

**Environmental Cleanup of the East Tennessee Technology Park - Year Three - A Status Report -
15522**

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ABSTRACT

On August 1, 2011, URS | CH2M Oak Ridge LLC (UCOR) began its five-year, \$1.4 billion cleanup of the East Tennessee Technology Park (ETTP), the former Oak Ridge Gaseous Diffusion Plant, located on the U.S. Department of Energy's (DOE) Oak Ridge Reservation (Reservation) in Tennessee. Under the contract, the base period scope of work to be completed by 2016 includes demolition of both the K-25 and K-31 gaseous diffusion buildings and all demolition waste dispositioned, initiation of demolition on the remaining K-27 gaseous diffusion building, safe storage of transuranic (TRU) waste for eventual transfer to the Transuranic Waste Processing Center, previously designated "No-Path-To-Disposition Waste" dispositioned to the extent possible, and completion of design and engineering of a mercury treatment system to be installed at the Y-12 National Security Complex (Y-12). UCOR will have also managed DOE Oak Ridge Office of Environmental Management (OREM)-owned facilities at ETTP, Oak Ridge National Laboratory (ORNL), and Y-12 in a safe and cost-effective manner.

Since assuming responsibilities as the ETTP and Oak Ridge Reservation cleanup contractor, UCOR has completed its life-cycle Performance Measurement Baseline; received its Earned Value Management System (EVMS) certification; completed the deactivation and demolition (D&D) of the 44-acre K-25 gaseous diffusion building; removed and disposed of a contaminated underground storage tank (Tank W-1A) at ORNL; dispositioned mercury-contaminated storage tanks at Y-12; completed closure of the Toxic Substances Control Act Incinerator; disposed of more than 158,000 cubic yards of cleanup waste while managing the on-site Environmental Management Waste Management Facility (EMWMF); and conducted operations, surveillance, and maintenance activities at 180 DOE EM facilities at ETTP, ORNL, and Y-12.

In 2014, UCOR completed the removal and disposal of all of the K-25 demolition debris; completed the removal of asbestos-laden transite siding on the K-31 gaseous diffusion building and began demolition of that 17-acre building; advanced the characterization and deactivation of the K-27 gaseous diffusion building, readying the building for the start of demolition in 2015; advanced the design and engineering of a Mercury Treatment Facility to be located at Y-12; continued the cost-effective and safe disposition of all cleanup wastes; and readied ETTP for Voluntary Protection Program Star Status Assessment in 2015.

Project performance as of December 31, 2014, continued to be excellent:

- Cost Performance Index – 1.12
- Schedule Performance Index – 1.02

At the same time, since safety is the foundation of all cleanup work, UCOR's safety record goes hand-in-hand with its excellent project performance. Through calendar year 2014, UCOR's recordable injury rate was 1.04 occurrences per 200,000 work hours, and the lost workday case rate was 0.52.

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This performance continues to be due, in large part, to the people and processes URS and CH2M HILL, the parent companies of UCOR, brought to the project. Key enablers included:

- Selected and deployed experienced staff in key leadership positions throughout the organization, continually re-energizing the organization with new leaders
- Implemented previously successful safety programs and initiatives from other DOE sites, such as DOE's Voluntary Protection Program
- Brought fresh thinking and innovation to tackling tough project issues, such as the deactivation of the Technetium-99-contaminated areas of K-27, applying lessons learned from the D&D of K-25; and implementing a "waste factory" approach to cleanup
- Maintained continuing alignment between UCOR's contract with DOE and its Performance Measurement Baseline – rapidly addressing contract changes when they arose
- Maintained a readiness both from a process as well as experienced personnel perspective to support DOE OREM in performing other significant Oak Ridge Reservation cleanup activities

INTRODUCTION

The 2,200-acre East Tennessee Technology Park (ETTP) is located in the southwestern portion of the Department of Energy (DOE) Oak Ridge Reservation in East Tennessee. Figure 1 shows the location of ETTP on the Oak Ridge Reservation. ETTP's uranium enrichment facilities operated for more than 40 years and date back to the World War II Manhattan Project, which produced fissionable material for the world's first nuclear weapon. The site also produced enriched uranium for the commercial nuclear power industry from 1945 to 1985. Uranium enrichment operations were permanently shut down in 1987. As a result of these operations, ETTP has a legacy of radiologically contaminated buildings, soil, sediment, and groundwater that require remediation for the protection of human health and the environment. The DOE Office of Environmental Management (EM) is overseeing cleanup operations at the site with the end goal of transforming ETTP into a private sector industrial park as well as a national historical preservation site.

