DOE Oak Ridge Environmental Management Program

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. 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.

Remedial Action Progress

Development of a Zone 1 Final Record of Decision (ROD) for groundwater, surface water, sediment, and ecological soil risk is in progress. Information collected is being evaluated to support the ongoing technical evaluations required for the Remedial Investigation/Feasibility Study, Proposed Plan, and ROD.

Characterization and verification data for remediated areas in Zones 1 and 2 have resulted in about 1,400 acres of land receiving regulatory approval from the Environmental Protection Agency and the state as requiring "no further action."

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^3 of secondary construction waste was accepted for incineration at ETTP's Toxic Substances Control Act (TSCA) Incinerator in September 2003.

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

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.

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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^3 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 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 of at EMWMF. The site has been re-contoured and revegetated.

Depleted Uranium Hexafluoride

Approximately 7,200 cylinders at ETTP were shipped offsite for disposal, most of them going to DOE's Portsmouth Site. Most of the disposed 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.

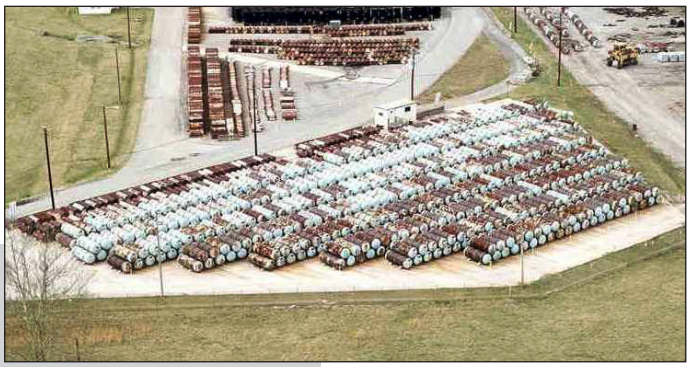
More than 1,200 empty and near-empty cylinders containing residual uranium compounds other than depleted UF_6 were disposed at the Nevada National Security Site, with that phase of the project completed in FY 2003.

UF_6 cylinder being loaded for transport at ETTP

Scrap Removal Project

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 ETTP.

In addition to scrap material from ETTP, 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 principle radionuclides of concern were those associated with uranium enrichment.



One of ETTP's cylinder yards before and after cylinder removal

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

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^3 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 operation, 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 ETTP 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^3) 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.

K-770 Soils

Following removal of the scrap material from this site, 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. Ap-

Soil excavation at the K-770 Scrap Yard

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proximately 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, UT.

Ponds Remediation

Recontouring and fish removal have been completed at the ETTP P1 Pond (located next to Building K-1007), and workers have planted aquatic vegetation in the pond.

Fish removal was also conducted in two additional ETTP ponds located adjacent to Highway 58, with approximately 8.5 tons of fish recovered from all three. Removal of the fish was necessary because the species that were in the ponds would stir the contaminated sediment at the bottom of the ponds. The fish have been disposed in a clay-lined pit adjacent to the P1 Pond.

The pond was restocked with fish species that are less likely to stir the pond sediment. Barriers were placed along Burchfield Road to prevent fish from migrating into the pond from Poplar Creek.

The pond is now in the operational monitoring phase of the remediation, which is designed to measure the performance of the actions that have been taken and conduct additional activities (e.g., more planting or restocking) as needed.

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.

K-1070-B during remediation

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 groundworked 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.

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 Treatability Study

A groundwater treatability study was initiated in FY 2008 to evaluate the feasibility of in situ treatment of an ETTP groundwater plume contaminated with volatile organic compounds.

In FY 2009, the contaminated groundwater plume was delineated by characterization of 14 boreholes at depths of 110 to 160 feet.

In FY 2011, the groundwater treatability study was delayed, and in FY 2012, the treatability study site was closed and the wells grouted to limit the spread of contamination until the treatability study is resumed.

Zone 1

In FY 2012, a Final Remedial Investigation/Feasibility Study (RI/FS) was prepared to support development of a final Zone 1 Record of Decision. Activities included conducting groundwater, soils, surface water, and land use controls workshops to review data and develop an alternative for the feasibility study.

The first draft RI/FS was transmitted to the regulators in March 2012; regulator comments were received in August 2012. FY 2013 work includes transmittal of the second draft RI/FS,

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K-33 Site after demolition

K-33 before demolition

preparation of the Proposed Plan, a public meeting and preparation of the initial draft of the Zone 1 Final Record of Decision.

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 nearby K-724 Storage Building, the K-1131 Feed and Tails Building, the K-1410 Plating Facility, and the adjacent 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 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^2 of floor space.

All three buildings were to be cleaned up and converted to usable facilities for private industrial tenants. However, DOE later decided that K-29 and K-33 were not suitable for reindustrialization.

