Completing the Cleanup of the US Department of Energy's East Tennessee Technology Park – Four Years Early - 16067

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ABSTRACT

On August 1, 2011, URS | CH2M Oak Ridge LLC (UCOR) began its $2.6 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 (ORR) in Tennessee. Under the contract [1], the scope of work to be completed includes demolition of all gaseous diffusion buildings, namely K-25, K-31 and K-27, as well as other facilities such as the Toxic Substance Control Act (TSCA) Incinerator, the K-1200 Centrifuge Complex and the K-1037 Barrier Plant. Additionally, UCOR will remove contaminated soils and treat contaminated groundwater. Waste generated by these cleanup activities will be disposed at onsite as well as offsite facilities. UCOR will also continue to manage hundreds of the DOE Oak Ridge Office of Environmental Management (OREM)-owned facilities across the ORR.

Due largely to funding challenges early in the project, the DOE estimated in their October 2013 *Program Plan 2014-2024*[2] that ETTP cleanup would not be achieved until 2024, four years later than originally scheduled in UCOR's contract with the DOE. In November 2014, the DOE Manager for OREM, Susan Cange, publicly shared her "vision" for ETTP cleanup by 2020, four years earlier than the DOE's current plan. As part of Vision 2020, all gaseous diffusion buildings would be demolished by the end of 2016. In response to Ms. Cange's vision, UCOR published a Strategic Plan describing how ETTP could be cleaned up by 2020, provided that a number of funding and programmatic and technical challenges could be overcome. UCOR is in the midst of implementing its Strategic Plan, and progress is being made to that end.

Since assuming its responsibilities as the ETTP cleanup contractor, UCOR has completed its life-cycle Performance Measurement Baseline (PMB); received its Earned Value Management System (EVMS) certification; completed the D&D of the 44-acre K-25 and 17-acre K-31 gaseous diffusion buildings; completed the K-1070-B Burial Ground remediation project; completed RCRA closure of the TSCA Incinerator; and disposed of more than 541,411 cubic yards of cleanup waste while managing the on-site Environmental Management Waste Management Facility (EMWMF).

In 2015, UCOR achieved safety "Star Status" under the DOE's Voluntary Protection Program (VPP); completed the demolition of the K-31 gaseous diffusion building; advanced the characterization and deactivation of the K-27 gaseous diffusion building, readying the building for the start of demolition in 2016; and began characterization activities in the K-1037 Barrier Plant as well as a number of facilities in the Poplar Creek Area of the ETTP Site.

Project performance through December 31, 2015, is as follows:

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

Since safety is the foundation of all cleanup work, UCOR's safety record goes hand-in-hand with its project performance. Through calendar year 2015, UCOR's recordable injury rate was 0.94 occurrences per 200,000 work hours, and the day away case rate was 0.31. These rates are both below the DOE and UCOR goals.

INTRODUCTION

The 2,200-acre ETTP is located in the southwestern portion of the DOE ORR in East Tennessee. 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 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 Historic Preservation (NHP) site.

Major cleanup activities at ETTP began under a previous contractor in 1998. Beginning in August 2011, UCOR is completing this work under a nine-year contract. The contract project scope of work consists of:

- Demolition of the K-25, K-27, and K-31 uranium enrichment gaseous diffusion buildings
- Demolition of remaining ETTP facilities, such as the TSCA Incinerator, Central Neutralization Facility (CNF), K-1037 barrier plant, K-1200 centrifuge facilities, and other ancillary facilities and structures
- Environmental remediation of soil and groundwater contamination on the ETTP site
- Disposition of all D&D and remediation waste, either onsite at the EMWMF or offsite at commercial or the DOE treatment or disposal sites

In November 2014, the DOE Manager for OREM, Susan Cange, publicly shared her "vision" for ETTP cleanup by 2020, four years earlier than the DOE's current plan embodied in their October 2013 *Program Plan 2014-2024.* Ms. Cange's vision calls for demolition of all gaseous diffusion plants (GDP) at ETTP by 2016, as well as continuation of cleanup activities at the Y-12 National Security Complex (Y-12) and the ORNL. ETTP cleanup is envisioned to wrap up by 2020 to include the continuing transfer of properties for reindustrialization. Upon completion of ETTP, cleanup efforts will transition, without delay, to other high-priority contaminated buildings on the ORR with a focus on mercury-use facilities at Y-12.