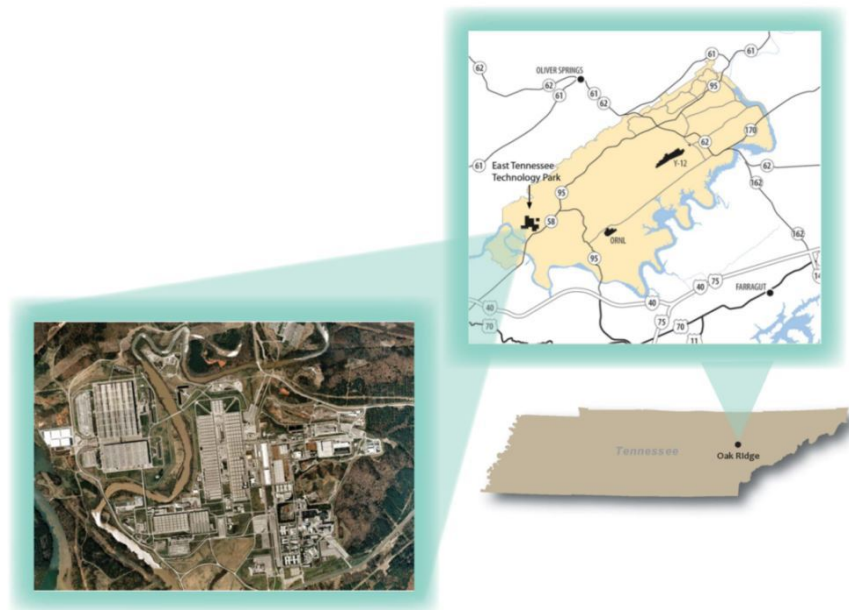


Figure 1. Location of ETTP on the Oak Ridge Reservation in East Tennessee.

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Major cleanup activities at ETTP began under a previous contractor in 1998. URS | CH2M Oak Ridge LLC (UCOR) is completing this work under a five-year contract¹ with an additional four-year option. The complete contract project scope of work consists of:

- Demolition of the K-25, K-27, and K-31 uranium enrichment buildings
- Demolition of remaining ETTP facilities, such as the Toxic Substances Control Act Incinerator (TSCAI), Central Neutralization Facility (CNF), K-1037 manufacturing plant, centrifuge facilities, and other ancillary buildings and structures
- Environmental remediation of soil and groundwater contamination on the ETTP site
- Disposition of all Deactivation and Demolition (D&D) and remediation waste, either onsite at the Environmental Management Waste Management Facility (EMWMF), or offsite at commercial or DOE treatment or disposal sites
- Design and engineer a mercury treatment facility for Outfall 200 to treat mercury contaminated stormwater exiting Y-12

ETTP CLEANUP PROJECT STATUS

The ETTP Cleanup Project is ahead of schedule and under budget. At the end of Calendar Year (CY) 2014, project cost and schedule performance against the Performance Measurement Baseline were as follows:

- Cost variance of \$100M with a cost performance index of 1.12.
- Schedule variance of \$21M, with a schedule performance index of 1.02.

A key enabler to any successful DOE EM nuclear cleanup project is its safety record. UCOR's recordable case rate for CY 2014 was 1.04 and a lost workday restricted case rate of 0.52 (per 200,000 hours worked).

Another key enabler of a successful nuclear cleanup project is environmental compliance. In CY 2014, all regulatory milestones were met and no environmental non-compliances were noted by State and Federal environmental regulators.

Following are notable accomplishments in 2014.

Removal of All Demolition Debris from the K-25 Footprint

The K-25 facility was a former gaseous diffusion plant built as part of the Manhattan Project in the early 1940s. Once the largest building under one roof in the world, it separated isotopes of uranium and concentrated fissionable U-235 isotope first for use in nuclear weapons and later for use in nuclear reactors. The mile-long facility was comprised of three major sections – the east and west wings and the north end – aligned in a “U” shape. The north end forms the base of the “U” and was the smallest section.

The west wing was demolished prior to UCOR's arrival, and the east wing (consisting of 23 “units”) and the north end (consisting of three units) remained to be demolished when UCOR took over the contract. A unit typically consists of about 60 converters, 120 compressors, and associated piping and auxiliary

equipment. The east wing was divided into two sections. The smaller section, consisting of five units, was contaminated with significant quantities of technetium-99 (Tc-99), a radioactive isotope that is more mobile in the environment than other radioactive materials. Special techniques were used to manage and dispose of these wastes. The larger section, consisting of 18 units, did not contain significant quantities of Tc-99.

The demolition of the K-25 building was completed on December 19, 2013, five years after demolition started on December 16, 2008. In 2014, all demolition debris was removed from the K-25 footprint and disposed both onsite and offsite.



Figure 2. Removal of remaining demolition debris from the K-25 footprint.

