that began operating in 1945. It only operated a short time because uranium enrichment operations at the site ceased in 1985.

The 11,000-square-foot cooling water pumphouse, which operated from 1946 to 1985, pumped recirculating cooling water from the K-832-H Cooling Tower basin through the gaseous

diffusion cascade equipment. After being shut down, it was used to store electrical equipment and batteries.

In early FY 2018, workers demolished the K-1203 facility, which provided the site with sanitary sewage treatment. It consisted of an aeration biological treatment plant, lift stations sedimentation basins, filtration and facilities for percolation of sludges, ultraviolet light disinfection, and chlorination and dechlorination equipment.

## Group 2 Buildings, Phase 3

Approximately 500 above-ground facilities have been or are scheduled to be demolished. These facilities include administrative buildings, laboratories, process facilities, pump houses, utilities, and other structures. Most of these facilities have actual or potential elevated concentrations of radiological and/or other hazardous substances. Demolition activities include characterization, utility decommissioning, segregation of demolition waste streams, and disposal in appropriate Oak Ridge Reservation or other disposal facilities, as required.

Major facilities that have been successfully demolished include the K-1004-A, B, C, and D Laboratories, K-1004-L, K-1008/K-1020 areas, K-1501 steam plant, K-1420, K-29, K-1401, K-1231, K-1233, K-413, and K-1035. In FY 2011, D&D of seven Warehouse Row buildings was completed (K-1061, K-1036, K-1055, K-1058, K-1415, K-1059, and K-1416), and the D&D of the K-1310-CD building and tanks was completed.

## Building K-1037

Preparation has begun for demolition of the K-1037 Building, which once produced barrier material for the gaseous diffusion process.

Planning walkdowns have been conducted to identify issues with the building's electrical service and combustibles storage. The original electrical distribution has been isolated, and a new temporary lighting service has been installed. Workers have been removing combustible materials from the building. Planning and engineering walkdowns have been conducted to allow for asbestos and hazardous material abatement.

## TSCA Incinerator

The Toxic Substances Control Act (TSCA) Incinerator was shut down permanently on Dec. 2, 2009, after treating 35.6 million pounds of liquid and solid waste over a 19-year period. It was the only U.S. facility permitted to incinerate certain radioactive and/or hazardous wastes.

Closure activities were completed in December 2010, and the State of Tennessee granted permit termination on Sept. 21, 2012.



*K-832-H Cooling Tower demolition.*



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Actions were taken to encapsulate remaining PCB and radioactive contamination to minimize water management actions and to reduce the cost of ongoing surveillance and maintenance. Work to prepare the facility for demolition has been completed, and it will be under surveillance and maintenance until demolition.

## Central Neutralization Facility

The Central Neutralization Facility (CNF) was a wastewater treatment facility for industrial wastewater generated at ETPP. CNF was constructed in stages from 1945 until 2000. In 2013, CNF was decommissioned, and the facility's water treatment equipment was cleaned of all hazardous waste contamination.

In 2017, UCOR completed characterization of CNF for the disposal of demolition debris. Additionally, legacy waste removal, universal waste removal, and fixed equipment removal were nearing completion to prepare CNF for demolition.

## Reindustrialization Progress

Oak Ridge's Reindustrialization Program is in its 21st year as the model DOE asset reuse program. During that time, the site has been transformed throughout from a former uranium enrichment complex to a private sector industrial business park.

As OREM moves toward the final phases of environmental cleanup at ETPP, the site continues its trek toward a private sector park, as well as a national park and conservation area. A Closure Plan was developed in FY 2017 to address the necessary transfer and disposition path for all site assets. It includes transition planning for all of the remaining facilities, land, and utility infrastructure.

Additionally, a formal revitalization plan was developed that reevaluated and modernized the master planning for the Heritage Center. This approach accounted for recent cleanup accomplishments and new developments, such as the proposed regional general aviation airport. Several stakeholders worked



*The Powerhouse Six solar array began operating at ETPP in 2015. It is a 1 megawatt power-generating facility located on a five-acre parcel and generates around 1.4 million kWh annually.*

together to coordinate the Heritage Center's development to achieve a common goal.

The Reindustrialization Program has transferred 185 acres in the former K-33/K-31 Area to the Community Reuse Organization of East Tennessee (CROET), which was the largest land transfer to occur at the Heritage Center. This is a highly desirable parcel because of its large size, flat topography, and significant infrastructure. The Reindustrialization program also moved forward with making other larger parcels of land available for major manufacturing developments, including the 400-acre Powerhouse Area and the 200-acre Duct Island parcel. These properties are the first available at ETPP that can accommodate large-scale manufacturing developments, which would contribute significantly to job growth in the area.

A proposed plan to build an airport on the ETPP site reached a major milestone in FY 2017 with the completion of a master plan, which has been submitted to the Federal Aviation Administration (FAA) for approval. The Metropolitan Knoxville Airport Authority (MKAA), working closely with DOE, is leading this project. MKAA will proceed with final design work when the master plan is approved by FAA.