STATUS (THE SITE TODAY)

Since assuming its responsibilities as the ETTP cleanup contractor in August 2011, UCOR has:

- Completed its life-cycle PMB
- Received its Earned Value Management System (EVMS) certification
- Completed the D&D of the 44-acre K-25 gaseous diffusion building
- Completed the demolition of the 17-acre K-31 gaseous diffusion building
- Completed the remediation of the K-1070-B Burial Ground
- Completed the RCRA closure of the TSCA Incinerator and CNF
- Disposed of more than 541,411 cubic yards of cleanup waste
- Initiated NHP activities including launch of the K-25 Virtual Museum (website)

In addition to its work at the ETTP Site, UCOR has managed the EMWMF at Y-12, performed surveillance and maintenance (S&M) activities at hundreds of facilities at the ETTP, as well as Y-12 and the ORNL. Further, during this period of time, UCOR has begun the design of the Mercury Treatment Facility and the Environmental Management Disposal Facility (the successor disposal site to the EMWMF) at Y-12, and removed highly radioactive components from the 3042 reactor located at the ORNL and safely disposed of these components.

THE WORK AHEAD

Figure 1 provides a breakdown of the type of work that remains to complete ETTP cleanup. For example, about 36 percent of the project's life-cycle budget will be spent on D&D activities. Deactivation involves removing utility sources (e.g., power, water), identifying and removing hazardous materials (e.g., asbestos, PCBs), determining the types and quantities of radiological contamination, and removing process equipment and piping that exceed radioactivity limits. When deactivation is complete, crews dismantle the structure using heavy equipment.