Begin Demolition of K-31

The K-31 facility was a former gaseous diffusion plant built in December of 1951. The 750,000-square-foot facility was part of the post-World War II expansion of the Oak Ridge Gaseous Diffusion Plant. It ceased operation in 1985. The uranium process gas equipment contained within the building had already been removed by a previous contractor, and the building was also partially decontaminated. K-31 is one of only two gaseous diffusion plants remaining at ETTP from the original five facilities.

UCOR commenced demolition of K-31 facility on October 8, 2014. This was one month ahead of the baseline schedule and five months ahead of UCOR's proposal. Acceleration was made possible by a combination of cost savings UCOR generated in Fiscal Years (FY) 2013 and 2014 as well as additional funding received in FY 2014. As important to the acceleration of K-31 was the availability of skilled and

trained demolition crews coming from the successful demolition of K-25. Demolition is expected to take approximately one year.



Figure 3. Beginning demolition of the 17-acre K-31 plant.

Deactivation Progress of K-27

K-27 is a smaller “sister” gaseous diffusion facility to K-25, occupying an area of 374,000 square feet. When operational, K-27 produced low enrichment uranium 235 feed material for K-25. Built in 1945 and operating for nearly 20 years, K-27 was shut down in 1964.

In April 2012, UCOR began the deactivation (pre-demolition) of the K-27 facility, almost two years ahead of the Performance Measurement Baseline schedule. This acceleration was made possible by cost savings identified by UCOR during Fiscal Years 2011 and 2012, availability of some additional characterization monies from the American Recovery and Reinvestment Act (ARRA) that were being managed by DOE and the Oak Ridge Institute for Science and Education (ORISE), and the availability of characterization resources from the K-25 Project.

As part of hazard removal deactivation activities, sodium fluoride (NaF) traps were removed from the K-27 building in late February 2014. When K-27 was operational, the NaF traps were part of the final uranium removal process. Sodium fluoride pellets were used to trap the uranium, and these particular traps still contain uranium materials from when the facility was shut down decades ago. The NaF traps were considered some of the highest-risk components remaining in the building. Lessons learned from the previous successful removal of NaF traps at K-25 were used.

As part of the deactivation process, the K-27 Project Team has completed installation of lifelines and grip strut, deactivated the fire system, vented and purged residual waste gases and liquids of over 135,000 linear feet of pipe, performed cell floor intrusive sampling, and conducted cell floor process gas non-

destructive assays. Characterization and deactivation efforts continue, including duct cutting and vent/purge/drain activities. As of December 2014, deactivation was about 57% complete and characterization was 100% complete.



Figure 4. Deactivating K-27 – Removing Process Piping

Outfall 200 – Design and Engineering of the Mercury Treatment Facility at Y-12

In 2014, UCOR began the design and engineering of a mercury treatment system to be installed at Y-12 to treat mercury-contaminated surface water leaving the Y-12 site at Outfall 200. Historical nuclear weapons development missions at Y-12 resulted in the release of significant quantities of mercury to the environment estimated to be in excess of one million pounds. The treatment facility is being designed to remove mercury from surface water generated during planned source removals actions, such as building demolition of the facilities that employed mercury in their processes. Surface water leaving Y-12 flows directly into the City of Oak Ridge. The presence of mercury in the environment and in the facilities at Y-12 is considered to be the single largest environmental risk at Y-12.

At the end of December 2014, the Outfall 200 Mercury Treatment Facility Project completed the DOE EM Peer Review assessing its readiness for Critical Decision 1 (CD-1) approval. The assessment determined that technical facility performance requirements were sufficiently defined to begin preliminary design. Further, the DOE's Office of Acquisition and Project Management performed an independent cost review and has recommended that CD-1 be approved by the DOE Acquisition Executive.

Waste Disposition and the “Waste Factory Model”

Cleaning up ETTP and making it suitable for a private sector industrial park as well as a national historical preservation site requires a robust approach to the disposal of the many wastes that result from the cleanup. These wastes include significant quantities of building demolition wastes, much of it radiologically and/or chemically contaminated, and soil and groundwater remediation wastes. Further, there are also significant quantities of containerized stored wastes, some of which were originally believed to have no known path to disposal.

The common thread through these cleanup activities is waste flows (i.e., processes that take waste from where they lie through ultimate disposal). Given the large volumes of D&D wastes, the flow of these wastes is vital to the ETTP execution strategy and plan to ready the site for eventual reuse. The manner with which these wastes are evaluated and summarily dispositioned can be thought of as “waste factory.” The purpose of the waste factory is to safely, cost-effectively, and in an environmentally sensitive manner dispose of these cleanup wastes.