K-29 was transferred to Bechtel Jacobs Company in July 2005. BJC began demolishing K-29 in January 2006 and completed it 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.

Ongoing D&D Projects

K-25 Demolition

Demolition activities are under way at the K-25 Building, a massive U-shaped structure that originally contained 1.64 million ft^2 of floor space and occupied about 40 acres near the center of ETTP.

The former gaseous diffusion building contains radioactive contamination and hazardous materials. The demolition process leaves the basement slabs in place. A future ETTP ROD will address 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 buildings unique U shape.

Previous activities within the K-25 Building include cleanout and disposal of a large quantity of loose stored material and equipment, installation and upgrades to K-25 power systems, installation of a reconfigured Radiation Criticality Accident Alarm System, and other preparations for removal of the process system and equipment. Additionally, building and operation of a stand-alone Non-Destructive Assay and Segmentation Shop for high-risk equipment processing was completed.

Work has been initiated in the technetium-99-contaminated units. The initial activities under way include asbestos abatement; duct and cell house cutting; vent, purge, and drain of the process system; and non-destructive assay of the process system.

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

The north end of the K-25 Building, shown in the foreground, was demolished earlier this year.

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While preservation of the K-25 Building's north end was once 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 will provide 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 will be used to purchase the property and stabilize the structure until the Inn can be transferred to a private developer.

NaF trap removal from the K-27 Building

K-25 north end demolition

K-27 Building

The K-27 Building consists of nine building units occupying a 383,000 ft^2 footprint with more than 1.1 million ft^2 of total floor area. It is similar in structure to the K-25 Building and was one of the site's gaseous diffusion process buildings.

In FY 2012, DOE and UCOR, DOE's EM contractor for Oak Ridge, developed a plan to accelerate demolition of the K-27 Building. The building is in a severely deteriorated state, necessitating timely attention to ensure safe and efficient demolition. Pre-demolition work that has been initiated includes inventory management; collection of Non-Destructive Assay measurements of process pipe; vent, purge, drain, and inspection of process equipment; and the installation of safety controls.

Limited pre-demolition activities, including removal of high-hazard sodium fluoride (NaF) traps, are continuing in preparation for building demolition.

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. A

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total of 374 facilities have been demolished, with several others deactivated and characterized.

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.

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.

Reindustrialization Progress

Through comprehensive site end-use planning and the transfer of land, buildings, and technologies, DOE is reducing costs while creating a foundation for the Heritage Center, a private-sector industrial park located at ETTP. Industrial reuse of the site is creating new jobs and increasing tax revenues for the community.

With the transfer of Parcel ED-10 to the Community Reuse Organization of East Tennessee (CROET), an additional 13 acres in the central area of ETTP were made available for private use. Babcock Services purchased 2.5 acres of Parcel ED-10 and began construction of an 11,400 ft^2 facility. The property will be used to manage, recover, and refurbish radioactively contaminated components from commercial nuclear power plants and is projected to create more than 100 jobs.

An additional 26.5 acres in the former Powerhouse Area along the Clinch River were made available via a lease to CROET for industrial development, increasing the total 308 acres. Oak Ridge Forest Products is leasing a portion of this site from CROET in support of its operations to supply wood chips that fuel a biomass gasification plant at ORNL.

In Spring 2012, a 200 kW photovoltaic solar farm at the entrance to ETTP began generating enough electricity to power 22 homes. The land for the solar farm, called Brightfield 1, was purchased from CROET by RSI, the developer and operator of the system. This project required collaboration with the Tennessee Valley Authority, DOE, UCOR, and the City of Oak Ridge.

In April 2013, a ribboncutting ceremony was held for a second solar array built at ETTP by German company Vis Solis Inc. It is located at the former duct back area, owned by CROET.

The new $35 million Carbon Fiber Technology Facility at Oak Ridge's Horizon Center is nearing completion. This advanced materials facility will allow researchers to develop and demonstrate the commercial viability of low-cost carbon fiber products for several industry sectors. Long considered a desirable lightweight substitute for steel and other materials, use of carbon fiber has been limited due to its high production costs. The development of low-cost production methods is expected to create new possibilities for its use in a wide array of applications for building structures, industrial products, wind turbines, and others.

The DOE Oak Ridge Office hosted an Asset Revitalization Workshop in June 2012. The workshop brought together DOE officials, government contractors, and community stakeholders from across the nation to gain a better understanding of transitioning federal land and facilities for beneficial reuse. Asset Revitalization experts from Oak Ridge were able to share their many years of experience, successes, and lessons learned in implementing this unique program.

The Brightfield 1 solar farm at ETTP generates enough electricity to power 22 homes.