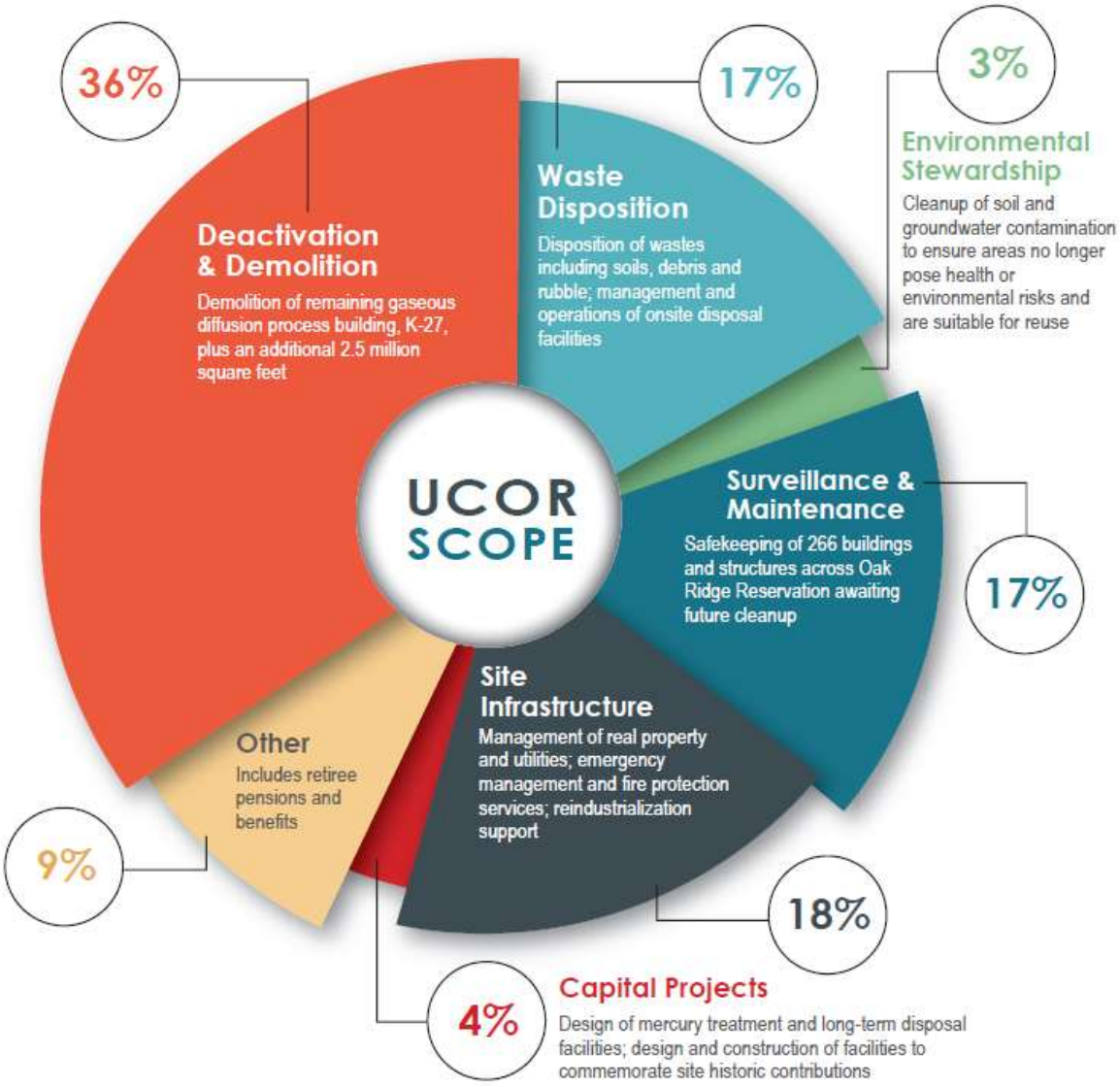

Fig. 1. The Work Ahead.

D&D of Remaining Facilities

To achieve 2020 cleanup, D&D crews will demolish the site's remaining GDPs and 200-plus additional facilities and structures, totaling ~2.5 million square feet. Major facilities include:

> **K-27 GDP.** The four-story, 383,000 square foot GDP was built in 1945 to enrich uranium in support of weapons production.

Poplar Creek Facilities. The Poplar Creek Facilities supported GDP activities and includes 23 buildings, tie lines and smaller ancillary structures.

Building K-1037. The K-1037 Building produced barrier material that was used to separate U-235 and U-238 in the uranium enrichment gaseous diffusion process.

Central Neutralization Facility. This facility encompasses 49 structures, including buildings, containment and storage tank facilities, and support trailers.

K-1200 Centrifuge Complex. These 11 facilities were used to explore a more efficient uranium enrichment alternative to the gaseous diffusion process.

Balance of Facilities. These ~84 buildings and structures, located throughout the site, are generally low hazard.

Building K-731. The ~69,000 square-foot electrical switch house supplied power to the K-27 Building.

Toxic Substances Control Act Incinerator. The facility incinerated hazardous and radioactive wastes containing polychlorinated biphenyls (PCBs).

Environmental Remediation

Crews will clean up soil and groundwater contamination to ensure areas are suitable for reuse, and no longer pose health or environmental risks. UCOR will use the existing D&D workforce to execute the environmental scope—retaining valuable skills and saving dollars. The environmental remediation work scope includes:

Buffer Zone. Commonly known as Zone 1, this 1,400-acre area surrounds the main process facilities. Work includes capping the 770 burial ground and performing targeted soil excavations.

Building Zone. Referred to as Zone 2, this 800-acre footprint contained process buildings and ancillary structures. Work includes Mitchell Branch stream cleanup, soil characterization and excavation, groundwater remediation, and land use controls.

K-25 Footprint. Work includes evaluation of the slab and underlying soil currently under way to support cleanup goals and historic preservation efforts.

Sitewide Record of Decision. Work includes groundwater cleanup and obtaining final regulatory approval.

Waste Disposition

Cleanup includes the disposition of wastes including soils, debris and rubble from demolition and remediation activities. UCOR manages onsite disposal facility operations at EMWMF and ORR Landfill at Y-12. It is projected that to complete the cleanup of ETTP, more than 852,425 cubic yards of waste will need to be characterized, packaged, and either transported to the EMWMF or offsite for disposal.

Reindustrialization

UCOR supports the DOE in reindustrialization/reuse of the ETTP site as private-sector industrial park through efficient transfer of land, properties and infrastructure.

Historic Preservation

UCOR will design and construct facilities to interpret the significant role of the K-25 Site in the Manhattan Project and the Cold War era. In November 2015, UCOR launched the K-25 Virtual Museum (website) as part of K-25 historic preservation efforts.