Under the waste factory model, waste is disposed at the point of generation, minimizing the length of time it is exposed to the environment. Long before the wastes are generated, UCOR works cooperatively with DOE OREM and state and federal regulators to determine the appropriate disposal paths for the wastes. Wastes are tracked from point of generation to disposal using radio-frequency identification techniques much like those used in warehouses and factories.

In 2014, UCOR disposed 35,000 cubic yards onsite and 8,100 cubic yards offsite at various commercial and DOE disposal sites. Since contract inception in August 2011, UCOR has safely disposed of over 158,000 cubic yards of waste. Four of six “no path to disposal” wastes have been dispositioned to date. Wastes have been transported nearly 2.5 million miles with no accidents.

Additionally, as a result of the current shutdown of the Waste Isolation Pilot Plant to transuranic waste receipts, UCOR is receiving transuranic wastes for temporary storage from the Transuranic Waste Processing Center (TWPC) located on the Oak Ridge Reservation. UCOR expects to temporarily store more than 1,000 drums of waste for TWPC.

Surveillance and Maintenance of EM Facilities

UCOR manages more than 180 OREM facilities and more than 5,600 acres located at ETTP, ORNL and Y-12. The facilities that UCOR manages across the Reservation for OREM range from defunct gaseous diffusion plants at ETTP; highly radiologically contaminated hot cells, a Molten Salt Reactor and various other reactors at ORNL; and industrial and radiological waste disposal facilities and mercury contaminated nuclear weapon production facilities at Y-12. A key activity that is also performed include the management of the Liquid and Gaseous Waste Operations (LGWO) facilities that treat approximately 120 million gallons of process waste water per year.

Eventually the facilities under UCOR’s Surveillance and Maintenance Program will be decommissioned or demolished as part of the long-term cleanup of the Oak Ridge Reservation.

EXECUTION WITH CERTAINTYSM

The continuing success of the ETTP Cleanup Project was made possible originally with a roadmap that guided UCOR during the bid/proposal development, through transition, and finally to project execution.

The execution of the roadmap relied on people recruited by UCOR largely from its parent companies, URS and CH2M HILL, who brought the requisite and specific skills and leadership to the ETTP cleanup project. These selected individuals brought not only time-tested processes and approaches used successfully at other successful DOE EM nuclear cleanup projects such as Rocky Flats, Savannah River Site, Hanford, Idaho and Mound, but also innovative new approaches to accomplishing work safer and more efficiently. The leadership team, along with the excellent workforce that was already at the Site, enabled the cleanup project to get off to a fast start and sustain the momentum now three years into the project.

Other key enablers to UCOR's performance to date include:

1. Leadership. UCOR has been continually "re-energizing" the organization with new leaders from other cleanup sites. These new leaders have brought additional innovative approaches to performing work safely and cost effectively. For example, UCOR has recently reorganized to adopt an "Enterprise Model" that organizes the workforce so they are more prepared and adept at tackling some of the new cleanup opportunities that OREM has presented UCOR. Additionally, a number of new safety programs have been instituted such as the "Questioning Attitude Recognition Program," which recognizes the workers when they see something amiss and raise the issue to supervision.
2. Safety Focus. UCOR has expanded its Behavior Based Safety Program, expanding the use of Local Safety Improvement Teams. The aim of this program is to improve workers recognition of not only their own safe behaviors, but also those of their peers. There has also been a renewed focus on preparing for the 2015 assessment of the site's Voluntary Protection Program. UCOR is pursuing "Star Status," an achievement that signifies that the site has implemented an effective safety and health management system and maintains injury and illness rates below national averages for their respective industries. The ETTP site has not achieved Star Status previously.
3. Learning. Based on the successful demolition of K-25 and some of the challenges encountered, UCOR has implemented a number of lessons learned and applied them to both the K-31 demolition as well as the deactivation of K-27. Specifically, a number of lessons-learned on dealing with Tc-99-contaminated equipment and areas have been implemented ranging from equipment removal to management of water used for dust suppression during demolition.
4. Contract and Baseline Alignment. Maintaining continuing alignment between UCOR's contract with DOE and its Performance Measurement Baseline – rapidly addressing contract changes when they arise has been key to ensuring that work is performed in an organized and approved fashion. Since contract true-up in 2012, UCOR has managed all contract changes within the 180 day goal established by DOE.

CONCLUSION

The excellent project performance UCOR has achieved in its third year of cleanup of the ETTP was largely attributable to the people and processes (Execution with CertaintySM) brought to the ETTP cleanup project, combined with the experienced personnel that transitioned from the previous contractor. Based on performance to date, UCOR expects to continue completing cleanup and remediation ahead of schedule and under budget as it moves toward final completion of the project.

REFERENCES

1. U.S. Department of Energy Oak Ridge Office, 2011, Contract DE-SC-0004645, “East Tennessee Technology Park” Contract