THE PLAN

UCOR has outlined an aggressive strategy to complete ETTP cleanup by 2020 – four years ahead of the DOE's original schedule. The plan includes demolition of the site's final gaseous diffusion building, K-27, by the end of 2016. Another 20-plus buildings, tie lines and ancillary structures that supported gaseous diffusion processes, known as Poplar Creek Facilities, will be demolished by mid-2017. Simultaneously, crews will tackle Building K-1037, the facility that produced barrier material for the uranium separation process.

UCOR's strategy is founded in:

Safe Performance.

To achieve ETTP cleanup by 2020, one factor stands above every other in determining success. That crucial, unwavering component is safe performance.

A robust safety culture – grounded in worker involvement and management commitment and applied to every task performed – will enable the safe accomplishment of work.

Adequate Funding.

UCOR has determined that the project will need an early investment of $110 million to complete the ETTP cleanup by 2020. The early allocation of funds—appropriated in 2016, 2017, 2018, and 2019—will result in $450 million in savings realized by the elimination of costs associated with site operations and infrastructure and safeguards and security (see Table I).

Table I. Annual Funding Targets

Year	Funding Target
FY2016	$307 million
FY2017	$262 million
FY2018	$264 million
FY2019	$264 million

Skilled, Dedicated Workforce.

Optimal utilization of the ETTP's highly skilled, high performing workforce will be a critical aspect to achieve 2020 cleanup. Meticulous work sequencing will keep the workforce effectively and efficiently employed, performing tasks directly applicable to the cleanup mission. Initially, as required by the contract[1], demolition was tackled one facility at a time completing a building, then moving to the next.

With the efficiencies gained through time on the job and innovations developed and applied by the workforce, UCOR now deploys multiple crews to multiple buildings concurrently, fully employing talent and resources.

Figure 2 describes the schedule of activities necessary to achieve 2020.

Strong Partnerships.

Achieving ETTP cleanup by 2020 will require all stakeholders working together. Alignment in purpose and approach will enable focus on the work, avoiding distractions that could derail progress.

Cleanup partners—the DOE, regulators, government officials, community leaders, workforce, and unions—will bolster the effort with technical competency, leadership, and advocacy.

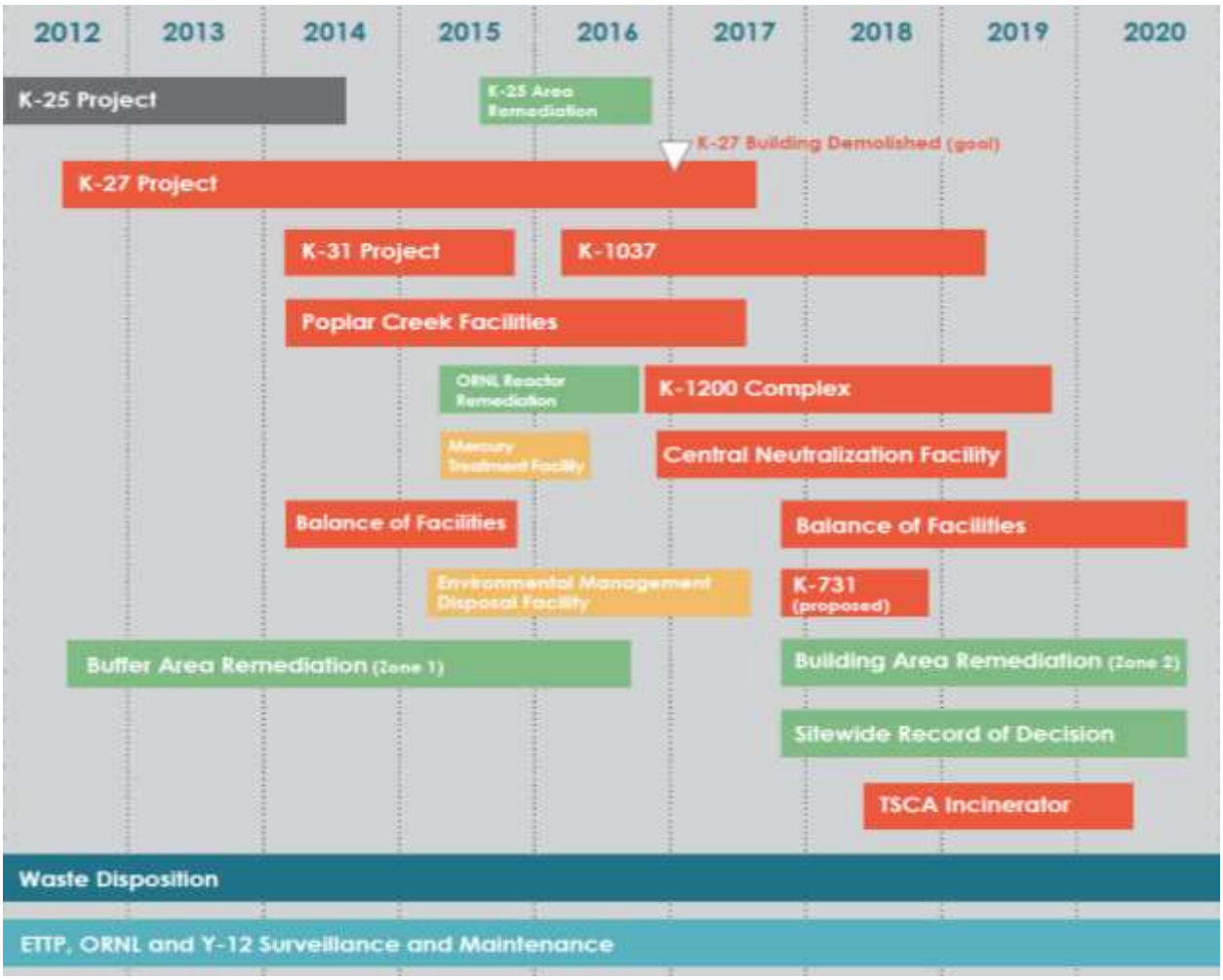

Fig. 2. Vision 2020 Cleanup Schedule.

THE CHALLENGES

Much of the remaining work presents complex technical and regulatory challenges.

- High-risk, high-hazard work environment with radiological and chemical contamination
- Funding availability
- Packaging and disposal of classified equipment and security-cleared personnel to perform work
- Effective utilization of resources as work transitions from large, single building focus to multiple buildings spanning the site
- Soil contamination levels unknown until final demolition

- Increasing S&M costs due to deteriorating infrastructure

THE BENEFITS

Completing the ETTP four years early responsibly addresses cleanup priorities, both fiscally and environmentally, by

- Accelerating the removal of legacy environmental liabilities
- Turning early allocation of funds into $450 million savings, demonstrating sound return on investment for American taxpayers
- Accelerating redevelopment and reuse of the site footprint, bringing diverse private-sector jobs to the region

The DOE's original cleanup plan for the ETTP called for project completion in 2024. By accelerating site cleanup, the American taxpayer will save $450 million (see Figure 3) in security, S&M, and other operations costs to maintain the aging, deteriorating and contaminated facilities.

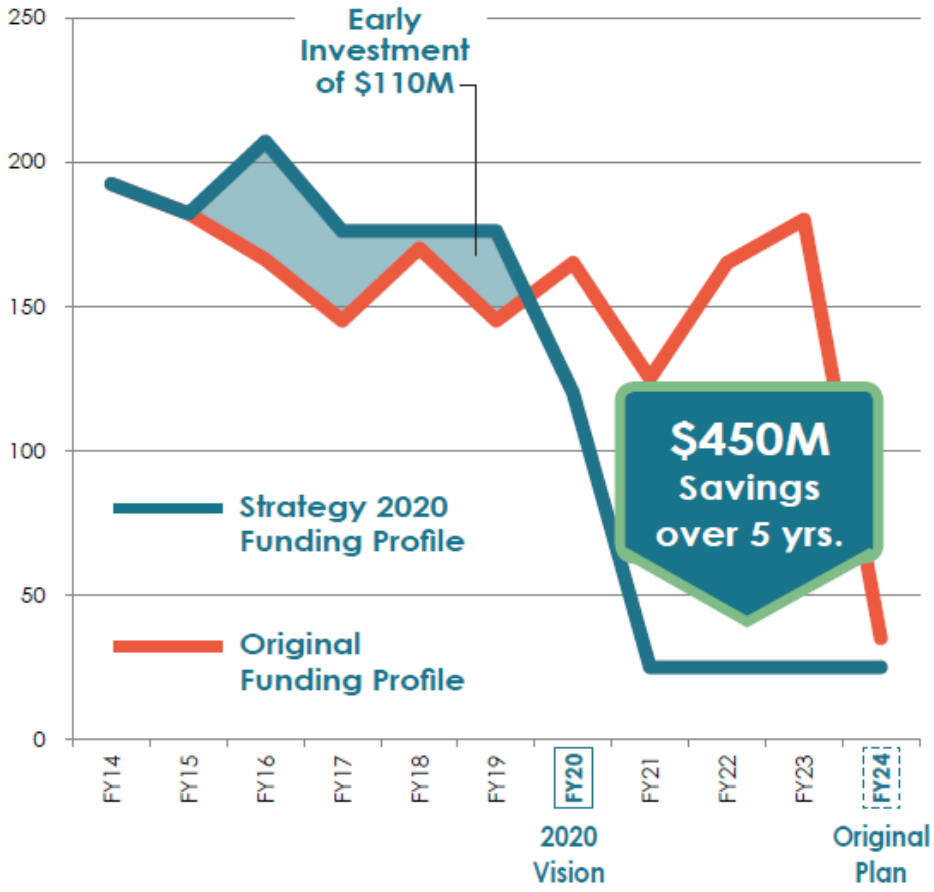

Fig. 3. Early Investment Yields $450 Million in Savings.

CLEANUP PROGRESS TOWARD PLAN

UCOR is currently on schedule to achieve the ETTP contract scope by 2020. At the end of Calendar Year (CY) 2015, project cost and schedule performance against the PMB were as follows:

- Cost performance index of 1.12 (cost variance of $136.3M)
- Schedule performance index of 1.02 (schedule variance of $28.2M)

The following are notable 2015 accomplishments toward achieving cleanup by 2020.

Voluntary Protection Program Star Status Achieved

UCOR earned VPP Star status, demonstrating safety excellence and a robust safety culture. This is the first time the the ETTP site has achieved Star recognition.

K-31 Demolition Complete

UCOR completed demolition of the 750,000-square-foot K-31 facility and removal of all demolition waste in August 2015. The former gaseous diffusion plant, built in 1951 to support weapons production, has been shut down since 1985. The uranium process gas equipment contained within the building were removed by a previous contractor, and the building was also partially decontaminated. Work was completed one month ahead of the baseline schedule and five months ahead of UCOR's proposal.

Pre-Demolition Activities in K-27 Complete

K-27 is the smaller, "sister" gaseous diffusion facility to K-25, occupying an eight-acre footprint. When operational, K-27 produced low enrichment U-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 PMB schedule.

As part of hazard removal 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 K-27 deactivation team also installed 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 included duct cutting and vent/purge/drain activities. Deactivation reached 96 percent completion in December 2015 with demolition scheduled to start in early 2016.

Fig. 4. Deactivating K-27 – Process Piping Removal.

Waste Disposition

The ETTP 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.

Given the large volumes of D&D wastes, the flow (i.e., processes that take waste from where they lie through ultimate disposal) of these wastes is vital to the ETTP execution strategy and plan to ready the site for eventual reuse.

In 2015, UCOR disposed 171,497 cubic yards onsite and 6,509 cubic yards offsite at various commercial and the DOE disposal sites. Since contract inception in August 2011, UCOR has safely disposed of over 541,411 cubic yards of waste. Four of six "no path to disposal" wastes have been dispositioned to date. Wastes have been transported nearly 3.3 million miles with ***no*** accidents.

THE FUTURE

In 2020, the ETTP skyline will look markedly different. The gaseous diffusion plants, centrifuge complex and hundreds of other facilitites and structures have been demolished, wastes removed and soils remediated.

With risks reduced, hazards removed and the environment restored, the DOE has transferred ownership of many ETTP building and land assets to the community for redevelopment and reuse. Portions of the land have become part of the Black Oak Ridge Conservation Easement, used for conservation and recreational purposes. A history center, equipment building, viewing tower, and wayside exhibits tell the story of the K-25 site, honoring its defense, energy and cleanup contributions during the past 70 years.

CONCLUSION

Excellent progress is being made toward the goal of realizing the DOE's vision of a cleaned up ETTP by the end of 2020. A number of challenges have to be overcome to reach this goal with the most important near-term one being sufficient project funding.

REFERENCES

1. U.S. Department of Energy Oak Ridge Office, 2011, Contract DE-SC-0004645, "East Tennessee Technology Park Contract."
2. U.S. Department of Energy Oak Ridge Office of Environmental Management October 2013 "Program Plan FY2014 to 2024."